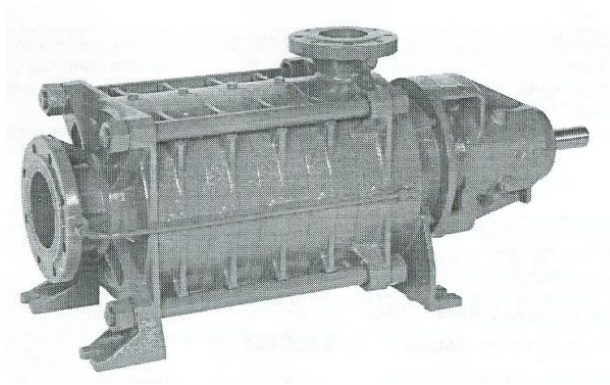


INSTALLATION AND OPERATING MANUAL

TM Series Multi-stage Pump



MANUFACTURED BY



Sterling Pumps Pty Ltd
14 Sharnet Circuit
PAKENHAM, VICTORIA 3810
AUSTRALIA

TELEPHONE: (03) 5941 3400
FAX: (03) 5940 2645
www.sterlingpumps.com.au

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ATTENTION:

Before unpacking the unit, please read this instruction manual very carefully.

If you do not pay attention to the operating instructions:

- **Danger may be created for you and your colleagues**
- **the pump or the pump unit may be damaged**
- **The manufacturer is not liable for damages resulting from this non observance.**

PLEASE BE AWARE OF YOUR RESPONSIBILITY TO YOUR FELLOW MAN WHEN WORKING AT THE PUMP OR THE PUMP UNIT.

Table of Contents

| | |
|--|----|
| 1. General Information | 4 |
| 1.1 Function and instructions for use and maintenance manual | 4 |
| 2. Safety & Warnings | 5 |
| 2.1 Symbols and qualifications of assigned operators | 5 |
| 2.2 General warnings | 6 |
| 3. Transport, Handling & Storage | 7 |
| 3.1 Transportation & Handling | 7 |
| 3.2 Storage & Preservation | 7 |
| 4. Technical specifications | 8 |
| 4.1 Product description | 8 |
| 4.2 Construction | 8 |
| 4.3 Operating data | 8 |
| 4.4 Applications | 9 |
| 4.5 Frequency of start-ups | 9 |
| 5. Installation | 10 |
| 5.1 Preliminary verifications | 10 |
| 5.2 Attach the pump/electropump to the ground | 10 |
| 5.3 Connecting the pipes | 11 |
| 5.4 Electrical connection | 12 |
| 6. Operation & Settings | 13 |
| 6.1 Preliminary verifications | 13 |
| 6.2 Commissioning | 13 |
| 6.3 Checks while running | 13 |
| 6.4 Stop the pump/electropump | 14 |
| 6.5 Storage | 14 |
| 7. Maintenance | 14 |
| 7.1 General Information | 14 |
| 7.2 Components subject to wear | 15 |
| 8. Decommissioning & Disposal | 15 |
| 9. Failures, causes & remedies | 16 |
| 10. Spare parts | 17 |

1. General Information

- a) This manual is to be considered an integral part of the supply of the product; in the event it is ruined or any part is illegible, you should immediately request a copy.
- b) The manufacturer declines all responsibility for improper use of the product, for damage caused following operations not contemplated in this manual or unreasonable interventions.
- c) The product must only be used to satisfy the needs for which it was expressly designed; any other use is considered dangerous. Any intervention that modifies the structure of the product must be expressly authorized only by the manufacturer's engineering dept.
- d) Use original spare parts only and exclusively; the manufacturer accepts no responsibility for damage caused following the use of non-original spare parts.
- e) This product is free from manufacturing defects.
- f) The manufacturer reserves all reproduction rights to this manual. This manual may not be transferred to third parties without the manufacturer's written authorization.
- g) The manufacturer reserves the right to change the design and make improvements to the product without notice to clients already in possession of similar models.

1.1 Function and instructions for use and maintenance manual

- a) These instructions describe the operation of the product and how to use it safely, economically and in conformity with the rules. Observing these instructions will contribute to avoiding danger, reducing the cost of repairs and downtime and increasing the useful life of the product.
- b) This manual must be whole and legible in all of its parts; every operator assigned to use the product or responsible for its maintenance must know its location and must be able to consult it at any time.
- c) Before performing any operation on the machine, it is indispensable that you be completely familiar with the entire use and maintenance manual.

2. Safety & Warnings

2.1 Symbols and qualifications of assigned operators

All the man—machine interactions described in this manual must be performed by the personnel defined in the manufacturer's instructions.



Generic operators: Personnel without specific skills, capable of using the tools under the supervision of competent personnel.



Maintenance mechanics: Personnel with specific mechanical skills capable of performing the installation, maintenance and/or repairs indicated in this manual.



Maintenance electricians: Personnel with specific electrical skills capable of performing the installation, maintenance and/or repairs indicated in this manual. Not enabled to work on mechanical parts.



Cautionary warning to be followed to guarantee the safety of the operator and those persons present in the work area.



Failure to comply with instructions may result in electric shock.



Failure to comply with instructions may result in damage to the motor pump or to the system.

2.2 General warnings



Tampering with the product is prohibited.

The user is responsible for dangers or accidents in relation to other persons and their property. Use the pump/electropump only for the purposes described in the paragraph "Anticipated use." Any other use can be a cause of accidents.

Each transport, installation, connection, setting at work, control and eventual maintenance or stop operation shall be executed by trained and qualified staff. Furthermore, possible local regulations or directions not mentioned in this manual must be taken into consideration as well.



Before executing any operation, the feeder cables shall be disconnected from the terminals of the motor.

Never touch the electric pump while it is working.



Do not touch any parts of the pump when it is operating: maximum temperature for the supports 95°C, the temperature of the pump body depends on the temperature of the liquid (max 120°C). It's the installer's responsibility to use the suitable protections to avoid any risk of contact with hot surfaces, but ensuring the necessary air exchange for cooling the pump and the motor.



With dangerous liquids or liquids having a temperature $> 60^{\circ}\text{C}$, the pump must be provided with devices for the collection and the safe disposal of the drained liquid or of the liquid coming from possible leaks.

In case of motor with internal combustion, forecast a device of collection and safe disposal of gas.

3. Transport, Handling & Storage

3.1 Transportation & Handling

Make sure that the lifting means adopted have a capacity adequate to the load to be lifting and that they are in good condition.

Do not pause or pass under the load during lifting or transport.

The pump/group must only be lifted using an adequate lifting device (crane, lift truck, etc.). Adjust the length of the cables or belts so that the load is maintained horizontal.

3.2 Storage & Preservation

During periods of storage, the material must be protected from humidity, dirt, vandalism or access by unauthorised personnel.

If the pump/electropump remains inactive at low temperatures (the water inside the pump could freeze and cause serious damage) or, at any rate, for a period exceeding three months, it is a good idea to empty the pump and protect it by applying suitable products to its surfaces. To empty the liquid, see the chapter "Decommissioning and disposal."

4. Technical specifications

4.1 Product description

Centrifugal multistage horizontal pumps driven by elastic or hydro-dynamic coupling, anti-clock wise rotation looked from drive side. The pumps in the TM series can be connected to electric, Diesel, hydraulic engines or turbines whose revs are within a range of 1450 and 3500.

TMZ-2P: Electric pump with 2 poles motor 2950 rpm

TMZ-4P: Electric pump with 4 poles motor 1450 rpm

4.2 Construction

Suction body with axial inlet; intermediate stage composed of stage body and the corresponding diffuser with wearing rings. Replaceable impeller seats. Delivery body with upward outlet, with the possibility of turning it at 90°C, both directions. Drive side bearing support with high rigidity. Suction side support of sliding type, lubricated by the pumped liquid. Shaft in stainless steel completely protected. Adjustable packing seal on the shaft, in alternative not balanced or balanced mechanical seal, according to the working pressure. External tie rods for tightening of the intermediate stages.

4.3 Operating data

Flow rate: (Refers to quote / proposal for details)

Head: (Refers to quote / proposal for details)

Speed: 1450 - 3500 R.P.M.

Inlet: PN 16

Outlet: PN 40

Maximum working pressure: 40 bars

Temperature of pumped liquid: min:-15°C; max: 120°C (90° with stuffing box packing, standard)

Ambient Temperature (group of electric pump): max 40°C (please request verification for higher temperatures).

The pumped liquid has to be chemically and mechanically suitable for the utilized materials.

4.4 Applications

The centrifugal multistage horizontal pumps of series TM are used in irrigation systems, systems of high pressure lifting, refrigeration, heating, snowing, cleaning, in boiler systems, in condensed extraction and in fire-fighting systems.

Do not use the pumps for uses other than those specified. Any other use is to be considered improper and, for this reason, potentially dangerous for the operator's health as well as voiding the warranty.

Never use the electric pump in explosive atmospheres or to pump inflammable or dangerous liquids.

Check the norms locally in force concerning the indicated materials for particular uses (use with drinking water or foodstuffs, fire protections, etc...).

In order to avoid seriously damaging the components, observe the following recommendations:

- never use the pump in absence of liquid
- never use the pump with null delivery (closed delivery)
- always use the pump with a delivery indicated in the working diagram.

4.5 Frequency of start-ups

| Start-ups/hour with 2 poles | | Start-ups/hour with 4 poles | |
|-----------------------------|-------------|-----------------------------|-------------|
| Installed Power (kW) | Starts/hour | Installed Power (kW) | Starts/hour |
| Up to 22 kW | 15 | Up to 37 kW | 15 |
| from 30 kW to 37 kW | 10 | from 45 kW to 55 kW | 10 |
| from 45 kW to 55 kW | 7 | from 75 kW to 90 kW | 8 |
| from 75 kW to 90 kW | 4 | | |

5. Installation

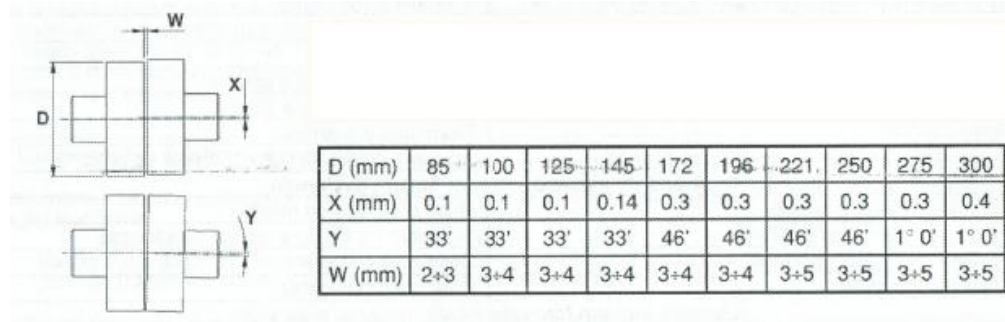
5.1 Preliminary verifications

- Verify that the data shown on the plate, and in particular, power, frequency, voltage, absorbed current, are compatible with the characteristics of the electric line or current generator available. In particular, the voltage of the line voltage can have a variance of $\pm 5\%$ from the nominal voltage value on the plate.
- TM series of pumps: the useful output power provided by the engine must be above the power absorbed by the pump.
- Verify that the protection and insulation grade indicated on the plate are compatible with the environmental conditions.
- Verify that the chemical/physical characteristics of the liquid to be moved correspond to those specified on the order.
- Verify the environmental conditions: Pumps can be installed in enclosed or, at any rate, protected areas, with maximum ambient temperature of $+ 40\text{ }^{\circ}\text{C}$ in a non-explosive atmosphere.
- Verify that the electrical system corresponds to the CEI EN 60204-1 standard and, in particular: the existence of an earth connection, the presence of a lockable disconnecting switch to isolate the motor in the event of malfunction or small maintenance interventions and the presence of an emergency stop button.
- Verify that the pump's flow rate and head correspond to the required characteristics.
- Make sure that the pump's support surface is solid and even (so that it rests on all the feet) and that the load capacity of the surface is adequate for the weight shown on the plate.
- Check that the strength of the concrete foundations is appropriate and complies with current relevant regulations.
- Verify that the surrounding area is sufficient for ventilation and allows movement in the case of maintenance.

5.2 Attach the pump/electropump to the ground

- The pumps in the TM series can be connected to electric, Diesel, hydraulic engines or turbines by means of a base and an elastic joint.
- The pump/electropump must be installed as close as (possible) to the suction point of the liquid.
- The foundation bolts must be inserted in the base and uniformly tightened.
- For series TM and TMZ pumps, after having attached the base:
 - * Check the horizontal alignment of the unit with a spirit level.
 - * It is necessary to carefully check the alignment of the pump axis with the axis of the motor and the distance between the two flanges of the joint. More precisely, with reference to the table below and according to the diameter of the joint, it is necessary that alignment errors X and Y are less than the maximum allowable

values shown; the distance W between the two flanges falls within the indicated limits; moreover, when rotating the pump, the distance W must be constant along the entire circumference. To make corrections, loosen the attachment screws and shim with calibrated plates.



- Always check the alignment of the pump shaft with the engine shaft after securing the base to the foundations, even in the case ready-assembled electropump units are supplied (the TMZ series).
- Only operate the unit if it is fitted with a lap plate that complies with UNI EN 953 standards.

5.3 Connecting the pipes

Before connecting the pipes to the relative openings, make sure that the rotating part of the pump turns freely and is not hindered.

The following warnings must be observed for the correct operation of the pump and the system:

- The NPSH value available in the lifting system must always be greater than the NPSH value of the electropump in order to avoid cavitation.
- The intake and delivery pipes must not transmit forces to the pumps/electropumps due to their own weight and/or heat expansion, at the risk of possible liquid leaks or breaking the pump. For this reason, the pipes must be supported by anchorages and expansion joints must be inserted in the appropriate positions.
- The intake pipe must always be perfectly airtight and not positioned horizontally, but must always rise towards the pump. On the other hand, in the case of operation under water head, the intake pipe must always slope down towards the pump. For this reason, any fitting cones must be eccentric and oriented as shown in the figure to avoid the formation of bubbles during priming or operation.
- It is a good idea to protect the pump by inserting a filter on the intake pipe; especially during the initial period of operation, the pipes release slugs capable of damaging the pump seals. The filter must have a mesh less than 2mm and a free passage area of at least 3 times the section area of the pipe so as to avoid excessive losses of head.
- To adjust the flow rate, it is a good idea to install a shutter on the delivery pipe.

- If the difference in geodetic level exceeds 10 m, or the pipe has a length of over 50 m, it will be necessary to install a non-return valve between the pump and the shutter to protect the pump from "water hammers."
- To achieve the good operation of the pump, we recommend mounting a foot valve.

5.4 Electrical connection

The electropumps are not provided with an electrical panel. The user is responsible for realizing and installing it in observance of the CEI EN 60204-1 standard.

After having verified the data indicated on the plate, proceed to connect the electricity to the motor terminals in observance of the diagrams in fig.5 or in the terminal board, according to the voltage and number of phases of the power supply.

Fit the earth connection.

In the case of a three-phase power supply, verify that the rotation direction of the electropump corresponds to that indicated by the arrow on the pump body. Rapidly apply and remove voltage and observe the rotation direction of the motor cooling fan through the holes of fan guard. In the event that the pump is rotating in reverse, reverse two phases on the terminal board.

Perform this operation with the pump full of liquid.

6. Operation & Settings

6.1 Preliminary verifications

- The pump has been completely filled up with liquid.
- The system has been fitted with all the necessary hydraulic, electrical and mechanical protection devices and that these have been correctly adjusted.
- The direction of rotation is correct.
- All connections are watertight.

6.2 Commissioning

For installations under water head, close the valve on the delivery pipe.

- Prime the pump by filling it with water through the loading plughole located on the upper part of the pump body.
- Within filling, unscrew all the plugs located at the top in order to release the air, and fill the pump up completely.
- For installations under water head, fill the pump by opening the shutter in the intake pipe and that of the delivery to release the air.
- Close the shutter on the delivery.
- Feed current, waiting for the pump to reach full operating speed.
- Slowly open the valve on the delivery until you achieve the desired flow rate.
- In the event that you observe small leaks, it is a good idea to wait until it reaches full operating speed and temperature to see if they stop.

6.3 Checks while running

After a sufficient period of time to reach normal operating conditions, verify that:

- There are no liquid leaks.
- There are no vibrations or anomalous noises.
- There are no oscillations of the flow rate.
- The ambient temperature does not exceed 40 °C.
- The temperature of the pump body does not exceed 120 °C.
- The motors current absorption does not exceed that shown on the plate.

In the presence of even only one of these conditions, stop the pump and find the cause.

Stuffing box packing: tighten the packing gland after 4/5 hours of operation. After tighten the gland, the amount of leaking liquid should be a slight dripping and, at any rate, must be less than prior to this operation.

Mechanical seal: the mechanical seal does _not require any adjustment and/or maintenance. Liquid may leak at the beginning of operation due to the bedding-in of the seal itself. Should the leakage fail to cease, stop the unit and identify the cause.

6.4 Stop the pump/electropump

- If the non-return valve is not present, close the shutter on the delivery pipe.
- If there is no foot valve present, close the intake shutter.
- Disconnect the electric power supply to the pump engine.

6.5 Storage

Pump installed, not in operation but ready to be started up: operate the pump for at least 10 minutes once a month. Pump removed from the system and put into storage: clean the pump and protect its surfaces from corrosion by applying appropriate products.

7. Maintenance

7.1 General Information

In the event it is necessary to perform any type of maintenance, the following precautions must be followed:

- Disconnect the pump motor from the electrical system;
- Ensure the status of the unit is safe and prevent it from being started up again by accident.
- Wait until the temperature of the liquid is such not to create a danger of burns;
- If the liquid handled by the pump is harmful for one's health, it is indispensable to observe the following warnings:
 - = Abide by the relevant legal regulations;
 - = the operator must wear suitable individual protection devices (mask, goggles, gloves, etc.);
 - = the liquid must be carefully collected and disposed of with respect for current law;
 - = the pump must be washed inside and out, disposing of the residues as said above.

7.2 Components subject to wear

The components subject to routine wear are: the bearings, gaskets, O-rings, rings and mechanical seal.

The status of components subject to wear should be checked at least once every 15,000 hours of operation, or every 2 years, replacing them if necessary.

However, we recommend replacing these components every time the pump is disassembled / reassembled.

8. Decommissioning & Disposal

At the end of the operating life of the pump/electropump or any of its parts, it must be disposed of in observance of current regulations. This is also valid for the liquid contents, with particular regard if classified toxic or harmful, which must be drained either in the case of demolition or maintenance, proceeding as follows:

- under the drain plug, provide a collection container or allow the liquid to drain freely according to its characteristics;
- unscrew the lower drain plug and the upper loading plug and let drain completely.
- Proceed in a similar manner for any oil contained in the bearing support (optional).

9. Failures, causes & remedies

| Problems | |
|--|--|
| Causes | Remedies |
| The motor doesn't start and there is no noise or vibration | |
| No voltage in the motor cable. | Check the device and/or electric line. |
| The fuses are burnt out. | Replace the fuses with others of the same value. |
| Motor cable interrupted. | Repair or replace the cable. |
| Motor broken. | Replace the motor. |
| The motor doesn't start and there is noise and/or vibration | |
| The motor was incorrectly connected. | Correct the incorrect electrical connection. |
| The rotating part is hindered. | Disassemble and remove the cause. |
| The electrical protection devices are triggered | |
| The power supply voltage does not match that shown on the motor plate. | Change voltage or motor. |
| A cable is grounded or has a short circuit. | Repair or replace the cable. |
| The winding is grounded. | Disassemble the motor and repeat the winding or replace the motor. |
| Cable terminals loose. | Tighten all the terminal clamps. |
| The rotating part is blocked. | Disassemble and remove the cause. |
| Excessive amount of sand in the water. | Reduce the flow rate using the delivery shutter. |
| Density and/or viscosity of liquid too high. | Contact the manufacturer. |
| Insufficient or no flow rate | |
| The pump was not correctly filled with liquid. | Fill the pump. |
| The intake pipe is narrow or has leaks. | Replace the pipe or gasket. |
| The foot valve is clogged. | Clean or replace the valve. |
| Impeller obstructed. | Disassemble and overhaul. |
| The level in the well is lower than anticipated. | Adjust the flow rate of the pump to that of the well. |
| Head less than declared | |
| Incorrect rotation direction. | Change the rotation direction. |
| Leaks in the delivery pipe. | Replace the damaged pipe or gasket. |
| Inside parts worn. | Disassemble and overhaul. |
| Air or gas in the water. | Contact the manufacturer. |
| The pump operates irregularly and/or vibrates | |
| Pump operating with head too low. | Adjust the shutter on the delivery pipe. |
| Mechanical parts worn. | Disassemble and overhaul. |
| System NPSH is insufficient. | Reduce the flow rate. Lower the installation level. |
| The pump is operating in an irregular manner and/or vibrates and there is leakage from the seal | |
| The unit is not correctly aligned. | Align. |
| Leakage from the seal or pump | |
| The unit is not correctly aligned. | Align. |

| | |
|--------------------|--|
| The seal is worn. | Replace the seal. |
| Tie rods/ Gaskets. | Tighten the tie rods/ Replace the gaskets. |

10. Spare parts

Use only original spare parts. To order spare parts, refer to the catalogues or contact the Sterling Pumps specifying the kind of pump, the serial number and the year of manufacture.