2—1 SEQUENCE

1 to 3 : Pre-operational inspection
4 to 9 : Check during operation

3 Insulation resistance

Check the insulation resistance of the motor, including cable, it should be at least 1 MΩ. (See Page 16.)

2 Motor protector

Ascertain setting is proper for motor rating. (See Page 16.)

7 Checking voltage and current

(See Page 18.)

5 Checking the head

(See Page 15.)

9 Quantity of water

(See Page 15.)

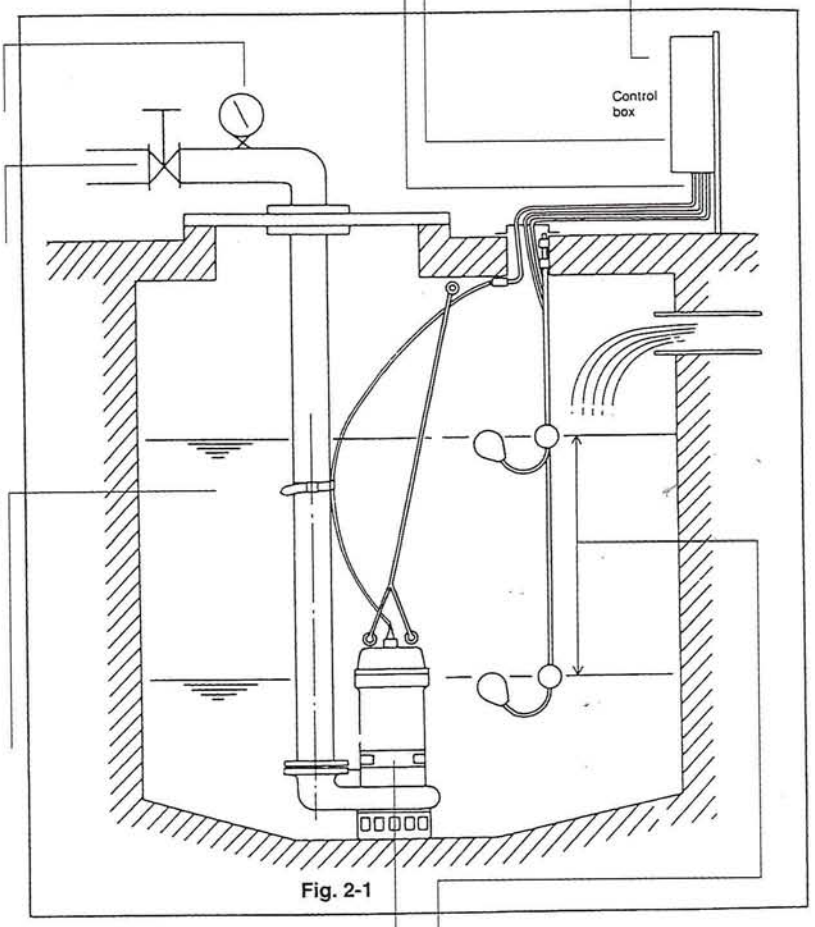

Fig. 2-1

1 Water tank interior

Check the interior of the water tank to determine if the water level is above that for normal operation. (See Page 3 to 6 and the instruction manuals pertaining to the various models.) Check for possible foreign matter in the pump. (See Page 1.)

8 Possible vibration/ noise

(See Page 15.)

4 Rotation direction

(See Page 14.)

6 Automatic Operating water level

(See Page 3 to 6 and instruction manuals pertaining to various models.)
Ensure water level is above that for normal operation, and that air is not drawn into the pump.

2—2 MEASURING WATER LEVEL IN WATER TANK

①Deep well water-level measurement

Bare the tip of the two-core covered wire and lower into the well; upon contact with water it will become conductive. Check for conduction with a multi-meter. Water level is determined by measuring length of the wire from the ground to water surface.

②Exercize care when measuring water level

Water level should be measured while operating the pump as well as when it is stopped. In particular, water level during operation has a direct influence on pumping action. Be sure to take this measurement.

2—3 VERIFYING ROTATION DIRECTION

①With pressure gauge

1) Open the valve on pump discharge side slightly (one or two full turns) and operate pump. Pressure gauge reading is denoted as P_1.
2) Operate pump with motor wiring changed as shown in the following figure (leave the valve open). Here, pressure gauge reading is denoted as P_2.
3) Compare P_1 with P_2.
   The reading showing the higher value indicates correct rotation.

Connection between Power Source and Motor Cables (three-phase)

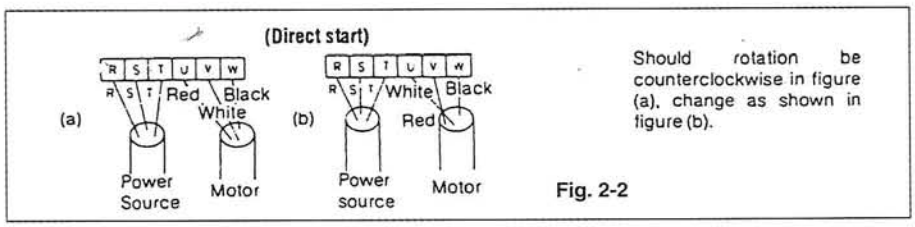

Fig. 2-2

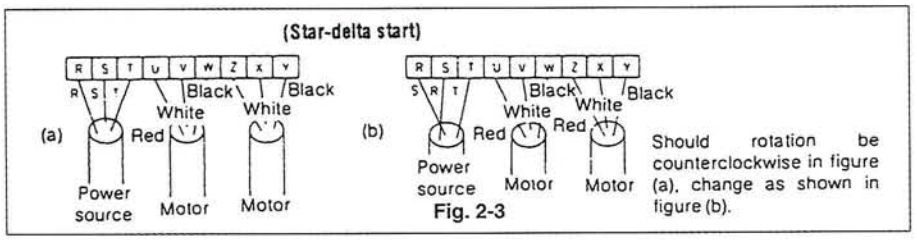

Fig. 2-3

②Without pressure gauge

1) Fully open discharge valve, operate pump and check quantity of water.
2) Change rotation direction as shown in the above figure, operate pump again and check quantity of water.
3) The largest quantity of water indicates correct rotation.

2—4 MEASURING TOTAL HEAD

Total head of pump in operation is calculated as follows:

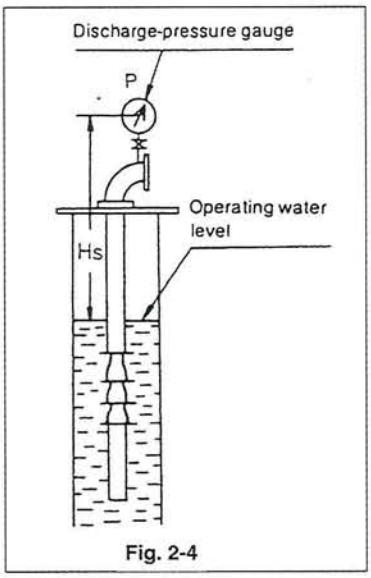

Fig. 2-4

Total head=Reading of pressure gauge + Hs
Hs: Vertical distance (m) from gauge to operating water level.

2—5 VIBRATION AND NOISE

①Noise during operation

1) Any abnormal noise emanating from the interior of the water tank may be caused by reversed rotation, presence of foreign matter, strainer clogging, etc. Hoist pump and inspect. If noise develops after a substantial period of use, the cause may be wear.
2) Surface noise may stem from resonance of piping or foundation. Use of flexible joints in piping or the placing of a rubber mat under manhole will prevent this type of noise.

②Noise when stopped

In most cases this type of noise is caused by water-hammer. As a countermeasure, it is recommended the check valve on the discharge side be replaced with an fast closing check valve.

2—6 QUANTITY OF WATER

It is difficult to measure the quantity of water discharged from the pump at the worksite. It can be estimated, however, on the basis of the measured value of the pump head and the characteristics curve of the pump.

2—7 MOTOR PROTECTOR CHECK

Make sure the capacity of the motor protector and check it appropriate for the motor used.
Be sure the voltage, phase and frequency are correct by checking the name plate. Avoid trial operation using a temporary power source. Temporary sources often have unstable voltage or lack protection, leading to accidents.

2—8 VERIFYING MOTOR INSULATION AND CONDUCTOR RESISTANCE

①Testing insulation resistance

Measuring instrument: Resistance tester (500V cap.)
Measured values: As shown in the following figure...Standard judgement.

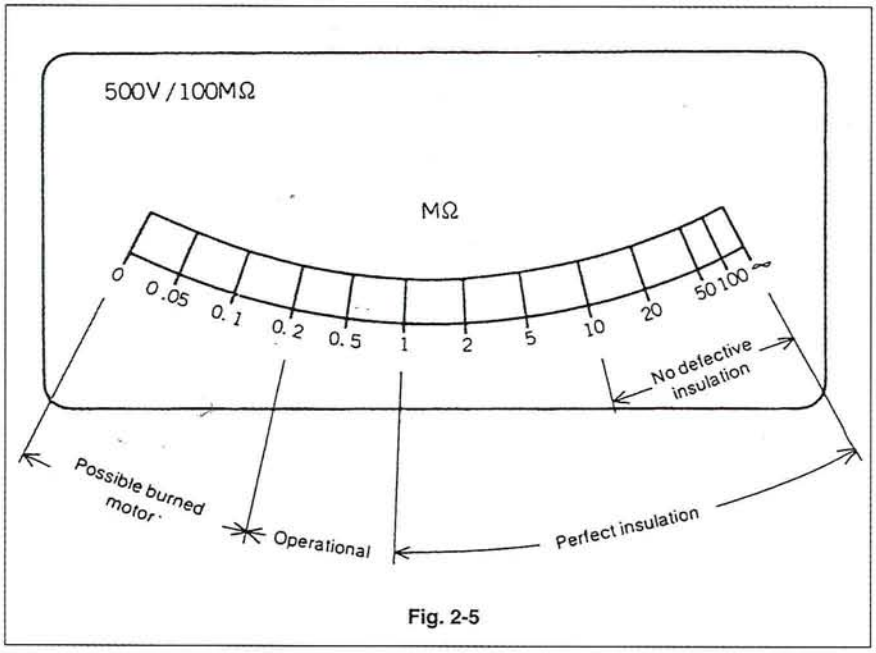

Fig. 2-5

②Cautions

(1) To measure motor insulation resistance, disconnect motor lead from the control panel and take measurement using the end of the power cable.
(2) Consideration of measured values.
1) When, despite proper insulation resistance, the motor fails to start, conductor resistance must be measured, because either the coil is defective or the power cable is broken.
2) Since insulation resistance value varies, according to conditions, a sudden drop indicates potential trouble.
It is therefore necessary to implement appropriate countermeasures, such as reducing the load after the occurrence of this phenomenon.
When using a volute pump, for example, the valve on the discharge side should be slightly closed.

* Example

	Pump 1	Pump 2
Oct.1	5MΩ	10MΩ
Nov.1	5MΩ	5MΩ

Measurement on Nov. 1 showed the values of both models were 5MΩ.
The value of Pump 1 remained unchanged, while that of Pump 2 changed from 10MΩ to 5MΩ.
This is an indication of trouble and appropriate action should be taken.

③Measuring conductor resistance

Equipment: Multi-meter

Method: Stop the motor, disconnect motor lead from the control panel, set tester range to Ω, and measure the resistance between U-V, V-W and W-U using the end of the motor cable. All values should be approximately the same.

- Since motor coil resistance varies according to output and usually indicates several Ω values, it is difficult to make precise measurements with a multi-tester. Thus measured values merely determine motor condition.

* Based on measurements, decisions can be made as follows:

For break of motor coil

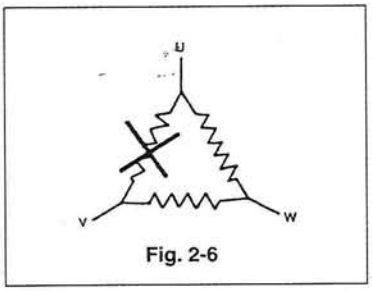

Fig. 2-6

When the coil is broken between U and V, resistance between U and V becomes twice the value of the other two phases.

Example: UV=4Ω
VW=2Ω
UW=2Ω

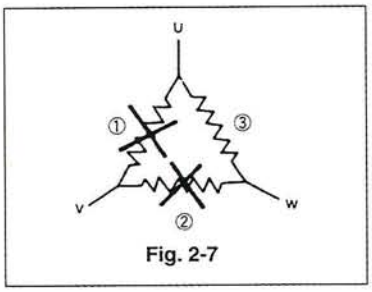

Fig. 2-7

When the two phases of the coil are broken (between U-V and V-W), resistance value between U-V and V-W becomes ∞Ω. Resistance value between U-W may have several Ω values.

2—9 TESTING VOLTAGE

①Measurement at R.S.T. terminals

This measurement determines if there are abnormalities in the power source of the primary side from the control panel. When measuring R-S, S-T and R-T with a voltage tester, each value should be within ±10% of the regulated voltage. However, when the measured voltage is unbalanced (more than 3%), current may become excessive.

If voltage decreases during operation, it is probable that the cable is either too small or the power being received is insufficient.

Inspection is recommended by a competent electrician.

②Voltage measurement at U.V.W. terminals

When there are no voltage abnormalities at R.S.T. terminals, the voltage should be checked at U.V.W. terminals with the control panel activated.

Ensure measured voltage is within ±10% of normal voltage and that the balance between each phase is properly maintained.