AxFlow

NDM SERIES OPERATION & MAINTENANCE MANUAL

Single Stage
Magnetically Coupled
End Suction
Centrifugal Pump
built to ISO 2858
standard

IMPORTANT NOTES

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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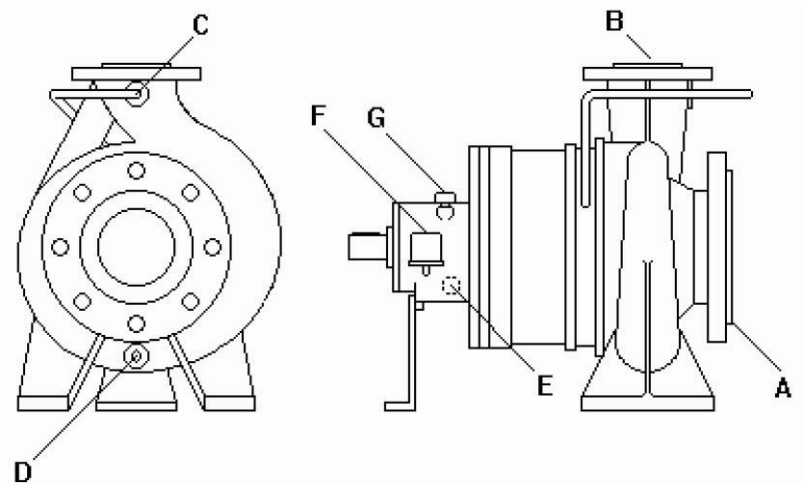
GENERAL

AxFlow Aturia NDM pumps are single stage magnetically coupled end suction pumps. Details of the pump type and model, serial number and operating data are indicated on the pump nameplate.

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.

Pump overview



A	Suction Nozzle	**B**	Discharge Nozzle
C	Circulating Pipe	**D**	Casing Plug
E	Oil Drain Plug	**F**	Constant Level Oiler (option)
G	Oil Dipstick		

Noise levels

The following table reports the noise level produced by AxFlow Aturia NDM Series pumps running with in 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	61
71	67	62
80	71	64
90	73	66
100	77	68
112	79	69
132	80	69
160	81	69
180M	81	69
180L	83	71
200	83	71
225	88	74
250	88	74
280	89	83
315S	89	83
315M	90	84
355	91	87
400	93	89

Area of operation

AxFlow Aturia NDM 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.

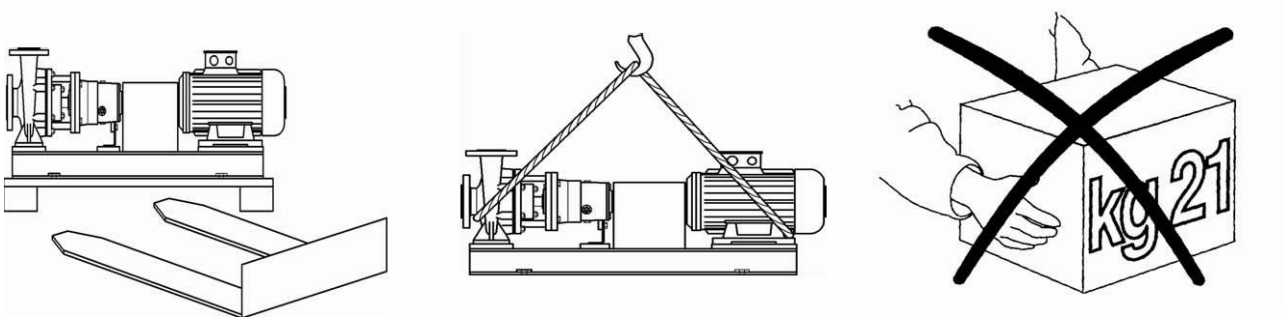
The pump user is strongly recommended to carry replacement spares for parts which are wearing items as follows:

- Casing wear ring
- Casing gasket

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

- Pair of motor bearings

Transport



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. If the pump is close-coupled to the motor, remove the fan cover from the motor and rotate the fan by hand. To check long-coupled pumps for free rotation, remove the coupling guard and rotate the pump and motor shafts at the flexible coupling.

Storage

If not to be used immediately, the pumpset should be stored in a dry warm and vibration free environment.

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.

Do not remove flange covers until the pump is ready to be connected to the pipework.

Drivers

AxFlow Aturia NDM 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.

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.

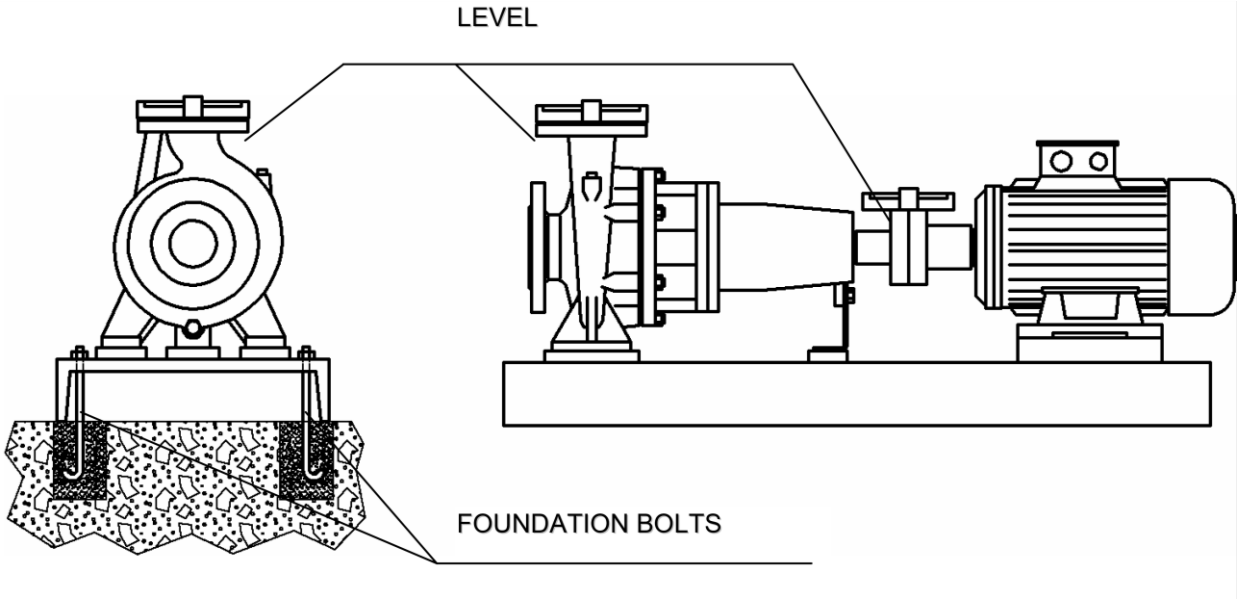
Close-coupled motor-pump unit without baseplate

Level the pump base accurately, using shims under the pump feet. The pump must sit firmly and evenly on its foundation. It must not be distorted by bolting to an uneven surface.

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

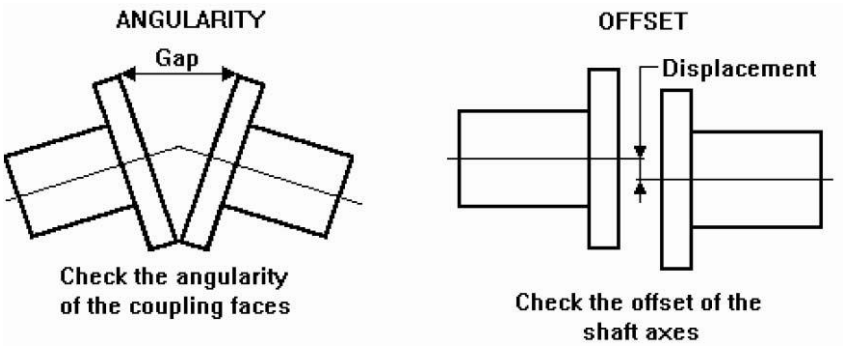


Close-coupled pumps have been aligned prior to shipment and if they turn freely by hand, no further adjustments are necessary.

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

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

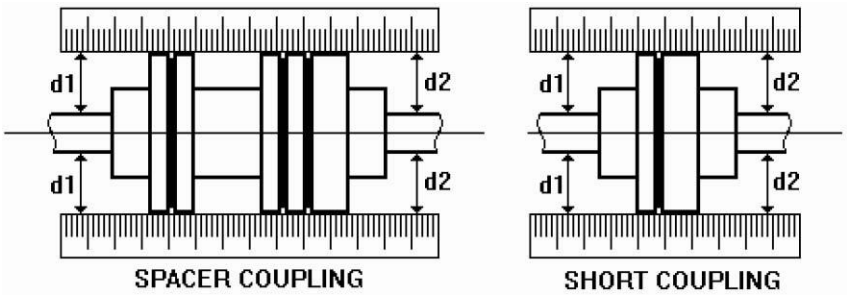


TYPE	DISPLACEMENT	GAP
Short flexible coupling (3000 rpm)	0.05 mm	0.04 mm per 100 mm coupling diameter
Flexible spacer coupling (3000 rpm)	0.07 mm per 100 mm spacer length	0.04 mm per 100 mm coupling diameter

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 d1 and d2 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 lost accurate is the reverse indicator method, using two gauges, which overcomes errors due to `sag' of the gauge bars.

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.

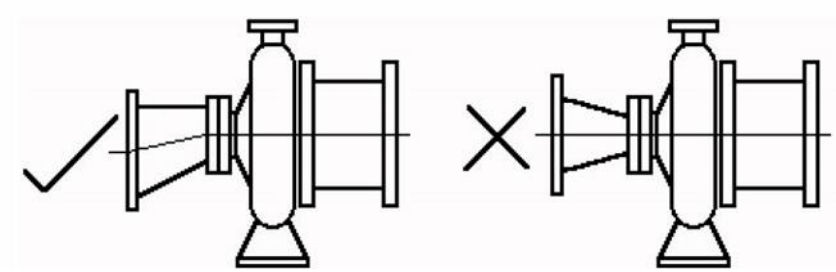
The suction line should be as short and straight as possible, with a minimum number of bends. Bends should be large radius type: avoid sharp elbows. Bends and fittings should be no closer than 20 pipe diameters to the pump suction, to allow undisturbed flow to the pump impeller. Liquid velocity in the 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.

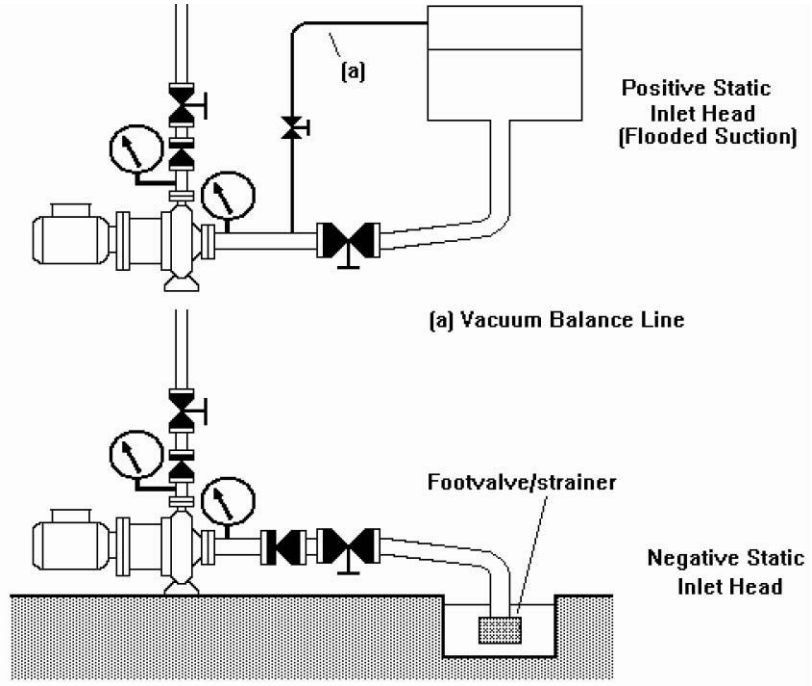
INSTALLATION

ATTENTION !



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.

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.

If the pump is fitted with a STEAM HEATING JACKET, the steam must flow into the upper connection and out of the lower connection. The heating fluid may be water with a maximum temperature of 1700C or saturated steam with a maximum pressure of 7 bar (100psi).

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.

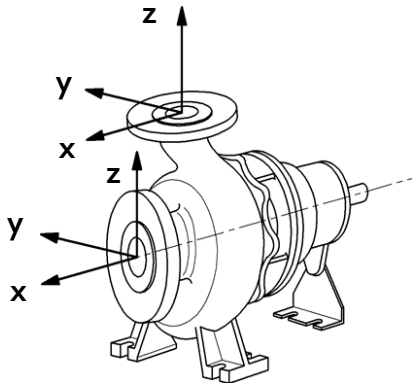
BE VERY CAREFUL not to allow the temporary strainer to become plugged, causing low inlet pressure with cavitation or dry running. A pressure gauge should be installed on either side of the temporary strainer to measure the pressure drop across it. If there is any risk of ingestion of solids during normal 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.

DO NOT PUMP LIQUIDS CONTAINING IRON OXIDES OR FERROMAGNETIC PARTICLES, HOWEVER SMALL. THESE MAY ADHERE TO THE INTERNAL MAGNET AND CAN EVENTUALLY BUILD UP INTO DAMAGING DEPOSITS.

Admissible external forces and torques on pump flanges



TYPE	FLANGE	TORQUES, (daN)				MOMENTS, (daN.m)			
		Fx	Fy	Fz	ΣF	Mx	My	Mz	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
6x5x12 6x5x16	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	75	60	45	110	50	250	40	200
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
12x8x16 12x8x20 12x8x25 12x8x31 12x8x40	Suction	250	200	170	370	190	100	150	260
	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
25x20x40	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.

INSTALLATION

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"

Long-coupled pumps only

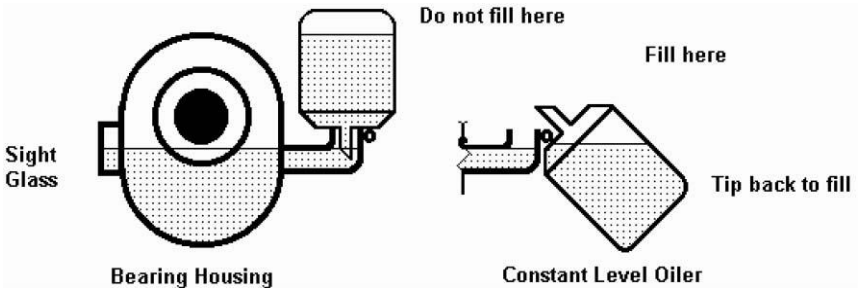
Prior to starting the pump the bearing housing should be filled with one of the following oils:

Use ISO VG-46 viscosity oil for bearing temperature from 0° to 70°C.
Use ISO VG-68 viscosity oil for bearing temperature 70° to 90°C.

OIL QUANTITY : BEARING BRACKET SIZE 24 0.4 lt.

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.



Direction of rotation

AxFlow Aturia NDM 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 7.3 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.

OPERATION

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.

Care must be taken to make sure that the sleeve bearings in the pump are replaced in sufficient time to prevent mechanical rubbing between the inner magnet and the rear casing of the pump. This condition can be detected by an increase in power consumption and loss of pump performance. In addition the pump may vibrate or operate noisily.

IF LEFT UNATTENDED, THE RUBBING WILL EVENTUALLY BREAK THE REAR CASING CAUSING LEAKAGE OF THE LIQUID INTO THE ENVIRONMENT

Be sure to maintain properly the ball bearings supporting the outer magnet in the external bearing housing (or the motor bearings in the case of close-coupled pumps).

BEARING FAILURE WILL RESULT IN THE OUTER MAGNET MECHANICALLY RUBBING ON THE OUTSIDE OF THE REAR CASING, WHICH IF LEFT UNATTENDED WILL CAUSE THE REAR CASING TO FAIL, WITH LIQUID LEAKAGE INTO THE ENVIRONMENT

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 and dry running of the bearings, risking serious damage to the pump.

OPERATION

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 internal pump bearings and/or the external bearing housing and/or the motor bearings. Your supplier will advise you on vibration monitoring on request.

If a temperature sensor is fitted to the pump, check regularly to ensure that it is working properly.

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.

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
Internal bearing system	Check thrust bearings and sleeve bearings for wear. On reassembly use new gaskets and O-rings	After 2500 hours of operation, check for premature wear. Thereafter, check every 5000 hours or once a year, whichever is shorter.
Casing wear ring	Check wear ring clearance (See INSPECTION PRIOR TO REASSEMBLY section)	After 2500 hours of operation, check for premature wear. Thereafter, check every 5000 hours or once a year, whichever is shorter.
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.	

DISASSEMBLY

Strong magnet essential precautions

MAGNETS CAN PRODUCE STRONG MECHNICAL FORCES!

THERE IS A DANGER OF INJURY WHEN TWO MAGNETS ARE BROUGHT TOGETHER BY HAND!

MAGNETS ARE BRITTLE AND ARE EASILY DAMAGED! BREAKAGE CAN OCCUR WHEN A MAGNET IS PLACED NEAR ANOTHER MAGNET OR IRON OBJECT WITHOUT MECHANICAL GUIDANCE AND SPECIAL CARE.

IF MAGNETIC PARTICLES GET INTO THE EYES, GET MEDICAL HELP IMMEDIATELY!

HEART PACEMAKERS CAN BE DAMAGED!

TOOLS OR OTHER IRON OBJECTS CAN BE ATTRACTED SUDDENLY!

CARDS WITH MAGNETICALLY STORED INFORMATION, I.E. CREDIT CARDS, ETC., CAN BE DAMAGED!

WATCHES CAN BE DAMAGED!

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!

DO NOT ALLOW MAGNETIC MATERIALS TO CLING TO THE PUMP MAGNETS!

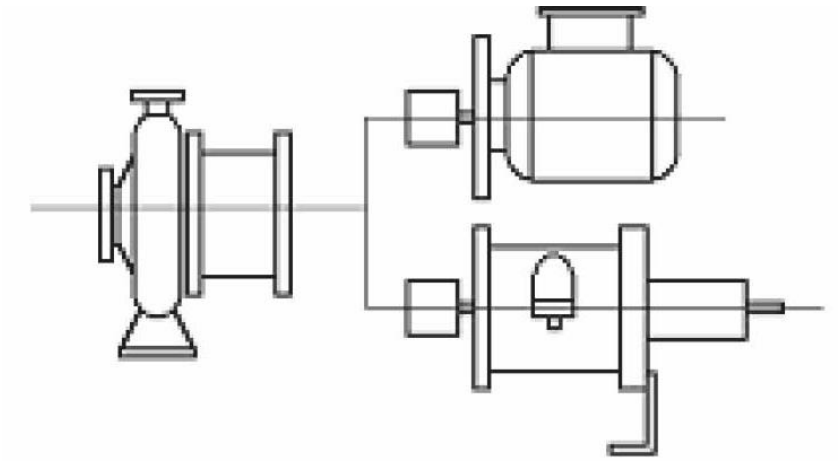
DO NOT USE FORCE!

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.

1. Check that the pump has been fully drained and flushed out, before you start work on it.
2. Isolate the motor from its electrical supply.
3. Isolate the pump from the rest of the hydraulic system. Isolate and disconnect any jacketing or other auxiliary pipework from the pump.
4. Discharge the oil from the bearing housing. Replace the oil chamber plugs.
5. Remove the spacer element of the coupling, or if no spacer is present, remove the motor. With close-coupled pumps, the motor and external magnet assembly must be removed carefully, without damaging the magnet. See 7. below.
6. Remove the external cooling/recirculation pipe by disconnecting the pipe unions at each end.

7. Dismantling the magnetic drive.



SAFETY NOTE!

See STRONG MAGNET ESSENTIAL PRECAUTIONS

Take care not to trap your fingers as the two halves of the magnetic coupling are separated

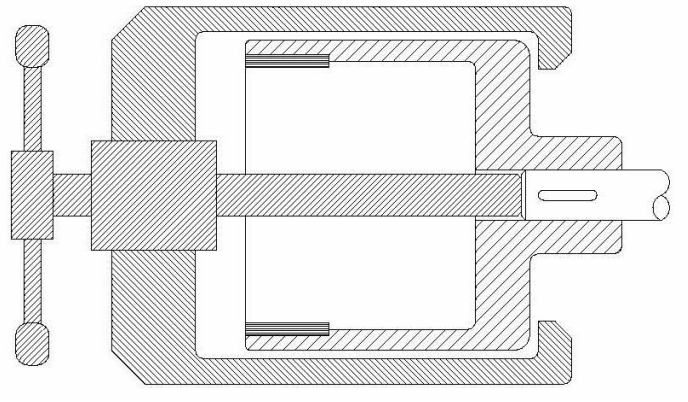
Remove the bolts securing the bearing housing to the bracket and carefully withdraw the external bearing housing with the external magnet attached. Withdraw the external bearing housing and external magnet slowly and progressively, taking care to avoid damaging the brittle magnetic elements inside the external magnet.

DISASSEMBLY

Removing the external magnet from the motor shaft or the external bearing shaft

First loosen the grub screws securing the external magnet. Then use a puller to extract the magnet slowly and progressively from the shaft. If a suitable puller is not available, use wooden levers.

MAGNET PULLER



DO NOT STRIKE THE MAGNET!

The magnetic elements are brittle and easily damaged.

DO NOT ALLOW THE MAGNET TO FALL TO THE FLOOR!

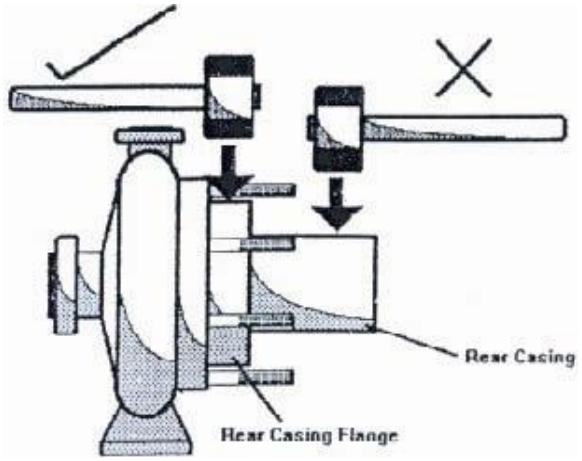
Removing the internal pump assembly

Remove the nuts securing the bracket to the pump head. Carefully withdraw the internal pump assembly from the pump head. If the internal pump assembly does not move easily, **DO NOT LEVER**, but gently tap the flange of the rear casing on alternate sides with a softheaded mallet, to free the internal assembly.

DISASSEMBLY

DO NOT STRIKE THE 'CAN' OF THE REAR CASING!

This thin walled component must not be distorted or damaged.



Removing the impeller

Place the internal assembly on a clean surface, impeller upwards. Flatten the impeller lock washer. Holding the impeller firmly around its circumference, loosen and remove the impeller nut. Remove the impeller and its key. Remove the front thrust bearing.

Stripping the internal pump assembly

Remove the countersunk screws securing the internal bearing housing assembly in the rear casing.

You are strongly recommended to use JACKING SCREWS in the tapped holes provided. The countersunk screws can be used for this purpose.

Remove the shaft / internal magnet/thrust bearing sub-assembly slowly and carefully from the internal bearing housing. Take great care not to chip the brittle silicon carbide shaft sleeve bearings.

Stripping the shaft/internal magnet/thrust bearing sub-assembly

Remove the bolts from the assembly, and remove the internal magnet. Take care to catch the thrust bearing as the last bolt is removed.

The silicon carbide bearing sleeves may now be removed from the shaft by removing the grub screws that locate them, and sliding the sleeves off their tolerance rings. Remove the metal spacer separating the two sleeves on the shaft.

Stripping the internal bearing housing

Remove the silicon carbide bearing sleeves in their metal supports by removing the screws that secure them. Use bolts as JACKING SCREWS if necessary.

Remove the silicon carbide sleeves from their metal housings by removing the grub screws that locate them.

Disassembly and re-assembly of the EXTERNAL BEARING HOUSING (long-coupled units only)

Drain oil from the pedestal housing. Loosen the grub screw and remove the external magnet from the shaft using a suitable extractor tool.

SEE SECTION DRAWING N° ODM0020

Undo bolts and remove bearing covers. Using a bench press, press out shaft together with outer bearing. Press out the inner bearing. Inspect bearings for wear and replace if necessary. Remove any burrs from shaft keyway.

Reassembly

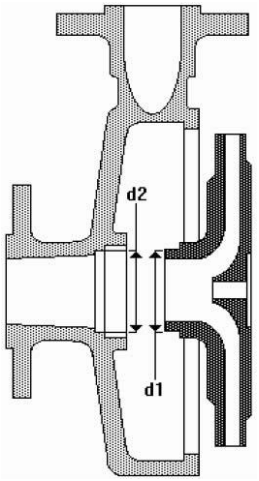
Using a bench press, insert inner bearing into pedestal housing. Assemble outer bearing and shaft. Press shaft and bearing assembly into pedestal housing. Locate bearing covers onto pedestal housing, ensuring the oil ways are at the bottom. Replace and tighten bolts.

REASSEMBLY

Inspection prior to reassembly

Check the clearances between the collar of the impeller and the wear ring in the pump casing.

Clean all the parts carefully. Ball bearings should be washed in a clean solvent and allowed to dry, then oiled. Check all pump parts and replace worn ones.



PUMP SIZE Discharge Nominal Bore, mm	DIAMETER CLEARANCE FOR STAINLESS STEEL		DIAMETER CLEARANCE FOR OTHER ALLOYS	
	mm	in	mm	in
32, 40	0.45 – 0.55	0.018 – 0.020	0.25 – 0.35	0.010 – 0.015
50, 65, 80, 100	0.50 – 0.60	0.020 – 0.023	0.35 – 0.40	0.012 – 0.018
125, 150	0.55 – 0.65	0.021 – 0.025	0.35 – 0.45	0.015 – 0.018

All AxFlow Aturia NDM pumps are equipped with silicon carbide sleeve bearings and thrust bearings. When new, diametrical clearances between the inner and outer silicon carbide sleeves are as follows:

NDM PUMPS I RANGE : 0.025 – 0.0475 mm / 0.0009 – 0.0018 inch

NDM PUMPS II RANGE : 0.08 – 0.13 mm / 0.003 – 0.005 inch

NDM PUMPS III RANGE : 0.1 – 0.2 mm / 0.0039 – 0.0078 inch

REASSEMBLY

Reassembling the pump

WORK IN A CLEAN AREA!
DO NOT ALLOW MAGNETIC MATERIALS TO CLING TO THE PUMP MAGNETS.

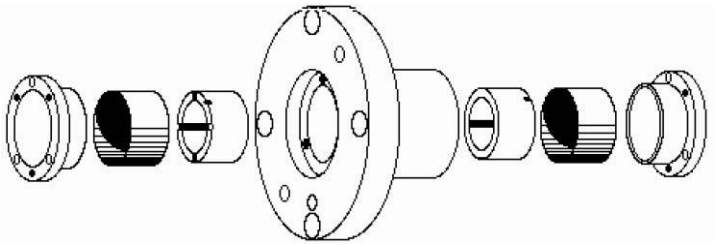
See Page 20 for PRECAUTIONS WHEN WORKING WITH STRONG MAGNETS.

CAUTION!

IF LUBRICANTS OR THREADLOCKING COMPOUNDS (e.g. `LOCTITE') ARE USED ON ANY INTERNAL THREAD OR OTHER WETTED SURFACE IN THE PUMP, THEY MUST BE COMPATIBLE WITH THE PUMPED LIQUID. (If in doubt consult the manufacturer of the compound)

Internal bearing sub-assembly

1. Replace the silicon carbide sleeve bearings in their metal housings. Each silicon carbide bearing has a plain and a slotted end. The slotted ends face outwards.



2. Align the slots in the silicon carbide sleeves with the tapped holes in the metal housings, and replace the locating grub screws.

REASSEMBLY

Shaft / magnet sub-assembly

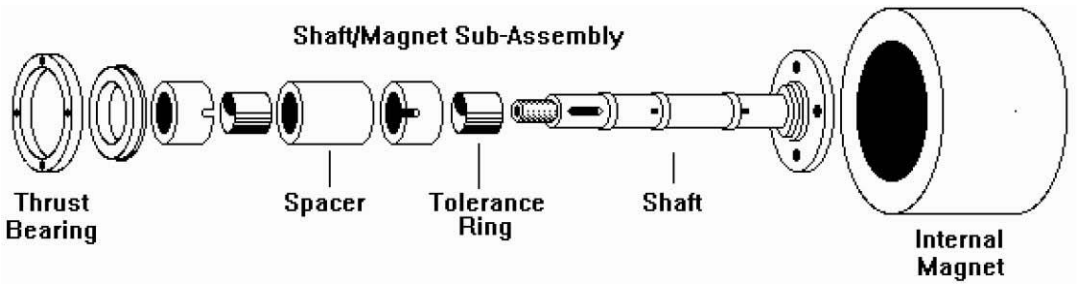
1. Fit the rear tolerance ring onto the shaft, aligning the gap in the tolerance ring with the tapped hole in the shaft.

2. Pinch the tolerance ring firmly on to the shaft, align the slot in the silicon carbide sleeve carefully with the gap in the tolerance ring, and slide the sleeve over the ring. Replace and tighten the locating grub screw. Replace the metal sleeve separating the front and rear silicon carbide sleeve bearings.

3. Repeat procedure 2. for the front silicon carbide sleeve bearing.

4. Secure the internal magnet and rear thrust bearing to the shaft, using bolts and lock washers. **NOTE:** The silicon carbide face of the rear thrust bearing must point forwards, towards the impeller.

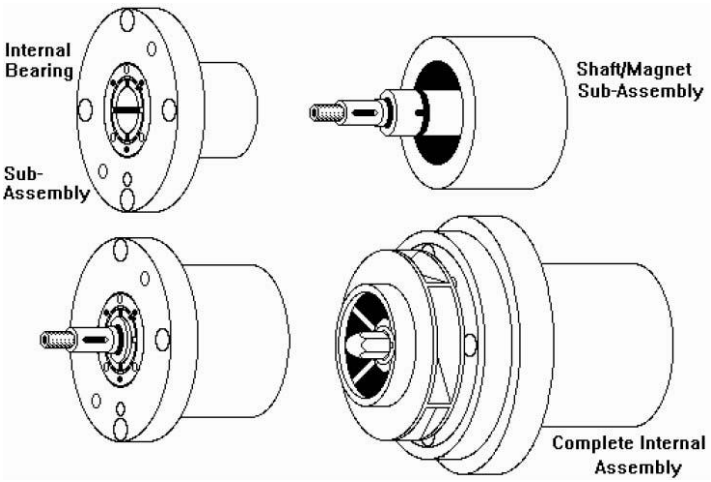
Internal pump assembly



Rebuild the internal pump assembly with the internal bearing sub-assembly and the shaft/magnet sub-assembly.

REASSEMBLY

1. Slowly and carefully slide the shaft sub-assembly into the rear of the internal bearing sub-assembly.



Take great care not to damage the brittle silicon carbide bearings.

2. Stand the assembly with the free end of the shaft upwards. Slide the front thrust bearing on to the shaft, silicon carbide face downwards. Replace the shaft key. Slide the impeller on to the shaft.

3. Replace the impeller lock washer, locating its internal tab in the shaft keyway. Grip the impeller firmly around its circumference, replace and tighten the impeller nut. Bend up one edge of the impeller lock washer against a flat on the impeller nut.

4. Turn the impeller to check for free rotation.

5. Fit the internal pump assembly into the rear casing, aligning carefully the alignment marks on the internal bearing housing and the rear casing.

Reassembly of the complete pump

1. Fit the external flushing pipe loosely to the union on the pump body, first making sure that both sealing surfaces are clean.

2. Inspect and carefully clean the main sealing surfaces on the rear casing and the pump body. Fit a new main gasket.

3. Offer up the internal pump assembly to the pump body, aligning it so that the pipe connection in the rear casing is correctly located to accept the pipe. Slide the internal assembly into the pump body. Connect the free end of the pipe loosely to the union on the rear casing, first making sure that the sealing surfaces are clean.

4. Align the bracket carefully with the locating dowel in the rear radial face of the flange of the rear casing.

5. Secure the bracket to the pump body, tightening the nuts progressively and evenly. The recommended torque on the nuts is 6kgm.

6. Secure the bracket foot to the baseplate, making sure that the pump is properly leveled and supported under all its feet. See METHODS OF CHECKING ALIGNMENT instructions, page 8.

7. Tighten both joints on the external cooling/re-circulation pipe.

8. A hydrostatic pressure test may now be carried out with water, to test for leaks. The standard pump is suitable for use at system pressures up to 16 bar as ISO 2858 pumps.

Replacing the external magnet and motor or bearing housing

Long-coupled units

Rebuild the external bearing housing if necessary: see DISASSEMBLY AND RE-ASSEMBLY OF THE EXTERNAL BEARING HOUSING (LONG-COUPLED UNITS ONLY) section.

Fit the external magnet on to the external bearing shaft or the motor shaft. First, clean the bore of the drive magnet hole and the surface of the shaft with fine emery paper, and lightly oil both surfaces.

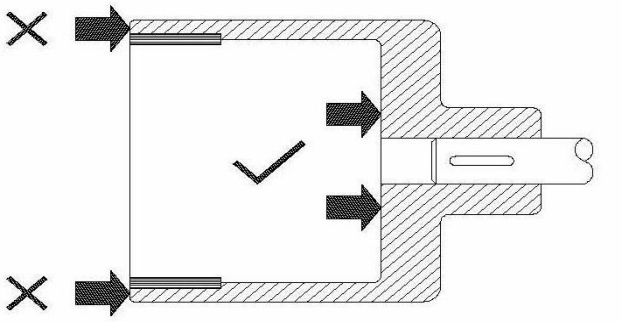
REASSEMBLY

Refitting the external magnet (with its bearing housing or motor) to the pump

SAFETY NOTE - See STRONG MAGNET ESSENTIAL PRECAUTIONS section.

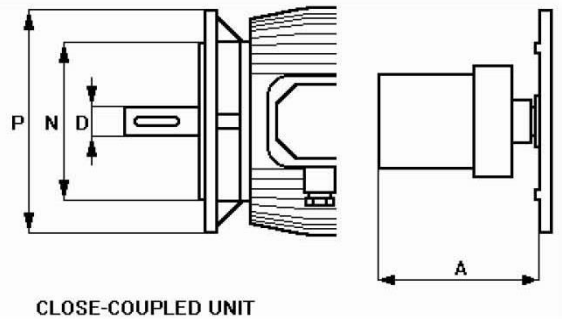
Fit the key into the keyway. Push the magnet onto the shaft, it should be a smooth interference fit. If necessary, use a light hydraulic press to push the magnet into position, pressing on the inside base of the magnet hub. See table below for correct positioning of the magnet on the shaft.

DO NOT STRIKE THE MAGNET! The magnet elements are brittle and are easily damaged.



LOCATION OF EXTERNAL MAGNET ON MOTOR OR PEDESTAL SHAFT

CLOSE COUPLED UNITS							LONG COUPLED UNITS	
External Magnet Type	Motor Frame Size	Dimensions P	N	D	A mm		External Magnet Type	A mm
SS							SS	
SM	100L / 112M	250	180	28	108		SM	108
SM	132S / 132M						SM	
MM							MM	



CLOSE-COUPLED UNIT

Insert key into shaft keyway and locate the outer magnet on the shaft in accordance with dimension A shown above, and tighten the grub-screw. Fill the bearing housing with oil to the middle of the sight glass.

REASSEMBLY

Check the magnetic elements of the external magnet, and remove any loose metal particles attached to them. The magnet must be clean internally.

Fit the external magnet with its attached bearing housing or motor, into the pump bracket, using three JACKING BOLTS to bring the two magnets together progressively in a controlled manner. JACKING BOLT sizes are:

NDM series I pumps	**:**	**M10 x 150mm**
NDM series II pumps	**:**	**M12 x 200mm**
NDM series III pumps	**:**	**M16 x 250mm**

Take care to avoid damaging the brittle magnetic elements inside the external magnet.

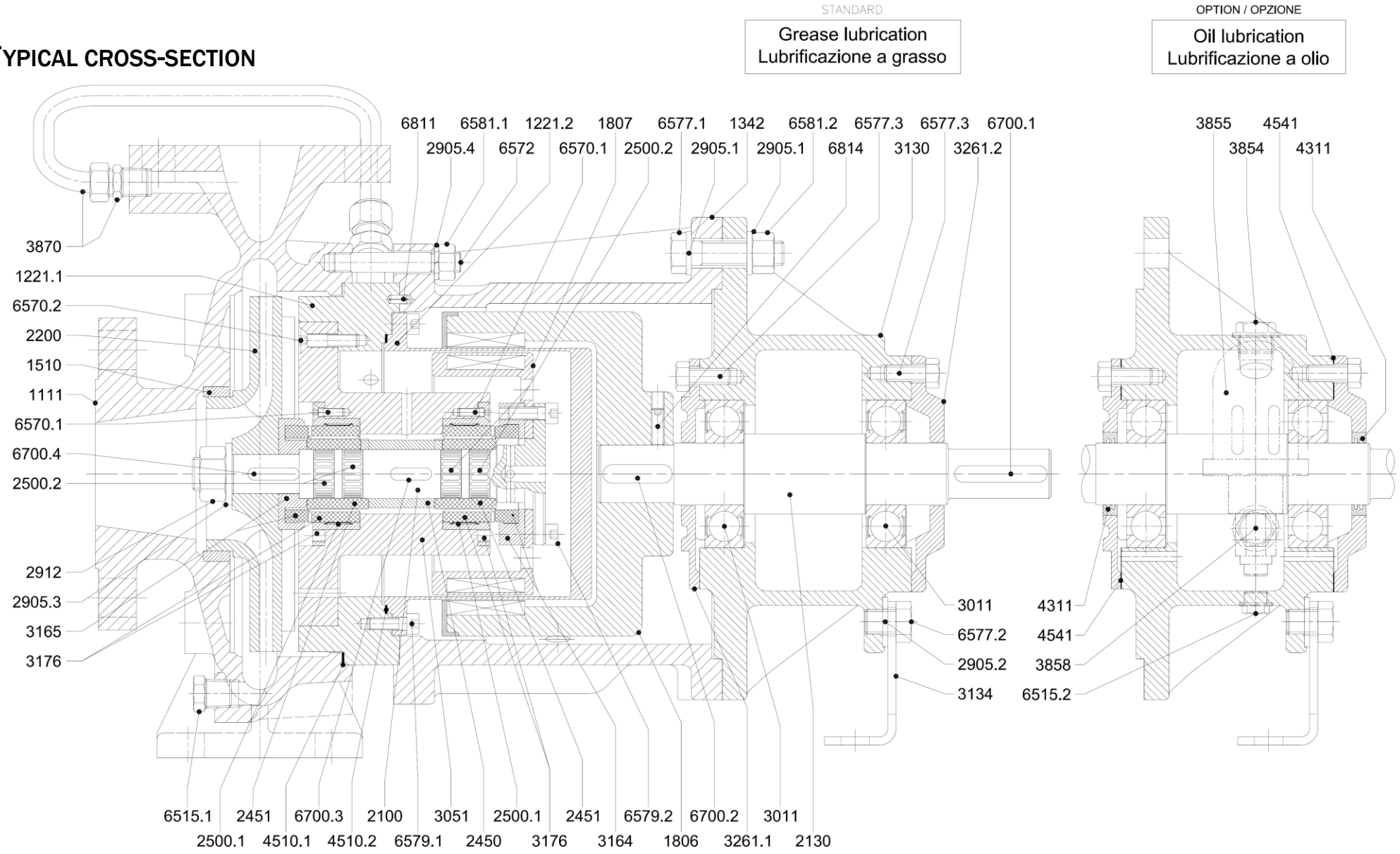
When the pump is fully assembled, turn it over by hand to check for free rotation. The pump should turn over evenly, with no noise or extra resistance at any point.

Refitting the coupling (long-coupled units only)

Fit the two coupling halves to their shafts, checking that they run concentrically. Fit the spacer (if present). Check the coupling carefully for correct ALIGNMENT (see METHODS OF CHECKING ALIGNMENT instructions).

TYPICAL CROSS-SECTION

TYPICAL CROSS-SECTION



TYPICAL CROSS-SECTION

PART No.	DESCRIPTION	QTY
1111	Pump Casing	1
1221.1	Casing Cover	1
1221.2	Rear Casing	1
1342	Bracket	1
1510	Casing Wear Ring	1
1806	Outer Magnet	1
1807	Inner Magnet	1
2100	Pump Shaft	1
2130	Bearing Frame Shaft	1
2200	Impeller	1
2450	Sleeve Bearing Adaptor	1
2451	Sleeve Bearing	2
2500.1	Corrugated Ring	2
2500.2	Corrugated Ring	4
2905.1	Washer	8
2905.2	Washer	1
2905.3	Impeller Nut Lock Washer	1
2905.4	Washer	8
2912	Impeller Nut	1
3011	Ball Bearing	2
3051	Pump Shaft Housing	1
3130	Bearing Frame Casing	1
3134	Bearing Frame Foot	1
3164	Rear Thrust Bearing	1
3165	Front Thrust Bearing	1
3176	Stationary Bearing	2
3261.1	Bearing Frame Rear Cover	1

PART No.	DESCRIPTION	QTY
3261.2	Bearing Frame Front Cover	1
3854	Oil Plug	1
3855	Constant Level Oiler	1
3858	Bull Eye	1
3870	Flushing Pipe	1
4311	Bearing Frame Lip Seal	2
4510.1	Body Gasket	1
4510.2	Rear Casing Gasket	1
4541	Bearing Frame Cover Gasket	2
6515.1	Drain Plug	1
6515.2	Bearing Frame Oil Drain	1
6570.1	Allen Screw	6
6570.2	Allen Screw	4
6572	Stud Bolt	8
6577.1	Hex Screw	4
6577.2	Hex Screw	1
6577.3	Hex Screw	6
6579.1	Allen Screw	12
6579.2	Allen Screw	4
6581.1	Hex Bolt	8
6581.2	Hex Bolt	4
6700.1	Motor Shaft Key	1
6700.2	Outer Magnet Key	1
6700.3	Pump Shaft Key	1
6700.4	Impeller Key	1
6811	Pin	1
6814	Allen Screw	1

TROUBLESHOOTING

Provided your AxFlow Aturia NDM-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 NDM-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.

TROUBLESHOOTING

PROBLEM	PROBABLE CAUSE	SOLUTION
INSUFFICIENT FLOW	Actual total discharge head exceeds rated head of pump	• Increase speed of rotation if possible. • Fit larger diameter impeller. • Reduce total head of system. • Increase discharge pipework size. • Check that discharge valve is fully open. • Replace pump: seek advice from your pump supplier.
	Pump rotating in reverse	• Check direction of rotation. Refer to INSTALLATION section.
	Air or vapour trapped in inlet pipework	• Check for trapped air or vapour. Refer to INSTALLATION section.
	Liquid contains entrained air or vapour	• Check for vortexing in the inlet line. • Fit baffles in supply tank to prevent vortexing. • Fit a settling tank in the inlet line to allow entrained gas to separate from the liquid.
	Low inlet pressure, giving rise to cavitation and loss of efficiency	• Decrease suction lift (negative head). • Increase static suction (positive head) • Check for inlet obstructions or restrictions. • Reduce liquid temperature. • Increase inlet pipework bore. • Decrease length of inlet pipework. • Open inlet valve fully. • Check for excessive liquid viscosity: increase liquid temperature if necessary.
	Wear of Impeller collar and / or wear ring	• Check condition of impeller collar and wear ring. Replace if excessively worn. Refer to DISASSEMBLY and REASSEMBLY sections.
	Liquid temperature too close to boiling point	• Reduce liquid temperature

TROUBLESHOOTING

PROBLEM	PROBABLE CAUSE	SOLUTION
NO FLOW	Pump has lost its prime	• Reduce liquid temperature.
		• Check inlet line for air leaks. • Check for loss of liquid supply. • Re-prime pump. Refer to OPERATION section.
	Blocked inlet line	• Check for blockage in the inlet pipework. • Check if any inlet strainers / filters are blocked. • Check for closed valves in the inlet pipework.
	Magnetic drive de-coupled	• Reduce flow rate: partly close discharge valve. • Reduce liquid density. • Reduce rated head of pump (check first with your supplier). • Check for free rotation of pump impeller: inspect pump internally if it does not rotate freely. • Reduce motor power (check first with you pump supplier). • Use a soft start system for pump starting.
	Motor has stopped	• Check power supply. • Check motor condition.
EXCESSIVE FLOW	Actual total discharge head is below rated head of pump	• Reduce speed of rotation if possible. • Fit smaller diameter impeller. • Partly close discharge valve to restrict flow. • Fit orifice plate in discharge line to restrict flow.

TROUBLESHOOTING

PROBLEM	PROBABLE CAUSE	SOLUTION
MOTOR OVERHEATS AND / OR CUTS OUT	Actual total discharge head is below rated head of pump	• Reduce speed of rotation if possible. • Fit smaller diameter impeller. • Partly close discharge valve to restrict flow. • Fit orifice plate in discharge line to restrict flow.
	Excessive liquid density	• Reduce flow rate by partly closing discharge valve. • Reduce flow rate by introducing an orifice plate into discharge line.
	Pump has or is about to seize	• Check pump for free rotation. • Check pump internally for obstructions.
	Motor and pump misaligned	• Refer to INSTALLATION section.
	Undersized motor	• Fit a larger motor: check first with you pump supplier.
	Incorrectly set motor overload cut out	• Check motor overload setting
	Electronic dry running protector has tripped	• Check for loss of flow. • Check for loss of liquid supply.

TROUBLESHOOTING

PROBLEM	PROBABLE CAUSE	SOLUTION
PUMP RUNS NOISILY AND / OR VIBRATES	Low inlet pressure, with cavitation, loss of efficiency and loss of liquid film in the pump bearings. **STOP THE PUMP IMMEDIATELY!** (Mechanical damage may be occurring)	• Decrease suction lift (negative head). • Increase static suction (positive head) • Check for inlet obstructions or restrictions. • Reduce liquid temperature. • Increase inlet pipework bore. • Decrease length of inlet pipework. • Open inlet valve fully. • Check for excessive liquid viscosity: increase liquid temperature if necessary.
		• Reduce liquid temperature
	Worn, eroded, fouled or damaged impeller	• Check pump internally for wear, damage or obstruction.
	Worn, eroded, fouled or damaged internal bearings	• Check pump internally for wear, damage or obstruction.
	Motor and pump misaligned	• Refer to INSTALLATION section.
	Coupling worn	• Replace coupling. • Check alignment of motor and pump.
	Worn external pump bearings	• Check bearings and replace if necessary
	Worn motor bearings	• Check bearings and replace if necessary
	Pump feet, motor feet or baseplate not firmly secured	• Check for 'soft-foot'. Refer to PUMP FOUNDATION section.
	Misaligned or badly secured pipework	• Check pipework alignment and support. Refer to LOCATION AND PIPING section.
	Pump starting while rotating in reverse	• Stop pump immediately and allow discharge line to drain completely before re-starting.

TROUBLESHOOTING

PROBLEM	PROBABLE CAUSE	SOLUTION
OVERHEATED (EXTERNAL) PUMP BEARINGS (Long-coupled units only)	Low inlet pressure, with cavitation, loss of efficiency and loss of liquid film in the pump bearings. **STOP THE PUMP IMMEDIATELY!** (Mechanical damage may be occurring)	• Decrease suction lift (negative head). • Increase static suction (positive head) • Check for inlet obstructions or restrictions. • Reduce liquid temperature. • Increase inlet pipework bore. • Decrease length of inlet pipework. • Open inlet valve fully. • Check for excessive liquid viscosity: increase liquid temperature if necessary.
		• Reduce liquid temperature.
	Misaligned or badly secured pipework	• Check pipework alignment and support. Refer to LOCATION AND PIPING section.
	Lack of oil in bearing housing	• Check oil level: refill oil if necessary. • Replace bearings if necessary.
	Incorrect oil in bearing housing	• Drain and replace oil if necessary. • Replace bearings if necessary.
	Excessive temperature of pumped liquid	• Refill bearing housing with correct oil for working temperature of the pump.

AxFlow

NOTES

AxFlow

"*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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