Vertical Shaft Chemical Waste Pumps

PSP & MDP SERIES

PSP & MDP
ATEX Version

OPERATING MANUAL

Mas Grup

Revision No: 02

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EC DECLARATION OF CONFORMITY

AT UYGUNLUK BEYANI

Manufacturer / *İmalatçı* **: MAS DAF MAKİNA SANAYİ A.Ş.**

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Teknik Dosyayı Derleyen Yetkili Kişi ve Adresi
Vahdettin YIRTMAÇ
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Tuzla - İSTANBUL / TÜRKİYE

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* : Vertical Shaft Chemical Waste Pumps / *Düşey Milli Kimyasal Atık Pompaları*

Seri / *Model-Tip* : PSP and MDP Series – *PSP ve MDP Serisi*

For pumps supplied with drivers/ *Elektrikli Pompa Üniteleri*
Related Directives / *Yönetmelikler*
2006/42/EC Machinery Directive **/ 2006/42/AT** *Makine Emniyeti Yönetmeliği*
2014/35/EU Low Voltage Directive **/ 2014/35/AB** *Alçak Gerilim Yönetmeliği*
2014/30/EU Electromagnetic Compatibility Directive **/ 2014/30/AB** *Elektromanyetik Uyumluluk Yönetmeliği*
EUP 2009/ 125 /EC Electric Used Products Directive/ *Elektrik Kullanan Ekipmanlar Direktifi (EUP)*
94/9/EC Equipment For Explosive Atmospheres / *Patlayıcı Ortamlardaki Ekipman Yönetmeliği*

Regulations applied acc. to harmonize standards / *Uygulanan Uyumlaştırılmış Standartlar*
TS EN ISO 12100:2010, TS EN 809+A1, TS EN 60204-1:2011.

We hereby declare that this equipment is intended to be incorporated into, or assembled with other machinery to constitute relevant machinery to comply with essential health and safety requirements of Directive The machinery covered by this declaration must not be put into service until the relevant machinery into which it is to be incorporated has been declared in conformity with provisions of the directive.
Ekipman, uygun bir makina oluşturmak amacıyla diğer ekipmanlar ile birleştirilirken ya da monte edilirken gerekli sağlık ve güvenlik yönetmeliklerine uyulması gerekmektedir.
Bu bildiri kapsamında yönetmelikte belirtilen bütün hükümler yerine getirilmeden makinanın devreye alınmaması gerekmektedir.

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

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

Signature of authorized person **:**
Yetkili Kişinin İmzası

TABLE OF CONTENTS

INTRODUCTION

- This manual contains instructions for the installation, operation and maintenance of the PSP and MDP type vertical shaft chemical waste 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

Sign for protecting against explosion

1. IMPORTANT SAFETY PRECAUTIONS

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

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

All Other Health and Safety Rules, Laws and Regulations Must Be Applied

2. GENERAL

2.1. Definition of Pump and Usage Areas

PSP and MDP series pumps single stage, vertical shaft process pumps. They are used in:

- Wastewater with fibres
- Industrial facilities
- Industrial waste liquids
- Tank drain
- Corrosive liquids
- Discharging bilge water in ships
- Pumping chemical liquids

CAUTION

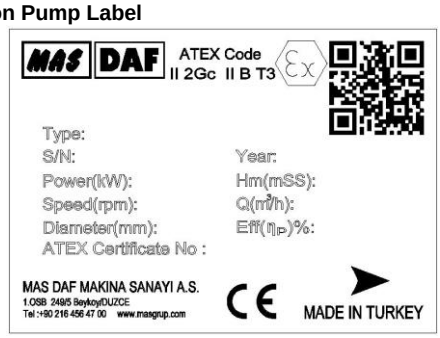
Please contact MAS DAF MAKINA SANAYI A.Ş. for liquids that have different chemical and physical specifications.

Technical specifications

	PSP	MDP
Discharge Flange	DN 32 – DN 80	Up to 200 mm
Operating Pressure	6 Bar	10 Bar (16 Bar)
Impeller Diameter	Ø120 – Ø250	Ø120 – Ø380
Capacity	3-100 m^3/h	10-800 m^3/h
Hm	15-50 m.	35 m
Temperature	90°C	90°C
Speed	1000—3600 rpm.	1450 rpm.

Pump Label

ATEX Version 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

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

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

2.3. Warranty Conditions

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

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

2.4. Test

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

2.6. ATEX Description

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

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

ATEX Codification

ATEX -95

Ex 2G /D c Tx (85 ºC – 200 ºC)

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

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

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

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. Informations about Protection against Explosion

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

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

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

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

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

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

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

3.6. Spare Parts Replacement

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

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

4. TECHNICAL INFORMATION

4.1. Design

Single stage, with open or vortex type impellers and vertical shaft process pumps.

4.1.1. Casing

The casing has a radial discharge nozzle. Thanks to casing and bearing fixing element, the parallel verification is provided among the column, suction cover and bearing.

4.1.2. Impeller

PSP pumps have open impeller and impeller connects to shaft with key. It has a locking mechanism for preventing rotation in reverse direction.
Impellers are balanced according to ISO G 6.3. By the impeller with rear wings, axial loads are decreased and prevented entering of solid particles.
There are 3 alternatives being open, closed and vortex for impellers in MDP pumps.

4.1.3. Filter

The filter apertures are sized to prevent the entry of large solid particles.

4.1.4. Discharge Elbow

The elbow is designed in order to provide maximum hydraulic performance. With special design of the fasteners it allows possible minimum clearance.
Threaded connections on the discharge pipe allow pipe to be dismantled without removing pump from the well.

4.1.5. Column Pipe

The column pipe has flanged connection and the pipes are machined to provide accurate parallelism.

4.1.6. Shaft

In Standard design, one-piece shaft is used to provide parallelism.
Shaft surface is machined precisely and it is cleared to prevent the vibration of the shaft and to reduce the collapse of the shaft.
In all series, standard bearing lenght provide shaft to be kept below the first critical speed.

4.1.7. Bearing and Lubrication

Axial bearing is provided with single row ball bearing (6400 type) with grease lubricated. Through mounted to shaft, all axial thrust and also some radial load are carried. All contact surfaces are machined precisely.

4.1.8. Seals

In standard manufacturing, uncooled teflon braided soft packing is used as a seal upper side. There are two oil seals on upper and lower side of the plain bearing.

4.1.9. Motor Connection Part

Motor connection part is manufactured from casting and it is machined precisely to be smooth alignment between the motor and pump. Motor connection part is designed for vertical flanged motors.

4.2. Construction of Pump Group

4.2.1. Drive

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

Specifications of electrical motor;

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

4.2.2. Coupling and Coupling Guard

In PSP-MDP pumps, a flexible coupling with spaces or without spaces is used in accordance with DIN 740.

4.2.3. Base Plate

The base plate is manufactured from high strength steel sheet.

5. TRANSPORT AND STORAGE

Please check after receiving the pump. Carefully check that everything is in accordance with order. If there are damaged or missing parts, please contact **Mas-Daf Makine San. A.Ş.**

5.1. Transport

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

5.2. Storage

Short-term: (Less than 6 months)

The packaging procedure of **MAS DAF MAKİNA SANAYİ A.Ş.** is designed that how the pump will be transport.
Keep the pump indoor and dry places.

Long-term: (More than 6 months)

In storage for long-term, protection applications are necessary for bearings and machined surfaces. It is necessary to change the contact surfaces of the shaft by rotating shaft once every three months. The pump and motor must be kept in dry places.

5.3. Transportation

The pump and its parts are heavy so incorrect lifting may damage the pump unit and cause injuries. The personnels working during the loading should wear special shoes.

Be careful when moving pumps. Ensure that lifting equipments support all installation enough. Remove the pump in the vertical by position using the appropriate ring and rope. Try to prevent the movement of the pump and damages and injuries that it will cause. Put down the pump to the well. Determine the final position of the motor and balance it.

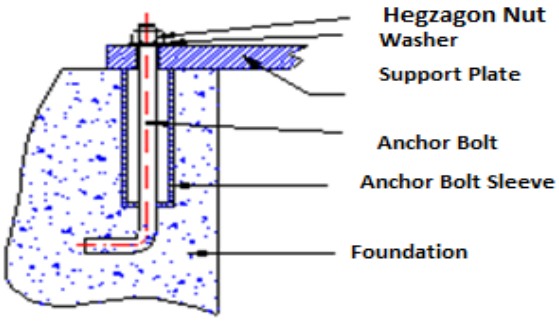
6. ASSEMBLY / INSTALLATION

6.1. Control

1. Remove all parts inside the transportation container.
2. Clean the underside of the support plate.
3. Clean the grease on machined parts.

6.2. Installation Location - Foundation

It must be enough space for installation, operation, maintenance and examination procedures of the pump. Space at the upper side of the pump must be such as to allow installation and movement of the pump. The pump should be at least 10 mm away from any edge of the pit.
Vertical well pumps are normally connected to the concrete well and steel tanks. The support structure extinguishes vibrations by providing rigid support consistently. If the anchor bolt is poured into the concrete, sleeve-type structure shown below must be prefered.



1. Put down the pump and the support plate over the bolt in the foundation.
2. By using washers and wedges, bring the support plate at the same level from all sides.
3. Tighten the anchor bolt by hand and check level of the support plate, if it is necessary balance it again.
4. Tighten all anchor bolts with box end wrench without damaging the support plate.
5. Make sure that the same level of support plate.

6.3. Engine Mounting

PSP and MDP series are designed to work with DIN 42673-IM 3011 V1-A type electric motors in accordance with the standad IEC and VDE with appropriate speed and power.

1. Before making the assembly of the motor, insert the coupling parts to the pump shaft and the motor shaft.
2. Down carefully the motor over the pump by using hoisting ropes and superimpose the bolt holes.
3. Assemble bolts by hand.
4. Make wiring of motor before completion of installing couplings and check the direction of motor rotation. In PSP and MDP pumps, the correct direction of rotation is clockwise when looking down from the motor.

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, overchargeproblems 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. (Figure4)(For more precision alignments, special apparatus can be used).
Coupling misalignments in general are of two kinds:

1. Paralel Axis Misalignment (Figure 2)

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 3)

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.

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

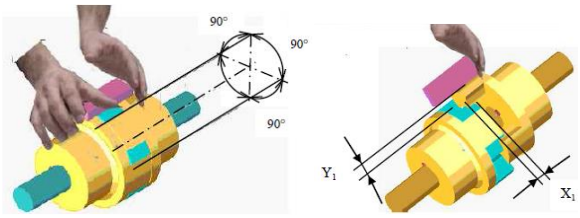


Figure 3: The Control of the Coupling Alignment in Horizontal and Vertical Planes

6.5. Piping

6.5.1. General

- Do not use the pump as the hinged support for the piping system.
- Piping should be as little to reduce friction losses.
- Don not connect piping before connection of the pump to the ground.
- Clean all pipes, valves and fasteners before the pipe installation.
- Check-valves and isolation valves should be installed on the discharge side. Place check-valf in between the pump and isolation valf. Check-valf prevents damage of back flow when the pump stopped.
- Expansion elements sholuld be put between the pump and check-valf to reduce friction losses.
- 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.
- Avoid piping system loads on pump by installing flexible components (compensator) to suction and discharge of the pump.

6.6. Motor Connection

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

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

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

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

Never operate pump units not connected electrical cable connections correctly.

6.6.1. Motor Connection Diagram

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

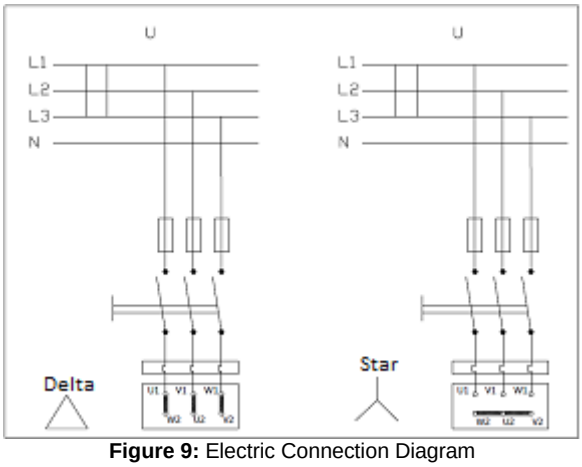


Figure 9: Electric Connection Diagram

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

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

Grease lubricated bearings
Grease-lubricated bearings are lubricated in the factory. Check whether there is enough of lubrication. Change the oil if it is necessary.

Plain Bearing
There are oil seals at the top and bottom side of plain bearing (Şekil 5). The bearing is lubricated in the factory. Change the oil if it is necessary.

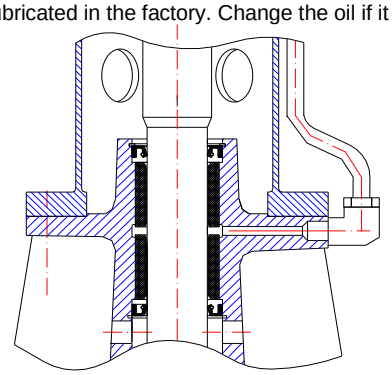


Figure 5

Top Stuffing Box
The upper stuffing box is at the top of column pipe. As Standard, soft packing is used. Because of there is no lubrication fluid in the column, the seals are lubricated with grease. The seal is inserted to the pump before transportation. The seal is lubricated after the grease cup is filled with grease. The lubrication must be performed periodically for a regular lubrication. Lubrication intervals should be determined according to the intensity of using.

7.2. Checking The Direction of Rotation

CAUTION

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

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

7.3. Start up Procedure

- Check whether the pump shaft rotates in a relaxed way.
- 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.

CAUTION

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

8. MAINTENANCE

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

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

The instructions below should be applied.

8.1. Maintenance Scheduling

The maintenance schedule applied for the pump extends life of the pump. Parts made regular maintenance have more long lifetime and need less repair. That done the registrations of maintenance correctly serves the detection of potential problems in advance.
To make possible the visual control, one must be able to reach the pump from any direction. Especially, to be able to dismount the internal units of the pump and the engine, sufficient free space must be created around them for maintenance and repair. Furthermore, one must make sure that the piping system can easily be dismounted.

8.2. 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).
- Bearing temperature must never exceed 80°C if the ambient temperature is 30°C.

- 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.
- Check the elastic components of the coupling. Replace them when necessary.

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

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

8.3. Maintenance Instructions in ATEX Version Pumps

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

8.4. Routine Maintenances

- Bearin lubrication
- Pressure control
- Temperature monitoring
- Vibration analysis
- Seal monitoring

8.4.1. Routine Checks

- Check the noise, the vibration and the bearing temperature.
- Check whether there is a leakage on the pump or piping system.
- Check grease on bearing. Take into account periods of lubrication in Table 1.

Table 1				
Periods of Lubrication According to Working Hours				
Pompa type	Less than 1500 rpm	1500 rpm	3000 rpm	3600 rpm
PSP	2000	1800	800	600

8.4.2. Control Periods

- Control periods should be reduced if the pumping fluid is abrasive or corrosive.

8.4.3. Quarterly Checks

- Check whether the tightening of anchor bolts.
- Turn the shaft a few laps to prevent corrosion of the shaft while the pump is not working.
- Bearing’s grease must be replaced by taking into account Table 1.
- Check the shaft alignment again and correct if not correct.

8.4.4. Annual Checks

- Check the flow, pressure and power of the pump. If pump performance does not reach the setpoint, remove the pump and inspect the components.

8.5. Maintenance of Bearing and Bearing with Grease Lubricated

- Ball bearings of PSP and MDP pumps are transported after it lubricated with grease. It should be noted that clean of grease and grease container.

Re-lubrication procedure
Notice: It should be noted that no dirt in the bearing re-lubricated. Grease and grease nipple must be clean.

8.6. Shaft Seal Maintenance

8.6.1. Packing

- Before replacing the soft packing, the gland must be dismounted 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.

The pumps that working with high temperature liquids has applications on cooling sealing.

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.

8.6.2. Coupling

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

Worn out elastic bands must be replaced.

9. SPARE PARTS

The spare parts of PSP and MDP 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:

10.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.

11.DISMANTLING

WARNING

The pump parts may be heavy. Apply appropriate lifting methods to prevent damage to the pump parts and/or physical injury. Use protected shoes.

WARNING

PSP and MDP pumps can be used to be pumped dangerous and/or poison liquids. Eye and skin protection may be required. Required measures must be taken to prevent physical injuries. Conditions of liquids pumping must comply with environmental rules.

WARNING

Remove the power supply connection of motor to prevent accidental operation of the pump and causing physical injuries.

WARNING

Operator must be aware of properties of liquids and safety precautions to prevent physical injuries.

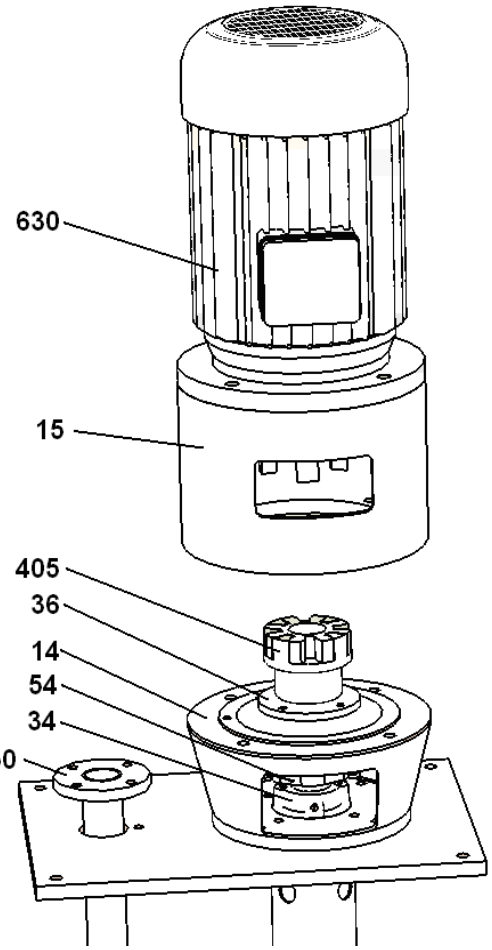


Figure 6: Removing the motor

- Close all valves on the flow.
- Drain liquid remaining in the pipes. Clean the pump with liquid if necessary.
- Remove all auxiliary pipes.

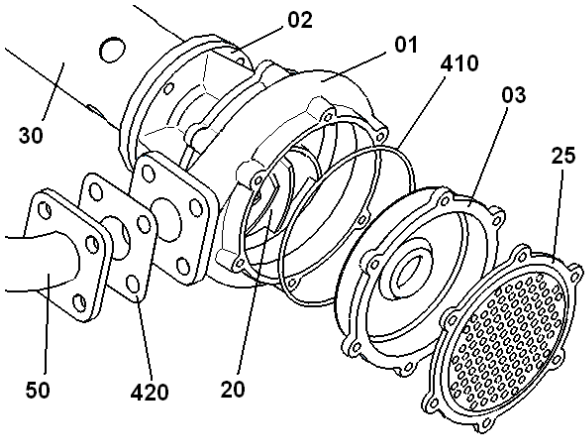


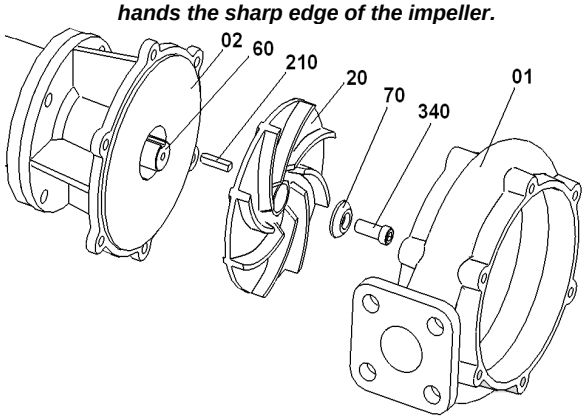
Figure 7: Remove the filter, the suction cover and the discharge pipe

- Remove the coupling guard.
- Remove the coupling
- Remove the motor connection part bolts.
- Seperate motor and motor connection part by using appropriate lifting rope.
- Dismantle anchor bolts on the support plate.
- Take the pump out of the well by using appropriate hanger.
- Place the pump so that the gap to make the dismantling horizontally on a plate.
- Remove the suction cover.
- Remove the O-Ring on the suction cover and replace it.

Disassembly of Impeller

WARNING

While dismantling of the impeller, wear gloves to avoid cutting your hands the sharp edge of the impeller.



Şekil 8: Disassembly of impeller

- Dismantle bolts between the casing and the adapter.
- Seperate the impeller screw and the bushing in front of the impeller.
- Disconnect the impeller from the shaft. If the key is not damaged protect it and use it when mounted again.
- While removing the impeller, push outward from the shaft with a puller apparatus.

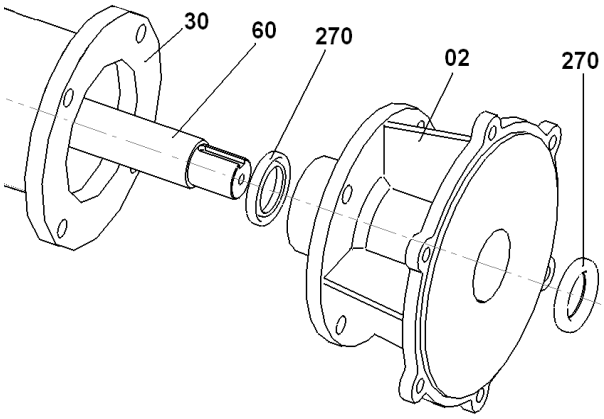


Figure 9:Removing the top cover (Removing the fixed graphite bearing)

Removing the fixed graphite bearing

- Remove the top cover.
- Remove the oil seal. Oil seal is located on the both sides of graphite bearing.

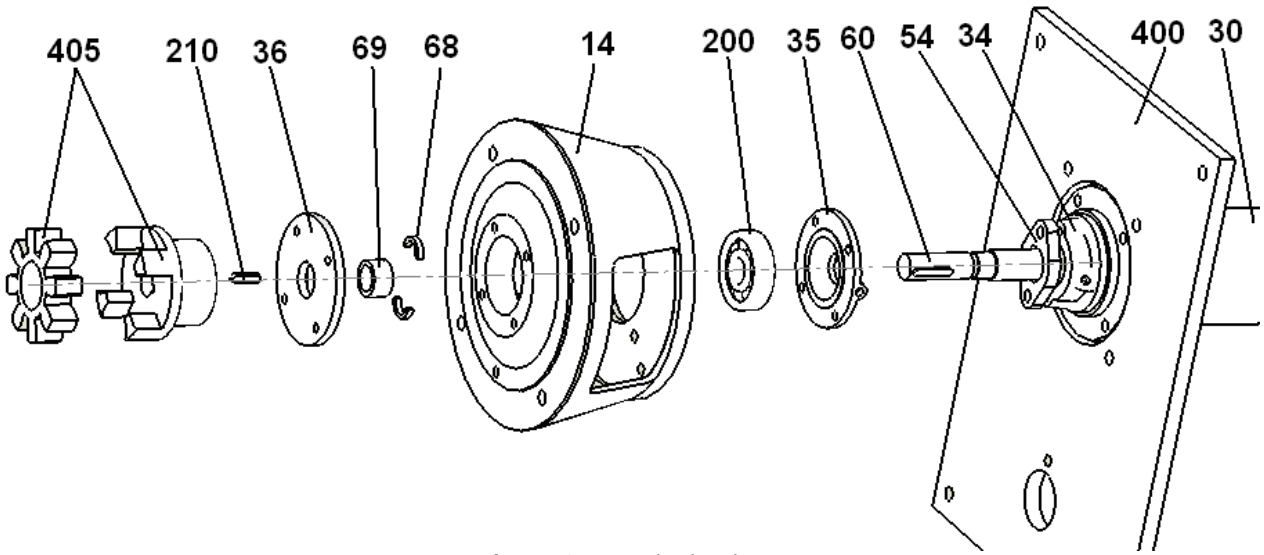


Figure 10: Removing bearings

Disassembly of Bearing

- Remove the coupling key.
- Remove the coupling cover.
- Remove the safeguard bushing.
- Remove the clips that two parts.
- Seperate bearing from the support plate.
- Remove the ball bearing.
- Check the ball bearing.
- Remove the bearing cover.
- Remove the gland and the seal.
- Disconnect stuffing box from the column pipe.

12. EXAMINATION

Pay attention to the following criteria before reassembly PSP and MDP pumps. Replace the pump parts corresponding to the following criteria.

Casing and Suction Cover

- Pay attention to whether casing and suction cover are exposed to extreme surface wear and surface fatigue. Replace parts if necessary.
  A- More than 3 mm depth, regional wear or pitting.
  B- More than 3 mm depth surface fatigue.
- Examination of smoothness of casing O-Ring.

Top Cover and Graphite Bearing

- Measure internal diameter of the oil seal. Replace it if necessary.
- Check internal diameter of the graphite bearing. Replace it if more than the allowable.
- If the wear in place mounted graphite bearing is too, replace it.
- Examine whether there is a crack or extreme corrosion in area coupled the casing and the column. If there is any of the above cases, correct it.

Impeller

- Observe whether there is a damage on impeller blades. If there is an indentation more than 1,6 mm or a wear more than 0,8 mm, replace the impeller.
- Examine the impeller back blade. If there is a wear more than 0,8 mm, replace it.

Column Section

- Examine whether there is any crack or corrosion in column section. If there is a damage, replace it.

Shaft

- Check bearing housing. If it is out of tolerances, replace it.
- Check the area located graphite bearing. If there is a wear more than 0,05 mm, replace it.

Bearing

- Examine whether there are particles that it may affect operation of ball bearing in ball bearing and whether the bearing is damaged. Please note bearing lubrication conditions. Determine bearing damage what caused it. Send it to service if the cause of wear is not normal.

Don't use used bearing.

13. INSTALLATION

Installation Bearing, Column Pipe, Stuffing Box and Carrier Plate

- Connect the bearing and the carrier plate with bolts.
- Assemble the bearing and the column pipe. Pay attention to drain hole on the bearing housing and grease putting hole.

Installation of Rotating Elements

- Insert the shaft towards stuffing box underneath. Insert the gland, the bearing cover and bearing housing to the shaft.
- Place bearings to bearing housing.

CAUTION

Shafts can be damaged by improper handling. The shaft being more than 2 m must be moved by two people to prevent bending of shaft.

Notice: There are many methods for the installation of bearing house.

- Place clip.
- Attach the safeguard bushing on the clip.
- Insert the upper bearing cover.
- Insert the lower bearing cover.

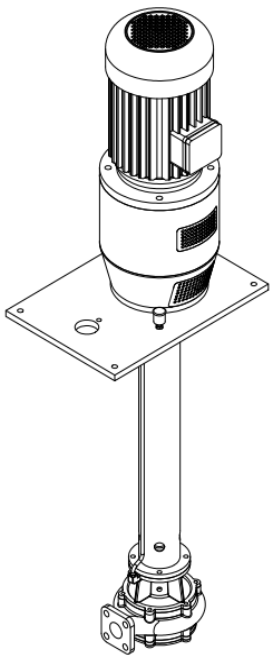
Installation of Suction Cover and Graphite Bearing

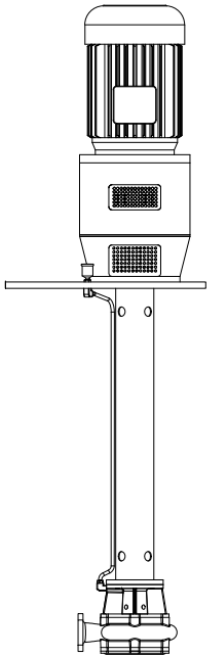
- Place the graphite bearing to the upper cover by appropriate press.
- Place oil seal to the top and bottom section of the graphite bearing.
- Connect the upper cover to the column pipe.

Installation of Casing, Impeller and Filter

- Place the impeller.
- Place the casing.
- Place the suction cover and the filter.
- Mount the disharge pipe and fasten it to the carrier plate.

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





14. POSSIBLE FAILURES, CAUSES AND 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	Pump and/or pipe cannot discharge air, cannot suck	No water in the wells. Vent completely the pump and the pipe.
	Discharge head too high	Check the discharge head and friction losses. Readjust the operating point
	Speed is too low	Check the motor speed.
	Direction of ratation is wrong	Check the direction of ratation.
	Impeller, discharge pipe, filter are completely engorged.	Remove obstruction
	The problem about suction pipe	Check the suction head, it may be high or may be engorged.
	$NPSH_{Available}$ is too low.	Check $NPSH_A$ and $NPSH_R$. Increase the liquid level if necessary.
The pump delivers insufficient capacity or discharge head.	Some part of impeller, discharge pipe and filter is engorged.	Remove obstruction
	Direction of ratation is wrong	Check the direction of ratation.
	Discharge head may be higher than expected.	Check the discharge head and friction losses.
	Corroded impeller	Check and if necessary replace it
	The problem about suction pipe	Check the suction head, it may be high or may be engorged.
	Speed is too low	Check the motor speed.
	Entering air or gas into the liquid	Dip deeper. Check the piping and edit air inlet.
	$NPSH_{Available}$ is too low.	Check $NPSH_A$ and $NPSH_R$
The pump stops after starting	Flow control was set incorrectly.	Check it.
	Entering air or gas into the liquid	Dip deeper. Check the piping and edit air inlet.
	Entering air into the suction pipe	Prevent leaks.
	Incorrect adjustment	Be coupled pump and motor properly.
Bearings are too high	Incorrect lubrication	Check the condition of the oil.
	Contact with the ground is not firm	Tighten the bolts.
Noisy operation and vibration.	Inappropriate pump / motor coupling	Correct the direction of the shaft.
	Some part of impeller is engorged or unbalanced.	Clean shaft with backward flow.
	Broken rotating elements	Check and if necessary replace it.
	The shaft is bending	Straighten or replace.
	The bearing is wearing	Check and if necessary replace it.
The motor is consuming too much power	It gives more flow in the same discharge head	Cut the impeller.
	The fluid is heavier than expected	Check density and viscosity.
	Rotating parts are rubbing.	Check the wearing rings.
	Rotational speed is too much	Check the motor.

15. TIGHTENING TORQUES

THREAD DIAMETER	TIGHTENINGTORQUE 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

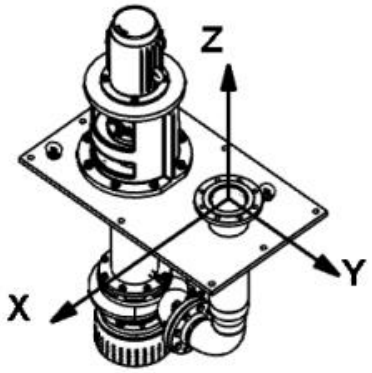
16. FORCES AND MOMENTS AT THE PUMP FLANGES

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

- Any component of a force or a moment, must be limited 1,4 times of the maximum allowable value,
- The actual force sand moments acting on each flange, should provide the following formula:

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

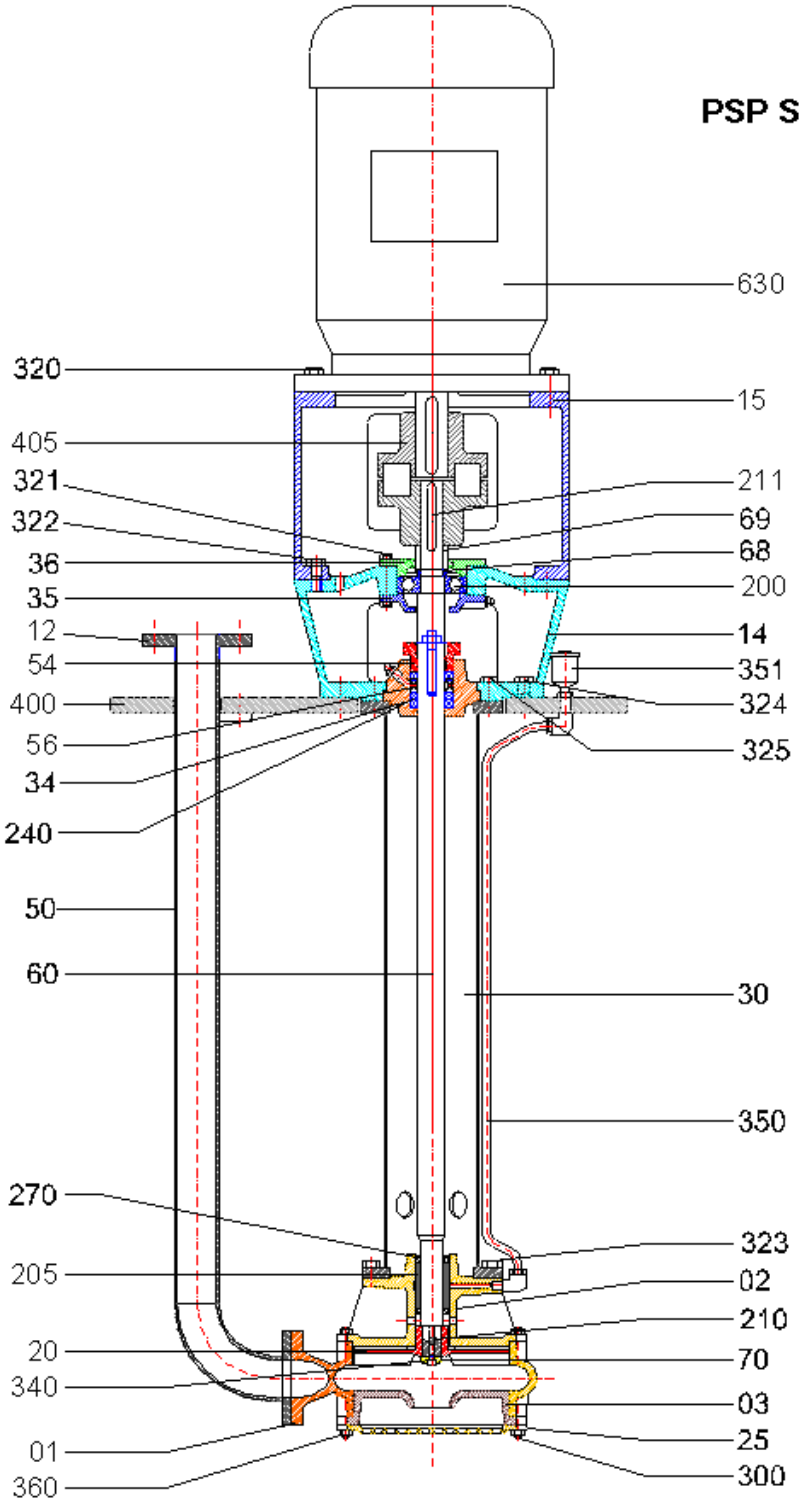
In here, $\sum|F|$ and $\sum|M|$ arearithmetic sum of the loads for each flange at the pump level, without regard of the algebraic signs of the actual and maximum allowable values.



	Forces			Moments		
	Fx	Fy	Fz	Mx	My	Mz
PSP 32	510	540	630	510	660	450
PSP 50	810	900	990	690	840	600

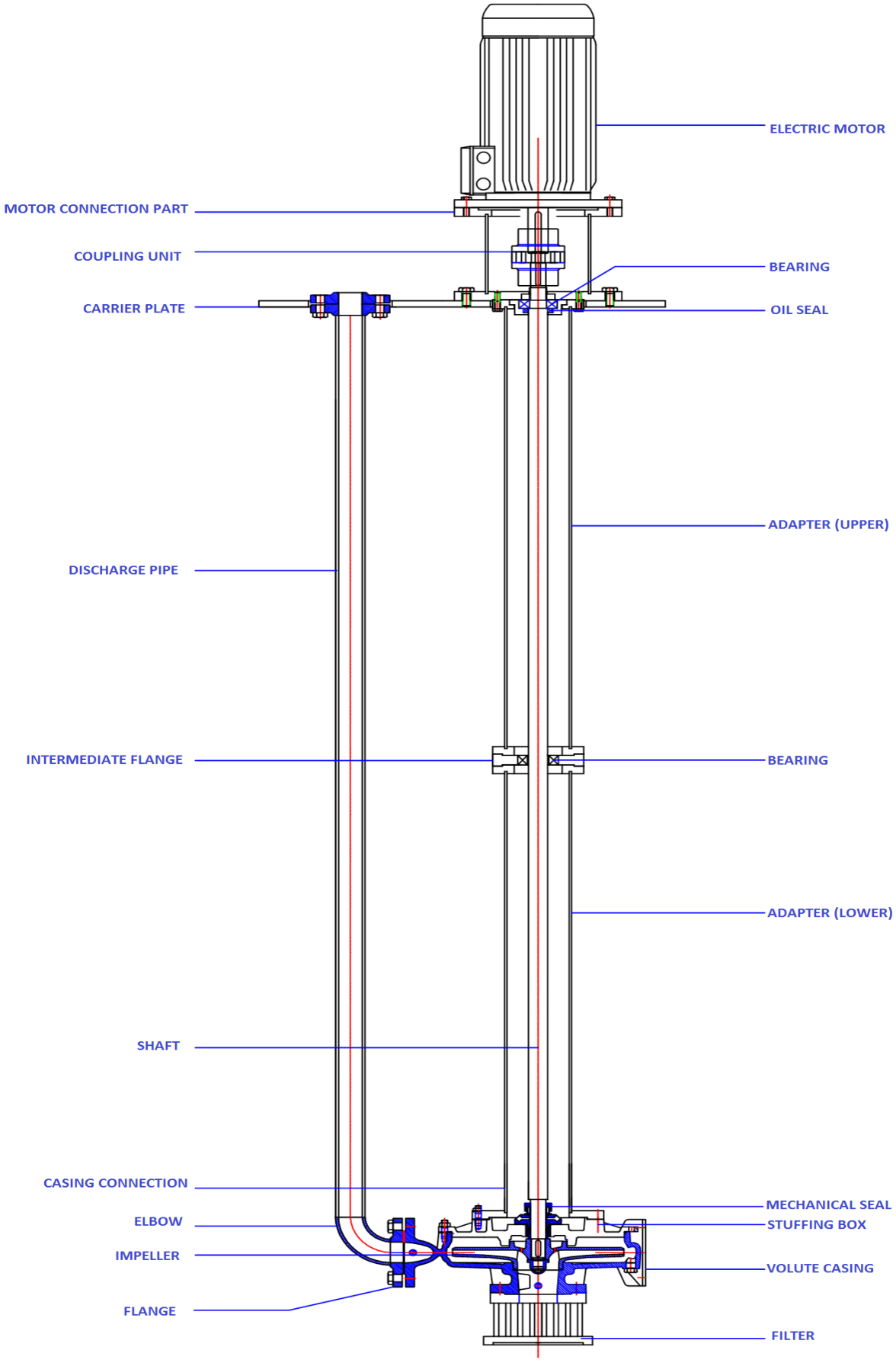
Forces at the pump flanges were calculated according toTS EN ISO 5199 standard. The calculations are valid for the materials of cast iron and bronze. Forces and moments at the flanges that made of stainless material will be approximately twice as moments in the table.

17. PSP SECTIONAL DRAWING AND PART LIST



Part No	Part Name
01	Casing
02	Upper cover
03	Suction cover
12	Discharge flange
14	Bearing house
15	Motor connection part
20	Impeller
25	Filter
30	Column pipe
34	Stuffing Box
35	Outer bearing cover
36	Inner bearing cover
50	Discharge pipe
54	Gland
56	Lantern ring
60	Shaft
68	Clip
69	Safeguard bushing
70	Impeller front side bushing
200	Bearing
205	Graphite bearing
210	Impeller key
211	Coupling key
240	Seal
270	Oil seal
300	Stud
320	Hexagon bolt
321	Hexagon bolt
322	Hexagon bolt
323	Hexagon bolt
324	Hexagon bolt
325	Hexagon bolt
340	Imbus bolt
350	Lubrication pipe
351	Spring oil box
360	Nut
400	Carrier plate
405	Coupling unit
630	Motor

18. MDP SECTIONAL DRAWING AND PART LIST



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