

INSTALLATION AND MAINTENANCE INSTRUCTIONS

MEN
Life-time
lubricated
bearings

NOT 04 96 356 V06 AN



Dear Customer,

You have chosen a pump from FLOWSERVE for your plant, thank you for trusting us. The information contained in this leaflet will allow you to benefit from a motor pump in the best conditions of installation, operation and maintenance, therefore we ask you to take enough time to read it.

Your FLOWSERVE agent is at your disposal for any further information about your equipment (installation, running, additional equipments). Do not hesitate to contact him if needed.

Traduction en Anglais du manuel d'installation et d'entretien NOT 04 96 356 V06 FR

Translation of the instruction book NOT 04 96 356 V06 FR

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1. SAFETY

This operation manual gives basic instructions which are to be observed during installation, operation and maintenance of the pump. It is therefore imperative that this manual be read by the responsible personnel/operator prior to assembly and commissioning. It is always to be kept available at the installation site.

It is not only the general safety instructions contained under this main heading safety that are to be observed but also the specific information provided under the other main headings.

Qualifications and training of personnel

The personnel responsible for operation, maintenance, inspection and assembly must be adequately qualified. Scope of responsibility and supervision of the personnel must be exactly defined by the plant operator. If the staff does not have the necessary knowledge they must be trained and instructed, which may be performed by the machine manufacturer or supplier on behalf of the plant operator. Moreover, the plant operator is to make sure that the contents of the operating manual are fully understood by the personnel.

Hazards in the event of non-compliance with the safety instructions

Non compliance with the safety instructions may produce a risk to the personnel as well as to the environment and the machine and results in a loss of any right to claim damages.

For example, non-compliance may involve the following hazards :

- Failure of important functions of the machines/plant
- Failure of specified procedures of maintenance and repair
- Exposure of people to electrical, mechanical and chemical hazards
- Endangering the environment owing to hazardous substances being released.

Gloves and safety boots are compulsory in all the plants and, no matter how small the risk of an object falling, a safety helmet is recommended.

Never exceed the limits of flow rate, pressure and temperature specified in this leaflet. It is possible that the equipment may not withstand and create material or physical damages.

Unauthorized alterations and production of spare parts

Any modification may be made to the machine only after being authorized by the manufacturer. Using spare-parts and accessories authorized by the manufacturer is in the interest of safety. Use of other parts may exempt the manufacturer from any liability.

Pump noise

When the pump noise level exceeds 85 dBA attention must be given to prevailing Health and Safety Legislation, to limit the exposure of plant operating personnel to excessive noise. The usual approach is to control exposure time to the noise or to enclose the machine to reduce emitted sound to the surroundings.

Pump noise level is dependent on a number of factors :

the type of motor fitted, the operating capacity, pipework design, and acoustic characteristics of the building.

The noise levels specified in the table below give a general guide to the levels to expect.

	2900 min ⁻¹	2900 min ⁻¹	1450 min ⁻¹	1450 min ⁻¹
MOTOR SIZE kW	PUMP & MOTOR dBA	PUMP ONLY dBA	PUMP & MOTOR dBA	PUMP ONLY dBA
<0.55	64	62	63	62
0.75	67	62	63	62
1.1	67	64	65	64
1.5	70	66	66	66
2.2	71	68	68	68
3	74	70	70	70
4	75	71	71	71
5.5	83	73	72	71
7.5	83	74	73	72
11	84	76	74	73
15	85	77	75	74
18.5	85	79	76	75
22	85	79	77	75
30	93	81	80	76
37	93	82	80	76
45	93	83	80	76
55	95	84	82	77
75	95	86	83	78
90	95	86	85	78
110	95	87	86	79
132	95	87	86	79
160	96	88	86	79

The dBA values are based on the noisiest ungeared electric motors which are likely to be encountered, they are Sound Pressure levels at 1 meter from the directly driven pump, for "free field over a reflecting plane".

If a pump unit only has been purchased, for fitting with your own driver, then the "pump only" noise levels from the table should be combined with the level for the driver obtained from the supplier. Consult a Noise Specialist for this calculation.

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.

Pumps for Food Use or Potable Water

If the pump has not been specifically ordered for a food or drinking water application it must not be used for these type of applications. If it has been ordered for this type of application the following recommendations are to be followed.

Cleaning prior to operation

Pumps that are to be used for a food or drinking water application should be cleaned before being put into initial operation and after the installation of spare parts that are in contact with the liquid.

The cleaning should include at least the following steps :

- Caustic rinse for 20-25 minutes at 80°C.
- Clean water rinse for 20-25 minutes at 80°C.
- Acid rinse for 15-20 minutes at 80°C.
- Clean water rinse for 20-25 minutes at 80°C.

The flow rate during this period must be at least 100 % of the maximum operation flow.

The concentrations of the caustic and acid rinses should be as per the supplier's recommendations.

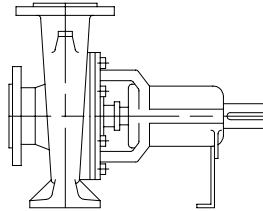
The above procedure is a general procedure. The user should adjust the conditions based on their experience. Cleaning once the pump has been commissioned will depend on the application and operating conditions. The user must ensure that the cleaning procedures are suitable for the application and operating conditions.

2. PUMP DESCRIPTION

The MEN pump 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, of the settlement feet as well as of the shaft end diameter and position correspond to standards : DIN 24255 and NF EN 733.

⚠ 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 according to the conditions given in this manual. The maximum values specified in this manual must never be exceeded.

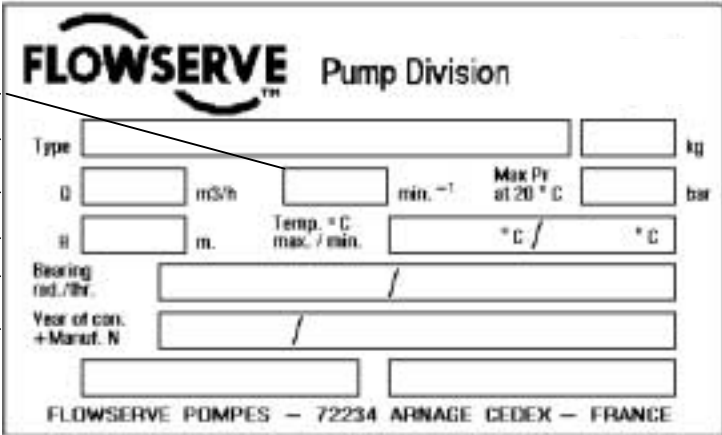


- * Maximum working pressure at discharge 16 bars
- * Maximum working pressure at suction 10 bars
- * Maximum pumped fluid temperature :
 - Gland packing $\leq 105^{\circ}$ Celsius
 - Mechanical seal $\leq 120^{\circ}$ Celsius
- * Minimum pumped fluid temperature - 10° Celsius
- * Maximum ambient temperature 40° Celsius
- * Maximum solid suspension 50 g/m^3
- * Density 1
- * Viscosity $1 \text{ mm}^2/\text{s}$
- * Rotation speed (frequency 50 Hz) :
 - MEN 1450 min^{-1}
 - MEN 2900 min^{-1}
- * Rotation speed (frequency 60 Hz) :
 - MEN 1750 min^{-1} (ou) 3500 min^{-1}

⚠ The maximum speed is shown on the pump nameplate.

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


Each pump is supplied with the following nameplate :

Speed of rotation		Mass
Pump type		Maximum admissible Pressure at 20°C
Flow rate		Maximum / minimum temperature
Head		
Radial/thrust bearing		
Year of construction + Manufacture number		

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Each pump unit is supplied with the following nameplate :

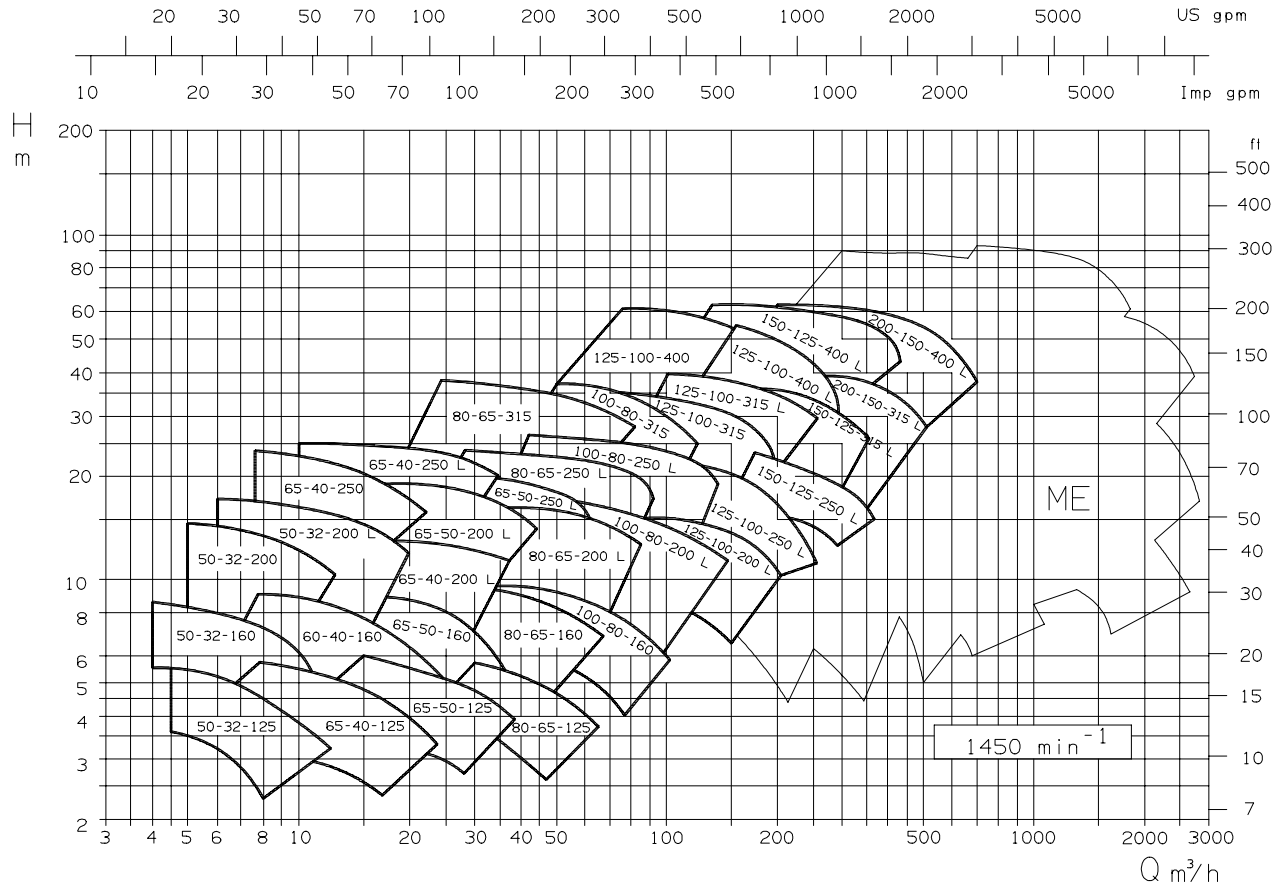
Mass of the set



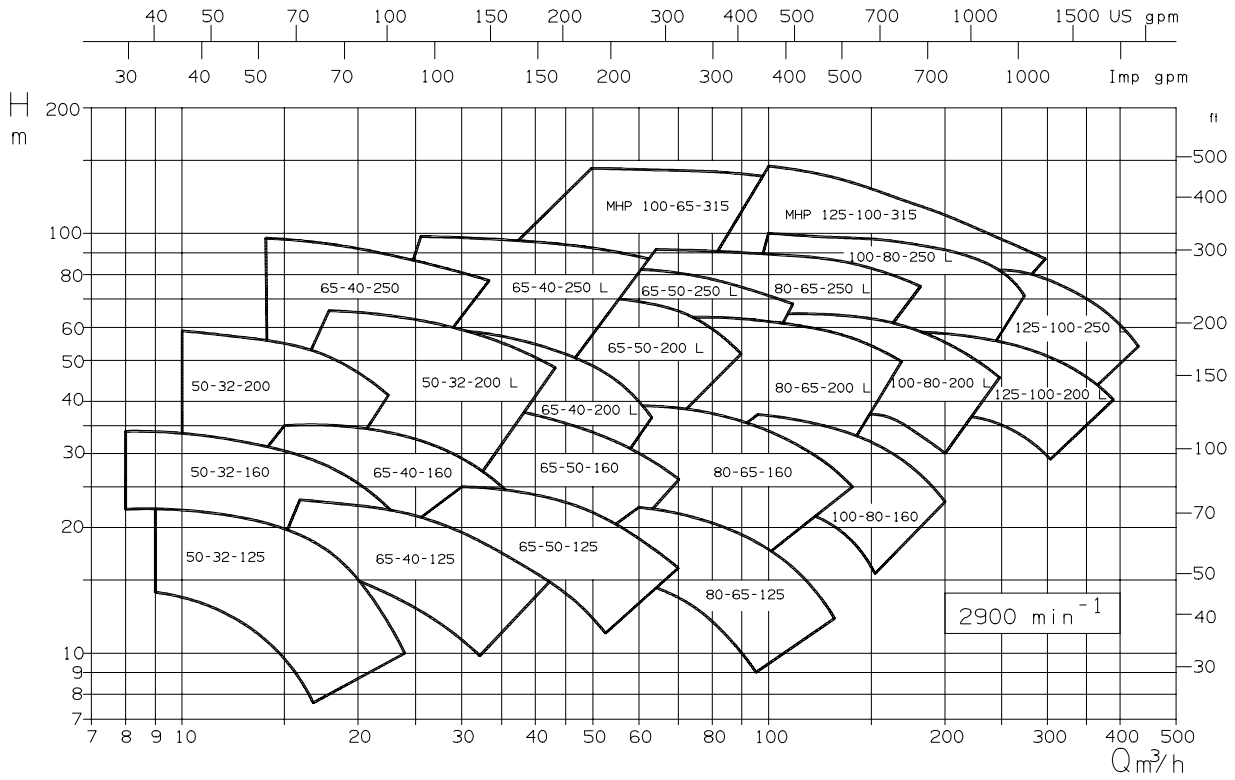
 kg

2.1 Coverage charts

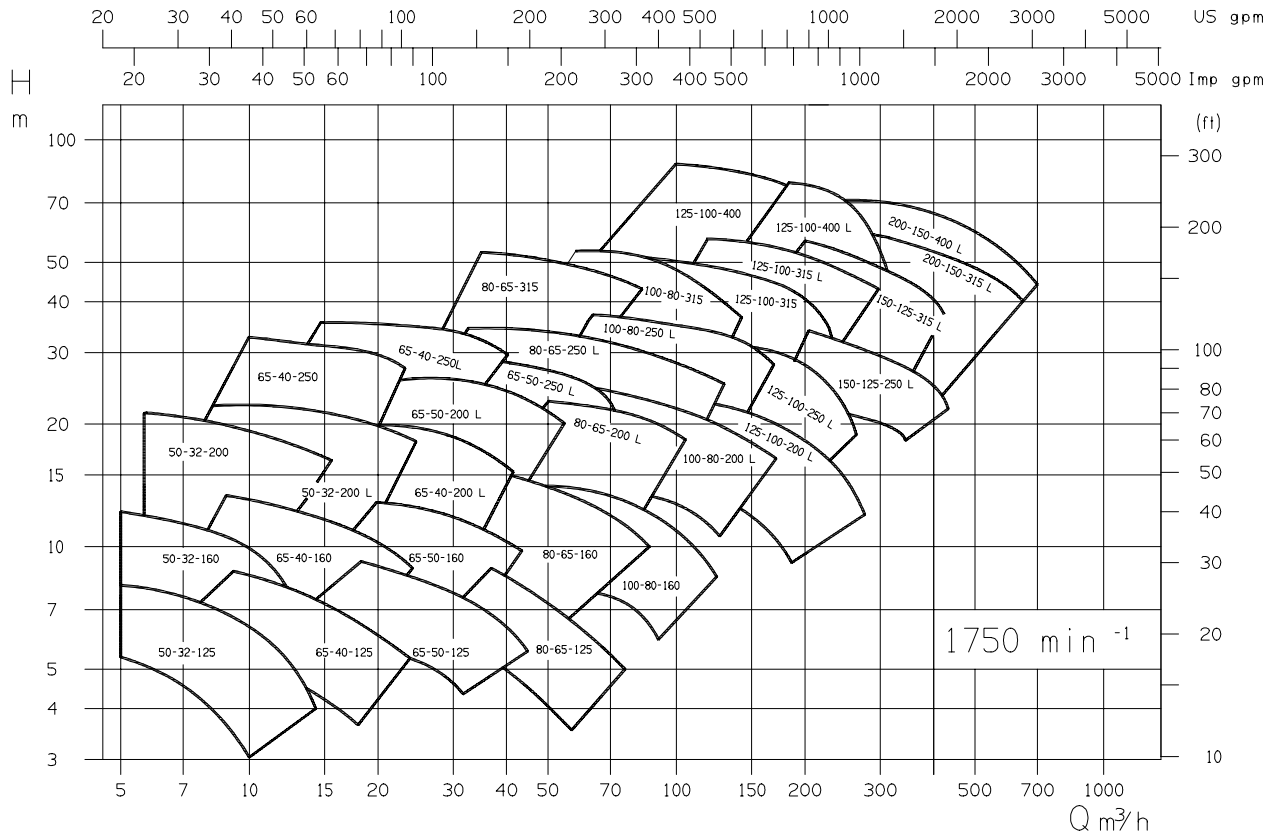
2.1.1 1450 min⁻¹ (50Hz) : coverage charts (Q,H)



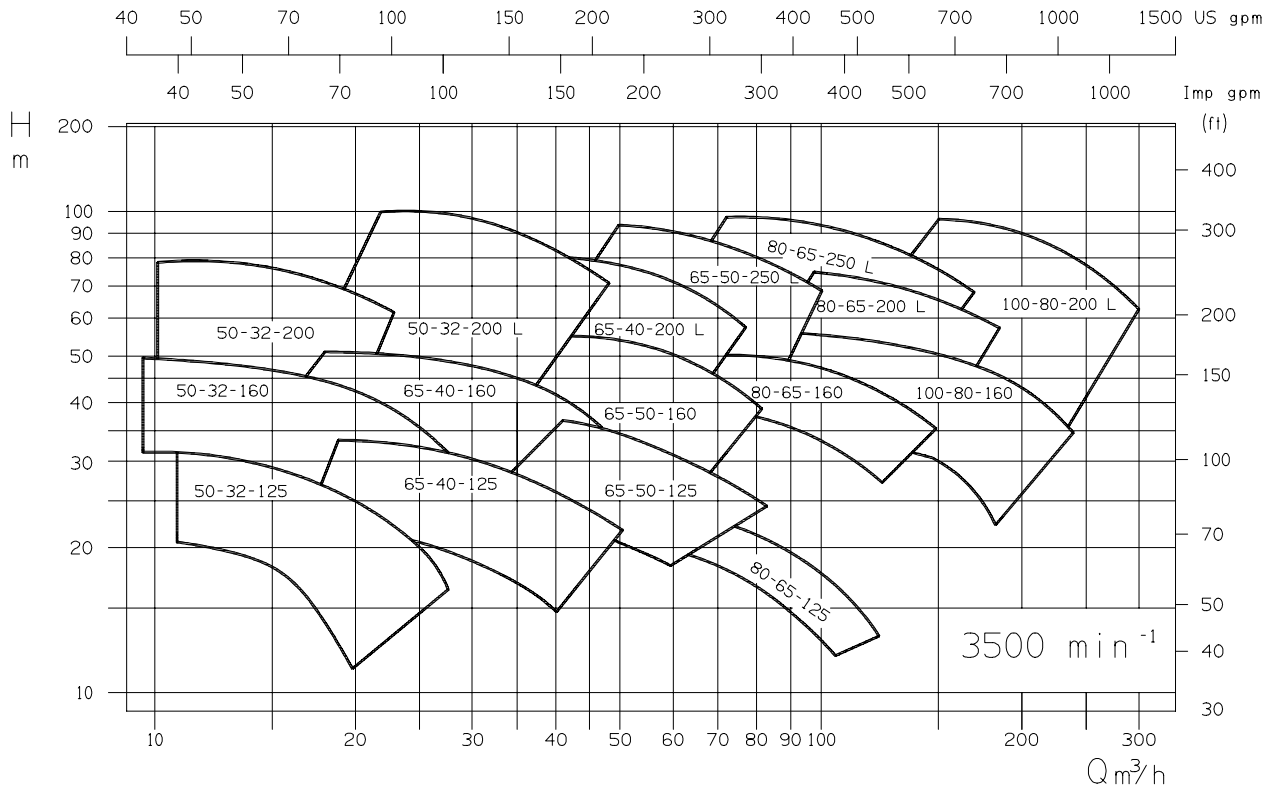
2.1.2 2900 min⁻¹ (50Hz) : coverage charts (Q,H)



2.1.3 1750 min^{-1} (60 Hz) : coverage charts(Q,H)



2.1.4 3500 min^{-1} (60 Hz) : coverage charts(Q,H)



3. **HANDLING**

3.1 General instructions concerning handling

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

To lift heavy pieces above 30kg, 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 positionned 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.

3.2 Pump masses

All masses are in kg

PUMP TYPE	PUMP MASS	MASS OF PUMP CASING	MASS OF CASING COVER		
MEN 50-32-125	30	Mass < 30 kg	Mass < 30 kg		
MEN 50-32-160	35				
MEN 50-32-200	38				
MEN 50-32-200L	43				
MEN 65-40-125	33				
MEN 65-40-160	36				
MEN 65-40-200L	44				
MEN 65-40-250	51				
MEN 65-40-250L	58				
MEN 65-50-125	35				
MEN 65-50-160	44				
MEN 65-50-200L	48				
MEN 65-50-250L	57				
MEN 80-65-125	39				
MEN 80-65-160	46				
MEN 80-65-200L	55				
MEN 80-65-250L	85			32	
MEN 80-65-315	105			43	
MEN 100-80-160	49	31			
MEN 100-80-200L	78	33			
MEN 100-80-250L	91	40			
MEN 100-80-315	113	47			
MEN 125-100-200L	94	43			
MEN 125-100-250L	100	50			
MEN 125-100-315	123	52			
MEN 125-100-315L	125	56			
MEN 125-100-400	185	72	39		
MEN 125-100-400L	189	75	40		
MEN 150-125-250L	120	72	Mass < 30 kg		
MEN 150-125-315L	200	73	30		
MEN 150-125-400L	230	88	38		
MEN 200-150-315L	203	103	30		
MEN 200-150-400L	240	104	38		

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



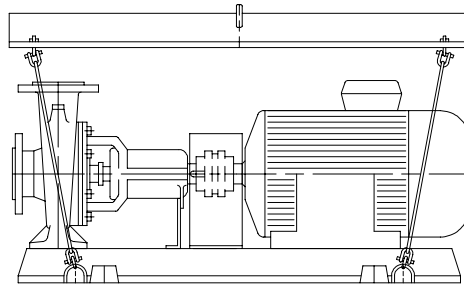
For masses above 30 kg, manual handling is forbidden.

3.3 Slinging of motor pumps units

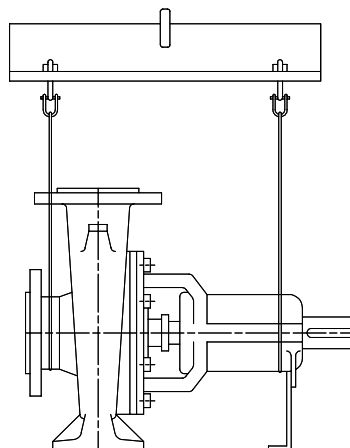
- ⚠ Use handling means in accordance with motor pump unit mass mentioned on the CE plate. For the masses of the pumps bare end of shaft see table § 3.2 and nameplate.

To avoid distortion, lift up motor pump unit as shown

Motor pump unit



Bareshaft pump



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

- ⚠ For masses above 30 kg, manual handling is forbidden.

4. PREPARATION BEFORE INSTALLATION

4.1 Unpacking and Inspection

The pump should be checked against the delivery advice note and any damage or shortage reported immediately to Flowserve. Any crate/carton/wrappings should be checked for any spare parts or accessories which may be packed with the pump.

4.2 Storage

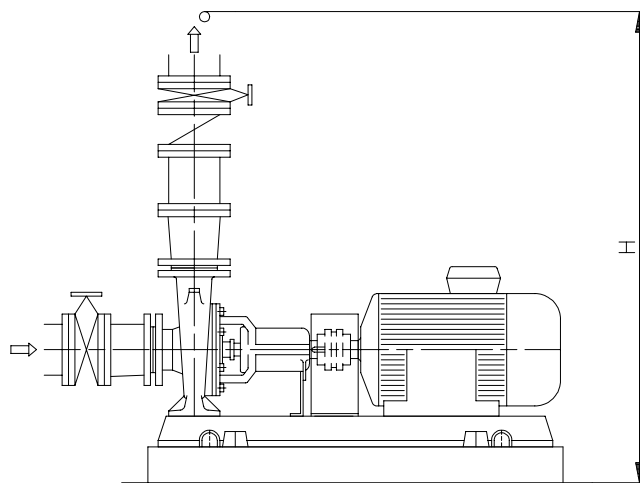
Store the pump in a clean, dry location away from vibration. Leave piping connection covers in place to keep dirt and other foreign material out of pump casing. Turn pump once a week to prevent brinelling of the bearings and the seal faces, if fitted, from sticking.

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

5. INSTALLATION

5.1 Location

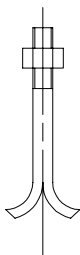
The pump should be located to allow room for access, ventilation, maintenance and inspection with ample headroom for lifting and should be as close as practicable to the supply of liquid to be pumped



5.2 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 baseplate 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.

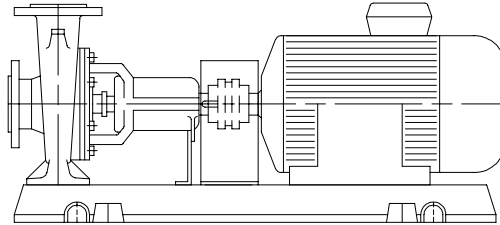


NF E 27 811

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

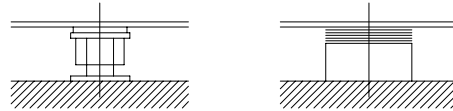
Provide sufficient space in the foundation to accommodate the anchor bolts. If necessary, provide concrete risers.

Usually the pump and its drive are mounted on a common baseplate. If not, individual baseplates underneath each machine foot shall be installed. Baseplates are to be fully grouted.

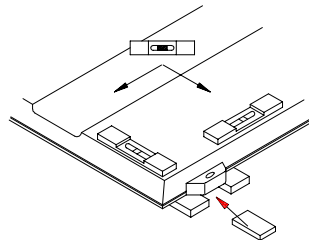


5.2.1 Setting the baseplate for anchoring

- 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, levelling screws can be used).

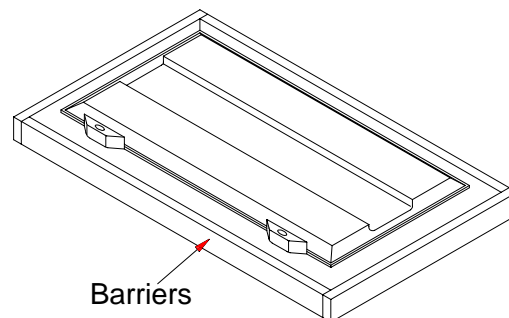


- Lay the baseplate and level in both directions with extra shims. The baseplate should be level to within 0,5 mm per 1 m

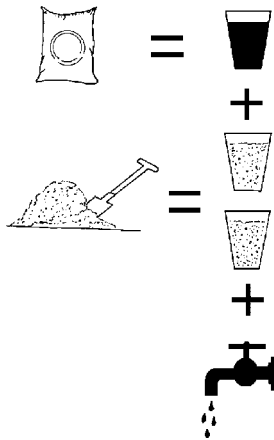


5.2.2 Baseplate grouting

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.

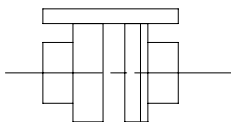


Use grouting products with anti-shrinking components.

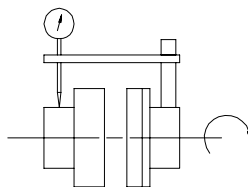
- Pour grout up to the required level. Polish surfaces. Take necessary precautions to avoid air bubbles.
- Lay-down the barrier, break external angles, polish the different surfaces.
- After grout starts to cure, definitively tighten anchor bolts.
- Control the alignment such as described as follows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

5.3 Alignment

Parallelism and concentricity check



with a rule

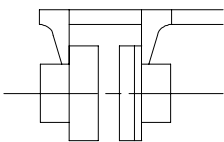


with a comparator

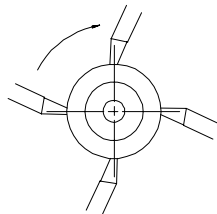
Check the alignment at three or four points, before pipeworks assembly.

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

WARNING

The alignment will be definitive only after pipework connection (see § 5.4).

If necessary, improve the machine alignment :

→ *Complete unit mounted on common baseplate :*

The machines are first aligned accurately in our workshops. Usually, any misalignment observed on-site is due to a wrong adjustment under the baseplate (disturbed during transport or because of forces exerted by the pipework). It is only necessary to rectify the adjustment under baseplate. If it proves to be insufficient, modify the motor and the pipeworks adjustment.

→ *Pump and motor mounted on individual baseplates :*

Machines are (or must be) first mounted on their own baseplate in the workshop. Once the pump is set, it will be regarded as the fixed piece. Any alignment necessary shall be carried out on the motor.

 **Never connect the electric motor before the setting has been completely finished.**

5.4 Suction and discharge pipework

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

- First, choose a flow speed < 2m/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.

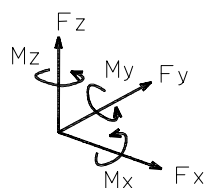
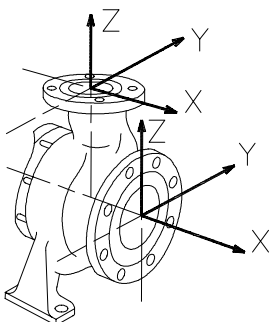
Do not mount expansion joints in such a way that their force, due to internal pressure, may act on the pump flange.

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 (§ 5.4.1, § 5.4.2, § 5.4.3) 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 :

MEN Pump	Suction DNA (mm)	Discharge DNR (mm)	Forces (daN)		Moments (mdaN.)
			Fv max	Fh max	Σ Mt 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



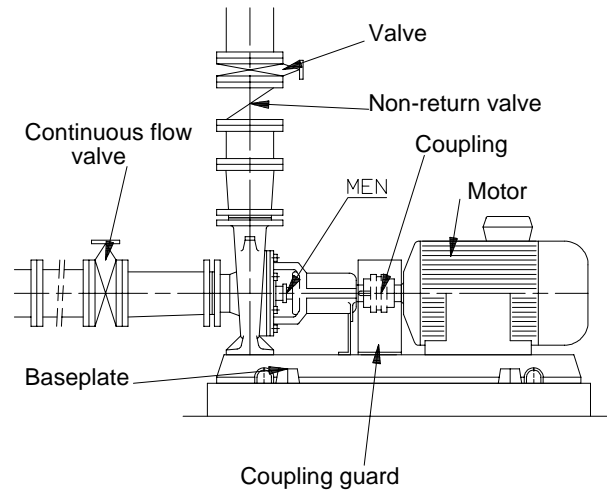
Forces and moments values are applied to the whole flanges and not flange by flange. For their sharing out on the pump flanges, refer to standard NFE 44 - 145.

INSTALLATION AND MAINTENANCE INSTRUCTIONS

The information contained in this document is confidential. It must not be disclosed or copied without our written consent.

5.4.1 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.



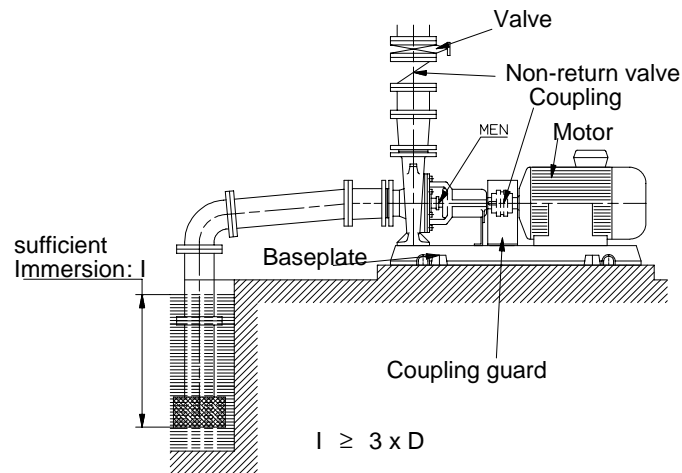
Flooded suction configuration

- Avoid sharp elbows or sudden narrowings. Use convergents $\leq 20^\circ$ (total angle).
- Arrange the pipework so that there are no air pockets (no bulges).
- If high points cannot be avoided in suction line, provide them with air relief cocks.
- If a strainer is necessary, its net area should be three or four times the area of the suction pipe.
- If an inlet valve is necessary, choose a model with direct crossing.

⚠ Do not tighten flanges before the final check (see § 5.4.4).

5.4.2 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

- Avoid sharp elbows or sudden narrowings. Use convergents $\leq 20^\circ$ (total angle) with upright generating.
- Arrange that the suction pipework is inclined upwards towards the pump ensuring that there are no peaks.
- If a foot valve is necessary, do not oversize it because it would generate pulsations (valve beating).

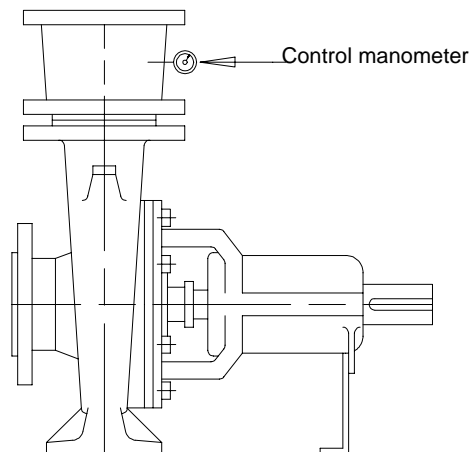
⚠ Do not tighten flanges before the final check (see § 5.4.4).

5.4.3 Design of a discharge line

- If discharge line is provided with a divergent, its total angle will be between 7° and 12° .
- Install the discharge valve after the non-return valve downstream.

The non-return valve will be set in the discharge pipe to protect the pump from any excessive pressure surge and from reverse rotation.

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



⚠ Do not tighten flanges before the final check (see § 5.4.4).

5.4.4 Final check and completion of installation

- Check the tightening of anchor bolts
Tighten them if necessary !
- Check that protective covers on suction and discharge flanges are removed
- Check that holes of pipework flanges are parallel and correspond to those of the pump.
- **Tighten suction and discharge flanges !**
- Check the alignment pump-motor according to the procedure § 5.3.
Rectify if necessary by adjusting the motor only !
- Check by hand that the pump turns freely.
A binding indicates a distortion of the pump, which is due to excessive pipes strains. If necessary the pipework design must be re-examined !
- If it provided, connect auxiliary pipe systems (hydraulic, pneumatic, sealing system).
- Control tightness and functionality of auxiliary pipings.

5.5 Electrical Connections

Electrical connections should be made by a qualified electrician in accordance with the relevant local regulations.

The motor must be wired up in accordance with the motor manufacturer's instructions (normally supplied within the terminal box) including any temperature, earth leakage, current and other protective devices as appropriate. The identification nameplate should be checked to ensure the power supply is appropriate.

A device to provide emergency stopping shall be fitted.

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



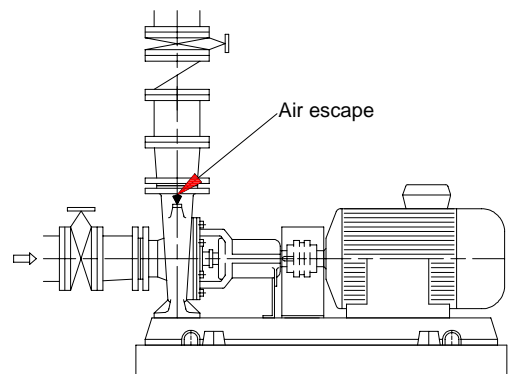
To avoid any risk of jamming, the direction of rotation will be checked after priming of the pump (§ 6.1, 6.2) and before the first start (§ 6.4).

6. STARTING AND RUNNING

These operations must be carried out by personnel with approved qualifications

6.1 Priming of a flooded pump

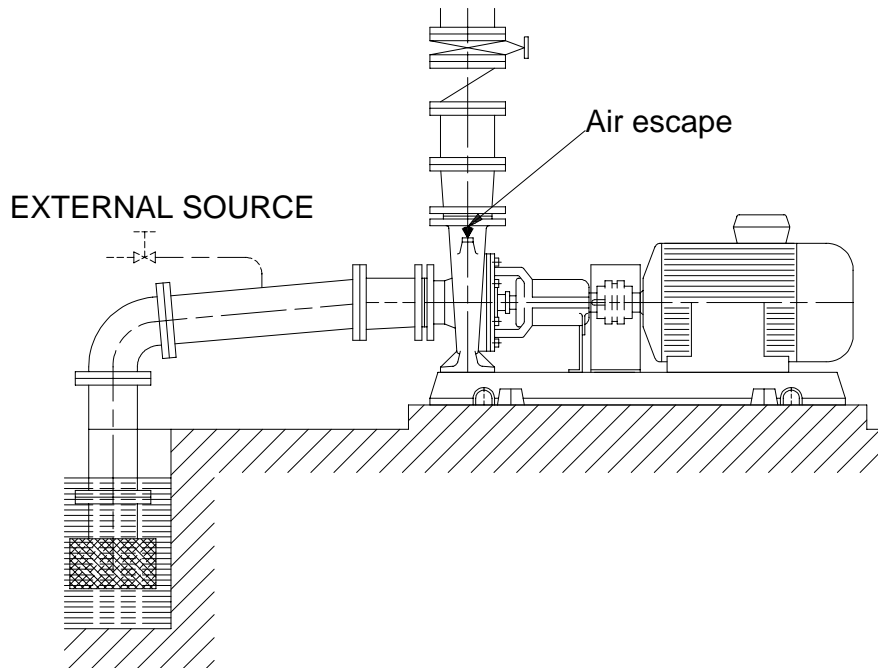
- As discharge valve is closed, fill the pump by opening the valve at suction. Let air escape by removing the plugs located on the pump.
- The discharge pipe is headed and there is a by-pass valve on the check valve, open slightly the discharge valve and the by-pass of the check valve.
- When the pump is totally free of air bubbles, replace the plugs.



Priming of a flooded pump

6.2 Priming of a sump suction pump

- * With foot valve :
 - Fill suction pipe and casing with liquid from an independent source. (pressure 1 to 2 bars).
 - Let air escape by removing the plugs located on the pump.
 - When the pump is totally free of air bubbles, replace the plugs.



Priming of sump suction pump with foot valve

Without foot valve :

- Priming may be accomplished by means of venting system.

NOTE : Foot valves are not recommended when the pumped liquid has suspended solid particles. They may lodge between foot valve seat and shutter.

6.3 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.

- * Check the direction of rotation of the motor. Refer to the rotation arrow of the pump.

⚠ Install all protection systems and more particularly the coupling guard and the shieldgrid (reference 9610) of the bearing.

- * Open all suction valves (if existing)

- * Close the outlet valve and the bypass valve

- * Ensure inlet pipe and pump casing are completely full of liquid.

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°Celsius, a warning plate must be clearly placed 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 are used.

6.4 First pump start-up

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

Start motor and check outlet pressure.

If pressure is satisfactory, slowly OPEN outlet valve

Do not run the pump with the outlet valve closed for a period longer than 30 seconds.

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

The pump should run smoothly and without vibration.

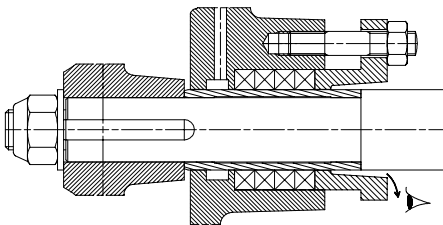
The pump must never run at a capacity of less than 40% of that at the best efficiency.

⚠ Never remove a plug when the pump is running.

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 fingertight only. Leakage should take place soon after the stuffing box is pressurised. 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 restarted. When the pump is restarted it should be checked to ensure leakage is taking place at the packed gland.

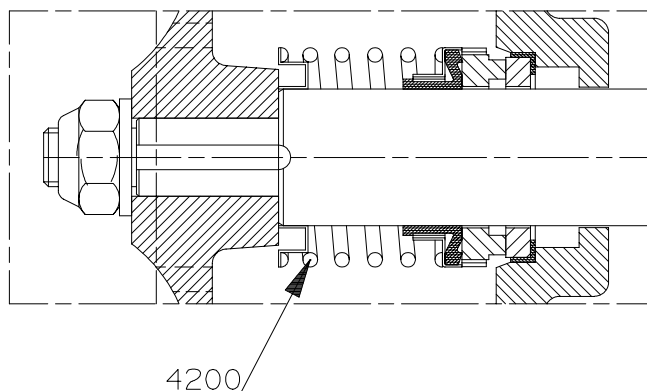
The pump should be run for ten minutes with steady leakage and the gland nuts tightened by 10 degrees at a time until leakage is reduced to an acceptable level, normally between 10 to 20 drops per minute. Bedding in of the packing may take around 15 minutes.



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

Pump fitted with a mechanical seal :

A mechanical seal ensures a seal without leakage and does not need any adjustment. Nevertheless if a light leakage occurs during start-up, it should disappear after the initial running in of the friction faces.



NEVER RUN A MECHANICAL SEAL DRY, EVEN FOR A SHORT WHILE.

INSTALLATION AND MAINTENANCE INSTRUCTIONS

The information contained in this document is confidential. It must not be disclosed or copied without our written consent.

6.5 Running

6.5.1 Routine Inspection (daily/weekly)

Check the behaviour of the pump while running : noise level, vibrations, bearings temperature, flow rate and pressure.

- Normal running Effective speed of vibration $\leq 5,6$ mm/s
Temperature $\leq 70^\circ$ Celsius
- Alarm Effective speed of vibration between 5,6 mm/s and 11,2 mm/s
Temperature between 70° Celsius and 90° Celsius
- Compulsory stop Efficient speed of vibrations $> 11,2$ mm/s
Temperature $> 90^\circ$ Celsius

Check that there are no abnormal fluid or lubricant leaks (static and dynamic seals) and that any sealant systems (if fitted) are full and operating normally.

Pump fitted with a stuffing box : leakage of 10 to 20 drops per minute.
Pump fitted with a mechanical seal : no leakage.

6.5.2 Periodic inspection (6-Monthly)

Check foundation bolts for security of attachment and corrosion.

Check pump running records for hourly usage to determine if bearing lubricant requires changing.

The coupling should be checked for correct alignment and worn driving elements.

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.

6.6 Stopping and restarting in continuous running

According to hydraulic conditions of the installation and its automation degree, stop and restart procedures can have different forms. Nevertheless all of them must respect imperatively the following rules :

- * Stopping :
 - Avoid that the unit turns in the opposite direction to the normal running.
 - Make sure that the discharge line pressure does not reach the foot valve.
 - Avoid a continuous running below the authorized flow rate (see § 6.4)

- * Restart :
 - Ensure that the pump is completely full of liquid.
 - Ensure a continuous supply with a sufficient available NPSH.
 - Ensure a back pressure so that the motor power is not in excess.



Respect the starting frequency imposed by the motor manufacturer.



Protect the pump against water hammer when stopping or starting.

6.7 Shutdown

- Close the outlet valve and stop the motor
- Eventually close the inlet valve.

For prolonged shutdowns 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.

7. FAULT FINDING CHART

							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 deaerate 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	Wrong rotation	- Reverse 2 phases on motor terminal boxes	
x	x	x				The motor is running on 2 phases only	- Check and control the motor electrical power supply	
x						Motor running too low	- Check the connection in the terminal box according to the voltage	
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 FLOWERVE	
x					x	Pipes (valves, filter...)	- Control, dismantle and clean	
					x	Insufficient flow rate	- Check the suction and discharge pipes (valves, back pressure)	
x						Worn wear-ring surfaces	- Foresee pump mending. CONSULT FLOWERVE	
	x	x	x		x	Seizure, jamming	- CONSULT FLOWERVE	
	x	x	x		x	Excessive strains on flanges	- Check the flange connections and eliminate strains (pipe positioning or elastic sleeves mounting)	
					x	Defective mechanical seal	- Check and replace all the mechanical seal parts - Mechanical seal : CONSULT FLOWERVE	
	x	x	x		x	Defective motor bearings	- CONSULT FLOWERVE	
					x	Specific gravity or viscosity of liquid too high	- Consult our local agent to analyse the problem	
					x	Misalignment	- Check the alignment of the pump and of its driver	
					x	Foundations not sufficiently rigid	- Check the setting of baseplates : tightening, bad adjustment, seal	

Insufficient pressure

Pump loses prime after starting

		<i>POSSIBLE CAUSES</i>	<i>SOLUTIONS</i>
x		Rotation speed too low (check the driver)	- Check the connection in the terminal box according to the voltage
x	x	Presence of air	- Check and deaerate
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 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	Obstruction of suction pipe	- Check condition of pipe
	x	Defective gland packing on the shaft	- Check the screwing of the gland and the gland packing. - Check and replace all the gland pakings. Never run dry - Mechanical seal : CONSULT FLOWSERVE
	x	Defective gasket	- CONSULT FLOWSERVE

8. MAINTENANCE

8.1 Generalities about inspections and maintenance .

It shall be the plant operator's responsibility to ensure that all maintenance inspection and assembly work is performed by authorised and qualified personnel who have adequately familiarised themselves with the subject matter by studying this manual in detail.

Any work on the machine shall only be performed when it is at a standstill, it being imperative that the procedure for shutting down the machine described in this manual be followed.

On completion of work all safety and protective facilities must be re-installed and made operative again. Prior to restarting the machine, the instructions listed concerning operation/commissioning are to be observed.



An oil and grease leakage may make the ground slippery. The maintenance of a machine must always begin and finish by cleaning the ground and the exterior of the machine.

- When platforms, stairs and guard rails are required for maintenance, they must be placed for an easy access to areas where maintenance and inspection must be carried out by the operator . However, the positioning of these accessories must not hold up the access or the lifting of a piece to be serviced.
- When air or compressed inert gas are used to clean the machines, the operator and those people in the vicinity must be careful and have appropriate gas-protection, wearing at least eye protectors. DO NOT SPRAY air or compressed inert gaz 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 avoid an uncontrolled start . Put on the starting device a warning board with the words : "Machine under repair : do not start" . Concerning electric drive equipment, lock the main switch open and withdraw fuses . Put a warning board with these words : " Machine under repair : do not connect" on the fuse box or on the main switch.
- Never clean pieces with inflammable solvents or carbon tetrachloride . Protect yourself against toxic fumes when cleaning pieces with cleaning agents .

8.2 Maintenance Schedule

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.

8.3 Standard maintenance

Roller bearing

The bearing housings are provided with life-time lubricated ball bearings. No maintenance is required.

8.4 Maintenance of the shaft seal system

8.4.1 Pump fitted with a packed gland

A well run in and correctly adjusted packed gland requires little maintenance.

If, after some time, leakages become too important, the gland should be tightened again, in order to restore these to a normal level.

If a re-tightening is not possible, the gland must be refilled :

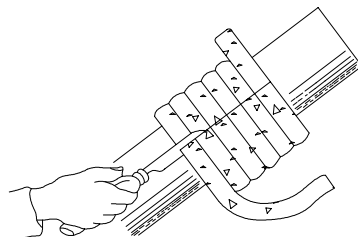
Removal and valuation

- Remove the shieldgrids
- Draw back the gland
- Remove the packing rings with an extractor designed for this purpose (including the lantern if it exists ; relocate its position and its direction of rotation).
- Carefully control the state of the sleeve surface ; the presence of many marked grooves will indicate that it must be replaced.
- Carefully clean the different pieces of the packed gland.

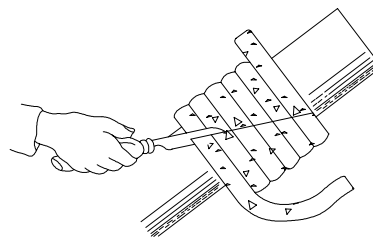
Fitting of the packing rings

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 damage of the sleeve)



Example of straight cut



Example of bevel cut

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

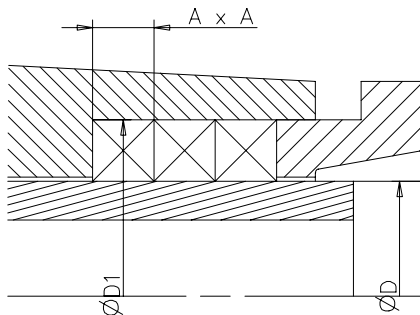
Setting of packing

Follow the instructions :

- Assembly of the packing in S.
- Staggering by about 90° between two packings.
- Assemble packing after packing.

After setting the last packing, fix the gland on the packings 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 packings.



Ø D	Ø D1	A x A	No x lgth	Bearing
30	46	8	3 x 125	24
40	50	10	4 x 165	32
50	70	10	4 x 195	42

For the bearing of 24 : Do not forget to mount the 4131 follower between the last packing and the gland flange.

8.4.2 Pump fitted with a mechanical seal

The current maintenance is limited to seal control. It is necessary to detect the least leakage which announces the beginning of the deterioration of friction faces or secondary seal elements (rings, bellows, synthetic membranes). It is advisable to stop as quickly as possible the machine and to call on an approved engineer to repair the seal.

9. 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

 **Assembly and disassembly must be carried out by FLOWSERVE personnel or its approved repairers whose list may be sent on request. It is obvious that the following instructions and recommendations cannot replace their knowledge and experience.**

- The pump should be disassembled only if certain signs of anomalies or malfunction are observed.

Disassemble only to the extent that the problem spot may be reached..

- In any case, the disassembly must be carried out by qualified personnel who have read the instructions of the leaflet, and in particular the safety instructions.

- Disassembly must be done with great care to avoid damage to the pumps internal parts. To make reassembly easier, display parts in the disassembly order. Protect all machined surfaces from metal/metal contacts and from corrosion.

Before all disassembly it is imperative to :

NEVER DO MAINTENANCE WORK WHILST THE UNIT IS CONNECTED TO POWER

*Close the outlet and inlet valve

*Wait until the pump casing is at ambient temperature

*Be sure that the pump casing is not under pressure

DRAIN PUMP AND ISOLATE PIPEWORK BEFORE DISMANTLING THE PUMP.

9.1 Dismantling of a MEN pump

9.1.1 Dismantling of a MEN pump with the gland packing option

DISMANTLING OPERATIONS

Loosen the 9906.01 hexagon bolts (or 9906.02 for gripped casing cover with stuffing box) and remove the complete rotor set.

Release the 9929 nut, remove the 9941 plain washer, the 2250 radial flow impeller, the 6700.02 key

Loosen the 9906.02 hexagon bolts (if casing cover with stuffing box is not gripped) and remove the 1222 casing cover with the complete seal (4130, 4131, 9402, 9923.01, 9951.01)

Dismantling of packed gland :

Loosen the 9923.01 hexagon nut, remove the 9402 gland flange, loosen the 9951.01 studs, the 4131 follower in one part, the 4130 gland packing.

To dismantle the 2450 shaft sleeve : heat the shaft sleeve up to 200 °C to destroy the loctite film

Dismantling of bearing :

Remove the 2540 thrower, the 6546 circlips, the 3260 bearing covers, the 2110 shaft and bearing housing. Remove the 3011 shaft radial ball bearings

9.1.2 Dismantling of a MEN pump with the mechanical seal GM option

DISMANTLING OPERATIONS

Loosen the 9906.01 hexagon bolts (or 9906.02 for gripped casing cover with stuffing box) and remove the complete rotor set.

Release the 9929 nut, remove the 9941 plain washer, the 2250 radial flow impeller, the 6700.02 key sub

Loosen the 9906.02 hexagon bolts (if casing cover with stuffing box is not gripped) and remove the 1222 casing cover with the fixed ring of the 4200 mechanical seal. Remove the fixed ring of the 4200 mechanical seal from the 1222 casing cover with the stuffing box

Dismantling of bearing : remove the 2540 thrower, the 6546 circlips, the 3260 bearing covers, the 2110 shaft and bearing housing. Remove the 3011 shaft radial ball bearings

9.2 Reassembly of a MEN pump

9.2.1 Packing option

ASSEMBLY OPERATIONS

Mount the 3011 radial ball bearings with press in support on the 2110 pump shaft collars. Do not press on the outer bearing race but on the inner one.

Press the 3260 bearing cover, pump side

Press the 6546 circlips and check its position in the bearing arrangement, pump side.

Turn over the bearing and attach the bearing cover with the circlip.

Put the bearing housing vertically, pump side, supported on the work bench, press together the shaft + radial ball bearings + 3260 bearing cover (coupling side) into the bearing housing. Position the bearings in their arrangements without pressure, (press on the outer bearing race, if the 3260 bearing cover is not mounted).

Press the circlips on the coupling side, check its correct position in the groove

Check that the shaft freely rotates without any jarring

Verify that the axial clearance is between 0,1 and 0,5 mm.

Mount the 2540 rubber thrower against the pump cover (at 1 mm).

Carefully degrease the surface of the shaft sleeve of the 2110 shaft and the 2450 bore of the sleeve.

Spray the « T of LOCTITE » activator on the shaft sleeve surface

Lay down the 601 « LOCTITE BLOCPRESS » glue on the shaft surface and in the bore of the 2450 sleeve

Press the shaft sleeve on the shaft surface (big external bevel towards the pump) by rotating to spread well the glue. Wipe up the excess glue. Let the loctite glue polymerize for at least 15 min.

Prepare and clean the 1222 casing cover with stuffing box

Press the 4130 gland packing taking care to stagger the joints by 90°degrees to eachother. (See the paragraph concerning the stuffing box conception) . Press the 4131 follower.

Press the 9951.01 stuffing box studs and thoroughly tighten

Lubricate the external diameter of the 9402 gland flange

Assemble the 9402 gland flange and screw up the 9923.01 hexagon nut by hand

ASSEMBLY OPERATIONS

Check by hand that the shaft sleeve is secured well to the shaft

Mount the 1222 casing cover with stuffing box on the bearing, and adjust it suitably (stud of the stuffing box in the horizontal axis).

Tighten screws of the 9906.02 casing cover with stuffing box according to torque (see torque table, do not use striking-face wrench to block).

* For the pumps 50.32.125, 65.40.125, 65.50.125, 80.65.125, 50.32.160, 65.40.160, 100.80.200 and 125.100.200, the 1222 casing cover with stuffing box is gripped between the 3200 bearing and the 1111 pump casing and will be fixed only when the pump casing is mounted with 9906.02 hexagon bolts.

Prepare the 2250 impeller, carefully check water lines and clean them if necessary. Lightly grease hydraulic rings.

Mount the 6700.02 key on the shaft

Mount the impeller on the shaft

Mount the 9941 plain washer

Grease the threaded shaft end. Screw up and tighten the 9929 self-braked nut while being careful with torques (see § 9.3).

Prepare and carefully clean the 1111 pump casing.

Mount the 9621.01 and 02 hexagonal filling and drain plugs with their 4590.01 and 02 gaskets.

Put the pump casing supported on the suction flange and install the 9460 special ring.

Suspend the bearing, casing cover and impeller arrangement vertically from a lifting block and set lower the whole arrangement into the well orientated pump casing.


Prepare the 9906.01 or 02 hexagon bolts. For the pump of types MEN 80.65.125, 80.65.160, 80.65.200 L, 100.80.160, 125.100.250 L, put a tightness product such as « TUBETANCHE 577 » on these bolts.

Screw up and stagger according to recommended torque. Do not use a striking-face wrench.

Check the mobile rotation which should not have any jarring

Mount the 6700.01 key on the shaft.

You may tighten a little, by hand, the nuts of the stuffing box.

 Reset the 9610 workpiece guards on the bearing and the 3134 support foot.

9.2.2 Mechanical seal option

ASSEMBLY OPERATIONS

Mount the 3011 radial ball bearings with press in support on the 2110 pump shaft collars. Do not press on the outer bearing race but on the inner one.

Press the 3260 bearing cover, pump side

Press the 6546 circlips and check its position in the bearing arrangement, pump side.

Turn over the bearing and the bearing cover rests on the circlip for a bore

Put the bearing housing vertically, pump side, supported on the work bench, press together the shaft + radial ball bearings + 3260 bearing cover (coupling side) into the bearing housing. Position the bearings in their arrangements without pressure, (press on the outer bearing race, if the 3260 bearing cover is not mounted).

Press the circlips on the coupling side, check its correct position in the groove

Check that the shaft freely rotates without any hard spot

Check that the axial clearance is located at 0,1 mm maximum.

Prepare and clean the 1222 casing cover on the bearing

Tighten screws of the 9906.02 casing cover with stuffing box according to torque (see table torque, do not use striking-face wrench to block).

* For the pump 50.32.125, 65.40.125, 65.50.125, 80.65.125, 50.32.160, 65.40.160, 100.80.200 and 125.100.200, the 1222 casing cover with stuffing box is gripped between the 3200 bearing and the 1111 pump casing and will be fixed only when the pump casing is mounted with 9906.02 hexagon bolts.

Prepare the 4200 mechanical seal

Put O-ring for rotating seal ring and joint O-ring for stationary seal ring into soapy water.

Mount the stationary seal ring in the casing cover with the set of tools defined in § 9.4

Mount the rotating seal ring, the spring and the mechanical seal cupel with the set of tools defined in § 9.4

Prepare the 2250 impeller. Check the vanes cleanliness

Grease hydraulic rings

Mount the 6700.02 key on the shaft

Mount the impeller on the shaft and avoid gripping the mechanical seal cupel.

Mount the 9941 plain washer

Grease the shaft end threading. Screw up and tighten the 9929 self-braked nut and respect torques (see § 9.4).

Prepare and carefully clean the 1111 pump casing.

Mount the 9621.01 and 02 hexagonal filling and drain plugs with their 4590.01 and 02 gasket.

Put the pump casing supported on the suction flange and install the 9460 special ring.

Present the bearing, the casing cover, the impeller hanging vertically from a lifting block and set the whole in the well orientated pump casing.

INSTALLATION AND MAINTENANCE INSTRUCTIONS


ASSEMBLY OPERATIONS

Prepare the 9906.01 ou 02 hexagon bolts. For the pump of types MEN 80.65.125, 80.65.160, 80.65.200 L, 100.80.160, 125.100.250 L, put a tightness product such as « TUBETANCHE 577 » on these bolts.

Screw up and stagger according to recommended torque. Do not use a striking-face wrench.

Check the good rotation of the moving body (no jarring)

Mount the 6700.01 coupling key on the shaft.

 Reset the 9610 workpiece guards on the bearing and the 3134 support foot.

Nota : These recommendations correspond to a consecutive assembly and to a complete dismantling. For a partial dismantling, only certain areas will be relevant.

9.3 Recommended screw torques

The torques to be applied are :

SCREW	TORQUE	
	Casing / cover	Casing cover/Bearing
HM 10	3 m.daN	3 m daN
HM 12	5 m.daN	
HM 14	10 m.daN	5m.daN

SHAFT END NUT	
Diameter	Torque
M 12	6 m daN
M 14	8 m daN
M 18	12 m.daN
M 20	14 m.daN
M 24	16 m.daN

The tightening torques have been calculated as a function of the forces produced by the pumps. These torques correspond to a tension of the shaft end of 25 % to 50 % of the elastic limit.

The tolerance allowed on the tightening torques is $\pm 30 \%$

9.4 Mechanical seal

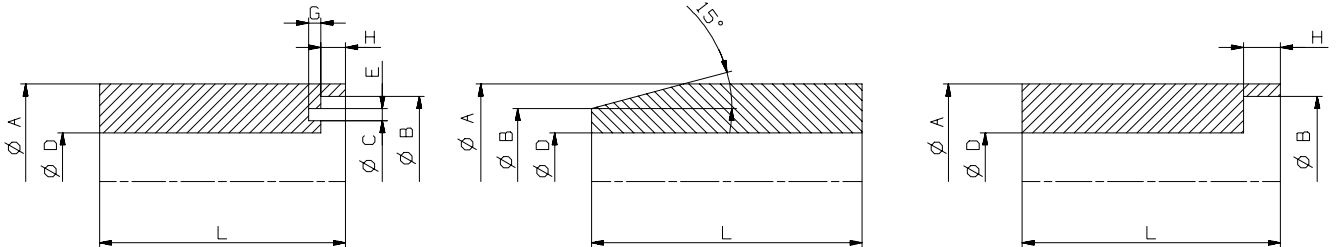
The mechanical seal assembly does not need any particular adjustment. The correct setting is ensured by a clear support of the mechanical seal cupel on the impeller hub. The stationary seal ring is set with the help of the tube and the rotating seal ring, with its joint slided on the shaft, is set with the help of the assembly cone and the tube.

Set of tools for mechanical seal assembly (not supplied by FLOWERVE)

Tube for stationary seal ring

Assembly cone for rotating seal ring

Tube to complete setting of the ring



O-ring $\phi 3$

SET OF TOOLS	SET OF TOOLS DIMENSIONS								PUMP TYPE	
TUBE FOR STATIONARY SEAL RING	$\phi A^{+0,5}_0$	$\phi B^{+0,1}$	$\phi C^{+0,2}$	$\phi D^{+0,2}$	$\phi E^{+0,15}_0$	$\phi G^{+0,1}$	$\phi F^{+0,2}$	L	MEN	
	42	39,7	30	28,5	3,3	1,25	3	60	50-32-125,50-32-160,50-32-200 50-32-200L,65-40-125,65-40-160 65-40-200L,65-40-250,65-40-250L 65-50-125,65-50-160,65-50-200L 65-50-250L,80-65-125,80-65-160 80-65-200L,100-80-160	
	55	52,7	44,1	38,5	3,3	1,25	3	60	80-65-250L,80-65-315,100-80-200L 100-80-250L,100-80-315,125-100-200L 125-100-250L,125-100-315,125-100-315L 150-125-250L	
	69	66,9	54,4	51	3,3	1,25	5,5	60	125-100-400,125-100-400L,150-125-315L 150-125-400L,200-150-315L,200-150-400L	
ASSEMBLY CONE FOR ROTATING SEAL RING	$\phi A^{+0,1}$		$\phi B^{+0,1}_0$		$\phi Dg6$		$L^{+0,5}$		MEN	
	22		19		16		30		50-32-125,50-32-160,50-32-200 65-40-125,65-40-160,65-50-125 65-50-160,80-65-125	
	28		24		20		40		50-32-200L,65-40-200L,65-40-250 65-40-250L,65-50-200L,65-50-125 80-65-160,80-65-200L,100-80-160	
	38		28		24		55		80-65-315,100-80-315,125-100-315	
	38		34		32		60		80-65-250L,100-80-200L,100-80-250L 125-100-200L,125-100-250L 125-100-315L,150-125-250L	
50		46		40		69		125-100-400,125-100-400L,150-125-315L 150-125-400L,200-150-315L,200-150-400L		
TUBE FOR ROTATING SEAL RING	$\phi A^{+0,2}$		$\phi B^{+0,4}_0$		$\phi D^{+0,1}$		$\phi H^{+0,1}$		L	MEN
	37		28,5		28,5		7,9		60	50-32-125,50-32-160,50-32-200 50-32-200L,65-40-125,65-40-160 65-40-200L,65-40-250,65-40-250L 65-50-125,65-50-160,65-50-200L 65-50-250L,-80-65-125,80-65-160 80-65-200L,100-80-160
	46,1		38,5		38,5		7,9		60	80-65-250L,80-65-315,100-80-200L 100-80-250L,100-80-315,125-100-200L 125-100-250L,125-100-315 125-100-315L,150-125-250L
	60,5		51		51		8,5		60	125-100-400,125-100-400L 150-125-315L,150-125-400L 200-150-315L,200-150-400L

INSTALLATION AND MAINTENANCE INSTRUCTIONS

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10. RECOMMENDED SPARES

Flowserve keep 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 pumps safety certification.

Apply the request to :
FLOWSERVE POMPES
Route d'Angers
72234 Arnage Cedex
FRANCE

Tél : 02 43 40 57 34
(33) 2 43 40 57 34
Télex : 720079
Fax : 02 43 40 58 17
(33) 2 43 40 58 17

10.1 Recommended Spares

1500, 2250, 3011, 4130 (ou 4200), 4590-01, 4590-02, 9460

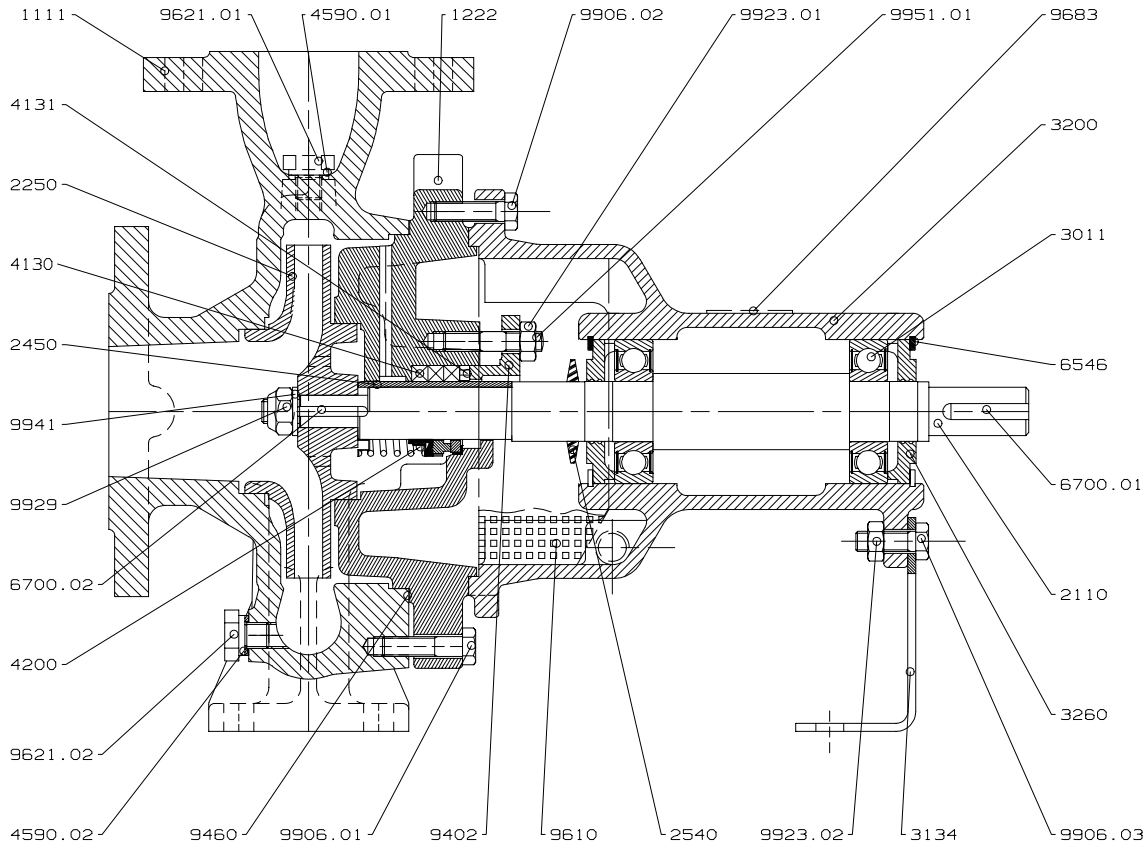
Destroy all the rings after dismantling, replace them when reassembling

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

After serving during two years, replace the gland packing.

10.2 General arrangement drawing

MEN pumps

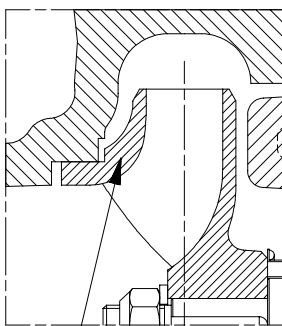


IMPELLER DIAMETER 125

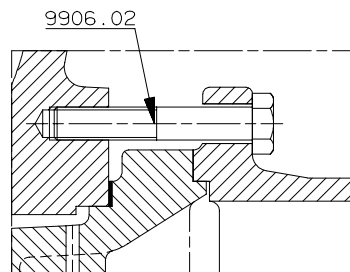
Without back hub ring
(MEN pumps)

Clamped casing cover

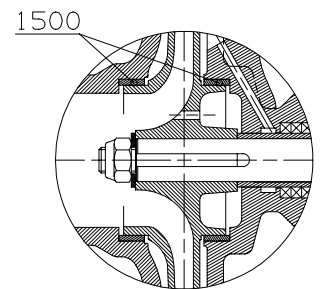
With wear-rings



2250



9906.02



1500

INSTALLATION AND MAINTENANCE INSTRUCTIONS

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10.3 Sectional drawing parts list

ITEMS	DESIGNATION
1111	Pump casing
1222	Casing cover with stuffing box
1500	Wear ring
2110	Pump shaft
2250	Radial flow impeller
2450	Shaft sleeve
2540	Thrower
3011	Radial ball bearings
3134	Support foot
3200	Bearing housing
3260	Bearing cover
4130	Gland packing
4131	Follower
4200	Mechanical seal
4590-01	Gasket
4590-02	Gasket
6546	Circlip
6700-01	Key
6700-02	Key
9402	Gland flange
9460	Special ring
9610	Various protections
9621-01	Screwed plug
9621-02	Screwed plug
9683	Description plate
9906-01	Hexagon bolt
9906-02	Hexagon bolt
9906-03	Hexagon bolt
9923-01	Hexagon nut
9923-02	Hexagon nut
9929	Self-braked nut
9941	Plain washer
9951-01	Stud