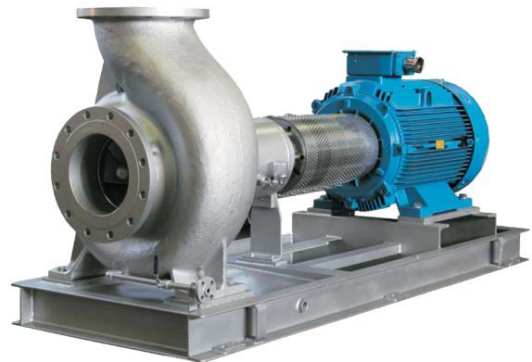




**ND SERIES  
OPERATION  
&  
MAINTENANCE  
MANUAL**

*fluidity.*  
**nonstop**



**Single Stage  
Mechanically Coupled  
End Suction  
Centrifugal Pump**  
built to  
ISO 2858 – ISO 5199  
standard



Read these instructions before putting the pump into service.



Installation and operation should be carried out by qualified personnel only.



Danger of electrocution. Electric supply must be isolated before working on the pumpset.



Electrical work should only be carried out by qualified personnel

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## GENERAL

### Construction features

AxFlow Aturia ND series pumps are single stage pumps with hydraulically balanced overhung impeller, simple volute casing with end suction and top radial delivery.

The impellers, developed to be highly efficient, guarantee the most economic service.

Standardisation of the common parts to a very high degree simplifies spare parts storage. UNI 2223/29 – ISO 7005 PN 16 flange nozzles are used for the standard construction (on request flanges according to ANSI 150 RF).

#### ***Pump casing***

The pump casing is back pull out, monobloc type, with casted feet fixed by 4 bolts to the common Pump / motor baseplate.

#### ***Shaft seal housing***

The shaft seal housing closes back the pump casing.

It is designed to allow mounting of mechanical seal (simple, balanced or double, according to pumped liquid or as for plant requirements).

The shaft seal housing has a chamber for cooling or heating, if required, according to pump service or to the type of pumped liquid.

#### ***Support***

The support is back pull out type, fixed on the stuffing box by a set of screws.

The standard construction for pump with support size 24-32-42 is fitted with two ball bearings.

Heavy duty pumps, pumps with support size 55, and pumps with high suction pressure are fitted with one roller bearing (pump side) and double thrust bearing (motor side) suitable to support a high axial thrust.

The bearings are oil lubricated by a constant level oiler.

#### ***Pump nameplate***

Details of the pump type and model, serial number and operating data are indicated on the pump nameplate.

Pump nameplate reports the following data :

- Manufacturer
- Pump type
- Serial number
- Capacity (m<sup>3</sup>/h)
- Head (m)
- Shaft speed
- Year of construction

The pump must be installed and operated in full compliance with these instructions. The pump may not be operated outside the limits specified on the nameplate and within this manual. The pump should only be operated by skilled trained personnel. The manufacturer will not accept liability if these instructions are not followed.

This manual does not take into account any specific local regulations or bylaws that may be applicable, and it is the responsibility of the installer to ensure compliance with such regulations.

### **Fields of applications**

AxFlow Aturia ND series pumps are mainly employed in the following applications :

- General Industrial services
- Petrochemical plants
- Chemical plants
- Transfer of corrosive and/or dangerous fluids
- Distribution
- Marine
- Hot pressurized water
- Heat transfer oil

The operating limits are shown on the technical data sheet.

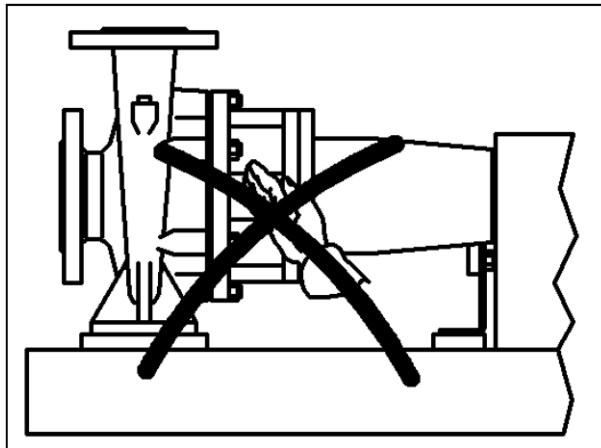
### Precautions during operation



**ATTENTION !**

Always take the following safety precautions :

- The coupling guard must be at its place on the baseplate.
- If warm liquids are pumped, protect the pump to prevent contact with warm pump surfaces.
- Never put your hands or any kind of object into pump openings where the shaft rotates (see picture)



**Protect motor and all electric parts according to current regulations**

**Noise levels**

The following table reports the noise level produced by AxFlow Aturia ND Series pumps running within their operating limits and installed according to the instructions given in this manual (average values measured in free field at 1 meter from the pump set and elaborated according to ISO standard R1680 – curve A). The values are referred to groups with AxFlow standard electric motors. For other motors the table values shall be compared to the actual used motors.

MOTOR FRAME SIZE	MOTOR SPEED	
	2 Pole	4 Pole
63	65	65
71	67	65
80	71	65
90	73	67
100	77	69
112	79	70
132	80	71
160	81	72
180M	82	73
180L	82	73
200	83	74
225	84	75
250	85	77
280	86	80
315S	89	83
315M	90	84
355	91	87
400	93	89

If noise levels are to be guaranteed, add an allowance of 3 dB for measurement and manufacturing tolerance.

Increase for 60 Hz operation :

3500 rpm +3 dB,

1750 rpm +1 dB,

1160 rpm +.--- dB



## Operating limits

The operating limits are the following :

Suction pressure	max. 4 bar	
Max. operating pressure at delivery	max. 20 bar	
Pumping liquid temperature	max. 250 °C	min. -50°C

Performances are described in the technical specification enclosed in the AxFlow order confirmation.

## Residual risks

Inobservance of the safety instructions here reported or improper use of the pump may result in heavy damage to things and/or injuries to the person.

Always keep to the following directions :



**DON'T KICK THE PUMP**



**DON'T DAMAGE THE PUMP BY MISHANDLING**



**DON'T PRESSURIZE THE PUMP BEYOND RECOMMENDED LIMITS**



**AVOID DRY RUNNING, OPERATION AT LOWER CAPACITY THAN ALLOWED OR RUNNING AGAINST A CLOSED DISCHARGE VALVE**



**AVOID THERMAL SHOCK FROM COLD FLUIDS AGAINST WARM SURFACES**



**ONLY USE THE PUMP WITH FLUIDS SPECIFIED IN THE ORDER DATASHEETS**

**In case of emergency**

- Switch off line voltage
- Warn service personnel responsible of the plant

**Area of operation**

AxFlow Aturia ND series pump sets may be installed within a building or externally. Wherever installed, protect the pump from frost, snow and flooding.

Care must be taken to ensure that cold weather will not cause the pump or pipes to freeze, and installers may wish to consider lagging or trace heating.

If supplied, standard electric motors are only suitable for operation in safe areas, free from the danger of explosive liquids or gases.

**Spare parts**

Spare parts are available from AxFlow throughout Great Britain. Please quote the pump model and serial number for all spares enquiries.

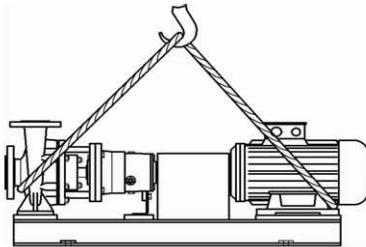
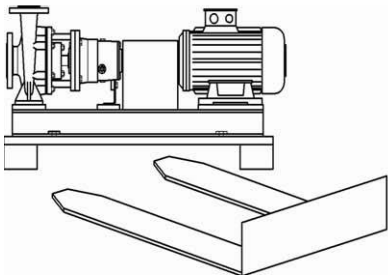
The pump user is strongly recommended to carry replacement spares for parts which are wearing items as follows:

- Radial ball bearing (3011 / 1)
- Radial roller bearing (3012) if planned
- Double thrust bearing (3032) if planned
- Impeller (2200)
- Casing wear ring (1500 – 1520)
- Gasket (4590.1 / 2)
- Mechanical seal (4200)
- Radial lip seal (43000.1 / .2)
- O-Ring (4610)

If an electric motor is supplied as the drive then also include the following:

- Pair of motor bearings

## Transport



THE PUMP SHOULD BE TRANSPORTED BY EQUIPMENT SUITED FOR ITS' WEIGHT AND TO THE SHAPE OF PACKAGE



LIFTING BY HAND IS ALLOWED ONLY FOR LOWER WEIGHTS THAN 20 KILOGRAMS

Check the nameplate on the pump against the receiving and purchase order documents to be sure that the correct size of pump and materials of construction have been supplied. If a motor has been supplied, check that the power, speed, and voltage are correct.

Prior to unpacking, check for physical damage to the packing and the pump unit and notify the forwarding agent **IMMEDIATELY** if any damage is found.

Check that the port covers are intact. If not, check whether foreign objects may have found their way into the pump casing through the ports. Remove the port covers only when you are ready to connect the pipes to the pump.

When shipped, the pumps are suitable for short-term storage only. If long-term storage is necessary before the pump will be put into operation, we suggest that you contact your pump supplier for long-term storage recommendations.

Check for free rotation of the pump. To check long-coupled pumps for free rotation, remove the coupling guard and rotate the pump and motor shafts at the flexible coupling.

## Storage

The delivered pump is generally suitable for immediate installation.

### ***Storage for a period shorter than 3 months***

- Store the pump in a dry and sheltered area.
- Check that ambient temperature never falls below 5°C.
- It is recommended that the pump shaft is rotated at regular intervals ( every 30 days ): this prevents damage to the bearings and seizure of the rotating parts.

### ***Storage for a period exceeding 3 months (but shorter than 12 months)***

- Raise the pump by means of wooden supports.
- Open the package, if any, removing the protection from the pump nozzles and clean by compressed air then carefully dry inside the pump, if necessary.
- Protect the pump inside with anti-condensation products and close the flanges so that no foreign objects can enter the pump.
- Cover the pump with a plastic film and put inside some products the prevent water condensation.
- Check protections periodically.
- It is recommended that the pump shaft is rotated at regular intervals ( every 30 days ): this prevents damage to the bearings and seizure of the rotating parts.

### ***Storage (after operation)***

- In case of long periods after operation, drain the pipes and the pump through the drain hole in the lower part of the pump casing.

If an electric motor is supplied as the drive, then before putting into service, the motor winding insulation should be tested. If the reading is below 10 Mega ohms, move to a warm dry place for a few hours until the motor insulation value rises.

**Drivers**

AxFlow Aturia ND series pumps may be driven by an electric motor through a shaft-to-shaft coupling.

There are particular points which can affect the pump:

- Shaft -to-shaft flexible couplings must be properly aligned, as poor alignment will cause high loads on the pump bearings. Couplings must be suitably rated, and provide sufficient flexibility to prevent shock forces and oscillating loads from being transmitted to the pump shaft. This is particularly important for diesel engine drives.
- When designing the drive system and prime mover, take into account that the pump dismantles by removing the rotating element out from the back of the pump casing. Sufficient space should be allowed to facilitate dismantling of the pump.

## INSTALLATION



**Isolate the supply before commencing work on the pump.**

### Site installation



**DURING SITE INSTALLATION AND MAINTENANCE ALL COMPONENTS MUST BE SAFELY TRANSFORTED**



**TRAINED PERSONNEL MUST USE PROPER SLINGS IN ORDER TO AVOID ANY DAMAGE TO EQUIPMENT AND / OR PERSONNEL**



**THE LIFTING EYEBOLTS OF PUMPING SET COMPOUNDS MUST BE USED FOR LIFTING EACH RELATED COMPONENT**

### Foundations

The foundation should be substantial in order to reduce vibrations, and rigid enough to prevent flexing which can result in misalignment. Foundation bolts of the correct size should be located by reference to certified drawings if the baseplate is supplied with the pump.

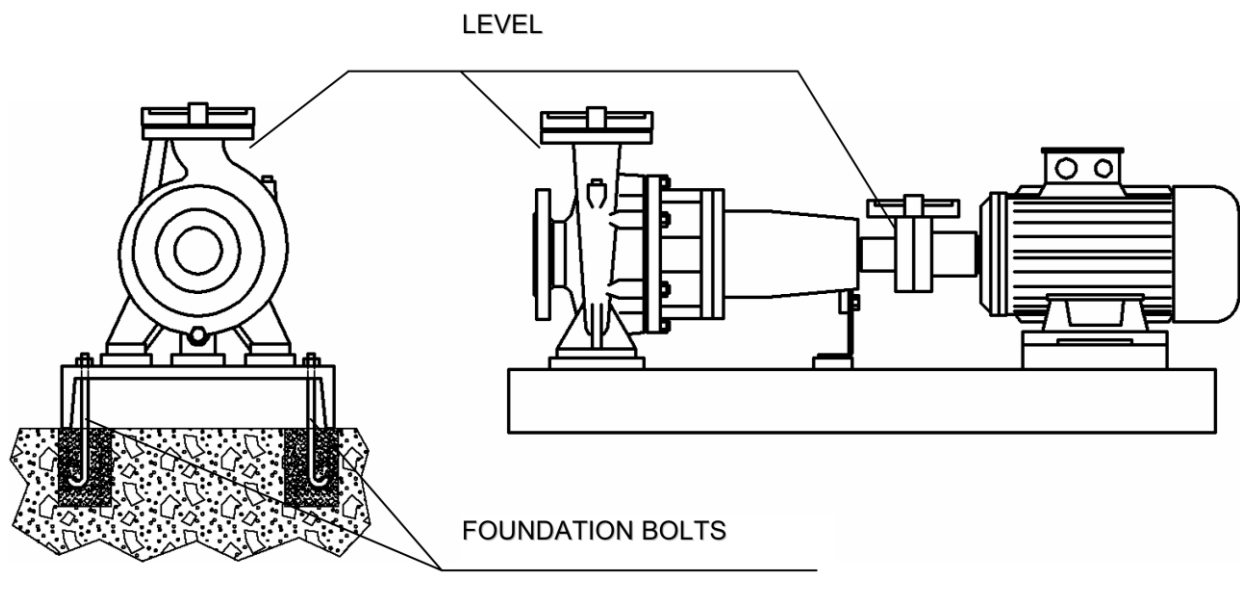
The pump must be mounted horizontally on a level foundation, with the discharge port vertically upwards.

The pumpset should be mounted on a level horizontal base. The base should be of sufficient rigidity to prevent flexing. When bolting the pump down, insert shims as necessary under the pump feet to level the pump using a spirit level on the suction and discharge flanges of the pump. Use all six bolt holes to mount the pump.

#### ***Motor-pump units on baseplates***

Level the baseplate accurately, using shims under the base-plate next to the foundation bolts. The baseplate must sit firmly and evenly on its foundation: it must not be distorted by bolting to an uneven surface, which will throw the pump and motor out of alignment.

## Pump and motor alignment



Long-coupled pumps have been pre-aligned with the motor prior to shipment. If pump units receive rough treatment during shipment, they can become misaligned. The flexible coupling is not designed to compensate for misalignment. Improper alignment will cause vibration and premature bearing failure.

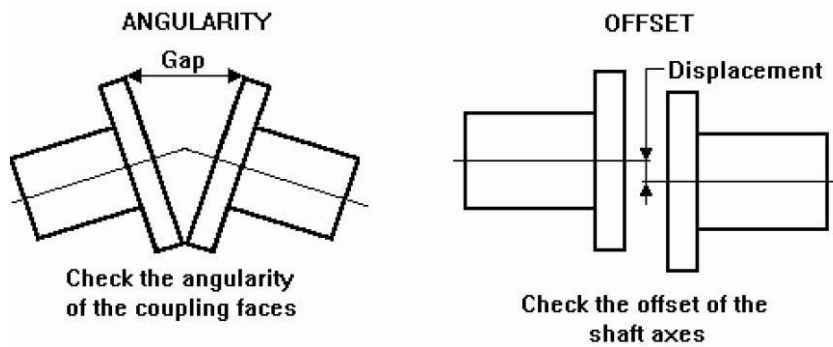


**CHECK THE ALIGNMENT OF  
PUMP AND MOTOR PRIOR  
TO START-UP**



**COUPLING GUARD MUST  
BE FITTED ON BASEPLATE  
AFTER ALIGNMENT**

A final alignment check should be made after the baseplate has been grouted and set, and the foundation bolts have been tightened.

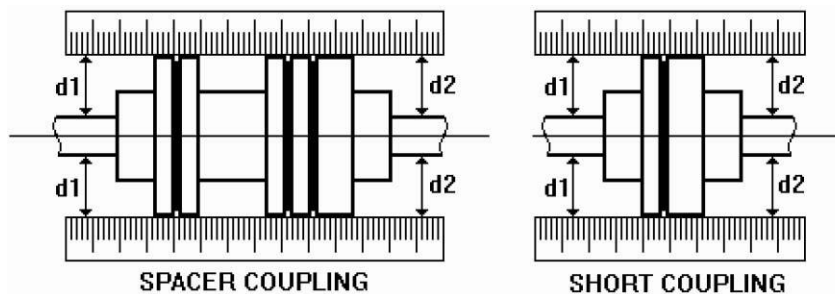


TYPE	DISPLACEMENT	GAP
Short flexible coupling (3000 rpm)	0.05 mm	0.04 mm per 100 mm coupling diameter
Flexible spacer coupling (3000 rpm)	0.07 mm per 100 mm spacer length	0.04 mm per 100 mm coupling diameter

## Methods of checking alignment

### *Straight edge*

Using a straight edge, check the distance from the shaft at several points on the circumference of the coupling. The distances  $d_1$  and  $d_2$  should each remain constant.



**IMPORTANT NOTE:** The straight edge method checks static coupling alignment, not shaft alignment. It relies for its accuracy on the accurate alignment of each coupling half on its shaft. The straight edge method is a useful preliminary check, but should not be seen as an effective final alignment method.



### **Dial gauge ("clocking")**

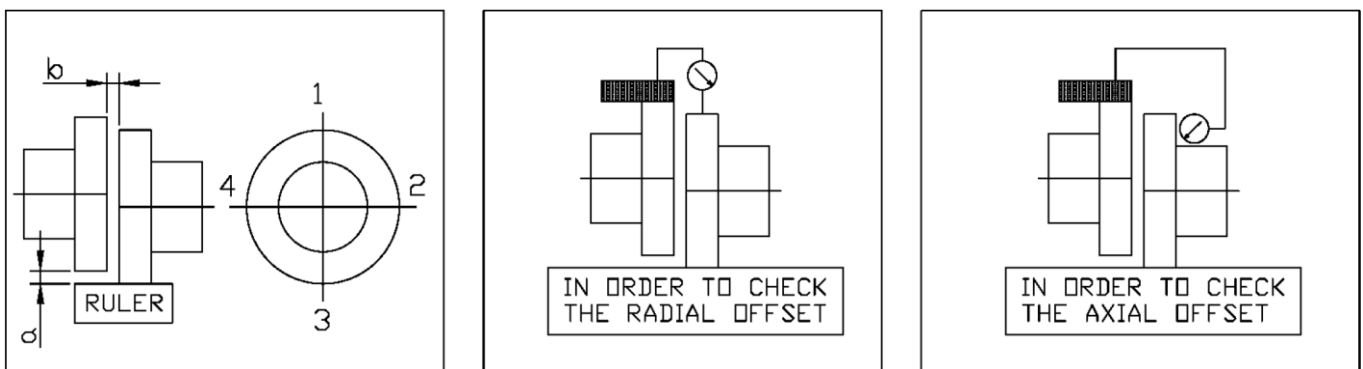
There are several methods, using one or two dial gauges. The most accurate is the reverse indicator method, using two gauges, which overcomes errors due to 'sag' of the gauge bars.

Place the ruler in positions 1-2-3-4 ( see below picture ) and check radial offset "a" it should not exceed 0.1 mm.

Measure then the distance " b " with a thickness gauge at positions 1-2-3-4.

The difference between readings in positions 1-3 and 2-4 should not exceed 0,1 mm.

Group alignment can be checked more accurately by using a millesimal comparator (millesimal dial indicator).



### **Optical methods**

Several proprietary systems are available, such as the 'OPTALIGN' system (INA Linear Systems).

Mechanical errors are eliminated by optical alignment techniques. On request, AxFlow can provide further information about suitable alignment methods, including allowances for **THERMAL EXPANSION IN HIGH TEMPERATURE USE.**

## Location and piping

The correct pipework sizes should be selected according to the allowable limits of liquid velocity and pressure drop at the required flow rate. Check the NPSH required by the pump at its specified duty point, and ensure that the minimum NPSH available exceeds that required.

**This is particularly important for liquids near their boiling temperature (or bubble point).**

Check that the pipework is **THOROUGHLY CLEAN** before the pump is installed.

Pipework connections must be accurately aligned with the pump ports, so that they can be connected to the pump without forcing. Maximum allowable bending moments are set out in the Table overleaf.

These moments must not be exceeded, otherwise the pump may distort internally, or the pump and motor may become misaligned.

Pipework must be fully and independently supported as close as practicable to the pump.

Locate the pump as close as possible to the liquid source.

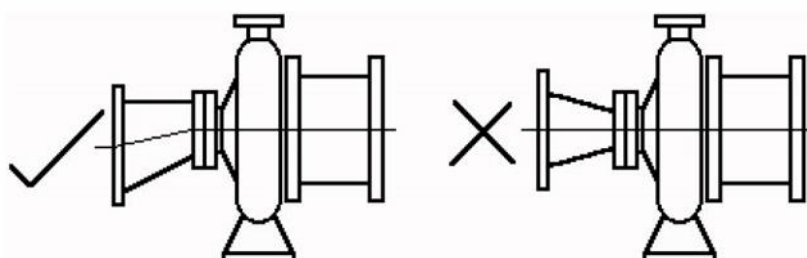
The suction line should be as short and straight as possible, with a minimum number of bends. Bends should be large radius type: avoid sharp elbows. Bends and fittings should be no closer than 20 pipe diameters to the pump suction, to allow undisturbed flow to the pump impeller. Liquid velocity in the suction line should normally be between 0.7 and 2.0m/sec. If the liquid is near its boiling temperature (or bubble point), its velocity may need to be reduced to 0.5-1.0m/sec. If the suction line is oversized, the reducer at the pump inlet port should be **ECCENTRIC**, not concentric.

Generally, suction piping should be one or two sizes larger than the inlet bore of the pump, to keep liquid velocity low and friction losses to a minimum. This becomes more important as the distance between the pump and the liquid supply increases.

The suction line should slope so as to avoid air pockets.



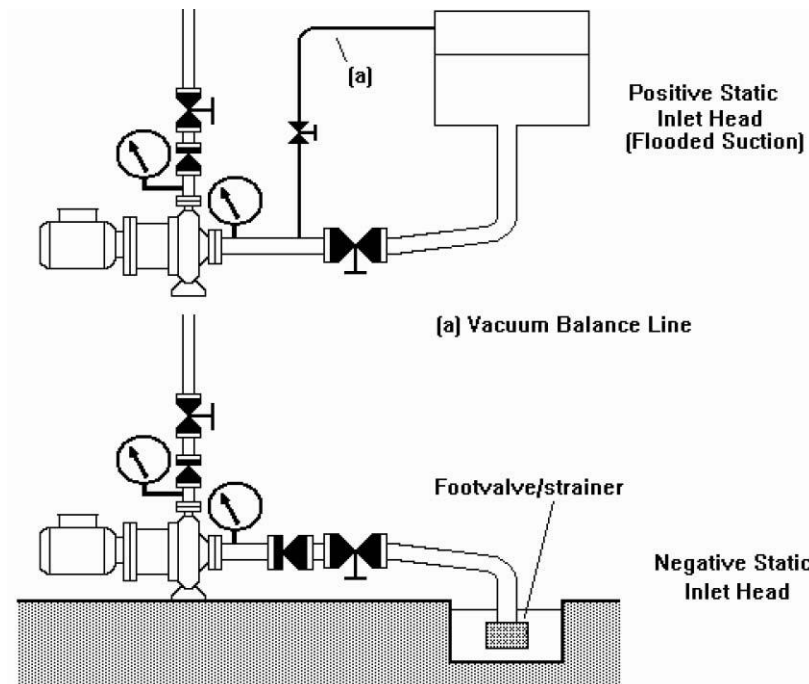
**ATTENTION !**



## INSTALLATION

Valves on the suction side should be mounted with stems horizontal, or vertically downwards. All joints in the suction line must be tight, to prevent air from entering into the system, with the risk of vapour locking.

If the pump is installed with a negative static inlet head (lower diagram), the foot valve/ strainer must always be immersed at a sufficient depth to avoid entry of air into the pump. Take suitable precautions to prevent vortexing in the supply vessel. A pressure gauge should be installed in the suction line, as close as possible to the pump.



If the supply vessel is under vacuum, a pressure balancing line should connect the supply vessel and the pump inlet port.

The discharge line should be as short and direct as possible to minimize friction losses. An air vent (if permissible) should be installed at the first high point in the discharge line.

Leave enough space for motor ventilation.

## INSTALLATION

A check valve and gate valve should be installed as close as possible to the pump discharge nozzle. The check valve is installed to protect the pump from excessive back pressure or reverse flow rotation, and to prevent back flow into the pump during shut down. The discharge (gate) valve is used to regulate the flow. The check valve should be installed between the pump and the discharge valve to allow the pump to be removed from service without emptying the discharge line.

A pressure gauge should be installed on the discharge side of the pump as close as possible to the discharge nozzle.

Prior to starting the pump it is important to flush the piping to make sure that the system is free of solids such as pipe scale, welding beads, and dirt. If possible a TEMPORARY START-UP STRAINER with a 40 mesh screen should be installed in the suction line.

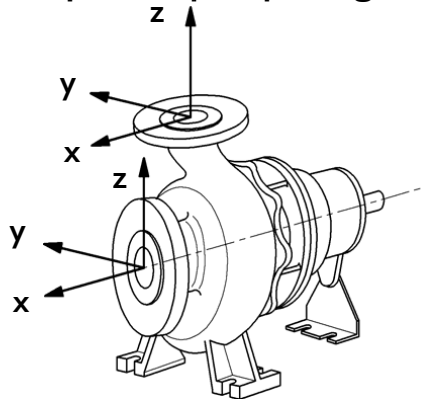
**BE VERY CAREFUL** not to allow the temporary strainer to become plugged, causing low inlet pressure with cavitation or dry running. A pressure gauge should be installed on either side of the temporary strainer to measure the pressure drop across it. If there is any risk of ingestion of solids during normal operation, once the pump has been successfully commissioned, a PERMANENT INLET STRAINER should be fitted in the inlet line.



**AVOID PUMPING LIQUIDS  
CONTAINING  
SUSPENDED SOLIDS**

Standard AxFlow pumps are designed to handle clean liquids. Unless specifically agreed prior to purchase of the pump from your supplier, suspended solid matter must be kept out of the pump by a suitable inlet strainer. The strainer mesh size should be less than 0.5mm, with an open surface area at least 2.5 x nominal cross-sectional area of pump inlet bore. The strainer must be inspected regularly and cleaned when necessary.

## Admissible external forces and torques on pump flanges



TYPE	FLANGE	TORQUES, (daN)				MOMENTS, (daN.m)			
		F <sub>x</sub>	F <sub>y</sub>	F <sub>z</sub>	ΣF	M <sub>x</sub>	M <sub>y</sub>	M <sub>z</sub>	ΣM
5x3x12 5x3x16 5x3x20 5x3x25	Suction	90	75	60	135	50	25	40	70
	Delivery	65	50	40	95	30	15	20	40
6x4x20 6x4x25 6x4x31	Suction	110	90	75	160	75	35	55	100
	Delivery	70	55	42	100	35	18	25	45
8x5x12 8x5x16	Suction	110	90	75	160	75	35	55	100
	Delivery	75	60	45	110	50	25	40	70
8x5x20 8x5x25 8x5x31	Suction	140	110	90	200	100	50	75	135
	Delivery	90	75	55	130	75	35	55	100
8x6x12 8x6x16	Suction	140	110	90	200	100	50	75	135
	Delivery	90	75	55	130	75	35	55	100
10x6x20 10x6x25 10x6x31	Suction	190	150	120	275	150	75	110	200
	Delivery	90	75	55	130	75	35	55	100
10x8x12 10x8x16	Suction	190	150	120	275	150	75	110	200
	Delivery	110	90	70	160	100	50	75	135
12x10x20 12x10x25 12x10x31 12x10x40	Suction	250	200	170	370	190	100	150	260
	Delivery	150	120	95	220	150	75	110	200
15x12x25 15x12x31 15x12x40 15x12x50	Suction	330	260	210	480	250	125	190	340
	Delivery	200	170	125	300	190	100	150	260
20x15x25 20x15x31 20x15x40 20x15x50	Suction	520	400	330	750	380	190	270	500
	Delivery	260	210	165	380	250	125	190	340
20x40	Suction	700	560	460	1030	520	260	400	700
	Delivery	390	320	250	575	380	190	270	500

**Protecting the pump against dry running**

The pump must not be allowed to run dry. Dry running will result in loss of liquid film to the bearings, causing over-heating and eventual bearing failure, leading to seizure of the pump.

Avoid the following conditions:

***Loss of liquid supply***

Ensure that an adequate supply of liquid is available at the pump inlet at all times. Pressure and/or flow sensors should be installed if necessary, to monitor the hydraulic conditions in the inlet pipework.

***Low inlet pressure***

Low inlet pressure due to restriction or blockage of the inlet pipework, causing liquid vaporization and cavitation in the pump, with the risk of loss of liquid film in the bearings.

***'Dead-heading'***

If the pump is permitted to run against a closed discharge for more than a short time (depending on the liquid, the duty, and the pump model and power), the liquid in the pump casing will heat up and evaporate with consequences as above.

**Electronic dry running protection**

A rapid and reliable method of stopping a centrifugal pump, in the event of loss of liquid supply or interruption of flow, is to monitor the power output of the motor. The 'EL-FI' device monitors both current and phase angle, providing pump protection without pipework sensors or attachments. It is easily fitted in the power supply to the motor, in place of a normal starter. Details of power monitors are available on request from your pump supplier.



**Isolate the supply  
before commencing  
work on the pump**

### Electrical connection

The electrical connection to the motor should be carried out by a properly qualified electrician, using cable, cable glands and connection procedures suitable for the electrical load and for the location of the installation.

All regulations governing electrical installations in HAZARDOUS AREAS must be strictly followed. It is the responsibility of the pump user to ensure that a safe electrical installation is made and maintained.

#### *Connecting the electric motor*

1. Isolate the electric supply cable from the power supply.
2. Bring the cable end into the terminal box through a suitable cable gland.
3. Follow the motor manufacturer's instructions for electrical connection. These will normally be found inside the terminal box, either on a separate instruction sheet or attached to the inside of the terminal box cover.

Check that the terminal links are correctly positioned for the supply voltage.

Ensure that the earth connection is properly and securely made.

Before replacing the terminal box lid, check that the sealing surfaces and the gasket or o-ring seal are clean and in good condition. With flameproof electric motors, the opposing metal surfaces of the terminal box seal should be lightly greased to keep out condensation and prevent corrosion.

A proper electrical starter must be used. A starter will:

- a. prevent accidental restarts after power failure
- b. provide a safe, waterproof switch enclosure (IP55 'hose-protected' specification)
- c. protect the motor with a correctly set thermal overload cut-out: a fuse protects only the wiring
- d. withstand the heavy starting current of the motor, preventing arcing and rapid contact wear.

If there is a toothed spacer coupling between the pump and the motor, check whether it needs to be filled with oil. Follow the coupling manufacturer's instructions as required.

Check direction of rotation

**WARNING! "DO NOT RUN THE PUMP DRY"**

## Oil lubricated

### *Bearings*

It is very important to check the bearing operation, their temperature and the oil level.

Check bearing housing temperature: it can raise up to 50°C above the ambient temperature, but it should never exceed 90°C.

- For the first start-up it is recommended to replace the oil after 50 hours running.
- Then every six months or after a long stop it is necessary to replace the oil.

### *Oil type*

Prior to starting the pump the bearing housing should be filled with one of the following oils:

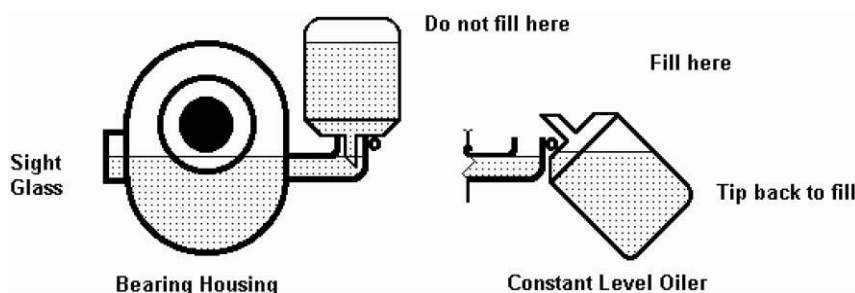
Use ISO VG-46 viscosity oil for bearing temperature from 0° to 70°C: AGIP OSO46 classification or equivalent.

Use ISO VG-68 viscosity oil for bearing temperature 70° to 90°C: AGIP OSO 68 classification or equivalent.

OIL QUANTITY :	BEARING BRACKET SIZE	24	0.4 ltr
		32	0.6 ltr
		42	0.8 ltr
		55	1.0 ltr

Fill to the middle of the sight glass, using the following procedure:

- pour oil into the bearing housing, through the filler cap on top of it, until oil is just visible at the bottom of the sight glass.
- tip back the transparent bulb of the constant level oiler (if mounted), and fill it with oil.
- allow the bulb to return to its normal position. Wait for the oil to flow into the bearing housing.
- repeat the operation until oil no longer flows out of the bulb.





### Direction of rotation

AxFlow Aturia ND series pumps rotate anti-clockwise when viewed from in front of the pump inlet nozzle.

To confirm the direction of rotation (refer to the rotational arrow on the pump casing) use the following procedure:

- a. Open the suction and discharge valves, allowing the pump to fill with liquid.
- b. Remove the coupling guard of a long-coupled pump, or the motor fan cover of a close-coupled pump.
- c. 'Bump' the motor by pressing the motor start and stop buttons in quick succession. If the direction of rotation is incorrect, reverse any two of the three-phase power leads to the motor.
- d. After confirming correct rotation, replace the coupling guard or motor fan cover.

### OPERATION

#### Supervision

When correctly installed and operated, this AxFlow pump will give many years of trouble free service. In operation, the pump should be free from vibration and run smoothly. Any changes to smoothness of operation should be investigated immediately.

The pump should be visually checked periodically.

#### Priming the pump



**DO NOT RUN THE  
PUMP DRY!**

Check that the liquid supply is at the correct temperature, with any necessary heating/cooling in operation. Open the suction and discharge valves, allowing the pump to fill with liquid.

**NOTE:** If the direction of rotation has not been checked, this must be done before proceeding (see above).

1. Open the discharge valve to 1/4 open.
2. Start the motor and immediately check the discharge pressure gauge. The pressure should rise quickly and hold steady. If the pressure rises and then falls back, there is air or vapour in the system.

#### **STOP THE PUMP IMMEDIATELY! Wait a few seconds before restarting pump**

3. If the pressure gauge does not hold steady after repeating step 2 several times, shut the pump down, open the discharge vent (if permissible) and check that all vapour or air is purged from the system.
4. Once the pump is fully primed and a steady discharge pressure is established, slowly open the discharge valve until the desired operating point is reached. Check that the electric motor current does not exceed the rated full load current shown on the motor plate.
5. If the pump starts to vibrate, rattle or run noisily, the flow rate has become excessive. Close the discharge valve **IMMEDIATELY** until the pump runs smoothly again. Vibration and noise are an indication of cavitation, which can cause rapid and severe damage if permitted to continue. If the flow rate needs to be permanently restricted, a permanent orifice in the discharge line is more secure than an adjustable valve. Your pump supplier will advise on a suitable orifice size if necessary.

**Start-up**

Before starting the pump :

- Check motor direction of rotation ( when the pump is disconnected ); if the motor rotates in the wrong
- Check oil level in the bearing housing and, if necessary, add oil.
- Direction, reverse two electric cables and change the position in the terminal box.
- Check group alignment again after fitting of the pipes.
- Make sure that the pump and suction pipe are filled with water.
- Make sure that water circulates freely in the cooling system, if any.
- In case of suction from sumps, install a foot valve with strainer.
- Check good tightening of suction pipes to avoid air entry.

Start the motor for a while and make sure that it works properly when stopped.

Once the pump has been primed, close delivery gate valve, start the pump and open gradually the delivery gate valve ( start-up with closed gate valve reduces the initial temporary voltage peak ).

During operation, check shaft seal: it is a mechanical seal and, therefore, there should be no leaks.

**ATTENTION!**

Running with closed gate valve for more than one minute will cause overheating.

**ATTENTION!**

Avoid dry running.

**ATTENTION!**

Check also that the pump runs within its' operating limits and that voltage rates reported on the control panel do not exceed motor nameplate rated values.

**ATTENTION!**

If necessary, partially close the gate valve or adjust the intervention of the pressure switch.

**ATTENTION!**

**IF ANY PROBLEM IS DETECTED DURING OPERATION, STOP THE PUMP IMMEDIATELY AND INVESTIGATE**

## Pump operation

Operators should make frequent visual inspections to check that the pump is running smoothly without noise or vibration, and that the discharge pressure is holding steady, without fluctuation, at the correct figure. Over-heating of the pump or motor bearings is cause for alarm. The bearing housing should not be more than 50°C above ambient temperature, nor should it exceed 80°C (too hot to touch) in any event. If the bearings over-heat, shut the pump down immediately, investigate the cause, and take corrective action.

Follow the motor manufacturer's recommendations and keep the motor bearings maintained.



### **ATTENTION!**

**Never throttle the pump by closing a valve in the suction line. Throttling the suction line can cause serious damage to the pump.**



### **ATTENTION!**

**Do not allow the pump to run against a closed discharge valve for more than a few seconds. This will cause rapid heating of the liquid in the pump casing, with vaporization, risking serious damage to the pump.**

AxFlow Aturia pumps are dynamically balanced during manufacture and are tested prior to dispatch to ensure that they run smoothly and without vibration. Replacement impellers are also balanced prior to dispatch.

Vibration monitoring in service can detect poor hydraulic conditions, bearing wear, internal erosion or chemical attack before it seriously damages the pump. Vibration may be monitored on the external bearing housing and/or the motor bearings. Your supplier will advise you on vibration monitoring on request.

### IMPORTANT SAFETY NOTE

When the pump is stopped, unless a non-return valve is fitted in the discharge line, liquid will drain back through the pump, causing it to rotate in reverse. Do not start the pump while it is turning backwards, as this can result in immediate and severe damage. Allow ample time for complete drainage of the discharge line before the pump is restarted.



**NEVER START THE PUMP WITHOUT THE  
COUPLING GUARD INSTALLED!**



**NEVER START THE PUMP WITHOUT THE  
MOTOR TERMINAL COVER INSTALLED!**

## MAINTENANCE



**Isolate the supply  
before commencing  
work on the pump**

### Supply isolation

For pumps driven by electric motor, always isolate the supply before working on the pump. Affix a notice on the electrical isolator to inform others that the work is being carried out on the installation. If possible lock closed the supply isolator.

### Maintenance schedule

Provided the pumped liquid is clean and free of suspended solids, and the pump is operated within the manufacturer's stated performance limits and is not allowed to run dry, your AxFlow Aturia pump is capable of running for very long periods with minimal attention. Please see previous PUMP OPERATION section.

PARTS TO BE INSPECTED	ACTION TO BE TAKEN	FREQUENCY
External bearing housing (long coupled units)	Fill with appropriate oil to the middle of the sight glass	Weekly. Change the oil every 5000 hours
Mechanical seal	Check mechanical seal for leaks	Every 4000 hours of operation.
Motor bearings	Unless otherwise specifically stated in the pump instructions, motor bearings are grease-filled and sealed for life. We recommend regular checks on motor bearing condition, and replacement when necessary.	

**Mechanical seal**

The mechanical seal must be checked every 4.000 working hours; check that the seal faces and shaft sleeves are perfectly smooth, especially on seal o-ring contact zone.

The mechanical seal shall not leak. Replace the seal if worn.

**Bearings**

As per data sheet information bearing could be:

***Grease lubricated***

Bearings are airtight self-lubricated ( i.e. containing enough grease for their normal life ), no maintenance is required; anyway, please check their temperature periodically.

Their temperature can raise up to 50°C above ambient temperature, but it shall never exceed 80° C  
For pump with grease lubricated bearing, time interval from a greasing and the other is about 6000 working.

The recommended grease to use is type AGIP F1.GR-MU/EP2 or equivalent

***Oil lubricated***

It is very important to check the bearing operation, their temperature and the oil level.

Check bearing housing temperature: it can raise up to 50°C above the ambient temperature, but it should never exceed 90°C.

- For the first start-up it is recommended to replace the oil after 50 hours running.
- Then every six months or after a long stop it is necessary to replace the oil.

## Oil type

Prior to starting the pump the bearing housing should be filled with one of the following oils:

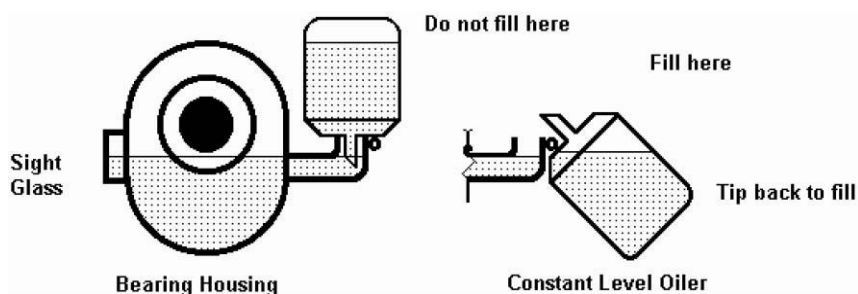
Use ISO VG-46 viscosity oil for bearing temperature from 0° to 70°C: AGIP OSO46 classification or equivalent.

Use ISO VG-68 viscosity oil for bearing temperature 70° to 90°C: AGIP OSO 68 classification or equivalent.

OIL QUANTITY :	BEARING BRACKET SIZE		
	24		0.4 ltr
	32		0.6 ltr
	42		0.8 ltr
	55		1.0 ltr

Fill to the middle of the sight glass, using the following procedure:

- i. pour oil into the bearing housing, through the filler cap on top of it, until oil is just visible at the bottom of the sight glass.
- ii. tip back the transparent bulb of the constant level oiler (if mounted), and fill it with oil.
- iii. allow the bulb to return to its normal position. Wait for the oil to flow into the bearing housing.
- iv. repeat the operation until oil no longer flows out of the bulb.



## Pump stop for long period

Before any stop it is necessary to :

- Switch off the line.
- Close suction and delivery gate valves.
- Drain the pump through the hole on the lower side of the pump casing.



## DISASSEMBLY

### Disassembling the pump

These operations should be carried out only by skilled personnel. Damage caused by careless or improper disassembly or reassembly is excluded from the supplier's guarantee.



**WORK IN A CLEAN AREA!**



**ISOLATE PUMP MOTOR BEFORE DISASSEMBLY!**



**DO NOT USE FORCE!**

The pump should be taken apart with the help of the labelled sectional drawing(s) supplied with it.

If necessary the internal assembly of the pump can be removed from the pump casing without disturbing the pipework. If a spacer coupling is fitted between pump and motor, the pump can be dismantled without disturbing the motor.

### Before disassembling

1. Switch off line voltage.
2. Close suction and delivery gate valves.
3. Drain the pump through the suited drain plug ( 6515 - 6515.1 ).
4. Disconnect the auxiliary pipes, if any.
5. Remove the coupling guard, the coupling spacer and the half coupling, pump side.
6. Release the support foot (3134).
7. Pump casing remains connected to the baseplate and to the pipes.



**MECHANICAL SEAL: MARK THE CORRECT POSITION OF EACH COMPONENT AND DO NOT DAMAGE THE SEAL PARTS AND LAPPED SURFACES**

### Pump disassembling

1. Loose the nuts (6580), remove the bearing bracket with lantern (3132). Stuffing box housing (4110) and impeller (2220).
2. Loosen the impeller nut (2912).
3. Remove the impeller (2220) and the key (6710).

### Mechanical seal inspection

#### ***Pump with integral mechanical seat site in stuffing box housing***

1. After removing the impeller (2220), extract the mechanical seal (4200) with its ring positioning (if fitted).
2. If the ring is locked on the shaft (2110), before unscrew grains fixing point out the exact position.
3. Pull the shaft seal housing (4110) with the seat stationary.
4. Remove the seat of the mechanical seal from the stuffing box housing.

#### ***Pump with integral mechanical seat site in mechanical seal cover***

1. After removing the impeller (2220), remove the outer flushing (if any), blocking the cartridge (see manual instruction of the cartridge) or detect the exact position on the sleeve.
2. Loosen grains detained sleeve rotating, unscrew the nut (6580.1), remove the stuffing box housing (4110) and finally remove the mechanical seal cartridge (4200).

Surfaces in contact to the mechanical seal must be integral and smooth and the gaskets must be in good condition, while shaft sleeve must be perfectly smooth particularly in contact point with the gasket.

### Bearings inspection

For standard (24-32-42) bearing housings proceed as follows:

1. Remove the vent plug (6521) and discharge the lubricant oil removing the drain plug.
2. Remove the thrower (2540), the bearing cover pump side (3262) with the radial lip seal (4300.1),
3. slackening the fastening screws (6576.1).
4. Remove the key (6742), the screw (6576), the bearing cover motor side (3261) with radial lip seal (4300).
5. Withdraw the shaft (2110) complete with bearings by slightly forcing on motor side.
6. Remove the two bearings (3011 - 3011.1).

For reinforced bearing housings (24-32-42 and 55 ) withdraw the shaft after slackening the screws, by slightly forcing on impeller side

The shaft should come out complete with thrust bearings.

**REASSEMBLY****WORK IN A CLEAN AREA!****Before reassembling**

1. Clean all components carefully.
2. Make sure that all mounting surfaces are free from defects ( mainly those in contact with gaskets )
3. Verify the wear ring clearance, any increase reduces pump performances.  
The clearances can be restored by replacing worn components.
4. If necessary, replace the bearings by using the same original type. The bearings should be mounted forced on the shaft and sliding in the bearing housing.

**Reassembling the pump**

The pump will be easily reassembled if dismantling has been carried out in the right order.

Refer to disassembling and proceed in the reverse order.

Start from the bearing bracket, then reassemble shaft seal, stuffing box housing and impeller.

### Mechanical seal reassembling

For this operation we must pay particular attention for exact positioning, the fragility of the components to the mechanical seal, and not to ruin the plans required.

#### ***Pump with integral mechanical seat site in stuffing box housing***

1. Insert the stationary ring, complete with gasket on the shaft seal housing (4110).
2. Put the shaft seal housing on the shaft (2110).
3. Insert the rotating part of the mechanical seal with his ring positioning (if fitted), on the shaft.
4. Blocking the ring positioning in the position first detected with the grain (if fitted).
5. Mount the impeller (2220) and other components in the reverse of disassembly.

#### ***Pump with integral mechanical seat site in mechanical seal cover***

1. Insert the cartridge onto the shaft (2110).
2. Put the shaft seal housing (4110) on the shaft
3. Mount the impeller (2220) and other components in the reverse of disassembly
4. Lock the cover seal cartridge screwing nuts (6580.1)
5. Lock on the shaft the sleeve cartridge with the appropriate grain
6. Unlock the cartridge (see instruction manual for keeping a cartridge)
7. Put all the rotating so assembled in the pump casing (1111), put its gasket flat (4590) and setting it all through the nut (6580) of the stud (6573).
8. The tightening of nuts must be done in a gradual and uniform order following a cross.
9. Reconnect the flushing of the mechanical seal if exists.
10. Put half coupling on the pump shaft and any spacer.



#### **NOTE!**

**A slight dripping from the mechanical seal at start-up is quite normal and should not be a worry, but afterwards no leakage should occur. In case of leakage check seal assembly again.**



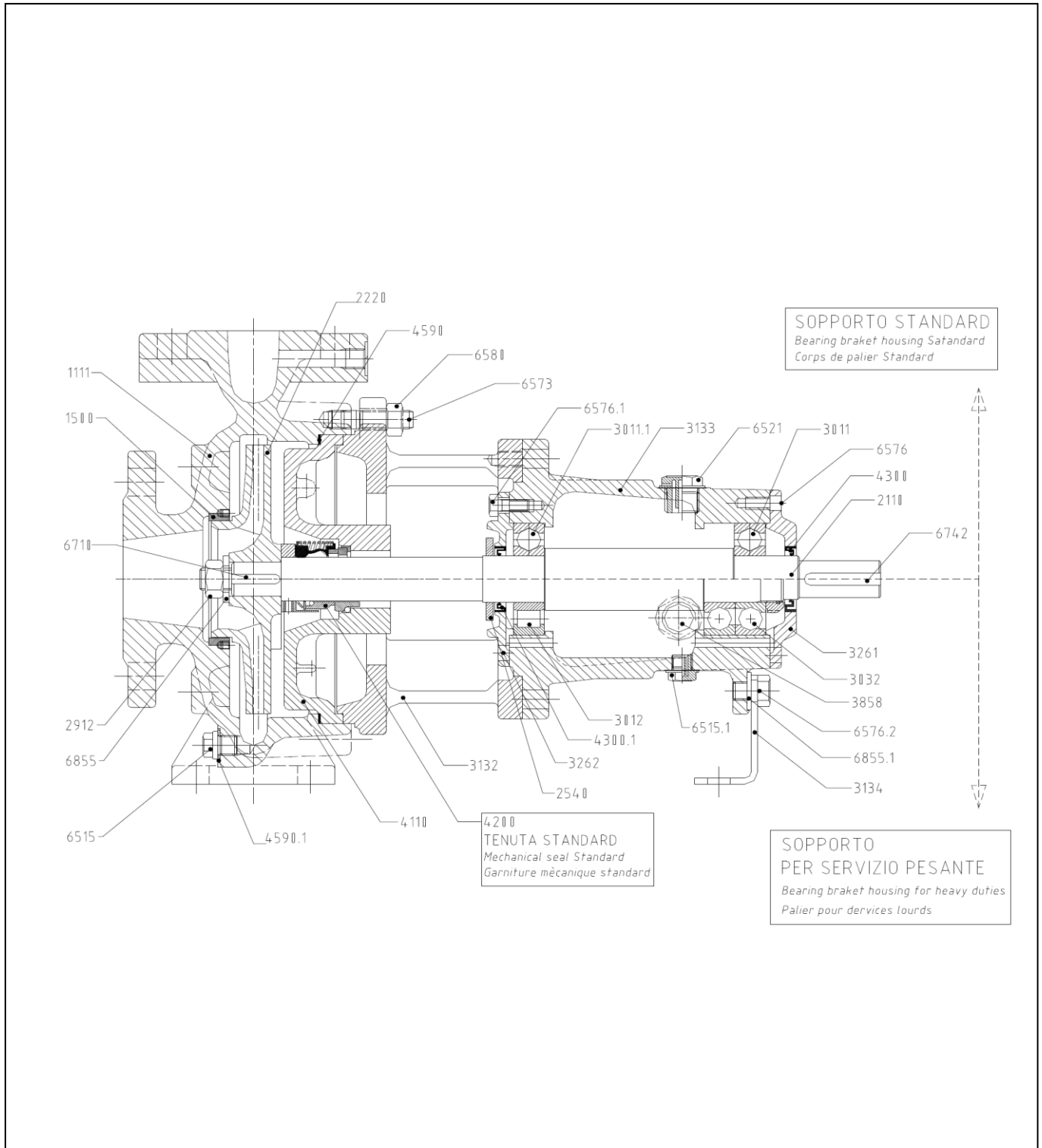
**PUMP ALIGNMENT MUST ALWAYS BE CHECKED!**

## TYPICAL CROSS-SECTION

### TYPICAL CROSS-SECTION

#### Support 24 – Mechanical seal standard

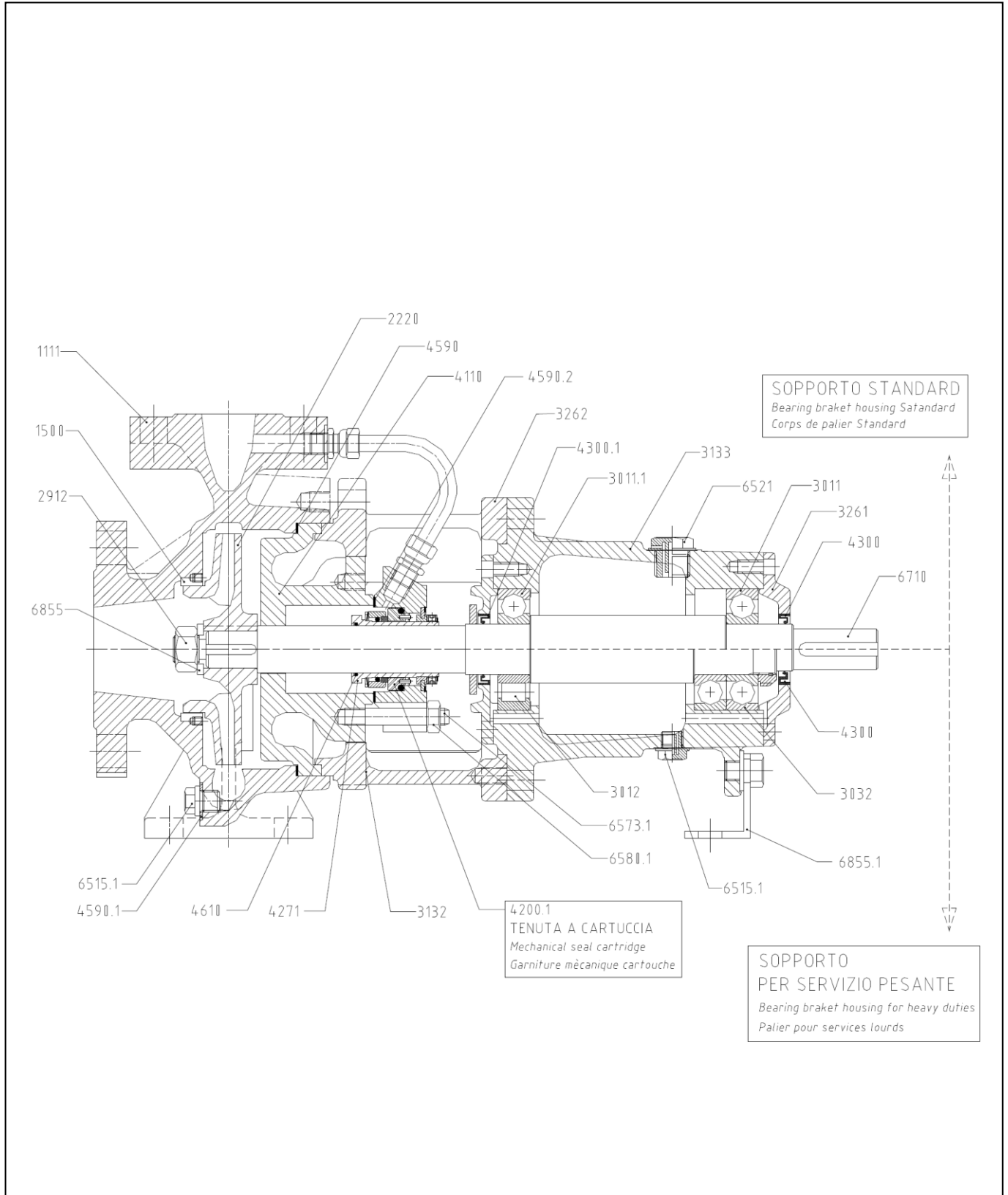
5x3x12 – 6x5x12 – 8x6x12 – 10x8x12 – 5x3x16 – 5x3x16H – 6x5x16 – 8x6x16 – 4x3x20 – 5x3x20 – 6x4x20 – 8x5x20



## TYPICAL CROSS-SECTION

### Support 24 – Mechanical seal cartridge

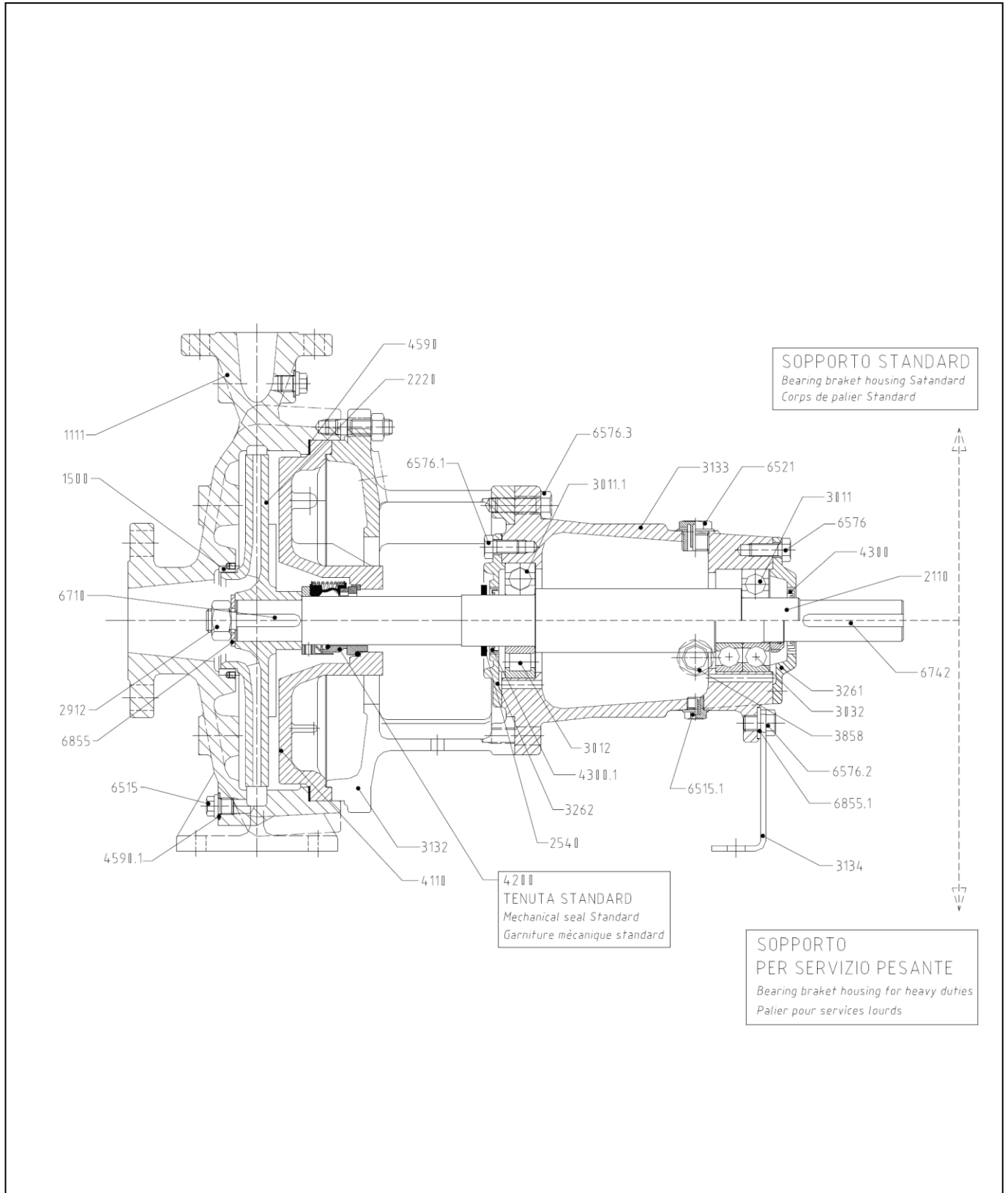
5x3x12 – 6x5x12 – 8x6x12 – 10x8x12 – 5x3x16 – 5x3x16H – 6x5x16 – 8x6x16 – 4x3x20 – 5x3x20 – 6x4x20 – 8x5x20



## TYPICAL CROSS-SECTION

### Support 32 – Mechanical seal standard – Impeller with back blades

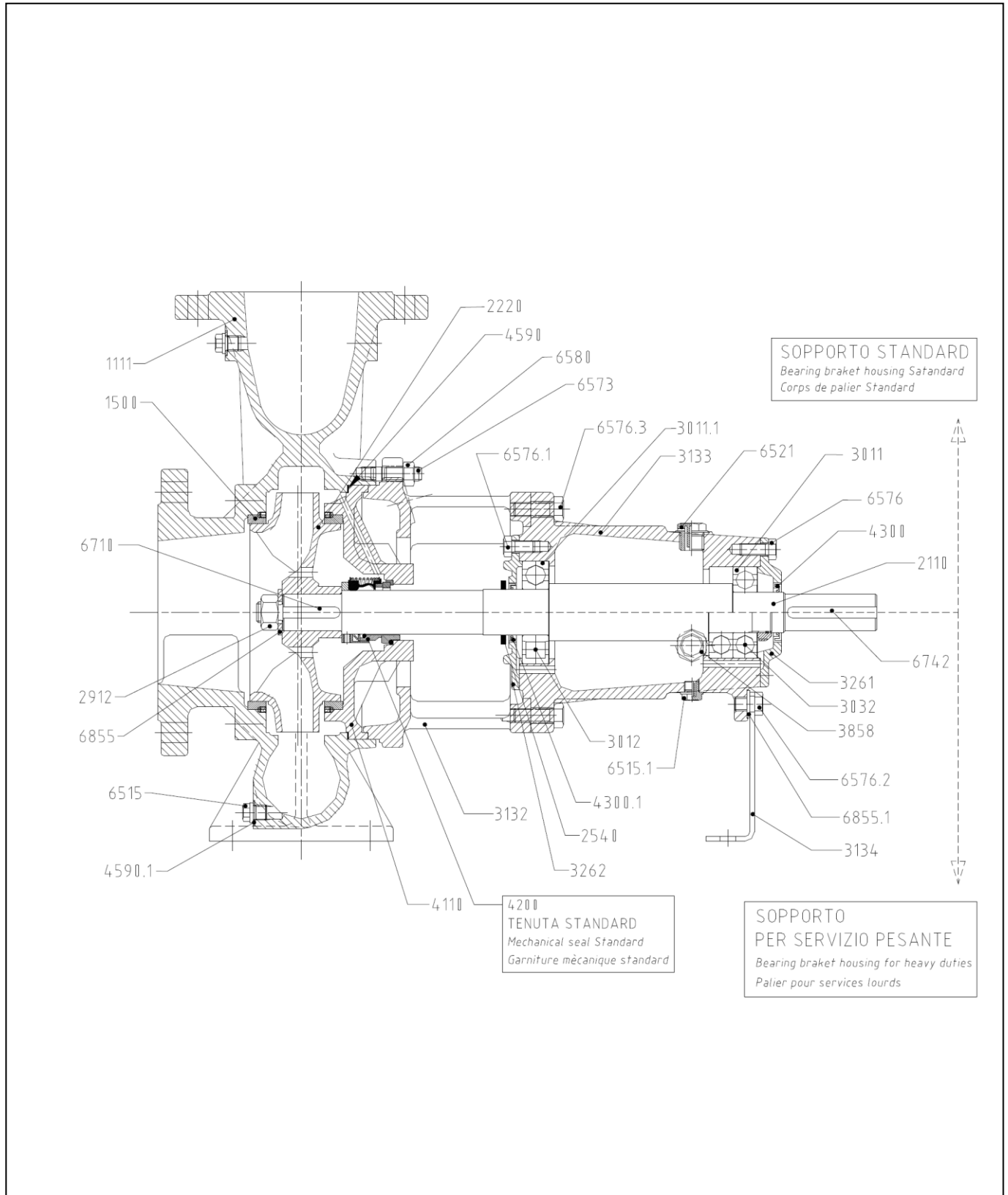
5X3X25 – 6X4X25 – 8X5X25 – 10X8X16 – 12X8X16



## TYPICAL CROSS-SECTION

### Support 32 – Mechanical seal standard

6x4x31 – 8x5x31 – 10x6x20 – 10x6x25 – 12x8x20 – 12x8x25 – 12x10x20

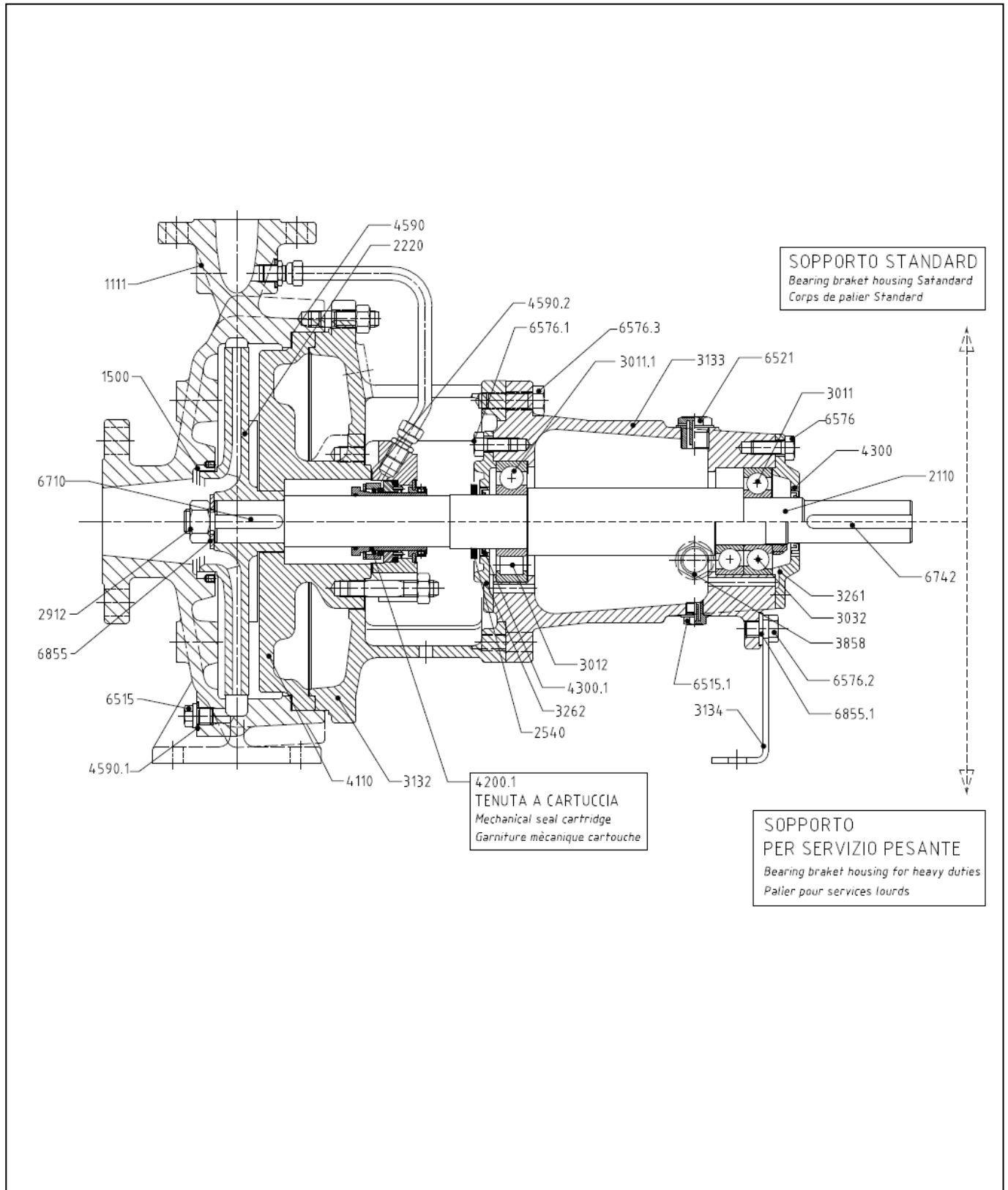




## TYPICAL CROSS-SECTION

### Support 32 – Mechanical seal standard – Impeller with back blades

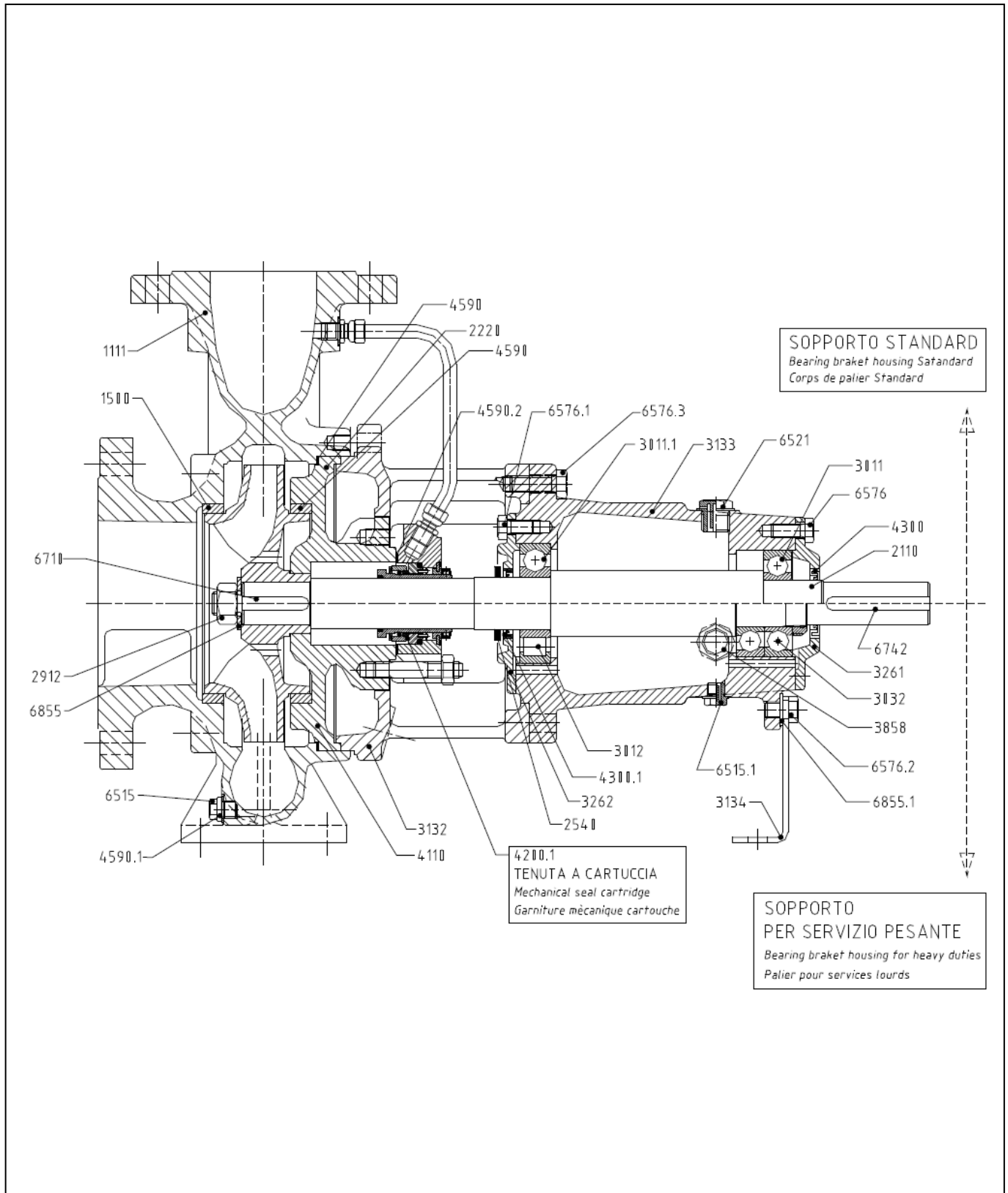
5X3X25 – 6X4X25 – 8X5X25 – 10X8X16 – 12X8X16



## TYPICAL CROSS-SECTION

### Support 32 – Mechanical seal cartridge

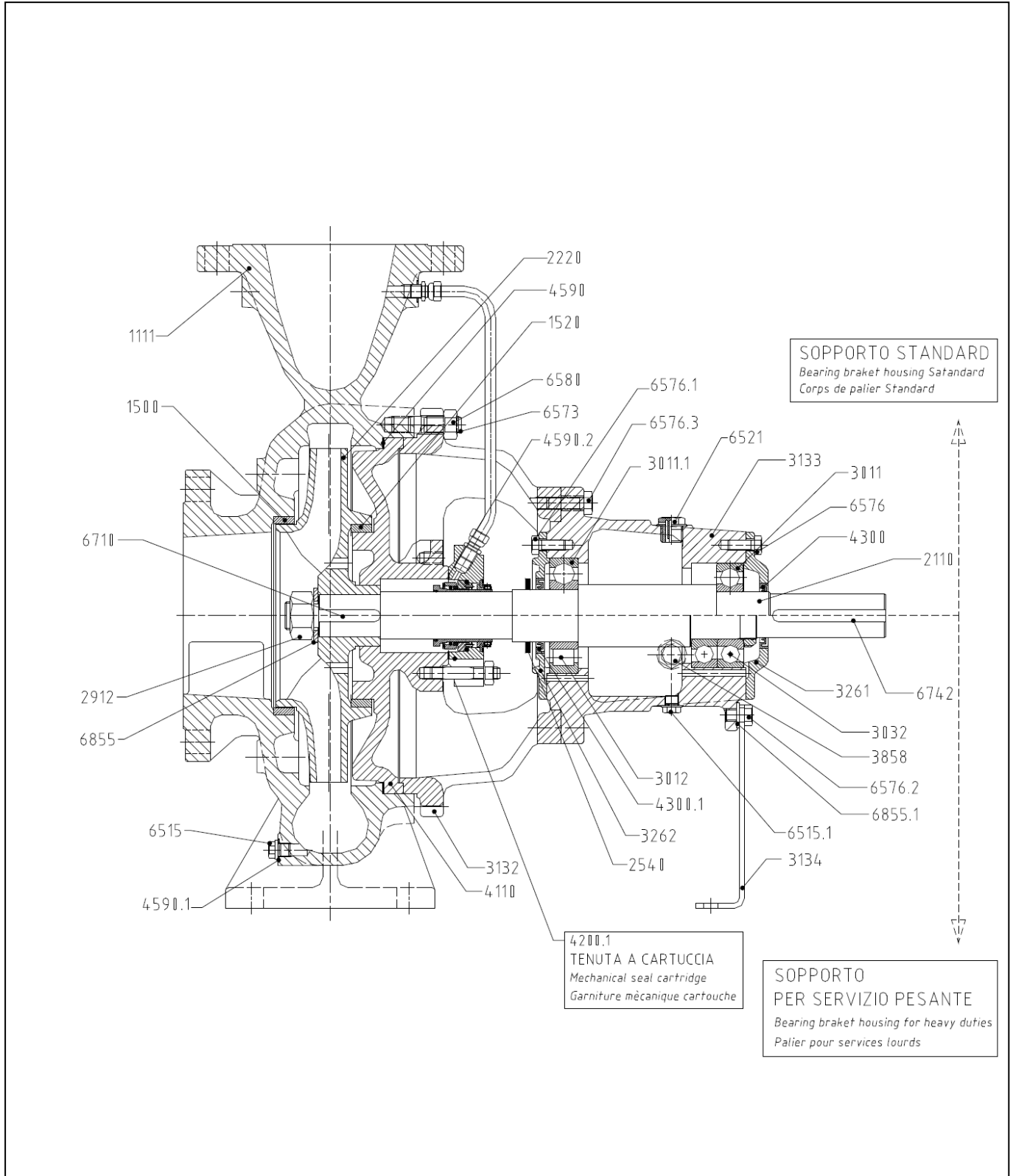
6x4x31 – 8x5x31 – 10x6x20 – 10x6x25 – 12x8x20 – 12x8x25 – 12x10x20



## TYPICAL CROSS-SECTION

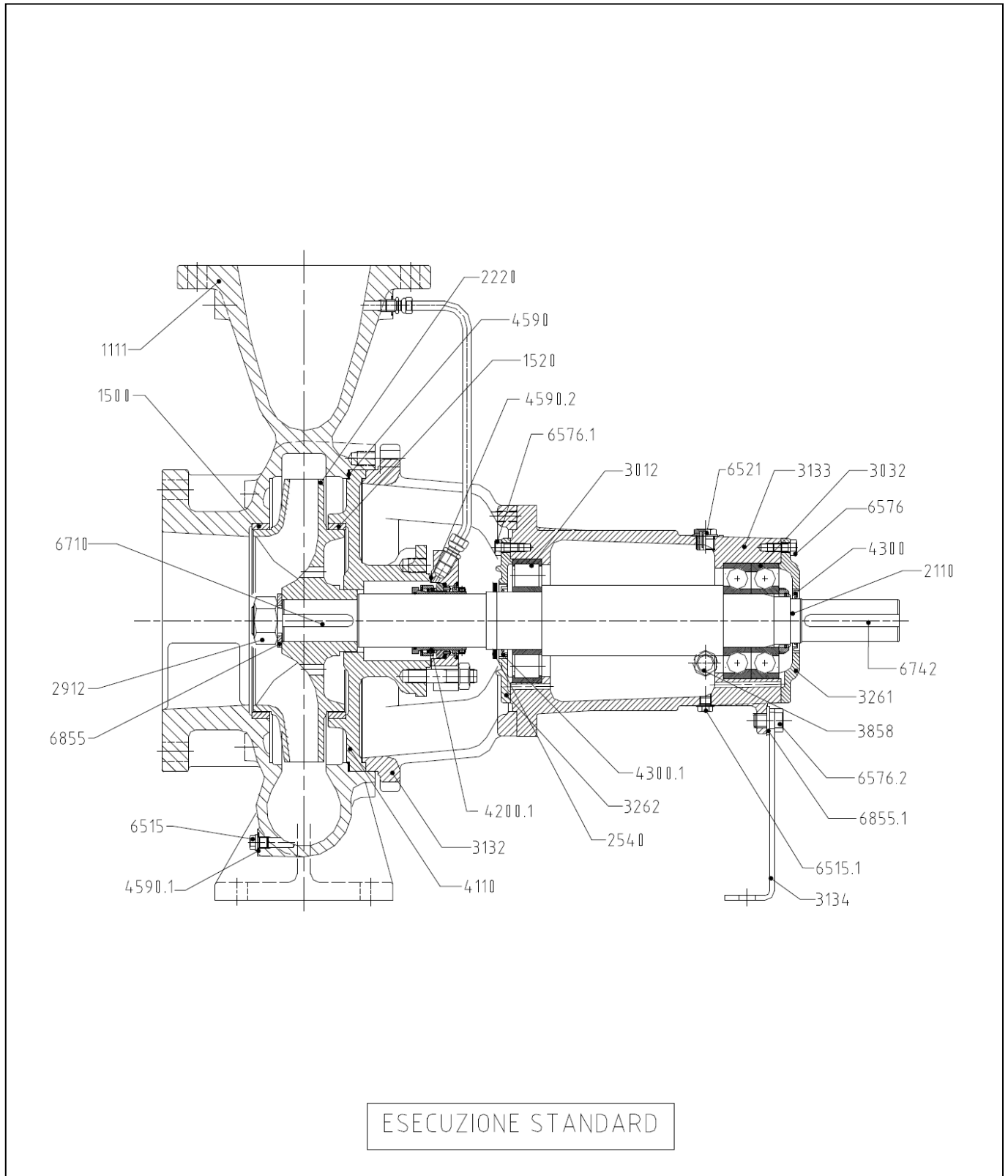
### Support 42 – Mechanical seal cartridge

10x6x31 – 12x8x31 – 12x8x40 – 12x10x25 – 12x10x31 – 15x12x25 – 12x12x31 – 15x12x40 – 20x15x15 – 12x10x40



### Support 48 – Mechanical seal cartridge

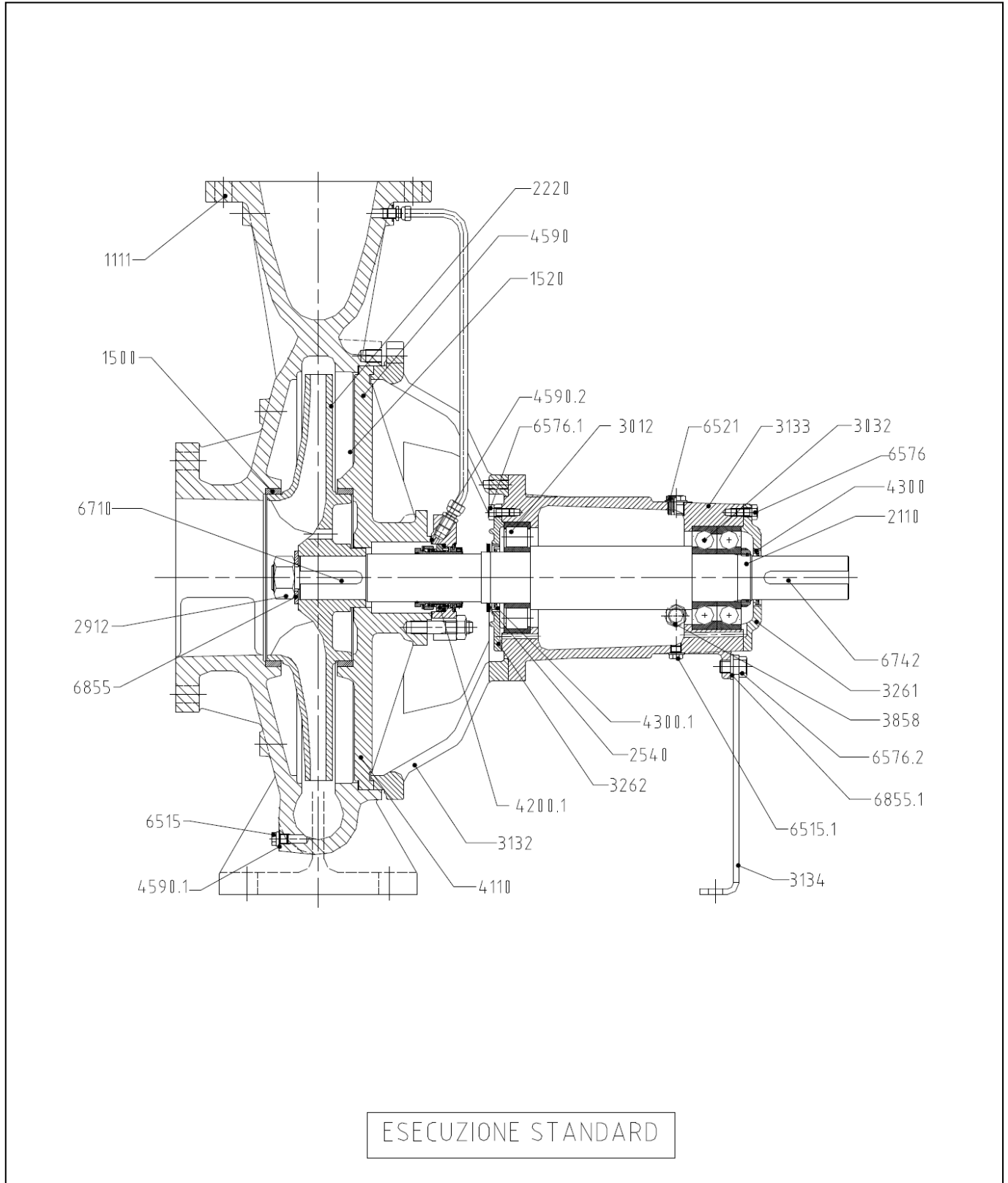
20X15X31 – 20X15X40



## TYPICAL CROSS-SECTION

### Support 55 – Mechanical seal cartridge

25X20X40 – 15X12X50 – 20X15X50 – 25X20X31 – 35X30X40 – 35X30X50





## TYPICAL CROSS-SECTION

POS. No.	DESCRIPTION
1111	Pump Casing
<b>1500*</b>	<b>Casing Wear Ring, suction side</b>
2110	Pump Shaft
<b>2220*</b>	<b>Impeller</b>
<b>2300*</b>	<b>Impeller Ring</b>
<b>2450*</b>	<b>Shaft Sleeve</b>
2540	Thrower
2912	Impeller Nut
<b>3011*</b>	<b>Radial Ball Bearing, drive side</b>
<b>3011.1*</b>	<b>Radial Ball Bearing, pump side</b>
<b>3012*</b>	<b>Radial Roller Bearing</b>
<b>3032*</b>	<b>Double Thrust Bearing</b>
3132	Bearing Bracket Lantern
3133	Bearing Bracket Housing
3134	Support Foot
3261	Bearing Cover, drive side
3262	Bearing Cover, pump side
3858	Oil Level Sight Glass
4110	Stuffing Box Housing
<b>4200*</b>	<b>Mechanical Seal</b>
<b>4200.1*</b>	<b>Mechanical Seal Cartridge</b>
4271	Shaft Sleeve for Mechanical Seal

POS. No.	DESCRIPTION
<b>4300*</b>	<b>Radial Lip Seal</b>
<b>4300.1*</b>	<b>Radial Lip Seal</b>
<b>4590*</b>	<b>Gasket</b>
<b>4590.1*</b>	<b>Gasket</b>
<b>4590.2*</b>	<b>Gasket</b>
<b>4610*</b>	<b>O-Ring</b>
6515	Plug
6515.1	Plug
6521	Vent Plug
6573	Stud
6573.1	Stud
6576	Screw
6576.1	Screw
6576.2	Screw
6576.3	Screw
6580	Nut
6580.1	Nut
6710	Impeller Key
6742	Coupling Key
6855	Washer for Impeller
6855.1	Washer

\* **Recommended Spares Parts**



## **TROUBLESHOOTING**

### **TROUBLESHOOTING**

Provided your AxFlow Aturia ND series pump is correctly installed and is operated within its designed performance envelope, it is capable of running for very long periods with minimal attention.

Regular inspection, and preventive maintenance when necessary, will help to prevent breakdowns.

There are many possible reasons why a pump may not run properly. If your AxFlow Aturia ND series pump does not run satisfactorily, be prepared to look critically at the system as well as at the pump itself.

This section lists some possible pumping problems and indicates how they may be overcome. Your pump supplier will do his best to assist you further if necessary.

PROBLEM	PROBABLE CAUSE	SOLUTION
<b>INSUFFICIENT FLOW</b>	Actual total discharge head exceeds rated head of pump	<ul style="list-style-type: none"> <li>• Increase speed of rotation if possible.</li> <li>• Fit larger diameter impeller.</li> <li>• Reduce total head of system.</li> <li>• Increase discharge pipework size.</li> <li>• Check that discharge valve is fully open.</li> <li>• Replace pump: seek advice from your pump supplier.</li> </ul>
	Pump rotating in reverse	<ul style="list-style-type: none"> <li>• Check direction of rotation. Refer to INSTALLATION section.</li> </ul>
	Air or vapour trapped in inlet pipework	<ul style="list-style-type: none"> <li>• Check for trapped air or vapour. Refer to INSTALLATION section.</li> </ul>
	Liquid contains entrained air or vapour	<ul style="list-style-type: none"> <li>• Check for vortexing in the inlet line.</li> <li>• Fit baffles in supply tank to prevent vortexing.</li> <li>• Fit a settling tank in the inlet line to allow entrained gas to separate from the liquid.</li> </ul>
	Low inlet pressure, giving rise to cavitation and loss of efficiency	<ul style="list-style-type: none"> <li>• Decrease suction lift (negative head).</li> <li>• Increase static suction (positive head)</li> <li>• Check for inlet obstructions or restrictions.</li> <li>• Reduce liquid temperature.</li> <li>• Increase inlet pipework bore.</li> <li>• Decrease length of inlet pipework.</li> <li>• Open inlet valve fully.</li> <li>• Check for excessive liquid viscosity: increase liquid temperature if necessary.</li> </ul>
	Wear of Impeller collar and / or wear ring	<ul style="list-style-type: none"> <li>• Check condition of impeller collar and wear ring. Replace if excessively worn. Refer to DISASSEMBLY and REASSEMBLY sections.</li> </ul>
	Liquid temperature too close to boiling point	<ul style="list-style-type: none"> <li>• Reduce liquid temperature</li> </ul>



## TROUBLESHOOTING

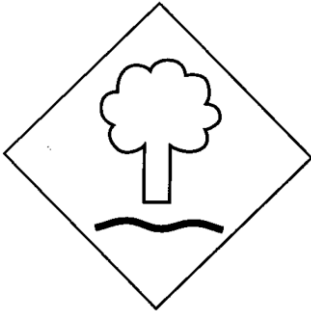
PROBLEM	PROBABLE CAUSE	SOLUTION
<b>NO FLOW</b>	Pump has lost its prime	<ul style="list-style-type: none"> <li>• Reduce liquid temperature.</li> <li>• Check inlet line for air leaks.</li> <li>• Check for loss of liquid supply.</li> <li>• Re-prime pump. Refer to OPERATION section.</li> </ul>
	Blocked inlet line	<ul style="list-style-type: none"> <li>• Check for blockage in the inlet pipework.</li> <li>• Check if any inlet strainers / filters are blocked.</li> <li>• Check for closed valves in the inlet pipework.</li> </ul>
	Motor has stopped	<ul style="list-style-type: none"> <li>• Check power supply.</li> <li>• Check motor condition.</li> </ul>
<b>EXCESSIVE FLOW</b>	Actual total discharge head is below rated head of pump	<ul style="list-style-type: none"> <li>• Reduce speed of rotation if possible.</li> <li>• Fit smaller diameter impeller.</li> <li>• Partly close discharge valve to restrict flow.</li> <li>• Fit orifice plate in discharge line to restrict flow.</li> </ul>
<b>MOTOR OVERHEATS AND / OR CUTS OUT</b>	Actual total discharge head is below rated head of pump	<ul style="list-style-type: none"> <li>• Reduce speed of rotation if possible.</li> <li>• Fit smaller diameter impeller.</li> <li>• Partly close discharge valve to restrict flow.</li> <li>• Fit orifice plate in discharge line to restrict flow.</li> </ul>
	Excessive liquid density	<ul style="list-style-type: none"> <li>• Reduce flow rate by partly closing discharge valve.</li> <li>• Reduce flow rate by introducing an orifice plate into discharge line.</li> </ul>
	Pump has or is about to seize	<ul style="list-style-type: none"> <li>• Check pump for free rotation.</li> <li>• Check pump internally for obstructions.</li> </ul>
	Motor and pump misaligned	<ul style="list-style-type: none"> <li>• Refer to INSTALLATION section.</li> </ul>
	Undersized motor	<ul style="list-style-type: none"> <li>• Fit a larger motor: check first with you pump supplier.</li> </ul>
	Incorrectly set motor overload cut out	<ul style="list-style-type: none"> <li>• Check motor overload setting</li> </ul>
	Electronic dry running protector has tripped	<ul style="list-style-type: none"> <li>• Check for loss of flow.</li> <li>• Check for loss of liquid supply.</li> </ul>

PROBLEM	PROBABLE CAUSE	SOLUTION
<p style="text-align: center;"><b>PUMP RUNS NOISILY AND / OR VIBRATES</b></p>	<p>Low inlet pressure, with cavitation, loss of efficiency and loss of liquid film in the pump bearings.</p> <p style="text-align: center;"><b>STOP THE PUMP IMMEDIATELY!</b></p> <p>(Mechanical damage may be occurring)</p>	<ul style="list-style-type: none"> <li>• Decrease suction lift (negative head).</li> <li>• Increase static suction (positive head)</li> <li>• Check for inlet obstructions or restrictions.</li> <li>• Reduce liquid temperature.</li> <li>• Increase inlet pipework bore.</li> <li>• Decrease length of inlet pipework.</li> <li>• Open inlet valve fully.</li> <li>• Check for excessive liquid viscosity: increase liquid temperature if necessary.</li> </ul>
	<p>Unbalanced rotating assembly</p>	<ul style="list-style-type: none"> <li>• Repair the pump.</li> </ul>
	<p>Motor and pump misaligned</p>	<ul style="list-style-type: none"> <li>• Refer to INSTALLATION section.</li> </ul>
	<p>Coupling worn</p>	<ul style="list-style-type: none"> <li>• Replace coupling.</li> <li>• Check alignment of motor and pump.</li> </ul>
	<p>Worn external pump bearings</p>	<ul style="list-style-type: none"> <li>• Check bearings and replace if necessary</li> </ul>
	<p>Worn motor bearings</p>	<ul style="list-style-type: none"> <li>• Check bearings and replace if necessary</li> </ul>
	<p>Pump feet, motor feet or baseplate not firmly secured</p>	<ul style="list-style-type: none"> <li>• Check for 'soft-foot'. Refer to PUMP FOUNDATION section.</li> </ul>
	<p>Misaligned or badly secured pipework</p>	<ul style="list-style-type: none"> <li>• Check pipework alignment and support. Refer to LOCATION AND PIPING section.</li> </ul>
	<p>Pump starting while rotating in reverse</p>	<ul style="list-style-type: none"> <li>• Stop pump immediately and allow discharge line to drain completely before re-starting.</li> </ul>
<p style="text-align: center;"><b>MECHANICAL SEAL LEAKS EXCESSIVELY</b></p>	<p>Worn Seal</p>	<ul style="list-style-type: none"> <li>• Replace the seal.</li> </ul>
	<p>Coupling worn</p>	<ul style="list-style-type: none"> <li>• Replace the pump shaft.</li> </ul>

PROBLEM	PROBABLE CAUSE	SOLUTION
<b>OVERHEATED (EXTERNAL) PUMP BEARINGS</b> (Long-coupled units only)	Low inlet pressure, with cavitation, loss of efficiency and loss of liquid film in the pump bearings. <b>STOP THE PUMP IMMEDIATELY!</b> (Mechanical damage may be occurring)	<ul style="list-style-type: none"> <li>• Decrease suction lift (negative head).</li> <li>• Increase static suction (positive head)</li> <li>• Check for inlet obstructions or restrictions.</li> <li>• Reduce liquid temperature.</li> <li>• Increase inlet pipework bore.</li> <li>• Decrease length of inlet pipework.</li> <li>• Open inlet valve fully.</li> <li>• Check for excessive liquid viscosity: increase liquid temperature if necessary.</li> </ul>
	Misaligned or badly secured pipework	<ul style="list-style-type: none"> <li>• Reduce liquid temperature.</li> <li>• Check pipework alignment and support. Refer to LOCATION AND PIPING section.</li> </ul>
	Lack of oil in bearing housing	<ul style="list-style-type: none"> <li>• Check oil level: refill oil if necessary.</li> <li>• Replace bearings if necessary.</li> </ul>
	Incorrect oil in bearing housing	<ul style="list-style-type: none"> <li>• Drain and replace oil if necessary.</li> <li>• Replace bearings if necessary.</li> </ul>
	Excessive temperature of pumped liquid	<ul style="list-style-type: none"> <li>• Refill bearing housing with correct oil for working temperature of the pump.</li> </ul>

### DECOMMISSIONING AND DISMANTLING

When pump is permanently stopped and dismantled, its various components should be properly disposed of.



Make sure that no residual polluting liquids are trapped with the pump.

The disposal of polluting liquids and materials should follow current environment regulations.

The materials used in pump construction are :

- Steel and Cast Iron
- Aluminium
- Rubber and Plastic
- Copper, Brass and Bronze



## NOTES



## NOTES



*"fluidity.nonstop"* is our promise and our commitment to a level of service and a quality of product, performance and expertise the like of which has not been seen before. We are Europe's leading source of pumps and pump expertise for the process industry and we intend to maintain that position by working fluidly, and ceaselessly, to bring you the best.



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**nonstop**

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