IWAKI PUMPS

IWAKI

Magnetic Drive Pump

MX Series (MX-70/MX-100/MX-F100)

Instruction Manual (Asian Edition)

⚠ Read this manual before use of product

This is patent pending product.

Thank you for having selected the Iwaki Magnetic Drive Pump MX series. This manual deals with the correct handling and operation procedures and troubleshooting methods for the pump. To make maximum use of the pump and to ensure safe, long operation, please read this manual carefully prior to operating the pump. Pay special attention to the "Warning" and "Caution" sections as they relate to matters of safety and proper usage of the pump.

Contents

Important Instruction

For the Safe and Correct Handling of the Pump

- Read the "Safety Instructions" sections carefully to prevent accidents involving your customers or other personnel and to avoid damage or loss of other assets. Always follow the instructions and advice found in these sections.
- Observe and abide by the instructions described in this manual. These instructions are very important for protecting pump users from dangerous conditions and situations related with the use of the pump system.
- The symbols relate to the following meanings described below:

⚠ **Warning**	**Nonobservance or misapplication of the contents of the "Warning" section could lead to a serious accident, including death or injury.**
⚠ **Caution**	**Nonobservance or misapplication of the contents of the "Caution" section could lead to serious physical injury to the user or serious damage to the product.**

Types of Symbols

⚠ Indicates that "Warning" or "Caution" must be exercised. Inside this triangle, a concrete and practical image provided as a warning or caution message is depicted.

⃠ Indicates a prohibited action or procedure. Inside or near this circle, a concrete and practical image of the activity to be avoided is depicted.

❗ Indicates an important action or procedure which must be performed or carried out without fail. Failure to follow the instructions herein can lead to malfunction or damage to the pump.

1. Safety Instruction

⚠ Warning

- **Turn off the power supply.**
  Working without disconnecting the power supply may cause an electrical shock. Before engaging upon any working procedures involving the pump, make sure to turn the power supply switch off and to stop the pump and other related devices.


Electrical Shock

- **Terminate operation.**
  When you detect or become aware of a dangerous sign or abnormal condition during operation, terminate the operation immediately and start it from the beginning again.

- **For specified application only.**
  The use of a pump in an application other than those clearly specified may result in injury or damage to the pump. Use the pump strictly in accordance with the pump specifications and application range.


Prohibited

- **No remodeling.**
  Never remodel a pump. Otherwise, a serious accident may result. Iwaki will not be responsible for any accident or damage of any kind which is caused by the user remodeling the pump without first obtaining permission or instructions from Iwaki.


No Remodeling

- **Wear protectors.**
  If you touch or come in contact with any type of hazardous chemical liquid, including but not limited to chemicals, you may experience a serious injury. Wear protective gear (protective mask, gloves, etc.) during the pump operation.


Wear protective gear

⚠ Caution

- **Qualified operators only.**
  The pump operator and pump operation supervisor must not allow any operators who have little or no knowledge of the pump to run or operate the pump. Pump operators must have a sound knowledge of the pump and its operation.


Prohibited

- **Specified power only.**
  Do not operate the pump on voltage which is not specified on the nameplate. Failure to do so may result in damage or fire. Only the specified power level is to be applied.


Prohibited

- **Do not wet or dampen.**
  If the motor or wiring cable becomes wet or dampened with the operating liquid by mistake, this may result in a fire or cause an electrical shock. Install the motor and wiring cable in positions which are not likely to become wet or dampened with any liquid.


Prohibited

- **Ventilate.**
  Poisoning may result during an operation which involves toxic or odorous liquid. Ventilate the operating site sufficiently.


Caution

- **Spill-out accident.**
  Protective measures should be taken against any accidental spill-out or leakage of the operating liquid as a result of unexpected damage on the pump or the related piping.


Caution

⚠ Caution

- **Operating site must be free of water and humidity.**
  The pump is not designed to be water-proof or dust-proof. The use of the pump in places where water splashes or humidity is high may result in an electrical shock or short circuit.


Prohibited

- **Do not damage power cable.**
  Do not scratch, damage, process, or pull the power cable forcibly. An extra load onto the cable, such as heating the cable or placing something heavy on the cable, may damage the cable and finally cause a fire or an electrical shock.


Caution

- **Do not cover the motor.**
  Running a covered motor may accumulate heat inside the motor and cause a fire or a mechanical failure. Ventilate the motor sufficiently.

- **Arrange grounding.**
  Do not operate the pump without connecting the grounding wire. Otherwise, an electrical shock may result. Make sure the grounding wire is connected with the grounding terminal.


Grounding

- **Install an earth leakage breaker (option).**
  The operation of a pump without using an earth leakage breaker may cause an electrical shock. Please purchase an optional leakage breaker and install in the system.


Electrical Shock

⚠ Caution

- **Power cable cannot be replaced.**
  Never use a damaged or affected power cable. Otherwise, a fire or an electrical shock may result. Handle the power cable carefully, as it cannot to be replaced by a new cable. (The complete motor must be replaced in that circumstance.)


Caution

- **Limited operating site and storage.**
  Do not install or store the pump in the following places:
  * Places where a flammable gas or material is used or stored.
  * Places where the ambient temperature is extremely high (40°C or higher) or extremely low (0°C or lower).


Prohibited

- **Do not drain the liquid in the site.**
  The liquid discharged out of the pump, including a hazardous chemical liquid, must be drained into a special container. Never drain such liquid directly onto the floor in or near the operation site.


Prohibited

- **Disposal of used pump.**
  Disposal of used or damaged pumps must be done in accordance with the relevant local laws and regulations. (Consult a licensed industrial waste products disposing company.)

- **Countermeasure for static electricity.**
  When liquids with a conductivity at rest of less than 1000 pS/m, especially less than 100 pS/m (e.g. hydrocarbons and halogenated hydrocarbons) are pumped, static electricity may be produced inside the pump during high flow velocities, which causes leakage from pump housing due to pin holing. Take countermeasure to avoid static electricity (e.g. increase conductivity, reduce flow velocity). Dangerous static electricity is not expected to occur with homogenous water mixed liquids.

2. Unpacking and Inspection

After unpacking the product, check the following points.

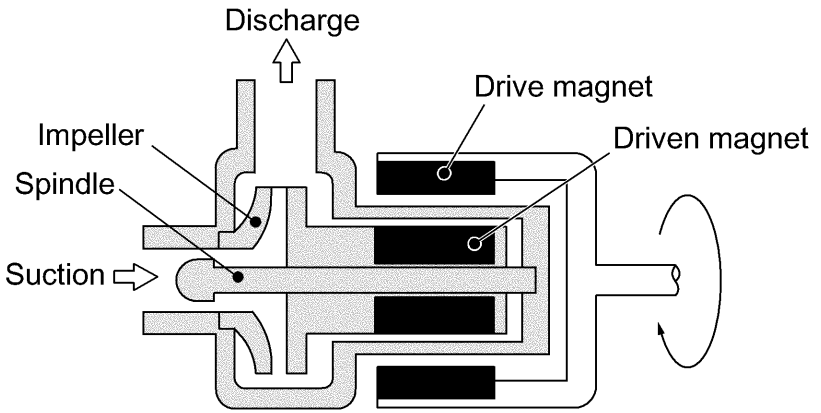
[1] Do the model, flow and head indicated on the nameplate correspond with your order?

[2] Has the pump or any part of it been damaged as a result of accident or handling during shipment?

If you find any discrepancy, please contact your dealer.

3. Operating Principle

The centrifugal pump is driven by pair of magnets which are incorporated in the impeller and motor shaft. The sealless pump structure eliminates shaft seals such as conventional mechanical seals because the pump chamber is shielded by the casings and the impeller is operated by the magnets. The combined coupling torque of the drive magnet and impeller magnet gives sufficient driving power against the motor torque.



4. Model Identification Codes

MX – F 100 V M Y – 32
(1) (2) (3) (4) (5) (6)

(1) Series code

MX : Casing material of GFRPP
MX-F : Casing material of CFRETFE

(2) Pump size code

70 : Not available for MX-F type
100 : Available for MX and MX-F types

(3) Wet end material code

MX V : FKM O ring
E : EPDM O ring
MX-F RV : PTFE bearing × FKM O ring
KV : SiC bearing × FKM O ring

(4) Connection of suction/discharge ports

No code : Hose connection (Available for MX only)
M : Threaded connection

(5) Impeller code

MX : No code
MX-F : Y for both 50 and 60Hz
Z for exclusive for 60Hz

(6) Motor voltage code

No code : 1-phase 100V
11 : 1-phase 110V
13 : 1-phase 220/240V
32 : 3-phase 200/220V
33 : 3-phase 220/380V
34 : 3-phase 400/440V

5. Specifications

50/60Hz

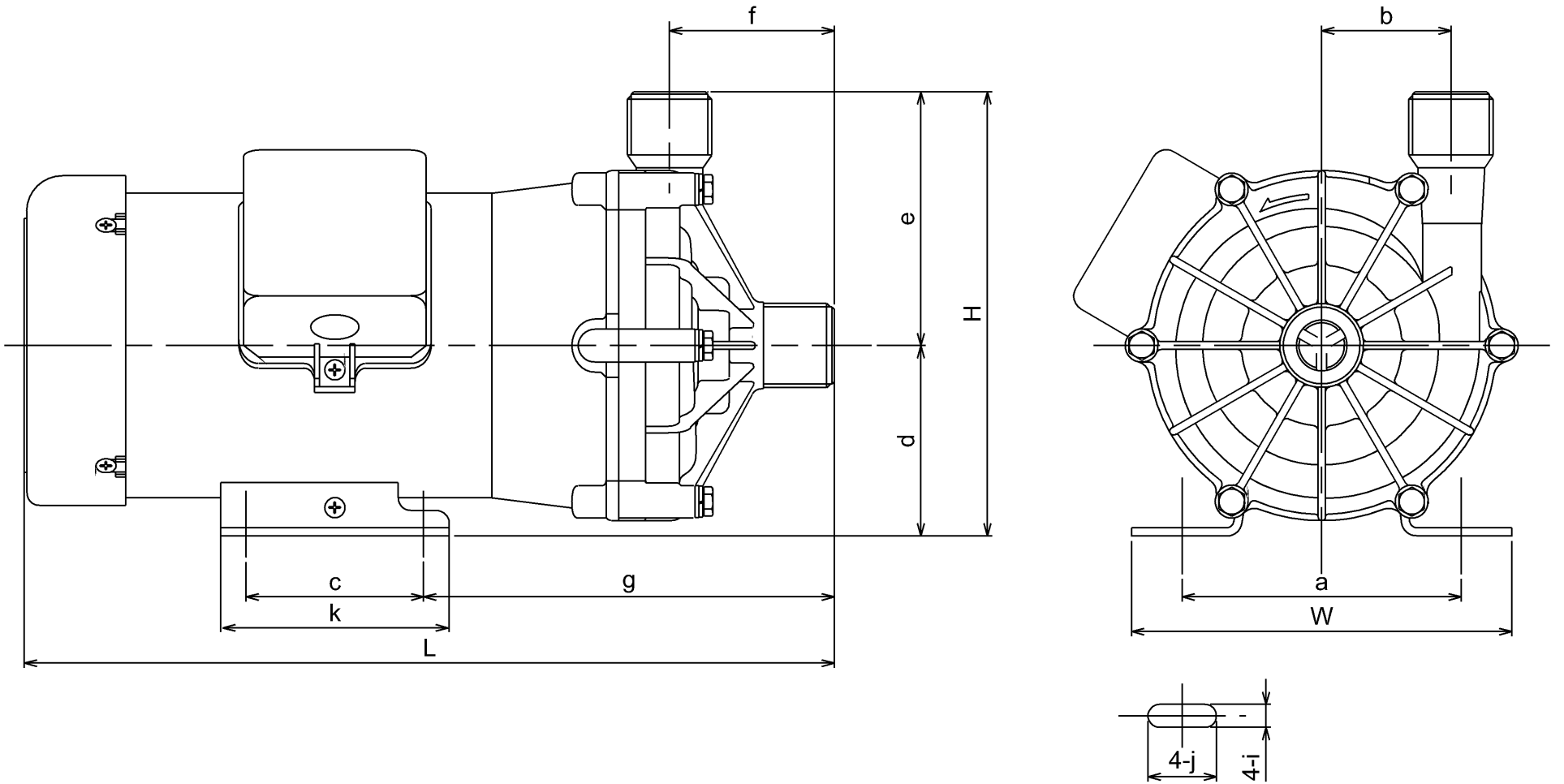
Model	Port size (mm)		Threaded connection		Max. flow rate (*l*/min)	Max. head (m)	Max. specific gravity of liquid	Motor		Mass (kg)
	Suction port	Discharge port	Suction/ Discharge	Union				Power source voltage (V)	Rated output (W)	
MX-70 (M)	26	26	G1	20	90/100	8/11	1.0	Single phase : 110V, 220/240V Three phase : 200/220V, 220/380V, 400/440V	150/180	6.5
MX-100 (M)	26	26	G1	20	110/125	8.4/11.7	1.2		260/260	8.2
MX-F100MY	–	–	G1	–	110/125	8.2/11.5	1.9/1.2			8.5
MX-F100MZ	–	–	G1	–	–/110	–/8.2	–/1.8			

Note:

1. Pump performance data is based on pumping clean water at amb. temp.
2. Do not run pump with discharge valve fully closed. Otherwise pump life may be shortened.
3. Maximum viscosity of liquid: 0.03 Pa·s (for a specific gravity of 1.0)
4. Permissible liquid temperature: 0~80°C
   (When IWAKI option union is used, the liquid temp. is limited to 0~55°C. Also, the permissible temperature may differ depending upon the type of liquid and operating conditions.)
5. The maximum specific gravity of the liquid is the value at max. flow rate.
   The value varies depending on the flow rate, ambient temperature, viscosity of liquid, etc.
6. Motor: Single-phase capacitor motor or 3-phase motor.

   * Built-in thermal protector
   A thermal protector is built in the motor. The device automatically stops motor operation when the motor is overheated. (The motor starts again the operation when the temperature falls to normal.)

6. Outer Dimensions and Performance Curve



	W	H	L	a	b	c	d	e	f	g	i	j	k
MX-70 (M)	130	155	258.5	110	48	40	65	90	53	159.5	7	11	60
MX-(F)100 (M)	150	175	319.5	110	51	70	75	100	65	162	9	27	90

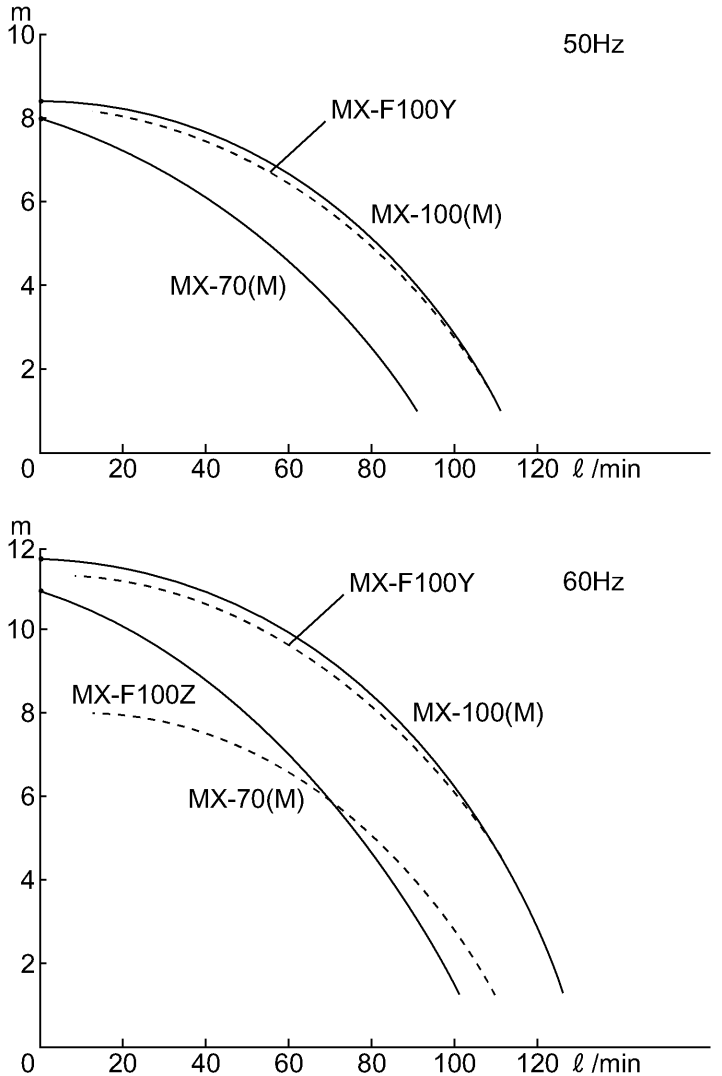
■ Optional accessory

Available are unions for threaded suction/discharge ports.
Not available for MX-F100.

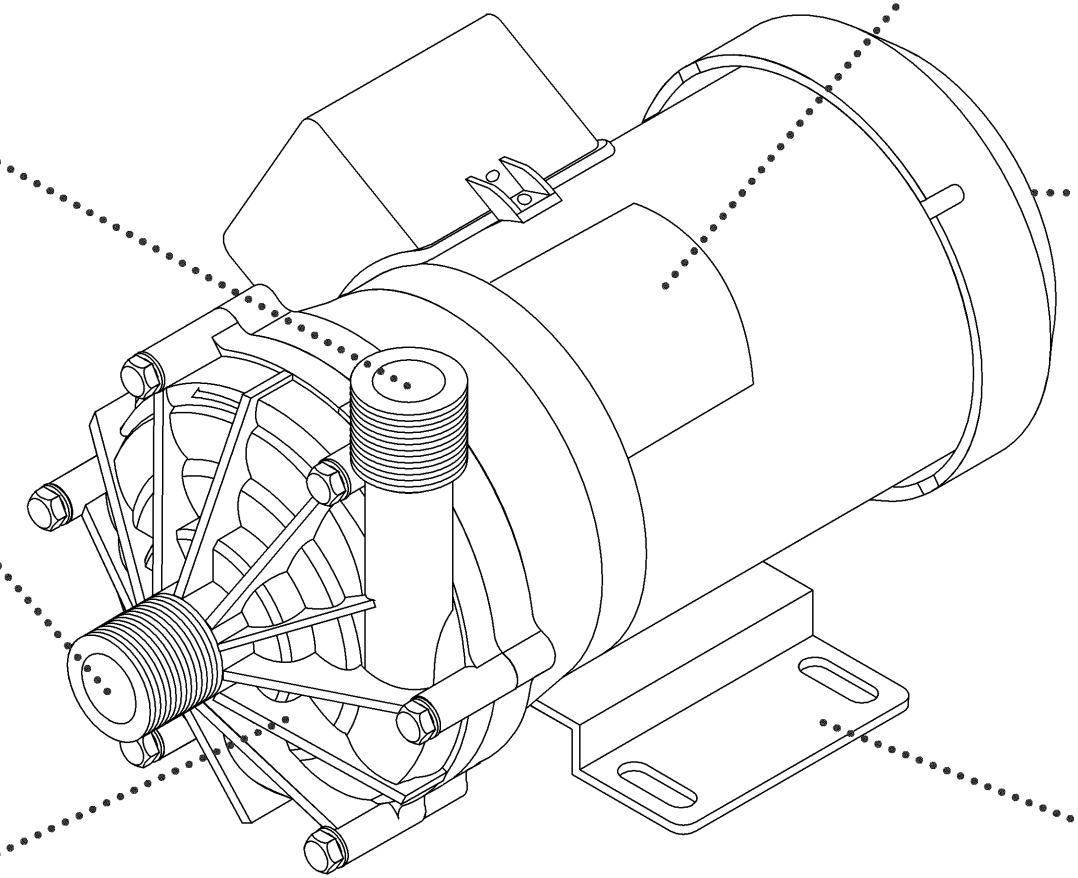
Model	Connection size	Applicable O ring	Applicable union
MX-70 (M)	G1	AS-568-020	20A
MX-100 (M)	G1	AS-568-020	20A

■ Standard Performance Curve

(Pumping clean water at room temperature)



7. Main Parts and Label



Specifications label
Use the pump observing the specifications described on the label.

Discharge port

Motor (Driving unit)
Install the pump at the place where the liquid can not be splashed.

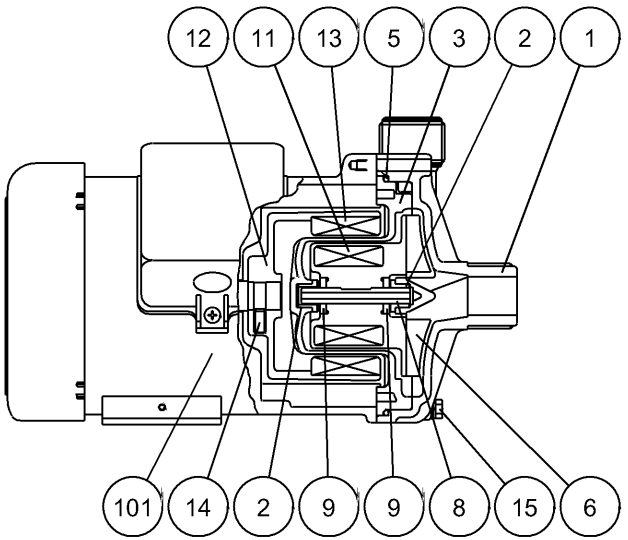
Suction port

Base
Fix pump securely.

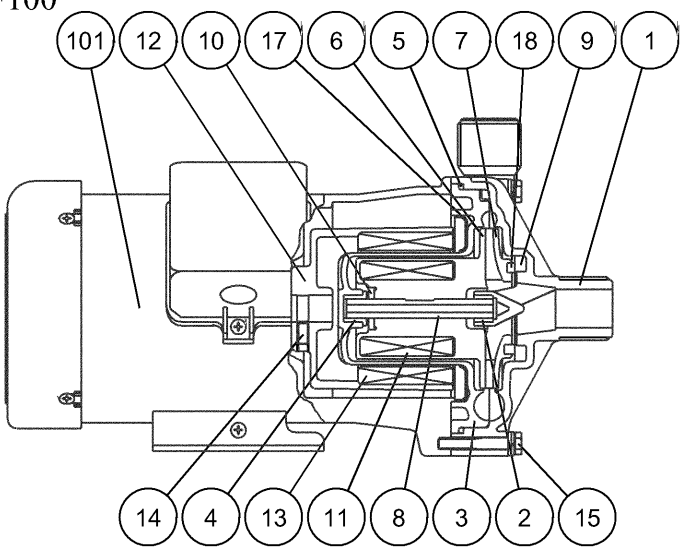
Pump unit
Pump is not self priming. Install pump so that pump chamber can be filled with liquid.

8. Name of Parts

MX-70



MX-100/F100



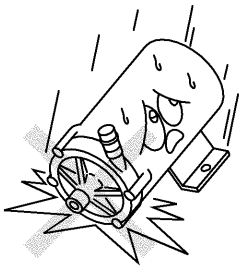
No.	Parts name	Q'ty	Material				No.	Parts name	Q'ty	Material			
			MX-70	MX-100	MX-F100RV	MX-F100KV				MX-70	MX-100	MX-F100RV	MX-F100KV
1	Front casing	1	GFRPP		CFRETFE		10	Impeller thrust (Note)	1	–	Ceramic	High purity ceramic	SiC
2	MX-70:Bearing	2	PPS	–	–	–	11	Driven magnet	1				
	MX-100:Bearing A	1	–	Fluoroplastics		SiC	12	Magnet housing	1				
3	Rear casing	1	GFRPP		CFRETFE		13	Drive magnet	1				
4	MX-100:Bearing B	1	–	Fluoroplastics		SiC	14	Hex. soc. head screw	2	Steel			
5	O ring	1	FKM, EPDM		FKM		15	Hex head bolt	6	Stainless steel			
6	Impeller	1	CFRPP		CFRETFE		17	Retainer ring	1	–	Stainless steel		
7	Shroud	1	CFRPP		CFRETFE		18	Mouth ring	1	–	Fluoroplastics		–
8	Spindle	1	Ceramic		High purity ceramic	SiC	101	Motor	1				
9	MX-70:Thrust	2	Ceramic	–	–	–							
	MX-100:Front thrust	1	–	Ceramic	High purity ceramic	–							

Note: MX-F100KV has two impeller thrusts (front and rear).

9. Handling

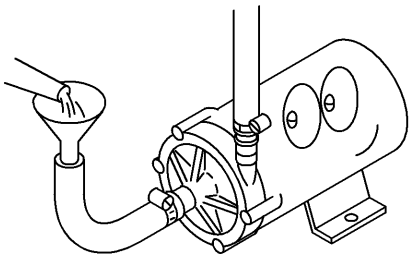
(1) Handle the pump carefully

Strong impacts caused by dropping the pump on the floor or striking it may result in damage or faulty performance.



(2) Priming water

Be sure to fill the pump unit with liquid as priming water before pump operation.



⚠ Caution

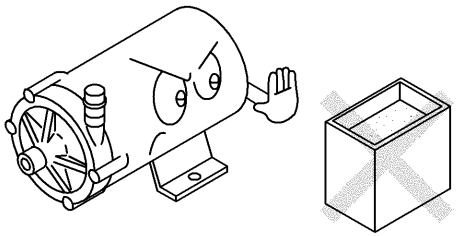
Operating the pump dry (operation without liquid) may cause seizure or wear of pump parts resulting in damage of pump.
It is also possible that, after more than 30 seconds dry running, incendive elctrostatic discharges are produced.

(3) Range of liquid temperature

0 ~ 80°C

The above range may differ depending on liquid. However, any liquid that freezes cannot be used. For details, contact Iwaki or your dealer.

(4) As there is a powerful magnet inside the pump unit, do not use any liquid that contains metallic substances such as iron, nickel, etc.



(5) Do not operate the pump in the following places.

- The pump unit is not designed to be dust and water-proof.
  - · Places exposed to rain and/or wind
  - · Places where the temperature falls below 0°C
  - · Places where corrosive gas (such as chlorine gas) is generated.
  - · Places exposed to splashing or dropping of water
  - · Places where the ambient temperature is 40°C or above
  - · Places where explosive.

(6) The relative humidity should be 90% or below. Be careful not to allow dust and water inside the motor unit. The motor should not be splashed with water, otherwise it may short-circuit or burn.

(7) Do not operate the pump with the following liquids.

- For the compatibility to chemical liquid or any special liquid, contact IWAKI sales representative.
- Liquids that significantly swell polypropylene (for MX-70, MX-100)
- Paraffinic hydrocarbons such as gasoline and kerosene (for MX-70, MX-100)
- Halogenated hydrocarbons such as trichloroethylene and carbon tetrachloride
- Ether and low-grade ester
- Slurry
  (Never use slurry, which wears out the pump bearing.)

⚠ **Cautions when dangerous liquids are transferred.**

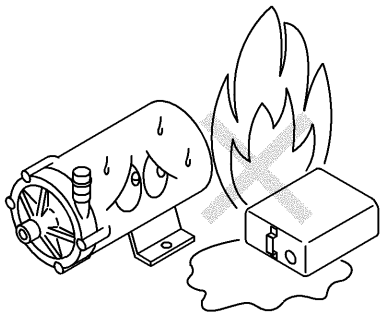
When the pumps are used to transfer the dangerous liquids mentioned as below, the pumps always must be checked and watched so that the liquids can not be leaked. The operation of the pumps leaking the liquids may result in personal injury and/or explosion, fire accidents.

- Inflammable liquids
- Corrosive and toxic liquids
- Liquids harmful to human body

Diethylether, carbon disulphide, peroxides, explosives, organic compounds with high ring tension such as cyclo butane and ethylene oxide, and similar liquids can not be pumped. Special care must be taken to avoid dry running when liquids are pumped which produce their most incendive vapour at room temperature (e.g. toluene).

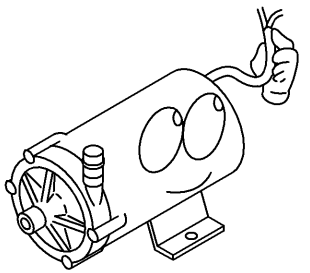
(8) Keep the pump away from fire.

To prevent fire and explosions, do not place dangerous or inflammable substances near the pump.



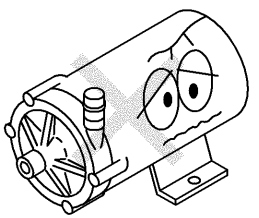
(9) Grounding

Be sure to connect the grounding cable (green/yellow). In addition, arrange an earth leakage breaker to prevent electrical shocks.



(10) If pump is damaged

Do not operate a damaged pump, otherwise there may happen the electricity leakage or electric shocks.



(11) Surface temperature

The surface temperature of the motor or the pump may be extremely high during the pump operation.
Do not touch it directly.

(12) Sound generated by pump

Level of sound generated by pump is shown in table below.

(dB)

Model	Sound Level (Note)
MX-70	70
MX-(F)100	75

Note: When measured at a distance of 1m A scale.

10. Installation, Piping and Wiring

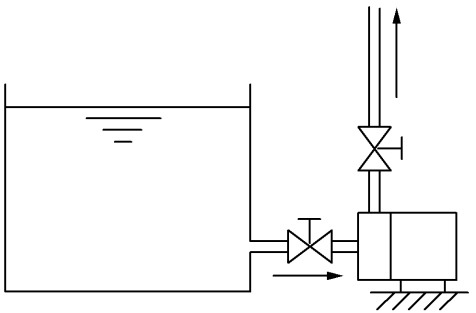
10-1. Installation

(1) Installation site

An installation site must be an ambient temperature of 0~40°C and a relative humidity of lower than 90%. Install the pump at the place where the maintenance and inspection work can be done easily.

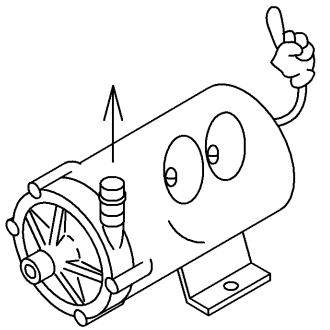
(2) Pump installation method

This pump is not the selfpriming pump. The pump shall be installed in a position lower than the liquid level of the suction tank.
Liquid level must be higher by 30 cm than the pump suction port level. If this distance is too short, the air may be sucked in the pump, which will cause abnormal wear of pump bearing.



(3) Direction of pump discharge port

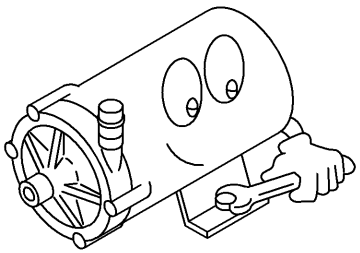
The discharge port can be directed as desired. However, for efficient elimination of the air out of the pump chamber, it is recommended that the discharge port is directed upward.



(4) Anchoring of base

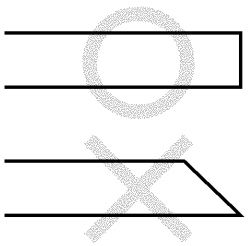
The base of the pump must be anchored firmly.

The pump must not be mounted in a vertical position.



(5) Hose preparation

The ends of the hoses should be cut flat before connecting them.



10-2. Piping

Piping instructions

(1) To minimize the friction resistance, the shortest piping possible with the minimum number of bends should be utilized. Especially for suction piping, employ as larger and shorter hose as possible.

(2) Use a corrosion-resistant vinyl hose that can endure the pressure made by the pump operation.

If the connection on the suction side is inadequate, air may be mixed in.

(3) Hose size

Select a hose in accordance with the diameter of the pump port.
A reliable connection is not guaranteed if different size of hose is used.

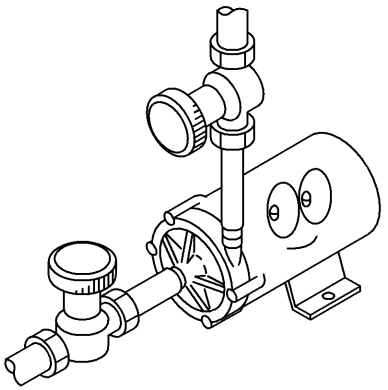
As the hose on the suction side, in particular, tends to be crushed under the sucking force, the use of a braided hose is recommended. **(In the case of hot liquid feeding, special attention must be paid in the selection of a hose.)**

(4) Valve installation

Install valves close to the suction and discharge port.

· Suction side valve:
For easy removal or maintenance of the pump.

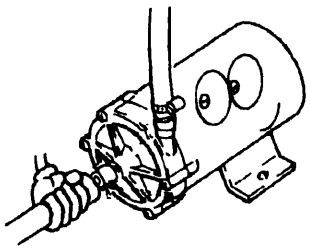
· Discharge side valve:
For adjustment of the discharge rate or head.



(5) Hose connection

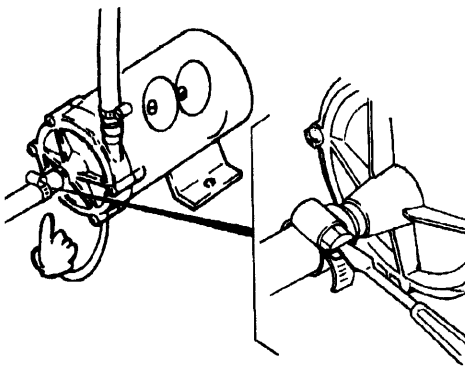
Press the hose end firmly against the discharge or suction port until it reaches the bottom of the port.

*Use a fastener (such as a hose band) to make the connection firm and free of liquid leakage.



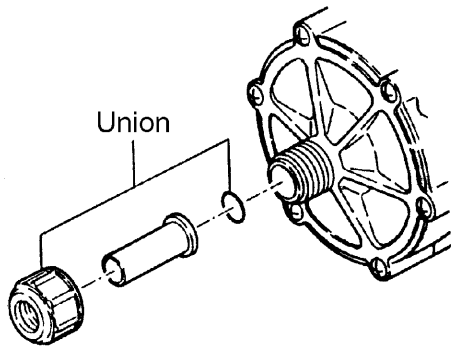
⚠ **Caution**

Do not tighten the connection ports (suction and discharge) excessively as they are made of plastic resin and are easily damaged.



(6) Piping (Threaded connection)

a) Use the pipe resistible to pump pressure. For piping of MX-F100, use chemical resistible pipe such as Teflon pipe or Teflon lined steel pipe.
Apply seal tape to the threads so that the air can not be sucked in.

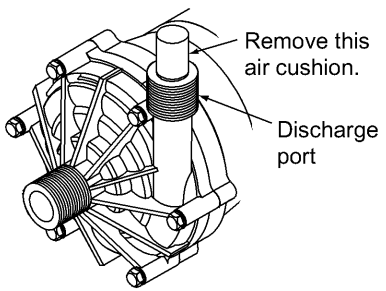


b) Pay attention not to tighten threads excessively.
As an option, union is available. (Not available for MX-F100.)

⚠ Caution
Wrong and insufficient connection at suction side make air be sucked in, which may cause lowered performance, dry running and impeller seizure and blockage.

⚠ Caution
Do not use O ring seal for union connection for MX-F100.

⚠ Caution
For MX-F100KV model, an air cushion is put in discharge port to avoid the crack of inside parts during transportation. Take the air cushion off before the piping work is done. Pay special attention to handling MX-F100KV model because this model employs SiC material parts which may be possibly broken by external shock.



c) Do not load on suction and discharge ports.

10-3. Electrical wiring

(1) Prior to wiring work, check the voltage specified on the Nameplate and check if the power is disconnected.

(2) Observe the local regulations related with electrical work.

(3) Pump has not ON/OFF switch. It starts running when power is supplied by connecting the cable.

(4) Connect a ground wire to the screw marked "E"

(5) In case an earth leakage breaker is installed
When an earth leakage breaker operates, reset it after the reason was settled.

Rated current, Starting current

Power source voltage	Rated current (50/60Hz)		Starting current (50/60Hz)	
	MX-70 (M)	MX-(F)100 (M)	MX-70 (M)	MX-F100 (M)
110V (1-phase)	2.7A / 3.8A	4.0A / 4.0A	8.2A / 7.6A	8.8A / 8.4A
220·240V (1-phase)	1.2A / 1.8A	1.58A / 1.83A	3.4A / 3.1A 3.6A / 3.3A	3.9A / 3.7A 4.3A / 3.9A
200·220V (3-phase)	0.9A / 1.3A	1.2A / 1.2A	3.5A / 3.2A	3.7A / 3.4A
220·380V (3-phase)	1.1A · 0.7A	1.1A · 0.63A	3.5A · 2.0A	3.7A · 2.1A
400·440V (3-phase)	0.46A / 0.61A	0.58A / 0.6A	1.2A · 1.3A	1.9A / 2.0A 2.1A / 2.1A

11. Operation

■ Operation instructions

⚠ Caution

- *Before operating the pump, confirm that the hoses or pipes connected with the discharge port and suction port are firmly fixed in position.*
- *Dry operation (operation without liquid in the pump) damages the pump. It is also possible that, after more than 30 seconds dry running, incendive electrostatic discharges are produced. Be sure to fill the pump with priming liquid in advance.*
- *Do not keep on operating the pump with entirely or almost closed discharge or/and suction side valve(s).*
- *Do not open or close the suction or discharge side valve suddenly, otherwise the magnet coupling may be detached, disabling the rotation of the impeller. (Under such circumstances, turn off the power supply. When the motor stops rotating, the coupling will be connected.)*

■ Operation

After the installation, piping and wiring processes are completed, operate the pump in accordance with the following steps.

No.	Operation Step	Description (Points to be Checked)
1	Check piping, wiring and voltage.	Check in accordance with the 'Hose connection' and 'Wiring' sections. Check the power supply voltage by referring to the information on the nameplate.
2	Open and close valves.	• Fully open suction side valve. • Fully close discharge side valve.
3	Check that pump chamber is filled with liquid.	• Fill pump chamber with priming water (feeding liquid). Carry out sufficient priming in case of suction lift method.
4	Supply power to pump	After steps 1 to 3 above, connect power supply to start pump.

No.	Operation Step	Description (Points to be Checked)
5	Adjust discharge capacity & head to desired values.	Adjust discharge side valve gradually till desired discharge capacity and head are obtained. Do not open or close valves suddenly. ***Note: Do not keep discharge side valve closed for more than 1 minute.*** ***Note: Check that pump feeds liquid normally. If not, turn off power immediately and eliminate cause referring to 'Causes of Trouble and Troubleshooting' section (p.18).***
6	Checkpoints during operation	• Be careful to prevent foreign matter from entering pump. Foreign matter in pump may cause impeller to be locked, hindering liquid circulation. Motor itself continues to rotate even if impeller is locked. In such a case, turn off power supply at once. • When earth leakage breaker is activated, turn off power supply at once and eliminate cause by referring to 'Causes of Trouble and Troubleshooting' section.

■ Pump Stopping Procedure

No.	Stopping Step	Description
1	Close discharge side valve.	Close discharge side valve gradually. Do not use electromagnetic valve for quick closing.
2	Turn off power supply. (Check stopping condition.)	Check that motor stops smoothly after power supply is disconnected. If not, pump should be inspected. (For details, contact Iwaki or your dealer.)

■ How to store pump when it is out of use for a long time

Remove the liquid from the pump if it is to be stored for a long time. In addition, run it with water circulating for about 5 minutes every 3 months to prevent rust on the motor bearing.

12. Causes of Trouble and Troubleshooting

Trouble / Cause	Pump does not start.	No pumping or insufficient pumping.	Electric current is too high.	Excessive noise or vibration.	Liquid leaks.	Troubleshooting
Power is not supplied or wiring is faulty.	○		○			Supply power or contact your dealer.
Motor is out of order (disconnected coil or capacitor failure).	○		○			Contact your dealer.
There is residual air in the pump.		○		○		Eliminate air completely.
Air is sucked in via suction port.		○				Fasten hose or pipe tightly.
Pump is driven dry.		○	○	○		Supply priming water to pump.
Specific gravity/viscosity of liquid is too high.	○	○	○			Use suitable type of pump.
Periphery of impeller magnet is in contact with rear casing.		○	○	○		Contact your dealer.
Impeller is damaged.	○	○	○	○		Contact your dealer.
Foreign matter adheres to impeller.		○	○	○		Contact your dealer.
O ring is damaged.					○	Contact your dealer.
Loosened front casing fixing bolts.		○			○	Tighten bolts.

13. Maintenance and inspection

Tightening of screws

When the pump has been used for a long time, it may happen the pump mounting screws are loosened. In this case tighten screws paying attention not to deform the plastic materials.
When the pump has been stocked, also tighten screws.
Screw tightening torque : 2.9 Nm for MX-70, 3.4 Nm for MX-100 & MX-F100

Daily inspection

Check to see if pump makes no abnormal vibration nor abnormal sound. Also check the electric current of motor and pump discharge capacity. If you find any abnormality, quickly switch off the power and see the item Troubleshooting to settle the trouble.

Draining Method

⚠ Warning

- *Before starting the draining procedure, turn off the power supply.*
- *Be sure to wear proper safety gear (gloves, protective shoes, etc.) during draining work. When chemical liquid is used, wear rubber gloves, goggles).*

⚠ Caution

- *Pay special attention to the remaining liquid which may run out of the discharge port or the suction port when removing the hose. Pay attention not to allow the motor or electric parts to come into contact with the liquid.*
- *Never discharge hazardous or chemical liquid over the ground or floor in the plant. Instead, use a draining pan (or container). Observe each applicable local law or regulation for the handling or disposal of hazardous liquids.*

Draining procedure:

(1) Turn off the power supply.
(Make sure no other operator will turn on the power supply accidentally.)

(2) Close the discharge and suction sides valves fully.

(3) Remove the hoses connected with the discharge port and the suction port.
Position the draining pan below the pump unit in advance. Loosen the hose band and rotate the hose clockwise and counterclockwise slowly to completely pull the hose off of each port. (Liquid will run out when the hose is disconnected.)

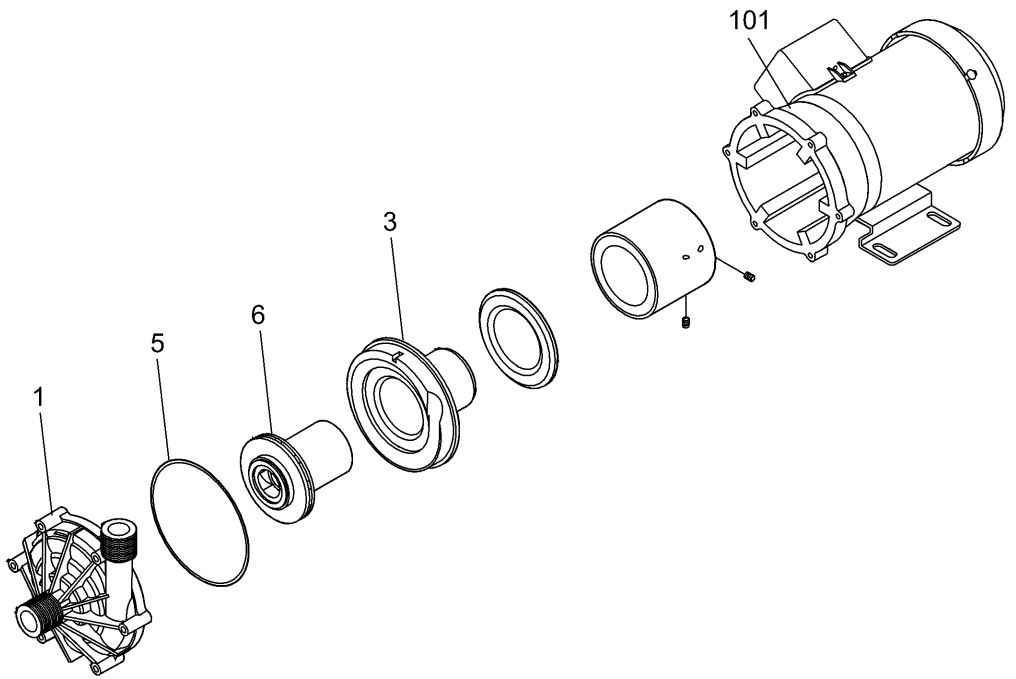
(4) Remove the screws on the pump base to detach the pump unit.

(5) Direct the discharge port downward to drain the liquid into the draining pan.
Never discharge hazardous liquid, over the ground or the floor inside the plant. Use a draining pan (or container).

14. Consumable parts

- Consumable parts shown below must be replaced within indicated replacement time. Replacement time shown below is based on pumping clear water at ambient temperature and it is influenced by characteristics and temperature of handled liquid and also influenced if liquid contains slurries (solid substance).
- Damage or loss caused by corrosion by liquid or wear by slurries are not guaranteed.
- Replace O ring every time when pump is disassembled regardless of replacement time shown below.

No.	Parts	Replacement time
1	Front casing unit	10,000 hours
5	O ring	
6	Impeller unit	
3	Rear casing unit	
101	Motor	



IWAKI PUMPS

( )Country codes

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Sweden	: IWAKI Sverige AB	TEL : (46)8 511 72900	FAX : 8 511 72922
Finland	: IWAKI Suomi Oy	TEL : (358)9 2742714	FAX : 9 2742715
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Belgium	: IWAKI Belgium n.v.	TEL : (32)1430 7007	FAX : 1430 7008

T454-7 '03/12

IWAKI PUMPS

IWAKI Magnetic Drive Pump

MX Series (MX-250~403)

Instruction Manual (Asian Edition)

⚠ Read this manual before use of product

This is patent pending product.

Thank you for selecting the Iwaki Magnetic Drive Pump MX Series. This instruction manual has been prepared to ensure correct and safe handling of the pump.

Please read this manual carefully and thoroughly prior to operating the pump.

Pay special attention to the "Safety Instruction to Prevent Personal Injuries," "Warning," and "Caution" messages included in this manual.

This instruction manual should be kept by each end user and within reach of the actual operator, for quick reference when needed.

Contents

Safety section

For the Safe and Correct Handling of the Pump

- Before use of the pump, read carefully this "Safety Section" to prevent accidents and to avoid the damage or loss of other assets.
- Observe and abide by the instructions described in this "Safety Section". These instructions are very important for protecting pump users or other persons from hazard or from loss of assets.
- Meaning of symbols
  Following two symbols describe the extent of hazards and loss which may brought if the instructions are not observed or if the pump is wrongly used.

 **Warning**	**Nonobservance or misapplication of the contents of the "Warning" could lead to a death or heavy injury of person.**
 **Caution**	**Nonobservance or misapplication of the contents of the "Caution" could lead to a injury of person or damage of assets.**

Following two symbols describe the content to be observed.

	**Prohibited action or procedure is indicated. Inside or near this circle, a concrete activity to be prohibited is depicted.**
	**Action or procedure which must be performed without fail is indicated. Inside this circle, a concrete activity to be performed is depicted.**

Safety section

⚠ Warning

- **Damaged or deteriorated tools are very dangerous.** Use qualified and suitable tools only.

- **Use of protectors:** When disassembling, assembling, and conducting maintenance or when handling a dangerous type of liquid or a liquid of unknown property, be sure to wear safety gloves, a helmet, and protective shoes. In addition, when handling wet-end parts, always wear protective goggles, masks, etc.

- **To prevent death or injury from a falling pump,** make sure the rope or chain used for lifting the pump is not accidentally cut or disconnected during installation. Make sure the rope or the chain used to lift the pump has sufficient strength in relation to the pump weight.

- **When lifting the pump with rope or chain,** be sure to use lifting bolts (or rings). Never use any other points for lifting the pump. Otherwise the pump may drop and results in human injury.

- **Always turn off the power supply prior to do maintenance or other works.** Make special provisions so that no other operator mistakenly turns on the power supply while someone is working on the pump. In a noisy or poor visibity environment, display a sign near the power supply switch to notify others that someone is "WORKING" on the pump. Power supply mistakenly turned on during maintenance may lead to personal injury.

- **Magnetic field hazard**
  The magnetic drive pumps contain strong magnets which are located in magnet capsule and drive magnet cylinder. The powerful magnetic fields could adversely affect persons who are assisted by electronic devices such as pacemaker. etc.

- **When handling a toxic or odorant liquid,** ventilate the working area well. In addition, the operator must wear protector gear (such as a safety mask, safety goggles, and protective gloves).

Safety section

⚠ Warning

- **Platic material parts (Casing, flange, baseplate)**
  Do not hold plastic material parts when you lift the pump. Otherwise plastic parts may be broken and pump may drop resulting in human injury.

- **No remodeling**
  Remodeling of the pump by the user may result in serious personal injury, electric shock, or damage to the pump. Do not attempt remodeling as it is very dangerous.

- **Cautions when dangerous liquids are transferred.**
  When the pumps are used to transfer the dangerous liquids mentioned as below, the pumps always must be checked and watched so that the liquids can not be leaked. The operation of the pumps leaking the liquids may result in personal injury and/or explosion, fire accidents.
  - Explosive and inflammable liquids
  - Corrosive and toxic liquids
  - Liquids harmful to human body

⚠ Caution

- **Qualified operators only**
  The pump operator and pump operation supervisor must not allow any operators who have little or no knowledge of the pump to run operate the pump. Pump operators must have a sound knowledge of the pump and its operation.

- **For specified application only**
  The pump is designed and manufactured to the specifications agreed upon by the user and Iwaki. The use of a pump in any application other than those clearly specified may result in injury or damage to the pump. Use the pump strictly in accordance with the pump specifications and application range. If you change any specification, contact Iwaki or your dealer.

- **Run the pump at the specified power supply voltage indicated on the nameplate.**
  Otherwise, pump failure, fire or electric shock may result.

- **Spill-out prevention measures**
  Suitable protective measures should be taken against any liquid spill-out accidents. Never discharge hazardous liquid, including, but not limited to, chemical liquid, over the ground or floor on the pump operating site. Follow local rules and regulations in disposing of hazardous substances.

Safety section

⚠ Caution

- **Do not operate the pump dry.**
  Do not run the pump dry (without liquid inside the pump). Heat generated as a result of abrasion between elements inside the pump during operation without liquid may damage the inside of the pump. Operating the pump with the suction valve fully closed will result in dry operation.


Prohibited

- **Keep away from heat or flame.**
  Do not place any open flame or flammable object near the pump.


Prohibited

- **Do not stand on the pump.**
  Do not stand on the pump or use the pump as a step under any circumstances. Otherwise, you may experience a serious injury.


Prohibited

- **Do not touch the pump.**
  When the pump is used to feed a hot liquid, do not touch the pump or the piping with your bare hands during and immediately after operation as their surfaces are dangerously hot.


Caution

- **Arrange grounding**
  Do not operate the pump without connecting the grounding wire. Otherwise, an electrical shock may result. Make sure the grounding wire is connected with the grounding terminal.


Grounding

- **Install an earth leakage breaker**
  The operation of a pump without using an earth leakage breaker may cause an electrical shock. Please install an optional leakage breaker in the system.


Electrical Shock

- **Do not install or store the pump in the following places.**
  - Places where flammable gas, dust or material is used or placed.
  - Places where corrosive gas (chlorine gas or the like) is generated.
  - Places where the ambient temperature is extremely high (40 deg. C or higher) or extremely low, 0 deg. C or lower.
  - Places where the pump is exposed to extreme dust or humidity. (Excluding the outdoor type)
  - Places where vibrations occur.


Prohibited

- **Pump start-up**
  When connecting a power supply to the pump, make sure there is no person around the pump. The pump has no ON/OFF switch. The pump starts operation when the power is supplied by connecting the power supply cable.


Caution

Safety section

⚠Caution

- **Foreign matter**
  Should foreign matter enter the pump, turn off the power at once and remove the obstruction. Using the pump with foreign matter inside may cause damage to the pump or a malfunction.

- **Disposal of used pump**
  Disposal of used or damaged pumps must be done in accordance with local laws and regulations. (Consult a licensed industrial waste products disposing company.)

- **Strong magnetic power**
  The magnet used in the pump has a very high magnetic power. Be careful not to allow your fingers to be seized by the magnet or to allow the magnet near any electronic device which may be affected by the magnet's power.

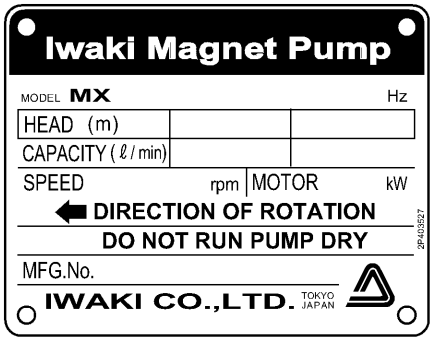
- **When suspending pump operation for a prolonged period**
  When suspending pump operation for a prolonged period, drain and clean the pump. Take appropriate measures to prevent the foreign matter getting into the pump. If the pump is not operated for a period longer than one year, replace the O ring and inspect the pump inside.

- **Countermeasure for static electricity**
  When low electric conductivity liquid such as ultra-pure water and fluor inactive liquid(e.g.FluorinertTM) are handled, the static electricity may be generated in pump, which may cause static discharge and break down of pump. Take countermeasure to avoid and remove the static electrici.

- **Ventilate**
  When toxic and odorous liquid is handled, ventilate the site to avoid poisoring.

OUTLINE OF PRODUCT

1. Unpacking and inspection



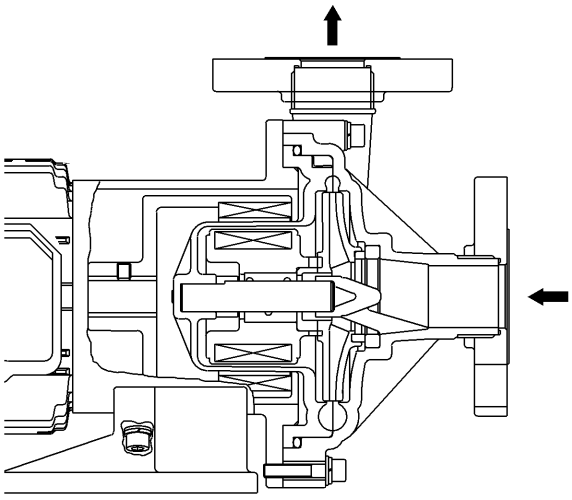
After unpacking, check the following points to confirm that the delivered product and its accompanying parts and elements are exactly what you ordered.

[1] Do the model and frequency indicated on the nameplate conform to your order?

[2] Has the pump unit or any part of it been damaged or have bolts and nuts been loosened during delivery?

If you find anything wrong, please refer to the dealer you placed your order with.

2. Principle of operation



➡ : Liquid flow

The MX pump is a magnet-driven centrifugal type pump developed for various applications.
The impeller inside the pump chamber (front casing) is rotated by magnetic force to transfer liquid from the suction side to the discharge side.

3. Model identification code

MX – 400 C V 6 C – 2 S
(1) (2) (3) (4) (5) (6) (7)

(1) Pump bore and motor output code

Code	Pump bore (Suc. × Disch.)	Motor output
250	25A × 25A	0.4kW
251	25A × 25A	0.75kW
400	40A × 40A	0.4kW
401	40A × 40A	0.75kW
402, 402H	50A × 40A	1.5kW
403, 403H	50A × 40A	2.2kW

Note) Motor is two pole, three phase.

(2) Rubbing parts material

C : Carbon bearing × Alumina ceramic spindle

R : Filler charged fluoroplastics bearing × Alumina ceramic splindle

A : Alumina ceramic bearing × Alumina ceramic spindle (available for MX-250 to 401)

(3) O ring material

V : FKM

E : EPDM

A : Aflas®

(4) Impeller code

5 : 50Hz

6 : 60Hz

(5) Kind of motor

No code : Totally enclosed fan cooled indoor use

C : Totally enclosed fan cooled outdoor use

A : Safety increased motor

(6) Motor power voltage

MX-250, 251, 400, 401

Symbol	Voltage & frequency
2	200V (50/60Hz), 220V (60Hz)
3	220V (50/60Hz), 380V (50/60Hz)
4	380V (50/60Hz), 400V (50/60Hz), 415V (50Hz), 440V (60Hz)

MX-402(H), 403(H)

Symbol	Voltage & frequency
2	200V (50/60Hz), 220V (60Hz)
3	220V (50/60Hz), 380V (50/60Hz)
5	415V (50Hz)
6	380V (50/60Hz)

(7) Special version

S : Special version

4. Specification

50/60Hz

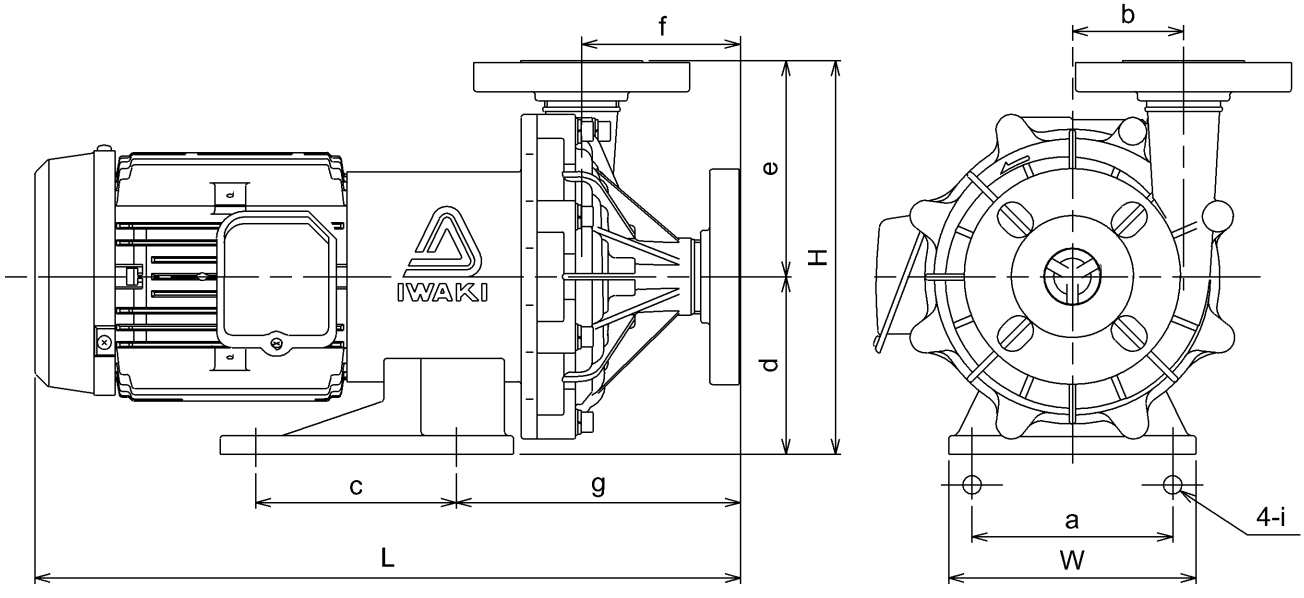
Model	Bore Suc. × Disch.	S.G. limit	Max. head (m)	Standard Specification (l/min, -m)	Max. Discharge capacity (l/min)	Motor output
MX-250	25 × 25	1.0	15.5	50 – 14/13.5	150	0.4kW
MX-251	25 × 25	1.0	22	80 – 19	150	0.75kW
MX-400	40 × 40	1.2	12.5/11.5	100 – 10.5/10	280	0.4kW
MX-401	40 × 40	1.2	17.5/17	150 – 14.5	320	0.75kW
MX-402	50 × 40	1.2	26/23	200 – 20	450	1.5kW
MX-402H	50 × 40	1.0	31	100 – 30	160	1.5kW
MX-403	50 × 40	1.2	30	250 – 23	500	2.2kW
MX-403H	50 × 40	1.0	35.5/37	100 – 35	300/250	2.2kW

Mass of pump (with motor)

MX-250, 400	MX-251, 401	MX-402, 402H	MX-403, 403H
13.5 kg	18.5 kg	30.5 kg	33 kg

5. Dimension

Model	W	H	L	a	b	c	d	e	f	g	i
MX-250	160	255	411	130	65	130	115	140	90	163	12
MX-251	160	255	444	130	65	130	115	140	90	171	12
MX-400	140	225	411	110	54	98	95	130	87	150	12
MX-401	160	255	457	130	72	130	115	140	103	184	12
MX-402(H), 403(H)	260	280	516	208	80	200	120	160	89	157	14×36

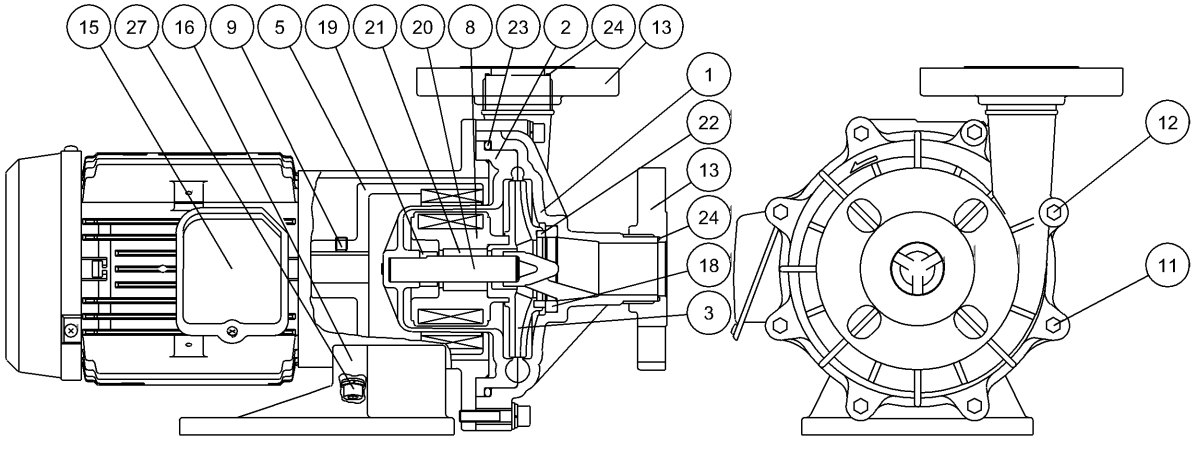


6. Name of parts and construction

(1) MX-250, 251 & 401

			MX-250		MX-251		MX-401	
No.	Name	Q'ty	Material	Remarks	Material	Remarks	Material	Remarks
1	Front casing	1	GFRPP		GFRPP		GFRPP	
2	Rear casing	1	GFRPP		GFRPP		GFRPP	
3	Impeller	1	GFRPP		GFRPP		GFRPP	
5	Drive magnet unit	1	Ferrite mag. + aluminum alloy		Ferrite mag. + FDC450		Ferrite mag. + FDC450	
8	Magnet capsule	1	Ferrite mag. + polypropylene		Ferrite mag. + polypropylene		Ferrite mag. + polypropylene	
9	Hex. head screw	2	Steel	M8 × 10	Steel	M8 × 10	Steel	M8 × 10
11	Hex. head bolt	6	Stainless steel	M8 × 35, with PW, SW	Stainless steel	M8 × 35, with PW, SW	Stainless steel	M8 × 40, with PW, SW
12	Hex. head bolt	2	Stainless steel	M8 × 50, with PW, SW	Stainless steel	M8 × 50, with PW, SW	Stainless steel	M8 × 50, with PW, SW
13	Flange	2	GFRPP		GFRPP		GFRPP	
15	Motor	1	0.4kW, 2P, 3-phase		0.75kW, 2P, 3-phase		0.75kW, 2P, 3-phase	
16	Base	1	GFRPP		GFRPP		GFRPP	

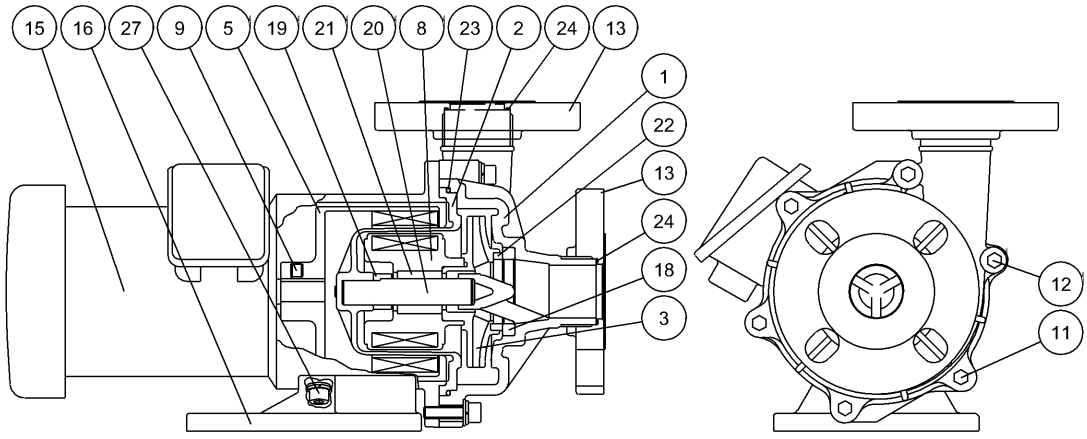
						MX-250, 251	MX-401
No.	Name	Q'ty	Material			Remarks	Remarks
			CV	RV	AV		
18	Liner ring	1	Alumina ceramic 99%				
19	Rear thrust	1	CFRPPS				
20	Spindle	1	Alumina ceramic 99.5%				
21	Bearing	1	Carbon	Filler charged fluororesin	Alumina ceramic		
22	Mouth ring	1	Filler charged fluororesin				
23	O ring	1	FKM			JIS B 2401 G165	JIS B 2401 G165
24	O ring	2				JIS B 2401 G25	AS568-129
27	Hex. head bolt	4	Steel			M8 × 20, with PW, SW	M8 × 20, with PW, SW



(2) MX-400

No.	Name	Q'ty	Material	Remarks
1	Front casing	1	GFRPP	
2	Rear casing	1	GFRPP	
3	Impeller	1	GFRPP	
5	Drive magnet unit	1	Ferrite magnet + aluminum alloy	
8	Magnet capsule	1	Ferrite magnet + polypropylene	
9	Hex. head screw	2	Steel	M8 × 10
11	Hex. head bolt	6	Stainless steel	M8 × 30, with PW, SW
12	Hex. head bolt	2	Stainless steel	M8 × 40, with PW, SW
13	Flange	2	GFRPP	
15	Motor	1	0.4kW, 2P, 3-phase	
16	Base	1	GFRPP	

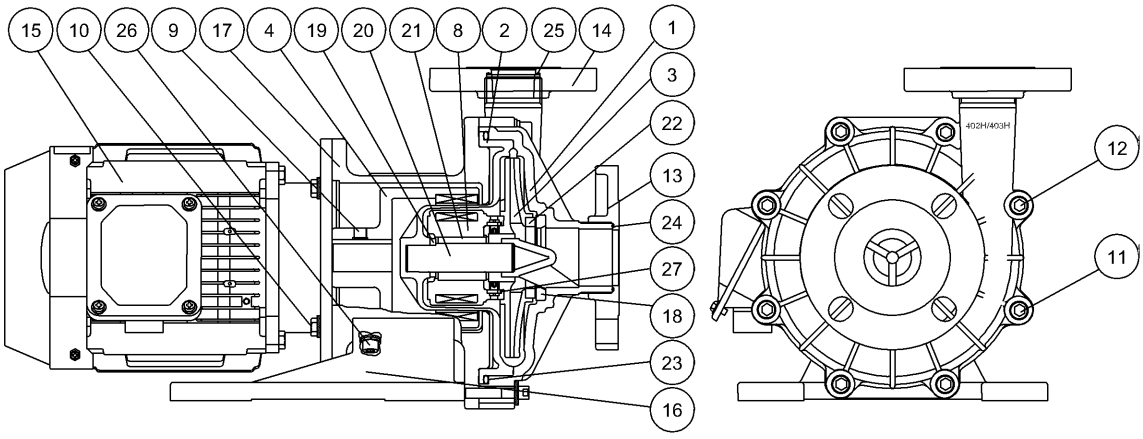
No.	Name	Q'ty	Material			Remarks
			CV	RV	AV	
18	Liner ring	1	Alumina ceramic 99%			
19	Rear thrust	1	CFRPPS			
20	Spindle	1	Alumina ceramic 99.5%			
21	Bearing	1	Carbon	Filler charged fluororesin	Alumina ceramic 99%	
22	Mouth ring	1	Filler charged fluororesin			
23	O ring	1	FKM			JIS B 2401 G135
24	O ring	2				AS568-129
27	Hex. head bolt	4	Steel			M8 × 20, with PW, SW



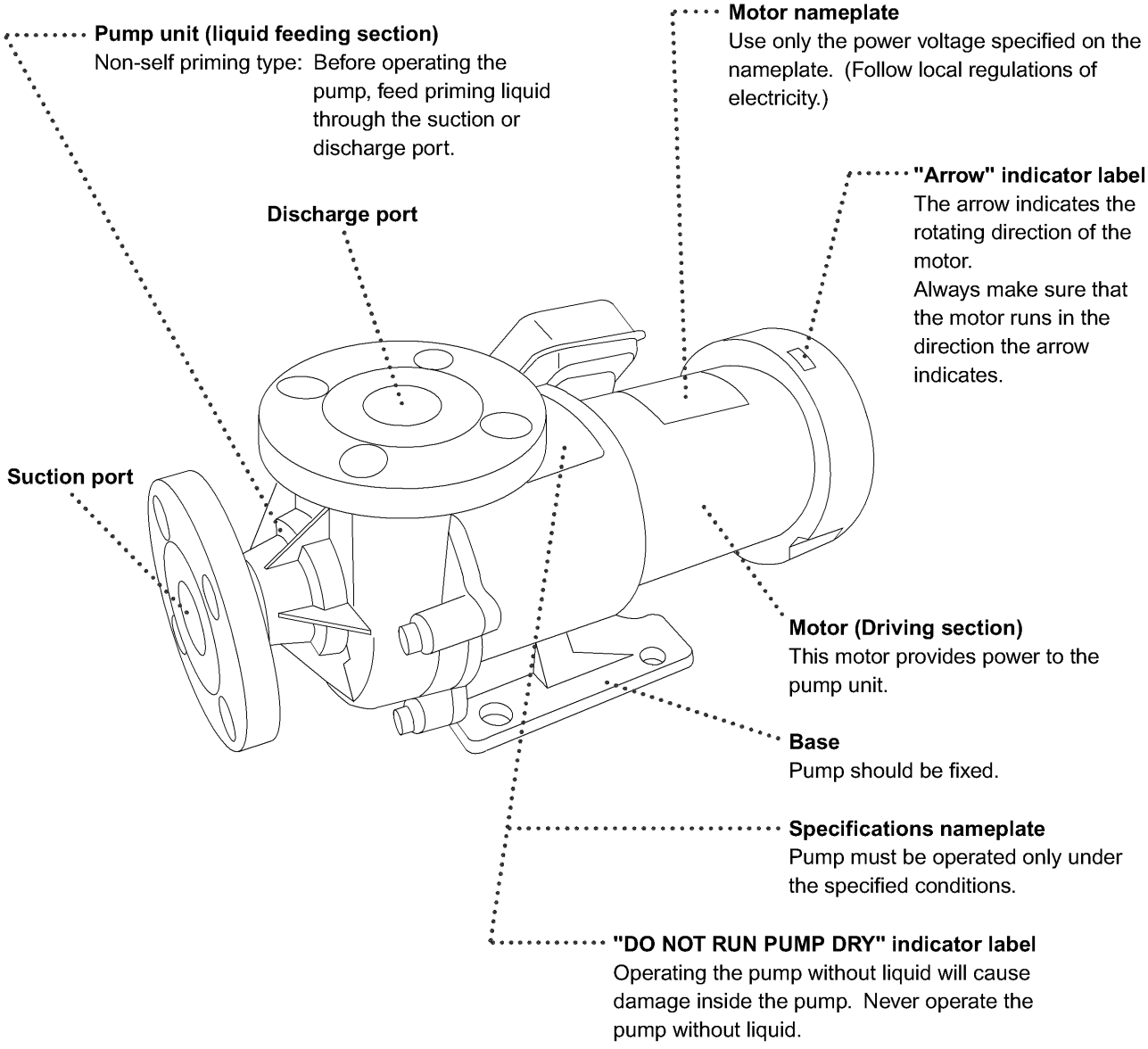
(3) MX-402(H)/403(H)

No.	Name	Q'ty	Material	Remarks
1	Front casing	1	GFRPP	
2	Rear casing	1	GFRPP	
3	Impeller	1	GFRPP	
4	Drive magnet unit	1	Rare earth magnet + FCD 450	
8	Magnet capsule	1	Rare earth magnet + polypropylene	
9	Hex. head screw	2	Steel	M8 × 10
10	Hex. bolt	4	Stainless steel	M10 × 30, with SW
11	Hex. head bolt	7	Stainless steel	M10 × 45 with PW, SW
12	Hex. head bolt	1	Stainless steel	M10 × 60 with PW, SW
13	Flange	1	GFRPP	
14	Flange	1	GFRPP	
15	Motor	1	1.5/2.2kW, 2P, 3-phase	
16	Base	1	GFRPP	
17	Bracket	1	FC200	

No.	Name	Q'ty	Material		Remarks
			CV	RV	
18	Liner ring	1	Alumina ceramic 96%		
19	Rear thrust	1	CFRPEEK		
20	Spindle	1	Alumina ceramic 99.5%		
21	Bearing	1	Carbon	Filler charged fluororesin	
22	Mouth ring	1	Filler charged fluororesin		
23	O ring	1	FKM		JIS B 2401 G195
24	O ring	2			AS568-136
25	O ring	1			AS568-129
26	Hex. bolt	4	Steel		M8 × 20 with PW, SW
27	Lock pin	2	GFRPPS		



7. Main parts and label



⚠ CAUTION

When cleaning the pump, be careful not to wipe the labels or the pump body with solvent.

Installation

1. Before use

⚠ Caution

Do not run pump dry

When the pump is operated for the first time after it was installed or after it was disassembled and repaired, fill the pump chamber with the liquid to be pumped. If pump runs dry without any liquid, rubbing parts of pump are seized. The rubbing parts of MX pump are lubricated and cooled by the pumped liquid. Do not run pump dry or with suction side valve fully closed. Otherwise, pump is damaged. If the pump runs dry by mistake, switch off the power and leave it for more than one hour to cool it down slowly. IWAKI dry run protector DR model is recommended to protect pump from dry running.

Keep pump away from fire

To prevent fire and explosions, do not place dangerous or inflammable substances near to pump.

No remodeling

Do not remodel the pump. Otherwise you may be injured or electrically shocked.

1. Precautions on handling

1) Precautions when pump is started or stopped

To avoid water hammer phenomenon, pay attention to the followings when pump is started or stopped. Especially, pay special attention in case the discharge piping is long.

a. When pump is started

After priming is done, do not fail to fully close the discharge valve before the power is switched on to start pump. After the pump is started, gradually open the discharge valve to get to desired duty point.

b. When pump is stopped

Gradually close the discharge valve and switch off the power to stop pump after the valve was completely closed.

Never close the discharge line suddenly with solenoid valve or like. Sudden close of discharge line causes water hammer resulting in pump damage.

2) Do not install or store pump at the following places.

- Place where temperature falls below 0 deg. C.
- Place where exist corrosive gas or explosive gas.
- Place where water is splashed (except the pump equipped with weather-proof motor)
- Place where ambient temperature exceeds 40 deg. C.
- Humid place (Allowable humidity : 35 to 85%RH)
- Place influenced by powder, fire, earthquake and external shock.

3) Prime pump

The pump is not self-priming. Before the pump is started, prime the pump with pumped liquid. Dry running causes the seizure and quick wear of parts.

4) Pump allowable pressure

Pump allowable pressure is shown below. Pay attention so that the discharge pressure does not exceed the allowable pressure.

Model	MX-250	MX-251	MX-400	MX-401	MX-402, 403	MX-402H, 403H
Max. allowable pressure (MPa)	0.25	0.33	0.22	0.28	0.43	0.5

5) Liquids to be transferred

a. Liquid containing slurry

Slurry can not be handled but type AA (with alumina ceramic bearing) can handle slurry liquid of which the concentration up to 5%, slurry size of 50 micron m or below and hardness up to 80Hs. Contact IWAKI if you wish to handle slurry liquid.

b. Performance influenced by specific gravity and viscosity of liquid

Liquid which is heavier or more viscous than water influences the shaft power, discharge capacity and head. The pump you purchased is made according to the specifications you gave us when ordered. If you wish to change the conditions, please contact us.

c. Alumina ceramic bearing (types AV, AE, AA) may be worn in a short time depending on the characteristics of liquid (low viscosity or so). Please ask us if you have any question.

d. Influence by temperature

Pump performance is not influenced by the change of liquid temperature but the liquid changes its viscosity, vapor pressure and chemical corrosivity according to the change of temperature. Pay attention to the change of characteristics of handled liquid.

Temperature of liquid to be handled : 0 – 80 deg. C (for water)
Permissible ambient temperature : 0 – 40 deg. C
Permissible humidity : 35 – 85% RH

Refer to chemical resistant table for permissible temperature for specific chemical liquids.

6) Intermittent operation

Frequent repeat of pump stop and run may hasten pump damage. Keep the start/stop frequency within six times an hour.

7) Disconnection of magnet coupling

If the magnet coupling is disconnected, stop pump within a minute. If the pump runs with the magnet coupling being disconnected, the power of coupling will be decreased.

8) Use of pump in the range of bell-shaped pump performance curve

For the pump which shows bell-shaped performance curve in a small capacity range (Refer to standard performance curve of the pump), if this pump is used at the section of the curve that ascends, the pump may operate unstable and make vibration or noise. To avoid such a surging operation, pay attention to the followings.

1) Arrange the discharge piping so that air pocket can not be generated.

2) Install the valve near to the pump discharge port to adjust discharge capacity.

2. Installation

⚠ Warning

Switch off power

When the works are done, switch off the power. Take care other person not to switch on the power when the works are being done. In a noisy or poor visibility envoronment, display a sign near to the power supply switch to notify that someone is "Working" on the pump.

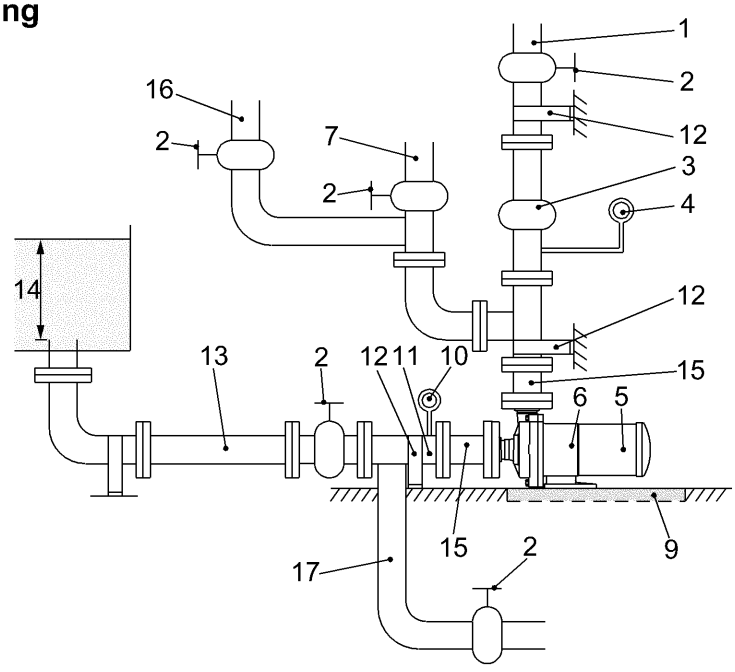
Do not hold plastics made parts when transferring pump

To transfer the pump, do not hold plastics made parts such as casing, flange or base. Otherwise, plastics parts may be broken and pump may fall resulting in personal injury. The weight of pump is approx. 20 kg max. Put the pump and motor horizontally with the base downward.

Electrical works

Electrical works should be done by qualified person. Otherwise personal injury or products damage may happen.

● Example of piping



(1) Discharge pipe (Support the pipe to keep the pump free of piping load.)
(2) Valve
(3) Check valve
(4) Pressure gauge
(5) Motor
(6) Pump
(7) Air vent pipe
(9) Drain ditch
(10) Vacuum gauge
(11) Suction pipe (pipe diameter: D) (The horizontal section should be as short as possible and there should be an ascending gradient of 1/100 toward the pump.)
(12) Pipe support
(13) Suction pipe (pipe diameter: D)
(14) 2D, 500 mm or above
(15) Expansion joint
(16) Piping for flushing (Discharge side)
(17) Piping for flushing (Suction side)

1) Installation position

- Install the pump as close to the suction tank as possible and in the lowest position available (for flooded suction).
- If the suction port of the pump is to be positioned higher than the suction tank (for suction lift), be sure to arrange for a foot valve in the priming pipe and suction pipe.

* The lift head depends upon the liquid properties, temperature, and length of the suction piping. For details of the setup, consult Iwaki or your dealer.

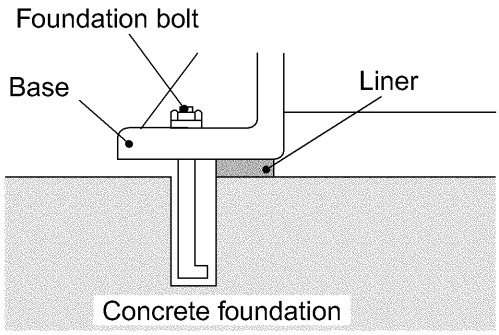
2) Indoor and outdoor use

The pump can be operated either indoors or outdoors. However, safety measures should be taken so as not to expose the motor and power distribution unit to flooding or other natural hazards.

3) Installation site

Select an installation site that is flat and free of vibrations caused by nearby machines. Space sufficient for maintenance work should be provided.

● Foundation work



1) The area for anchoring the pump must be greater than the area of the base. If the anchoring area is not enough, the base may be destroyed due to a concentrated load on it.

2) If pump operation is to be subject to vibration (resonation with the piping, for example), provide an expansion joint between the pump and the piping. Otherwise, the piping, gauge, etc., may be damaged.

3. Piping

● Connection of pipe

Table below shows bolt size and tightening torque to connect pipes to pump flanges.

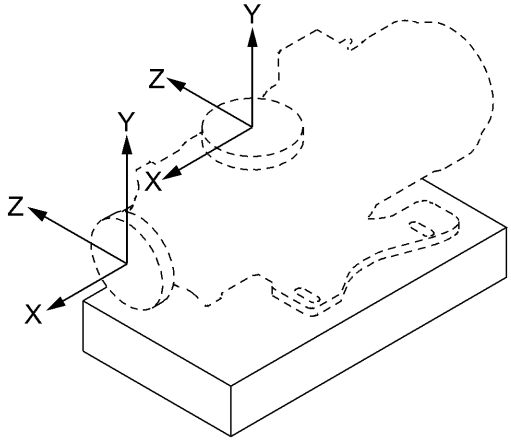
Observe the bolt size and tightening torque. (Figures on the table refer to metal flange and rubber gasket.)

Model	Bolt size	Tightening torque (N·m)
MX-250, 251, 400, 401, 402, 403	M16	20

● Load of piping and momentum of piping

The permissible stress and moment applicable to pump connection arrangement are as shown below.

The piping should be designed and worked so that stress and moment, higher than those values indicated in the table, should not be applied to the pump.



Permissible pipe load to disch. flange

	Dia. of pipe (mm)	
	25	40
	Load	
Direction of load	kN	
Fx	0.10	0.15
Fy: compression	0.15	0.20
Fy: tension	0.10	0.10
Fz	0.10	0.15

Permissible pipe load to suc. flange

	Dia. of pipe (mm)	
	25	40, 50
	Load	
Direction of load	kN	
Fx	0.10	0.10
Fy	0.10	0.15
Fz	0.10	0.15

Permissible pipe moments to disch. flange

	Dia. of pipe (mm)	
	25	40
	Load	
Direction of load	kN·m	
Mx	0.02	0.05
My	0.05	0.10
Mz	0.05	0.10

Permissible pipe moments to suc. flange

	Dia. of pipe (mm)	
	25	40, 50
	Load	
Direction of load	kN·m	
Mx	0.05	0.10
My	0.02	0.05
Mz	0.05	0.10

● Suction piping

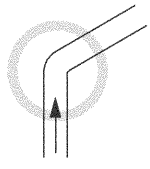
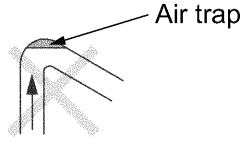
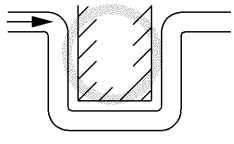
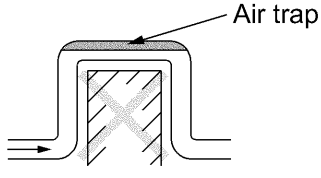
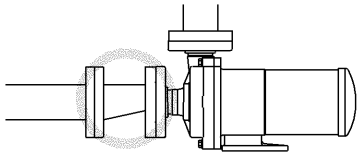
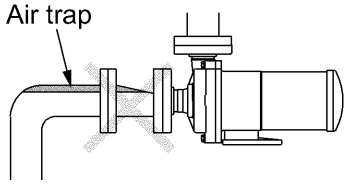
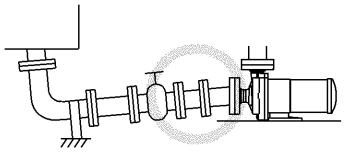
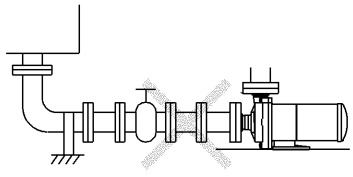
(1) The suction pipe should employ the flooded suction method if possible. The shortest pipe possible, with the minimum number of bends, should be used. Arrange a proper support under the suction pipe such as an expansion joint or the like so that the weight and thermal stress of the pipe are not applied to the pump.

(2) Attach the coupling on the suction pipe carefully so as not to allow air inside the line. Air in the suction pipe may damage the system.

(3) If suction is not good (e.g., the suction tank is a vacuum, the suction head is large, or the suction pipe is long), the condition NPSHa > NPSHr + 0.5 m should be established. For the NPSHr level, refer to the standard performance curve.

(4) When using an elbow pipe on the suction side, install a straight pipe with a length of at least 500 mm or 8 times the suction port diameter before the pump suction port. Provide the largest radius possible for the R of the bend.

(5) Do not allow any projection where air may be trapped along the suction pipe. The suction pipe should have an ascending gradient of 1/100 toward the pump.

Good conditions	Unacceptable conditions
○ good 	× No good 
○ good 	× No good 
○ good 	× No good 
○ good 	× No good 

(6) If the diameters of the pump suction port and the suction pipe are different, use an eccentric reducer pipe. Connect the eccentric reducer pipe such that the upper surface is level. In any case, never use a suction pipe with a diameter smaller than that of the suction port.

(7) It is also recommended, in the case of flooded suction, that a gate valve be installed on the suction pipe for easier overhaul inspection of the pump. Keep the gate valve fully open during ordinary pump operation; it is required to be closed only during an overhaul inspection.

(8) When circulating a dangerous liquid, arrange the flushing pipes so that internal cleaning is possible when disassembling the pump.

(9) The diameter of the suction pipe must be larger than that of the pump suction port.

Note: The items below (10), (11), and (12) above are applied to the suction lift method.

(10) The end of the suction pipe should be located 500 mm or more below the surface of the liquid.

(11) A screen should be provided at the inlet in the suction tank to prevent the entry of foreign matter into the suction pipe. The end of the suction pipe should be 1~1.5 D (D: diameter of suction pipe) or more away from the bottom of the suction tank. Note that the entry of foreign matter may cause the pump to malfunction.

(12) In the case of the suction lift method, install a foot valve on the suction pipe.

● Discharge piping

(1) Use a support so that the weight of the pipe is not applied to the pump as load.

(2) If a method other than flooded suction is employed, install a priming pipe.

(3) If the pipe is too long the piping resistance may increase, hampering the pump's performance. The diameter of the pipe should be determined by calculating the piping resistance.

(4) A check valve should be installed if any one of the following conditions is present. When selecting the check valve, consider the check valve pressure limit (including the influence of water hammer or back flow onto the pump).
   ① The discharge piping is very long
   ② The discharge lift exceeds 15 m
   ③ The end of the discharge pipe is 9 m higher than the surface of the suction tank
   ④ Several pumps are connected parallel to one another on the same piping

(5) It is recommended that a valve be installed on the discharge pipe for the adjustment of discharge volume and for the prevention of overload onto the motor. When installing both a check valve and a valve, the check valve should be positioned between the pump and the valve.

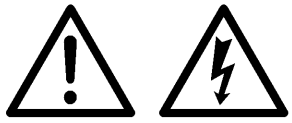
(6) Do not fail to install a pressure gauge on the discharge piping.

(7) Install an air vent valve if the discharge pipe is very long horizontally.

(8) Install a drain valve for the drainage of liquid if there is a chance that the liquid in the discharge pipe might freeze.

4. Wiring

Electrical connections



ATTENTION

The electrical connection should be carried out by an authorized electrician in accordance with local regulations. We are not responside for any accident which is cansed by non observance of this instruction. Cousult us or distributor when necessary.

(1) Use an electromagnetic switch that conforms with the specifications (voltage, capacity, etc.) of the pump motor.

(2) If using the pump outdoors, waterproof the wiring to protect the switches from rainwater.

(3) Electromagnetic switch and push button switch should be firmly installed at the place reasonably distant from the pump.

Operation

1. Precautions on operation

⚠ Caution

- Never operate the pump dry or with the suction-side valve closed. Otherwise, the pump will be damaged.

- Check the direction of pump rotation. (Clockwise rotation is correct seen from motor fan.) If pump continues to run in reverse rotation, it may be damaged.

- In the event of cavitation, stop the pump within a minute.
  In addition, do not continue pump operation with the air mixed into the suction side.

- If the magnet coupling disconnects, stop the pump within a minute. The power of the magnet coupling is reduced if operation is continued with the coupling disconnected.

- The temperature fluctuation should not exceed 80 °C through the starting, stopping, and operating the pump

- Before starting operation, close the discharge valve fully to prevent water hammer action upon start-up.

- Note that pump operation with the discharge valve closed fully over a long time will raise the temperature of the liquid inside the pump and finally damage the pump.

- In the event of a service power failure, turn off the power switch immediately and close the discharge valve.

- Make sure that the pressure beyond the specified one is not applied to the pump.
  See page 16 for max. allowable pressure.

- Maximum pump surface temperature
  The max. pump surface temperature of each model is shown in the table. Arrange protective measures in accordance with the temperature levels.

Model	Liquid temp (deg. C)	Maximum surface temperature when ambient temperature is at 40 deg. C (deg. C)
MX-250, 251, 400, 401, 402(H), 403(H)	80	80

- Sound generated by pump
  The level of sound generated by each type of pump is shown in the table. Arrange a muffling measures in accordance with the sound level.

Model	MX-250, 400	MX-251, 401	MX-402(H), 403(H)
Sound Level	70 dB	75 dB	80 dB

2. Preparation for operation

Preparations should be made, as described below, in the case of initial operation after installation and in the case of restarting of operation after a long period of inactivity.

(1) Thoroughly clean the inside of the pump and pipe. Then, supply liquid.

(2) Tighten the flange connecting bolts and the installation bolts on the base.

(3) After priming the pump, close the discharge valve fully.
Also, make sure the air-vent valve and flushing piping valve are closed.

(4) Run the motor instantaneously to check for correct direction of motor rotation. The motor should run in the direction indicated with the arrow on the pump. If the direction is reversed, exchange any two wires of the three-phase power wires.

3. Operation

Operate the pump by following the steps given below.

<table>
<tr><th>No</th><th>Operation Step</th><th>Procedure</th></tr>
<tr><td>1</td><td>• Close or open the valve.</td><td>• Suction valve-Fully opened
• Discharge valve-Fully opened</td></tr>
<tr><td>2</td><td>• Prime the pump</td><td>• Confirm pump is filled with liquid. If pump is not filled with liquid, fill it in accordance with steps [5] and [6] of 'Start-up preparation'. After priming completely, close the discharge valve fully.</td></tr>
<tr><td>3</td><td>• Check the motor for correct rotating direction.
Switch on the power and then immediately switch off the power (within a second)</td><td>• Supply power immediately to run the pump only when checking the rotating direction of the pump. (Correct direction of pump operation is indicated with arrow on the pump. Check the direction of motor fan by looking at the fan through the fan cover.)
• Observe carefully to see if the motor fan slowly and smoothly stops rotating when the power switch is turned off.
Note: If the motor fan does not stop smoothly, the pump may be locked inside.
In this case, inspect the inside of pump.</td></tr>
<tr><td>4</td><td>• Turn on the power and start the pump. Then, adjust the discharge pressure and discharge volume.</td><td>• Within 1 minute, open the discharge valve gradually and adjust the discharge pressure while checking the reading of the pressure gauge on the discharge side. (Otherwise, adjust the flow rate while checking the reading of the flowrate meter.)
⚠ Caution
Open valve carefully while paying attention to ampere meter, to prevent motor from being overloaded from excessive opening of valve.</td></tr>
<tr><td></td><td colspan="2">Following discharge volumes should be kept during pump operation.
MX-250, 251, 400, 401 : 10 l/min. or more

• In case of automatic drive, too, close discharge valve before start-up and open valve slowly within one minute.
⚠ Caution
Do not run pump longer than 1 minute with a fully closed discharge valve.</td></tr>
<tr><td>5</td><td>Points to be observed during operation.
If pump enters continuous operation mode, check flow meter and confirm that pump operation is as per specifications.</td><td>• If flow meter is not available, check the values of discharge pressure, suction pressure, and electric current with reference to piping resistance.</td></tr>
<tr><td colspan="3">⚠ If any trouble happened, switch off power at once and settle the cause referring to the item of Troubleshooting.</td></tr>
</table>

Stop the pump by following step.

	Check/Operation Step	Procedure
1	• Close discharge valve gradually.	• Do not cause sudden closure with solenoid valve, etc., otherwise pump may be damaged by water hammer action which is likely in case of long discharge piping.
2	• Turn off the power and stop pump operation.	• Observe carefully whether the motor fan slowly and smoothly stops rotating. If not, check inside of pump.
3	Points to be observed when stopping pump • If the pump operation is stopped during cold weather, liquid in pump may freeze and damage pump. When circulating a dangerous liquid, carry out internal cleaning by using flushing piping. Then drain the liquid fully. • Be sure to remove all liquid after stopping pump. In case of short-term suspension of operation, which does not allow for removal of liquid, use band heater, etc., to prevent liquid inside from freezing. • In event of power failure, turn off power switch and close discharge valve.	

Maintenance

1. Troubleshooting

In the case of trouble, turn off the power supply immediately and refer to this table.

Problem	Symptom on pump		Cause	Inspection and Measures
	With Discharge Valve Closed	With Discharge Valve Opened		
Liquid is not lifted.		Pressure gauge and vacuum gauge indicate 'zero'.	● Not enough priming water ● Dry running.	○ Stop pump, feed sufficient priming water, and restart pump.
	Water goes down at once when priming is carried out.		● Foreign matter is clogging foot valve.	○ Clean foot valve. ○ Check whether seat is clogged with foreign matter.
	Pressure is reduced if discharge valve is opened after start-up step.	Points of pressure gauge and vacuum gauge swing but return to zero at once.	● Air enters through suction pipe or gasket section.	○ Check again whether connecting flange in suction piping is sealed airtight. ○ Check whether suction liquid level is abnormally lowered.
			● Magnet coupling has disconnected.	○ Measure electric current level to check for overload condition. ○ Check for foreign matter between impeller and casing. ○ Check whether the voltage level is normal.
	Pointer of pressure gauge never rises.		● Speed of pump is too low. ● Pump rotates in reverse direction.	○ Check wiring and motor and make necessary repairs. ○ Exchange wires.
Discharge volume is small.		Pointer of vacuum gauge indicates a high value.	● Strainer is clogged with foreign matter and liquid passage is blocked.	○ Eliminate the foreign matter in strainer.

Problem	Symptom on pump		Cause	Inspection and Measures
	With Discharge Valve Closed	With Discharge Valve Opened		
Discharge volume is small.	Pointers of pressure gauge and vacuum gauge indicate normal values.	Pointer of vacuum gauge indicates extraordinarily high value.	● Air is trapped in suction pipe.	○ Inspect setup condition of suction pipe and modify it if necessary.
			● Inlet section of impeller unit is clogged with foreign matter.	○ Eliminate foreign matter.
		Pointers of pressure gauge and vacuum gauge swing.	● Air enters through suction pipe or gasket section.	○ Check connecting section of suction pipe and tighten it if necessary..
			● Discharge side of pump is clogged with foreign matter.	○ Eliminate foreign matter in the pump. ○ Eliminate foreign matter or scale inside pipe..
		Pointer of vacuum gauge indicates a high value while that of pressure gauge indicates normal value.	● There is an air trap or resistance in suction pipe.	○ Check whether there is protruding section in suction pipe and take necessary measures.
		Pointer of pressure gauge indicates high value while that of vacuum gauge indicates normal value.	● There is portion in discharge pipe that causes resistance, or actual head and loss of head are too high.	○ Check actual head and piping loss of discharge pipe and take necessary measures.
	Pointer of pressure gauge indicates low value and that of vacuum gauge indicates extraordinarily low value.	Pointers of pressure gauge and vacuum gauge indicate low values.	● Rotation direction is reversed.	○ Exchange wires.

Problem	Symptom on pump		Cause	Inspection and Measures
	With Discharge Valve Closed	With Discharge Valve Opened		
Motor is overheated.			● Voltage is lowered. ● Overload.	○ Check whether the voltage and frequency levels are adequate. ○ Check whether the specific gravity and viscosity of liquid are adequate. ○ Improve air ventilation.
Discharge volume is suddenly lowered.		Pointer of vacuum gauge indicates high value.	● Strainer is clogged with foreign matter.	○ Eliminate foreign matter.
Pump vibrates.			● Foundation is defective. ● Anchor bolt is loose. ● Suction pipe is closed. Cavitation is caused. ● Wear or melting of pump bearing. ● Magnet capsule or spindle is damaged. ● Dynamic balance of drive magnet assembly fluctuates. ● Impeller and/or magnet capsule is in contact with fixing section. ● Wear of motor bearing.	○ Reinstall. ○ Retighten bolts. ○ Clean, and eliminate cause of cavitation. ○ Replace. ○ Replace. ○ Eliminate cause or replace. ○ Replace. ○ Replace bearing or motor.

2. Maintenance and inspection

⚠ Warning

Wear protectors

Hazardous liquids such as chemical liquids may harm your eyes or skin if you touch them directly or they are splashed. When you do the works, wear protectors (mask, goggles, gloves etc.).

Turn off power

To avoid electrical shock, switch off the power to stop pump and equipment when works are done.

● Daily inspection

(1) Check to be sure there is no liquid leakage in the pump before operating it. If leakage is detected, never try to operate the pump.

(2) Check whether the pump operates smoothly, without generating any abnormal noise or vibration.

(3) Check the level of the liquid in the suction tank and the suction pressure.

(4) Compare the discharge pressure and electric current measured during operation with the values indicated on the motor nameplate for the verification of normal pump load.

* Note that the values indicated on the pressure gauge is in proportion to the specific gravity of the liquid. The cock of the pressure gauge or vacuum gauge must be opened only when measurement is carried out. It must be closed upon the completion of each measurement. If the cock remains open during pump operation, the meter mechanism may be affected by abnormal pressure caused by water hammer action.

(5) If a spare pump is prepared, activate it from time to time to keep it ready for use any time.

(6) Check to be sure the discharge pressure, discharge flow rate, and motor power supply voltage do not fluctuate during pump operation. If considerable fluctuation of the respective values occurs, refer to "Troubleshooting" for correct measures.

● Periodic inspection

To ensure efficient and smooth operation of the pump, carry out periodic inspections by following the procedures described below. When the pump is disassemble, handle the rubbing parts and plastics parts with care not to damage them. Pay attention not to pinch your fingers because the drive magnet and magnet capsule have strong magnetic force

Inspection Timing	Part Name	Check Points	Countermeasures
Every 6 months * Inspection record should be kept.	Drive magnet unit	● Are there slide-scratches? ● Is drive magnet fixed correctly? Is hex. socket set screw loose? ● Are inner perimeter of magnet and motor shaft coaxial? (Max. eccentricity: 1/l0 mm)	○ Contact your dealer if abnormality is found. ○ Fix drive magnet correctly. Tighten set screw. ○ Tighten set screw correctly or replace drive magnet. (Contact your dealer if replaced.)
	Rear casing	● Are there slide-scratches in bore? ● Are there cracks on liquid end part? ● Wear of rear thrust. ● Wear of spindle. ● Stains in rear casing.	○ Contact your dealer if abnormality is found. ○ Replace rear casing if abnormality is found. ○ Contact your dealer if abnormality is found. ○ Replace if wear limit comes. ○ Clean.
	Magnet capsule	● Are there slide-scratches in the rear section or in the cylindrical body? ● Are there cracks in resin of rear section or in cylindrical body? ● Wear of bearing. (Measure dimensions.) ● Condition of impeller fixed to magnet capsule	○ Contact your dealer if abnormality is found. ○ Contact your dealer if abnormality is found. ○ Replace if wear limit comes. ○ Replace or contact your dealer if fixing is loose.
	Impeller	● Wear of mouth ring. (Measure dimensions.) ● Are there cracks? ● Stains or clogging inside impeller. ● Dimensional change in impeller.	○ Replace if wear limit comes. ○ Replace if abnormality is found. ○ Clean ○ Replace if abnormality is found.
	Front casing	● Stains in liquid contacting part. ● Are there cracks? ● Are there wear, slide-scratches, or cracks in liner ring? ● Are there expansion or cracks on O ring. ● Slide-scratches in unlikely position.	○ Clean ○ Replace if abnormality is found. ○ Contact your dealer if abnormality is found. ○ Replace O ring if it is expanded or cracked. ○ Contact your dealer if abnormality is found.
	Spindle	● Are there cracks? ● Wear of rubbing parts	○ Replace if abnormality is found. ○ Replace if wear limit comes.

● Wear limits of bearing and spindle

Unit: mm

Model / Part	MX-250, 251, 400, 401		MX-402, 402(H), 403, 403(H)	
	When shipped	When replaced	When shipped	When replaced
Inner diameter of bearing	18	19	24	25
Outer diameter of spindle	18	17	24	23

* If the difference between the inner diameter of the bearing and the outer diameter of the spindle exceeds 1 mm, either the bearing or the spindle whichever has the greater wear should be replaced regardless of the values in the above table. In the case of AV or AE type pump (MX-250 to 401), the spindle and the bearing should be replaced simultaneously.

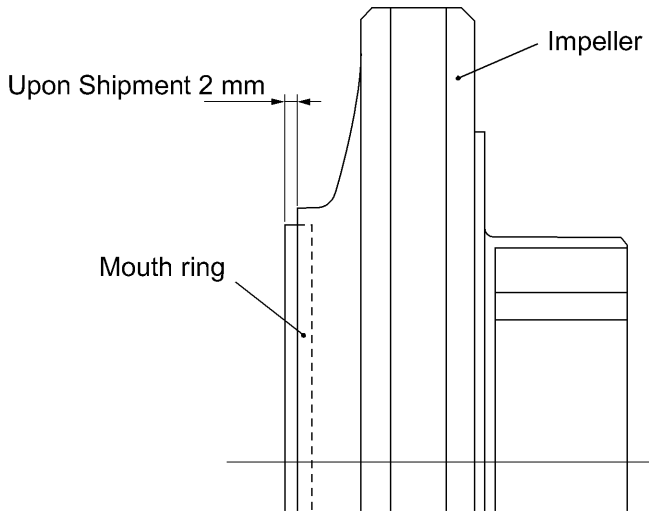
* Initial wear may appear in the sliding parts in the first stages of operation. This is not abnormal.

● Wear limit of mouth ring

Unit: mm

Model	MX-250, 251, 400, 401, 402(H), 403(H)
Thickness when shipped	8
Thickness when replaced	6

* The step between the surfaces of the mouth ring and the impeller upon shipment is 2 mm (3 mm for MX-250). The wear limit of the mouth ring is that this step is reduced to 0 mm. Replace the impeller with the mouth ring then.



3. Spare parts

Appropriate spare parts are necessary to ensure long, continuous operation of the pump. It is recommended that consumable parts be kept at hand constantly. When placing an order, supply the following information.

(1) Name of part and part number (in accordance with the drawings in this instruction manual)
(2) Pump model number and manufacturing number (as indicated on the pump nameplate)
(3) Drawing number if you have received the Iwaki-approved drawing

Part name	MX-250	MX-251	MX-400	MX-401	MX-402	MX-403	MX-402H	MX-403H
Front casing unit	MX0109		MX0125	MX0131	MX0174		MX0188	
Rear casing	MX0110		MX0126	MX0132	MX0175		MX0189	
Impeller unit 50Hz	MX0111	MX0120	MX0127	MX0133	MX0176	MX0184	MX0190	MX0191
Impeller unit 60Hz	MX0112	MX0121	MX0128	MX0134	MX0177	MX0185	MX0185	MX0176
Magnet capsule unit C (Carbon)	MX0113	MX0122	MX0113	MX0122	MX0178	MX0186	MX0178	MX0186
Magnet capsule unit R (PTFE)	MX0114	MX0123	MX0114	MX0123	MX0179	MX0187	MX0179	MX0187
Magnet capsule unit A (Alumina ceramic)	MX0115	MX0124	MX0115	MX0124	—	—	—	—
O ring (for casing)	MX0116		MX0129	MX0116	MX0180			
O ring (for flange)	MX0117		MX0130		Suction side (50A) MX0181		Discharge side (40A) MX0130	
Spindle	MX0118				MX0182			
Rear thrust	MX0119				MX0183			

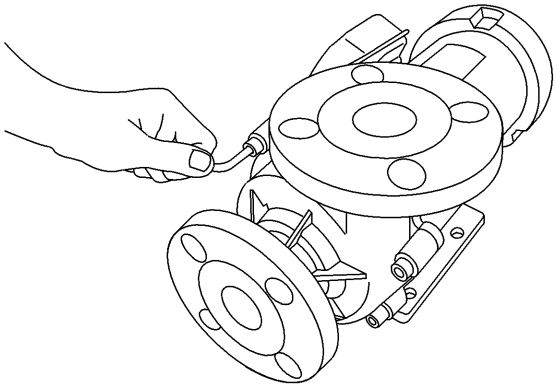
Note: Parts code of O ring is for V type (FKM).
Ask us for E type (EPDM) and A type (Aflas®).

4. Disassembling and assembling

⚠ Warning
Wear protectors Hazardous liquids such as chemical liquids may harm your eyes or skin if you touch them directly or they are splashed. When you do the works, wear protectors (mask, goggles, gloves etc.). **Turn off power** To avoid electrical shock, switch off the power to stop pump and equipment when works are done.

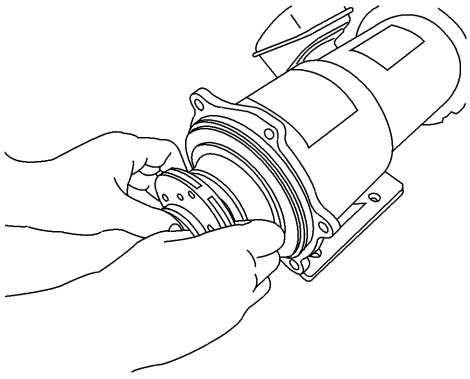
Precautions when disassembling and assembling pump

* When power wires to motor are removed, mark on each wire so that the wires can be connected correctly not to rotate in reverse when they are connected again.
* Do not disassemble the pump beyond the extent shown on this manual.
* Fully close suction and discharge sides valves before the works are done and clean pump inside.
* The magnet force used in the pump are strong. Pay attention for your fingers not to be pinched on disassembling and assembling of pump. Pay attention for iron pieces or powder not to be attracted by the magnets.
* Do not put the electronic devices which dislike magnetic field near to the magnets.



4.1 Disassembling

1) Remove hex. socket head bolts to remove a front casing from a motor bracket and evacuate the casing of residual liquid and clean it.

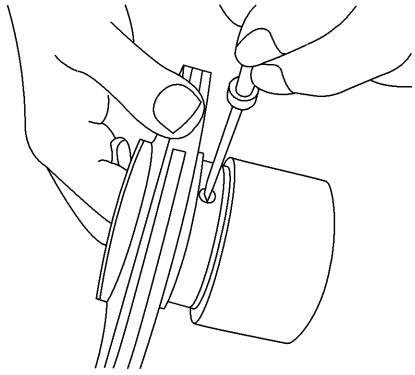


2) Pull out an impeller and a magnet capsule. Pay attention for your fingers not to be pinched.

3) When the impeller is removed from the magnet capsule, take following procedure paying attention not to scratch the parts.

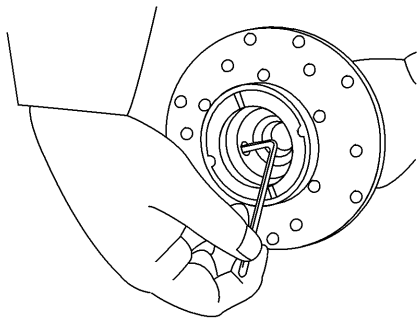
a. In case of MX-250-401

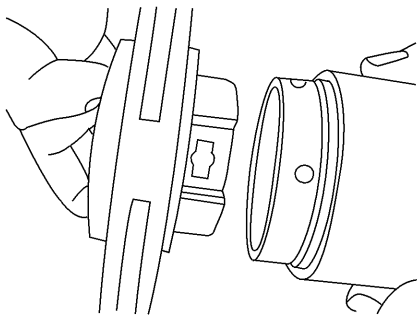
Hold the magnet capsule by hand and slightly tap the back side of impeller by plastics hammer to remove it from magnet capsule. If it is hard to be removed, do not remove them by force but put them in hot water (approx. 90 deg. C) for five minutes. Take care for your fingers not to be burnt by hot water.



b. In case of MX-402(H) and 403(H)

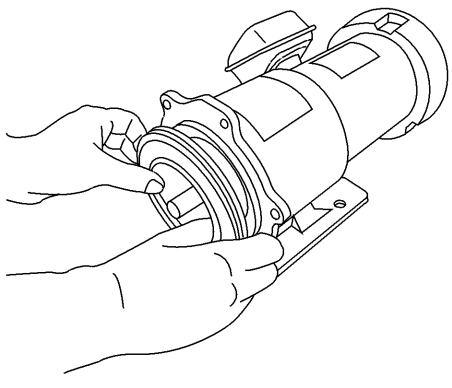
Turn the lock pin counter clockwise direction by 90 degree using a minus screw driver and then push it out to inside. If it is hard to push it out, slightly tap the end of driver handle. If the screw driver can not be used because the groove of pin was crushed, turn the pin from inside of magnet capsule using hex. wrench. In this case pay attention to turn the wrench clockwise. The lock pin will be damaged if it is turned in reverse direction. After the pin was turned, push it out from outside using a bar or like.



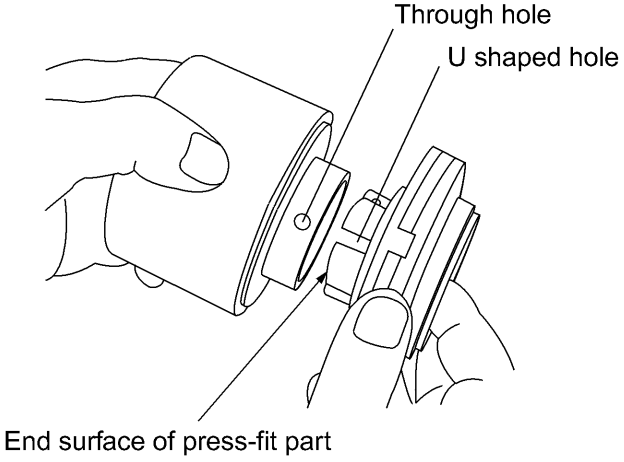


After two lock pins are removed, remove the impeller from the magnet capsule by slightly tapping the periphery of impeller with plastic hammer. If it is hard to remove, warm it with hot water (approx. 90 deg. C) for five minutes and remove it by slightly tapping it as above. Pay attention not to burn yourself.

Impeller can not be separated from magnet capsule unless lock pin is removed. The parts are broken if impeller is removed by force.



4) To remove a rear casing, insert a minus screw driver to the periphery of rear casing and slightly pull forward the screw driver. Pay attention not to scratch an O ring.

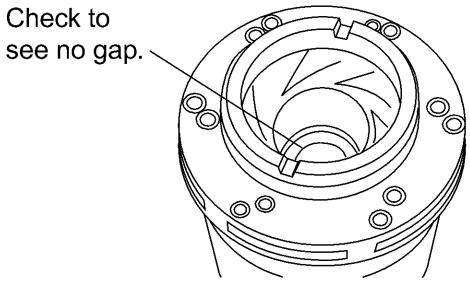


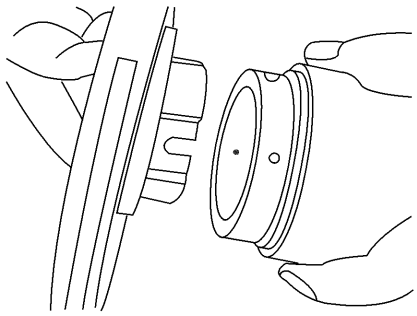
4.2 Assembling

1) Mount the impeller to the magnet capsule.

a. In case of MX-250-401.

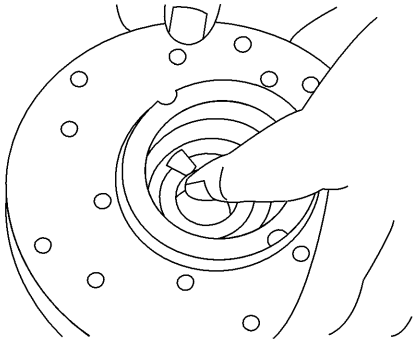
Fit together the projected and recessed parts of magnet capsule and impeller and push the impeller to the bottom. Put a through hole of magnet capsule and U shaped hole of impeller together. If you find no gap between the end surface of impeller and bearing end surface, this means the impeller was securely press fit into the magnet capsule. If it is hard to press fit them, do not put them by force but warm the magnet capsule only by putting it in hot water (approx. 90 deg. C) for five minutes. Take care for your fingers not to be burnt by hot water.

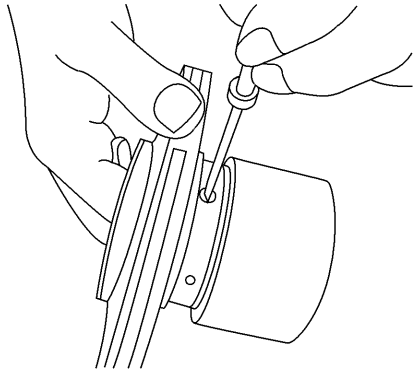




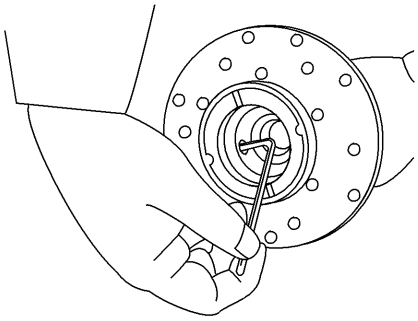
b. In case of MX-402(H) and 403(H)

Mating part of magnet capsule has two holes of a bigger hole for lock pin (stepped hole of outside 6 mm dia. and inside 12 mm dia.) and a smaller hole (3 mm dia.) for cooling purpose. U-shape hole of impeller and smaller hole (3 mm dia.) of magnet capsule are for cooling purpose. Insert the impeller into the magnet capsule slowly by positioning the two holes together. If it is hard to insert them, warm the magnet capsule only with hot water (approx. 90 deg. C) for five minutes.





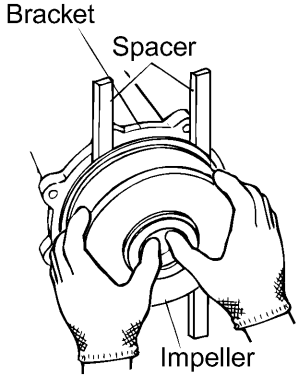
After the impeller is inserted (press-fit), insert the lock pin till the first step from inside and then, strongly holding it by finger from inside, tighten the pin by turning it clockwise by 90 degrees from outside with minus screw driver. You will feel the snap action when it is fixed securely. Mount two lock pins at symmetric position.



If the groove for minus screw driver is deformed and can not be used, the pin can be fixed from inside with 4mm hex. wrench. In this case pay attention to turn the wrench counter clockwise direction. The lock pin may be broken if it is turned in reverse.

2) Put the magnet capsule with impeller into the rear casing slowly. Check if iron pieces or other foreign matters do not adhere to the magnet capsule

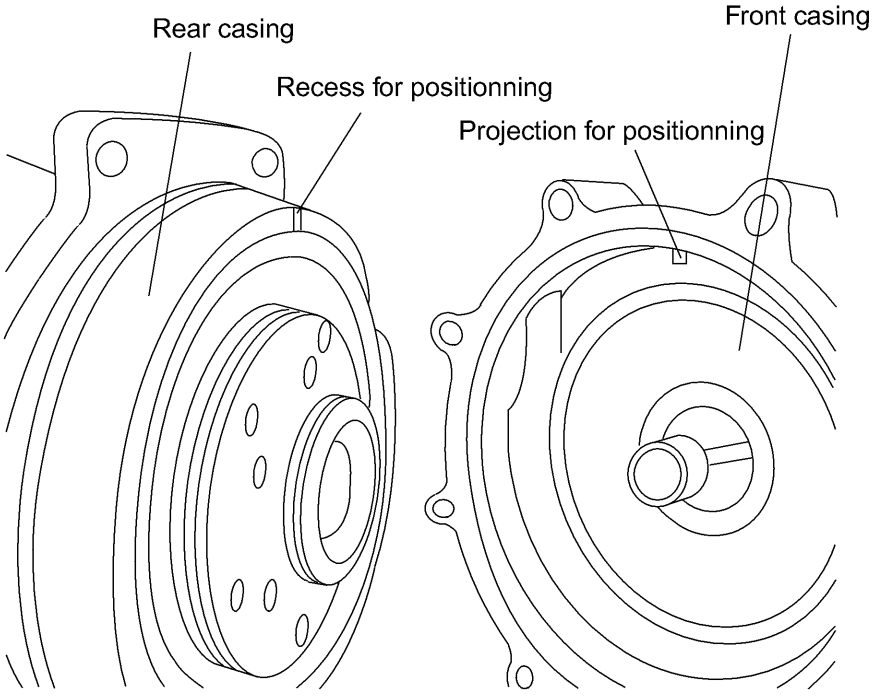
3) Mount the rear casing with magnet capsule to the bracket.



⚠ Caution

Magnet force is very strong. Apply plastics or wooden spacers between the rear casing and bracket not to pinch your fingers.

4) Put O ring to the front casing. Check to see if there is no dust or scratch on it. Pay attention for the O ring not to be forgotten to be put or not to be bitten. For the models MX-250, 251 and 401, fit together the recessed and projected portions of rear casing and front casing when the front casing is mounted to the rear casing. Two recesses on rear casing and projections on front casing are for MX-402(H) and 403(H).



5) Mount the front casing to the motor bracket.
Tighten the mounting bolts diagonally and evenly. Tightening torque is shown below.

Model	Bolt tightening torque
MX-250,251, 400, 401	11.8 N·m
MX-402, 402(H), 403, 403(H)	14.7 N·m

IWAKI PUMPS

( )Country codes

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