

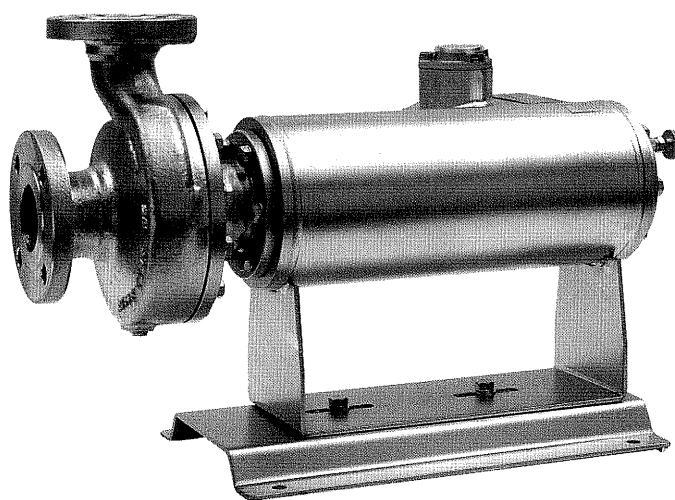
TEIKOKU MOTOR PUMP

INSTRUCTION MANUAL

BASIC MODEL (F-V, FA-V, F & FA-TYPE)

REVERSE CIRCULATION TYPE (R & RA-TYPE)

HIGH TEMPERATURE ISOLATION TYPE (B-TYPE)



IMPORTANT INFORMATION

- Before operating canned motor pump, read this "Instruction Manual" and "Caution Notes for Your Safety" to avoid wrong operation or work. It is essential for your safety and avoiding disaster.
- Keep this "Instruction Manual" near the pump to be available at any time.



TEIKOKU ELECTRIC MFG. CO., LTD.

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1. CAUTION NOTES FOR YOUR SAFETY TEIKOKU Canned motor Pumps

FOR YOUR SAFETY (1)

Hazards are listed at two levels



DANGER

Ignoring this warning can cause serious injury or even death



CAUTION

DANGER & CAUTION

Ignoring this warning can cause personal injury and/or damage to the pump

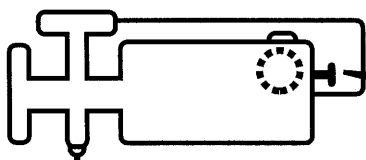


DO NOT RUN DRY!

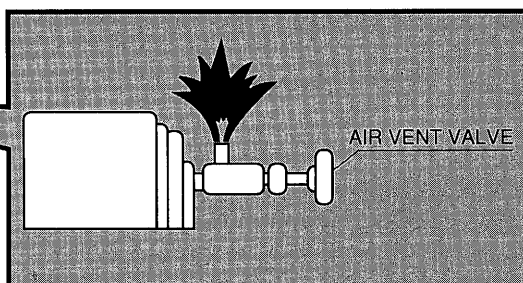
If the pump is allowed to run dry, the bearings, sleeves and other components could be damaged and serious overheating of the motor windings can occur.



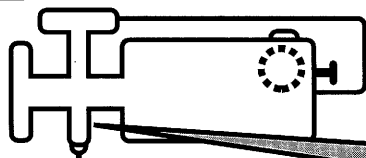
OPEN VENT VALVE SLOWLY!



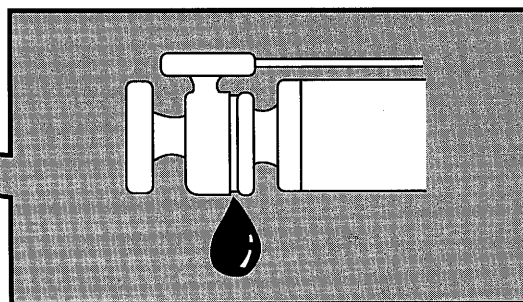
You must exercise caution, even when the pump is not operating, internal pressures can be high at any time. For toxic liquids, proper safety methods must be observed.



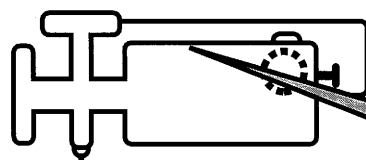
AVOID RAPID TEMPERATURE CHANGES!



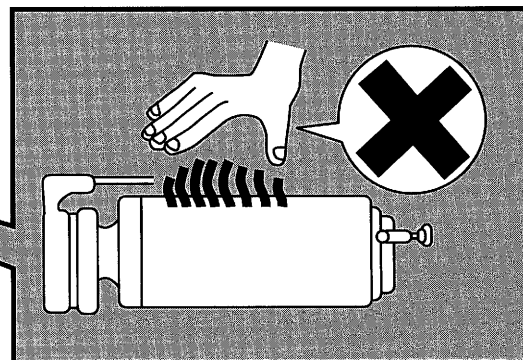
Large changes in temperature must be avoided. Rapid changes can cause leaks to occur in gaskets. Published procedures for proper heating and cooling must be followed. If published procedures are not available check with Teikoku before operating the equipment.



HOT - DO NOT TOUCH!



Motor and pump can be hot, even when pumping cold liquids.



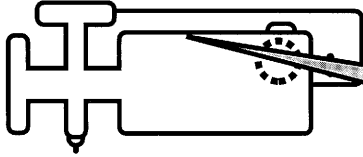
FOR YOUR SAFETY (2) TEIKOKU Canned motor Pumps

Hazards are listed at two levels

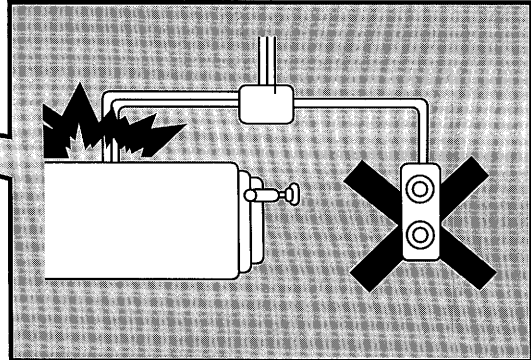
DANGER & CAUTION



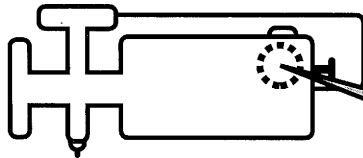
IF MOTOR TRIPS, DO NOT RESTART BEFORE DETERMINING THE CAUSE!



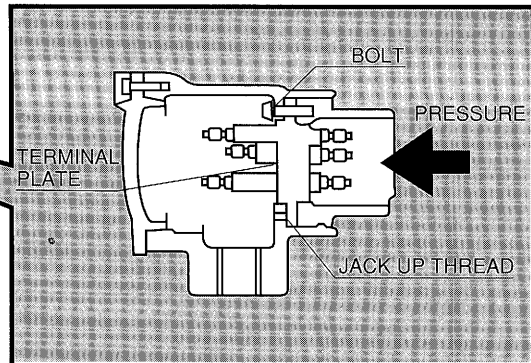
Restarting the motor before ascertaining the cause may result in excessive heat causing pump or motor failure.



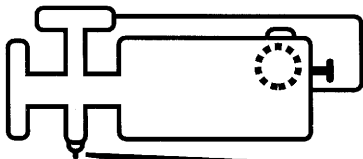
DO NOT REMOVE INTERNAL BOLTS IN TERMINAL BOX!



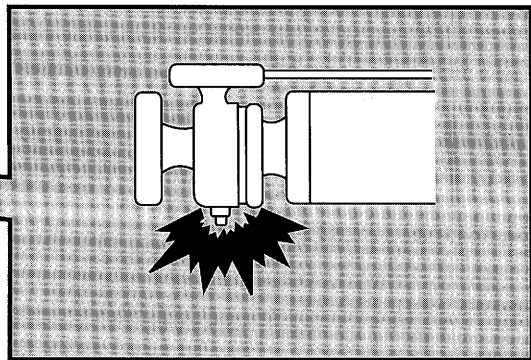
If it is necessary to remove the terminal box for any reason, first loosen the bolts by 2 or 3 turns to check if any internal pressure or liquid is present. You must take measures if the possibility exists that the gas or liquid is toxic or hazardous to personnel or the environment.



DO NOT REMOVE ANY BOLTS ON PUMP, MOTOR OR DRAIN PLUGS!



The internal pressure can be higher than the atmosphere. Always loosen the drain plug slowly to relieve any internal pressure before attempting to disassemble the pump. You must take adequate precautions if the liquid in the pump could be hazardous to personnel or the environment.



ALWAYS ASSUME THAT THERE IS LIQUID LEFT IN THE PUMP!

There is always the possibility that residual liquid could remain in the pump and motor in spite of through decontamination. Pay particular attention to the clearance between the shaft and the impeller, bearings, sleeves, bearing housings and gaskets. You must take adequate precautions to protect personnel and the environment if the liquid could be considered hazardous.

2. INTRODUCTION

This INSTRUCTION MANUAL covers standard type of;

- BASIC MODEL(F-V, FA-V, F&FA-type)
- REVERSE CIRCULATION TYPE(R&RA-type)
- HIGH TEMPERATURE ISOLATION TYPE(B-type)

Other type/model such as High Temperature application Motor(X, Y motor) etc.,needs different instruction manuals. Please check your type/model and if necessary, ask Sales Representative.

Read carefully and do not use the pump before you thoroughly understand all of the instruction manual.

Follow these instruction when operating the pump.

- (1) Do not run pump dry.
- (2) Completely remove foreign materials from piping and system.
- (3) Prime pump and completely vent air in motor housing before starting.
Reverse circulation lines must be fully open all the way to the suction tank.
Open all valves on reverse circulation line before priming.
- (4) Do not run the pump with discharge valve closed for more than one (1) minute.
- (5) Do not operate the pump in a wrong rotating direction.
- (6) If pump is equipped with cooling or heating jacket, do not operate the pump without coolant or heating media.
- (7) In case of noise or vibration, check causes and take steps to correct.
- (8) Do not keep the pump running when TRG (Teikoku Rotary Guardian) meter indicates RED.
- (9) When a protection device indicate problem, check the cause without fail and operate the pump only after the problem is corrected.
- (10) When liquid may freeze or crystallize during pump stop, take necessary precautions.
- (11) Should you need to operate the pump under different conditions from the initial specifications, please consult Factory or Sales Representative.

3. RATING, SPECIFICATIONS AND PERFORMANCE

The pump is manufactured in accordance with your specified requirements. Refer to "Drawings for Confirmation" for the details of rating and specifications. Also refer to the inspection certificates of performance.

Please keep this manual with the drawings and inspection certificates.

4. CONSTRUCTION

Please read relevant pages after having well understanding of the construction of basic model explained below:

4-1. Basic Model(F-V,FA-V,F&FA)

Basic models have two types of construction that have different circulation flow pattern, the hollow shaft construction and the circulation pipe construction. Constructions of the basic model with the hollow shaft (type F-V and FA-V) are shown in Figure 1 and 2. Constructions of basic model with a circulation pipe are shown in Figure 3 and 4. Photographs of component part of the FA-type are shown in Figure 5. The pump and (squirrel-cage induction) motor are assembled in one housing requiring no dynamic seal. The stator and rotor assembly are hermetically sealed with their individual cans. The motor is isolated from the pumped fluid. In the hollow shaft construction, pumped liquid flows from the discharge side of the

impeller to the inlet of the impeller in the following order.

Discharge side of Impeller (02) → Holes in Front Bearing Housing (32) (F-V type) → Gap between Stator Can (22) and Rotor Can (21) → Gap between Bearing (rear side) (15B) and Shaft Sleeve (17) → Rear Bearing Housing (14) → Center hole of Shaft (16) → inlet of Impeller (02) .

Another flow runs from;

Holes of Front Bearing Housing (32) → Gap between Bearing(front side) (15A) and Shaft Sleeve (17) → Orifice formed by Front Bearing Housing (32) and hub of Impeller (02) .

In FA-V type, liquid flows through holes of Adapter (33) into gap between Bearing(front side) (15A) and Shaft Sleeve (17) and then takes the same flow as mentioned above. In the circulation pipe construction, pumped liquid flows from the discharge side of the casing to the impeller in the following order.

Discharge flange of Casing (01) → Filter (03) → Circulation Pipe (34) → Rear Bearing Housing (14) → gap between Bearing(rear side) (15B) and Shaft Sleeve (17) → Gap between Stator Can (22) and Rotor Can (21) → Gap between Bearing(front side) (15) and Shaft Sleeve (17) → Balance hole of Impeller (02)

This circulation flow works as lubricant for Bearing (15A) (15B) and as coolant for motor. So liquid contained slurry or shortage of circulating flow rate may cause troubles. The Rotor Assembly (19) is supported by Bearing (15A) , (15B) on both side of Shaft (16) with Impeller (02) mounted on the end of the shaft. In this construction there is no shaft seal.

F-type and FA-type ;

On the F-type shown in Figure 1 and 3, the pump is close-coupled to the motor. On the FA-types, the pump is mounted with Adapter (33) .In addition to the basic F and FA-types, a variety of models can be provided to meet with a wide range of applications. Following are descriptions of modified pumps available.

4-2. Reverse Circulation Type(R&RA-type)

Reverse circulation type is shown in Fig.6 & 7. In this pump, circulation flow ,which lubricates Bearing (15A) (15B) and cools motor, runs to Rear Bearing Housing (14) as in the hollow shaft construction and then goes back to the suction tank, not to the inlet of Impeller (02) .This is to avoid heated circulated fluid coming into the pump suction. In case where liquids vaporize easily and have little NPSH, R or RA-type should be used. For good operation of reverse circulation type canned motor pump, keep reverse circulation flow rate at or within the specified range all the time while operation. The required flow rate is specified in the pump data sheet.

4-3. High Temperature Isolation Type(B-type)

The B-type pump in shown in Figure 8. This pump has Adapter (33) and is designed to handle high temperature liquid, such as thermal oil or hot water. It contains a high temperature pump housing which consists of Casing (01) and Impeller (02) , and a relatively low temperature motor housing which consists of Stator Assembly (20) and Rotor Assembly (19) . The liquid filling both housing(casing and motor)is the same and connected but thermally separated by an orifice formed by Adapter (33) and Spacer (64) so as to prevent mixing of the two. The adapter is designed to restrict heat transfer from the pump housing.

The pump has following flows:

• Main flow

(1) Suction - Impeller (02) - (01) Discharge

• Circulation flow(No.1)

Auxiliary Impeller (23) → Gap between Stator Can (22) and Rotor Can (21) → Gap between front Bearing (15A) and Shaft

Sleeve (17) Heat Exchanger (35) → Rear Bearing Housing (14) → Center hole of Shaft (16) end.

• **Circulation flow(No.2)**

Auxiliary Impeller (23) → Gap between rear Bearing (15B) and Shaft Sleeve (17) → Center hole of Shaft (16) end.

The hole on Adapter (33) is provided to induce high pressure from Impeller (02) to motor housing so that Auxiliary Impeller (23) does not cavitate.

5. INSTALLATION AND OPERATION

5-1. Instruction before Installation

- (1) Avoid rough handling at the time of transportation and unloading.
- (2) Store in original packed condition.
- (3) Check the specifications indicated on the name plate and test certificate attached to the pump and compare with your requirement specifications.
- (4) Take care not to damage Circulation Pipe (34) and heat exchanger assembly.

5-2. Installation and Wiring

- (1) Completely remove foreign materials from piping, including dirt or welding slag.
- (2) Disassemble Base (40) by taking out Bolt (46D) .
- (3) Set the base to the anchor and fasten bolts.
- (4) Clean flanges and gaskets, Slide the pump on the Base (40) and align the piping to the pump flanges.
- (5) Insert gaskets and fasten flange bolts.
- (6) Connect piping to the jackets, if the pump is equipped with jackets or heat exchanger.
- (7) After piping, fasten Holder (41) to the Base (40) with Bolt (46D) , Plate Washer (54) and Spring Washer (53C) .
- (8) Some R&RA-type pumps may have orifice plate to set in reverse circulation line. The orifice plate is set at the flange of Circulation Pipe (38)
- (9) Connect the electric terminals per "Drawings for Confirmation."

No.	NAME	No.	NAME
01	CASING	46C	BOLT
02	IMPELLER	46D	BOLT
		46E	BOLT
		46F	BOLT
14	RB HOUSING		
15A	BEARING A	48	SET SCREW
15B	BEARING A(grooved)		
16	SHAFT	53A	SPRING WASHER
17	SHAFT SLEEVE	53B	SPRING WASHER
18	THRUST COLLAR	53C	SPRING WASHER
19	ROTOR ASSEMBLY	54	PLAIN WASHER
20	STATOR ASSEMBLY	55A	WASHER
21	ROTOR CAN	55B	WASHER
22	STATOR CAN	55C	WASHER
		56	ADJUST. WASHER
24	TERMINAL BOX	57A	LOCK WASHER
32	FB HOUSING	57B	LOCK WASHER
		58A	KEY
		58B	KEY
		59	PLUG
36	AIR VENT VALVE		
		60	PIN
40	BASE		
41	HOLDER	66A	GASKET
46A	BOLT	66B	GASKET
46B	BOLT		

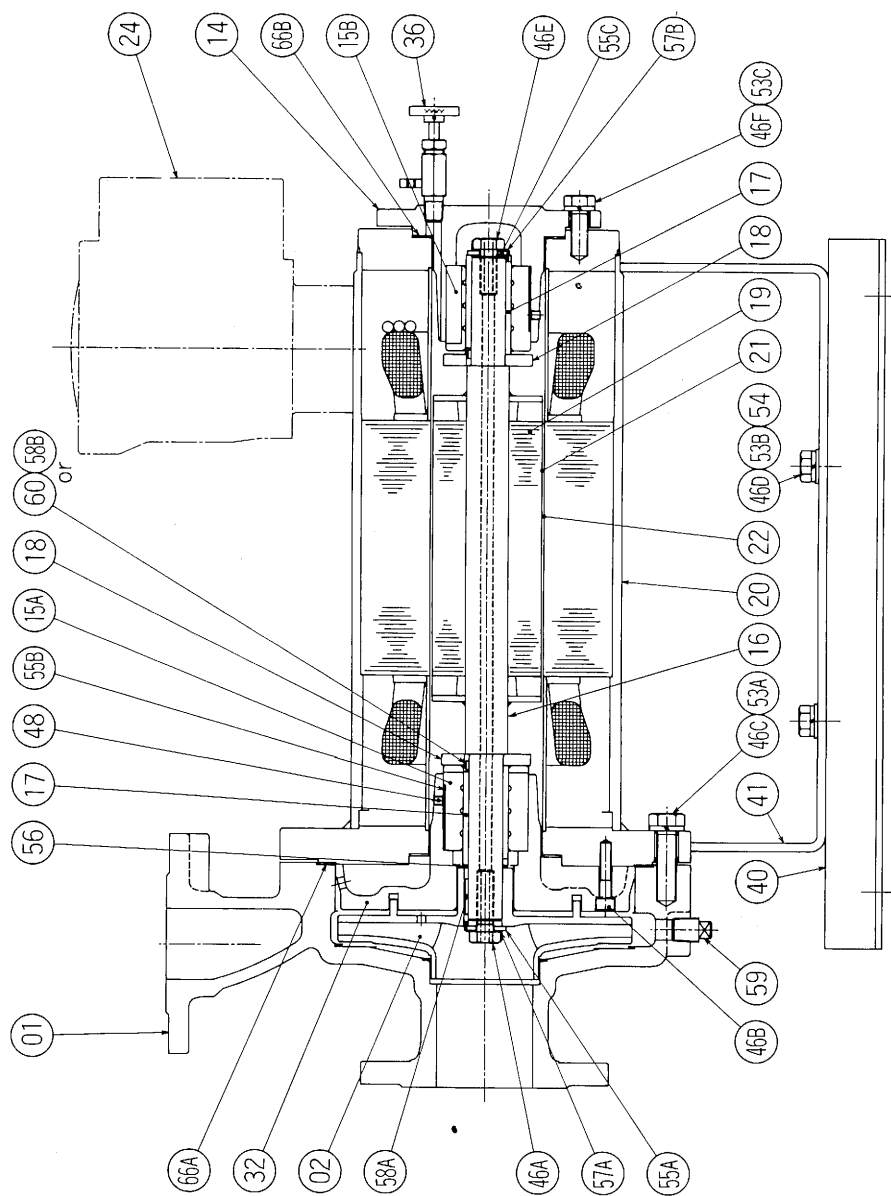


Fig. 1 BASIC MODEL(F-V TYPE)

No.	NAME	No.	NAME
01	CASING	46D	BOLT
02	IMPELLER	46E	BOLT
		46F	BOLT
14	RB HOUSING	48	SET SCREW
15A	BEARING A(grooved)		
15B	BEARING A(grooved)	53A	SPRING WASHER
16	SHAFT	53B	SPRING WASHER
17	SHAFT SLEEVE	53C	SPRING WASHER
18	THRUST COLLAR	53D	SPRING WASHER
19	ROTOR ASSEMBLY	54	PLAIN WASHER
20	STATOR ASSEMBLY	55A	WASHER
21	ROTOR CAN	55B	WASHER
22	STATOR CAN	55C	WASHER
		56	ADJUST.WASHER
24	TERMINAL BOX	57A	LOCK WASHER
		57B	LOCK WASHER
33	ADAPTER	58A	KEY
		58B	KEY
		59	PLUG
36	AIR VENT VALVE		
		60	PIN
40	BASE		
41	HOLDER	64	SPACER
46A	BOLT	66A	GASKET
46B	BOLT	66B	GASKET
46C	BOLT		

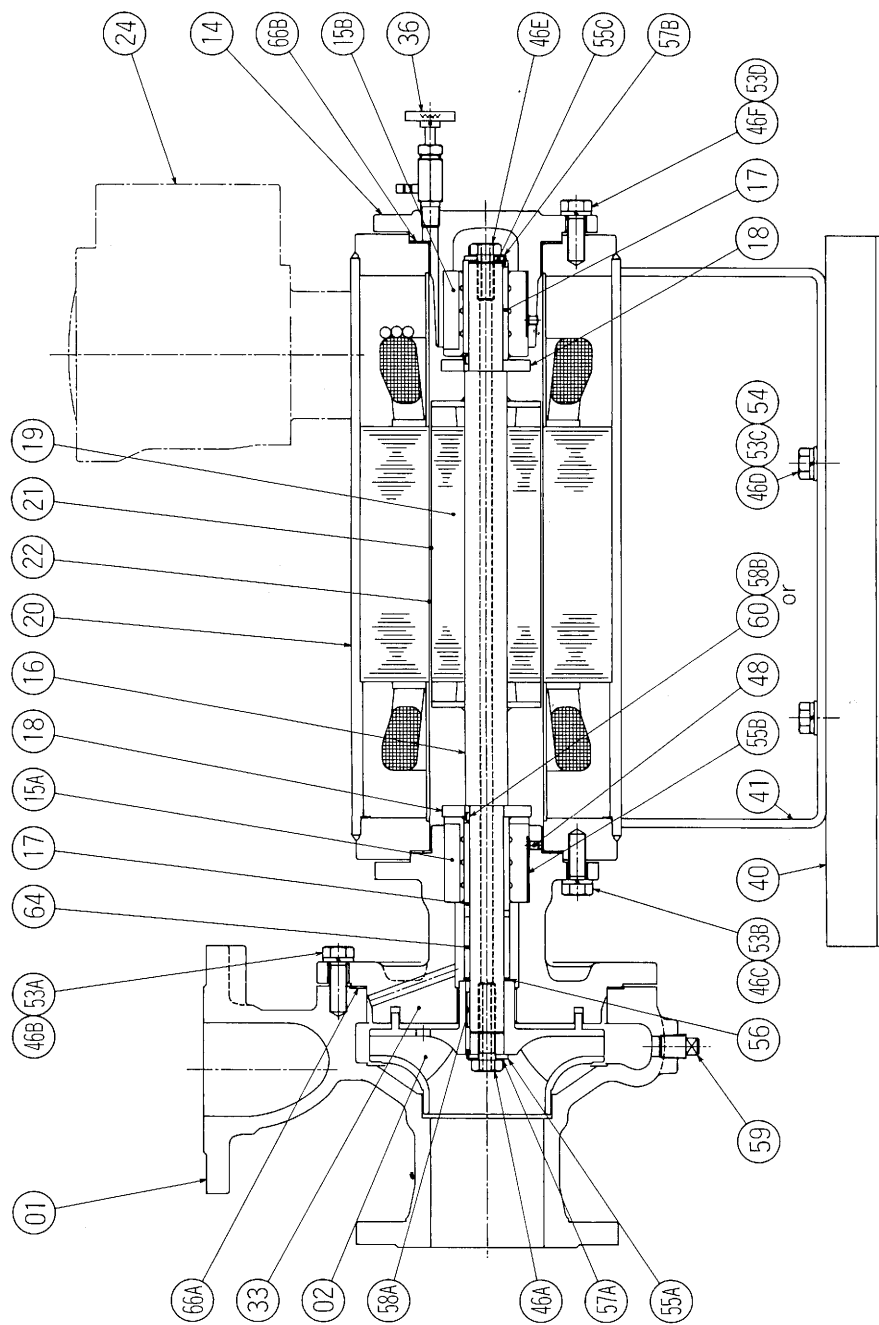


Fig. 2 BASIC MODEL(FA-V TYPE)

No.	NAME	No.	NAME
01	CASING	46B	BOLT
02	IMPELLER	46C	BOLT
03	FILTER	46D	BOLT
		46E	BOLT
14	RB HOUSING	46F	BOLT
15A	BEARING A(grooved)	48	SET SCREW
15B	BEARING A(grooved)		
16	SHAFT	53A	SPRING WASHER
17	SHAFT SLEEVE	53B	SPRING WASHER
18	THRUST COLLAR	53C	SPRING WASHER
19	ROTOR ASSEMBLY	54	PLAIN WASHER
20	STATOR ASSEMBLY	55A	WASHER
21	ROTOR CAN	55B	WASHER
22	STATOR CAN	55C	WASHER
		56	ADJUST. WASHER
24	TERMINAL BOX	57A	LOCK WASHER
32	FB HOUSING	57B	LOCK WASHER
		58A	KEY
34	CIRCULAT. PIPE	58B	KEY
		59	PLUG
36	AIR VENT VALVE		
		60	PIN
40	BASE	61	DOUBLE JOINT
41	HOLDER	66A	GASKET
46A	BOLT	66B	GASKET

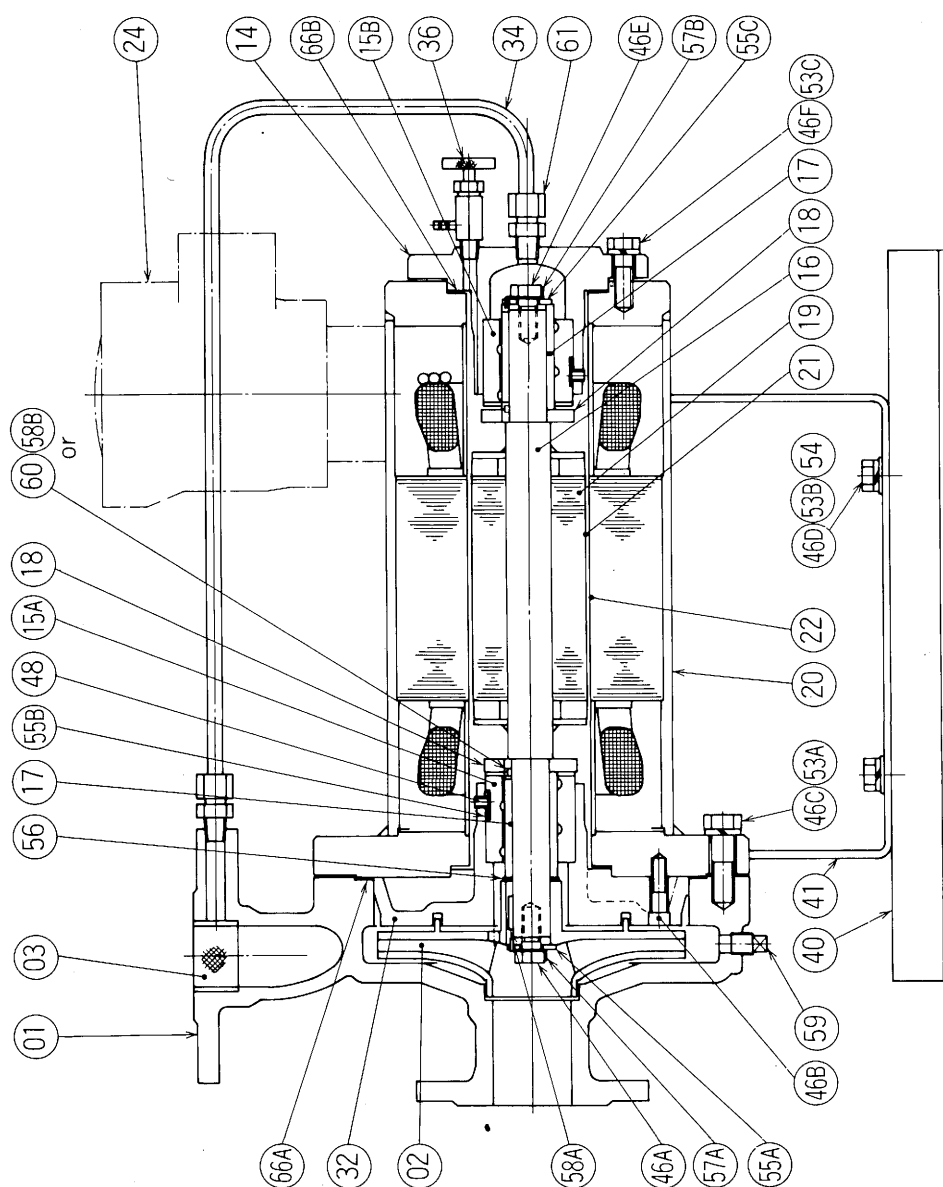


Fig. 3 BASIC MODEL(F-TYPE)

No.	NAME	No.	NAME
01	CASING	46E	BOLT
02	IMPELLER	46F	BOLT
03	FILTER		
14	RB HOUSING	48	SET SCREW
15A	BEARING A(grooved)	53A	SPRING WASHER
15B	BEARING A(grooved)	53B	SPRING WASHER
16	SHAFT	53C	SPRING WASHER
17	SHAFT SLEEVE	53D	SPRING WASHER
18	THRUST COLLAR	54	PLAIN WASHER
19	ROTOR ASSEMBLY	55A	WASHER
20	STATOR ASSEMBLT	55B	WASHER
21	ROTOR CAN	55C	WASHER
22	STATOR CAN	56	ADJUST. WASHER
24	TERMINAL BOX	57A	LOCK WASHER
33	ADAPTER	57B	LOCK WASHER
34	CIRCULAT. PIPE		
36	AIR VENT VALVE	58A	KEY
40	BASE	58B	KEY
41	HOLDER	59	PLUG
46A	BOLT		
46B	BOLT	60	PIN
46C	BOLT	61	DOUBLE JOINT
46D	BOLT	64	SPACER
		66A	GASKET
		66B	GASKET

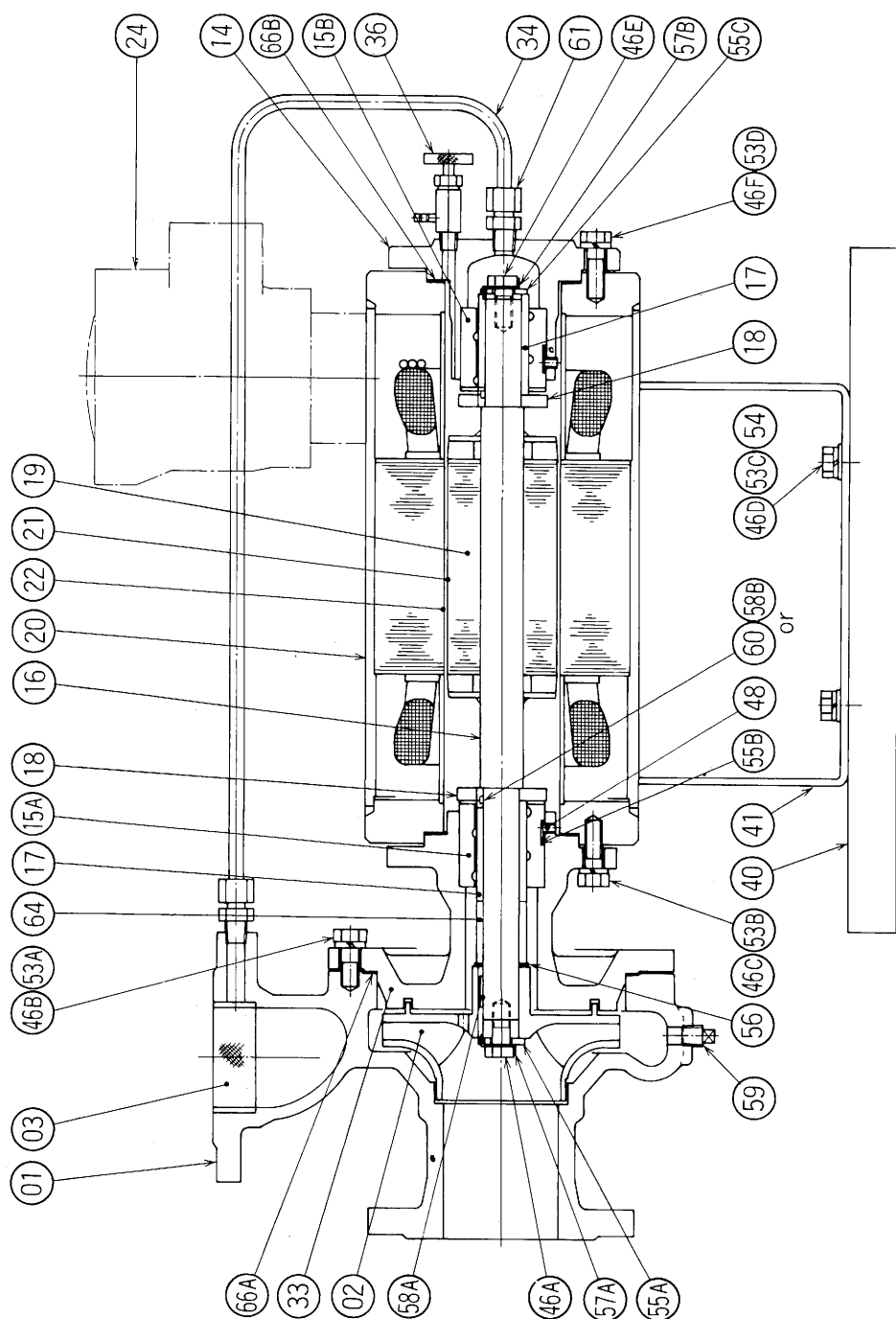
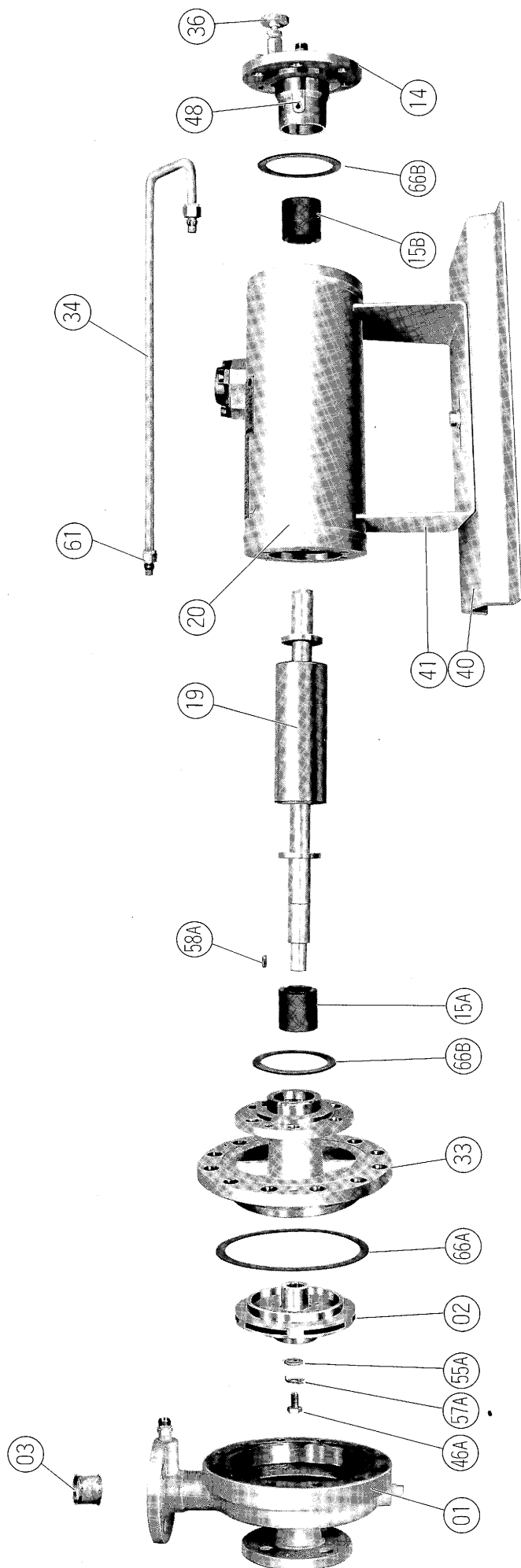


Fig. 4 BASIC MODEL(FA-TYPE)



19 ROTOR ASSEMBLY

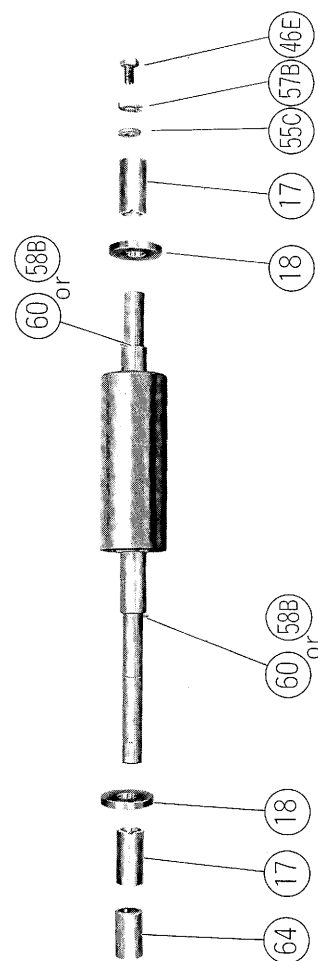


Fig. 5 PUMP ASSEMBLY(FA-TYPE CIRCULATION PIPE CONSTRUCTION)

No.	NAME	No.	NAME
01	CASING	46E	BOLT
02	IMPELLER	46F	BOLT
14	RB HOUSING	48	SET SCREW
15A	BEARING B	53A	SPRING WASHER
15B	BEARING A(grooved)	53B	SPRING WASHER
16	SHAFT	53C	SPRING WASHER
17	SHAFT SLEEVE	54	PLAIN WASHER
18	THRUST COLLAR	55A	WASHER
19	ROTOR ASSEMBLY	55B	WASHER
20	STATOR ASSEMBLT	55C	WASHER
21	ROTOR CAN	56	ADJUST.WASHER
22	STATOR CAN	57A	LOCK WASHER
		57B	LOCK WASHER
24	TERMINAL BOX	58A	KEY
32	FB HOUSING	58B	KEY
		59	PLUG
38	REVERSE CIRCULATION PIPE		
40	BASE	60	PIN
41	HOLDER		
46A	BOLT	66A	GASKET
46B	BOLT	66B	GASKET
46C	BOLT		
46D	BOLT		

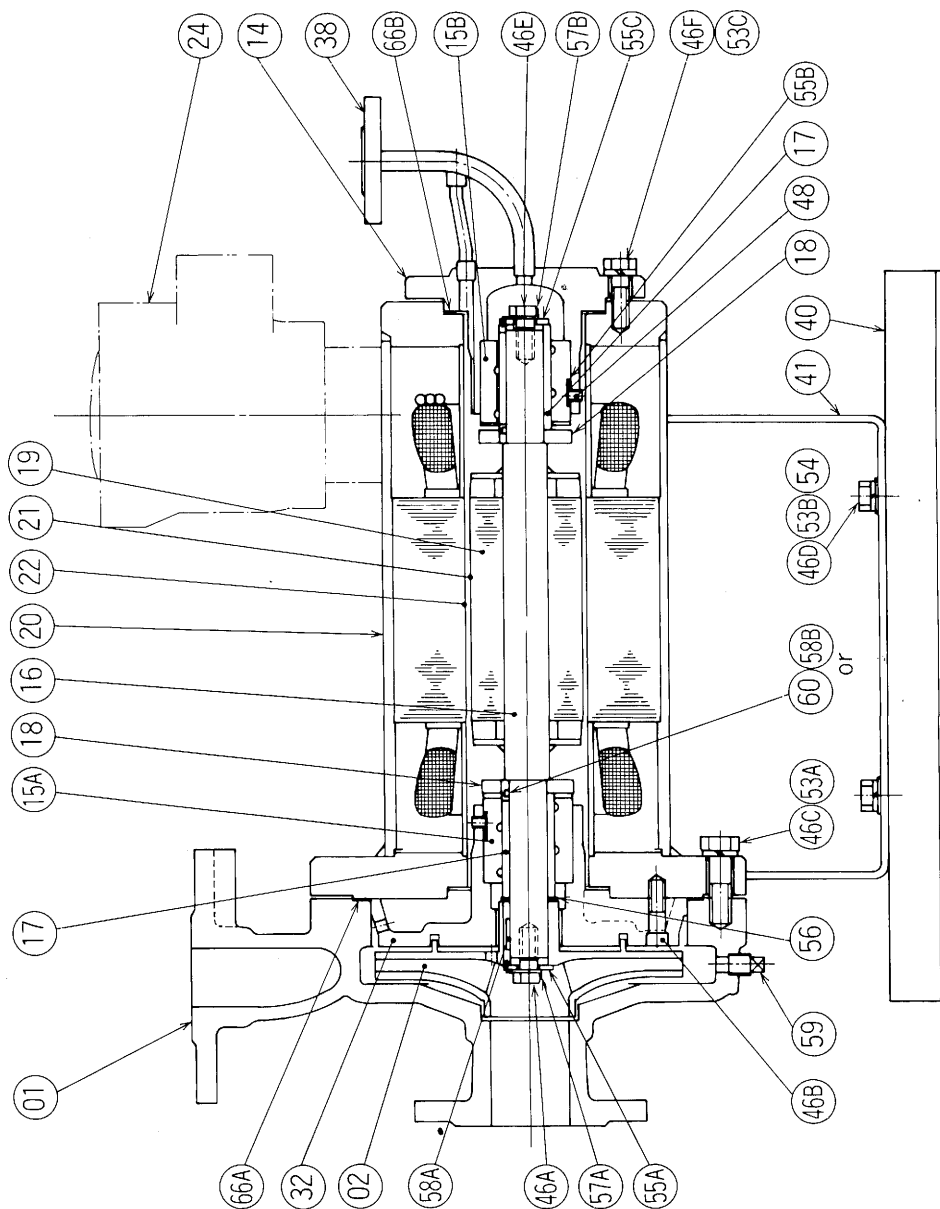


Fig. 6 REVERSE CIRCULATION TYPE(R-TYPE)

No.	NAME	No.	NAME
01	CASING	46E	BOLT
02	IMPELLER	46F	BOLT
14	RB HOUSING	48	SET SCREW
15A	BEARING A(grooved)		
15B	BEARING A(grooved)	53A	SPRING WASHER
16	SHAFT	53B	SPRING WASHER
17	SHAFT SLEEVE	53C	SPRING WASHER
18	THRUST COLLAR	53D	SPRING WASHER
19	ROTOR ASSEMBLY	54	PLAIN WASHER
20	STATOR ASSEMBLY	55A	WASHER
21	ROTOR CAN	55B	WASHER
22	STATOR CAN	55C	WASHER
		56	ADJUST. WASHER
24	TERMINAL BOX	57A	LOCK WASHER
		57B	LOCK WASHER
33	ADAPTER	58A	KEY
		58B	KEY
38	REVERSE CIRCULATION PIPE	59	PLUG
40	BASE	60	PIN
41	HOLDER	64	SPACER
46A	BOLT	66A	GASKET
46B	BOLT	66B	GASKET
46C	BOLT		
46D	BOLT		

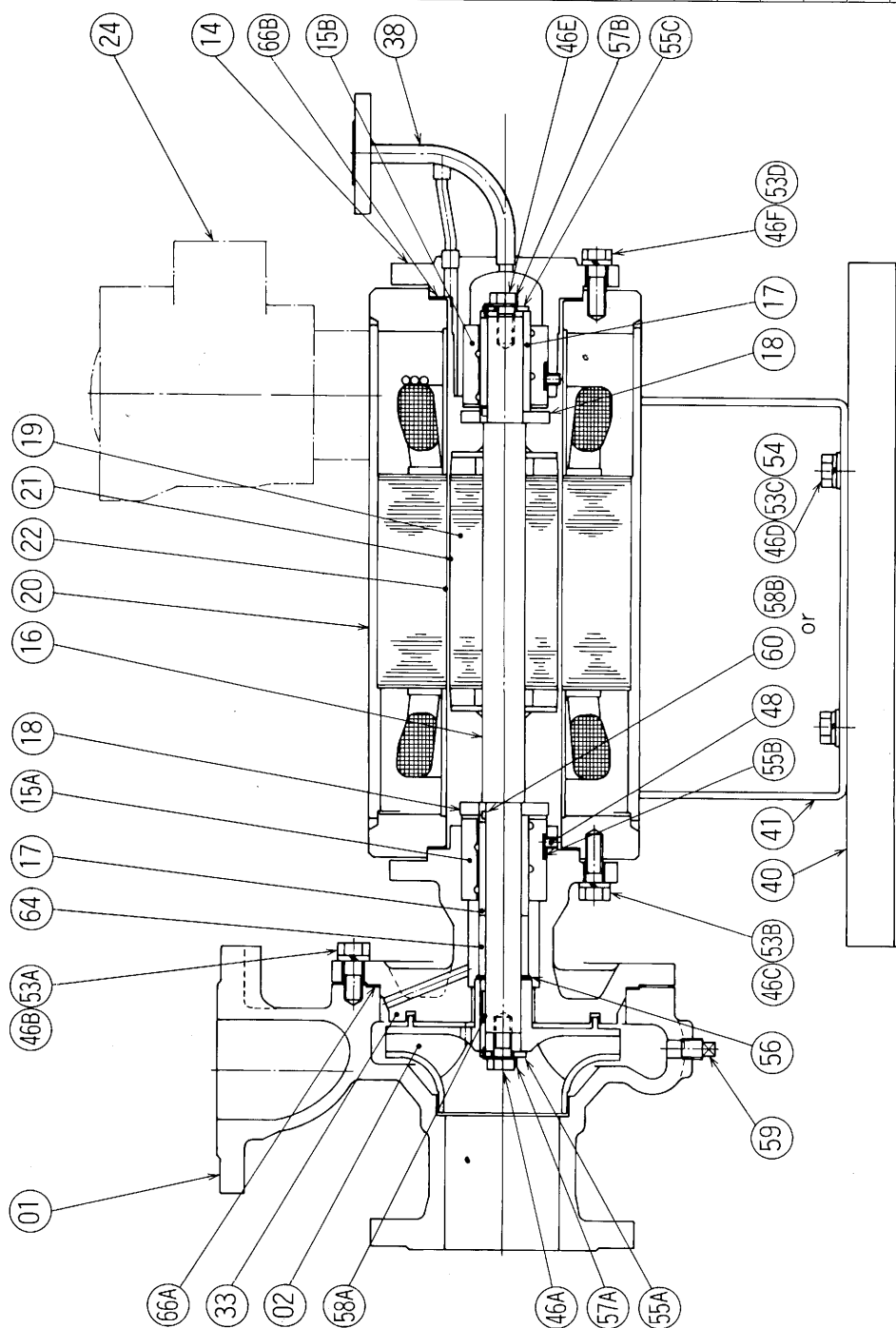


Fig. 7 REVERSE CIRCULATION TYPE(RA-TYPE)

No.	NAME	No.	NAME
01	CASING	46D	BOLT
02	IMPELLER	46E	BOLT
		46F	BOLT
14	RB HOUSING	48	SET SCREW
15A	BEARING A(grooved)	53A	SPRING WASHER
15B	BEARING B	53B	SPRING WASHER
16	SHAFT	53C	SPRING WASHER
17	SHAFT SLEEVE	53D	SPRING WASHER
18	THRUST COLLAR	54	PLAIN WASHER
19	ROTOR ASSEMBLY	55A	WASHER
20	STATOR ASSEMBLY	55B	WASHER
21	ROTOR CAN	55C	WASHER
22	STATOR CAN	56	ADJUST. WASHER
23	AUXILIARY IMPELLER	57A	LOCK WASHER
24	TERMINAL BOX	57B	LOCK WASHER
		58A	KEY
33	ADAPTER	58B	KEY
35	HEAT EXCHANGER	59A	PLUG
36	AIR VENT VALVE	59B	PLUG
		60	PIN
40	BASE	61	DOUBLE JOINT
41	HOLDER	64	SPACER
46A	BOLT	66A	GASKET
46B	BOLT	66B	GASKET
46C	BOLT	72	JACKET

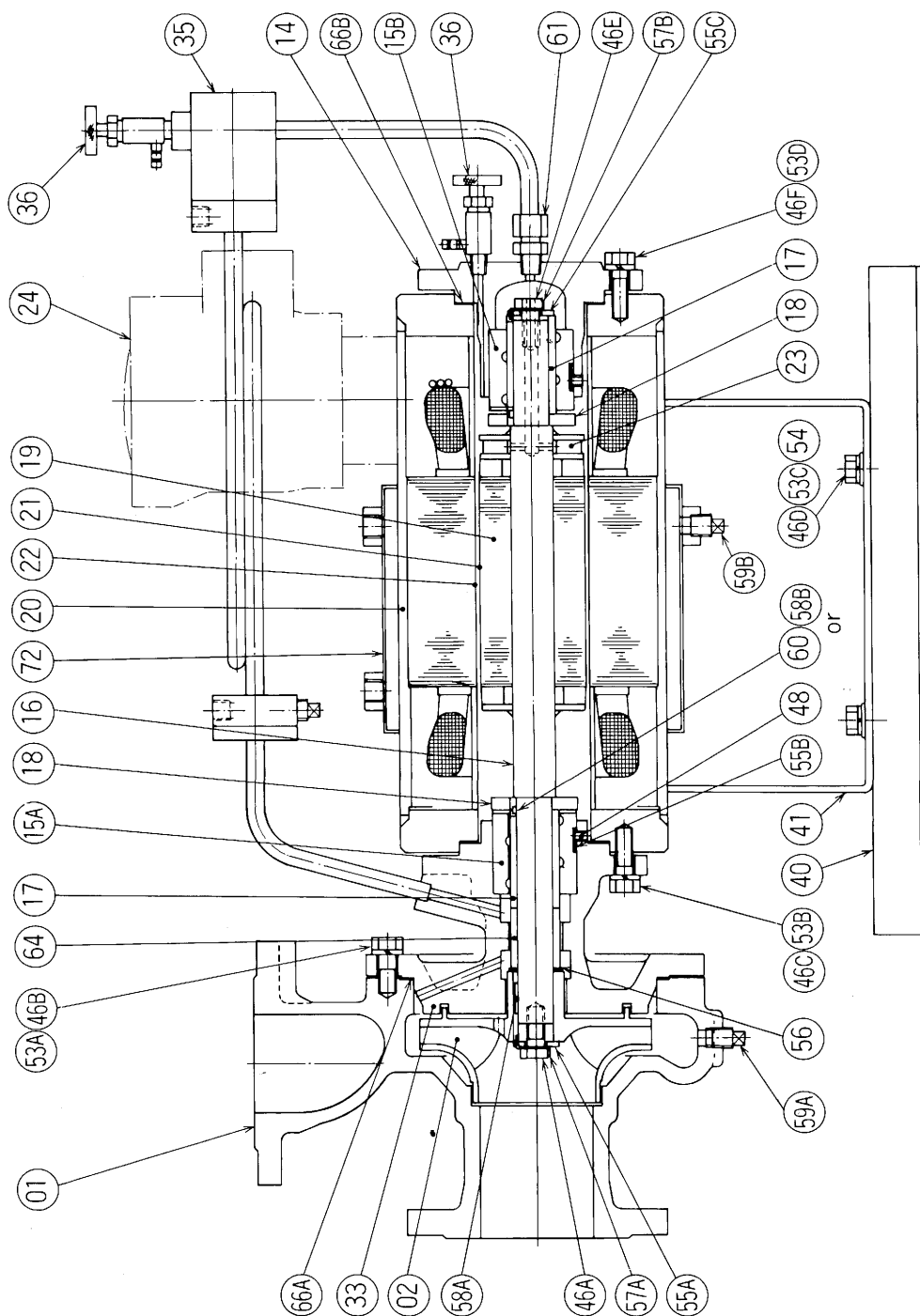


Fig. 8 HIGH TEMP. ISOLATION TYPE(B-TYPE)

5-3. Preparation for Operation and Trial Operation

Following devices are recommended for protection of canned motor pump.

- Over current relay • Leak current check relay

We can supply special low current relay that is useful for protect pumps possible to operate at no liquid conditions such as tank drain pump. Check wiring diagram in Drawing for Confirmation for thermostat wiring.

(1) Setting of overload relay

Because rated current at normal output in the canned motor is higher than that in general motors, set at the rated current indicated on the name plate. It is effective as a protecting device for canned motors to set the overload relay at as low current as possible. Generally, it is recommended to set the relay at the following value.

Variation of voltage & load is small Operating current X 1.1

Variation of voltage & load is big Operating current X 1.25

When operating current is far below of rated current, it is recommended to set the relay based on operating current not rated current.

(2) Priming and air venting

Complete priming should be carried out in the following order. Open vent valve slowly and pay attention for liquid, specially for toxic or high temperature liquid.

- 1) Close discharge valve
- 2) Open suction valve
- 3) Open discharge valve for a few seconds and close it again.
- 4) Bleed air from the air vent valve (36) . If handling a dangerous liquid, pay full attention to air venting. For R and RA-type pumps, there is no need for air venting. But all valves in reverse circulation piping should be opened.

(3) Utility piping

For heating/cooling jacket and heat exchanger, specified media and capacity should be used. Unless otherwise specified, following data shall be adopted.

Table 1. COOLANT FOR MOTOR JACKET & HEAT EXCHANGER

Motor Frame Number	Required Capacity of Coolant	
	Motor Jacket	Heat Exchanger
200	5 l/min or more (1.3 GPM)	15 l/min or more (4.0 GPM)
300	5 l/min or more (1.3 GPM)	20 l/min or more (5.3 GPM)
400	10 l/min or more (2.6 GPM)	20 l/min or more (5.3 GPM)
500	12 l/min or more (3.0 GPM)	25 l/min or more (6.6 GPM)
600	15 l/min or more (4.0 GPM)	25 l/min or more (6.6 GPM)
700	15 l/min or more (4.0 GPM)	50 l/min or more (13.2 GPM)

Note: 1. Temperature of coolant should be less than 35 °C(95°F).

2. When jacket piping is made in series between motor jacket and heat exchanger (for B-type), coolant capacity require for heat exchanger should be adopted and its coolant should flow in the following order;

→ Motor jacket → Heat exchanger →

3. Motor frame number 200 means 2**, that is all motor frame from 200 to 299. For example 700 motor frame means 716, 717, 719, 726, 728 and 729.

(4) Heating, Heating Operation

Heating or heating operation of B-type are as follows;

- 1) Start heating or heating operation at liquid temperature lower than 100 °C. During heating operation, operating current may be higher than rated due to liquid density and viscosity increase at low temperature. Check current and if necessary adjust valve opening to keep current under rated.
 - 2) Less than 50 °C/hr is recommended for temperature change. 150 °C/hr is the maximum heating speed. When heating pumps rapidly, deformation due to heat expansion may result leak from gaskets.
 - 3) For heating stand-by pump, suction valve should be open and discharge valve should be closed.
- (5) Trial Operation
- 1) Open suction valve.
 - 2) Close discharge valve or slightly open it.
 - 3) Check valves in reverse circulation piping are opened.(for R and RA-type).
 - 4) Switch on the pump.
 - 5) Slightly open discharge valve.
 - 6) Check discharge pressure.
 - 7) Check indication of TRG meter.
 - A. Meter overscale -----Pump rotates in reverse direction.
Correct connection of electric terminals.
 - B. Meter indicates YELLOW or RED -----Check causes.
 - C. Meter indicate GREEN -----Normal operating condition.
 - 8) After a few minutes operation, stop the pump and leave it for several minutes (longer time for higher viscosity of liquid).

5-4. Operation

- (1) Begin operation and gradually open valve up to the specified flow rate. When a by-pass piping is provided, open its valve. For R and RA-type pumps, adjust valve to set reverse circulation flow at the specified flow rate.
Check the following points during operation:
 - A. Operation current is less than the rated value?
 - B. Pressure gauge indicates the required value?
 - C. TRG meter indicates GREEN?
 - D. Any abnormal noise or vibration?
 If any abnormal condition is observed, stop the pump and check for possible causes in the following manner.

6. MAINTENANCE & INSPECTION

6-1. Disassembly

- (1) Fully close valves in discharge, suction and utility piping.
- (2) Remove Drain Plug (59) or open drain valve to drain the liquid in the pump. For quick drainage, slowly open Air Vent Valve (36) . Before opening Air Vent Valve (36) , check for high pressure build up in the pump.
- (3) Remove Circulation Pipe (34) (F and FA-type) or heat exchanger(B-type).
- (4) Since piping stress may be loaded, insert a sleeper under Casing (01) .
- (5) Remove fixing Bolt (46B) or (46C) of Casing (01) . Be careful not to spill any remaining fluid when removing.
- (6) Remove Bolt (46D) which fixes Holder (41) on to Base (40) , and slide the pump backward on the Base (40) while the Casing (01) attached to the piping is left as it is.
- (7) As shown, in Figure 9, measure the gap "g" before further disassembling.
- (8) For pulling out Impeller (02) , extend bend of Lock Washer (57A) , by which Impeller Bolt (40A) is locked, and remove Bolt (46A) . Pay attention not to lose small parts, such as key, bolt and washers.

- (9) For F and R-type pumps, remove Bolt (46B) and Front Bearing Housing (32) from the motor flange with the aid of jack-up screw. When the housing is removed, the liquid maintained in the motor housing will flow out. Pay attention to the liquid. When Front Bearing Housing (32) is removed, Bearing (15A) can also be removed along with the housing. Pay full attention not to damage bearing. For FA and RA-type pumps, Adapter (33) is mounted on the motor instead of the front bearing housing. Remove it in the same manner. For B-type pump, the flange which connects heat exchanger and connection pipe should be disconnected first.
- (10) Remove Bolt (46F) which fixes Rear Bearing Housing (14) and dismantle the housing in the same manner as above.
- (11) In taking out Rotor Assembly (19), take care not to damage it. The removed rotor should be put on a clean cloth so as not to damage Rotor Can (21).
- (12) Shaft Sleeve (17) on rear side can be removed by extending bend of Lock Washer (57B) and unscrewing Bolt (46E) which is LEFT-HANDED. Thrust collar (18) can also be removed at this time.

6-2. Inspection

- (1) Bearing (15A) (15B)

Check the following points;

A. Sliding surface(Luster, Scratches, etc.)

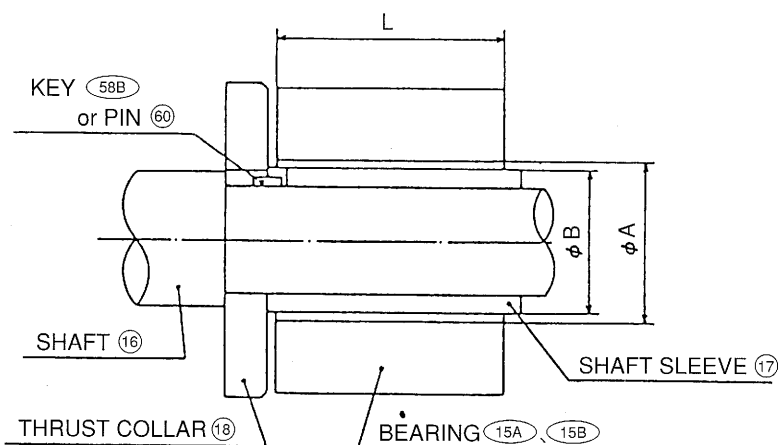
B. Wear inside bore(Refer to Table 2)

C. Wear and tear on thrust surface

If replacement of bearing is needed, remove the Set Screw (48) and take out bearing. In the following table, wear limit of bearing is indicated.

Table 2. BEARING (15) WEAR LIMIT

Motor Frame Number	$\phi A - \phi B$	L
110	0.3 mm (0.012 inches)	44.2 mm (1.746 inches)
210	0.4 mm (0.016 inches)	49.2 mm (1.937 inches)
310,220	0.4 mm (0.016 inches)	59.2 mm (2.331 inches)
410,320	0.4 mm (0.016 inches)	69.2 mm (2.724 inches)
510,420	0.5 mm (0.020 inches)	78.2 mm (3.079 inches)
610,520	0.5 mm (0.020 inches)	113 mm (4.449 inches)
710,620	0.5 mm (0.020 inches)	119 mm (4.684 inches)
720	0.6 mm (0.023 inches)	128.5 mm (5.453 inches)



- (2) Shaft sleeve (17) and Thrust Collar (18)
Check the following points:
 - A. Corrosion
 - B. Sliding surface(Luster, Scratches)
 - C. Wear and tear
- (3) Filter (33) , Circulation Pipe (34)
Are they not blocked or clogged?
- (4) Are there any other contact marks or wear?

6-3. Reassembling

Clean and dry parts. Reassembly is carried out in the reverse order of dismantling.

During assembly, some adjustment may be required. Pay attention to the following:

- (1) On each of the Thrust Collars (18) the hardened surface is one side chamfered smaller at the inside bore. Make sure that the hardened surface faces Bearings (15A) and (15B) .
- (2) Fit the Key (58B) or Pin (60) in place shown in the Fig-5. Make sure that the smaller at the inside bore. Shaft Sleeve (17) engages the key or pin properly.
- (3) Install the rear Shaft Sleeve (17) and lock with the Lock Washer (57) properly.

Table 3-1. PLAYING GAP OF ROTOR IN AXIAL DIRECTION
(Standard type)

Motor Frame Number	New Bearing
110	0.7 ~ 1.9 mm (0.028~0.075 inches)
210	0.7 ~ 2.1 mm (0.028~0.083 inches)
310	0.7 ~ 2.1 mm (0.028~0.083 inches)
410,320	0.9 ~ 2.5 mm (0.035~0.098 inches)
510,420	1.1 ~ 2.9 mm (0.043~0.114 inches)
610,520	1.2 ~ 3.0 mm (0.047~0.118 inches)
710,620	1.4 ~ 3.4 mm (0.055~0.134 inches)

Table 3-2. PLAYING GAP OF ROTOR IN AXIAL DIRECTION
(TBL type)

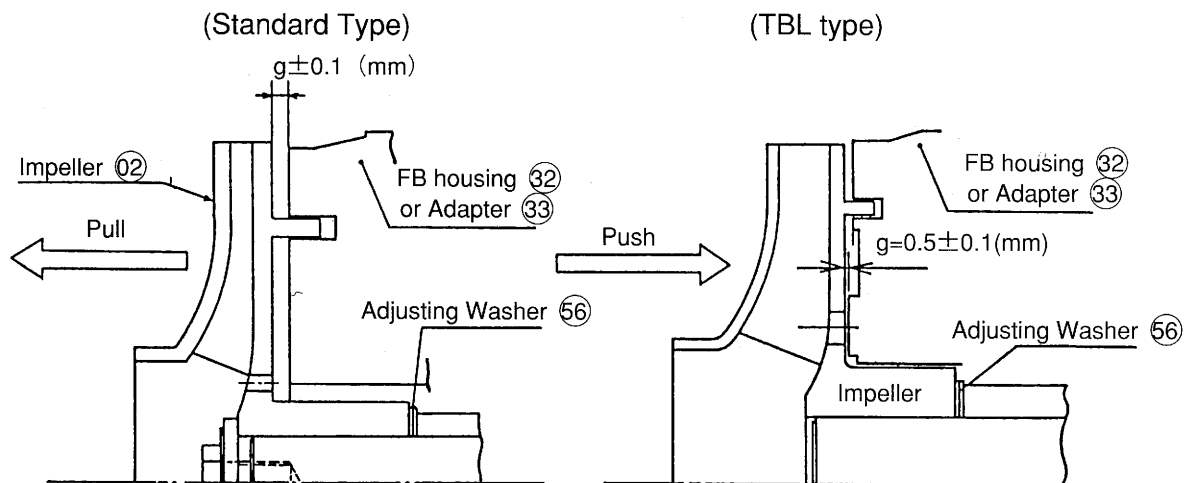
Motor Frame Number	New Bearing
110	1.5 ~ 1.9 mm (0.059~0.075 inches)
210	1.5 ~ 2.1 mm (0.059~0.083 inches)
310	1.5 ~ 2.1 mm (0.059~0.083 inches)
410,320	1.9 ~ 2.5 mm (0.074~0.098 inches)
510,420	1.8 ~ 2.9 mm (0.071~0.114 inches)
610,520	2.1 ~ 3.0 mm (0.083~0.118 inches)
710,620	2.5 ~ 3.4 mm (0.098~0.134 inches)

- (4) Adjustment of an axial play of the Impeller (See Fig-6)
For the standard type, under the condition of the Impeller and the Rotor assembly pulled forward, the gap "g" should be within the value shown in the Table 4. As to the gap "g" for TBL type, adjustment should be done under the condition of the Impeller and the Rotor assembly pushed backward shown in the Fig-9. Adjustment can be made with Adjusting Washers (56) .

Table 4. ADJUSTING VALUE OF GAP "g"

Motor Frame No.	Impeller Size	"g" adjusted
110	R	4 mm (0.158 inches)
210	R, S	4 mm (0.158 inches)
	T	4.2 mm (0.165 inches)
310	R, S	4 mm (0.158 inches)
	T	4.2 mm (0.165 inches)
	U	4.7 mm (0.185 inches)
410 320	R, S	4.2 mm (0.165 inches)
	T	4.5 mm (0.177 inches)
	U	5 mm (0.197 inches)
	V	6 mm (0.236 inches)
510 420	S	4.4 mm (0.173 inches)
	T	4.6 mm (0.181 inches)
	U	5 mm (0.197 inches)
	V	6 mm (0.236 inches)
610 520	S	4.4 mm (0.173 inches)
	T	4.6 mm (0.181 inches)
	U	5 mm (0.197 inches)
	V	6 mm (0.236 inches)
710~ 620~	T	4.8 mm (0.189 inches)
	U	5.4 mm (0.213 inches)
	V, W	6.4 mm (0.252 inches)

Figure 9



- (5) Tighten the Impeller (02) firmly and lock on the hex. head Bolt (46C) with the Washer (57A) securely.
- (6) Make sure that no defect or flaw exists on the Gaskets and their contact surfaces. Install gaskets after cleaned.
- (7) Teflon sealing tape for nipples and plugs should be replaced by new one.

6-4. Troubleshooting

TROUBLESHOOTING

Table 5A

		MOTOR							PUMP							NOISE&VIBRATION			
		Not energized	Over current	Over heat	Poor insulation	TRG indicates red zone	Abnormal wear of bearing	Seizure of bearing	No liquid pumped	Req'd capacity not pumped	Req'd pressure not emitted	Performance goes down	Cavitation occurs	Serging occurs	Abnormal vibration	Vibration increasing	Abnormal noise	Noise increasing	
MOTOR	Poor drying of coil				A														
	Rain water comes in				B														
	Motor size not suited		C	C					C	C									
PUMP	Corrosion		D				D		D	D	D				D			D	
	Wear & tear					E	E	E	E	E	E				E			E	
	Abnormal thrust load on bearing					F	F												
	Deformation of shaft					G					G				G	G			
	Unbalance of rotating unit														H	H			
	Foreign matter clogged	I					I	I	I	I	I				I	I			
	Pump size not suited		C	C			C		C	C									
OPERATION CONDITION	Suction loss is too big								J	J	J	J		J	J	J	J	J	
	NPSH avail. is not enough						K		K	K		K		K		K			
	Discharge loss is too big								J	J	J		J						
	Discharge loss is too small		L							L		L							
	Foreign matter clogged	I							I	I	I	I	I						
	Liquid contains slurry						M												
	S.G.is too big		H						H	H									
	Viscosity is too high		H				H	H		H	H		H						
	Air venting not completed						N	N	N	N	N						N	N	
	Air comes in from suction						O		O	O	O	O	O				O	O	
	Shortage or cut off of coolant			P															
	Poor piping								Q	Q	Q		Q	Q	Q		Q		
	Single phase	R				R			R										
	Anti-phase					S			S	S									
	Not switched on	T							T										

TROUBLESHOOTING

Table 5B

Letter	Countermeasures
A	Send back to service shop for drying
B	Repair gaskets of terminal box or change into packing type conduit
C	Send back complete unit for replacing it with the correct unit
D	Change material after having consultation
E	Repair or change wear parts, or change materials
F	Correct reverse circulation flow in designed or specified capacity for R(or RA-type) type of pump. For other type of pumps, consult us informing detailed operating conditions
G	Repair the deformation
H	Please consult us
I	Take out foreign matter and take measures to prevent occurrence of the same troubles
J	Clean up pipe line and strainers or review design of piping
K	Check liquid level and friction loss in suction side and take measures. Please consult us
L	Review design of piping and consult us
M	Take measures not slurry mixed in the liquid or change pump with slurry type
N	Air venting should be done again in a correct manner
O	Check causes and take measures
P	Provide relay for coolant cut off or increase coolant capacity when fluctuation of flow rate is too big
Q	Correct piping
R	Correct into three phase
S	Correct connection of electric wires
T	Check and/or repair wiring and instruments

REQUIREMENTS FOR PUMPS TO BE RETURNED FOR REPAIR

From the view points of pollution control and safety of workmen when you need repairs and return chemical pumps to us, please pay special precautions to the remaining liquid in pumps and motors.

1. Before you dispatch pump to us, please advise us damaged conditions, the name of liquid and handling care of the liquid and so on and attach them also to the pump.
2. Almost care should be taken for the pump which handles following fluid.
 - (1) Toxic material listed in the law of water pollution control.
Cadmium(Cd) and its compound, cyanide(CN), organic phosphoric acid compound, lead(Pb) and its compound, Cr(VI) compound, arsenic(As) and its compound
 - (2) Contaminants listed in the law of water pollution control
n-Hexane extracts, phenol, copper(Cu), zinc(Zn), dissolved iron, dissolved manganese, chromium(Cr), fluorine(F)
 - (3) Poisonous liquids
 - (4) Explosive liquids
 - (5) Toxic gasifying liquids
 - (6) Liquids with bad smell
 - (7) Strong acid and alkali
3. Pumps handling the above fluids should be treated in the following manner:
 - (1) Completely disassemble pump into parts.
 - (2) Wash pump completely according to 4. Procedure of washing.
 - (3) In case there is any possibilities of break of casing jacket or heat exchanger, those shall also be washed completely.
 - (4) Re-assemble pump and sent to us.
4. Procedure of washing
 - (1) After liquid draining, disassemble pump in accordance with the instruction manual.
 - (2) Wash out remained liquid in casing, impeller, rotor assembly and bearing housings.
 - (3) Circulation pipe and tubes of heat exchanger shall be washed out.
 - (4) As for stator assembly, wash all wetted parts in stator assembly including bolt holes and screws.
 - (5) In case stator can is broken due to corrosion and/or winding is spoiled, terminal box shall be removed first. The terminal box can be removed from the stator by using jack screw. There might be a case that gas bursts out when terminal box is removed, so please do not face to it during the work. When liquid is in stator winding, supply washing water from the opening for 1 to 2 hours continuously. After washing is completed, drain all water.



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