



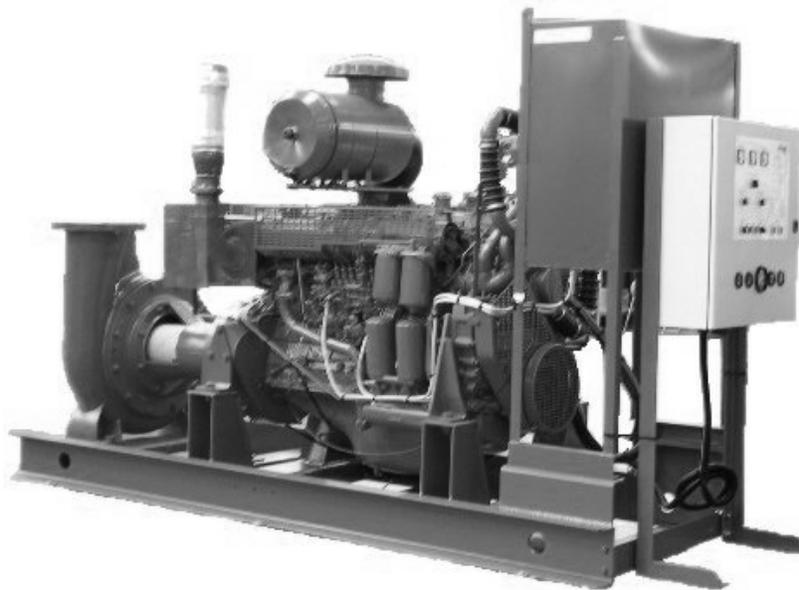
USER INSTRUCTIONS

MEN / MHP, MEN-TI (Sealed for life bearings) ME-TI (AND OTHER PUMPS)

Installation Operation Maintenance

Motor-pump unit reserved exclusively for fire-fighting purposes. Diesel engine cooled with a spent water heat exchanger centrifugal pump

PCN=71576298 - 11-09 (E) *Original instructions.*



These instructions must be read prior to installing, operating, using and maintaining this equipment.

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1 INTRODUCTION AND SAFETY

1.1 General



These instructions must always be kept close to the product's operating location or directly with the product.

Flowserve's products are designed, developed and manufactured with state-of-the-art technologies in modern facilities. The unit is produced with great care and commitment to continuous quality control, utilizing sophisticated quality techniques, and safety requirements.

Flowserve is committed to continuous quality improvement and being at service for any further information about the product in its installation and operation or about its support products, repair and diagnostic services.

These instructions are intended to facilitate familiarization with the product and its permitted use. Operating the product in compliance with these instructions is important to help ensure reliability in service and avoid risks. The instructions may not take into account local regulations; ensure such regulations are observed by all, including those installing the product. Always coordinate repair activity with operations personnel, and follow all plant safety requirements and applicable safety and health laws and regulations.



These instructions must be read prior to installing, operating, using and maintaining the equipment in any region worldwide. The equipment must not be put into service until all the conditions relating to safety noted in the instructions, have been met. Failure to follow and apply the present user instructions is considered to be misuse. Personal injury, product damage, delay or failure caused by misuse are not covered by the Flowserve warranty.

1.2 CE marking and approvals

It is a legal requirement that machinery and equipment put into service within certain regions of the world shall conform with the applicable CE Marking Directives covering Machinery and, where applicable, Low Voltage Equipment, Electromagnetic Compatibility (EMC), Pressure Equipment Directive (PED) and Equipment for Potentially Explosive Atmospheres (ATEX).

Where applicable the Directives and any additional Approvals cover important safety aspects relating to machinery and equipment and the satisfactory provision of technical documents and safety instructions. Where applicable this document incorporates information relevant to these Directives and Approvals.

To confirm the Approvals applying and if the product is CE marked, check the serial number plate markings and the Certification. (See section 9, *Certification*.)

1.3 Disclaimer

Information in these User Instructions is believed to be reliable. In spite of all the efforts of Flowserve Pump Division to provide sound and all necessary information the content of this manual may appear insufficient and is not guaranteed by Flowserve as to its completeness or accuracy.

Flowserve manufactures products to exacting International Quality Management System Standards as certified and audited by external Quality Assurance organizations. Genuine parts and accessories have been designed, tested and incorporated into the products to help ensure their continued product quality and performance in use. As Flowserve cannot test parts and accessories sourced from other vendors the incorrect incorporation of such parts and accessories may adversely affect the performance and safety features of the products. The failure to properly select, install or use authorized Flowserve parts and accessories is considered to be misuse. Damage or failure caused by misuse is not covered by the Flowserve warranty. In addition, any modification of Flowserve products or removal of original components may impair the safety of these products in their use.

1.4 Copyright

All rights reserved. No part of these instructions may be reproduced, stored in a retrieval system or transmitted in any form or by any means without prior permission of Flowserve.

1.5 Duty conditions

This product has been selected to meet the specifications of your purchaser order. The acknowledgement of these conditions has been sent separately to the Purchaser. A copy should be kept with these instructions.



The product must not be operated beyond the parameters specified for the application. If there is any doubt as to the suitability of the product for the application intended, contact Flowserve for advice, quoting the serial number.

If the conditions of service on your purchase order are going to be changed (for example liquid pumped temperature or duty) it is requested that the user seeks the written agreement of Flowserve before start up.

1.6 Safety

1.6.1 Summary of safety markings

These User Instructions contain specific safety markings where non-observance of an instruction would cause hazards. The specific safety markings are:

 **DANGER** This symbol indicates electrical safety instructions where non-compliance will involve a high risk to personal safety or the loss of life.

 This symbol indicates safety instructions where non-compliance would affect personal safety and could result in loss of life.

 This symbol indicates “hazardous substances and toxic fluid” safety instructions where non-compliance would affect personal safety and could result in loss of life.

 **CAUTION** This symbol indicates safety instructions where non-compliance will involve some risk to safe operation and personal safety and would damage the equipment or property.

Note: This sign is not a safety symbol but indicates an important instruction in the assembly process.

1.6.2 Personnel qualification and training

All personnel involved in the operation, installation, inspection and maintenance of the unit must be qualified to carry out the work involved. If the personnel in question do not already possess the necessary knowledge and skill, appropriate training and instruction must be provided. If required the operator may commission the manufacturer/supplier to provide applicable training.

Always coordinate repair activity with operations and health and safety personnel, and follow all plant safety requirements and applicable safety and health laws and regulations.

1.6.3 Safety action

This is a summary of conditions and actions to prevent injury to personnel and damage to the environment and to equipment. For products used in potentially explosive atmospheres section 1.6.4 also applies.

 **DANGER** NEVER DO MAINTENANCE WORK WHEN THE UNIT IS CONNECTED TO POWER

 **GUARDS MUST NOT BE REMOVED WHILE THE PUMP IS OPERATIONAL**

 **DRAIN THE PUMP AND ISOLATE PIPEWORK BEFORE DISMANTLING THE PUMP**
The appropriate safety precautions should be taken where the pumped liquids are hazardous.

 **FLUORO-ELASTOMERS (When fitted.)**
When a pump has experienced temperatures over 250 °C (482 °F), partial decomposition of fluoro-elastomers (example: Viton) will occur. In this condition these are extremely dangerous and skin contact must be avoided.

 **HANDLING COMPONENTS**
Many precision parts have sharp corners and the wearing of appropriate safety gloves and equipment is required when handling these components. To lift heavy pieces above 25 kg (55 lb) use a crane appropriate for the mass and in accordance with current local regulations.

 **THERMAL SHOCK**
Rapid changes in the temperature of the liquid within the pump can cause thermal shock, which can result in damage or breakage of components and should be avoided.

 **NEVER APPLY HEAT TO REMOVE IMPELLER**
Trapped lubricant or vapor could cause an explosion.

 **HOT (and cold) PARTS**
If hot or freezing components or auxiliary heating supplies can present a danger to operators and persons entering the immediate area action must be taken to avoid accidental contact. If complete protection is not possible, the machine access must be limited to maintenance staff only, with clear visual warnings and indicators to those entering the immediate area. Note: bearing housings must not be insulated and drive motors and bearings may be hot.

If the temperature is greater than 68 °C (155 °F) or below -5 °C (23 °F) in a restricted zone, or exceeds local regulations, action as above shall be taken.

 **HAZARDOUS LIQUIDS**
When the pump is handling hazardous liquids care must be taken to avoid exposure to the liquid by appropriate siting of the pump, limiting personnel access and by operator training. If the liquid is flammable and/or explosive, strict safety procedures must be applied.

Gland packing must not be used when pumping hazardous liquids.

CAUTION PREVENT EXCESSIVE EXTERNAL PIPE LOAD

Do not use pump as a support for piping. Do not mount expansion joints, unless allowed by Flowserve in writing, so that their force, due to internal pressure, acts on the pump flange.

CAUTION ENSURE CORRECT LUBRICATION
(See section 5, *Commissioning, startup, operation and shutdown.*)

CAUTION START THE PUMP WITH OUTLET VALVE PART OPENED
(Unless otherwise instructed at a specific point in the User Instructions.)

This is recommended to minimize the risk of overloading and damaging the pump motor at full or zero flow. Pumps may be started with the valve further open only on installations where this situation cannot occur. Pump outlet valve shall may need to be adjusted to comply with the duty following the run-up process. (See section 5, *Commissioning start-up, operation and shutdown.*)

CAUTION NEVER RUN THE PUMP DRY

CAUTION INLET VALVES TO BE FULLY OPEN WHEN PUMP IS RUNNING
Running the pump at zero flow or below the recommended minimum flow continuously will cause damage to the seal.

CAUTION DO NOT RUN THE PUMP AT ABNORMALLY HIGH OR LOW FLOW RATES
Operating at a flow rate higher than normal or at a flow rate with no backpressure on the pump may overload the motor and cause cavitations. Low flow rates may cause a reduction in pump/bearing life, overheating of the pump, instability and cavitations/vibration.

1.6.4 Preventing the build up of explosive mixtures

ENSURE PUMP IS PROPERLY FILLED AND VENTED AND DOES NOT RUN DRY.

Ensure pump and relevant suction and discharge pipeline system is totally filled with liquid at all times during the pump operation, so that an explosive atmosphere is prevented. In addition it is essential to make sure that seal chambers, auxiliary shaft seal systems and any heating and cooling systems are properly filled.

If the operation of the system cannot avoid this condition the fitting of an appropriate dry run protection device is recommended (eg liquid detection or power monitor).

1.7 Nameplate and safety labels

1.7.1 Nameplate

For details of nameplate, see the *Declaration of Conformity*, or separate documentation included with these User Instructions.

1.7.2 Safety labels

FLOWSERVE		WARNING	J218/JZ260
ESSENTIAL PROCEDURES BEFORE STARTING:			
INSTALL AND OPERATE EQUIPMENT IN ACCORDANCE WITH THE INSTRUCTION MANUAL SUPPLIED SEPARATELY. ENSURE GUARDS ARE SECURELY IN PLACE. ENSURE CORRECT DIRECTION OF ROTATION.	ENSURE ALL EXTERNAL CONNECTIONS TO THE PUMP / SHAFT SEALING AND DRIVER ARE CONNECTED AND OPERATIONAL. FULLY PRIME UNIT AND SYSTEM. DO NOT RUN UNIT DRY.	FAILURE TO FOLLOW THESE PROCEDURES MAY RESULT IN PERSONAL INJURY AND / OR EQUIPMENT DAMAGE	

J218/268	
ENSURE UNIT ON A FIRM FOUNDATION AND THAT COUPLING FACES ARE IN CORRECT ALIGNMENT PRIOR TO AND AFTER BOLTING BASEPLATE DOWN AND FIXING PIPEWORK. SEE MANUAL FOR TOLERANCES. S'ASSURER QUE LE GROUPE ELECTROPOMPE EST FERMEMENT INSTALLE SUR SON MASSIF. VERIFIER LE LIGNAGE DE L'ACCOUPEMENT AVANT ET APRES FIXATION DU SOCLE ET DE LA TUYAUTERIE. VOIR LES TOLERANCES D'ALIGNEMENT SUR LA NOTICE.	PUMP MUSS AUF FESTEM FUNDAMENT STEHEN. KUPPLUNGSHÄLFEN KORREKT AXIAL AUSRICHTEN, DANN PUMPE AUF GRUNDPLATTE FESTSPANNEN UND ANSCHLUSSLEITUNGEN BEFESTIGEN. TOLERANZEN S. BEDIEGUNGANLEITUNG. ZORG DAT POMPEENHEID OP EEN STEVIGE ONDERGROND OPGESTELD STAAT EN DAT KOPPELING CORRECT UITGELIJNT IS ZOWEL VOOR-ALS NADAT DE GRONDPLAAT MET BOUTEN IS VAST GEZET EN DE LEIDINGEN GEINSTALLEERD ZIJN. ZIE HANDLEIDING VOOR TOELAABARE SPELINGEN.
CDC: 603 604 610 612 621 623 624	

Oil lubricated units only:

J218/JZ262	
WARNING ATTENTION ACHTUNG WAARSCHUWING	THIS MACHINE MUST BE FILLED WITH OIL BEFORE STARTING CETTE MACHINE DOIT ÊTRE REMPLIE D'HUILE AVANT LA MISE EN MARCHÉ DIESE MASCHINE IST VOR DEM STARTEN MIT ÖL ZÜ FULLEN DEZE MASCHINE MOET VOOR HET STARTEN MET OIL GEVULD WORDEN
CDC: 603 604 610 612 621 623 624	

1.8 Specific machine performance

For performance parameters see section 1.5, *Duty conditions*. When the contract requirement specifies these to be incorporated into User Instructions these are included here. Where performance data has been supplied separately to the purchaser these should be obtained and retained with these User Instructions if required.

1.9 Noise level

Attention must be given to the exposure of personnel to the noise, and local legislation will define when guidance to personnel on noise limitation is required, and when noise exposure reduction is mandatory. This is typically 80 to 85 dBA.

The usual approach is to control the exposure time to the noise or to enclose the machine to reduce emitted sound. You may have already specified a limiting noise level when the equipment was ordered, however if no noise requirements were defined, then attention is drawn to the following table to give an indication of equipment noise level so that you can take the appropriate action in your plant.

Pump noise level is dependent on a number of operational factors, flow rate, pipework design and acoustic characteristics of the building, and so the values given are subject to a 3 dBA tolerance and cannot be guaranteed.

Similarly the motor noise assumed in the “pump and motor” noise is that typically expected from standard and high efficiency motors when on load directly driving the pump. Note that a motor driven by an inverter may show an increased noise at some speeds.

If a pump unit only has been purchased for fitting with your own driver then the “pump only” noise levels in the table should be combined with the level for the driver obtained from the supplier. Consult Flowserve or a noise specialist if assistance is required in combining the values.

It is recommended that where exposure approaches the prescribed limit, then site noise measurements should be made.

The values are in sound pressure level L_{pA} at 1 m (3.3 ft) from the machine, for “free field conditions over a reflecting plane”.

For estimating sound power level L_{WA} (re 1 pW) then add 17 dBA to the sound pressure value.

In areas where the staff has to intervene, remember that when the level of the sound pressure is:

- Below 70 dBA: it is not necessary to take special precautions.
- Above 70 dBA: people working continuously in the machine room must be supplied with protective devices against noise.
- Below 85 dBA: no particular measures need to be taken for casual visitors staying in the room during a limited period.

- Above 85 dBA: the room must be considered as a dangerous area because of the noise and a warning sign must be fixed at each entry warning the people coming into the room, even for a short period, that they must wear hearing protection.
- Above 105 dBA: special hearing protection adapted to this noise level and to the spectral noise components must be installed and a warning sign to this effect erected at each entry. The staff in the room must wear ear protection.

Make sure that the noise, which travels through the walls and windows, does not generate too high noise levels in the machine room's surroundings. In areas where the staff has to intervene, remember that when the level of the sound pressure is:

2 TRANSPORT AND STORAGE

2.1 Consignment receipt and unpacking

Immediately after receipt of the equipment it must be checked against the delivery and shipping documents for its completeness and that there has been no damage in transportation.

Note all reserves on the signed shipping note which is given back to the hauler. Later, claims cannot be accepted.

Check any crate, boxes and wrappings for any accessories or spare parts that may be packed separately with the equipment or attached to sidewalls of the box or equipment.

Each product has a unique serial number. Check that this number corresponds with that advised and always quotes this number in correspondence as well as when ordering spare parts or further accessories.

2.2 Handling

2.2.1 General instructions concerning handling

Boxes, crates, pallets or cartons may be unloaded using forklift vehicles or slings dependent on their size and construction.

To lift heavy pieces above 25 kg (55 lb), use a winch adapted to the mass and in accordance with the current local regulations.

To lift machines or pieces with one or several suspension rings, only use hooks and chains in compliance with the local regulations concerning safety. Never put cables, chains or ropes directly on or in the suspension rings. Cables, chains or lifting ropes must never present excessive bending.

Never bend the lifting hooks, suspension rings, chains, etc., which should only be made to endure stresses within, calculated limits. Remember that the capacity of a lifting device decreases when the direction of the lifting force direction makes an angle with the device axis.

To increase the safety and the efficiency of the lifting device, all the lifting elements must be as perpendicular as possible. If necessary a lifting beam can be placed between the winch and the load.

When heavy pieces are lifted up, never stay or work under the load or in the area, which could be in the path of the load if it were to swing or fall away. Never leave a load hanging from a winch. The acceleration or the slowing-down of lifting equipment must stay in the safety limits for the staff.

A winch must be positioned in such a way that the load will be raised perpendicularly. Where possible necessary precautions must be taken to avoid the swing of the load, using for example two winches making approximately the same angle, below 30°, with the vertical.

2.2.2 Pump masses

The masses of the pumps bare end of shaft are shown on the nameplate.

All motors (for masses see the motor description plate) must be handled with a winch.

 For masses above 25 kg (55 lb), manual handling is forbidden.

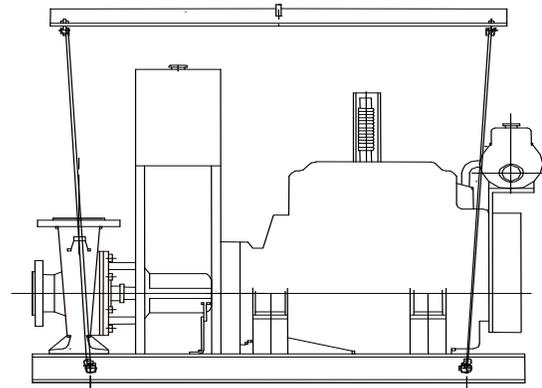
2.3 Lifting

2.3.1 Slinging of motor pumps units

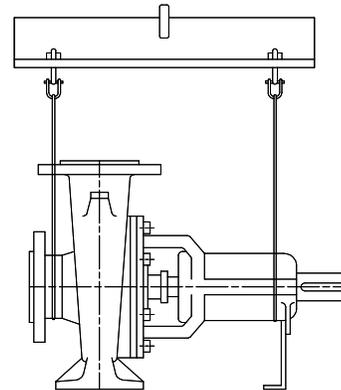
 Use handling means in accordance with motor pump unit mass mentioned on the CE plate. For the masses of the pumps bare end of shaft see table § 2.2.2 and nameplate.

 **CAUTION** To avoid distortion, the pump unit should be lifted as shown.

Motor pump unit



Bareshaft pump



 Components weighing less than 25 kg (55 lb) can be handled manually following the correct actions and using the correct posture.

 When handling always wear gloves, safety boots and an industrial safety helmet.

 For masses above 25 kg (55 lb), manual handling is forbidden.

2.4 Storage

 **CAUTION** Store the pump in a clean, dry location away from vibration. Leave piping connection covers in place to keep dirt and other foreign material out of pump casing. Turn pump at intervals to prevent brinelling of the bearings and the seal faces, if fitted, from sticking.

Do not store pumps starting on the fan guard.

The pump may be stored as above for up to 6 months. Consult Flowserve for preservative actions when a longer storage period is needed.

2.5 Recycling and end of product life

At the end of the service life of the product or its parts, the relevant materials and parts should be recycled or disposed of using an environmentally acceptable method and local regulations. If the product contains substances which are harmful to the environment, these should be removed and disposed of in accordance with current regulations. This also includes the liquids and or gases in the "seal system" or other utilities.



Make sure that hazardous substances or toxic fluid are disposed of safely and that the correct personal protective equipment is used. The safety specifications must be in accordance with the current regulations at all times.

3 PUMP DESCRIPTION

Note: Refer to the standard instructions if the pump used is different to that indicated below. In all cases the liquid temperature is limited to 25 °C.

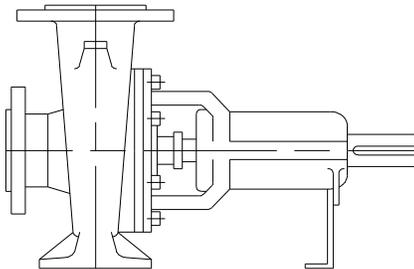
3.1 Configurations

This centrifugal pump unit is designed for the pumping of water [taken from a clean, non-aggressive, particle-free water supply].

The MEN pump or MEN-TI or ME-TI or MHP is a single stage centrifugal pump with an axial inlet and a vertical outlet. The dimensions of the volute pump casing of the suction and discharge diameters as well as the settlement feet correspond to standards: DIN 24225 and NF EN 733 (excepted ME-TI and MHP).



The pump must be stored in a non-explosive, ventilated location, sheltered from bad weather, dust and vibrations.



The reliability of the delivered machine can only be ensured if it is used and serviced according to the conditions given in this manual. The maximum values specified in this manual must never be exceeded.

- * Maximum working pressure at discharge:
 - MEN, MEN-T: 16 bars
 - ME-TI 200-400, ME-TI 250-400, ME-TI 200-500, ME-TI 250-500 Cast iron GL :12 bars
 - ME-TI 200-400 and ME-TI 250-400 Cast iron GS :12 bars
 - ME-TI 200-500, ME-TI 250-500 Cast iron GS :15 bars
 - MHP : 16 bars
- * Maximum working pressure at suction : 10 bars
- * Maximum pumped fluid temperature : 90 °C
- * Maximum solid suspension : 50 g/m³
- * Density : 1
- * Viscosity : 1 mm²/s



CAUTION The nominal speed is shown on the pump nameplate.

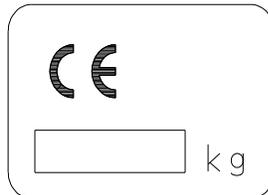
3.2 Nomenclature

Characteristics shown on the nameplate fixed on the pump are as shown below:

Each pump is supplied with the following nameplate:

Pump		Unit	
Type	<input type="text"/>	kg	<input type="text"/>
Q	<input type="text"/> m ³ /h	<input type="text"/> min ⁻¹	Max pr. <input type="text"/> bar
H	<input type="text"/> m	Max/min temp. °C	<input type="text"/>
		Bearing rad/thrust	<input type="text"/>
		Year + Manuf. N	<input type="text"/>
	<input type="text"/>		<input type="text"/>
Refer.	<input type="text"/>		
Year + Manuf. N	<input type="text"/>		
Satndard Type	<input type="text"/>		
Engine Type	<input type="text"/>		
Power Nom.	<input type="text"/> KW for	<input type="text"/> min ⁻¹	
Power Max.	<input type="text"/> KW for	<input type="text"/> min ⁻¹	
Pump Type	<input type="text"/>		
	100%	130%	
Q	<input type="text"/>	<input type="text"/>	m ³ /h
H	<input type="text"/>	<input type="text"/>	m
Eff.	<input type="text"/>	<input type="text"/>	%
P	<input type="text"/>	<input type="text"/>	KW

Each pump unit is supplied with the following nameplate:

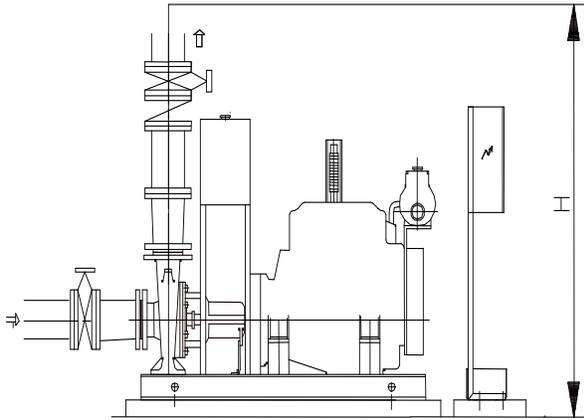


Mass of the set:

4 INSTALLATION

4.1 Location

The pump should be located to allow room for access, ventilation, maintenance and inspection with ample headroom for lifting and should be as close as practicable to the supply of liquid to be pumped, and to the venting system.



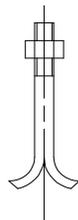
Disconnect the switching enclosure support from the pump support by removing the fastening bolts. The switching enclosure support must be off-set with respect to the pump motor base.

4.2 Foundation



There are many methods of installing pump units to their foundations. The correct method depends on the size of the pump unit, its location and noise vibration limitations. Non-compliance with the provision of correct foundation and installation may lead to failure of the pump and, as such, would be outside the terms of the warranty. The base plate should be mounted onto a firm foundation, either an appropriate thickness of quality concrete or sturdy steel framework. It should NOT be distorted or pulled down onto the surface of the foundation, but should be supported to maintain the original alignment.

Anchor bolts must be in accordance with the foot bolt holes. Use anchor bolts of accepted standards and sufficient to ensure safe fitting in the foundation. Particularly, this applies to individual plates where the anchor bolts have to withstand the driving torque.

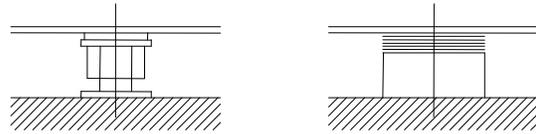


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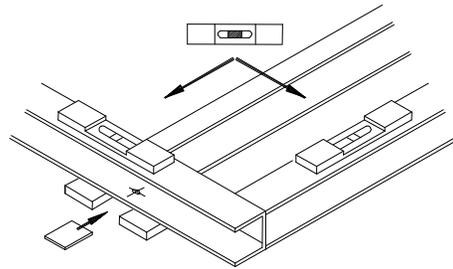
Provide sufficient space in the foundation to accommodate the anchor bolts. If necessary, provide concrete risers.

4.2.1 Setting the base plate for anchoring

- Clean the foundation surface thoroughly.
- Put shims on the foundation surface (approx 20-25 mm thick), one on each side of the bolt hole (as an alternative, leveling screws can be used).



- Lay the base plate and level in both directions with extra shims. The base plate should be level to within 0.5 mm per 1 m.

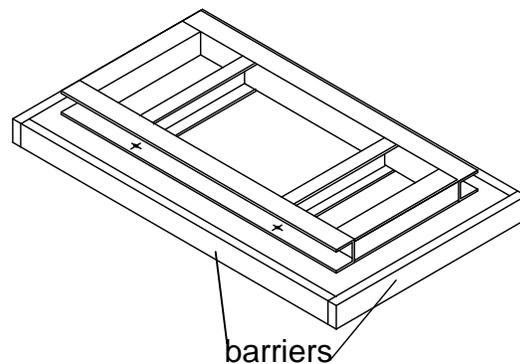


If anchor bolts have been pre-cast in the foundation slightly tighten the anchor bolts. Otherwise let them hang in the foundation holes.

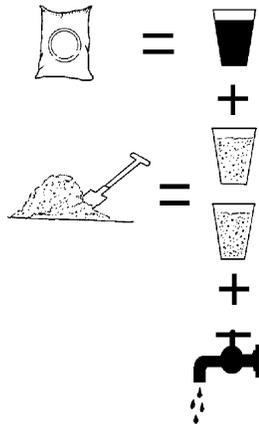
4.3 Grouting

4.3.1 Base plate grouting

Prepare the site for grouting. Before grouting clean the foundation surface thoroughly and provide external barriers as shown:



Prepare grouting product (concrete, resin) in accordance with manufacturers' instructions.



Use grouting products with anti-shrinking components.

- To grout up to the required level. Polish surfaces. Take necessary precautions to avoid air bubbles.
- Lay-down the barrier, break external angles, and polish the different surfaces.
- After grout starts to cure, definitively tighten anchor bolts.
- Control the alignment such as described as follows:

4.4 Initial alignment

4.4.1 Coupling assembly

4.4.1.1 Thermal expansion

CAUTION The pump and motor will normally have to be aligned at ambient temperature and should be corrected to allow for thermal expansion at operating temperature. In pump installations involving high liquid temperatures, the unit should be run at the actual operating temperature, shut down and the alignment checked immediately.

4.4.1.2 Alignment methods

DANGER Ensure pump and driver are isolated electrically; that the batteries and start-up shunt are disconnected and the half couplings are disconnected. Ensure that the pump piping, suction and discharge, is disconnected.

CAUTION The alignment MUST be checked.

Although the pump will have been aligned at the factory it is most likely that this alignment will have been disturbed during transportation or handling. If necessary, align the motor to the pump, not the pump to the motor.

Alignment

Parallelism and concentricity check

CAUTION Operations to be carried out by qualified FLOWSERVE employees only.

CAUTION Check the alignment at three or four points, before piping assembly.

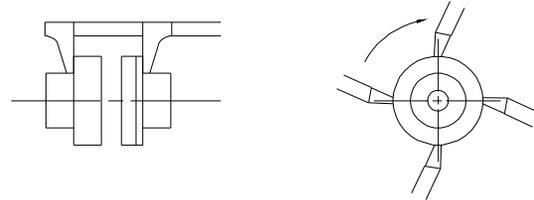


with a rule

with a comparator

Admissible margin for a motor with roller bearings:
 = 0.15 mm parallel checking
 = 0.1 mm angular checking

Angular checking:



with a sliding rule

with a caliper gauge

CAUTION The alignment will be definitive only after piping connection (see § 4.5.1).

! After alignment, the coupling protection cover must be refitted.

If necessary, improve the machine alignment:

→ *Complete unit mounted on common base plate:*
 The machines are first aligned accurately in our workshops. Usually, any misalignment observed on-site is due to a wrong adjustment under the base plate (disturbed during transport or because of forces exerted by the piping). It is only necessary to rectify the adjustment under base plate. If it proves to be insufficient, modify the motor and/or the piping and pump adjustment.

4.4.2 Drive shaft assembly

The battery must be disconnected. The distance between the end of the pump shaft and the engine flywheel must be $380 \text{ mm} \pm 5 \text{ mm}$. The pump and diesel engine must be aligned once the cardan link is fitted between the pump shaft and the engine flywheel.

The maximum axial misalignment allowed between the pump and the engine flywheel shaft is $9 \text{ mm} \pm 4.5 \text{ mm}$ on each side of the shaft used as a reference for alignment (see fig.1).

All that is required to align the pump and engine drive shafts correctly is a measuring tape or ruler graded in millimeters.

Alignment is checked as indicated below:

1) See fig.2

Place the marking A/B engraved on the surface of the cardan link flange at the top in the vertical position (12 o'clock).

Measure the distance X between the flange and the outside of the cardan shaft (point A). This distance must be $76 \text{ mm} \pm 3 \text{ mm}$.

With the cardan in the same position as above, measure the distance Y between the flange and the outside of the cardan shaft (point B). This distance must be equal to the distance $X \pm 1 \text{ mm}$.

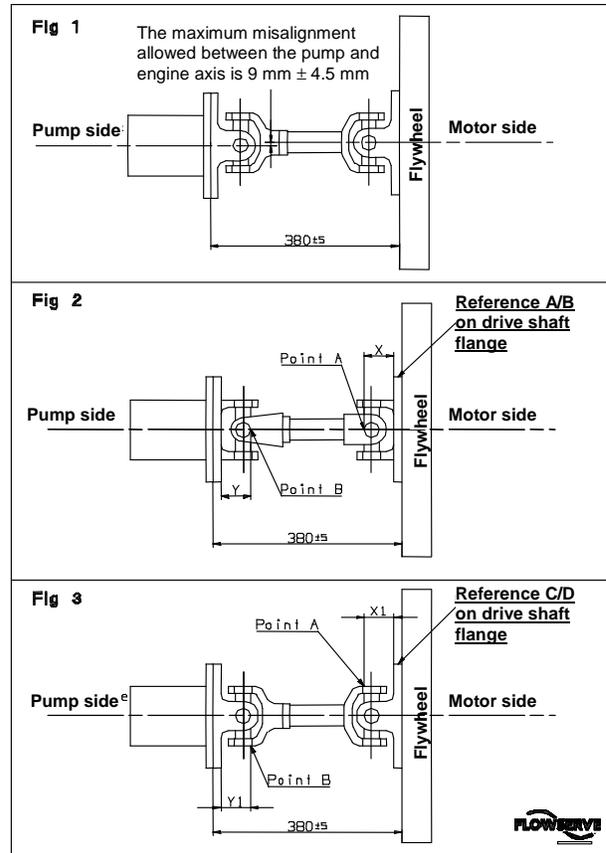
2) See fig.3

Turn the cardan 90° and place markings C/D engraved on the surface of the cardan link flange at the top in the vertical position.

Measure the distance X1 between the plate and outside of the cardan shaft (point A). This distance must be $78 \text{ mm} \pm 1 \text{ mm}$.

With the cardan in the same position as above, measure the distance Y1 between the flange and outside of the cardan shaft (point B). This distance must be equal to the distance $X1 \pm 1 \text{ mm}$.

Alignment is achieved by moving and/or shimming one or both of the elements.



4.5 Piping



Protective covers are fitted to the pipe connections to prevent foreign bodies entering during transportation and installation. Ensure that these covers are removed from the pump before connecting any pipes.

4.5.1 Suction and discharge piping

The dimensions of the pipes do not directly depend on suction and discharge diameters of the pump:

- First, choose a flow speed $< 2 \text{ m/s}$ at suction, and about 3 m/s at discharge.
- Take into account the available NPSH, which must be superior to the required NPSH of the pump.

Never use pump as a support for piping. Do not mount expansion joints in such a way that their force, due to internal pressure, may act on the pump flange.

Maximum forces and moments allowed on the pump flanges vary with the pump size and type. These external strains may cause misalignment, hot bearings, worn couplings, vibrations and the possible failure of the pump casing.

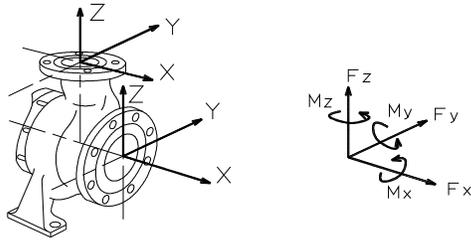
When designing the pipes (§ 4.5.2.1, § 4.5.2.2) take necessary precautions in order not to exceed maximum allowed strains.

Forces and moments applied to the pump flanges must never exceed the values shown in the table below.

Note: If the pump used is different to that indicated below, refer to the standard instructions corresponding to this pump.

ME-TI PUMP	DN Flange	Force (daN)				Moments (m.daN)			
		Fy	Fz	Fx	ΣF	My	Mz	Mx	ΣM
Vertical Discharge	150	160	200	180	310	45	60	80	110
	200	215	265	240	415	85	100	125	180
	250	270	335	300	520	125	145	180	260
	300	320	400	360	625	170	200	240	355
	350	375	465	420	730	220	255	310	455
	400	430	530	480	835	275	320	390	570
	450	485	600	540	940	340	390	480	705
	500	540	665	600	1040	410	470	580	850
Horizontal Suction	150	180	160	200	315	45	60	80	110
	200	240	215	265	415	85	100	125	180
	250	300	270	335	520	125	145	180	260
	300	360	320	400	625	170	200	240	355
	350	420	375	465	730	220	255	310	455
	400	480	430	530	835	275	320	390	570
	450	540	485	600	940	340	390	480	705
	500	600	540	665	1040	410	470	580	850

MEN -TI PUMP	Suction DNA (mm)	Discharge DNR (mm)	Force (daN)		Moments (mdaN) Σ Mt max
			Fv max	Fh max	
50-32-125	50	32	125	95	20
50-32-160	50	32	125	95	17
50-32-200	50	32	125	95	17
50-32-200L	50	32	125	95	17
65-40-125	65	40	135	100	22
65-40-160	65	40	135	100	22
65-40-200L	65	40	135	100	20
65-40-250	65	40	135	100	25
65-40-250L	65	40	135	100	25
65-50-125	65	50	135	100	22
65-50-160	65	50	135	100	22
65-50-200L	65	50	135	100	20
65-50-250L	65	50	135	100	25
80-65-125	80	65	145	105	27
80-65-160	80	65	145	105	27
80-65-200L	80	65	145	105	27
80-65-250L	80	65	145	105	27
80-65-315	80	65	145	105	27
100-80-160	100	80	180	125	47
100-80-200L	100	80	180	125	47
100-80-250L	100	80	180	125	47
100-80-315	100	80	180	125	47
125-100-200L	125	100	320	190	95
125-100-250L	125	100	330	200	102
125-100-315	125	100	310	185	92
125-100-315L	125	100	310	185	92
125-100-400	125	100	285	170	82
125-100-400L	125	100	285	170	82
150-125-250L	150	125	450	290	155
150-125-315L	150	125	415	260	140
150-125-400L	150	125	410	255	137
200-150-315L	200	150	500	325	175
200-150-400L	200	150	500	325	175



Forces and moments values are applied to the whole flanges and not flange-by-flange. For their sharing out on the pump flanges, refer to standard NF CR 13 391.

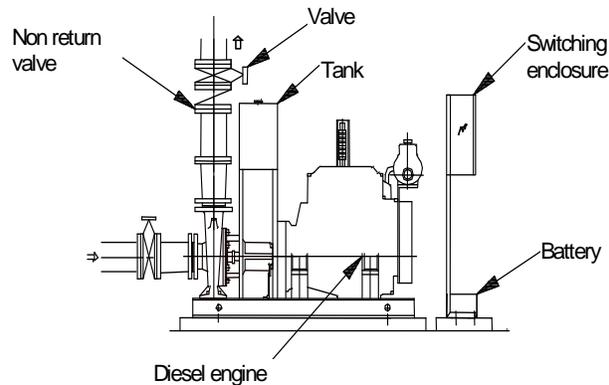
CAUTION Ensure piping and fittings are flushed before use.

CAUTION Ensure piping for hazardous liquids is arranged to allow pump flushing before removal of the pump.

4.5.2 Suction piping

4.5.2.1 Design of a flooded suction line

The suction line must be as short and direct as possible, never mount an elbow directly on the inlet flange of the pump.



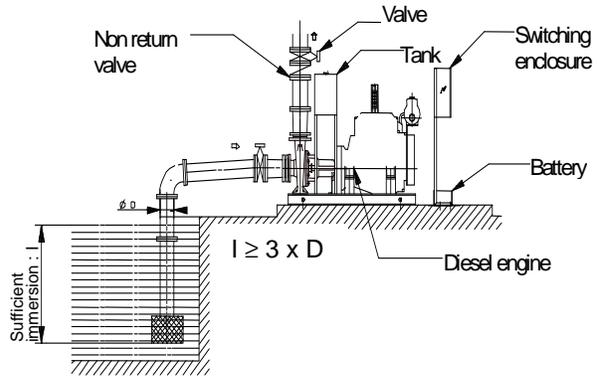
Flooded suction configuration

- a) Avoid sharp elbows or sudden narrowing. Use convergent $\leq 20^\circ$ (total angle).
- b) Arrange the piping so that there are no air pockets (no bulges).
- c) If high points cannot be avoided in suction line, provide them with air relief cocks.
- d) In case of frost risks, the piping in question has to be marked out.
- e) If a strainer is necessary, its net area should be three or four times the area of the suction pipe.
- f) If an inlet valve is necessary, choose a model with direct crossing.

CAUTION Do not tighten flanges before the final check (see § 4.5.3).

4.5.2.2 Design of a suction lift line

The inlet pipe must be as short and as direct as possible, never place an elbow directly on the pump inlet nozzle.

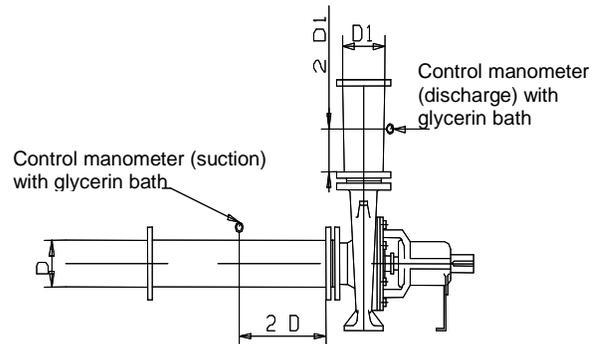


Sump suction configuration

- a) Avoid sharp elbows or sudden narrowing. Use convergent $\leq 20^\circ$ (total angle) with upright generating.
- b) Arrange that the suction piping is inclined upwards towards the pump ensuring that there are no peaks.
- c) In case of frost risks, the piping in question has to be marked out.
- d) If a foot valve is necessary, do not oversize it because it would generate pulsations (valve beating).

CAUTION Do not tighten flanges before the final check (see § 4.5.3).

If necessary, a control manometer can be connected on the piping.



Installation of control manometers Class I

CAUTION Do not tighten flanges before the final check (see § 4.5.3).

4.5.3 Final checks

- a) Check the tightening of anchor bolts. Tighten them if necessary.
- b) Check that protective covers on suction and discharge flanges are removed.
- c) Check that holes of piping flanges are parallel and correspond to those of the pump.
- d) Tighten suction and discharge flanges.
- e) Check the alignment pump-motor according to the procedure § 4.4.2.
Rectify if necessary by adjusting the motor only!
- f) If it is planned, connect piping (hydraulic, pneumatic, sealing system).
- g) Control seal and the working of auxiliary piping.

4.6 Electrical connections

DANGER Electrical connections must be made by a qualified Electrician in accordance with relevant local national and international regulations. This includes any grounding.

It is important to be aware of the EUROPEAN DIRECTIVE on electromagnetic compatibility when wiring up and installing equipment on site. Attention must be paid to ensure that the techniques used during wiring/installation do not increase electromagnetic emissions or decrease the electromagnetic immunity of the equipment, wiring or any connected devices. If in doubt, contact Flowserve for advice.
The installation comprises all appropriate safety devices such as magnetic overload, current overload, earth leakage relays, etc.... Ensure the power supply corresponds to the power rating given for the switching enclosure, i.e.: 5 kVA (220 V). An electrical protection device shall be fitted.

Carry out the ground connections according to the current local regulations.

4.7 Connection

Proceed with electrical connections to the terminals in accordance with instructions 71576402 01-06. Connect the switching enclosure to the mains power supply and check the supply voltage on terminals 39 and 40 (220 V single-phase).

Connect the start-up signal wires:

Double terminal n° 11: pressure switch N°1. B-contacts of these pressure switches must be potential free.

Double terminal n° 12: pressure switch N°2.

Note: Actual recommendations require the start-up signal contact to be open-started. All delivered units meet this requirement.

Information regarding the cabinet:

Sensor connection at recovery tank level on #15 double terminal. The contact will be opened in case of lack of water in the main tank and potential free.

CAUTION Opening the circuit controlling the primer tank starts the engine.

Options:

Sensor connection at the bottom of the primer tank on #16 double terminal. The contact will be opened in case of lack of water at the bottom of the primer tank and is potential free.

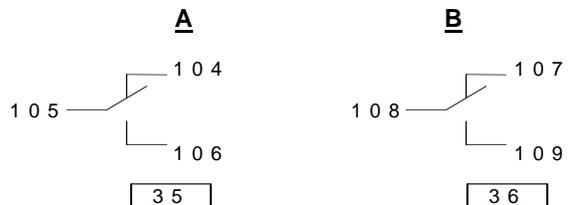
Sluice blade or ventilation damper connection on #43 and 44 double terminal (220 V servomotor).

Sluice blade opening limit connection on #15 double terminal. The contact will be closed when ventilation sluice blades are open and potential free.

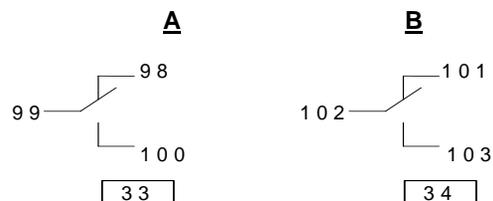
Alarm report:

All alarm reports are proposed on 2 changeover contacts (A and B) by 2 triple terminals.

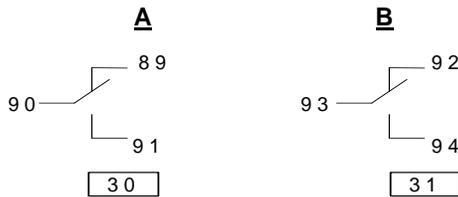
Connection of running data motor on terminals n°35 and n°36



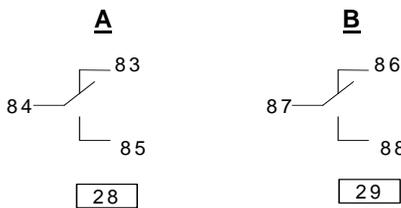
Manual connection of switching fault data on terminals n°33 and n°34



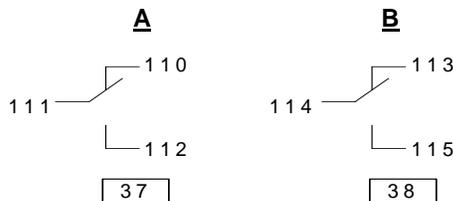
Connection of general fault data on terminals n°30 and n°31



Information connection Failure risk on n°28 and n°29 terminals



Information connection
No start-up on n°37 and n°38 terminals



4.8 Batteries

The lead-cell batteries are supplied "dry charged".

Switch off the "AUTO-STOP-MANUAL" key switches on the front panel of the switching enclosure.

Electrolyte is supplied by FLOWSERVE separately in 1.7-litre plastic containers.

Electrolyte is a sulphuric acid-based liquid. Appropriate protective clothing must be worn during handling. Avoid any contact with skin or clothing. In case of splashing, rinse thoroughly with running water (in case of contact with eyes, consult a doctor immediately).

Prepare the batteries 1 week before commissioning. Fill the batteries with electrolyte up to the maximum fill level indicated with a line in the top section of the battery.

The cables must not be exposed to oil, diesel or acid splashing and should be run accordingly. Check that the batteries are connected to the right poles and securely fastened (++ and --).

4.9 Switching on

The pump unit is supplied with the starter solenoid disconnected to avoid accidental start-up of the diesel engine during commissioning preparation work.

Reconnection may only be carried out by an employee qualified by FLOWSERVE, after examination before start-up.

The unit may only be switched on by an employee qualified by FLOWSERVE.

- Place the operating mode selector switch in the "Off" position.

- Close the switching terminals 5 and 6.

- Close fuse holders F1 to F4 and the circuit-breaker DD1.

Note:

A siren sounds when these electrical circuits are closed, press the "Siren off" and "cancel fault" push-buttons.

- Close the main circuit-breaker.

- The following indicators white/power on, green/electronics on, green/ charge batteries 1 or 2 and orange/non-auto, must be on.

4.10 Charge starter batteries

Both batteries are connected independently and alternatively to a self-regulated battery charger.

A possible charge fault is signaled by the "Charger 1 or charger 2 fault" indicator on the front panel of the enclosure, with activation of a local audible alarm signal and tripping of the general fault contact.

Each charger supplies the corresponding battery with a variable charge current in accordance with the battery charge level.

- Keep a bottle of distilled water available for topping up of electrolyte level.

The battery voltage selector switch enables monitoring of the battery voltage with charger supply interrupted.

4.11 Final shaft alignment check

Check the alignment pump-motor according to the procedure § 4.4.2.

Rectify if necessary by adjusting the motor only!

- If it is planned, connect piping (hydraulic, pneumatic, sealing system)

- Control seal and the working of auxiliary piping.

4.12 Protection systems

If leakage of product from the pump or its associated sealing system can cause a hazard it is recommended that an appropriate leakage detection system is installed.

To prevent excessive surface temperatures at bearings it is recommended that temperature or vibration monitoring are carried out.

4.13 Other check

See § 6.2

5 COMMISSIONING, START-UP, OPERATION AND SHUTDOWN

⚠ *These operations must be carried out by fully qualified personnel. The operator must monitor the machine as long as it is in operation.*

5.1 Guarding

⚠ Guarding is supplied fitted to the pump set. If this has been removed or disturbed ensure that all the protective guards around the pump coupling and exposed parts of the shaft are securely fixed.

5.2 Priming and auxiliary supplies

⚠ CAUTION Ensure all electrical, hydraulic, pneumatic, sealant and lubrication systems (as applicable) are connected and operational.

⚠ CAUTION Check that the supply pressures are compatible with the equipment to be supplied.

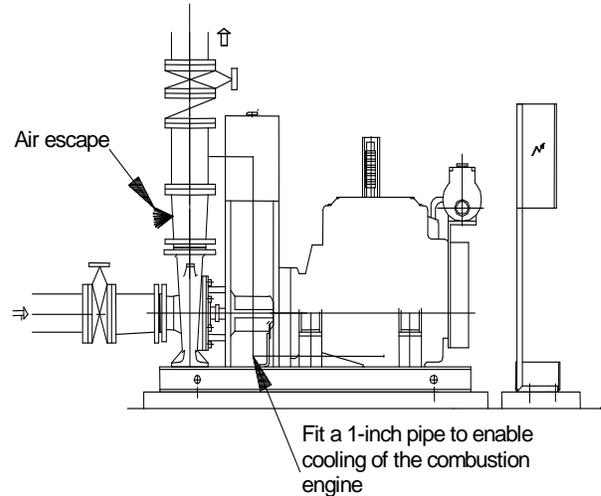
⚠ CAUTION Ensure the inlet pipe and pump casing are completely full of liquid before starting continuous duty operation.

5.2.1 Priming of a flooded pump

Close the discharge valve, fill the pump by opening the suction valve. Let air escape by removing the plug located on the piping.

The discharge pipe is headed and there is a by-pass valve on the check valve, open slightly the discharge valve.

When the pump is totally free of air bubbles, replace the plugs.



Priming of a flooded pump

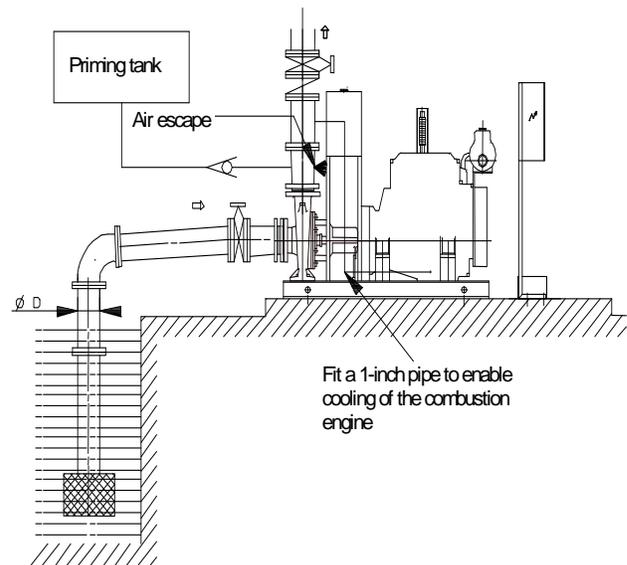
5.2.2 Priming of a sump suction pump

Installation of a foot valve is imperative.

Fill the pump and suction pipe with liquid via the priming tank.

Let air escape by removing the plugs located on the piping.

When the pump is totally free of air bubbles, replace the plugs.



Priming of a sump suction pump

5.3 Starting the pump

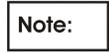
5.3.1 Bring controls and preparation before the first starting and after each service call

Necessarily:

Check the tightening of the different plugs.

Check that the gland lightly tightens the packing rings.

 Risk of seal ring overheating.

 If a mechanical seal is fitted, refer to the standard pump instructions.

5.3.2 Start the pump and diesel engine

 ***This initial start-up of pump and diesel engine may only be carried out by a qualified FLOWSERVE employee.***

A noise protection helmet must be worn by all persons present in the vicinity.

 Suction valves must be fully open when pump is running. Never run the pump dry, it will cause damage.

*Close the valve at discharge

* Start up the diesel engine and check the discharge pressure.

If pressure is satisfactory, slowly OPEN the outlet valve.

Do not run the pump with the outlet valve closed during initial start-up and after each maintenance intervention.

If NO pressure, or LOW pressure, STOP the pump. Refer to fault finding chart for fault diagnosis.

5.3.2.1 Starting the diesel engine

→ Initial start-up:

* Start the plant at moderate speed with push buttons to emergency start-up position 1 or 2.

* Check that the oil pressure indicated on the switching enclosure pressure gauge complies with the values given in the engine manual. If the oil pressure indicated on the pressure gauge is low with respect to these instructions, place the switch in the "Off" position and stop the engine using the direct stop control indicated "STOP" located on the injection pump until the engine is entirely at standstill.

→ Check engine cooling system:

* Check that the water in the primary cooling circuit is flowing freely (evacuation of lost water, discharge from heat exchanger), it must be possible to see and feel this flow.

* Water flow must be visibly unrestricted on the pump discharge side, with no shut-off elements incorporated. This discharge generally occurs at 35/45 °C.

* Cooling water flow-rate is limited by an adjustable throttle to obtain a flow-rate of approximately 30 liters/hour per kW.

* New circuits often contain impurities which may quickly clog the protection filter. If the raw water flow decreases, simply remove the filter and clean it until the circuit is clean. This operation is to be repeated.

* The manual by-pass on the cooling circuit main pipe is only used to ensure cooling, if necessary, when the plant cannot be shut-down during an intervention on the raw water filter or the hydraulic valve.

ENSURE THE RAW WATER FILTER ON THE MAIN COOLING CIRCUIT IS WEEKLY CLEANED.

→ Checks and adjustments:

* Progressively increase the engine speed until the setting limiter is attained. This limiter is set to obtain an off-load speed of 50 to 100 rpm above nominal speed in order to compensate for approximately 5 % motor slip between off-load and full-load engine speeds.

* With the plant running normally, progressively open the pump discharge valve until the specified performance is attained.

* Check the water temperature with the thermostat on the switching enclosure; this is only attained progressively, especially at low pump flow-rate.

If the temperature is above 95 °C, turn the selector switch to "Off" and activate the switch-off control marked STOP.

 ***In the beginning, when on load, the new plant sometimes emits exhaust smoke after start-up. This is perfectly normal and quickly disappears. Allow sufficient air circulation during initial start-up (work with doors open), and/or wear a protection mask.***

The switching enclosure is designed to detect and signal certain anomalies.

→ When running:

* Oil pressure too low
* Overheating

If one of these faults occurs, the alarm is triggered and signaled by:

- activation of the siren;
- illumination of the corresponding indicator;
- repeated signal on the terminal for transmission.

However, a fault does not stop the plant.

Immediate intervention is required to remedy the fault.

- The siren may be switched off by pressing the push-button "STOP SIREN". This operation does not cancel the siren if the fault signal is present at the alarm terminal.

- Turning the rotary key switch "CANCEL FAULT" remains ineffective as long as the fault persists and resets the audible alarm signal.

→ Simulation of faults:

The safety devices may be checked by simulating faults:

- a) Excess water temperature fault simulation by circuit opening between 55 wires and grounds.
- b) Oil pressure low by circuit opening between 35 and 56 wires. [No oil pressure by circuit opening between wires 035 and 56] if the engine is at standstill and by circuit closing (035 and 56) when the engine is running.

Water temperature fault function is activated only after an initial time period of approximately 10 seconds.

Oil pressure fault function is efficient only after an initial time period of approximately 1 minute.

→ Check room ventilation:

Ensure that room ventilation is correct by incorporating top and bottom air vents as standard practice. These vents must each have a minimum size of 0.5 m².

Engine overheating is generally due to:

- defective engine and/or room cooling,
- an exhaust pipe of insufficient diameter,
- non-standard utilization of the plant, in excess of its design characteristics.
- insufficient room ventilation

The temperature read on the thermometer located on the front panel of the switching enclosure must be stable between 70 and 90 °C when the plant is on-load and conform to nominal characteristics indicated in the specifications.

If the cooling water temperature rises above this threshold value, an audible alarm is triggered and a light indicator switches on.



Do not run the pump at zero flow-rate for more than 10 minutes as this will heat up the cooling water intended to cool the engine.

After approximately one hour of operation, the plant may be switched off by pressing the control button marked STOP.

ACTION MAINTAINED UNTIL TOTAL STANDSTILL OF THE ENGINE.

→ Automatic start-up pressure switch n°1 :

With the selector pressure switch n°1 in the "AUTO" position and selector pressure switch n°2 on stop, the contact given by one of the control pressure switches provokes immediate start-up of the plant at the set nominal speed.

* Supervision of start-up sequence

The engine should normally start up first time.

However, to overcome an anomaly such as:

- Low batteries, pump packing gland too tight
- No fuel
- Slight presence of air in the fuel circuit
- Engine and room insufficiently heated during cold weather

The automatic system is designed to energize the starter motor with 8-second impulses from each set of batteries alternatively.

The standard setting is 4 impulses of 8 seconds with a rest period of 3 seconds between each impulse.

At the end of a complete cycle, if the engine has not started, the alarm "FAIL START" is triggered, followed by:

- Activation of the siren
- Illumination of the "Fail start" indicator
- Repeated signal at the terminals for transmission.

The operator informed may attempt a manual start by pressing the "EMERGENCY START" push-button.

→ Automatic start-up pressure switch n°2:

Same automatic start-up procedure with pressure switch n°1 but in the reversed order.

* Simulation of a start-up sequence

It can be done by any of both selector pressure switch n°1 and n°2.

The first pressure switch contact to be opened will initiate its start-up sequence.

To check the start-up sequence, a simulation may be carried out in which the injection is blocked by pressing and holding the stop control while the plant is in "AUTO" mode and the contact of a pressure switch is closed (pressure drop in the network).

NOTE: The "FAIL START" alarm is cancelled by:
- Pressing the "STOP SIREN" push-button
- Pressing the "CANCEL FAULT" turn-key switch

This operation also resets the automatic cycle.



All pressure switches have a differential pressure. The contact triggered by a drop in pressure is only re-established when this pressure returns to a value greater than the pressure switch set value.

→ Battery fault:

At standstill:

The plant comprises a starter battery voltage-monitoring device. If the battery voltage is not in the required range, the battery fault is triggered, followed by:

- illumination of the corresponding indicator for battery 1 or battery 2,
- repeated signal on the terminals for transmission.

However, the plant continues to operate on the other battery.

→ Technical room temperature control (optional):

A technical room temperature inferior to + 10 °C lights up the "TEMPERATURE LOCAL SPRINKLER" red LED and activates the siren and the "FAILURE RISK" relay.

The siren can be stopped by pressing the "STOP SIREN" pushbutton. But this does not clear the fault which is reported on the alarm base station.

The "CLEAR DEFAULT" turn-key button is not working as long as the fault is present. If it is activated, it re-initiates the audible alarm.

→ Ventilation sluice blade control:

The ventilation sluice blade correct opening control is in service after motor start-up and activates the "VENTILATION SLUICE BLADE" red LED. The siren and the "FAILURE RISK" relay are activated if the sluice blade opening is not correct only after an initial time period of approximately 10 seconds.

The siren can be stopped by pressing the "STOP SIREN" pushbutton. But this does not clear the fault which is reported on the alarm base station.

The "CLEAR DEFAULT" turn-key button is not working as long as the fault is present. If it is activated, it re-initiates the audible alarm.

→ Starter cabinet electric connection control:

A cut-off in the wiring between the cabinet and the starter solenoid lights up the "CABINET STARTER CONNECTION" red LED and activates the siren and the "FAILURE RISK" relay.

The siren can be stopped by pressing the "STOP SIREN" pushbutton. But this does not clear the fault which is reported on the alarm base station.

The "CLEAR DEFAULT" turn-key button is not working as long as the fault is present. If it is activated, it re-initiates the audible alarm.

This fault is present only 1min30sec after start-up attempt.

→ Recovery tank level control:

In case of insufficient water level in the recovery tank, the "RECOVERY TANK LEVEL" LED lights up and the siren and the "FAILURE RISK" relay are activated.

The siren can be stopped by pressing the "STOP SIREN" pushbutton. But this does not clear the fault which is reported on the alarm base station.

The "CLEAR DEFAULT" turn-key button is not working as long as the fault is present. If it is activated, it re-initiates the audible alarm.

→ Filter clogging control (optional):

In case of raw water filter clogging or in case of engine temperature increase (independently from the water temperature alarm), the "FILTER CLOGGING" red LED lights up and the siren and the "FAILURE RISK" relay are activated.

The siren can be stopped by pressing the "STOP SIREN" pushbutton. But this does not clear the fault which is reported on the alarm base station.

The "CLEAR DEFAULT" turn-key button is not working as long as the fault is present. If it is activated, it re-initiates the audible alarm.

→ Diesel level control:

In case of low diesel level in fuel tank, the "DIESEL LOW" LED lights up and the siren and the "FAILURE RISK" relay are activated.

The siren can be stopped by pressing the "STOP SIREN" pushbutton. But this does not clear the fault which is reported on the alarm base station.

The "CLEAR DEFAULT" turn-key button is not working as long as the fault is present. If it is activated, it re-initiates the audible alarm.

→ Engine water reheating control:

When the engine water reheating protection circuit-breaker or reheating button are switched off, a red "ENGINE REHEATING" light indicator, audible alarm and "GENERAL FAULT" relay are triggered

The siren can be stopped by pressing the "STOP SIREN" pushbutton. But this does not clear the fault which is reported on the alarm base station.

The "CLEAR DEFAULT" turn-key button is not working as long as the fault is present. If it is activated, it re-initiates the audible alarm.

When the engine is operating, the engine water reheating is inhibited.
Mains cut-off lights up the reheating fault LED.

→ Engine water level control:

In case of low cooling water level in the engine, the "ENGINE WATER LEVEL" red LED lights up and the siren and the "FAILURE RISK" relay and **plant start-up** are activated.

The siren can be stopped by pressing the "STOP SIREN" pushbutton. But this does not clear the fault which is reported on the alarm base station.

The "CLEAR DEFAULT" turn-key button is not working as long as the fault is present. If it is activated, it re-initiates the audible alarm.

→ Priming tank level control (optional):

In case of low water level in priming tank, the "PRIMING TANK LEVEL" red LED lights up and the siren and the "FAILURE RISK" relay are activated. The unit then starts.

The siren can be stopped by pressing the "STOP SIREN" pushbutton. But this does not clear the fault which is reported on the alarm base station.

Check that the priming tank level is correct and stop the unit using the STOP handle on the engine.

The "CLEAR DEFAULT" turn-key button is not working as long as the fault is present. If it is activated, it re-initiates the audible alarm and restarts the motor pump if the level is not correct.

→ Control of pressure switch line:

In the case of a short circuit on the pressure switch connection cables, the warning light "Pressure Switch Line" lights up, and the alarm and "Risk of failure" relay are activated.

The siren can be stopped by pressing the "STOP SIREN" pushbutton. But this does not clear the fault which is reported on the alarm base station.

The "CLEAR DEFAULT" turn-key button is not working as long as the fault is present. If it is activated, it re-initiates the audible alarm.

→ Local signalization table:

							Non auto position switch fault	
							General fault	
							Failure risk	
							Not starting	
							Motor in operation	
							LED color	
							Audible alarm	
							Description	Meaning
						Green	Live electronics	Live electronic circuits (at least one of both power sources is present)
x						Yellow	x Mains shortage	Pre-heating and charger electric circuits are not powered by mains anymore (180s delay)
						Green	Battery 1 loading or Battery 2 loading	Shows that corresponding battery is loading (1 LED per battery)
x						Yellow	x Charger 1 fault or Charger 2 fault	Shows that corresponding battery charger does not deliver the necessary voltage at output during loading period (1 LED per charger) or that the mains power supply is absent.
x						Yellow	x Battery 1 fault or Battery 2 fault	Shows that corresponding battery cannot assume its function (1 LED per battery)
		x				Red	x Cabinet-starter connection	Cabinet-starter connection non guaranteed
				x		Green	Motor in operation	Shows that the pump is operating
						Green	Pressure switch 1 start-up	Shows that the pump has been started by pressure switch 1 or that the start-up sequence in progress was initiated by pressure switch 1
						Yellow	Pressure switch 2 start-up	Shows that the pump has been started by pressure switch 2 or that the start-up sequence in progress was initiated by pressure switch 2
						Green	Auto position	Pressure switch 1 or 2 controller is in automatic mode [element controlled with the corresponding pressure switches 1 or 2, in automatic mode]
x						Red	Non auto position	Pressure switch 1 or 2 controller is on STOP or MANUAL position [element controlled with the corresponding pressure switches 1 or 2 and STOP position or MANUAL mode]
				x		Red	x Not started	Shows that the pump did not start automatically at the end of the start-up sequence
x						Red	x Water temperature	Shows that cooling water temperature exceeds its limit (engine overheating)
		x				Red	x Filter clogging (optional)	Shows a filter clogging [indicates that the heat-exchanger circuit water filter is clogged]
x						Red	x Oil pressure	Shows an insufficient oil pressure
		x				Red	x Diesel level	Shows an insufficient diesel level
x						Red	x Engine reheating	Shows that the preheating system is out of service
		x				Red	x Engine water level	Shows an insufficient tank water level
		x				Red	x Recovery tank water level	Shows an insufficient level in the recovery or secondary tank
		x				Red	x Priming tank level (optional)	Shows an insufficient water level in the priming tank (for sump suction pumps) and triggers an engine start-up.
		x				Red	x Local sprinkler temperature	Shows that temperature is < 8°C in the local sprinkler water tank
		x				Red	x Ventilation sluice blades (optional)	Shows that the ventilation sluice blades in the source room are not opened when diesel engine is operating
		x				Red	x Pressure switch lines	Shows that a short circuit between the cables of the pressure-switch

* No red or yellow indicators may be on when the operator leaves the room.

5.3.2.2 Putting into service:

After completion of these checks and tests, the plant may be put into service:

- Turn the selector switch to the "AUTO" position
- Valves of the cooling circuit locked in the open position and the discharge valve of the pump positioned.
- Check all fill levels.
- Power-on displayed with light indicator.

5.3.2.3 Plant maintenance and servicing:

Once a week, check the voltage and electrolyte level of each battery; the water level of the internal cooling circuit, the engine oil fuel tank levels.

Respect all instructions given in the pump and engine manuals, as well as the regulations R1 given in appendix IV of the APSAD.

Do not run the pump with the outlet valve closed for a period longer than 10 minutes.

If NO pressure, or LOW pressure, STOP the pump. Refer to fault finding chart for fault diagnosis.

The pump must never run at a capacity of less than 40 % of that at the best efficiency for a longer period.

Never remove a plug when the pump is running.

The pump should run smoothly and without abnormal vibration for a diesel engine.

5.4 Running the pump

Never remove the exhaust heat screens.

The combustion engine may attain a temperature of 80 °C during operation and up to 450 °C at the exhaust pipe. Specific instructions must be sign-posted to inform all persons present of the risk of burns.

Inspections by the operator:

* The pressure gauge on the switching enclosure indicates the oil pressure in the diesel engine block: if the pressure gauge indicates a pressure lower than that designated by the red arrow on the dial, the engine must be stopped immediately by switching the selector switch to stop and moving the stop lever on the diesel engine.

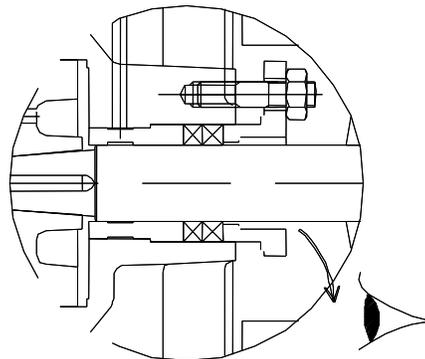
* The thermometer on the switching enclosure indicates the diesel engine cooling water temperature: if the thermometer indicates a temperature higher than that designated by the red arrow on the dial, the engine must be stopped immediately using the same procedure as indicated above.

The engine may only be restarted by an employee qualified by FLOWERVE.

5.4.1 Pump fitted with a stuffing box

If the pump has a packed gland there must be some leakage from the gland. Gland nuts should initially be finger-tight only. Leakage should take place soon after the stuffing box is pressurized. If no leakage takes place the packing will begin to overheat. If overheating takes place the pump should be stopped and allowed to cool before being re-started. When the pump is re-started it should be checked to ensure leakage is taking place at the packed gland.

The pump should be run for ten minutes with steady leakage and the gland nuts tightened by 10 degrees at a time until leakage is reduced a steady thin continuous stream is acceptable. The temperature of the gland should be checked after each round of tightening. If the temperature starts to climb rapidly then back off the gland nuts at standstill until the temperature drops down. Wait for the temperature to stabilize before tightening again. The leakage must not be reduced below a rate of 60 drops per minute. Bedding in of the packing may take several hours.



Shield grids being removed during installation of the gland packing, it must be ensured that they are replaced as soon as this operation is completed.

SAFETY INSTRUCTIONS WHEN THE PUMP IS RUNNING.

If hot or freezing components of the machine can present a danger to operators, they must be shielded to avoid accidental contact. If a 100 % protection is not possible, the machine access must be confined to the maintenance staff only.

If the temperature is greater than 80 °C, a warning plate must be clearly placed on the pump.

Check that the gland lightly tightens the packing rings.

CAUTION Risk of seal ring overheating.

After examination of the packing gland, DO NOT FORGETS TO REFIT THE BEARING PROTECTION SCREENS.

Open all suction valves.

Close the discharge valve.

Check that all suction pipes, as well as the pump itself, are correctly filled before switching on the pump.

It is strictly forbidden to open switch cupboards, switch boxes, or all other live electric equipment. If it is necessary to open them in order to take readings, to carry out tests or adjustments for example, only a skilled technician may do them with adapted tools. Make sure that physical protection against electrical risks is used.

Preparation of the diesel engine:

Take note of and respect the instructions relative to commissioning of the diesel engine in the engine instructions enclosed.

These operations may be carried out by personnel qualified by FLOWSERVE only.

For information:

The fuel tank (diesel) must be filled by the installer beforehand.



Smoking or naked flames are strictly forbidden during the fuel filling operation. Recommended fuel type: ASTM-D975-N°2, DIN 51601, SIS 155432, "vehicle fuel".

- a) Fill the cooler with cooling fluid and flush all air out of the internal circuit. Add antifreeze as indicated in the engine instruction manual in order to protect the engine in case of an excessively low temperature in the power station and to avoid corrosion inside the motor.
- b) Check the engine oil level.
- c) Flush the fuel circuit. If the circuit is not correctly flushed, the engine may not start up.

5.5 Stopping and switching off

Close the discharge valve and limit pump operation to maximum 10 minutes with the valve closed.

Stop:

By manually turning the shut-off control, marked "STOP", to the "STOP" position.

For prolonged shut-downs and especially when ambient temperatures are likely to drop below freezing point, the pump and any cooling and flushing arrangements must be drained or otherwise protected. The APSAD regulations require a constant room temperature of minimum 10 °C in the pumping station.

To restart, refer to § 5.3 and 6.2.

The following emergency measures must be taken whenever the equipment is shut down:
- ensure that persons and equipment are protected by applying the pre-defined procedures together with the health and safety department.
- have the work carried out by properly trained and competent staff.

6 MAINTENANCE

6.1 General



It is the plant operator's responsibility to ensure that all maintenance, inspection and assembly work is carried out by authorized and qualified personnel who have adequately familiarized themselves with the subject matter by studying this manual in detail (see also section 1.6.2).

Any work on the machine must be performed when it is at a standstill. It is imperative that the procedure for shutting down the machine is followed.

On completion of work all guards and safety devices must be re-installed and made operative again. Before restarting the machine, the relevant instructions listed in section 5, *Commissioning, start up, operation and shut down* must be observed.



Emergency start-up

As required by the APSAD regulations, the plant may be started by pressing the red emergency start button(s) on the switching enclosure, regardless of the other switching enclosure controls. In order to ensure safety during service interventions, the storage batteries must be disconnected.



Oil and grease leaks may make the ground slippery. Machine maintenance must always begin and finish by cleaning the ground and the exterior of the machine.

If platforms, stairs and guardrails are required for maintenance, they must be placed for easy access to areas where maintenance and inspection are to be carried out. The positioning of these accessories must not limit access or hinder the lifting of the part to be serviced.

When air or compressed inert gas is used in the maintenance process, the operator and anyone in the vicinity must be careful and have the appropriate protection. DO NOT SPRAY air or compressed inert gas on skin. DO NOT DIRECT an air or gas jet towards other people. Never use air or compressed inert gas to clean clothes.

Before working on the pump, take measures to prevent an uncontrolled start. Put a warning board on the starting device with the words:

"Machine under repair: do not start".

With electric drive equipment, lock the main switch open and withdraw any fuses.

Put a warning board on the fuse box or main switch with the words:

"Machine under repair: do not connect".

Never clean equipment with inflammable solvents or carbon tetrachloride. Protect yourself against toxic fumes when using cleaning agents.

6.2 Maintenance schedule

Operation supervision is obligatory whenever the equipment is in operation. It is recommended that a maintenance plan and schedule is adopted, in line with these User Instructions. It should include the following:

Inspection required at installation	Periodic maintenance inspections	INSPECTIONS AND PRECAUTIONS
X	X	- As the plant can start up automatically at any time and therefore represents a potential source of danger, it must be placed in a room reserved exclusively for this purpose with sufficient space and lighting and a lockable door. Access must be restricted to properly trained and authorized staff.
	X	- Due to the noise generated by the diesel engine, as well as the risk of splashing or burning, protective goggles, gloves and ear protection are obligatory. In the case of new equipment, or when excessive oil vapor is emitted, a protection mask should be worn if ventilation is insufficient. Do not touch the exhaust pipe, turbo-compressors or any moving parts. In the case of burns or scalds, always seek medical attention.
	X	- The motor-pump unit must only be used for fire-fighting purposes.
	X	- The concrete base supporting the motor-pump unit must be correctly dimensioned and manufactured in order to bear the static and dynamic loads of the unit. In the case of visible cracks the base will need to be repaired.
X	X	- Ensure that air inlets and ventilation are present, correctly dimensioned (min. 0.5 m ² each) and are not blocked (nests).
X	X	- The supply of fresh air and evacuation of heat generated by the engine require an adequate air intake and ventilation system in order to ensure that fresh air circulates through the room and the diesel engine is provided with the air required for combustion.
X	X	- The room must not be humid, plan for sufficient ventilation and heating. If the equipment is subjected to a high level of humidity for several days, check the electrical switching enclosure and replace all components which may be damaged (electronic card, chargers, etc...) with original spare parts.
	X	- Opening of the ventilation flaps when the motor-pump unit is running and ensuring they are not blocked is essential for correct operation. If these flaps are closed or blocked, the engine will draw in hot air with subsequent loss of power and risk of internal overheating.
	X	- The room must be kept at a temperature of more than 10 °C. Check that the heater functions correctly.
	X	- Remove traces of rust or oxidation from the power supply and battery terminals and coat with suitable grease.
	X	- Start the plant as indicated in the instructions, carry out the tests required and take note of all personal safety warnings and indications.
	X	- All abnormal leakages must be monitored and the engine dealer contacted.
	X	- Check that there is no visible damage and ensure all light indicators on the switching enclosure are green. Also check the room heating system and water pressure values if the equipment is supplied from the town water supply.
	X	- In case of a prolonged power supply shutdown, carry out a booster charge of the batteries or chargers. A full test must be carried out.
X	X	- Ensure the primer tank contact is perfectly connected or the terminal rail shunt if this contact is not used.
	X	- Clean pipes and filters after working on the water supply circuit.

		<p>- Ensure valves 1 and 2 on the heat-exchanger supply circuit are blocked open and the valve 3 is</p> <p>closed (see photo below). No other valves may be incorporated into this cooling circuit either upstream or downstream.</p>
X	X	
	X	- Clean the filter after each test.
	X	- Check that the water flows correctly after the heat-exchanger, the hydraulically-controlled valve is correctly opened and all hydraulic connections are in a good state of repair.
	X	- Check the coolant level with the engine switched off and cold. Opening the cap when the engine is hot could result in severe scalding due to splashing liquid. Always seek medical attention immediately in such a case.
	X	- Check the oil level with the engine switched off and cold before each test. The oil contributes towards the heat exchange process and provides lubrication.
X	X	- Check that the exhaust pipe is not blocked (nests) and it is protected against the entry of rain water.
	X	- Pay attention to parts subjected to vibrations (turbo-compressor, filters, exhaust, pipes, etc...) as the tightness of these elements may vary. If parts are not securely fastened, remedy the problem or contact the manufacturer's agent. Special attention must be given to the manual stoppage system which must slide effortlessly and must not remain blocked in the stop position.
	X	- Check for leaks or retighten the injectors. If the diesel supply or return pipes are removed, ensure they have not been accidentally switched.
	X	- The oil filters must be replaced once a year.
	X	- The diesel tank must be topped up with fuel compliant with the engine specifications. Special attention must be paid to ensure there is no water present in the system. If this is the case, the tank and pipes will need to be drained, rinsed and flushed out immediately.
	X	- The fuel filters must be replaced at least once a year.
	X	- If the engine runs out of fuel or the fuel system is disconnected, flush the entire fuel circuit as indicated in the engine instructions.
	X	- The air filters must be replaced at least once a year.
	X	- Check the drive belts and replace them if the slightest traces of wear or aging are noted, otherwise, replace them every 2 years.
	X	- Check the engine manufacturer's documentation for major maintenance work required (tappets, valves, head gasket, etc...) to be carried out at least once a year.
	X	- Check that the batteries charge and the electrolyte level every week (top up with distilled water when necessary) and ensure the batteries are replaced once a year.
	X	- Always check that the re-heater functions correctly before starting the engine (the engine temperature must be higher than 20 °C). Replace the re-heating element every year (we recommend the storage of spare parts, a thermostat and a heating element for maintenance purposes).
	X	<p>The heating element must be disconnected when the coolant is drained and the engine flushed before reconnecting.</p>
	X	- Check the vibration and temperature levels regularly. In case of a problem, contact the engine manufacturer's dealer.
	X	- Check alignment of couplings regularly and at least once a year.
	X	- A slight leak is imperative around the packing gland to guarantee lubrication and cooling of the seals (refer to the corresponding pages in the instructions for possible adjustment).
	X	- Oil leaks around certain component seals are possible: this is due to dilatations. These leaks must be wiped away to avoid soiling of the equipment.
	X	- The room must be kept clean at all times; clean away all stains and check their origin.
	X	- Do not store inflammable materials in the engine room (with the exception of approved fuel supplies) and keep the room locked.
	X	- An annual servicing is obligatory. It must be carried out by a qualified technician approved by FLOWSERVE.
	X	- The hydraulic hose between the heat-exchanger supply circuit and the heat-exchanger must be replaced every 5 years.
	X	- The fuel hydraulic hoses (supply and Return) must be replaced every 5 years.

Our specialist service personnel can help with preventative maintenance records and provide condition monitoring for temperature and vibration to identify the onset of potential problems.

If any problems are found the following sequence of actions should take place:

- a) Refer to section 7, *Faults; causes and remedies*, for fault diagnosis.
- b) Ensure equipment complies with the recommendations in this manual.
- c) Contact Flowserve if the problem persists.

If the problem renders the equipment in-operational, the following safety precautions must be taken:

- ensure that persons and equipment are protected by applying the pre-defined procedures together with the health and safety department.
- have the work carried out by properly trained and competent staff.

6.2.1 Standard maintenance

Note: For all maintenance work on the pump, refer to the standard instructions if the pump type used is different to that indicated below.

Roller bearing

6.2.1.1 MEN, MEN-TI and MHP pumps:
End bearings are factory-lubricated for life. They require no maintenance.

6.2.1.2 ME-TI pump:

The bearings fitted are pre-packed with grease at the factory. When the re-greasing period is reached it is necessary to remove as much of the old grease as possible with a clean lint free cloth and repack the bearings with fresh grease.

Note: If a check shows a bad running of the motor pump unit, the user must:

- Refer to the "fault finding chart" chapter 7 of this leaflet to apply the recommended solutions.
- Ensure that your equipment corresponds to the arrangements of this leaflet.
- Contact FLOWSERVE after-sales Department if the problem persists.

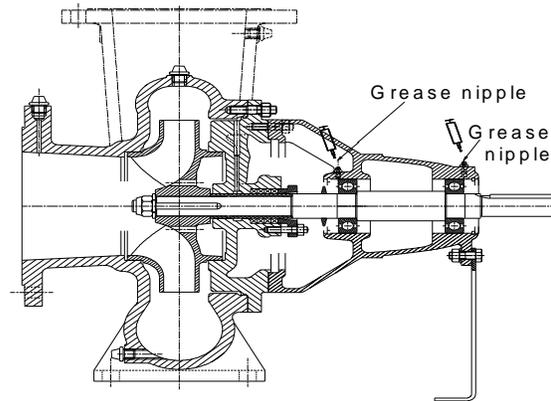
Pump type	Expected lubrication lifetime in hours of operation *	Quantity of top-up grease
	Speed of rotation rpm	in grams
ME-TI 200-400	1800 rpm : 8000 h	25
ME-TI 200-500	1800 rpm : 4000 h	25
ME-TI 250-400	1800 rpm : 8000 h	25
ME-TI 250-500	1800 rpm : 4000 h	30

* At least once a year.

The grease used in factory for first filling is:

SHELL ALVANIA R2

Its equivalents: MOBIL : Mobilux EP 2,
TOTAL : Multis 2,
ELF : ELF MULTI



6.2.2 Gland packing

6.2.2.1 Pump fitted with a packed gland

A well run in and correctly adjusted packing gland requires little maintenance. If, after some time, the leakage becomes too great, the gland should be tightened again in order to return these to a normal level. *If re-tightening is not possible, new packing must be installed*

6.2.2.2 Gland packing inspection and removal

- a) Remove the shield guards
- b) Slide back the gland
- c) Remove the packing rings with an extractor designed for this purpose (including the lantern ring if it exists; note its position and its direction of rotation).
- d) Inspect the state of the sleeve surface (except for ME-TI and MEN-TI pumps); the presence of many marked grooves will indicate that it must be replaced.
- e) Carefully clean the different pieces of the packing gland.

6.2.2.3 Gland packing fitting

If the packing is supplied as cord the packing must be cut so that the external diameter is lightly tightened and there is an initial gap between the sleeve and the packing ring.

For that purpose, wind the packing helically around the shaft sleeve or a chuck of the same diameter. (Take precautions to avoid damaging sleeve).

CAUTION Ensure a tightening on the stuffing box housing and not on the sleeve.

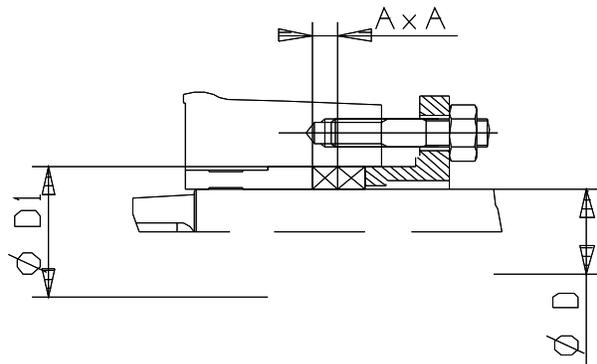
Setting of packing

Follow the instructions:

- a) Assemble of the packing in S.
- b) Stagger by about 90° between two rings.
- c) Assemble packing after packing.

After setting the last packing, fix the gland on the packing and screw up the nut by hand.

After this screwing phase, the shaft should turn by hand as easily as before the setting of the packing.



ϕ D	ϕ D1	A x A	Qty	Pumps Type
40	60	10x10	2	MEN-TI 125-100-315L
50	70	10x10	3	Other MEN-TI
50	90	12x12	4	ME-TI
44	64	10x10	4	MEN Bearing 32
56	76	10x10	4	MEN-MHP Bearing 42

6.3 Spare parts

6.3.1 Ordering of spares

Flowserve keeps records of all pumps that have been supplied. When ordering spares the following information should be quoted:

- 1) Pump serial number.
- 2) Pump size.
- 3) Part name
- 4) Part number
- 5) Number of parts required.

The pump size and serial number are shown on the pump nameplate.

To ensure continued satisfactory operation, replacement parts to the original design specification should be obtained from Flowserve. Any change to the original design specification (modification or use of a non-standard part) will invalidate the pump's safety certification.

6.3.2 Storage of spares

Spares should be stored in a clean dry area away from vibration. Inspection and re-treatment of metallic surfaces (if necessary) with preservative is recommended at 6 monthly intervals.

6.4 Recommended spares and consumable items

[1500], [2110], [2250], [3011], [3012], [3300], [4130], [4590], [4610], [4590-03]

Destroy all the gaskets after dismantling, replace them when reassembling.

IT IS RECOMMENDED THAT BEARINGS ARE NOT REUSED AFTER ANY REMOVAL FROM THE SHAFT.

After serving during two years, replace the gland packing.

The pump may be stored as above for up to 6 months. Consult FLOWSERVE for preservative actions when a longer storage period is needed.

6.5 Disassembly

CAUTION Refer to section 1.6, *Safety*, and section 6 *Maintenance*, before dismantling the pump.

CAUTION Before dismantling the pump for overhaul, ensure genuine Flowserve replacement parts are available. Refer to sectional drawings for part numbers and identification.

REPAIR OF THE PUMP

If the pump presents abnormalities or a persistent malfunction, contact immediately:

FLOWSERVE**After-sales Service**

Tel.: 02 43 40 57 57
(33) 2 43 40 57 57
Fax. : 02 43 40 58 17
(33) 2 43 40 58 17

According to the After-sales Service instructions, disassembly will be limited to the dismantling of the pump, the driver or the assembly.

**DANGER DISCONNECT THE UNIT FROM POWER**

- * Close the inlet valve (if fitted) and outlet valve.
- * Wait for the moment when the pump casing is Cooled and at ambient temperature.

**DRAIN PUMP**

- * Dismantle inlet and outlet pipe work as well as all pipe work.

**REMOVE PUMP TAKING INTO ACCOUNT SAFETY (§ 1) AND HANDLING (§ 2.2) PROCEDURES.**

ANY DISASSEMBLY, REPAIR OR REASSEMBLY WILL BE CARRIED OUT UNDER FLOWSERVE' RESPONSIBILITY, EITHER DIRECTLY BY THE AFTER-SALES SERVICE OR BY OTHER FLOWSERVE-AGENTS WHO WILL GET THE REQUIRED INSTRUCTIONS AND APPROVALS. THIS IS THE CASE OF AUTHORIZED REPAIRERS WHOSE ADDRESSES AND TELEPHONE NUMBERS WILL BE GIVEN ON REQUEST.

7 FAULTS; CAUSES AND REMEDIES

7.1 Faults on the pump

					Insufficient flow rate		
					Irregular pump running		
					Driver overloaded		
					Mechanical seal leak		
					Equipment vibration		
					Excessive pump casing temperature		
					POSSIBLE CAUSES	SOLUTIONS	
x	x			x	X	Pump or suction pipe not completely filled	- Check and complete filling
X	X			X		Air bubbles in pipes	- Check and desecrate the pipes
X				X	X	Suction level too low	- Check: the available NPSH > the required NPSH - Reduce geometrical suction lift - Reduce head losses in pipes and in fittings (diameter increase and appropriate fitting positions) - Check valves and strainers - Check the immersion head of the suction valve
X				X		Total manometric head system higher than pump differential head	- Check the discharge head - Check the head losses in discharge pipes (partly closed valve, foreign particles, back pressure too high) - Modify the installation or change the pump set
	X			X		Total manometric head system lower than pump differential head	- Throttle at discharge valve or trim the impeller (contact our local agent) CONSULT FLOWSERVE
X				X	X	Pipes (valves, filter...)	- Control, dismantle and clean
				X	X	Insufficient flow rate	- Check the suction and discharge pipes (valves, back pressure)
X						Worn wear-ring surfaces	- Foresee pump mending. CONSULT FLOWSERVE
	X	X	X	X		Seizure, jamming	- CONSULT FLOWSERVE
	X	X	X	X		Excessive strains on flanges	- Check the flange connections and eliminate strains (pipe positioning or elastic sleeves mounting)
			X			Defective gland packing on the shaft	- Check and replace all the gland packing parts - Mechanical seal: CONSULT FLOWSERVE
	X	X	X	X		Defective motor bearings	- CONSULT FLOWSERVE
		X			X	Specific gravity or viscosity of liquid too high	- Consult our local agent to analyze the problem
				X		Misalignment	- Check the alignment of the pump and of its driver
				X		Foundations not sufficiently rigid	- Check the setting of base plates: tightening, bad adjustment, seal

					Insufficient pressure		
					Pump loses prime after starting		
					POSSIBLE CAUSES	SOLUTIONS	
X	X					Presence of air	- Check and de-aerate
x						Suction pressure insufficient	- Check: the available NPSH > the required NPSH
X						Mechanical defects	- CONSULT FLOWSERVE
	X					Air leak in the suction pipe	- Check suction pipe is airtight
	X					Restriction in suction pipe	- Check diameter of suction pipe
	X					Suction level too low	- Check the NPSH >NPSH - Reduce geometrical suction lift - Reduce head losses in pipes and in fittings (diameter increase and appropriate fitting positions) - Check valves and strainers - Check the immersion head of the suction valve
	X					Obstruction of suction pipe	- Check condition of pipe
	X					Defective gland packing on the shaft	- Check and replace all the gland packing. - Mechanical seal: CONSULT FLOWSERVE
	X					Defective gasket	- CONSULT FLOWSERVE

7.2 Electrical faults

See Local signalization table (p.21)

If any problems are found the following sequence of actions should take place:

- a) Ensure equipment complies with the recommendations in this manual.
- b) Contact Flowserve if the problem persists.

If the problem renders the equipment in-operational, the following safety precautions must be taken:

- ***ensure that persons and equipment are protected by applying the pre-defined procedures together with the health and safety department.***
- ***have the work carried out by properly trained and competent staff.***

8 PARTS LIST AND DRAWINGS

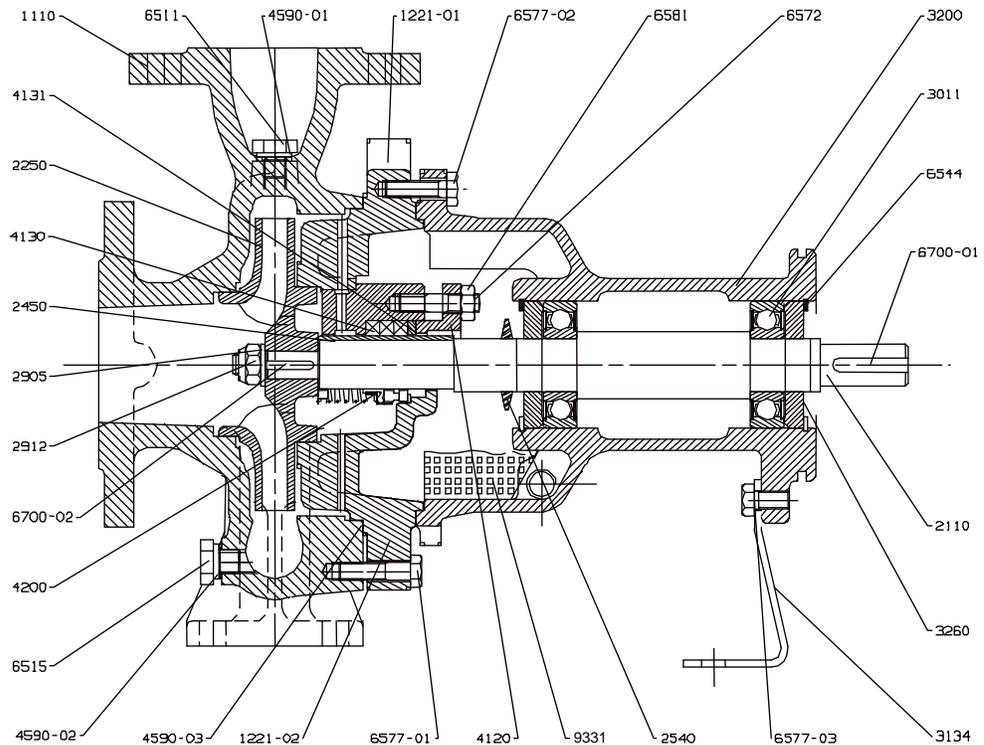
Note: Refer to the corresponding standard pump instructions if the pump type used is different to that indicated below.

8.1 Sectional drawings

8.1.1 MEN and MHP pumps

MEN 80-65-250L
 MEN 100-80-250L
 MEN 125-100-250L

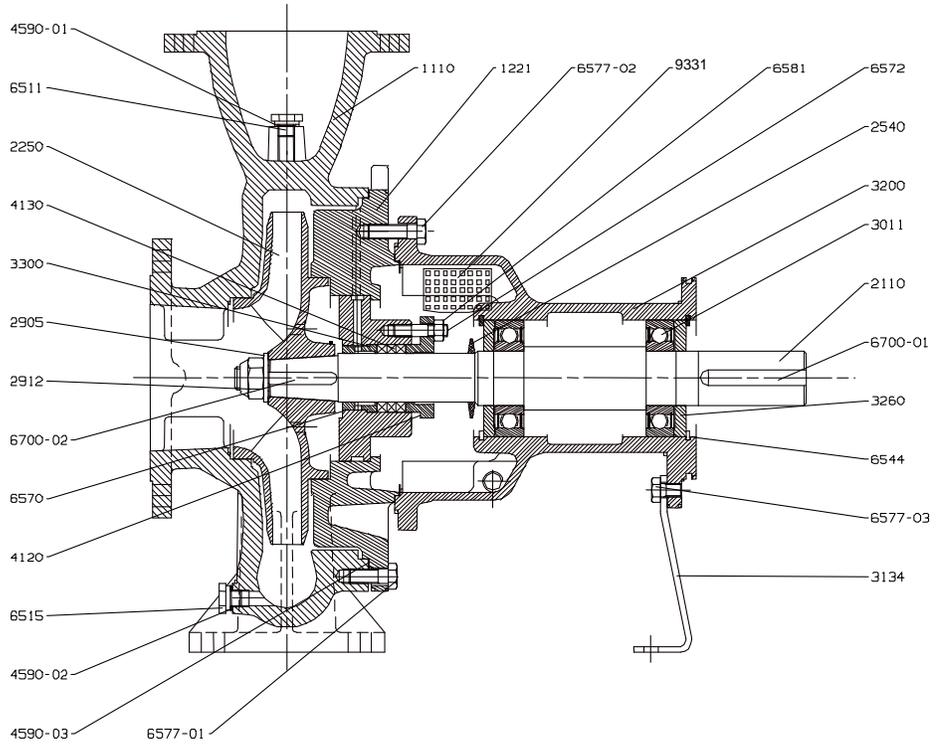
MHP 65-100-315
 MHP 125-100-315



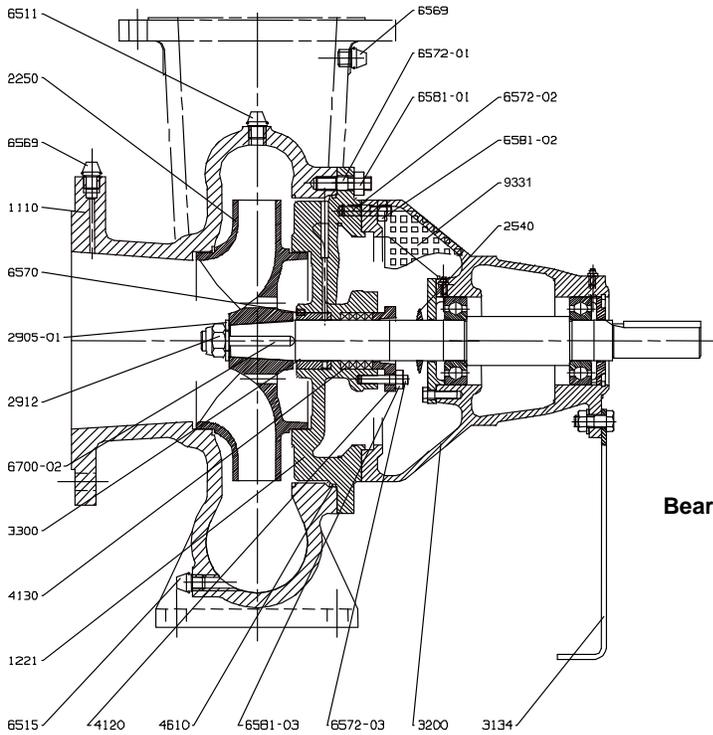
8.1.2 MEN-TI pumps

- MEN-TI 125-100-315 L
- MEN-TI 125-100-400
- MEN-TI 125-100-400 L
- MEN-TI 150-125-315 L

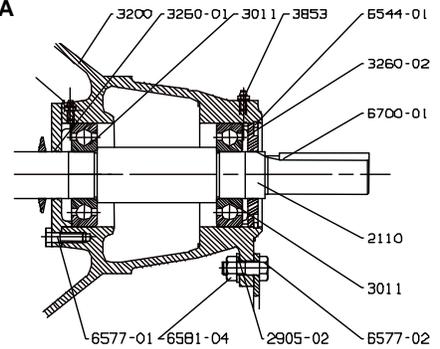
- MEN-TI 150-125-400 L
- MEN-TI 200-150-315 L
- MEN-TI 200-150-400 L



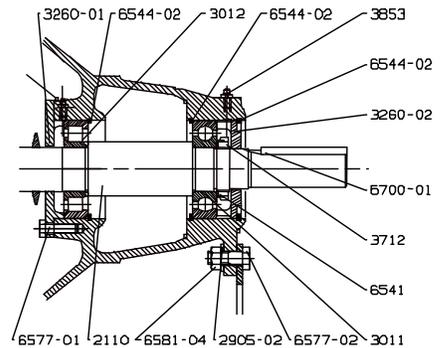
8.1.3 ME-TI pumps



Bearing 55A



Bearing 55B



8.2 Sectional drawings part list

8.2.1 Parts list MEN, MEN-TI, MHP

ITEM	DESIGNATION
1110	Pump casing
1221	Casing cover with stuffing box
2110	Pump shaft
2250	Radial flow impeller
2450	Shaft sleeve
2540	Thrower
2905	Plain washer
2912	Self-braked nut
3011	Radial ball bearing
3134	Support foot
3200	Bearing housing
3260	Bearing cover
3300	Bearing bush
4130	Gland packing
4590-01	Gasket
4590-02	Gasket
4590-03	Special ring
6511	Screwed plug
6515	Screwed plug
6544	Bore circlip
6570	Hexagon socket grub screw with cone point
6572	Stud
6577-01	Hexagon bolt
6577-02	Hexagon bolt
6577-03	Hexagon bolt
6581	Hexagon nut
6700-01	Coupling key
6700-02	Impeller key
9331	Cover plate

8.2.2 Parts list ME-TI

ITEM	DESIGNATION
1110	Pump casing
1221	Casing cover with stuffing box
2110	Pump shaft
2250	Radial flow impeller
2540	Thrower
2905-01	Plain washer
2905-02	Plain washer
2912	Self-braked nut
3011	Radial ball bearing
3012	Roller bearing
3134	Support foot
3200	Bearing housing
3260-01	Bearing cover
3260-02	Bearing cover
3300	Bearing bush
3853	Grease nipple
4120	Gland
4130	Gland packing
4610	Round section joint ring
6511	Screwed plug
6515	Screwed plug
6541	Lockwasher
6544-01	Bore circlip
6544-02	Bore circlip
6569	Screwed plug
6570	Hexagon socket grub screw with cone point
6572	Stud
6577-01	Hexagon bolt
6577-02	Hexagon bolt
6581-01	Hexagon nut
6581-02	Hexagon nut
6581-03	Hexagon nut
6581-04	Hexagon nut
6700-01	Coupling key
6700-02	Impeller key
9331	Cover plate

8.3 General arrangement drawing

The typical general arrangement drawing and any specific drawings required by the contract will be sent to the Purchaser separately unless the contract specifically calls for these to be included into the User Instructions. If required, copies of other drawings sent separately to the Purchaser should be obtained from the Purchaser and retained with these User Instructions.

9 CERTIFICATION

Certificates determined from the Contract requirements are provided with these instructions where applicable. Examples are certificates for CE marking, ATEX marking etc. If required, copies of other certificates sent separately to the Purchaser should be obtained from the Purchaser for retention with these User Instructions.

10 OTHER RELEVANT DOCUMENTATION AND MANUALS

10.1 Supplementary User Instructions

Supplementary instructions for the driver and the switching enclosure are provided as separate documents in their original format. If further copies of these are required they should be obtained from the supplier for retention with these User Instructions.

10.2 Change notes

If any changes, agreed with Flowserve Pump Division, are made to the product after its supply, a record of the details should be maintained with these User Instructions.

10.3 Additional sources of information

Reference 1:

NPSH for Rotor dynamic Pumps: a reference guide, Euro pump Guide No. 1, Euro pump & World Pumps, Elsevier Science, United Kingdom, 1999.

Reference 2:

Pumping Manual, 9th edition, T.C. Dickenson, Elsevier Advanced Technology, United Kingdom, 1995.

Reference 3:

Pump Handbook, 2nd edition, Igor J. Karassik et al, McGraw-Hill Inc., New York, 1993.

Reference 4:

ANSI/HI 1.1-1.5, Centrifugal Pumps - Nomenclature, Definitions, Application and Operation.

Reference 5:

ANSI B31.3 - Process Piping.

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To find your local Flowserve representative please
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www.flowserve.com

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