

End Suction Norm Pumps with Magnetic Coupling

NM mDrive SERIES



OPERATING MANUAL





EC DECLARATION OF CONFORMITY

AT UYGUNLUK BEYANI

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The undersigned Company certifies under its sole responsibility that the item of equipment specified below satisfies the requirements of the mainly Machinery Directive 2006/42/EC which is apply to it.

The item of equipment identified below has been subject to internal manufacturing checks with monitoring of the final assessment by MAS DAF MAKİNA SANAYİ A.Ş.

Aşağıda tanımlanmış olan ürünler için Makine Emniyeti yönetmeliği 2006 / 42 / AT' nin uygulanabilen gerekliliklerinin yerine getirildiğini ve sorumluluğun alınmış olduğunu beyan ederiz.

Aşağıda tanımlanan ürünler içüretim kontrollerine bağlı olarak MAS DAF MAKİNA SANAYİ A.Ş. tarafından kontrol edilmiştir.

Equipment / Ürün :Uçtan Emişli Manyetik Kaplinli Norm Santrifüj Pompalar- End Suction Norm Centrifugal Pumps with Magnetic Coupling

Seri / Model-Tip :NM mDrive Serisi – NM mDrive Series

For pumps supplied with drivers/ Elektrikli Pompa Üniteleri

Related Directives / Yönetmelikler

2006/42/EC Machinery Directive / 2006/42/AT Makine Emniyeti Yönetmeliği

2014/35/EU Low Voltage Directive / 2014/35/AB Alçak Gerilim Yönetmeliği

2014/30/EU Electromagnetic Compatibility Directive / 2014/30/AB Elektromanyetik Uyumluluk Yönetmeliği

EUP 2009/ 125 /EC Electric Used Products Directive/ Elektrik Kullanan Ekipmanlar Direktifi (EUP)

94/9/EC Equipment For Explosive Atmospheres / Patlayıcı Ortamlardaki Ekipman Yönetmeliği

Regulations applied acc. to harmonize standards / Uygulanan Uyumlaştırılmış Standartlar

TS EN ISO 12100:2010, TS EN 809+A1, TS EN 60204-1:2011.

We hereby declare that this equipment is intended to be incorporated into, or assembled with other machinery to constitute relevant machinery to comply with essential health and safety requirements of Directive. The machinery covered by this declaration must not be put into service until the relevant machinery into which it is to be incorporated has been declared in conformity with provisions of the directive.

Ekipman, uygun bir makina oluşturmak amacıyla diğer ekipmanlar ile birleştirilirken ya da monte edilirken gerekli sağlık ve güvenlik yönetmeliklerine uyulması gerekmektedir.

Bu bildiri kapsamında yönetmelikte belirtilen bütün hükümler yerine getirilmeden makinanın devreye alınmaması gerekmektedir.

Place and date of issue / Yer ve Tarih : İstanbul, 02.06.2014

Name and position of authorized person : Vahdettin YIRTMAÇ
Yetkili Kişinin Adı ve Görevi General Manager / Genel Müdür

Signature of authorized person :
Yetkili Kişinin İmzası

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The Signs Used in This Operation Manual


Read the instructions carefully in this operating manual and keep it for your future reference.



Warning sign against the electrical risks



Sign for the operator's safety



Sign for protecting against explosion.

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1. IMPORTANT SAFETY PRECAUTIONS

In order to minimize the accidents during the mounting and putting into service of the pump, the following rules have to be applied:

1. Do not work without taking safety measures relevant to equipment. Cable, mask and safety band must be used when necessary.
2. Be sure there is adequate amount of oxygen and there is no toxic gaseous around
3. Before using welding or any electrical equipment make sure that there is no risk of explosion.
4. Check the cleanliness of the area to take care of your help. (Dust, smoke, etc.)
5. Do keep in mind that there is a risk of having accidents related to electricity
6. Do not lift the pump before you check the transport equipment.
7. Be sure you have a by-pass line
8. Use helmet, eye glasses and protective shoes for your safety
9. Place a protective barrier around the pump within the necessary safety area
10. Dust, liquids and gaseous that may cause overheating, short circuit, corrosion and fire must be kept away from the pump unit.
11. By checking the noise level of the pump unit, necessary measures to avoid noisyoperation of the pump that can have harmful effects on the personnel and environment.
12. Be careful about the direction of transport and storage.
13. Cover appropriately the moving parts to avoid possible injury of the personnel. Mount the coupling guard and belting before starting-up the pump
14. All the electrical and electronic applications must be performed by authorized person conforming EN60204-1 and /or domestic instructions.
15. Protect the electrical equipment and motor against overloading
16. If flammable and explosive liquids are pumped, ground connection of electricity should be carried out properly
17. Do not expose the pump unit to sudden temperature variations
18. All personnel who work with the waste water system need to be vaccinated in case of contagious diseases.
19. If the pump contains hazardous liquids, one must use protective helmet against the risk of splatter. One also must accumulate the liquid in a proper container against any risk of leakage.

All Other Health and Safety Rules, Laws and Regulations Must Be Applied
2. GENERAL
2.1. Definition of Pump and Usage Areas

NM mDrive series pumps are single stage, end suction volute type pumps with magnetic coupling. They are used in:

- Chemical and petrochemical industries
- Detergents known as dangerous fluid in food facilities
- Harmful gas cleaning systems
- Biodiesel facilities
- Heating and cooling systems
- Power stations
- Solar energy systems
- Medical industries
- Electrostatic applications of powdered paint
- Cooling systems of carbon arc furnace

INTRODUCTION


- This manual contains instructions for the installation, operation and maintenance of the NM mDrive type single stage centrifugal pumps with magnetic coupling of **MAS DAF MAKINA SANAYI A.Ş.**
- Please read carefully this manual and apply all the instructions to operate pumps without problems. Pumps shall be used for their intended duties. In this manual, there are information on operating conditions, installation, starting-up, settings and main controls of pumps.
- These operating and maintenance instructions contain **MAS DAF MAKINA SANAYI A.Ş.**'s suggestions. The special operating and maintenance information of the plumbing that a pump is fitted to is not considered in these instructions. This information must be given by the plumbing constructors only.
- **Please refer to instructions of plumbing constructors.**
- Please pay attention to the warnings in this manual and ensure that it is read before the installation-start up process. **MAS DAF MAKINA SANAYI A.Ş.** is not responsible for the accidents resulting from negligence.
- If you cannot find an answer to your questions in this manual, it is suggested that you contact **MAS DAF MAKINA SANAYI A.Ş.** Please inform us about the rated value and especially the serial number of the pump when you get in contact for help.
- The safety instructions in this manual cover the current national accident protection regulations. Beside all of these, an operation, work and safety measure imposed by the costumer has to be applied.

They can be used in pressurising of toxic, burnable, explosive and dangerous liquids or valuable, volatile liquids and the liquids which they must not be mixed with external substances or hot liquids (up to 300 °C).



Please contact **MAS DAF MAKINA SANAYİ A.Ş.** for liquids that have different chemical and physical specifications.

Technical specifications

Suction Flange	: DN 50-DN 100
Discharge Flange	: DN 32-DN 80
Operating Pressure	: 10 bar
Casing Test Pressure	: 14 bar
Operating Temperature	: Up to 300°C
Impeller Diameter Range	: Ø120-Ø218
Capacity	: 10-200 m ³ /h
Hm	: 4-65 m.
Speed	: 1000-3600 rpm
Maximum Power	: 18.5 kw

2.2. Performance Information

Actual performance of the pump can be obtained from the order page and/or from the test report. This information is given on the pump label. The performance curves given in the catalog are valid for water whose density and viscosity are $\rho=1 \text{ kg/dm}^3$ and $\nu=1 \text{ cst.}$ respectively. For those liquids whose densities and viscosities are different from those of water, please consult with **MAS DAF MAKINA SANAYİ A.Ş.** since the performance curves vary with density and viscosity



Do not operate the pump with a motor that has a different power except for the given catalog and label values.

The pump is not to be operated at off-design point given in the order and supplied from the firm. It is necessary to ensure that the instructions are obeyed for the safe running of the pump.

2.3. Warranty Conditions

The entire products in our selling program are warranted by **MAS DAF MAKINA SANAYİ A.Ş.**

The warranty conditions will only be valid when all the instructions about installation and start-up operations of the pump unit are taken into account.

2.4. Test

All Pumps are dispatched for sale when all the performance and pressure tests are completed. Proper assurance of material and fault-free operation of pumps whose performance tests are made is under the warranty of **MAS DAF MAKINA SANAYİ A.Ş.**

2.5. Pressure Limit



Pressure at the discharge flange must not exceed 16 Bar. A special order is necessary for applications with higher pressures.

Pressure and Temperature Limits	Pressure	Temperature
NM mDrive	10 Bar	300°C

2.6. ATEX Description

The undersigned Company certifies under its sole responsibility that the item of equipment specified below satisfies the requirements of the ATEX Directive 94/9/EC which is apply to it.

Please read cautiously all instructions emphasized with ATEX sign in this manual.

ATEX Codification

ATEX -95



Figure 1: Pump Label

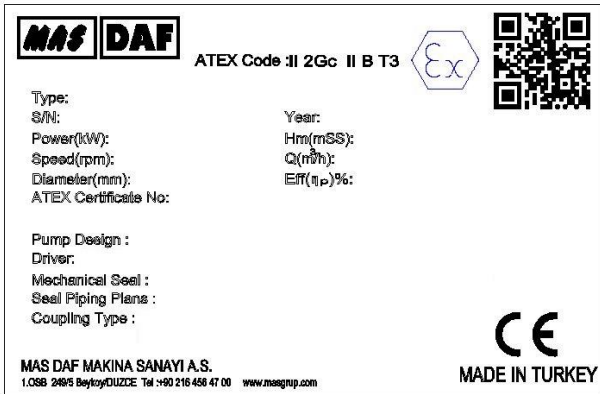
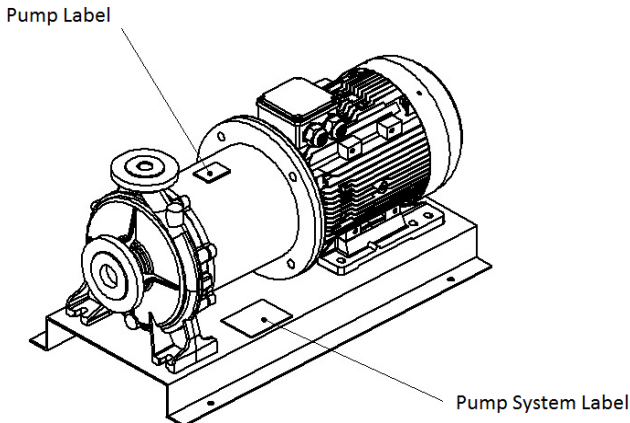


Figure 2: Pump System Label



Equipment Groups (Annex I of Directive 94/9/EC)							
Group I (mines, mine gas and dust)		Group II (other explosive atmospheres gas/dust)					
Category M 1	Category M 2	Category 1		Category 2		Category 3	
		G (gas) (Zone 0)	D (dust) (Zone 20)	G (gas) (Zone 1)	D (dust) (Zone 21)	G (gas) (Zone 2)	D (dust) (Zone 22)
For equipment providing a very high level of protection when endangered by an explosive atmosphere	For equipment providing a high level of protection when likely to be endangered by an explosive atmosphere	For equipment providing a very high level of protection when used in areas where an explosive atmosphere is very likely to occur	For equipment providing a high level of protection when used in areas where an explosive atmosphere is likely to occur	For equipment providing a normal level of protection when used in areas where an explosive atmosphere is less likely to occur			

3.2. Hazardous Conditions That May Occur When One does not Comply With the Safety Instructions

Incompliance with safety regulations may put the personnel, the environment and the machine in danger and thus may cause damages. Incompliance with safety regulations may give rise to situations listed below.

- Important operational functions of the factory may stop.
- Maintenance may get difficult.
- One may get injured by electrical, mechanical or chemical hazards.

3.3. Safety Measures for Operator

Dangerous, hot or cold components in the pump area must be covered so that one cannot touch them.

Moving components of the pump (such as coupling) must be covered so that one cannot touch them. Those covers must not be dismantled while the pump is running. Dangers that results from electrical connections must be removed. To get more information about this subject, you can refer to domestic electrical instructions.

3.4. Safety Measures for Maintenance and Installation

The costumer must assure that all maintenance, check and installment tasks are performed by qualified personnel. Repair work must only be performed while the machine is not running.

The pump and its auxiliary system must be cleaned thoroughly if it contains hazardous liquids. At the end of the repair work, all safety and protective equipment must be re-installed.

3.5. Informations about Protection against Explosion

The instructions specified intended for protection against explosion should be noted definitely during commissioning of the pump unit in environments with explosion risk.

Only pumps or pump units having related definitions and adequate suitability must be used in environments with explosion risk. The explosion protection should be noted that it is possible only with the use according to the instructions.



Limit values specified at the ATEX version pump label must not be exceeded definitely.

NOTE: If the categories are different depending on pump and motor temperatures it applies the lowest category.

Ensure that the coupling used for accouplement of motor and pump has ATEX sign.



Avoid all improper commissioning and installation in environments with explosion risk. Otherwise, the pump unit and/or the staff can be exposed to damage/injury. Consider the local explosion protection regulations and the informations at ATEX version pump label.



Check whether ATEX specification on the motor and the pump coincide with specified categories. Consider that If the categories of the pump and the motor are different it applies the lowest category.

3.6. Spare Parts Replacement

Replacement of spare parts and all modifications must be done after contacting with the manufacturer. Spare parts and accessories certified by the manufacturer are important for the safe operation of the system.

TEMPERATURE CLASS		
Temperature class required by the area classification	Ignition temperature of gas or vapor	Allowable temperature classes of equipment
T1	> 450 °C	T1 - T6
T2	> 300 °C	T2 - T6
T3	> 200 °C	T3 - T6
T4	> 135 °C	T4 - T6
T5	> 100 °C	T5 - T6
T6	> 85 °C	T6

Code	Description
II	The Usage in other non-mining explosive atmospheres
2	2. Category: High level of protection
G	For potentially explosive environments due to gases or vapors
T	Temperature class
X	ATEX Marking of the motor manufacturer

Classification explosion group of electric motors is II B.

3. SAFE OPERATING CONDITIONS

This manual contains main safety instructions for the installation, operation and maintenance. It must be read by the personnel who are responsible for installation and operation. This manual should always be kept near the installation location. It is important to comply with safety precautions stated in page 1 along with the general safety instructions as well as preventive measures repeated in other sections of this manual.

3.1. Training of Personnel

Installation, operation and maintenance personnel must have necessary knowledge in order to accomplish the given job. The responsibility, adequacies and controlling duties of such personnel must be determined by the costumer. It has to be certain that these personnel comprehend totally the content of the operating manual.

If the personnel do not have enough knowledge, required training must be given by the costumer. If training support is needed by the costumer, it will be provided by the manufacturer/seller.



Untrained personnel and unwillingness to comply with safety instructions may be risky for both machine and environment. **MAS DAF MAKINA SANAYI A.Ş.** is not responsible for this kind of damages.



Comply with EN 60079-19 and EN ISO 80079 about the repair, overhaul, reclamation and modification of equipment designed for use in explosive atmospheres.

Notice: MAS DAF MAKINA SANAYI A.Ş. is not responsible from the usage of improper spare parts.

FLUIDS	ELASTOMER T<100°	ELASTOMER T>100°	Pressure
ALCOHOLS	NBR	-	10 Bar
INDUSTRIAL OILS	NBR / VITON	VITON	
ETHYLENE GLYCOL	VITON	VITON	
ACID AT CONCENTRATION 50%	KALREZ	KALREZ	
GAS OIL	VITON / GRAPHITE/SBR	VITON / GRAPHITE	
HEAT TRANSFER OIL	NBR / VITON	VITON	
LUBRICATING OIL	NBR / VITON	VITON	
SEA WATER (CLEAN)	VITON	VITON	
SLUDGE	NBR	VITON	
SEWAGE SLUDGE (DIGESTED)	VITON	VITON	
VEGETABLE OILS	NBR / VITON	VITON	
WATER	NBR	VITON	

Table 1: Table of Liquid, Temperature, Elastomer

4. TECHNICAL INFORMATION

4.1. Design

These are single stage, single suction with a horizontal opening and a vertical discharge opening volute type (with horizontal shaft) and packless with magnetic coupling pumps. They have closed radial impellers. It complies with EN 733 and EN ISO 2858 and also as hydraulic EN ISO 9906 Class II.

4.1.1. Volute Casing

The axis of suction opening is horizontal while the axis of discharge opening is vertical and the pumps have volute type casings.

4.1.2. Locations of Flange – Flanges

Suction Flanges:	In axial direction	DN50-DN100
Discharge Flange:	Radially upward	DN32-DN80
Discharge Flange:		DIN 2533-PN 16
Suction Flanges:		DIN 2533-PN 16

4.1.3. Auxiliary Fittings

Please refer to the technical drawing of the pump for necessary auxiliary fittings.

4.1.4. Impeller

The impellers of NM mDrive type pumps are (full) radial, double-sloped (Francis type) or mixed flow types. The impellers are balanced dynamically in an electronic balance machine. The thrust (axial force) is balanced with the back wear ring and balance holes.

4.1.5. Shaft

The pumps are provided with the rigid shaft capable of supporting different loading conditions. Since the shaft diameter is highly resistant to bending and the shaft is short, pump can operate at optimal conditions for working properly.

4.1.6. Bearing and Lubrication

SiC plain bearings are used in NM mDrive series centrifugal pumps with magnetic coupling. Axial and radial loads are carried by these bearings. Lubrication of bearings is provided with the pumped liquid. The ability to work at high temperatures is provided via sintered SiC material bearings.

4.2. Construction of Pump Group

4.2.1. Drive

TEFC (Totally Enclosed Fan Cooled) 3 phase, squirrel caged, in accordance to DIN 42673, IM 1001B3 type electrical motor which complies with DIN IEC and VDE is used to drive the pump in proper speed and power.

Specifications of electrical motor;

Isolation class	: F
Protection class	: IP 54-IP 55
Frequency	: 50 Hz
Running type	: S1
Start up type	: Up to 4 kW, 3x380V (Y) More than 4 kW, 3x380V (Δ)+(Y/Δ)

4.2.2. Magnetic Coupling and Coupling Group

At NM mDrive series pumps, transfer of motor power to pump shaft is provided with magnetic coupling by being used magnetic forces without physical contact.

Magnetic coupling group consists of 3 components:

- Inner magnetic rotor
- Containment shroud
- Outer magnetic rotor

4.2.3. Base Plate

It is manufactured from U profile steel in accordance with DIN 24259.

5. TRANSPORT AND STORAGE

Suction, discharge and all auxiliary fittings must be closed during transport and storage. Dead-end covers must be removed while the pump unit is being installed.

5.1. Transport

Pump and pump group must be carried safely to the installation location by lifting equipments.



Current general lifting safety instructions must be applied. Please use a suspension system shown in figure while you are carrying and lifting the pump unit. The suspension rings may be broken because of the excessive load and may result in adamage of the pump. Prefer fabric cable for suspension.

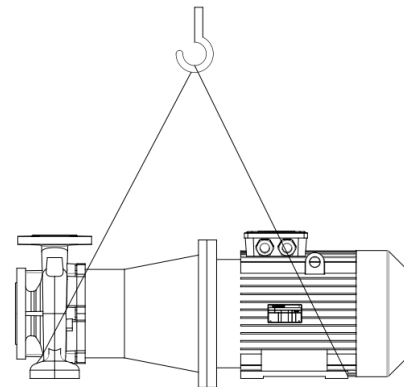


Figure 3: Transport of Pump Group



Incorrect lifting may damage the pump unit and cause injuries.

Damages caused in transport

Check the pump when it is delivered to you. Please let us know of there is any damage.

5.2.Storage



Please keep the unit clean and dry area during storage.

If the pump is out of use for a long time, please consider the instructions below.

- 1.If there is liquid inside the pump, drain it.
- 2.Clean the pump casing and impeller by jetting clean water for a short time.
- 3.Empty water inside the pump casing, suction line and discharge line.
- 4.Add small amount of antifreeze inside the pump casing if it is not possible to empty it completely. Rotate the pump shaft by hand to mix the antifreeze.
- 5.Close the suction and discharge exits with gasket
- 6.Spray an anti-corrosive into the pump casing.
- 7.Rotate the pump shaft by hand once in every month, in order to protect it from freezing and to lubricate the bearings.

6. ASSEMBLY / INSTALLATION

6.1.Installation

In our standard production, the pump and the motor have been installed in a common base plate.

6.1.1. Location of Installation

Pump shall be installed in a location where the control and the maintenance of the pump are easily made. The pump room shall be suitable for operation of lifting systems such as freight elevator, forklift, etc.

The pump group should be installed in the lowest possible location of the pumping system in order to achieve the highest suction pressure.

6.1.2. Location of Installation- Local Ambient Temperature

When the local ambient room temperature exceeds +40°C in a pumping system, suitable ventilation should be provided in order to remove the heat dissipated to the environment and supply fresh air.

6.2.Type of Connection

Type of connection depends on the design type and the size of the pump and the motor, as well as the local installation conditions. Foot-mounted horizontal pump-motor units have been installed in a common base plate.

6.3.Foundation

6.3.1. General

Base plate of the pump must be grouted. The foundation shall be of concrete or steel framework.

NOTICE: The foundation shall distribute the weight of the pumping group evenly.

6.3.2. Main Properties of the Steel Framework Bases

Foundations with steel framework shall be designed in such a way that the base plate is bolted or welded contacting to all area.



If base plate is supported from only four points, pump group will stay in the middle, causing misalignment of the coupling and increasing the noise level.

6.3.3. Foundation Properties

The foundation shall be horizontal, flat and clean and shall support all the weight.

NOTICE: Reinforced concrete bases are constructed from standard concrete with at least B 25 resistance class.

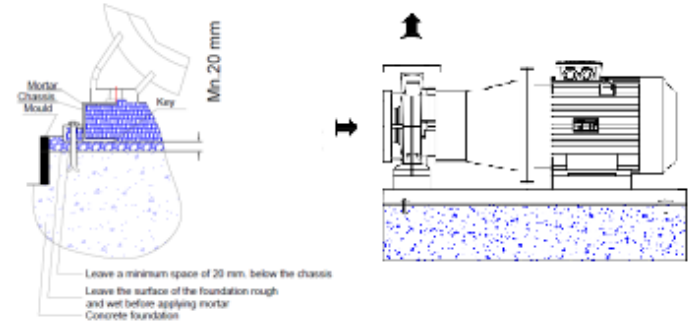


Figure 4: A Typical Concrete Foundation

6.3.4. Fixing (Securing) of Pump Group

After the alignment of the pump group on the foundation has been made, the mutual securing bolt screws should be used alternately to fix the pump group. All of the area of the base plate should be filled with gout as much as possible.

NOTICE: While securing pump group with the mortar bonding agents and molding, one has to make sure that the base plate contacts completely with the base with no cavities between the surfaces. Inside of the chassis (frame) should be completely filled with concrete

6.4. Coupling Group Alignment

6.4.1. General

For a proper operation of a pump group, a good alignment of the coupling is necessary. Overload and performance lose problems can be attributed to the wrong positioning of outer magnetic rotor.

6.4.2. Method of Coupling Alignment

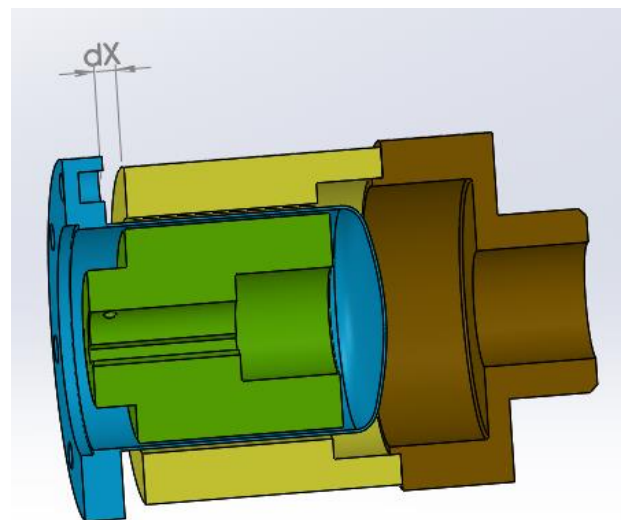


Figure 5: Distance of Coupling Group Alignment

In order to provide optimum torque transfer, dX dimension must be within specified tolerance values. In case of failure of dX dimension please consult to **MAS DAF Makine Sanayi A.Ş.**

6.5. Piping

6.5.1. General

- Do not use the pump as the hinged support for the piping system.
- Put enough supports under the piping system in order to carry the weight of the pipe and fittings.
- Avoid piping system loads on pump by installing flexible components (compensator) to suction and discharge of the pump.
- By mounting flexible supporting items, take into consideration the fact that these items may elongate under the pressure.
- Suction pipe shall be in a constantly increasing slope to the pump. Air in the suction pipe shall be arranged to move into the pump
- Discharge piping shall be in a constantly increasing slope to the reservoir or discharge point, without up and downs which can cause air pockets in the piping system. At locations where forming of air pockets is possible, special items like air valve and air cock are mounted to evacuate the trapped air.
- It is important that pipe diameter and fittings are at least as much as the pump opening diameter or preferable one or two size higher. One should never use fittings with smaller diameters than the pump exit diameter. In particular, preferred fittings like foot valve, strainer, filter, check valves and valves shall have large free passing area, and low friction loss coefficient.
- For piping systems with hot liquids, thermal expansions are to be taken into account and compensators shall be mounted in accordance with these expansions. Caution shall be exercised to avoid the loading of pump in this installation.



Be careful against loading out of permitted values at the pump nozzles. Leakage of flammable, corrosive, toxic or hot liquids may have a risk of death. Take into consideration forces and moments at the pump flanges.

6.5.2. Specification of Work in Piping Installation



In installation of pipes, follow the procedures below certainly.

- Install the pump on the concrete base as illustrated in Figure 3.
- Take out the guards (placed by the manufacturer) from suction and discharge openings of the pump.
- Close the suction and discharge flanges with rubber gaskets. This precaution is important to avoid the undesired substances (weld crust, weld slag, sand, stone, wood piece etc.) get into the pump. Do not take off this gasket until the installation is completed.
- Start the installation of piping from the pump side. Do the necessary assembling and welding of the parts in a successive order.
- In these operations, do not neglect to put the necessary supports in their respected locations.
- Following above procedure, complete all piping system at suction side up to the suction tank (or foot valve if available), at discharge side up to do discharge collector and discharge pipe.
- When all installation and welding process is done and the heat dissipated by welding is removed, dismantle all the bolted connections from the suction tank to discharge pipe. Take out all demountable parts.
- Clean these parts and then paint body coat completely inside and outside.
- Mount the parts again in their intended places. However, this time start from the discharge line and move downward to the pump. In this instance, do not forget to check the flange gaskets. If needed, (for example deformation during welding) replace them.
- Concerning the connection of the pump flanges to piping, in case of misalignment of axis and flange holes, do not force the system to eliminate the misalignment. Forcing the system may cause difficult-to-correct problems.
- If there is an axial misalignment between the flanges of the pump and the pipe, due to the welding or any other reasons, cut the pipe from a suitable location in order to fix the problem. Connect the pipe (pump side) to the pump. After carrying out the necessary correction, connect the parts again by welding.

- Dismantle and clean the last welded part. Repaint again and mount on its place.
- After all these processes are accomplished, remove the rubber gasket from the suction and discharge openings. Open their holes and mount them again on their intended place.

6.5.3. Specification of Work after Installation of Piping and Piping System

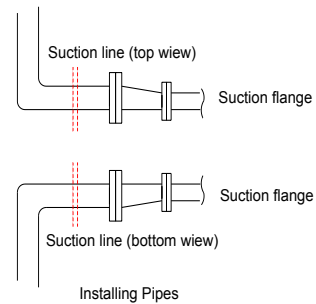


Figure 6: Piping System

An illustrative piping system is shown in Figure 20. Appropriate manometers shall be mounted on suction and discharge pipe lines.



Complete the auxiliary pipe connections in piping system if exist (cooling to bearing housing, and stuffing box (seal), relief pipe, oil pipe etc.)

6.6. Motor Connection

Motor shall be connected by an electrical technician according to the connection (switch) diagram. Local electricity policies regulations have to be applied.



- Electrical connections have to be made by authorized electricians.
- In dismantling the pump, make sure the electricity is cut off before taking the motor cover out.
- Use the appropriate electrical connection to the motor.

In environments where there is a risk of explosion, prescribed protective law and regulations shall be applied by competent authorities.

Connection points of the cable ends must be away from environment with explosion risk or provide allowable conditions for II 2G device category.



Never operate pump units not connected electrical cable connections correctly.

6.6.1. Motor Connection Diagram

Motors requiring high moments at start up shall not be connected star-delta
 Frequency controlled motors, require high moment at start up and have to be cooled properly at low speeds. Provide the necessary cooling for the motors.

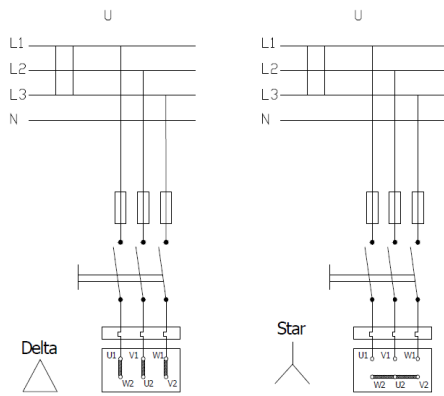


Figure 7: Electric Connection Diagram

Electrical circuit	Motor	
U (Volt)	230/400 V	400 V
3 x 230 V	Delta	
3 x 400 V	Star	Delta

6.6.2. Motor Protection

- Three phased-motor shall be connected to power supply.
- Wait the motor to cool down when thermic protected motor breaks in circuit due to the overheating. Make sure the motor does not start automatically until it cools completely
- In order to protect the motor from overcharging and short circuit use a thermic or thermic-magnetic relay. Adjust this relay to the nominal current of the motor.



Electrical equipments, terminals and the components of the control systems may carry electric current even though they are not operating. They may cause deadly and serious injuries or irreparable material damages.

TABLE OF GROUNDING CABLE SECTION	
MOTOR PHASE SECTION	EQUIPOTENTIAL CABLE SECTION
Min = 4mm ²	
S ≤ 16mm ²	S
16 < S ≤ 35	16
35 < S	S/2

Table 2: Table of Grounding Cable Section

7. COMMISSIONING, START UP AND OPERATING

7.1.Preparations Before Start Up

At NM mDrive series pumps, plain bearings lubricated with pumped liquid are used. Thanks to these bearings, there is no need for a lubrications.

- Check the magnetic coupling as shown section 6.4.
- Make sure that the pump and the suction pipe is completely filled with water before the starting. If the pump operates on a positive suction head, no problem will be encountered. Suction valve is opened and air drains are un-tightened.
- Pumps with foot valve are filled with water by opening the pump filling tap or, one takes advantage of the water accumulated in the discharge pipe and by using a small valve the check valve is bypassed and the pump is filled.
- In vacuum pump driven pumps, by operating the vacuum pump one achieves to fill the pump via increasing the water level in the suction pipe.

CAUTION

Do not start your pump dry (WITHOUT WATER).

7.2. Checking The Direction of Rotation

CAUTION

- The direction of rotation is indicated on the pump label with an arrow. Apart from special cases, it is clockwise direction when looking from the motor end. Observe if the pump is rotating in the expected sense by starting the motor for a very short instant. If it is turning in the opposite sense, interchange any of two motor leads.
- If the motor connection is delta, open the discharge valve slowly.
- If the motor connection is star-delta, set the time relay to maximum 5 seconds. Monitor the passage from star to delta by pressing the start button. As soon as you are assured that the connection is delta, open the discharge valve slowly. Continue opening the valve until you read the amperage on the electrical panel
- **One should always check the labels which show the direction of rotation and the direction of fluid flow. If you dismount the coupling protection to monitor the direction of rotation, do not restart the engine before remounting the protection.**



As a result of getting in touch with rotating and stable parts each other temperature increase can occur. Never check the direction of rotation while the pump is dry.

7.3. Start up Procedure

- Check if the suction valve is open and the discharge valve is closed. Start the motor
- Wait until the motor reaches sufficient speed. (In Star-delta connections, wait until the engine passes to delta connection.)
- Keeping an eye on the amperage shown on the panel, open the discharge valve slowly.
- In the primary operation, if the discharge pipe is empty, do not open the valve completely. By keeping an eye on the amperage, open the valve with care regarding that it should not exceed the value indicated on pump's label.
- After opening the valve completely, check the pressure from the pump exit manometer and make sure that this value is the pump operating pressure value and is indicated on pump's label.
- If the value one reads is less than the pump label value when the valve is completely open, it means that the height is miscalculated. Increase the value by narrowing the valve and bring it to pump's label value.
- If the value one reads is greater than the pump label value when the valve is completely open, it means that the height is calculated less than what it should be in reality. The device is pumping less than what is requested. Check the installation and the calculations.
- **Minimum flow rate:** If the pump is working with zero flow rates (closed valve) from time to time during its operation, the water inside the pump may endanger the pump by getting warmed up. In such cases, a minimum flow valve must be connected to the pump exit.

CAUTION

Stop the motor if the pump gets too hot. Wait until it gets cold. Then start the system up again carefully.

7.4. Shut Down Procedure

CAUTION

During sudden start ups and stops, a pressure reducing valve must be placed at the exit section of high flow rate pumps whose discharge pipelines are long, in order to reduce water hammer effect. Water hammer may explode the pump.

In normal conditions (apart from sudden power shut down, etc), stop the pump as below:

- Close the discharge valve slowly
- Switch the power off, stop the motor. Notice that the rotor slows down.
- Do not start up the motor at least before 1 to 2 minutes.
- If the pump will be out of use for a long time, close the suction valve and auxiliary circuits. If the pump is outside and if there exists a danger of frost, remove all drain taps and empty all the water inside the pump. (5.2. Storage)



If the pump is outside and if there exists a danger of frost, remove all drain taps and empty all the water inside the pump.

8. MAINTENANCE



Maintenance operations must be done by authorized personnel with protective clothing only. The personnel must also beware of high temperatures and harmful and/or caustic liquids. Make sure that the personnel read carefully the manual.

- The instructions in Safety Precautions must be executed during maintenance and repair
- Continuous monitoring and maintenance will increase the engine's and pump's lives.

The instructions below should be applied.

8.1. The Checks During the Operation

- Pump must never be operated without water.
- Pump must not be operated for a long time with the discharge valve closed (zero capacity).
- Precautions must be taken against flare up when the component temperatures are over 60°C. "Hot Surface" warnings must be placed over necessary areas.
- All the auxiliary systems must be in use while the pump is operating.
- If there is a noise, stop the motor and check synchronization between inner and outer magnetic rotors and group of plain bearing.
- If the system consists of a substitute pump, keep it ready by operating it once a week. Check also the auxiliary systems of the substitute pump.



Occuring explosive ambient inside of the pump must be prevent. The air of the pump and suction line must be drained before commissioning of the pump. The interior of the pump contacting with pumped liquid including gasket way and auxiliary systems must be filled with pumped liquid.

- Ensure that delivery pressure is enough.
- Exceeded the allowable using limits regarding pressure, temperature, transportating material and motor speed may cause explosion risk, hot and poison liquid may leak to external environment.
- Do not operate the pump at values above pressure, temperature or motor speed values specified by manufacturer, never use improper liquids with the pump.

8.1.1. Component Check



To make possible the visual control, one must be able to reach the pump from any direction. Especially, to be able to dismount the internal units of

the pump and the engine, sufficient free space must be created around them for maintenance and repair. Furthermore, one must make sure that the piping system can easily be dismounted.

8.1.2. Bearing and Lubrication

At NM mDrive series pumps with magnetic coupling, SiC material plain bearings lubricated with pumped liquid are used and they do not require maintenance and lubrication.

8.1.3. Coupling

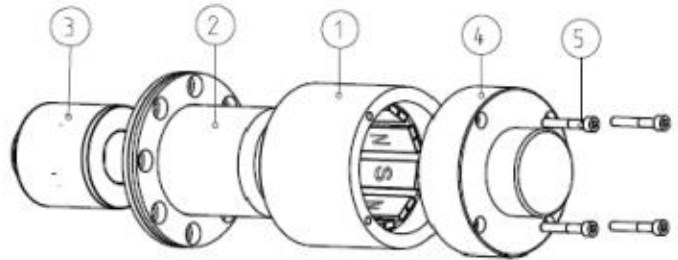


Figure 8: Structure of Magnetic Coupling

1. Outer Magnetic Rotor
2. Containment Shroud
3. Inner Magnetic Rotor
4. Motor Connection Part
5. Setscrew



Coupling alignment must check frequently as specified section 6.4.



Ensure that there are no magnetic components, electronic devices, instruments etc. in the area of the magnetic coupling. They can be affect magnetic coupling. Uncontrolled magnetic forces between magnetic components can cause injuries and damages.

8.1.4. Drive

Apply to the operating instructions of the motor manufacturer.

8.1.5. Auxiliary Components

Check regularly the fittings and the gaskets, replace the worn out pieces.

8.2. Maintenance Instructions in ATEX Version Pumps



- Consider the local safety instructions and ATEX version pump label specifications.
- During maintenance or repair by taking sparking into consideration, maintain or repair in environments where there is no a possibility of ignition.
- As a result of maintaining deficiently and / or faultily the pump may be damaged and explosion risk may occur. Maintain the pump or the pump unit regularly.
- Carry out maintenance the shaft sealing components properly and regularly. Hot or toxic pumped liquid may leak from the sealing components not maintained regularly. In this case, the damage to the pump, fire and explosion hazards are the likely consequences.
- Fire or explosion hazards may occur as a result of overheating in bearing housings or faulty bearing housing gaskets. Because of that, check the level of lubrication element and periods of lubrication regularly. Check the sounds come from the bearings during the running regularly.

8.3. Service

Our Customer Service Department offers after-sale service. Manager should employ authorized and trained personnel for mounting/dismounting procedures. Before these procedures, one must make sure that pump interior is clean and empty.

This criterion is also valid for the pumps which are sent to our factory or to our service points.



Maintain the safety of the personnel and the environment in every field procedure.

8.4. Spare Parts

The spare parts of NM mDrive type pumps are guaranteed for 10 years by **MAS DAF MAKINA SANAYI A.Ş.**

In your spare parts requests, please indicate the below listed values that are indicated on your pump's label.

- Pump type and size:**
- Motor power and speed:**
- Pump serial number:**
- Capacity and head:**

If you wish to keep spare parts in store, depending on the number of same type of pumps, for two operation years, the quantities which are listed in the table below are recommended.

Component Name	The Number of Equivalent Pumps in the Installation						
	1-2	3	4	5	6-7	8-9	10+
Shaft (Wedge included) (quantity)	1	1	2	2	2	3	%30
Impeller (quantity)	1	1	1	2	2	3	%30
O-Ring for casting (kit+1)	1	1	1	2	2	3	%40
O-Ring for shaft (if exist) (kit)	1	1	2	2	3	4	%50

Table 3: Spare PartList

9. NOISE LEVEL AND VIBRATION

The reasons which increase the noise level are indicated below:

- Touch of coupling halves due to worn rubber sleeves (incorrectly aligned)
- Noise level increases due to the fact that the pump is not founded properly (Vibration)
- If the installation does not have compensator noise and vibration increases.
- Wearing in ball bearing also increases noise level.



Check if there is any noise increasing elements in your installation.

9.1. Expected Noise Values

Measurement conditions:

- The distance between the measure point and the pump : 1m
- Operation : Without Cavitation
- Motor : IEC Standard Motor
- Tolerance : ±3 dB

Power of Motor PN [kW]	Sound Pressure Level (dB) *	
	Pumpwith Motor	
	1450 rpm/min	2900 rpm/min
<0,55	63	64
0,75	63	67
1,1	65	67
1,5	66	70
2,2	68	71
3	70	74

4	71	75
5,5	72	83
7,5	73	83
11	74	84
15	75	85
18,5	76	85
22	77	85
30	80	93
37	80	93
45	80	93
55	82	95
75	83	95
90	85	95

Table 4: Sound Pressure Level

(*) Without protective sound hood, measured at a distance of 1 m directly above the driven pump, in a freespace above a sound reflecting surface.

The above values are maximum values. The surface noise pressure level at dB(A) unit is shown as (L_{pA}). This complies withTS EN ISO 20361.

10. DISASSEMBLY, REPAIR AND REASSEMBLY



Before starting work on the pump set, make sure it is disconnected from the mains and can not be switched on accidentally.

Before starting;

- ✓ Wear protective clothes and use mask for your safety if necessary.
- ✓ Take into consideration all local regulations while dangerous, harmful liquids are being carried

Follow the safety precautions outlined in "Safety instructions".

10.1. Disassembly

- Close all valves in the suction and discharge lines, drain the pump by the drain plug.
- Remove coupling guard and other safety guards.

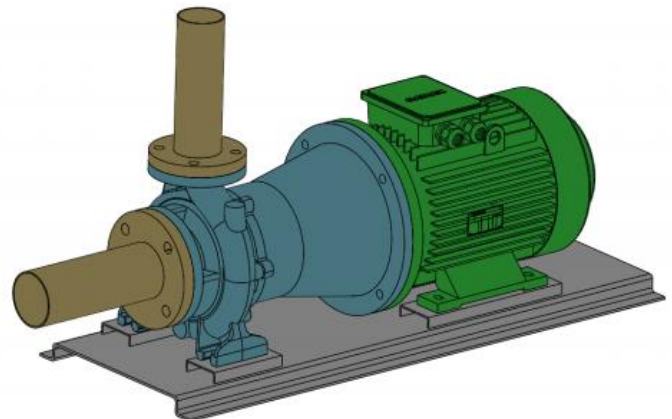


Figure 9- Disassembly - 1

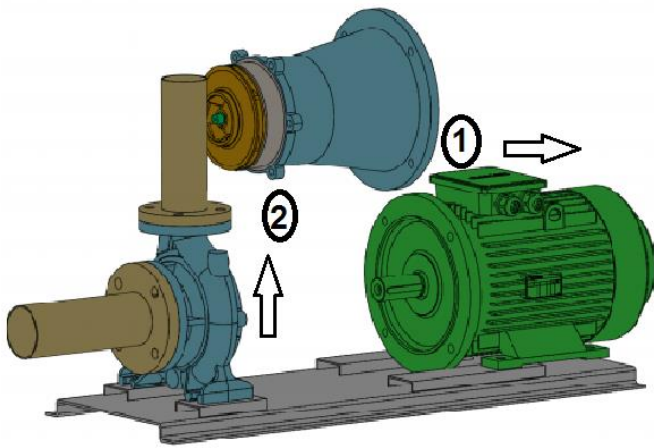


Figure 10: Disassembly – 2

- Thanks to “Back Pull Out Design”; the impeller, shaft and other rotating parts being removable no need to disconnect the suction and delivery pipes.
- If to take out the complete pump is necessary, disconnect pump from the driver, suction and discharge pipes and detach the baseplate.

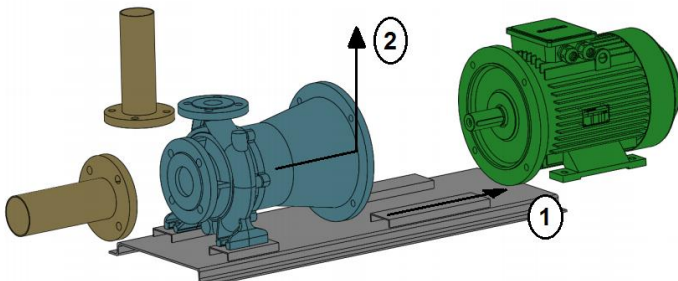


Figure 11: Disassembly – 3

- After dismantling the motor, dismantle outer magnetic rotor connected by key and setscrew to motor shaft.
- Disconnect the adapter from the volute casing.

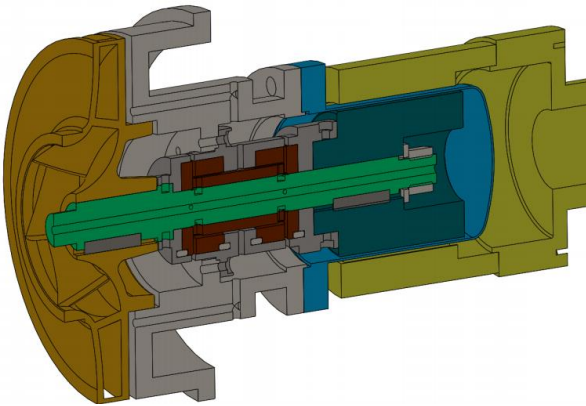


Figure 12: Disassembly -4

- Disconnect the containment shroud from the bearing housing.
- Disconnect bearing adjustment nut. By removing the inner magnetic rotor key, take out the inner magnetic rotor.

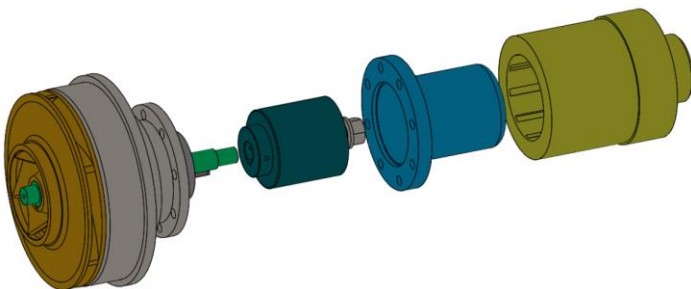


Figure 13: Disassembly -5

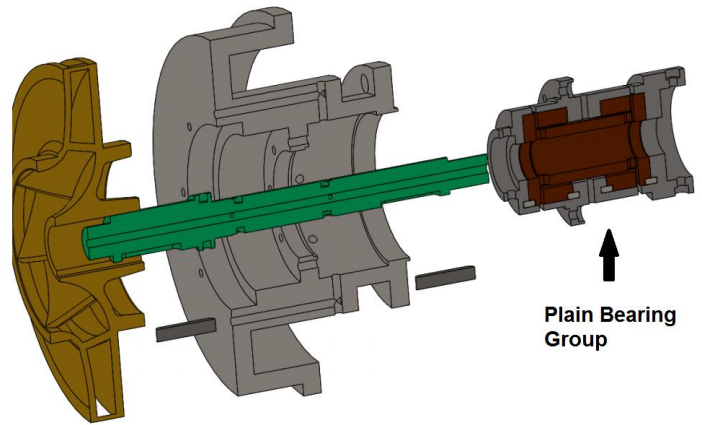


Figure 14: Disassembly -6

- Remove the SiC plain bearing group from the bearing housing.
- Unscrew the impeller end nut and take out the impeller and impeller key. Use rust remover solvent during dismantling if necessary.

10.2. Checks Before Assembling

- Check the mounting surfaces which are unsecured or can not support the loads. Because of these, injuries and damages may occur.
- The mounting surface must be completely horizontal and even.
- Check the structural requirements. All structural work required must have been prepared in accordance with the dimensions stated in the outline drawings.

10.3. Reassembly

- Reassembly proceeds in reverse sequence to disassembly as described in section 10.1. You may find the attached drawings useful.
- Coat the seats and screw connections with graphite, silicon or similar slippery substance before reassembly. If you can not find any of the above you may use oil instead (except the pumps for drinking water).
- Never use the old gaskets, make sure the new gaskets and o-rings are the same size as the old ones.
- Start mounting from the bearings. Place plain bearing group to bearing housing.
- Replace impeller key and pump impellers. Tighten the impeller nuts.
- Replace the inner magnetic rotor. Place their key. Place bearing adjustment nut and tighten it.
- Mount the containment shroud to bearing housing by setscrews.
- Connect adapter to volute casing.

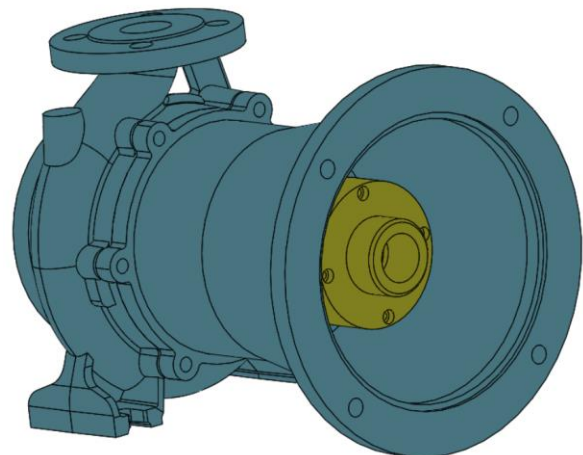


Figure 15: Assembly – 1

- Mount the outer magnetic rotor to motor shaft, place their key and tighten the setscrews.
- Now reassembly of the rotor group is completed.
- Finally mount rotor assembly to the volute casing. (In the repair shop or on site.)

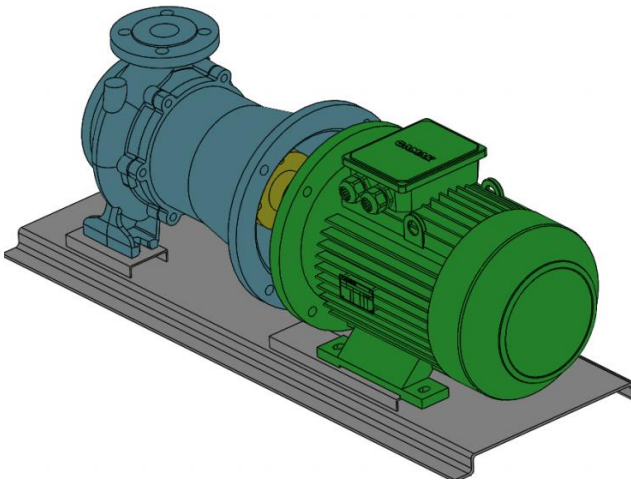


Figure 16: Assembly – 2

- Place the pump on the base plate, couple the motor. Connect suction and discharge pipes as well as auxiliary pipes. Take the unit into operation as it was indicated in section 7.



If flammable, explosive etc. liquids are pumping, improper installations may cause explosive atmospheres so personnel injuries or damages can occur. Comply with the applicable local explosion protection regulations. Observe the information in the data sheets and on pump and motor labels.



Check whether the faces contacting with another faces are damaged for avoiding explosion before reassembling of the motor. The parts having deformed faces must be replaced. Ensure that the rotating parts are fitted with the guards.

- Make sure the gaskets and o-rings are evenly placed without sliding and not damaged or not squeezed at all.

11. POSSIBLE FAILURES, CAUSES, SOLUTIONS

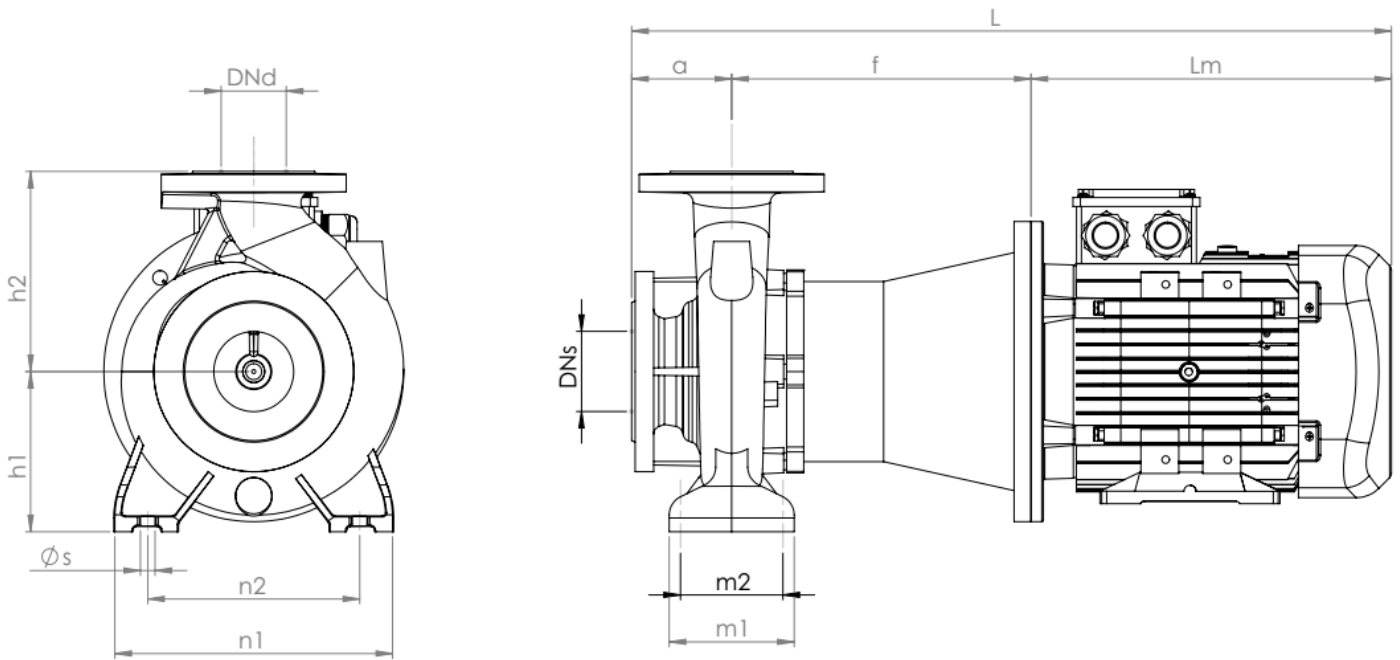
Possible failures and solution strategies are listed in the table below. Please apply to the Customers' Service Department of our company when a generic solution is not found to your problem.



While the failures are repaired the pump must always be dry and un-pressurized.

POSSIBLE FAILURE	CAUSES	SOLUTIONS
The pump delivers insufficient capacity	<ul style="list-style-type: none"> Discharge head too high Very high counter pressure Pump and/or pipe cannot discharge air, cannot suck Occurrence of air pockets inside the pipe NPSH is too low 	<ul style="list-style-type: none"> Readjust the operating point See if there is any undesired material inside the pipe Vent completely the pump and the pipe Change the piping configuration Increase the liquid level
Motor overload	<ul style="list-style-type: none"> System pressure is lower than the requested pressure level Speed too high Liquid pumped of different specific gravity and viscosity than that for which pump is rated Engine works at two phases 	<ul style="list-style-type: none"> Adjust the operating pressure to the label value Decrease the speed Increase the engine power Replace the fuse and control the electrical connections
Pump head is too high	<ul style="list-style-type: none"> System pressure is higher than the requested pressure level 	<ul style="list-style-type: none"> Set the operating pressure to the label value.
Bearing temperatures are high	<ul style="list-style-type: none"> Worn out coupling Too much, too little or improper lubrication Increase in axial forcing 	<ul style="list-style-type: none"> Replace the coupling Change the oil, decrease or increase its quantity Clean the balance holes on the impeller disc
Excessive leakage from the stuffing box	<ul style="list-style-type: none"> Worn out gland Loose gland 	<ul style="list-style-type: none"> Use brand new gland Change the stuffing bush Tighten the gland nuts
Noisy operation	<ul style="list-style-type: none"> Worn out motor or pump ball bearings Cavitation Worn out or misaligned coupling Operation in the far left or right of the performance curve 	<ul style="list-style-type: none"> Replace Close the delivery partially in order to reduce the capacity. Replace the coupling or align it Operate the pump at its label setting
Excessive increase in pump temperature	<ul style="list-style-type: none"> Pump and/or pipe can neither discharge, nor aspirate air Too low capacity 	<ul style="list-style-type: none"> Bleed completely the pump and the pipe Open more the valve
Vibration	<ul style="list-style-type: none"> Pump and/or pipe can neither discharge, nor aspirate air NPSH is too low Internal components of the pump are worn out System pressure is lower than the requested pressure level Coupling is misaligned Too much, too little or improper lubrication Rotor unbalanced Improper bearings 	<ul style="list-style-type: none"> Bleed completely the pump and the pipe Increase the liquid level Replace the worn out components Adjust the operating pressure to the label value Align the coupling In case of continuous overload, decrease the impeller diameter Change the oil, decrease or increase its quantity Balance the impeller again Use new bearings

Table 5: Possible Failures, Causes, Solutions

12. PUMP DIMENSIONS TABLE

Figure 17: NM mDrive Pump Dimensions Figure

PUMP TYPE	MOTOR			FLANGES		GENERAL	PUMP										
	KW	IEC	Lm mm	DNd mm	DNs mm	L mm	a mm	f mm	h1 mm	h2 mm	n1 mm	n2 mm	m1 mm	m2 mm	s mm		
32-160	1450 rpm	0.55	80	243.5	32	50	597.5	80	274	132	160	240	190	100	70	12	
		0.75	80	243.5			597.5		274								
	2900 rpm	1.5	90L	266.5	32	50	626	80	279.5	132	160	240	190	100	70	12	
		2.2	90L	266.5			626		279.5								
		3	100L	292			656.5		284.5								
4	112M	335.5	700	284.5													
5.5	132S	360.5	750	309.5													
32-200	1450 rpm	0.55	80	243.5	32	50	597.5	80	274	160	180	240	190	100	70	12	
		0.75	80	243.5			597.5		274								
		1.1	90L	266.5			626		279.5								
		1.5	90L	266.5			626		279.5								
	2900 rpm	4	112M	335.5	32	50	700	80	284.5	160	180	240	190	100	70	12	
		5.5	132S	360.5			735.5		295								
		7.5	132M	395.5			770.5		295								
		11	160M	666			475		345								
40-160	1450 rpm	0.55	80	243.5	40	65	597.5	80	274	132	160	240	190	100	70	12	
		0.75	80	243.5			597.5		274								
	2900 rpm	3	100L	292	40	65	656.5	80	284.5	132	160	240	190	100	70	12	
		4	112M	335.5			700		284.5								
		5.5	132S	360.5			750		309.5								
		7.5	132M	395.5			785		309.5								
	40-200	1450 rpm	0.55	80	243.5	40	65	617.5	100	274	160	180	265	212	100	70	12
			0.75	80	243.5			617.5		274							
1.1			90L	266.5	646			279.5									
1.5			90L	266.5	646			279.5									
2900 rpm		5.5	132S	360.5	40	65	755.5	100	295	160	180	265	212	100	70	12	
		7.5	132M	395.5			790.5		295								
		11	160M	666			1111		345								
		15	160L	666			1111		345								

50-160	1450 rpm	0.75	80	243.5	50	65	617.5	100	274	160	180	265	212	100	70	12	
		1.1	90L	266.5			646		279.5								
		1.5	90L	266.5			646		279.5								
	2900 rpm	4	112M	335.5	50	65	720	100	284.5	160	180	265	212	100	70	12	
		5.5	132S	360.5			770		309.5								
		7.5	132M	395.5			805		309.5								
		11	160M	666			1111		345								
	50-200	1450 rpm	1.1	90L	266.5	50	65	646	100	279.5	160	200	265	212	100	70	12
			1.5	90L	266.5			646		279.5							
2.2			100L	292	676.5			284.5									
2900 rpm		7.5	132M	395.5	50	65	790.5	100	295	160	200	265	212	100	70	12	
		11	160M	666			1111		345								
		15	160L	666			1111		345								
		18.5	160L	666			1111		345								
65-160		1450 rpm	0.75	80	243.5	65	80	618.5	100	275	160	200	280	212	125	95	12
			1.1	90L	266.5			646.5		280							
	1.5		90L	266.5	646.5			280									
	2.2		100L	292	677			285									
	2900 rpm	5.5	132M	395.5	65	80	795	100	299.5	160	200	280	212	125	95	12	
		7.5	132M	395.5			795		299.5								
		11	160M	666			1106		340								
		15	160L	666			1106		340								
	18.5	160L	666	1106	340												
65-200	1450 rpm	2.2	100L	292	65	80	679.5	100	287.5	180	225	320	250	125	95	12	
		3	100L	292			679.5		287.5								
		4	112M	335.5			723		287.5								
65-250	1450 rpm	5,5	132S	360	65	80	820	100	359.5	200	250	357	280	160	116	16	
80-160	1450 rpm	1.1	90L	266.5	80	100	671.5	125	280	180	225	320	250	125	95	12	
		1.5	90L	266.5			671.5		280								
		2.2	100L	292			702		285								
		3	100L	292			702		285								
	2900 rpm	7.5	132M	395.5	80	100	820	125	299.5	180	225	320	250	125	95	12	
		11	160M	666			1131		340								
		15	160L	666			1131		340								
		18.5	160L	666			1131		340								
	80-250	1450 rpm	5,5	132S	360	80	100	845	125	359.5	200	280	397	315	160	116	16

Table 6: NM mDrive Pump Dimensions Table

13. TIGHTENING TORQUES

THREAD DIAMETER	TIGHTENING TORQUE MAX (Nm)	
	Property Classes	
	8.8	10.9
M4	3.0	4.4
M5	5.9	8.7
M6	10	15
M8	25	36
M10	49	72
M12	85	125
M14	135	200
M16	210	310
M18	300	430
M20	425	610
M22	580	820
M24	730	1050
M27	1100	1550
M30	1450	2100
M33	1970	2770
M36	2530	3560

Table 7: Tightening Torques Table

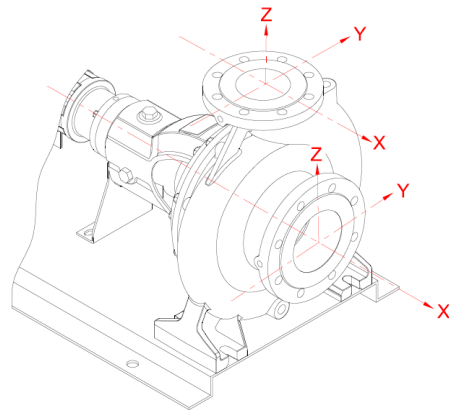
14. FORCES AND MOMENTS AT THE PUMP FLANGES

All of the applied load sif not reached the maximum allowable value, to provide that the following additional conditions, one of these loads may exceed the normal limit:

- Any component of a force or a moment, must be limited 1.4 times of the maximum allowable value,
- The actual force sand moments acting on each flange, should provide the following formula:

$$\left(\frac{\sum |F|_{\text{actual}}}{\sum |F|_{\text{maximum allowable}}} \right)^2 + \left(\frac{\sum |M|_{\text{actual}}}{\sum |M|_{\text{maximum allowable}}} \right)^2 \leq 2$$

In here, $\sum |F|$ and $\sum |M|$ are arithmetic sum of the loads for each flange at the pump level, without regard of the algebraic signs of the actual and maximum allowable values.



PUMP TYPE	FORCES								MOMENTS					
	DN FLANGE		SUCTION FLANGE			DISCHARGE FLANGE			SUCTION FLANGE			DISCHARGE FLANGE		
	SS	DS	N			N			Nm			Nm		
			F _y	F _z	F _x	F _y	F _z	F _x	M _y	M _z	M _x	M _y	M _z	M _x
NM mDrive 32-160	50	32	500	450	550	283	350	300	333	383	467	250	283	367
NM mDrive 32-200	50	32	500	450	550	283	350	300	333	383	467	250	283	367
NM mDrive 40-160	65	40	617	567	700	333	417	367	367	400	500	300	350	433
NM mDrive 40-200	65	40	617	567	700	333	417	367	367	400	500	300	350	433
NM mDrive 50-160	65	50	617	567	700	450	550	500	367	400	500	333	383	467
NM mDrive 50-200	65	50	617	567	700	450	550	500	367	400	500	333	383	467
NM mDrive 65-160	80	65	750	683	833	567	700	617	383	433	533	367	400	500
NM mDrive 65-200	80	65	750	683	833	567	700	617	383	433	533	367	400	500
NM mDrive 65-250	80	65	750	683	833	567	700	617	383	433	533	367	400	500
NM mDrive 80-160	100	80	1000	900	1117	683	833	750	383	433	533	383	433	533
NM mDrive 80-250	100	80	1000	900	1117	683	833	750	383	433	533	383	433	533

Table 8: Forces and Moments at The Pump Flanges

Forces at the pump flanges were calculated according to TS EN ISO 9906 standard. The calculations are valid for the materials of cast iron and bronze. Forces and moments at the flanges that made of stainless material will be approximately twice as moments in the table.

15. SAMPLE PLUMBING

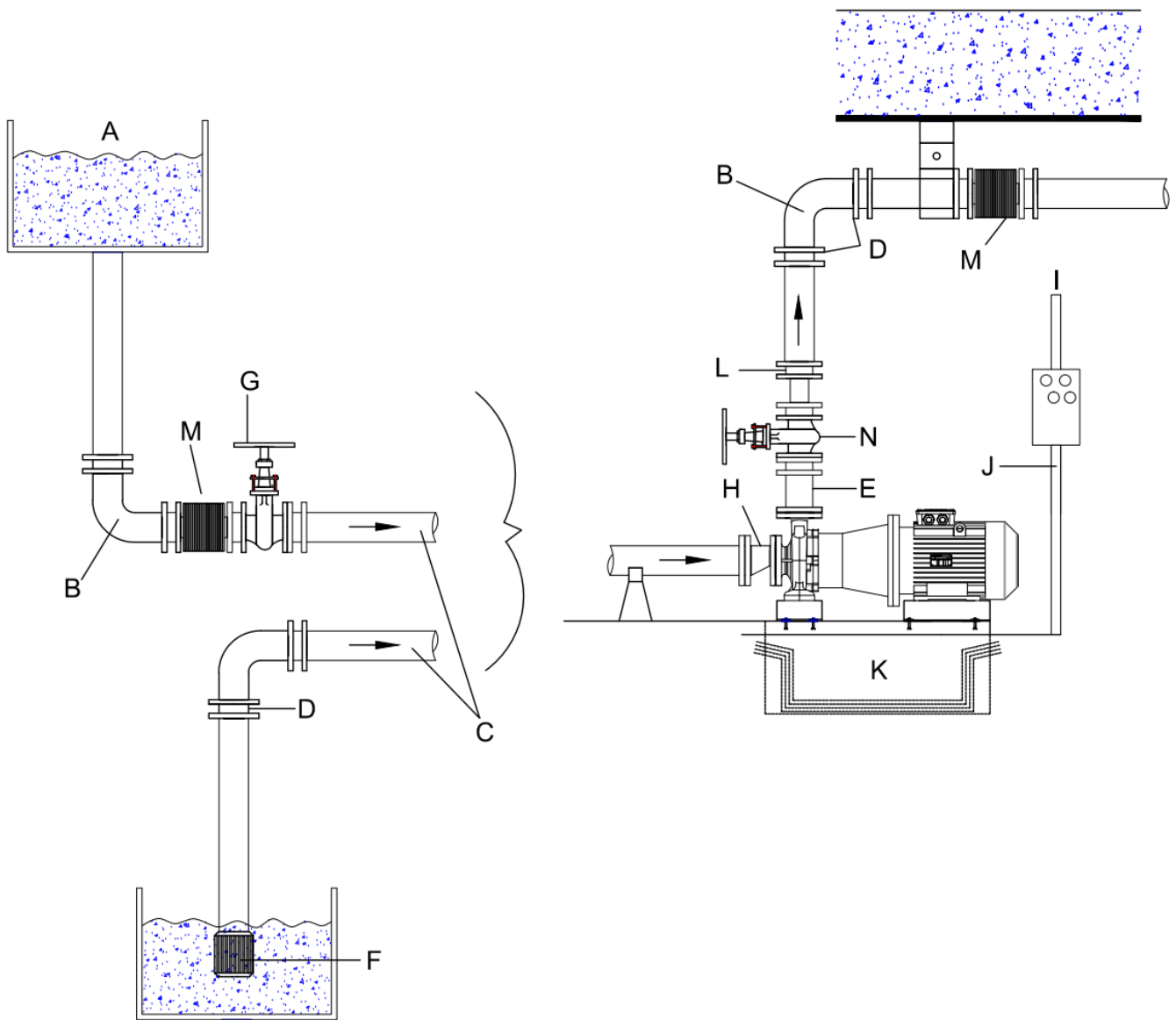
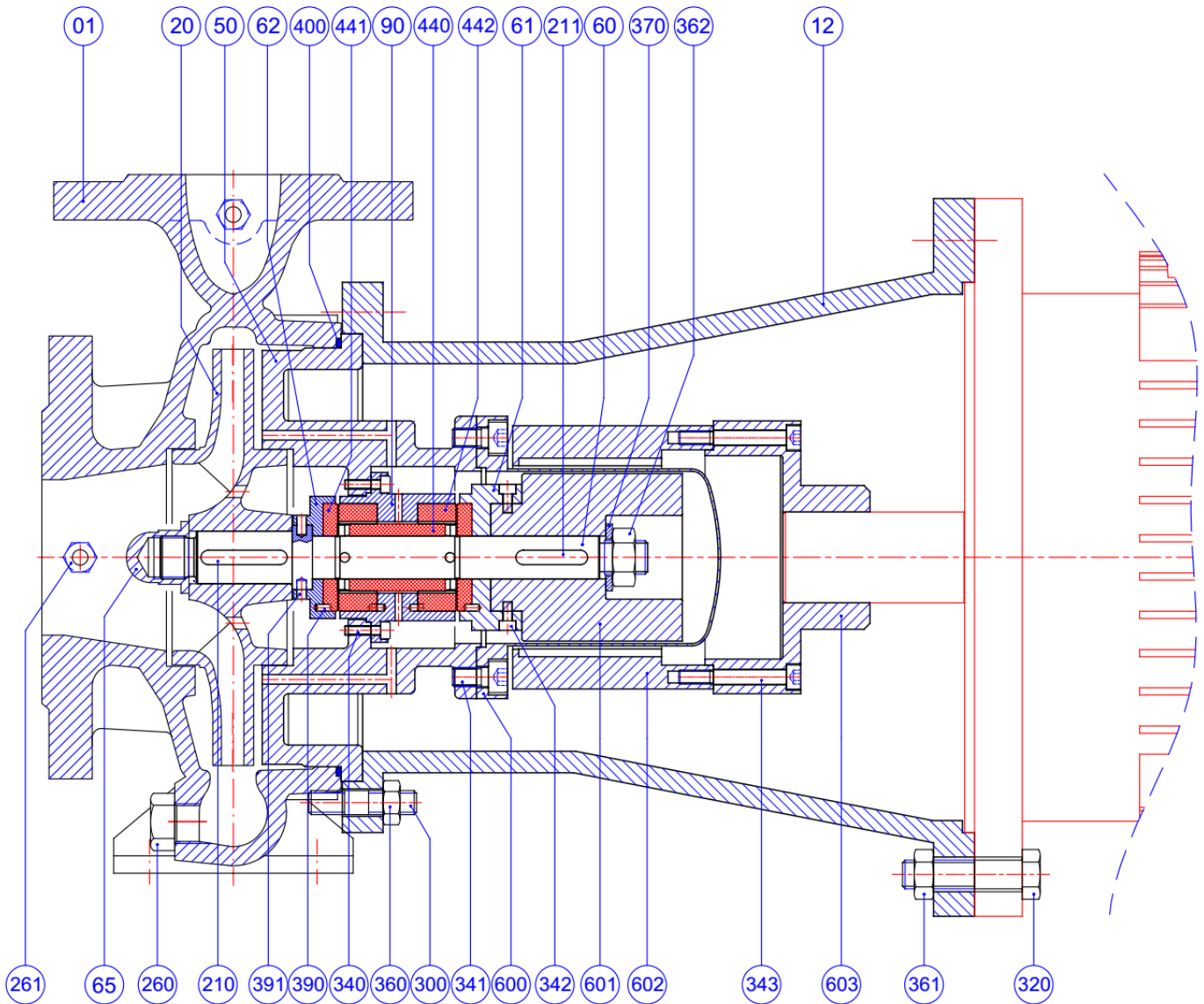


Figure 18: Sample Plumbing

- A. Tank
- B. Long radius elbow
- C. Minimum slope is 2 cm/m
- D. Fittings, flanges etc.
- E. Non-return valve
- F. Foot valve
- G. Suction valve
- H. Reducer
- I. Discharge valve
- J. Electrical connection
- K. Insulated cable
- L. Concrete foundation
- M. Compensator

16. NM mDrive SECTIONAL DRAWING AND PARTS LIST

Figure 19: NM mDrive Sectional Drawing

Part No	Part Name	Part No	Part Name
01	Volute Casing	342	Imbus Bolt
12	Adapter	343	Imbus Bolt
20	Impeller	360	Nut
50	Main Bearing Housing	361	Nut
60	Shaft	362	Bearing Adjustment Nut
61	Axial Back Bearing Casing	370	Bearing Adjustment Nut Washer
62	Axial Front Bearing Casing	390	Pin
65	Impeller Nut	391	Pin
90	Radial Bearing Casing	400	O-Ring
210	Impeller Key	440	SiC Radial Bearing Sleeve
211	Coupling Key	441	SiC Axial Bearing
260	Plug	442	SiC Radial Bearing Bushing
261	Plug	600	Containment Shroud
300	Stud (Casing)	601	Inner Magnetic Rotor
320	Bolt	602	Outer Magnetic Rotor
340	Imbus Bolt	603	Motor Connection Part
341	Imbus Bolt		

Table 9: NM mDrive Sectional Part List

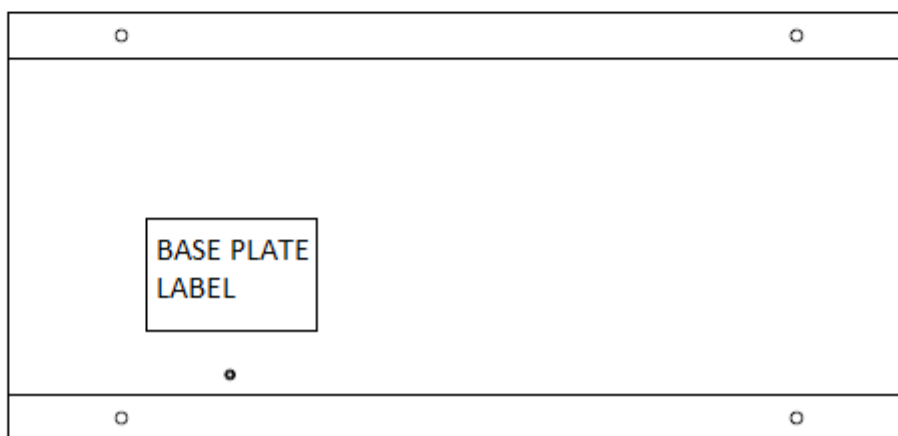
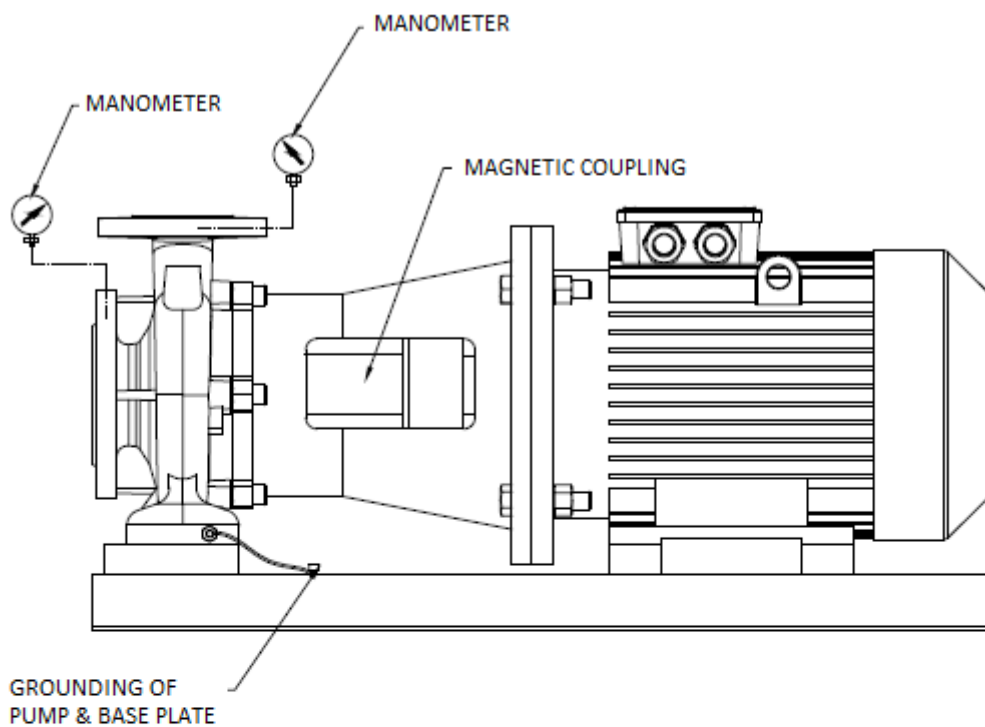
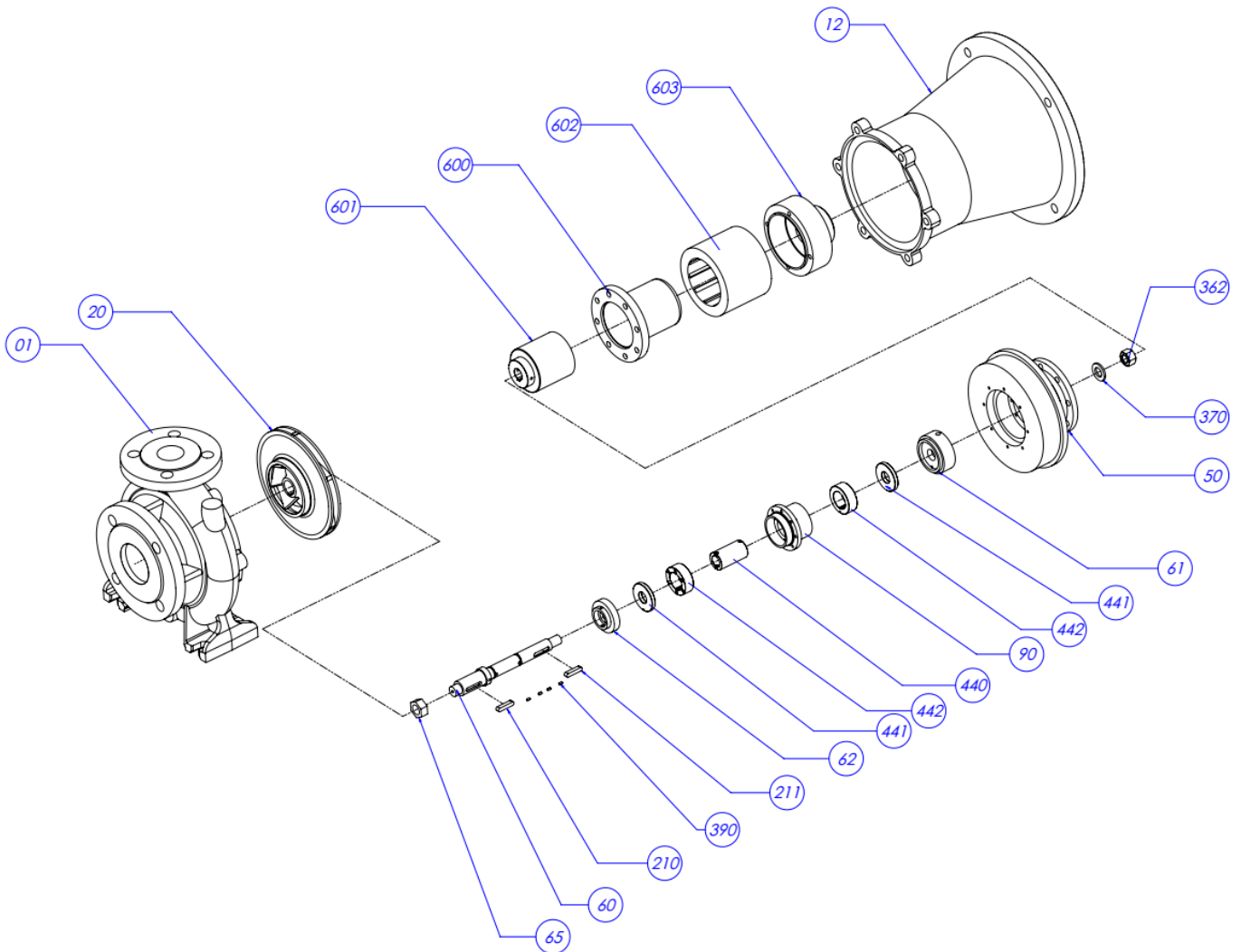


Figure 20: Presentation of pump base plate details and location of equipments to use

17. NM mDrive DRAWING FOR DISMANTLING

Figure 21: NM mDrive Drawing For Dismantling

Part No	Part Name	Part No	Part Name
01	Volute Casing	362	Bearing Adjustment Nut
12	Adapter	370	Bearing Adjustment Nut Washer
20	Impeller	390	Pin
50	Main Bearing Housing	440	SiC Radial Bearing Sleeve
60	Shaft	441	SiC Axial Bearing
61	Axial Back Bearing Casing	442	SiC Radial Bearing Bushing
62	Axial Front Bearing Casing	600	Containment Shroud
65	Impeller Nut	601	Inner Magnetic Rotor
90	Radial Bearing Casing	602	Outer Magnetic Rotor
210	Impeller Key	603	Motor Connection Part
211	Coupling Key		

Table 10: NM mDrive Drawing For Dismantling Part List

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