Single Stage Horizontal Type Sewage and Wastewater Pumps

ENDURO-PRO SERIES

OPERATING MANUAL

Mas Grup

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EC DECLARATION OF CONFORMITY

AT UYGUNLUK BEYANI

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Name and address of the person authorised to compile the technical file
Teknik Dosyayı Derleyen Yetkili Kişi ve Adresi Vahdettin YIRTMAÇ
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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 olunduğunu beyan ederiz.
Aşağıda tanımlanan ürünler içüretim kontrollerine bağlı olarak **MAS DAF MAKİNA SANAYİ A.Ş.** *tarafından kontrol edilmiştir.*

Equipment / *Ürün* : *Tek Kademeli Yatay Tip Kanalizasyon Kanalizasyon ve Atıksu Pompaları*
Single Stage Horizontal Type Sewage and Wastewater Pumps
Seri / *Model-Tip* :*ENDURO-PRO Serisi* – ENDURO-PRO 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)*
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 incorparated 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 yada 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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INTRODUCTION


- This manual contains instructions for the installation, operation and maintenance of the ENDURO-PRO Single-Stage Horizontal Type Sewage and Wastewater Pumps 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.

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, Law and Regulations Must Be Applied

2. GENERAL

2.1. Definition of Pump and Usage Areas

ENDURO-PRO 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 long fibers, big solid particles (close to the diameter of the pump intake). (S Type Single Vane 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.

Technical Specifications of ENDURO-PRO Type Pumps:

Discharge Flanges:	**DN 50 - DN 300**
Operating Pressure:	**10 bar**
Impeller Diameter:	**ø140 – ø430**
Q:	**20 – 1500 m^3/h**
Hm:	**10 – 50 m.**
Speed:	**1000 - 3600 d/d.**

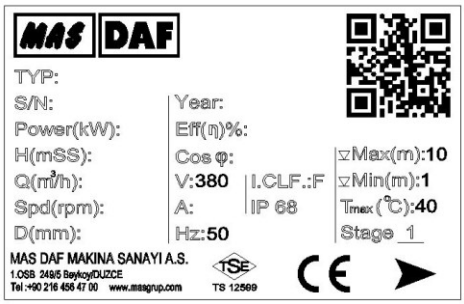


Figure 1 - Pump Label

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 ρ=1 kg/dm^3 and v=1 cst. respectively. For those liquids whose densities and viscosities are different from those of water, please consult with **MAS DAF MAKINA SANAYI A.Ş.** since the performance curves vary with density and viscosity

CAUTION

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 SANAYI A.Ş.**

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

4. TECHNICAL INFORMATION

4.1. Design

ENDURO-PRO 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 ENDURO-PRO 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

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. Impellers

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 suiteble 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.

S Type Single Vane Impellers

S type of impellers have single vane and easily handles
large solid particles. These type of impellers for liquids containing long fibers, big solid particles (close to the diameter of the pump intake). General applications of these type of impellers are raw sewage, solid - liquid mixtures, raw and digested sludge, circulated and heated sludge.

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.

4.1.3. Spare Parts

Please refer to the technical drawing of the pump for necessary spare parts.

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

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

4.1.6. Seals

Special Stuffing Box Design*

Spiral grooves in the big conical seal chamber avoid contamination of the sealing environment with solids improved mechanical seal life.

**Available on some models.*

Shaft Sealing

In 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.

4.1.7. Usage

MASDAF ENDURO-PRO Series Submersible sewage pumps are developed for the purpose of pumping domestic and industrial waste water containing large solid particles. These pumps are suitable for operating entirely immersed in water. Different types of impeller are used in ENDURO-PRO Series pumps for different purposes of pumping clean and waste water, sewage containing solids and fibrous materials and sludge.

4.2. Construction of The Pump

4.2.1. Drive

TEFC (Totally Enclosed Fan Cooled) 3 phase, squirrel caged, in accordance to DIN 42673, IM 2001B35 type, high efficiency IE2 or IE3 (optional) class electrical motor or diesel engine 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, 3x380 V (Y) More than 4 kW, 3x380V (Δ)+(Y/ Δ)

4.2.2. Coupling and Coupling Guard

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

Pump can only be run with a couplingguard 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. Flange 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. Prefer fabric cable for suspension.

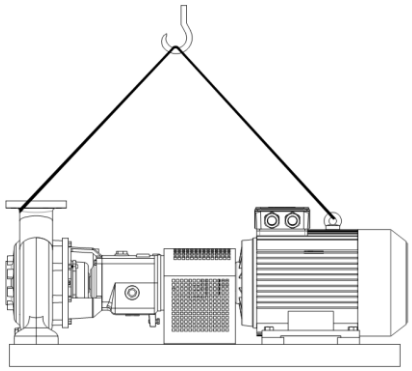


Figure 2 - Transport of Pump Group

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 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. Spray an anti-corrosive into the pump casing.
5. If the pump is not operated immediately, it has to be kept in clean and dry area in vertical position.

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.

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.

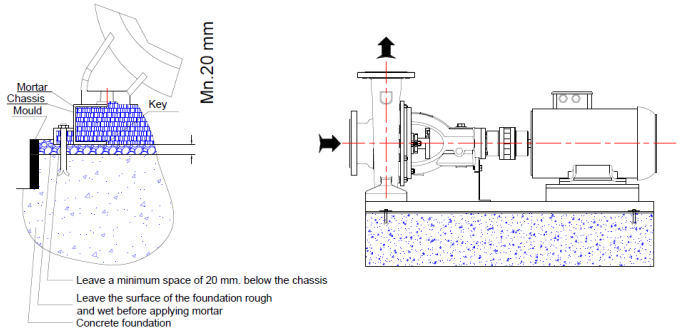


Figure 3: A Typical Concrete Foundation

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 4) (For more precision alignments, special apparatus can be used).
Coupling misalignments in general are of two kinds:

1. Paralel Axis Misalignment (Figure 5-Figure 7)
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 6-Figure 8)
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.

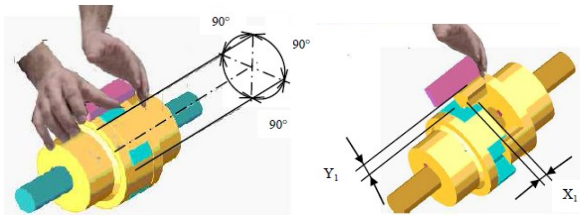


Figure 4: The Control of the Coupling Alignment in Horizontal and Vertical Planes

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

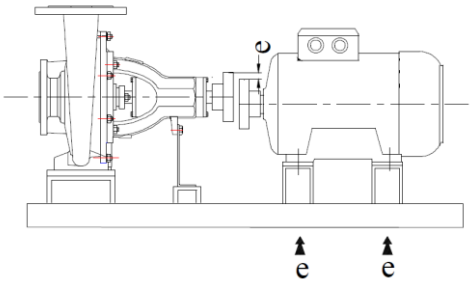


Figure 5: Paralel Axis Misalignment in Vertical Plane and Its Correction

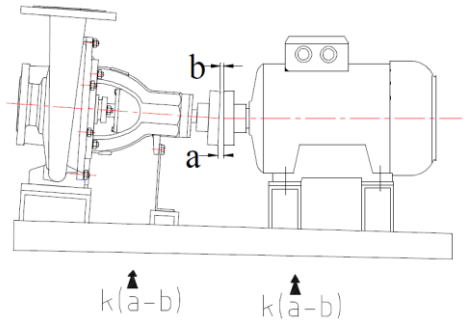


Figure 6: Angular Misalignment in Vertical Plane and Its Correction

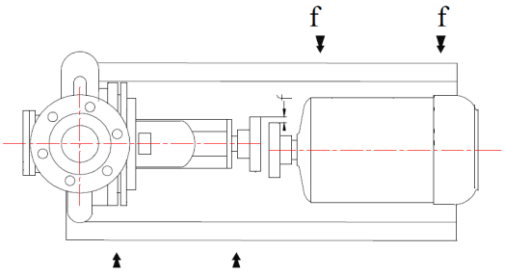


Figure 7: Parallel Axis Misalignment in Horizontal Plane and Its Correction

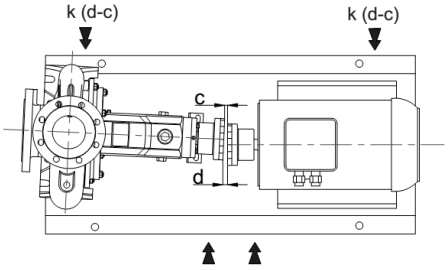


Figure 8: Angular Misalignment in Horizontal Plane and Its Correction

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

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 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

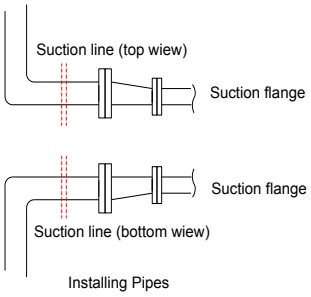


Figure 9: Piping System

An illustrative piping system is shown in Figure 11. 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.

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.

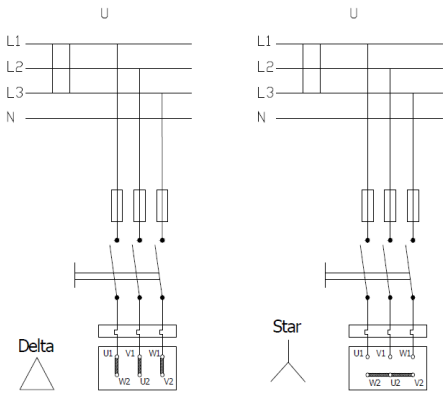


Figure 10: Electric Connection Diagram

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

Before pump is connected to the system, some points have to be controlled.

- Piping has to be made.
- Valves have to be closed and the piping should be empty.
- The entire pump must be in water.
- If there is electricity in control panel, electricity has to be cut off by switches and fuses.
- Oil leakage should be checked where the pump and other parts are located.
- It is certainly important that the ends of the cables are dry and not be submerged into the water.
- The voltage difference between phases should not be more than %5 in system where motor connected.
- Some precautions should be taken to prevent over and under voltage of electric motor. Suitable voltage control and phase control relays have to be used.
- Rotation of pump has to be controlled and if it is wrong, the cable connects have to be fixed by licensed electricians.

CAUTION

Do not start your pump dry (WITHOUT WATER)

7.1. 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.**

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 reads 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.

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).
- All the auxiliary systems must be in use while the pump is operating.
- 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.

Mechanical Seal

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

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.

8.2. Auxiliary Components

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

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 ENDURO-PRO 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+
Impeller	1	1	2	2	3	4	%50
Shaft	-	-	1	1	1	2	%20
Impeller Nut	1	1	2	2	3	4	%50
Bearing(Motor Side)	1	2	2	3	4	5	%60
Bearing (Pump Side)	1	2	2	3	4	5	%60
Mechanical Seal	2	3	4	5	7	9	%100
O-rings	1	2	2	3	4	5	%60

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 Noıse 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) * Pump with Motor	
	1450 rpm/min	2900 rpm/min
1,5	46	61
2,2	50	61
3	50	62
4	52	63
5,5	54	66
7,5	54	66
11	63	70
15	63	70
18,5	64	70
22	64	70
30	64	73
37	64	73
45	64	73
55	67	76

Table 2: Sound Pressure Level

(*) Without protective sound hood, measured at a distance of 1 m directly above the driven pump, in a free space 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. 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 3 - Tightening Torque List

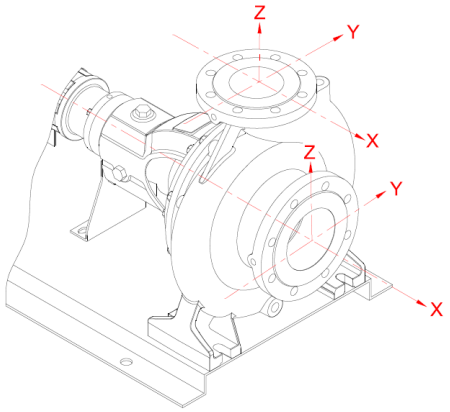
11. FORCES AND MOMENTS AT THE PUMP FLANGES

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 limited1.4times of the maximum allowable value,
- The actual force sand moments acting on each flange, should provide the following formula:

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

In here, $\sum|F|$ and $\sum|M|$ arearithmetic 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
50-200	50	50	500	450	550	450	550	500	333	383	467	333	383	467
80-250	80	80	750	683	833	680	830	750	383	433	533	383	430	530
100-250	100	100	1000	900	1117	900	1120	1000	383	433	533	417	480	580
100-315														
150-315	150	150	1500	1350	1667	1350	1670	1500	500	633	700	580	680	830
300-315	300	300	3410	3067	3810	2571	3181	2838	1200	1391	1695	1200	1391	1695

Table 4 - Forces and Moments at The Pump Flanges

Forces at the pump flanges were calculated according toTS 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.

12. DISASSEMBLY, REPAIR AND REASSEMBLY

Before starting work on the pump set, make sure it is disconnected from the mains and cannot be switched on accidentally.
Fallow the safety precautions outlined in “Safety instructions”.

12.1. Disassembly

- Close all valves in the suction and discharge lines, drain the pump by the drain plug(260) .
- Drain oil from the bearing housing (30) 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.
- 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.
- Disconnect the casing nuts (360) and take out the pump rotor assembly (Impeller + Shaft + Bearing Housing + Bearings + Bearing Covers + Stuffing box etc.)
- Remove the coupling using a puller and remove the key.
- Unscrew the impeller end nut (325) and take out the impeller (20) and impeller key (210). Use rust remover solvent during dismountling if necessary.
- Remove the mechanical seal sleeve (55).
- Remove the 1st mechanical seal (250).
- Remove the stuffing box (50).
- Remove the retaining ring (231) that supports 2nd mechanical seal sleeve.
- Remove 2nd mechanical seal sleeve (50) and then remove 2nd mechanical seal (250).
- Separate the sealing oil bath (14) from the Spacer (13).
- Unscrew the bolts (320) that connect spacer and bearing housing (30) and remove spacer (13).
- Separate the shaft (60) from the bearing housing (30) by removing the retaining ring (230) and bearing sleeve (53) respectively.
- Remove the bearings (200, 201) by unscrewing nut (361) and safety sheet (364) from the shaft (60). (You can removed with puller, press or by heating inner ring, do not use metal hammer for this operation)

12.2 Reassembly

- Reassembly proceeds in reverse sequence to disassembly as described in section 12.1. 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 (200, 201) on their places on the shaft (60) by slightly heating or by using press. (by using press or plastic hammer)
- Tighten the nut (361).
- Insert the shaft (60) to the bearing housing (30).
- Insert the retaining ring (230) and bearing sleeve (53).
- Assembly spacer (13) to the bearing housing (30) by using bolts (320).
- Assembly sealing oil bath (14) to the spacer (13).
- Insert 2nd mechanical seal to the sealing oil bath (14).
- Insert the mechanical seal sleeve (54) and retaining ring (231).
- Insert the stuffing box (50) to the spacer (13).
- Insert the 1st mechanical seal (250) to the stuffing box (50).
- Insert the impeller key (210) to the shaft (60).
- Insert the mechanical seal sleeve (55).
- Place the pump impeller (20). Screw the impeller bolt (325) and impeller washer (370). Insert the impeller (20) with bolt (325) and washer (370).
- Now reassembly of the rotor group is completed.
- Volute casing (01) and spacer (13) are combined with nuts (360). (In the repair shop or on site.)
- Finally, mount the supporting pedestal (39).
- Make sure the gaskets and o-rings are evenly placed without sliding and not damaged or not squeezed at all.
- Replace the coupling and coupling key.
- 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.

13. SAMPLE PLUMBING

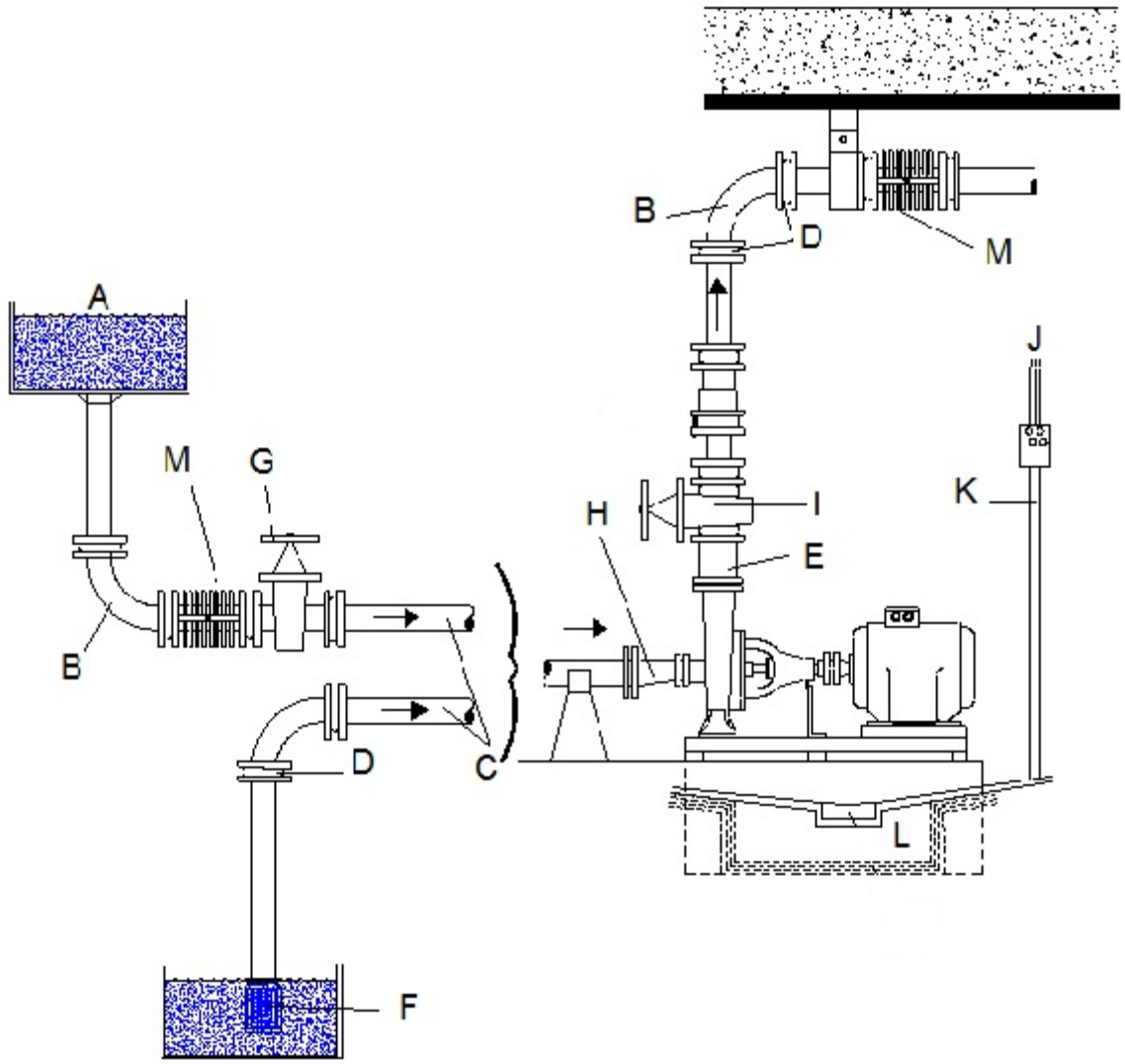


Figure 11: Sample Plumbing

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
İ. Discharge valve
J. Electrical connection
K. Insulated cable
L. Concrete foundation
M. Compensator

14. 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.

ERROR	POSSIBLE CAUSES	POSSIBLE SOLUTIONS
Motor is not working	• No electricity • Low voltage • Fuses cut down • Float gauges are broken (If applicable) • Energy and control cable is broken. • Diesel engine failed • No fuel	• Electrical components should be checked by licensed electricians. • Check the voltage • Fuses should be replaced by licensed electricians • Check the gauges. • Change the energy and control cables. • Check the diesel engine oil. • Check the oil level.
The pump delivers insufficient capacity	• 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 • Impellers are blocked. • Impellers worn or damaged	• 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 • Clean up the impellers. • Change the impeller.
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 • Too much, too little or improper lubrication	• Replace the coupling • Change the oil, decrease or increase its quantity
Leakage in the stuffing box	• Worn out and damage in stuffing box.	• Use new seal. • Replace any deformation of the seal bushing.
Noisy operation	• Worn out motor or pump ball bearings • Cavitation • Worn out or misaligned coupling • Operation in the far left or right of the performance curve	• Replace • Close the delivery partially in order to reduce the capacity. • Replace the coupling or align it • Operate the pump at its label setting
Vibration	• 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 • Pump is not secured properly.	• Bleed completely the pump and the pipe • Increase the liquid level • Replace the worn out components • Adjust the operating pressure to the label value • In case of continuous overload, decrease the impeller diameter • Align the coupling • Change the oil, decrease or increase its quantity • Balance the impeller again • Use new bearings • Check that the pump group is monted according to Chapter 6.

Table 5 - Possible Failures, Causes, Solutions

15. ENDURO-PRO SECTIONAL DRAWING AND PART LIST

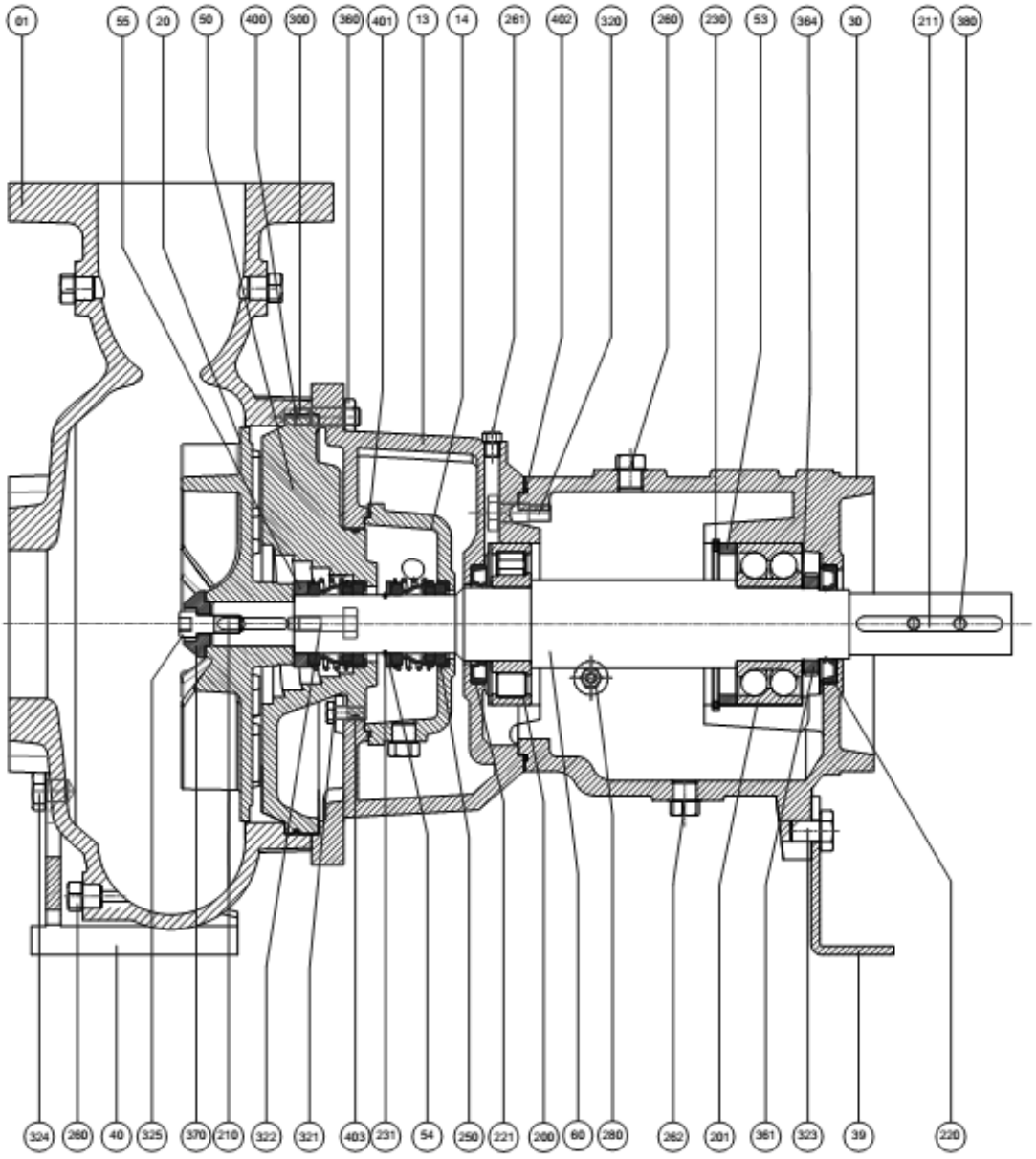


Figure 12 - ENDURO-PRO Sectional Drawing

PART NO	PART NAME	PART NO	PART NAME	PART NO	PART NAME
01	Volute Casing	210	Impeller Key	322	Bolt
13	Spacer	211	Key	323	Bolt
14	Sealing Oil Bath	220	Oil Seal	324	Bolt
20	Impeller	221	Oil Seal	325	Imbus Bolt
30	Bearing Housing	230	Retaining Ring	360	Nut
39	Supporting Pedestal	231	Retaining Ring	361	Nut
40	Supporting Foot	250	Mechanical Seal	364	Safety Sheet
50	Stuffing Box	260	Plug	370	Impeller Washer
53	Bearing Sleeve	261	Plug	380	Setscrew
54	Mechanical Seal Sleeve	262	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		

Table 6 - ENDURO-PRO Part List

16. PUMP DIMENSIONS TABLE

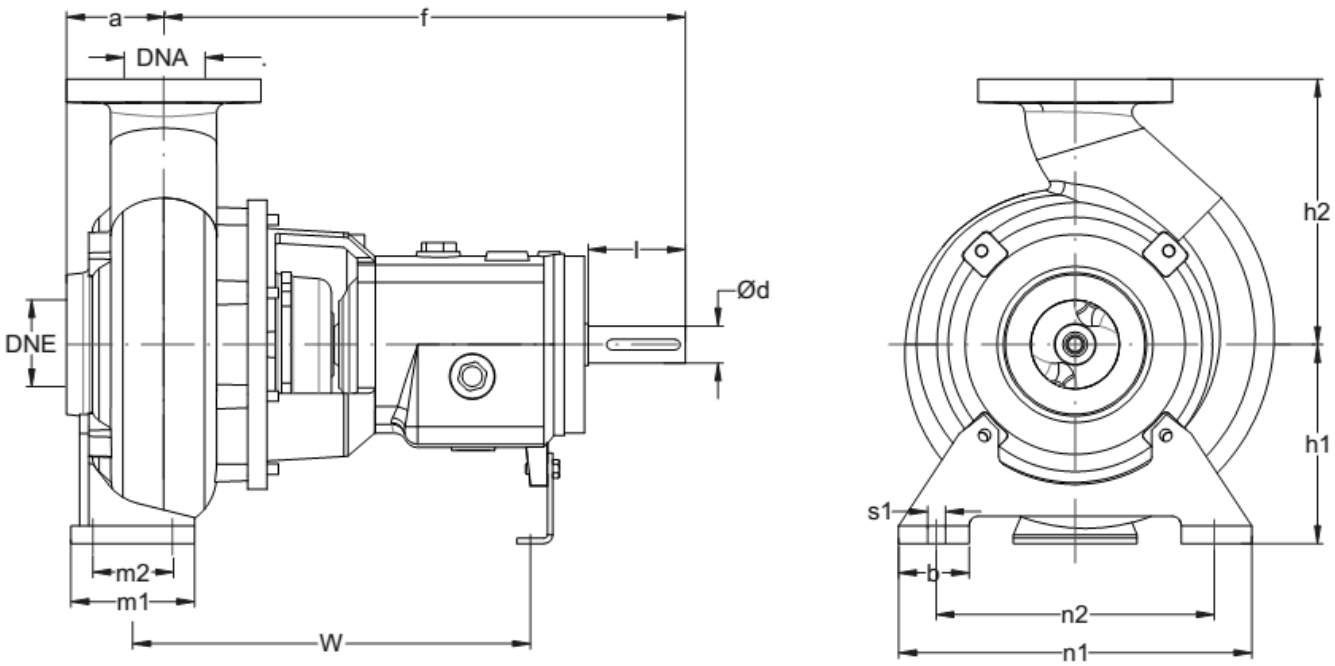


Figure 13 - ENDURO-PRO Pump Dimensions Drawing

Pump Type	DNE	DNA	ød	a	f	l	W	b	s1	m1	m2	n1	n2	h1	h2
50-200	50	50	24	70	370	50	220	50	14	100	70	265	215	180	225
80-250	80	80	42	83	560	110	425	80	16	140	75	400	315	225	282
100-250	100	100	42	110	570	110	450	80	16	140	75	400	315	275	300
100-315	100	100	42	130	715	95	540	80	18	180	110	470	400	300	355
150-315	150	150	42	130	715	95	540	80	18	180	110	470	400	300	355
300-315	300	300	45	275	730	110	575	146	30	240	180	620	500	355	600

Table 7 - ENDURO-PRO Pump Dimensions Table

17. DRAWING FOR DISMANTLING AND PART LIST

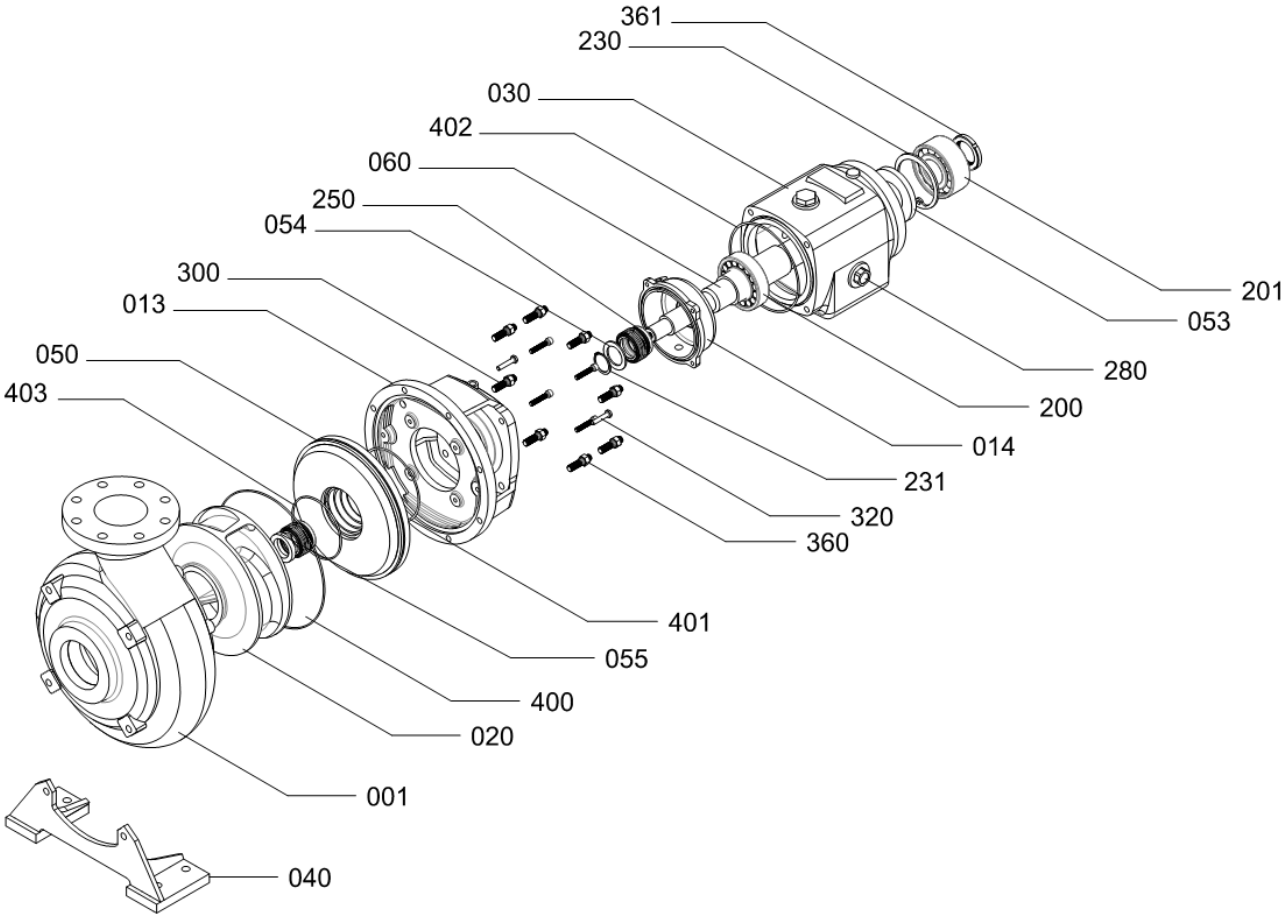


Figure 14 - Drawing for Dismantling

PART NO	PART NAME	PART NO	PART NAME	PART NO	PART NAME
01	Volute Casing	55	Mechanical Seal Sleeve	320	Bolt
13	Spacer	60	Shaft	360	Nut
14	Sealing Oil Bath	200	Bearing	361	Nut
20	Impeller	201	Bearing	400	O-Ring
30	Bearing Housing	230	Retaining Ring	401	O-Ring
40	Supporting Foot	231	Retaining Ring	402	O-Ring
50	Stuffing Box	250	Mechanical Seal	403	O-Ring
53	Bearing Sleeve	280	Oil Gauge		
54	Mechanical Seal Sleeve	300	Stud		

Table 8 - Part List of Distmantling

18. FIGURE LIST

19. TABLE LIST

Mas Grup

Head Office / Center Service:
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Ankara Regional Directorate:
Aşağı Öveçler Mah. 1329 Sok. No:6/9 Öveçler ANKARA / TURKEY
Tel: +90 (312) 472 81 60-67 Fax: +90 (312) 472 82 51

Factory:
1. Organize Sanayi Bölgesi Parsel 249/5 Beyköy - DÜZCE / TÜRKİYE
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