

End Suction Horizontal Shaft Single Stage Centrifugal Pumps

NM, NMM, NMP, EnduroPro Series

Operating Manual 2024

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EC DECLARATION OF CONFORMITY

AT UYGUNLUK BEYANI

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Teknik Dosyayı Derleyen Yetkili Kişi ve Adresi

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 iç üretim kontrollerine bağlı olarak MAS DAF MAKİNA SANAYİ A.Ş. tarafından kontrol edilmiştir.

Equipment / Ürün : End Suction Horizontal Shaft Single Stage Centrifugal Pumps
Uçtan Emişli Yatay Milli Tek Kademeli Santrifüj Pompalar
Seri / Model-Tip : NM, NMM, NMP, EnduroPro Series
NM, NMM, NMP, EnduroPro Serileri

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)
2009/125/EC European Ecodesign Directive, Regulation No: 547/2012 Ecodesign Requirements for Water Pumps / Avrupa Ekotasarım Direktifi, (SGM-2015/44) 547/2012 No'lu Su Pompalarında Ekotasarım Regülasyonu

Regulations applied acc. to harmonize standards / Uygulanan Uyumlaştırılmış Standartlar

TS EN ISO 12100:2010, TS EN 809+A1, TS EN 60204-1:2018.

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 ekipmanlarla 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, 01.08.2019
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INTRODUCTION



- This manual contains instructions for the installation, operation and maintenance of the NM, NMM, NMP, EnduroPro type single stage centrifugal pumps of **MASDAF 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 **MASDAF 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. **MASDAF 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 **MASDAF 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.

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





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 noisy operation 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 and NMM series pumps are single stage, horizontal shaft, end suction volute type pumps. NMM series is the monoblock design version of NM series models. They are used in:

- Water networks and pressurization facilities
- Irrigation, sprinkling and drainage systems
- Filling –Draining of tanks and reservoirs
- Hot and Cold water circulation in heating and cooling systems.
- Condense water pumping
- Water circulations in pools
- Health purification facilities
- Industrial and social facilities
- Fresh and sea water pumping in ships.

They shall be used to pressurize liquids which are clean or mildly impure, non abrasive, and not containing large solid particles or fiber.

CAUTION

Please contact MASDAF MAKINA SANAYI A.Ş. for liquids that have different chemical and physical specifications.





NMP series pumps are single stage, stainless steel, centrifugal pumps. NMP series stainless steel pumps have a large using area. They are used for transportation of industrial liquids. They can work in different point of temperature, capacity and pressure. They are used in;

- **Water Supply:** Water filtration and transportation, water networks and pressurization
- **Industrial Pressurization:** Wetting and cleaning systems
- **Transportation of Industrial Liquids:** Dyeing plants, pharmaceutical industry, food industry, chemical industry, boiler feed, condensate systems, cooling and heating systems, transportation of liquids containing acid or alkali
- **Water Treatment:** Water filtration (Reverse Osmosis) systems, swimming pools

They are used to pressurize liquids which are clean, non-explosive and not containing large solid particles or fiber.

CAUTION

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

EnduroPro series single stage, horizontal type sewage and wastewater pumps are designed for pumping domestic and industrial raw sewage waste transport, sewage waste transport, sewage treatment plants, liquids containing sludge and solid particles transport, factory waste water transport, liquids containing fibrous particles and other applications. They are used;

For pumping liquids containing long fibers (hair, thread, etc.), small solid particles and having a certain rate gaseous or air. (X Type Vorteks Impellers)

For pumping liquids containing up to certain size sludge and solid particles but not containing fiber, gaseous or air. (D Type Double Vane Impellers)

For pumping liquids containing up to certain size

sludge and solid particles but not containing fiber, gaseous or air. This type impeller is used only DN50 type pumps. (D Type Semi-Open Impellers)

CAUTION

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

Product Information as per Regulation No. 547/2012 (for Water Pumps with a Maximum Shaft Power of 150 kW) Implementing "Ecodesign" Directive 2009/125/EC

Minimum Efficiency Index for MAS NM and NMM Pump Series is shown on the pump label.

MEI values of MAS NM and NMM Pump Series are shown on the pump characteristic curves.

Minimum Efficiency Index for MAS NM and NMM Pump Series; Minimum 0.4. (MEI $\geq$ 0.4)

Efficiency values of the pump characteristic curves, which are cut diameter, are expressed in %.

NM and NMM Series water pumps, the pump efficiency can be achieved more than fix speed in case of variable speed control.

More information about the Ecodesign can be reached at www.europump.org

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 MASDAF MAKINA SANAYI A.Ş. since the performance curves vary with density and viscosity





CAUTION

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 **MASDAF 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

Pump performance values are valid under our factory test conditions.

2.5. Pressure Limit



Pressure at the discharge flange must not exceed 10 Bar. A special order is necessary for applications with higher pressures.

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.

CAUTION

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

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. 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.

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

4. TECHNICAL INFORMATION

4.1. Design

NM and NMM series pumps are single stage, single suction with a horizontal opening and a vertical discharge opening volute type (with horizontal shaft) pumps. They have closed radial impellers in accordance to DIN 24255 and EN 733 standards.

NMP series pumps are single stage, end suction centrifugal type stainless steel pumps.

EnduroPro series single-stage horizontal type

sewage and wastewater pumps are designed for pumping solid particles, raw sewages, industrial sewages.

Three type of impellers including single vane, double vane and vortex are used in EnduroPro series to pump containing long fibers, solid substances, coarse dirt as well as gaseous or air, raw sewage, activated sludge, circulated and heated sludge, raw and digested sludge, mixed water.

4.1.1. Volute Casing

In NM and NMM series pumps, the axis of suction opening is horizontal while the axis of discharge opening is vertical and the pumps have volute type casings. Suction and discharge flanges are in accordance to DIN 2533 standard.

In NMP series pumps, the axis of suction opening is horizontal while the axis of discharge opening is vertical and the pumps have volute type casings. Suction and discharge flanges are in accordance to EN 1092-2.

In EnduroPro series pumps, the axis of suction opening is horizontal while the axis of discharge opening is vertical and the pumps have volute type casings. Volute casing has large profile and designed for handling large solid particles. Solid particles that can pass through the impeller, can be easily handled with the volute casing.

4.1.2. Auxiliary Fittings

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

4.1.3. Impeller

The impellers of NM and NMM type pumps are fully 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.

Vortex (X Type) or Double Channel (D Type) impellers are used in EnduroPro series pumps which can offer different usage areas.





X Type Vorteks Impellers

In this type of impellers, liquid transfer is provided by vortex movement in front of impeller. These type of impellers are suitable for pumping liquids containing long fibers (hair, thread, etc.), small solid particles and having a certain rate gaseous or air. General applications of these type of impellers are raw sewage, activated sludge, circulated and heated sludge, wastewater containing hair, thread etc.

D Type Double Vane Impellers

D type impellers are designed with double vanes. Its symmetrical design provides balanced operation without vibration. These type of impellers for liquids containing up to certain size sludge and solid particles but not containing fiber, gaseous or air. Generally used for pumping grilled sewage, mechanically purified sewage, industrial waste water, activated sludge and floodwaters.

D Type Semi-Open Impellers (for DN50)

These types of impellers, which mounted on the pump DN50 dimensions, for liquids containing up to certain size sludge and solid particles but not containing fiber, gaseous or air. This impeller design is ensured that solid particles not clogged during delivery of the waste water. Generally used for pumping grilled sewage, mechanically purified sewage, industrial waste water, activated sludge and floodwaters.

4.1.4. 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 distance between the bearing and the sealing is short, pump can operate at optimal conditions for the sealing.

4.1.5. Bearing and Lubrication

Rolling bearings are used in NM series pumps. In pumps complying with DIN 24255, the bearing is provided with two 6300-2RS-C3 type ball bearings which are lubricated lifelong with special grease according to DIN 625 standard. For larger pumps,

one 3300 type and one 6300 or NU 300 type rolling bearing are used. In order to prevent the leakage flow into the bearing housing, deflectors are provided in front of the bearing covers.

NMM and NMP type monoblock pumps do not use bearings. The motor bearing is sufficient to accommodate axial and radial forces.

Lifelong oil lubricated bearings are used in EnduroPro series pumps. Alternatively, grease lubricated bearings are used. On pump and motor side 3300/6300 series heavy duty bearings can be used.

In our standard production, pumps with oil-lubricated bearings are shipped without oil inside. Before starting the pump, the oil level must be checked from the oil indicator. If the oil level cannot be seen from the indicator, add oil from the filling plug on the bearing housing. It should be ensured that the oil used is high quality, has a high operating temperature range and high oxidation resistance. For example, Shell Tellus T46 or equivalent oil is recommended.

In grease-lubricated pumps, a small amount of grease should be pressed from the plug on the bearing covers before the first start-up so that the grease does not reach to the point of leakage. Pressing too much grease will cause an increase in the bearing temperature. It should be ensured that the grease used is high quality, has a high operating temperature range and high oxidation resistance. For example, Shell Alvania RT3, Castrol Pyroplex Blue NLGI2 or equivalent grease is recommended.

4.1.6. Seals

NM series pumps can be designed with both soft and mechanical seals according to customer demands or the type of fluid to be pumped.

In monoblock pumps such as NMM and NMP series, sealing is provided by mechanical seal.

In EnduroPro series pumps as standard production, SiC-SiC mechanical seals are used for sealing. 2nd seal region is protected by a buffer oil region, can provide superior protection in case of leakage.





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)

Optionally, diesel engines can be used for NM and EnduroPro series.

4.2.2. Coupling and Coupling Guard

At pumps, a flexible coupling is used. A coupling guard is given in accordance with EN 953.



Pump can only be run with a coupling guard in accordance with EN 953 according to safety instructions. If there is no coupling cover, it is provided by the operator.

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.

CAUTION

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 damage of the pump. Prefer fabric cable for suspension.

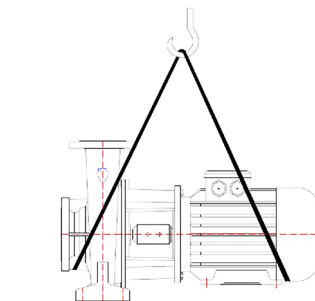
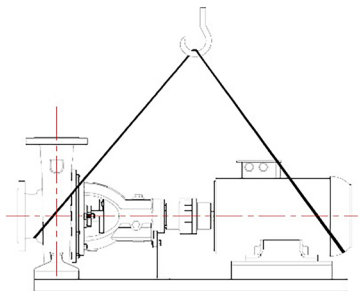


Figure 1: Transport of Pump Group



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 if there is any damage.





5.2. Storage



**Please keep the unit clean,
dry and closed area during storage**

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

1. If there is water 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 +40oC 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.

CAUTION

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.



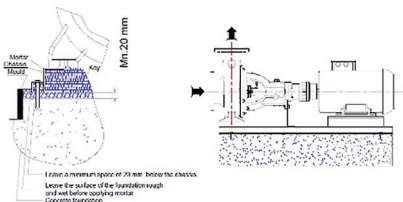


Figure 2: A Typical Concrete Foundation

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 Alignment

6.4.1. General

For a proper operation of a pump group, a good alignment of the coupling is necessary. Vibration, noise, overheating of the bearings, overcharge problems can be attributed to the misalignment of coupling or using an improper coupling.



Flexible coupling does not correct the axial misalignments between the pump and the motor axes. However, it allows pinpointing the misalignments. In order to avoid overheating, vibration, noise and wearing of the rolling bearings, alignment of the coupling has to be made properly and checked often. Do not use a different coupling other than the original type installed on pumping group.

6.4.2. Method of Coupling Alignment

In order to make the alignment of the coupling, it is required to have at least two pieces of about 10 cm tall, smooth-edged metal parts (e.g. a steel ruler or a gauge stick) and one precision calipers. (Figure 3) (For more precision alignments, special apparatus can be used).

Coupling misalignments in general are of two kinds:

1. Parallel Axis Misalignment (Figure 4-Figure 6)

In order to control parallel axis misalignment, a smooth edged gauge stick is pressed axially over the upper half of the coupling. Then, the gauge stick is checked for the other half of the coupling. For alignment, the gauge stick shall be in contact with both of the halves at the same time. This procedure shall be repeated for four sides of the coupling, (i.e. top, bottom, left and right sides of the coupling). When all four sides give reasonably accepted results, alignment of the coupling has been ensured.

2. Angular Misalignment (Figure 5-Figure 7)

In order to control the angular misalignment, the distance between the two halves of the coupling is measured in both horizontal and vertical planes. Measurements taken at four points shall be in agreement for the alignment.

Misalignments can be in horizontal or vertical planes. Misalignments in horizontal plane can be fixed by placing sheet iron at the bottom of the pump or motor base, while misalignments in vertical plane can be fixed by sliding the pump or the motor in horizontal plane.

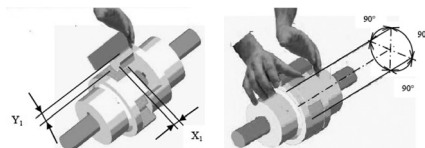


Figure 3: The Control of the Coupling Alignment in Horizontal and Vertical Planes

Figures below illustrate the possible coupling misalignments and the methods to correct them.



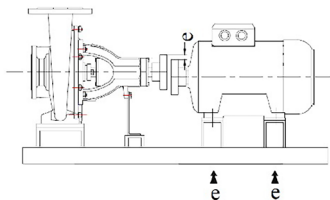


Figure 4: Parallel Axis Misalignment in Vertical Plane and Its Correction

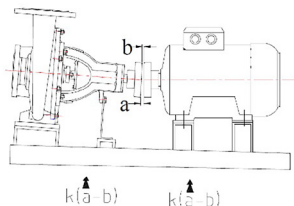


Figure 5: Angular Misalignment in Vertical Plane and Its Correction

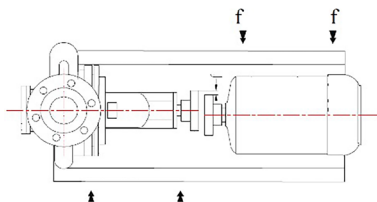


Figure 6: Parallel Axis Misalignment in Horizontal Plane and Its Correction

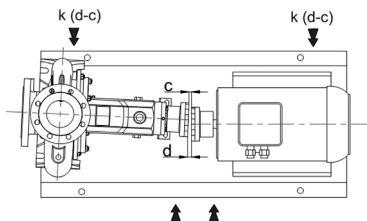


Figure 7: Angular Misalignment in Horizontal Plane and Its Correction



Install the coupling guard only when the alignment of the coupling is checked.

For centrifugal pumps, coupling alignment tolerances are critical to ensuring proper alignment. Coupling alignment tolerances can vary depending on a variety of factors, including coupling diameter, operating speeds, and the accuracy required by the application.

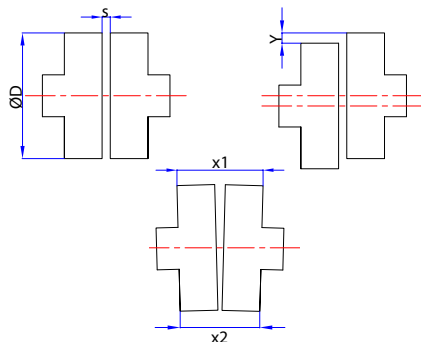
In general, coupling alignment tolerances are determined by the following parameters:

Axial Tolerance (Axis Misalignment): The amount of axial misalignment between the axes.

Angular Tolerance (Angular Alignment): The angular difference between two shafts.

Parallelism Tolerance (Lateral Alignment): The lateral misalignment of the centerlines of two shafts.

Recommended coupling alignment tolerances based on coupling diameter:



Coupling Diameter ØD (mm)	Axial Clearance S (mm)	Axial (mm)	Parallelism Y (mm)	Angularity X (mm/100mm)
69	3	0,05	0,05	0,05
78 - 96	4	0,1	0,1	0,1
106 - 200	5	0,2	0,2	0,2
224 - 400	6	0,2	0,2	0,2
450 - 550	8	0,25	0,25	0,25





6.4.3. Pump and Motor Mounting (Coupling)

If the coupling of the pump group is to be mounted on site, the following procedure should be followed.

1. Coat the shaft tip of the pump and the motor sides with a sheet of molybdenum disulfide.
2. Push the coupling halves with a driving apparatus towards the pump and the motor shafts, until the shaft is fit to snag to the hub of the coupling. If a driving apparatus is not available, heating coupling halves (with coupling rubbers off) to an approximately 100 °C may help the pushing. It is important that axial force is prevented from occurring while mounting the coupling. Support pump shaft from the impeller side, and motor shaft from the fan side while mounting the coupling. If necessary, dismantle the fan cover.
3. Screw the two bolts in coupling hub.
4. Make sure that a suitable spacing is left between the coupling halves while mounting pump and the rotor.
5. Horizontal pump groups mounted on the base plate or directly mounted on the base, alignment of the coupling shall be as described in 6.4.2.
6. Put into place the coupling guard.



According to the accident prevention regulations, all preventions and protective devices should be in their intended place and in operational form.

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.

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 2.
- 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

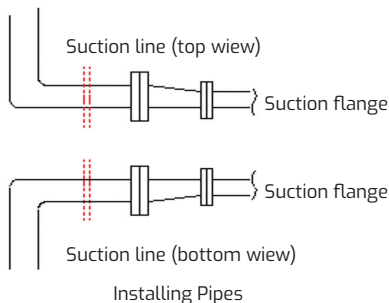


Figure 8: Piping System

An illustrative piping system is shown in Figure 18. 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.



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.

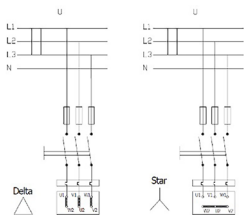


Figure 9: Electric Connection Diagram

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.

7.COMMISSIONING, START UP AND OPERATING



7.1. Preparations Before Start Up

OIL CHECK: In standard manufacturing, the pumps are provided with self-greased rolling bearings requiring no servicing in life long. Therefore, it is not necessary to check the oil.

- Check pump seals
- 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.
- Check that the pump shaft rotates easily by hand.

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 10 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)

CAUTION

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

CAUTION

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 the pump has mechanical sealing, there is no need for excessive maintenance. Water leakage from the mechanical sealing indicates the fact that the sealing is worn out and therefore needs to be replaced.
- 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.



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.
- Do not operate the pump at values above pressure, temperature or motor speed values specified by manufacturer, never use improper liquids with the pump.
- In oil and grease lubricated pumps, be sure to comply with the oil addition or change periods. Oil addition or change periods should be determined by the managements since they will vary depending on the operating conditions and operating times of the pumps in the plants. Never mix different types of oils.

Recommended oil change periods:

Speed [rpm]	Change Period
3000	1500 working hours
1500	2500 working hours
1000	4000 working hours

8.1.1. Component Check

CAUTION

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 dismantled.

8.1.2. Bearing and Lubrication

Pumps are provided with (life long) carefree rolling bearings in accordance to DIN 625. The usual service life of the rolling bearings attains at least the operating hours indicated in the technical specifications of DIN ISO 5199

8.1.3. Shaft Seal Maintenance

8.1.3.1. Soft Packing

- Before replacing the soft packing, the gland must be dismantled first. Used packing rings may be taken off by a sharp pointed tool. Take off the lantern ring if it exists, then clean the interiors of the sealing box, the gland and the lantern ring.
- Wrap a proper sized, good quality sealing over the shaft bush and make sure that the bush tip is completely covered.
- Place the first ring, its joint facing upwards and push it to its bed by using the gland
- If it exists push the watering ring to its bed.
- Place also the other rings to their beds alternating, i.e., their joints facing upwards and downwards.
- After placing the last ring, position the gland and tighten it completely. Thus, the squeezed sealing rings take the shape of the





sealing box.

- Then un-tighten the nuts. Rotating the shaft tighten them slowly again. When you feel that the shaft is put on a brake, stop the tightening.
- Water must come from the seals drop by drop as soon as the pump is started. The number of drops must not be less than 10 and not more than 30 per minute. Find the proper setting by tightening and un-tightening the opposite gland nuts.



- Ensure that the water leaking from the sealing is collected and/or discharged in a manner which is appropriate in terms of safety and environmental criteria.
- Check the sealing temperature two hours after the gland adjustment is made. For a system which pumps water at ambient temperature, the sealing temperature must not exceed 80°C.



Cooling seal arrangements are provided for pumps working with high temperature liquids.

CAUTION

When tightening the gland nuts do not work with long sleeve shirts. Otherwise it is possible to get caught by the turning shaft and get injured.

8.1.3.2. Mechanical Seal

Mechanical Seals are absolutely leak tight and needs less maintenance than soft packing.

Mechanical seal:

1. Provides leak proof operation in heavy operating conditions (in waste water pumps, chemical process and refinery pumps).
2. Easily mountable and needs less maintenance.
3. Does not cause wearing on the shaft
4. Sealing operation does not depend on the quality of shaft finishing.

8.1.4. Coupling

As mentioned in Section 6.4, coupling adjustment must be checked regularly.



Worn out elastic bands must be replaced.

8.1.5. Drive

Apply to the operating instructions of the motor manufacturer.

8.1.6. Auxiliary Components

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

8.2. Service

Our After Sales Services Department provides service support. 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.

8.3. Spare Parts

The spare parts of NM type pumps are guaranteed for 10 years by **MASDAF 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 (Key included) (quantity)	1	1	2	2	2	3	%30
Impeller (quantity)	1	1	1	2	2	3	%30
Ball bearing (kit)	1	1	2	2	3	4	%50
O-Ring for casing (kit+1)	1	1	1	2	2	3	%40
O-Ring for shaft (if exist) (kit)	1	1	2	2	3	4	%50
Soft packing (kit)	2	2	2	3	3	4	%50
Seal bushing (if exist)	1	1	1	2	2	3	%30
Coupling rubber (kit)	1	2	2	3	3	4	%50

Table 1: Spare Part List

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 2: 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 (LpA). 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.

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.
- Drain oil from the bearing housing if the pump is oil lubricated.
- Remove coupling guard and other safety guards.
- If a spacer type coupling is used between the pump and the motor, there is no need to disconnect the motor from the baseplate. To take out the spacer part is enough.

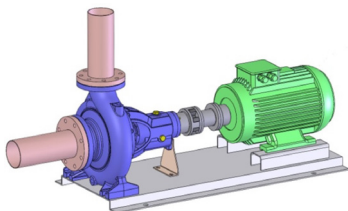


Figure 10: Disassembly - 1

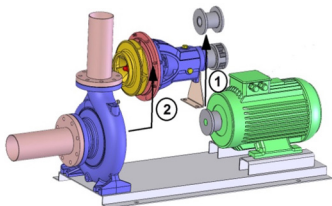


Figure 11: Disassembly - 2

- 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.

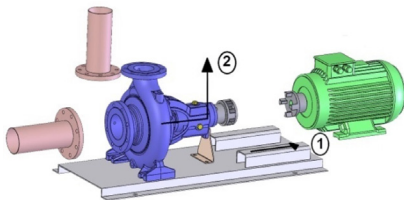


Figure 12: Disassembly - 3

- Disconnect the casing nuts and take out the pump rotor assembly (impeller + shaft + bearing housing + bearings + bearing covers + stuffing box etc.)
- Take out the pump coupling from the shaft using a pull-off device and remove the coupling key.
- Unscrew the impeller end nut and take out the impeller and impeller key. Use rust remover solvent during dismantling if necessary.
- Remove the mechanical seal bushing, if any.
- For EnduroPro series pumps, remove the first mechanical seal and remove the stuffing box. Remove the 2nd mechanical seal bushing and remove the 2nd mechanical seal. Separate the oil box from the intermediate bearing. Unscrew the bolts connecting the intermediate bearing and the bearing housing and remove the intermediate bearing. Separate the shaft from the bearing housing by removing the retainer ring and the bearing thrust bushing, respectively. Remove the bearings by unscrewing the safety nut and the safety plate from the shaft (you can remove it by pulling, pressing or heating the inner ring, do not use a hammer).





- Unscrew the nuts bearing housing to the stuffing box.

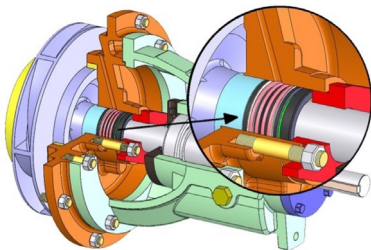


Figure 13: Disassembly – 4

- If there is the mechanical seal, unscrew the seal cover. Separate the stuffing box from the bearing housing. Mechanical seal will remain on the shaft.

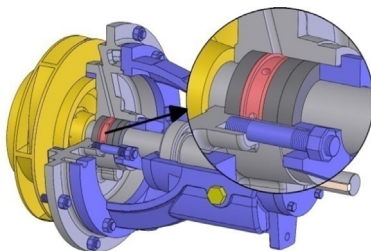


Figure 14: Disassembly – 5

- For pumps with soft packing, you can pull out stuffing box directly.
- Dismantle the bearing covers.
- Dismantle bearing by using a pull-off device. Do not use metal hammer for this operation.

10.2. 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 ball bearings on their places on the shaft by slightly heating or by using press.
- Wait until bearings get cool (cool if it is possible). Put this part to the bearing housing from the coupling side. (With pressor plastic hummer).
- For EnduroPro series pumps, tighten the lock nut. Insert the shaft into the bearing housing. Install the retainer ring with the bearing thrust bushing. Mount the intermediate bearing to the bearing housing with bolts. Install the oil box on the intermediate bearing. Place the second mechanical seal in the oil box. Install the mechanical seal bushing and retainer ring. Place the stuffing box on the intermediate bearing. Place the first mechanical seal in the stuffing box. Place the impeller key on the shaft. Install the mechanical seal bushing.
- Reassembly the bearing cover on its place.
- On pumps with mechanical seal is used; put the stationary part of mechanical seal in its place on the seal cover. Then put this part on the shaft. Afterwards put the rotating part of mechanical seal on its position.
- On pumps with packing is used; put the stuffing box gland in position. And fixed the gland nuts gently.
- Mount stuffing box to bearing housing.
- At this stage you can insert the stuffing box and lantern ring.
- Replace impeller key and pump impellers. Tighten the impeller nuts.
- Replace the coupling and coupling key.





- On pumps with mechanical seal is used, tighten mechanical seal cover; on pumps with packing is used, tighten the gland nut.
- Now reassembly of the rotor group is completed.
- Finally mount rotor assembly to the volute casing. (In the repair shop or on site.)
- Make sure the gaskets and o-rings are evenly placed without sliding and not damaged or not squeezed at all.
- 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.



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

10.3. Coupling Guard Assembly

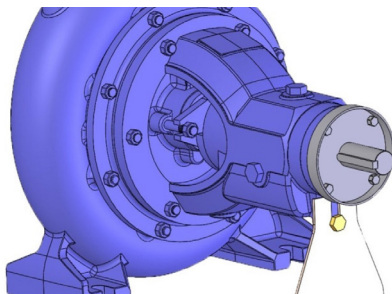


Figure 15: Coupling Guard Assembly - 1

Mount (1) numbered part to bearings mounted on the pump.

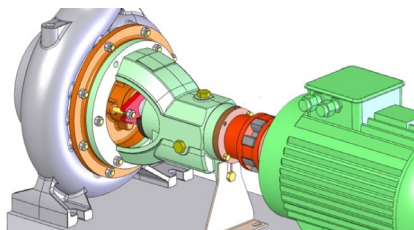


Figure 16: Coupling Guard Assembly - 2

Connect motor and pump with coupling.

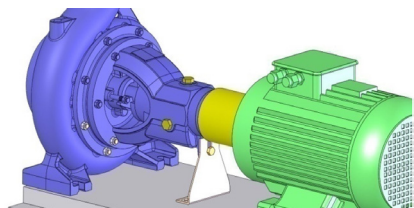


Figure 17: Coupling Guard Assembly - 3

Place the coupling guard.





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	Discharge head too high.	Readjust the operating point.
	Very high counter pressure.	See if there is any undesired material inside the pipe.
	Pump and/or pipe cannot discharge air, cannot suck.	Vent completely the pump and the pipe.
	Occurrence of air pockets inside the pipe.	Change the piping configuration.
	NPSH is too low.	Increase the liquid level.
Motor overload	System pressure is lower than the requested pressure level	Adjust the operating pressure to the label value.
	Speed too high	Decrease the speed.
	Liquid pumped of different specific gravity and viscosity than that for which pump is rated	Increase the engine power.
	Engine works at two phases	Replace the fuse and control the electrical connections.
Pump head is too high	System pressure is higher than the requested pressure level.	Set the operating pressure to the label value.
Bearing temperatures are high	Worn out coupling.	Replace the coupling.
	Too much, too little or improper lubrication.	Change the oil, decrease or increase its quantity.
	Increase in axial forcing.	Clean the balance holes on the impeller disc.
Excessive leakage from the stuffing box	Worn out gland.	Use brand new gland.
	Loose gland.	Change the stuffing bush.
		Tighten the gland nuts.
Noisy operation	Worn out motor or pump ball bearings.	Replace.
	Cavitation.	Close the delivery partially in order to reduce the capacity.
	Worn out or misaligned coupling.	Replace the coupling or align it.
	Operation in the far left or right of the performance curve.	Operate the pump at its label setting.



POSSIBLE FAILURE	CAUSES	SOLUTIONS
Excessive increase in pump temperature	Pump and/or pipe can neither discharge, nor aspirate air.	Bleed completely the pump and the pipe.
	Too low capacity.	Open more the valve.
Vibration	Pump and/or pipe can neither discharge, nor aspirate air.	Bleed completely the pump and the pipe.
	NP5H is too low.	Increase the liquid level.
	Internal components of the pump are worn out.	Replace the worn-out components.
	System pressure is lower than the requested pressure level.	Adjust the operating pressure to the label value.
	Coupling is misaligned.	Align the coupling.
	Too much, too little or improper lubrication.	In case of continuous overload, decrease the impeller diameter.
	Rotor unbalanced.	Change the oil, decrease or increase its quantity.
	Improper bearings.	Balance the impeller again.
		Use new bearings.

Table 3: Possible Failures, Causes, Solutions



12. TIGHTENING TORQUES

THREAD DIAMETER	TIGHTENINGTORQUEMAX (Nm)	
	PropertyClasses	
	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 4: Tightening Torques Table





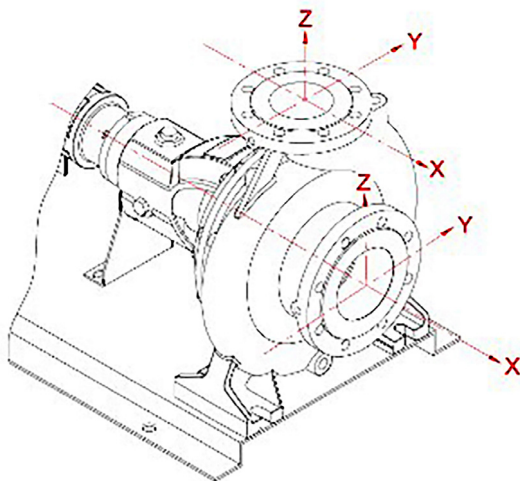
13. FORCES AND MOMENTS AT THE PUMP FLANGES

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:

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

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		
			Fy	Fz	Fx	Fy	Fz	Fx	My	Mz	Mx	My	Mz	Mx
NM 32-160 NM 32-200 NM 32-250	50	32	500	450	550	283	350	300	333	383	467	250	283	367
NM 40-160 NM 40-200 NM 40-250	65	40	617	567	700	333	417	367	367	400	500	300	350	433
NM 50-160 NM 50-200 NM 50-250 NM 50-315	65	50	617	567	700	450	550	500	367	400	500	333	383	467
NM 65-160 NM 65-200 NM 65-250 NM 65-315	80	65	750	683	833	567	700	617	383	433	533	367	400	500
NM 65-400 NM 80-160 NM 80-200 NM 80-250 NM 80-315 NM 80-400	100		80	1000	900				1117	683	833			
NM 100-200 NM 100-250 NM 100-315 NM 100-400	125	100	1183	1067	1317	900	1117	1000	417	483	583	417	483	583
NM 125-200 NM 125-250 NM 125-315 NM 125-400	150	125	1500	1350	1667	1067	1317	1183	500	633	700	500	633	700
NM 150-200 NM 150-250 NM 150-315 NM 150-400 NM 150-500	200	150	2286	1800	2233	1350	1667	1500	583	683	833	583	683	833
NM 200-315 NM 200-400 NM 200-500	250	200	2483	2250	2783	2057	2552	2286	876	1010	1238	876	1010	1238
NM 250-315 NM 250-400 NM 250-500 NM 250-500A	300	250	3410	3067	3810	2571	3181	2838	1200	1391	1695	1200	1391	1695
NM 300-315 NM 300-400	300	300	3410	3067	3810	3067	3810	3410	1200	1391	1695	1638	1886	2305
NM 350-450	400	350	4552	4095	5067	3581	4438	3981	2629	3029	3695	2095	2419	2952

Table 5: NM Series - Forces and Moments at The Pump Flanges



Forces at the pump flanges were calculated according to TS EN ISO 5199 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.

PUMP TYPE	FORCES								MOMENTS					
	DN Flange		Suction Flange			Discharge Flange			Suction Flange			Discharge Flange		
	SS	DS	N			N			Nm			Nm		
			Fy	Fz	Fx	Fy	Fz	Fx	My	Mz	Mx	My	Mz	Mx
NMM 32-160 NMM 32-200 NMM 32-250	50	32	500	450	550	283	350	300	333	383	467	250	283	367
NMM 40-160 NMM 40-200 NMM 40-250	65	40	617	567	700	333	417	367	367	400	500	300	350	433
NMM 50-160 NMM 50-200 NMM 50-250 NMM 50-315	65	50	617	567	700	450	550	500	367	400	500	333	383	467
NMM 65-160 NMM 65-200 NMM 65-250 NMM 65-315	80	65	750	683	833	567	700	617	383	433	533	367	400	500
NMM 65-400 NMM 80-160 NMM 80-200 NMM 80-250 NMM 80-315 NMM 80-400	100		80	1000	900				1117	683	833			
NMM 100-200 NMM 100-250 NMM 100-315 NMM 100-400	125	100	1183	1067	1317	900	1117	1000	417	483	583	417	483	583
NMM 125-200 NMM 125-250 NMM 125-315 NMM 125-400	150	125	1500	1350	1667	1067	1317	1183	500	633	700	500	633	700

Table 6: NMM Series - Forces and Moments at The Pump Flanges

Forces at the pump flanges were calculated according to TS EN ISO 5199 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.



PUMP TYPE	FORCES								MOMENTS					
	DN Flange		Suction Flange			Discharge Flange			Suction Flange			Discharge Flange		
	SS	DS	N			N			Nm			Nm		
			Fy	Fz	Fx	Fy	Fz	Fx	My	Mz	Mx	My	Mz	Mx
EnduroPro 50-200	50	50	500	450	550	450	550	500	333	383	467	333	383	467
EnduroPro 80-250	80	80	750	683	833	683	833	750	383	433	533	383	433	533
EnduroPro 100-250 EnduroPro 100-315	100	100	1000	900	1117	900	1117	1000	383	433	533	417	483	583
EnduroPro 150-315	150	150	1500	1350	1667	1350	1667	1500	500	633	700	583	683	833
EnduroPro 300-315	300	300	3410	3067	3810	3067	3810	3410	1200	1391	1695	1638	1886	2305

Table 7: EnduroPro Series - Forces and Moments at The Pump Flanges

Forces at the pump flanges were calculated according to TS EN ISO 5199 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.





14. SAMPLE PLUMBING

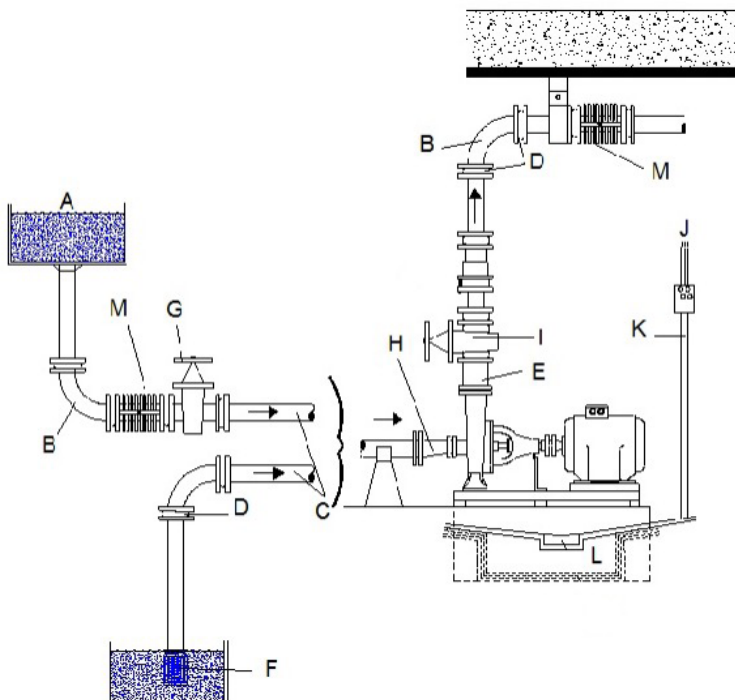


Figure 18: Sample Plumbing

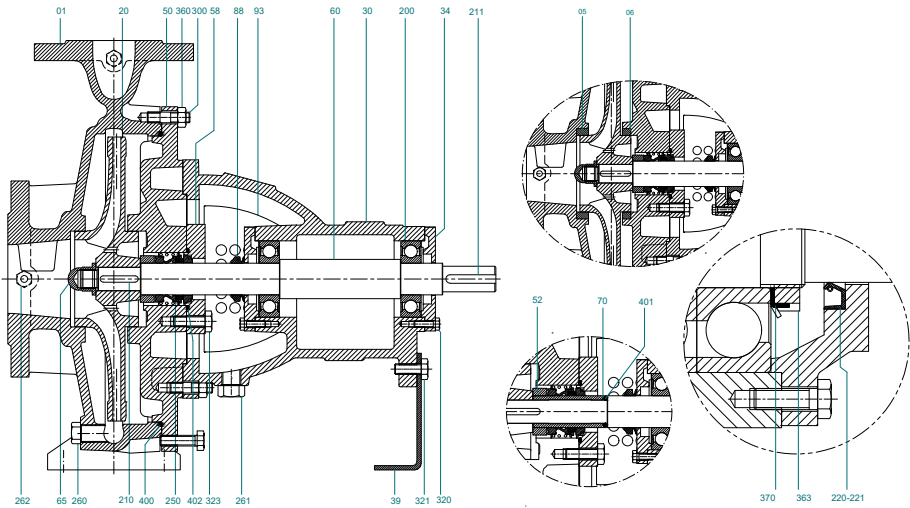
- A. Tank
- B. Long radius elbow
- C. Minimum slope is 2 cm/m
- D. Fittings, flanges etc.
- E. Non-return valve
- F. Foot valve
- G. Suction valve
- H. Reducer
- I. Discharge valve
- J. Electrical connection
- K. Insulated cable
- L. Concrete foundation
- M. Compensator





15. SECTIONAL DRAWING AND PARTS LISTS

15.1. NM Mechanical Seal Design Sectional Drawing and Part List

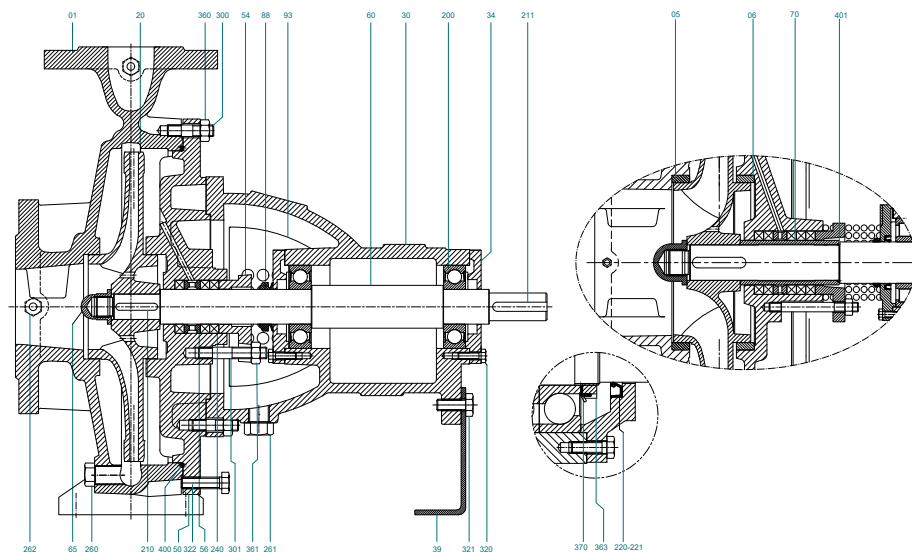


Part No	Part Name	Part No	Part Name	Part No	Part Name
1	Pump Casing	65	Impeller Nut	262	Plug
20	Impeller	88	V-Ring	300	Stud
30	Bearing Housing	93	Ball Bearing Safety Sheet	320	Hexagonal Bolt
34	Bearing Housing Cover	200	Ball Bearing	321	Hexagonal Bolt
39	Support Foot	210	Impeller Key	322	Hexagonal Bolt
50	Stuffing Box	211	Coupling Key	323	Hexagonal Bolt
52	Mech. Seal Sleeve	250	Mechanical Seal	360	Hexagonal Nut
58	Mech. Seal Cover	260	Drain Plug	400	O-Ring
60	Pump Shaft	261	Plug	401	O-Ring





15.2. NM Soft Packing Design Sectional Drawing and Part List

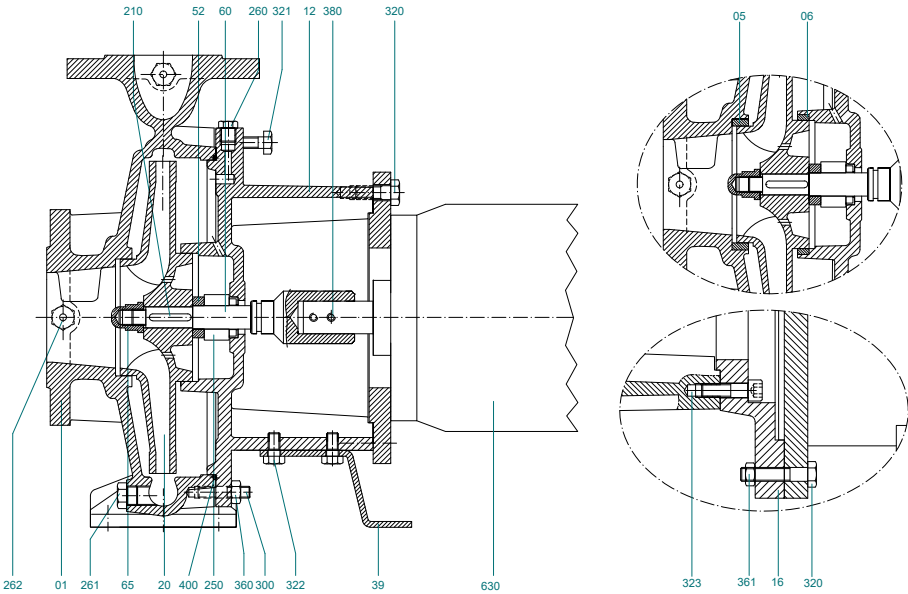


Part No	Part Name	Part No	Part Name	Part No	Part Name
1	Pump Casing	65	Impeller Nut	262	Plug
20	Impeller	88	V- Ring	300	Stud
30	Bearing Housing	93	Bearing House Safety Sheet	301	Stud for Gland
34	Bearing Housing Cover	200	Ball Bearing	320	Hexagonal Bolt
39	Supporting Part	210	Coupling Key	321	Hexagonal Bolt
50	Stuffing Box	211	Impeller Key	322	Hexagonal Bolt
54	Gland	240	Soft Packing	360	Hexagonal Nut
56	Lantern Ring	260	Drain Plug	361	Hexagonal Nut for Gland
60	Pump Shaft	261	Plug	400	O-Ring





15.3. NMM Monoblock Design without Coupling Sectional Drawing and Part List

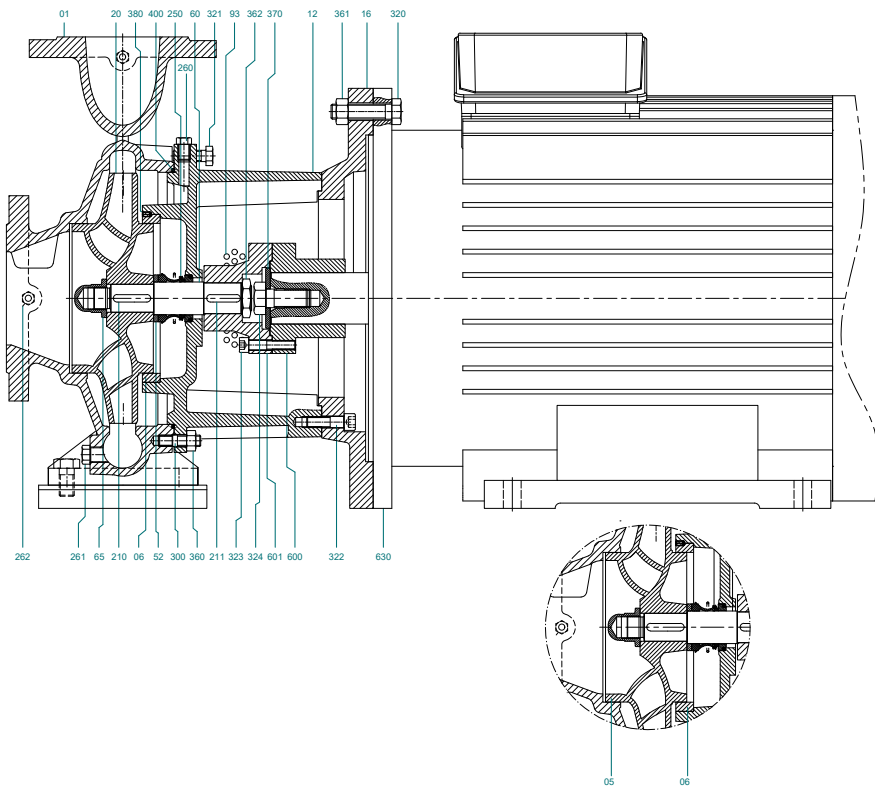


Part No	Part Name	Part No	Part Name	Part No	Part Name
1	Pump Casing	210	Impeller Key	320	Hexagonal Bolt
12	Adapter	250	Mechanical Seal	321	Hexagonal Bolt
20	Impeller	260	Plug (Adapter)	322	Hexagonal Bolt
39	Supporting Foot	261	Drain Plug	360	Nut
52	Packing Retaining Ring	262	Plug, Pump Casing	380	Setscrew
60	Pump Shaft	300	Stud, Pump Casing	400	O-Ring
65	Impeller Nut				





15.4. NMM Monoblock Design with Coupling Sectional Drawing and Part List

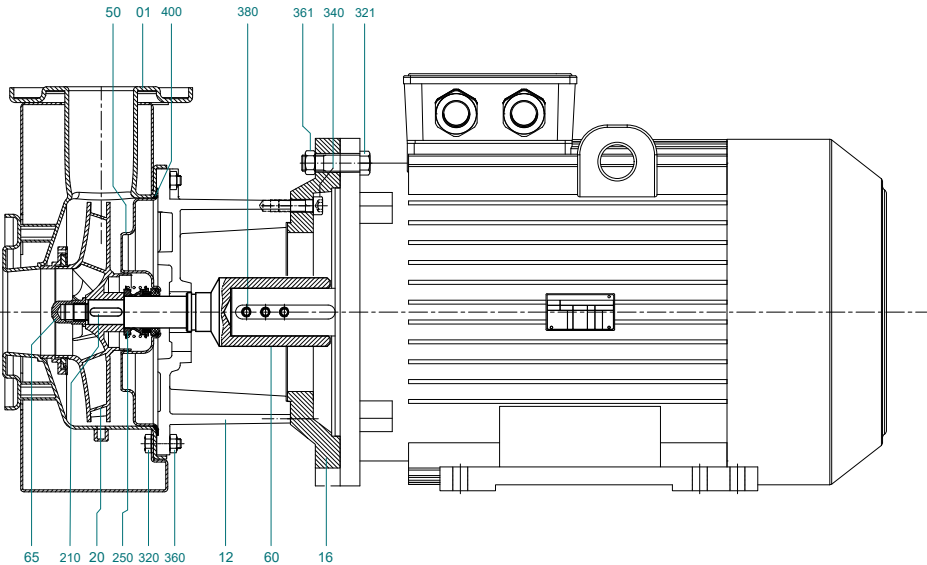


Part No	Part Name	Part No	Part Name	Part No	Part Name
1	Pump Casing	210	Impeller Key	321	Hexagonal Bolt
12	Adapter	250	Mechanical Seal	322	Hexagonal Bolt
20	Impeller	260	Plug (Adapter)	360	Nut
39	Supporting Foot	261	Drain Plug	380	Setscrew
52	Packing Retaining Ring	262	Plug, Pump Casing	400	O-Ring
60	Pump Shaft	300	Stud, Pump Casing	600	Coupling (Motor Side)
65	Impeller Nut	320	Hexagonal Bolt	601	Coupling (Pump Side)





15.5. NMP Monoblock Design Sectional Drawing and Part List

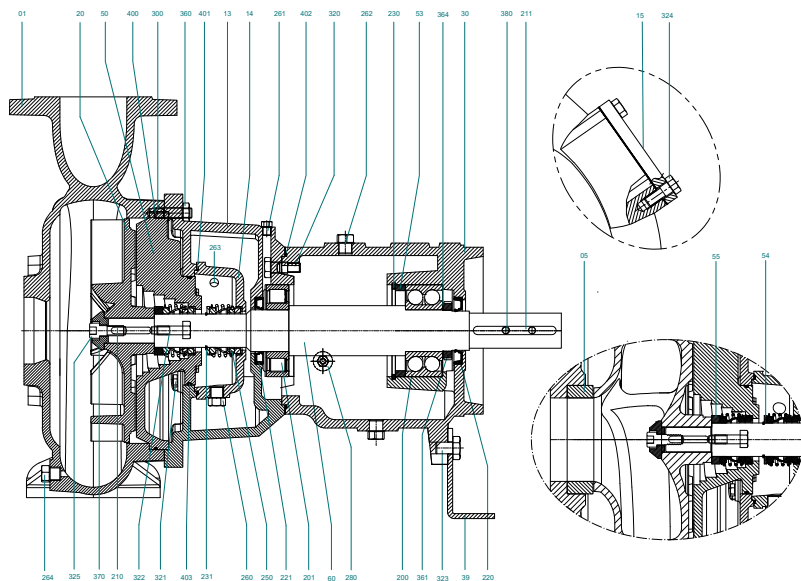


Part No	Part Name	Part No	Part Name	Part No	Part Name
1	Pump Casing	65	Impeller Nut	340	Bolt
12	Adapter	210	Impeller Key	360	Hexagonal Nut
16	Motor Flange	250	Mechanical Seal	361	Hexagonal Nut
20	Impeller	320	Hexagonal Bolt	380	Setscrew
50	Stuffing Box	321	Hexagonal Bolt	400	O-Ring
60	Pump Shaft				





15.6. EnduroPro Mechanical Seal Design Sectional Drawing and Part List



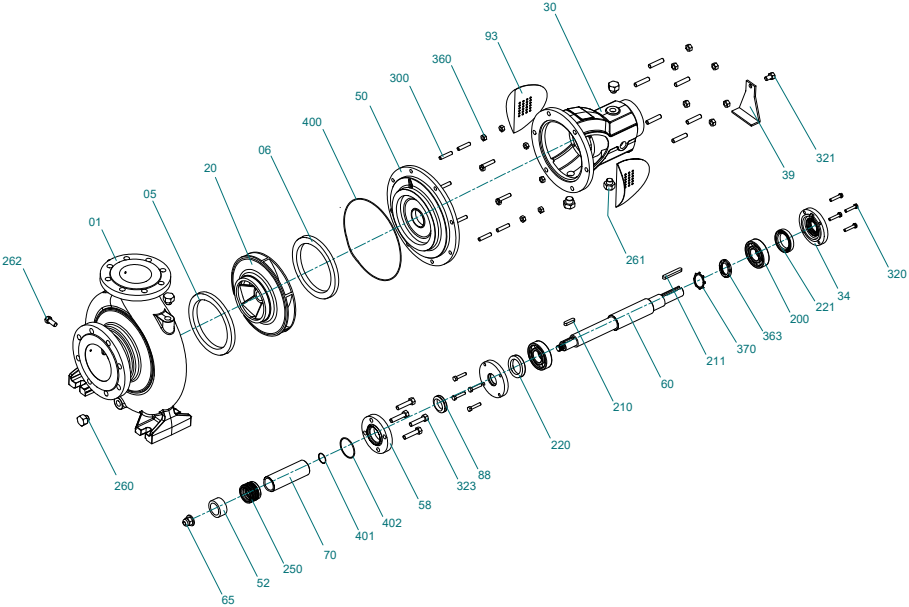
Part No	Part Name	Part No	Part Name	Part No	Part Name
1	Volute Casing	210	Impeller Key	322	Bolt
13	Spacer	211	Key	323	Bolt
14	Sealing Oil Bath	220	Oil Seal	325	Imbues Bolt
20	Impeller	221	Oil Seal	360	Nut
30	Bearing Housing	230	Retaining Ring	361	Nut
39	Supporting Foot	231	Retaining Ring	364	Safety Sheet
50	Stuffing Box	250	Mechanical Seal	370	Impeller Washer
53	Bearing Sleeve	260	Plug	380	Setscrew
54	Mechanical Seal Sleeve	261	Plug	400	O-Ring
55	Mechanical Seal Sleeve	280	Oil Gauge	401	O-Ring
60	Shaft	300	Stud	402	O-Ring
200	Bearing	320	Bolt	403	O-Ring
201	Bearing	321	Bolt		





16. EXPLODED VIEWS AND PART LISTS

16.1. NM Mechanical Seal Design Exploded View and Part List

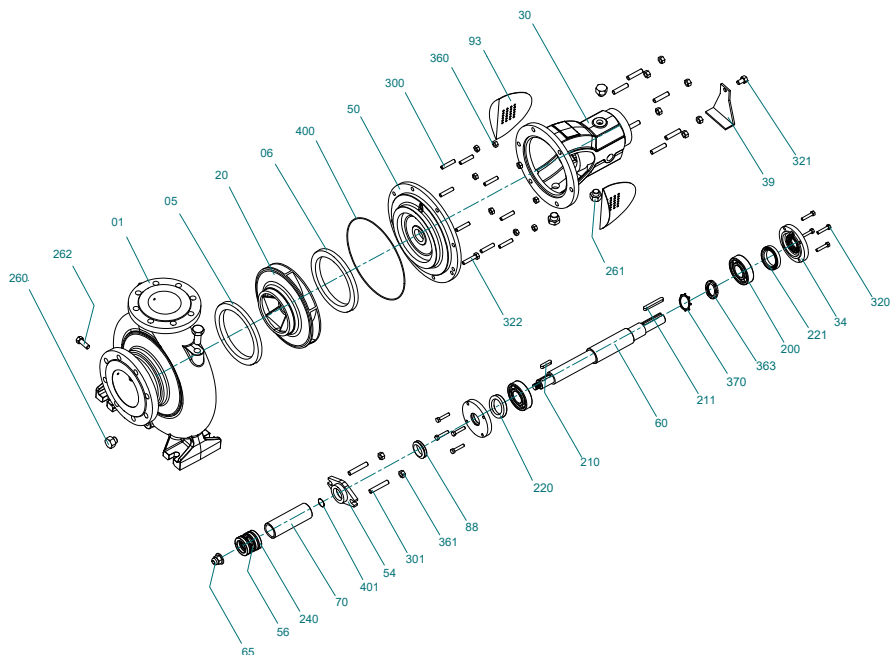


Part No	Part Name	Part No	Part Name	Part No	Part Name
1	Pump Casing	65	Impeller Nut	262	Plug
20	Impeller	88	V-Ring	300	Stud
30	Bearing Housing	93	Ball Bearing Safety Sheet	320	Hexagonal Bolt
34	Bearing Housing Cover	200	Ball Bearing	321	Hexagonal Bolt
39	Support Foot	210	Impeller Key	322	Hexagonal Bolt
50	Stuffing Box	211	Coupling Key	323	Hexagonal Bolt
52	Mech. Seal Sleeve	250	Mechanical Seal	360	Hexagonal Nut
58	Mech. Seal Cover	260	Drain Plug	400	O-Ring
60	Pump Shaft	261	Plug	401	O-Ring





16.2. NM Soft Packing Design Exploded View and Part List

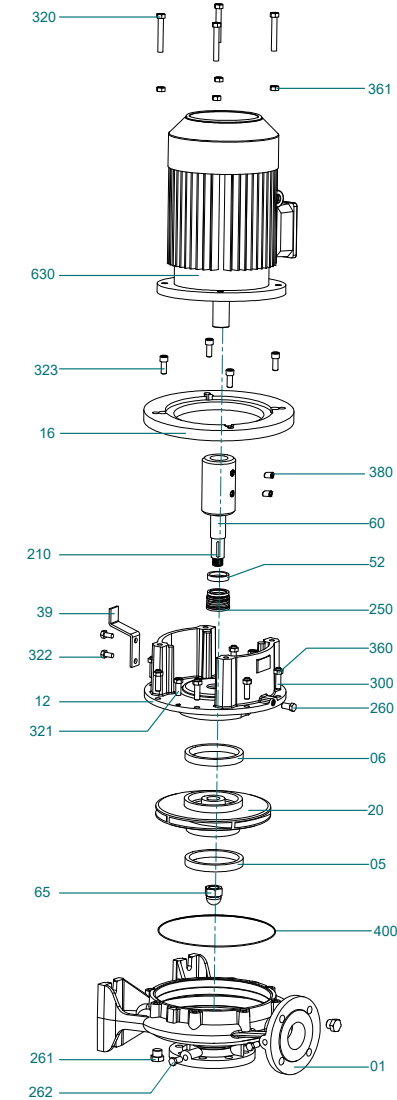


Part No	Part Name	Part No	Part Name	Part No	Part Name
1	Pump Casing	65	Impeller Nut	262	Plug
20	Impeller	88	V- Ring	300	Stud
30	Bearing Housing	93	Bearing House Safety Sheet	301	Stud for Gland
34	Bearing Housing Cover	200	Ball Bearing	320	Hexagonal Bolt
39	Supporting Part	210	Coupling Key	321	Hexagonal Bolt
50	Stuffing Box	211	Impeller Key	322	Hexagonal Bolt
54	Gland	240	Soft Packing	360	Hexagonal Nut
56	Lantern Ring	260	Drain Plug	361	Hexagonal Nut for Gland
60	Pump Shaft	261	Plug	400	O-Ring





16.3. NMM Monoblock Design without Coupling Exploded View and Part List

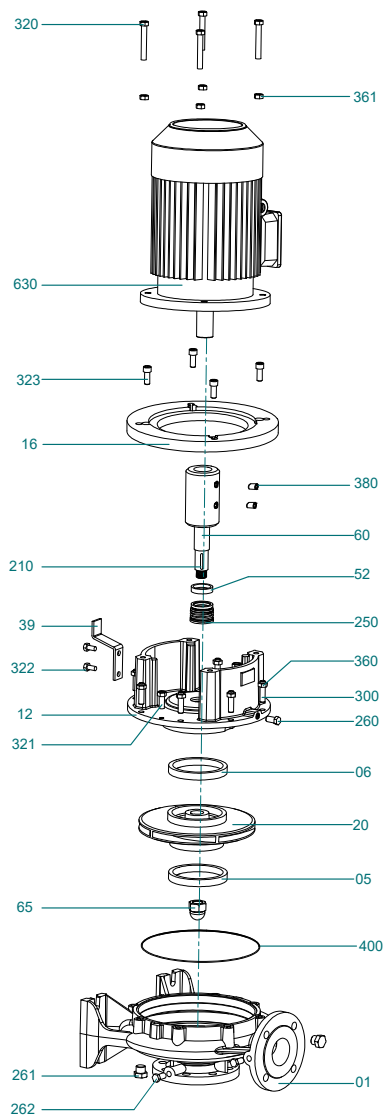


Part No	Part Name
1	Pump Casing
12	Adapter
20	Impeller
39	Supporting Foot
52	Packing Retaining Ring
60	Pump Shaft
65	Impeller Nut
210	Impeller Key
250	Mechanical Seal
260	Plug (Adapter)
261	Drain Plug
262	Plug, Pump Casing
300	Stud, Pump Casing
320	Hexagonal Bolt
321	Hexagonal Bolt
322	Hexagonal Bolt
360	Nut
380	Setscrew
400	O-Ring





16.4. NMM Monoblock Design with Coupling Exploded View and Part List

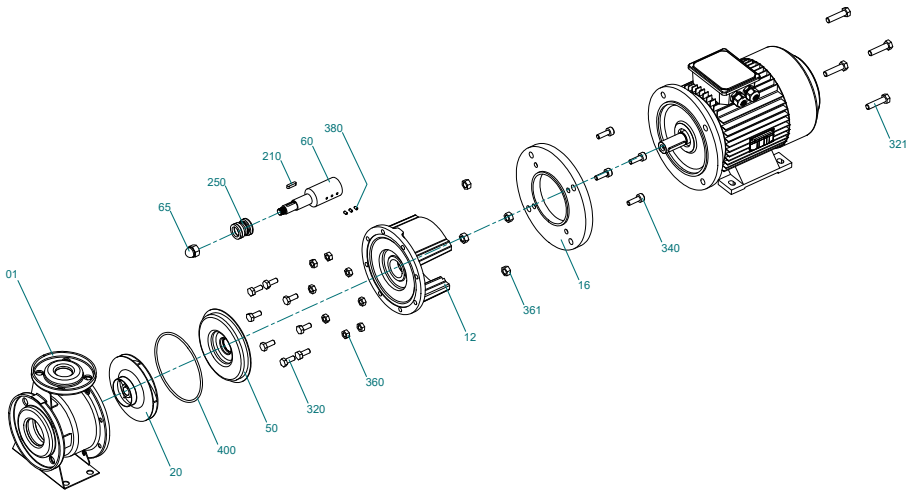


Part No	Part Name
1	Pump Casing
12	Adapter
20	Impeller
39	Supporting Foot
52	Packing Retaining Ring
60	Pump Shaft
65	Impeller Nut
210	Impeller Key
250	Mechanical Seal
260	Plug (Adapter)
261	Drain Plug
262	Plug, Pump Casing
300	Stud, Pump Casing
320	Hexagonal Bolt
321	Hexagonal Bolt
322	Hexagonal Bolt
360	Nut
380	Setscrew
400	O-Ring
600	Coupling (Motor Side)
601	Coupling (Pump Side)





16.5. NMP Monoblock Design Exploded View and Part List

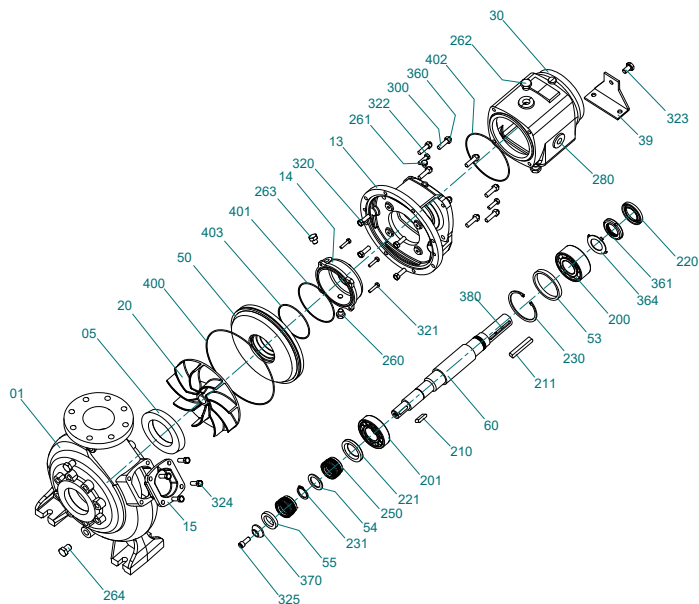


Part No	Part Name	Part No	Part Name	Part No	Part Name
1	Pump Casing	65	Impeller Nut	340	Bolt
12	Adapter	210	Impeller Key	360	Hexagonal Nut
16	Motor Flange	250	Mechanical Seal	361	Hexagonal Nut
20	Impeller	320	Hexagonal Bolt	380	Setscrew
50	Stuffing Box	321	Hexagonal Bolt	400	O-Ring
60	Pump Shaft				





16.6. EnduroPro Mechanical Seal Design Exploded View and Part List



Part No	Part Name	Part No	Part Name	Part No	Part Name
1	Volute Casing	210	Impeller Key	322	Bolt
13	Spacer	211	Key	323	Bolt
14	Sealing Oil Bath	220	Oil Seal	325	Imbues Bolt
20	Impeller	221	Oil Seal	360	Nut
30	Bearing Housing	230	Retaining Ring	361	Nut
39	Supporting Foot	231	Retaining Ring	364	Safety Sheet
50	Stuffing Box	250	Mechanical Seal	370	Impeller Washer
53	Bearing Sleeve	260	Plug	380	Setscrew
54	Mechanical Seal Sleeve	261	Plug	400	O-Ring
55	Mechanical Seal Sleeve	280	Oil Gauge	401	O-Ring
60	Shaft	300	Stud	402	O-Ring
200	Bearing	320	Bolt	403	O-Ring
201	Bearing	321	Bolt		





17. MEI VALUE TABLE

Pump Type	Speed (rpm)	MEI
NM 32-160	1450	≥ 0.6
NM 32-200	1450	≥ 0.7
NM 32-250	1450	≥ 0.5
NM 40-160	1450	≥ 0.4
NM 40-200	1450	≥ 0.7
NM 40-250	1450	≥ 0.7
NM 50-160	1450	≥ 0.4
NM 50-200	1450	≥ 0.6
NM 50-250	1450	≥ 0.6
NM 50-315	1450	≥ 0.5
NM 65-160	1450	≥ 0.6
NM 65-200	1450	≥ 0.5
NM 65-250	1450	≥ 0.5
NM 65-315	1450	≥ 0.6
NM 65-400	1450	≥ 0.6
NM 80-160	1450	≥ 0.4
NM 80-200	1450	≥ 0.4
NM 80-250	1450	≥ 0.4
NM 80-315	1450	≥ 0.6
NM 80-400	1450	≥ 0.4
NM 100-160	1450	≥ 0.5
NM 100-200	1450	≥ 0.4
NM 100-250	1450	≥ 0.5
NM 100-315	1450	≥ 0.5
NM 100-400	1450	≥ 0.4
NM 125-200	1450	≥ 0.4
NM 125-250	1450	≥ 0.5
NM 125-315	1450	≥ 0.5
NM 125-400	1450	≥ 0.6
NM 150-200	1450	≥ 0.4
NM 150-250	1450	≥ 0.4
NM 150-315	1450	≥ 0.4
NM 150-400	1450	≥ 0.6
NM 200-315	1450	≥ 0.4
NM 250-315	1450	≥ 0.4
NM 300-315	1450	≥ 0.4
NM 300-315A	1450	≥ 0.4

Table 9: NM MEI Table (1450 rpm)

Pump Type	Speed (rpm)	MEI
NM 32-160	2900	≥ 0.4
NM 32-200	2900	≥ 0.7
NM 32-250	2900	≥ 0.5
NM 40-160	2900	≥ 0.4
NM 40-200	2900	≥ 0.7
NM 40-250	2900	≥ 0.6
NM 50-160	2900	≥ 0.4
NM 50-200	2900	≥ 0.6
NM 50-250	2900	≥ 0.5
NM 50-315	2900	≥ 0.4
NM 65-160	2900	≥ 0.5
NM 65-200	2900	≥ 0.4
NM 65-250	2900	≥ 0.5
NM 65-315	2900	≥ 0.5
NM 80-160	2900	≥ 0.4
NM 80-200	2900	≥ 0.4
NM 80-250	2900	≥ 0.4
NM 80-315	2900	≥ 0.5
NM 100-160	2900	≥ 0.4
NM 100-200	2900	≥ 0.4
NM 100-250	2900	≥ 0.4
NM 100-315	2900	≥ 0.4

Table 10: NM MEI Table (2900 rpm)



Pump Type	Speed (rpm)	MEI
NMM 32-160	1450	0.4
NMM 32-200	1450	0.7
NMM 32-250	1450	0.4
NMM 40-160	1450	0.4
NMM 40-200	1450	0.7
NMM 40-250	1450	0.7
NMM 50-160	1450	0.4
NMM 50-200	1450	0.4
NMM 50-250	1450	0.5
NMM 50-315	1450	0.5
NMM 65-160	1450	0.7
NMM 65-200	1450	0.6
NMM 65-250	1450	0.4
NMM 65-315	1450	0.6
NMM 65-400	1450	0.5
NMM 80-160	1450	0.4
NMM 80-200	1450	0.5
NMM 80-250	1450	0.5
NMM 80-315	1450	0.5
NMM 80-400	1450	0.5
NMM 100-160	1450	0.5
NMM 100-200	1450	0.5
NMM 100-250	1450	0.4
NMM 100-315	1450	0.6
NMM 100-400	1450	0.5
NMM 125-200	1450	0.4
NMM 125-250	1450	0.5
NMM 125-315	1450	0.6
NMM 125-400	1450	0.6

Table 11: NMM MEI Table (1450 rpm)

Pump Type	Speed (rpm)	MEI
NMM 32-160	2900	0.4
NMM 32-200	2900	0.7
NMM 32-250	2900	0.4
NMM 40-160	2900	0.4
NMM 40-200	2900	0.7
NMM 40-250	2900	0.6
NMM 50-160	2900	0.4
NMM 50-200	2900	0.4
NMM 50-250	2900	0.4
NMM 65-160	2900	0.6
NMM 65-200	2900	0.4
NMM 65-250	2900	0.4
NMM 80-160	2900	0.4
NMM 80-200	2900	0.4
NMM 100-160	2900	0.5
NMM 100-200	2900	0.4

Table 12: NMM MEI Table (2900 rpm)



NOTES





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