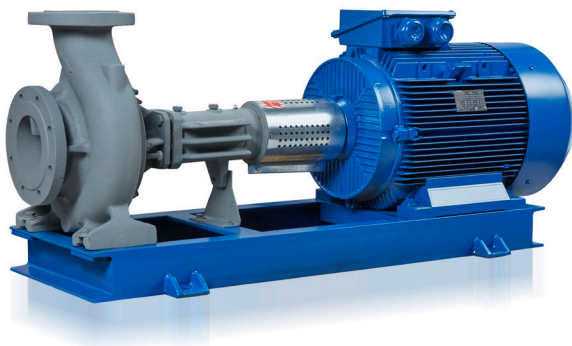


KYP SERIES

End Suction Heat Transfer Centrifugal Pumps



Operating Manual





EC DECLARATION OF CONFORMITY

AT UYGUNLUK BEYANI

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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 olduğunu beyan ederiz.

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

Equipment / Ürün : Kızgın Yağ (Isı Transfer Yağı) Pompaları - Thermal Hot Oil Pumps

Seri / Model-Tip : KYP Serisi - KYP Series

For pumps supplied with drivers/ Elektrikli Pompa Üniteleri

Related Directives / Yönetmelikler

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

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

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

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

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

2009/125/EC European Ecodesign Directive, Regulation No: 547/2012 Ecodesign Requirements for Water Pumps / Avrupa

Eko Tasarım Direktifi, (SGM-2015/44) 547/2012 No'lu Su Pompalarında Eko Tasarım Regülasyonu

Regulations applied acc. to harmonize standards / Uygulanan Uyumlulaştırılmış Standartlar

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

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

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

Bu bildiri kapsamında yönetmelikte belirtilen bütün hükümler yerine getirilmeden makinenin devreye alınması gerekmektedir.

Place and date of issue / Yer ve Tarih : İstanbul, 01.08.2019

Name and position of authorized person : Vahdettin YIRTMAC

Yetkili Kişinin Adı ve Görevi : Genel Müdür / 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 KYP type single stage, end suction, volute type heat transfer pumps of MAS POMPA CO.

• 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 POMPA'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 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 POMPA CO 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 POMPA CO. 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 Operating Manual



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



Warning sign against the electrical risk



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 health. (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, take 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 EN 60204-1 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

KYP series pumps are single stage, end suction volute type heat transfer pumps.

They are used in:

- Chemical and petrochemical facilities
- Paper mills and sugar factories
- Food and pharmaceutical factories
- Leather industry
- Plastics and synthetic fiber factories
- Rubber industry
- Cooking and heating ovens
- Textile industry
- Laundries
- Heat transfer facilities which utilize liquids that are over 100°C

KYP type pumps can pump all sorts of organic and synthetic oils that are produced for heat transfer.

KYP type pumps are horizontal shaft, single stage pumps that are designed to pump all kinds of heat transfer oil at high temperatures. They do not require an external cooling source. The hydraulic character of KYP pumps comply with DIN 24 256 (ISO 2858) standards which are prepared for chemical process pumps. KYP pump family can work with optimum performance in every operating condition.

Technical specifications of KYP type pumps

Suction and Discharge Flanges: DN 32-DN 100
 Operating pressure: 16 bars
 Capacity: 10-300 m³/hour
 Head: 5-90 m
 Speed: 1450-1750-2900-3600 Rpm.

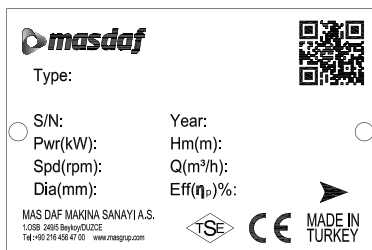


Figure 1: Pump Label

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 $\rho=1 \text{ kg/dm}^3$ and $\nu=1 \text{ cst.}$ respectively. For those liquids whose densities and viscosities are different from those of water, please consult with MAS POMPA CO. 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.

2.3. Warranty Conditions

The entire products in our selling program are warranted by MAS POMPA CO.

Warranty period is 24 months after delivery.

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 POMPA CO.

2.5 Pressure Limit



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

3. Safe Working 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. SAFE WORKING CONDITIONS

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 POMPA CO. 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 rigid coupling) must be covered so that one cannot touch them. Those covers must not be dismantled while the pump is running. Dangers that results from electrical connections must be removed. To get more information about this subject, you can refer to VDE and domestic electrical instructions.

3.4. Safety measures for maintenance and installation

The customer 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 POMPA is not responsible from the usage of improper spare parts.

4. TECHNICAL INFORMATION

4.1. Design

Regarding their hydraulic properties, KYP pumps single stage, horizontal shaft, volute type centrifugal pumps. Due to its mechanical design, the natural air convection forms a drastic temperature decrease from the casing to the bearing. Thus, without using an external cooling system, the mechanical seals and bearings can be cooled sufficiently. The pump and the motor are coupled with an elastic coupling over a common base-plate.

4.1.1. Volute Casing

The single piece pump is dismountable in the vertical plane. The suction and discharge flanges and the pump pedestal feet are on the casing. Since the rotor can be dismantled from the rear side, there is no need to dismount the pump casing and the plumbing when maintenance and/or repair is needed. When a secondary component coupling is used, there is no need to dismount the motor. The suction flange is in the front, and the discharge flange is above the pump.

4.1.2. Location of flange – flanges

Suction flanges	in axial direction	DN 50 – DN 125
Discharge flange	radially upward	DN 32 – DN 100
Discharge flanges		DN 2533 – PN 16

4.1.3. Auxiliary fittings

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

4.1.4. Impeller

Single suction, enclosed type, full centrifugal impellers are used. Radial blades behind the impeller are used in order to lower the seal pressure and to maintain axial balancing.

4.1.5. Shaft

The mechanical seal which maintains impermeability is embedded in the ball bearing, in front of the second bearing and close to the coupling. This placement signifies that the mechanical seal dwells in the low temperature region; far from the volute; which is a significant heat source. Therefore the life of the mechanical seal increases. The primary bearing is placed in between the impeller and the mechanical seal and is lubricated by the discharged fluid. Just behind the impeller, a packet type security seal, which withstands high temperature, sits. Thanks to this seal that, in case there is a malfunctioning in the mechanical seal, an increase in the escape flow rate is prevented. The second bearing dwells on the side of the coupling and is lubricated by grease.

4.2. Construction of pump group

4.2.1. Drive

A hermetic, 3 phase, totally enclosed, fan cooled, squirrel caged, IM 1001B3 type electrical motor which complies with DIN (42673) IEC, VDE and TSE standards 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	: 3x380 V(Y) up to 4 kW More than 4 kW, 3x380(Δ) + (Y/Δ)

4.2.2. Coupling and coupling guard

A flexible shaft coupling with or without secondary component in accordance with DIN 740 is used. A coupling guard is given in accordance with EN 294 in case of the pump group includes the coupling and chassis



Pump can only be run with a coupling guard in accordance with EN 294 according to the safety instructions

4.2.3. Base Plate

It is manufactured from stell plate or U profile stell in accordance with DIN 24259.

5. TRANSPORT AND STORAGE

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

5.1. Transport

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

CAUTION

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

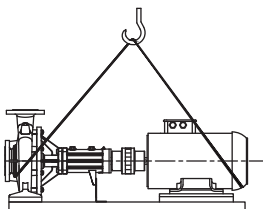


Fig.2: Transport of pump group



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. Close the suction and discharge exits with gasket. Spray an anti-corrosive into the pump casing.

5.2.1 Protection

The pumps that will be stored for a long time need to be protected against corrosion both internally and externally. The persistence against corrosion depends on storage conditions and the anti-corrosive agent. In ordinary conditions, the pump does not have a special protection. An extra information on proper protection agents may be obtained from our firm upon request.

5.2.1.1. External protection

External protection must be maintained by protective painting and spraying. All uncoated surfaces (shaft ends, couplings, flange surfaces, valve and manometer fittings) must be protected.

5.2.1.2 Internal protection

Protection is applied by filling up the pump. For this reason, the suction side of the pump must be closed with a dead flange. During filling-up, the discharge flange must be at a higher altitude than the suction flange and the shaft must be slowly rotated. Filling-up must continue until the protective agent reaches the impermeable face of the discharge flange without having air bubbles. Then the discharge end must be closed with a dead flange.

This procedure is not necessary for stainless steel pumps

CAUTION

In case long storage durations exist, the protection must be controlled by the client at given intervals. If necessary, the protective agent must be filled from discharge flange up to the impermeability surface. Moreover, impermeability must be controlled against deteriorations.



MAS-DAF MAKİNA SAN A.Ş. is not responsible from damages emanating from improper protection.

5.2.1.3 Emptying the protective agent



Before the pump is operated protective oil must be emptied. One must make sure that the waste is disposed according to the environmental rules

CAUTION

After a long storage duration, before commissioning, the structural elasticity of all of the elastomers (O-rings, seals) has to be checked. They need to be replaced immediately when the slightest damage is detected. The elastomers which are made of Ethylene-propylene need to be renewed.

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

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.

NOTE: 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.

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

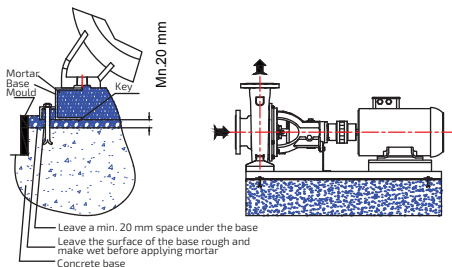


Figure 3. A typical concrete foundation for without trailer applications

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.

NOTE: 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 to pinpoint 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 smooth edged metal pieces (e.g. a steel ruler or a gauge stick) and one precision calipers. (Figure 3.)
(For more precision alignments, special apparatus can be used).

Coupling misalignments in general are of two kinds:

1. Parallel axis misalignment.

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

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

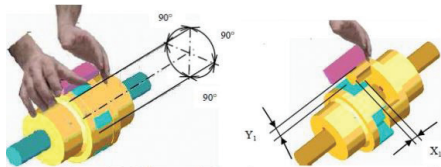


Figure 4. The control of the coupling alignment in horizontal and vertical planes.

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. Especially, the supporting items shall be placed in the direction of discharge flange axis of the pump (generally in vertical direction).
- Suction pipe shall be in a constantly increasing slope to the pump. Air in the suction pipe shall be arranged to move into the pump.
- Discharge piping shall be in a constantly increasing slope to the reservoir or discharge point, without up and downs which can cause air pockets in the piping system. At locations where forming of air pockets is possible, special items like air valve and air cock are mounted to evacuate the trapped air.
- It is important that pipe diameter and fittings are at least as much as the pump opening diameter or preferable one or two size higher. One should never use fittings with smaller diameters than the pump exit diameter. In particular, preferred fittings like foot valve, strainer, filter, check valves and valves shall have large free passing area, and low friction loss coefficient.
- For piping systems with hot liquids, thermal expansions are to be taken into account and compensators shall be mounted in accordance with these expansions. Caution shall be exercised to avoid the loading of pump in this installation.

6.5.2. Specification of work in piping installation



In installation of pipes, follow the procedures below certainly.

- Install the pump on the concrete base as illustrated in Figure 2.
- Take out the guards (placed by the manufacturer) from suction and 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

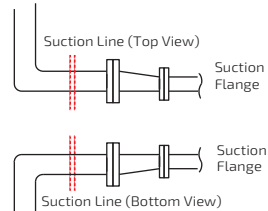


Figure 5: Piping System

An illustrative piping system is shown in Figure 10. Appropriate manometers shall be mounted on suction and discharge pipe lines.



6.6 Motor Connection

Motor shall be connected by an electrical technician according to the connection (switch) diagram. Local electricity policies and current VDE 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.

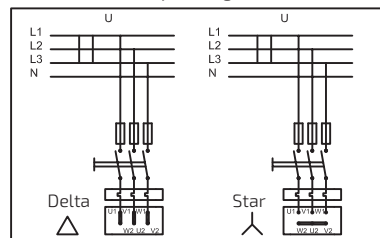


Figure 6. Electric Connection Diagram

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



During commissioning, start up and operating, apart from the safety regulations DIN 4754 and VDI 3033, accident prevention regulation: UVV/VBG 64 which is for "heat transfer facilities for organic heat transfer media" must be investigated.

7.1. Preparations before start-up

7.1.1 Pump fill up and discharge

Before commissioning, pump itself and the suction, discharge pipes have to be full with the pumping fluid. During fill up, in order to prevent that air pockets escape into the plumbing, the shaft must be rotated manually. During commissioning, if the pump does not create sufficient pressure (watch the manometer), repeat the discharge procedure.

CAUTION

Do not start your pump dry

7.1.2 Filling up/Discharge of the Ball bearing reservoir

Due to the impermeability property of the safety seal, bearing reservoir must also be filled with heat transfer oil.

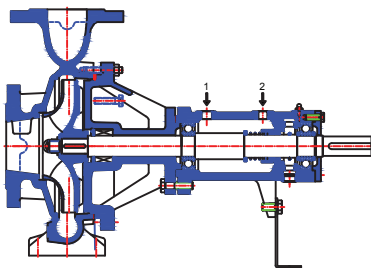


Figure 7. Ball Bearing Reservoir

For filling up and discharge, the dead plugs at fitting 1 and fitting 2 are removed. The filling from fitting 1 continues until the clean heat transfer oil comes up from fitting 2. To obtain a proper flow the heat transfer oil may be heated a priori. If there is no more air coming from fitting 2, the plugs may be replaced back.

7.1.3 Checking the Direction of Rotation

The direction of rotation must be same with the indication on the casing. To control the direction of rotation, the pump may be operated in the opposite direction for a little while. Opposite direction of rotation decreases the performance and may damage the pump. In a three phase pump, the direction of rotation may be corrected by swapping two phases.

7.2 Commissioning

7.2.1 Checking of coupling alignment

Prior to commissioning and after the first operation that attains operating temperature, the coupling alignment must be checked. The pump shaft must be rotating easily without any contraction.

7.2.2 Commissioning

To prevent excessive loading, the pump must be commissioned against closed discharge valve. The valve at the suction end must be kept fully open.

7.2.3 Drive

Start the pump. Pay attention to the characteristics of the product. Apply to the instructions of **MAS-DAF MAKINA SAN. A.Ş.**

7.2.4. Adjustment of Performance Values

Start the pump and bring the system to 100-130°C. To do this, the suction side stop valve must be fully open. The discharge side stop valve must be open such that the pump heats the entire system or such that it maintains

a minimum discharge capacity (see minimum capacity). Operate the system in this way until all the water vapor that is expected to exist in heat transfer oil evaporates. Then bring the system to operating temperature.

CAUTION

When the operating temperature is attained, open the discharge side valve until one reaches the desired discharge side pressure.

7.2.5. Minimum capacity

In order prevent the damage that may emanate from the excessive heating up of the pumping liquid, the pump must not be operated with closed valve except primary commissioning.

Minimum capacity

The power needed by the pump at its own impeller diameter, valve closed (kW) $\times 0.5 =$ Min. capacity (m^3/h)

7.2.6. Temperature

One must avoid sudden shocks.

7.2.7. More specific weight and viscosity

If the specific weight and the viscosity of the pumping fluid is more than the values foreseen in pump selection, the motor may be loaded more than necessary.

7.2.8. More Capacity

If the capacity is more than the value forecast while designing the pump, check whether the suction is still sufficient or not. Otherwise, cavitation may occur.

Requirement: $\text{NPSH}_{\text{avail}} > \text{NPSH}_{\text{req}}$.

The capacity must not be more than the one that is specified for η_{opt} .

7.2.9. Spare Pump

A spare pump must be awaiting as if it is going to be commissioned any time. For this reason, the suction side stop valve must be fully open all the time. The pump must be secured against return flow by placing a check valve to the discharge side.

CAUTION

In case of pump breakdown, against the risk of having unacceptable oil temperatures, a pump with appropriate capacity and head must be kept ready. Two separate energy sources must accompany both the operating and the spare pumps.

7.3. Shut-down and Restart-up

7.3.1. Shut-down and Restart-up

Keeping in operation

After the heating source is switched off, the pump must continue to operate for a little while. The temperature of the pumping fluid must be brought down to a level where there is no heat accumulation within the pump.

Discharge line

If a check valve is placed on the discharge line, the discharge valve may be left open. If a check valve does not exist, the discharge valve must be closed.

Drive

Shut down the motor. Make sure that the pump slows down and stops without hammering.

Suction line

Close the suction line valve.

7.3.2. Restart-up

Before restarting the pump, make sure that the pump shaft is not rotating. If there is a leakage in the suction line shut down valve, the pump may turn in the opposite sense due to counter flow.

CAUTION

If the pump shaft rotates in the opposite sense, the pump may be damaged.

7.3.3. Important points to consider when the pump is not used for a long time

If the pump is not operated for a long time, there is the risk of freezing. The pump must then be emptied and preserved.

8. MAINTENANCE / REPAIR

CAUTION

8.1. Maintenance

Conform with all the instructions that are given for safety at the beginning of this manual.

Regular monitoring and maintenance will increase the life of a pump.

8.1.1. General Monitoring

- Pump must never be operated without water
- Minimum flow rate must always be maintained
- Motor must never be highly loaded.

- There must be no uncontrolled leakages in the mechanical seal
- The bearing reservoir must always be filled with heat transfer oil. If the system and/or the pump is emptied, the ball bearing must be filled with heat transfer oil and later on the oil must again be discharged.
- Pressure and temperature indicators and flowmeters must be monitored.

Apart from these steps, the assembly of heat transfer systems, their operation and services they give must be investigated using DIN 4754 and VDI 3033.

8.1.2. Maintenance of parts

8.1.2.1. Bearing and Lubrication

Consists of two bearings which comply with DIN 625. While the ball bearing on the pump side is lubricated with pumping fluid, the one on the drive side is lubricated with a special grease. The nominal service life of ball bearings attains the standards of operation hours indicated in the technical specifications of DIN ISO 5199. The ball bearing on the drive side is filled with a proper amount of grease. If you want to get informed on the lubrication periods of greased bearing apply to the table below:

VELOCITY	SIZE OF BEARING RESERVOIR	
	385	508
Rpm.	LUBRICATION PERIOD IN TERMS OF OPERATION HOUR	
1450	13 500	12 300
1750	12 200	11 000

Note:

• When the maximum ambient temperature is 35°C and the maximum temperature of the oil is 350°C, the temperature of the bearing on the coupling side is 70°C. Higher ambient temperatures and poor ventilation give rise to higher temperatures.

• For temperatures higher than 70°C, the lubrication period must be halved.

• Inconvenient operating conditions like dust, higher air temperature, higher humidity; shorter periods of lubrications are necessary.

The ball bearings must be replaced in every two years. The filling of grease for the coupling side bearing is done as follows:

• 40% of the gap between the rotating components must be filled with grease. The quantity of grease is given in the table below with respect to the size of the bearing.

SIZE OF BEARING RESERVOIR	QUANTITY OF GREASE
385	6 GRAMS
508	12 GRAMS

- Scrape the excessive grease (do it with your finger, do not use metal objects).

8.1.2.2. Bearing Greases

Molibden disulphite greases have to be used in order to lubricate the drive side ball bearing. The quality and characteristics of molibden disulphite grease are given below:

Quality:

Resin, acid and anti-corrosives must not exist in bearing grease.

Characteristics:

Operation penetration; 265–295 mm/10

Dripping point; >200°C

Application temperature range; from -10°C to 150°C

8.1.2.3. Mechanical Seal

In KYP type pumps, safety seal coupled, single direction, maintenance free mechanical seals which comply with desired service conditions are used.

A reduction region exists between the mechanical and safety seals in order to decrease the temperature of the pumping liquid.

Even if the mechanical seal is damaged, the safety components are tailored such that an excessive leakage of the fluid is prevented (DIN 4754).

In case there is excessive leakage due to wearing, the mechanical seal must be replaced.

CAUTION

Since the mechanical seal is to be never operated dry, must be commissioned only when the pump is full and is deaired.

8.1.2.4. Coupling

The coupling alignment and the condition of the rubber must be checked in regular intervals first at the initial commissioning, and then as soon as it attains its first operating temperature.

The worn out rubber must be replaced.

8.1.2.5. Drive

Apply to the operating instructions of the motor manufacturer.

8.2. Repair

There exist skilled and qualified personnel in our company to be used in installment and repair work. If the repair work will be performed by the personnel of the client, one must be sure that the pump is empty and clean. This is also valid for pumps which are sent to our factories or to our service points to be repaired. For the safety of our own personnel and for reasons of

environmental consciousness, we do not accept the repair of such pumps. Otherwise, the cost of proper discharge of the fluid will be charged to the customer's account.

If the pump is working with a dangerous and/or hazardous material, and if it is sent to our factories or to our service points by the customer in order to be repaired, our personnel must be warned beforehand by the customer. In such cases, the specs of the material must be handed in together with service request form.

Hazardous Materials

Poisonous materials
Deleterious materials
Chemically abrasive materials
Irritating materials
Explosive materials
Burning materials
Materials with high flare-up capacity
Carcinogen materials
Materials causing reproduction difficulties
Genetically damaging materials
Other hazardous materials

During the field work, both the customer's employees and our service technicians must be warned against all the possible hazards.

The most important assembly and disassembly procedures are given in this instruction manual. All the steps must be strictly followed.

8.2.1. Disassembly of Centrifugal Pump

The following operations should be followed before the disassembly.



The power source cable should be dismantled from the motor by an experienced electrician. The risk of electrocution must be eliminated. Safety precautions must be taken against motor start up.

Start all the shutdown equipment along the suction and the discharge pipes.

Wait until the pump casing cools down to ambient temperature.

Empty the pump while the fluid is still fluent. Plug out all the drainage plugs.

Note: Use a reservoir.

The pump must be depressurized and all of the pumping fluid must be totally drained.



Hazardous material must be emptied, collected and eliminated in accordance to environmental regulations. If there is a pipe line it must be dismantled. All the manometers, manometer lines and fittings must be dismantled. Pedestal feet and accident preventive safety equipments must be dismantled.

8.3. Spare Parts

The spare parts of KMU type pumps are guaranteed for 10 years by **MAS-DAF MAKINA SAN. 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

Part Name	The number of equivalent pumps in the installation						
	2	3	4	5	6-7	8-9	10+
Shaft (key included) quantity	1	1	2	2	2	3	%30
Impeller (quantity)	1	1	1	1	2	3	%30
Bearings (kit)	1	1	2	2	3	4	%50
O-ring for ball bearing (kit)	4	6	1	8	9	12	%150
Mechanical seal	2	3	2	4	6	7	%90
Coupling rubber (kit)	1	2	2	2	3	4	%50
Soft packing (kit)	2	2	4	2	3	4	%50

Table 1. Spare Part List

9. NOISE LEVEL AND VIBRATION

The reasons to 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.

[KW]	2 Poles	4 Poles
	50 Hz n= 2950 Rpm. {dB(A)}	50 Hz n= 1450 Rpm. {dB(A)}
	L_{pA}	L_{pA}
0,37	<70	<70
0,55	<70	<70
1,1	<70	<70
1,5	<70	<70
2,2	<70	<70
3	<70	<70
4	<70	<70
5,5	<70	<70
7,5	76	<70
11	79	<70
15	78	<70
18,5	80	<70
22	84	<70
30	84	<70
37	82	72
45	85	74
55	87	75
75	87	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 with ISO 4871 and the tolerance is +3dB(A).

10. DISASSEMBLY, REPAIR AND REASSEMBLY



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

Follow the safety precautions outlined in "Safety instructions".

10.1. Disassembly

- Close all valves in the suction and discharge lines, drain the pump by the drain plug (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.

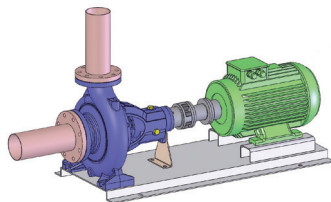


Figure 8- Disassembly - 1

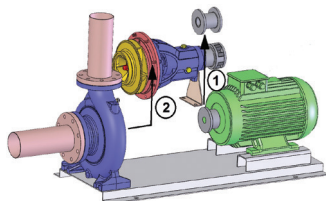


Figure 9: Disassembly - 2

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

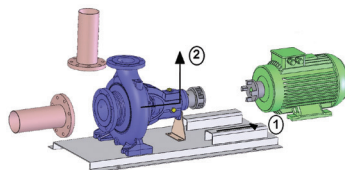


Figure 10: Disassembly - 3

- Disconnect the casing nuts (360) and take out the pump rotor assembly (Impeller + Shaft + Bearing Housing + Bearings + Bearing Covers + Stuffingbox etc.)
- Take out the pump coupling half from the shaft (60) using a pull-off device and remove the coupling key (211).
- Unscrew the impeller end nut (65) and take out the impeller (20) and impeller key (210). Use rust remover solvent during dismounting if necessary.
- Unscrew the nuts (360) bearing housing to the stuffing box.
- If there is the mechanical seal, unscrew the seal cover (55). Separate the stuffing box from the bearings. Mechanical seal will remain on the shaft.

- For pumps with soft packing, you can pull outstuffing box directly.
- Dismantle the bearing covers (35)
- Dismantle bearing by using a pull-off device. Do not use metal hammer for this operation.

10.2. Reassembly

- Reassembly proceeds in reverse sequence to disassembly as described in section 10.1. You may find the attached drawings useful.
- Coat the seats and screw connections with graphite, silicon or similar slippery substance before reassembly. If you can not find any of the above you may use oil instead (except the pumps for drinking water).
- Never use the old gaskets, make sure the new gaskets and o-rings are the same size as the old ones.
- Start mounting from the bearings. Place ball bearings on their places on the shaft by slightly heating or by using press.
- Wait until bearings get cool. (Cool if it is possible). Put this part to the bearing housing from the coupling side. (With pressor plastic hammer)
- Reassembly the bearing cover on its place.
- On pumps with mechanical seal is used; put the stationary part of mechanical seal in its place on the seal cover (58-59). Then put this part on the shaft. Afterwards put the rotating part of mechanical seal on its position.
- On pumps with packing is used; put the stuffing box gland in position. And fixed the gland nuts gently.
- Mount stuffing box (03) to bearing housing (30).
- At this stage you can insert the stuffing box and irrigation ring.
- Replace impeller key and pump impellers. Tighten the impeller nuts.
- Replace the coupling and coupling key.
- On pumps with mechanical seal is used, tighten mechanical seal cover; on pumps with packing is used, tighten the gland nut.
- Now reassembly of the rotor group is completed.
- Finally mount rotor assembly to the volute casing. (In the repair shop or on site.)
- Make sure the gaskets and o-rings are evenly placed without sliding and not damaged or not squeezed at all.
- Place the pump on the base plate, couple the motor. Connect suction and discharge pipes as well as auxiliary pipes. Take the unit into operation as it was indicated in section.

11. POSSIBLE FAILURES, CAUSES, SOLUTIONS

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



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

POSSIBLE FAILURE	CAUSES	SOLUTIONS
The pump does not operate properly	- Pump or the pipe line is not filled or deaired properly - Suction line or the impeller is clogged - Occurrence of air bubbles in the pipes - NPSH (suction) is too low - Direction of rotation is wrong - Interior components of the pump are worn out - The head is lower than the nominal head of the pump - Coupling alignment is wrong - Pump casing deformation - The impeller is imbalanced - Ball bearing is malfunctioning - Flow rate is lower than the minimum flow rate	- Fill in the pump or the pipe lines and deairate them properly - Clean the pump and the pipe lines. - Install a purge valve. 1. Check the water level in the suction reservoir. 2. Open completely the suction valve 3. Modify and reinstall the piping if the friction losses are too high. 4. If there is any filter along the piping, check them out. - Change the poles of the two phases on the motor. - Replace the worn out components 1. Adjust the operating point through the suction line valve 2. In case it continues to occur, decrease the impeller diameter. - Do the coupling alignment properly - Check if the pipes are connected with tension. 1. Clean the impeller 2. Balance the impeller again - Replace the ball bearing. - Increase the flow rate to the required minimum flow rate level
Pump is heating up too much	- Pump or the pipe line is not filled or deaired properly. - NPSH (suction) is too low - Flow rate is lower than the minimum flow rate.	- Fill in the pump or the pipe lines and deairate them properly. 1. Check the water level in the suction reservoir. 2. Open completely the suction valve 3. Modify and reinstall the piping if the friction losses are too high. 4. If there is any filter along the piping, check them out. - Increase the flow rate to the required minimum flow rate level.

Some other failures, which may occur apart from the failures mentioned above, are listed below:

CAUSES OF POSSIBLE FAILURE	SOLUTIONS
- Counter pressure is more than the design pressure - Rotation speed is too low - Density and viscosity is not the same with the one chosen for pump operation - Rotational speed too high. - Seal is harmed - Seal is not appropriate for the pumping fluid - The distance between coupling halves are wrong - Motor voltage is wrong - Motor operates at only two phases.	1. Open the discharge valve until it attains the operating point. 2. Install a larger diameter impeller. 3. Increase the rotational speed (turbine, frequency control...) • Increase the rotational speed (turbine, frequency control...) • Apply to our factory in case an incompatibility problem occurs • Decrease the rotational speed (turbine, frequency control...) • Check the seal. Replace it if necessary. • Wrong seal is in usage. Replace it with the correct one. • Adjust the distance according to the technical drawing. • Use the correct motor. 1. Check the cable connections 2. Change the fuses

Table 3: Possible Failures, Causes, Solutions

12. PUMP DIMENSIONS

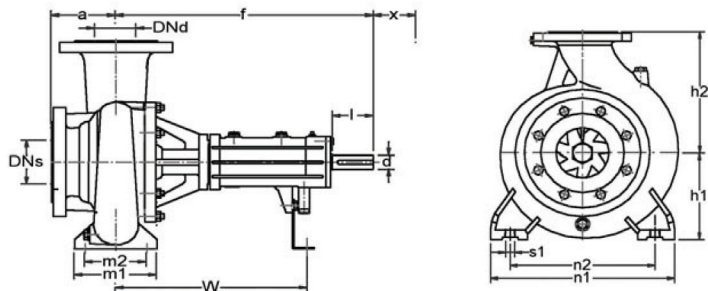


Figure 11: KYP Pump Dimension Figure

Pump Type	Flange (PN16)		Length		Height		Pump Feet		Fixing Details					Shaft End		(*)
	DN (Suction)	DN (Discharge)	a	f	h1	h2	b	m1	m2	n1	n2	s1(Ø)	W	d(Ø)	l	
KYP 32 -160	50	32	80	385	132	160	50	100	70	240	190	M12	285	24	50	65
KYP 32 -200	50	32	80	385	160	180	50	100	70	240	190	M12	285	24	50	65
KYP 32 -250	50	32	100	500	180	225	65	125	95	320	250	M12	370	32	80	80
KYP 40 -160	65	40	80	385	132	160	50	100	70	240	190	M12	285	24	50	75
KYP 40 -200	65	40	100	385	160	180	50	100	70	265	212	M12	285	24	50	75
KYP 40 -250	65	40	100	500	180	225	65	125	95	320	250	M12	370	32	80	75
KYP 50 -160	65	50	100	385	160	180	50	100	70	265	212	M12	285	24	50	80
KYP 50 -200	65	50	100	385	160	200	50	100	70	265	212	M12	285	24	50	85
KYP 50 -250	65	50	100	500	180	225	65	125	95	320	250	M12	370	32	80	85
KYP 65 -160	80	65	100	500	160	200	65	125	95	280	212	M12	370	32	80	100
KYP 65 -200	80	65	100	500	180	225	65	125	95	320	250	M12	370	32	80	100
KYP 65 -250	80	65	100	500	200	250	80	160	120	360	280	M16	370	32	80	100
KYP 80 -160	100	65	125	500	180	225	65	125	95	320	250	M12	370	32	80	100
KYP 80 -200	100	80	125	500	180	250	65	125	95	345	280	M12	370	32	80	100
KYP 80 -250	100	80	125	500	200	280	80	160	120	400	315	M16	370	32	80	115
KYP 100 -200	125	100	125	500	200	280	80	160	120	360	280	M16	370	32	80	120
KYP 100 -250	125	100	140	500	225	280	80	160	120	400	315	M18	370	32	80	120

Table 4: KYP Pump Dimensions

13. TIGHTENING TORQUES

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

Table 5: Tightening Torques Table

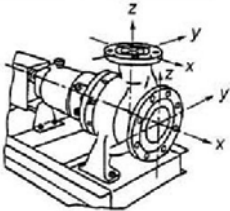
14. FORCES AND MOMENTS AT THE PUMP FLANGES

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

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

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

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



PUMP TYPE	FORCES								MOMENTS					
	DN FLANGE		SUCTION FLANGE			DISCHARGE FLANGE			SUCTION FLANGE			DISCHARGE FLANGE		
	SS	DS	N			N			Nm			Nm		
			F _y	F _z	F _x	F _y	F _z	F _x	M _y	M _z	M _x	M _y	M _z	M _x
KYP 32 -160	50	32	473	425	520	268	331	284	315	362	441	236	268	347
KYP 32 -200														
KYP 32 -250														
KYP 40 -160	65	40	583	536	662	315	394	347	347	378	473	284	331	410
KYP 40 -200														
KYP 40 -250														
KYP 50 -160	65	50	583	536	662	425	520	473	347	378	473	315	362	441
KYP 50 -200														
KYP 50 -250														
KYP 65 -160	80	65	709	646	788	536	662	583	362	410	504	347	378	473
KYP 65 -200														
KYP 65 -250														
KYP 80 -160	100	80	945	851	1055	646	788	709	362	410	504	362	410	504
KYP 80 -200														
KYP 80 -250														
KYP 100 -200	125	100	1118	1008	1244	851	1055	945	394	457	551	394	457	551
KYP 100 -250														

Table 6: Forces and Moments at The Pump Flanges

Forces at the pump flanges were calculated according to 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.

15. TYPICAL PIPING

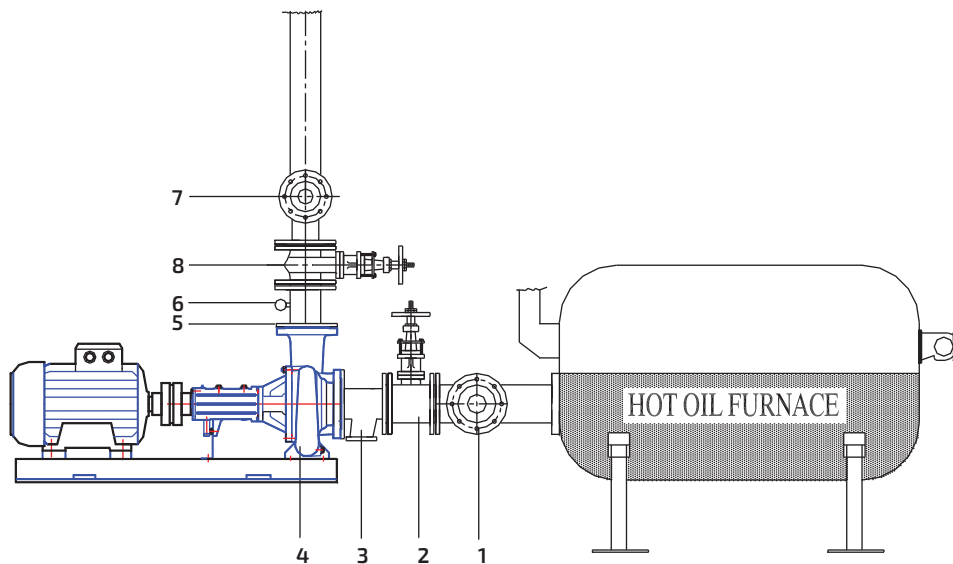


Figure 12: Sample Plumbing

1. SUCTION COLLECTOR
2. SUCTION VALVE
3. FILTER
4. PUMP
5. GASKET
6. MANOMETER
7. DISCHARGE COLLECTOR
8. DISCHARGE VALVE

16. KYP SECTIONAL DRAWING AND SPARE PART LIST

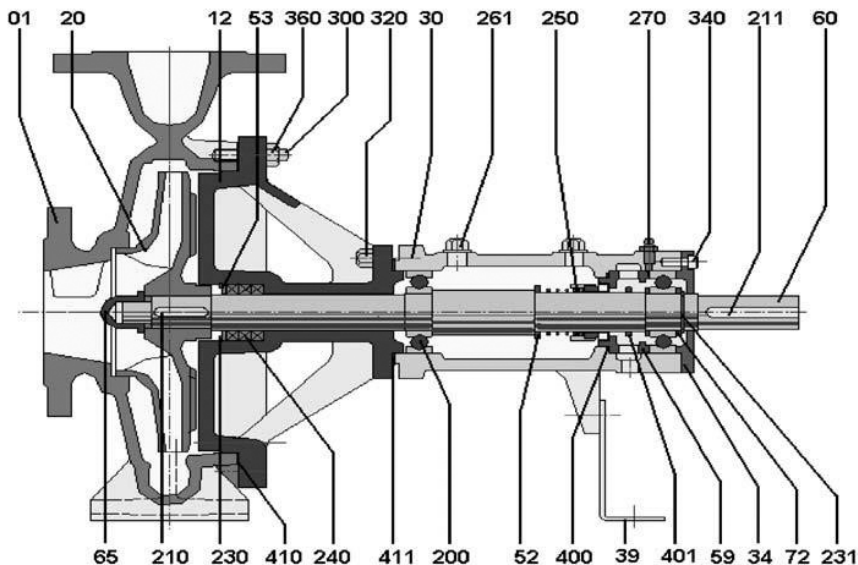


Figure 13: KYP Sectional View

Part List:

Part No	Part Name	Part No	Part Name	Part No	Part Name
01	Volute casing	65	Impeller nut	270	Grease hole
12	Back cover	72	Intermediate bush	300	Casing stud
20	Impeller	200	Ball bearing	320	Hex-bolt
30	Ball bearing	210	Impeller key	340	Bolt
34	Bearing lid	211	Coupling key	360	Casing nut
39	Pedestal	230	Housing segment	400	Casing gasket
52	Mechanical seal ring	231	Shaft segment	401	O-ring (Mechanical seal)
53	Soft seal ring	240	Soft sealing	410	O-ring (Shaft)
59	Mechanical seal housing	250	Mechanical sealing	411	Rolling bearing gasket
60	Shaft	261	Oil plug		

Table 7: KYP Drawing For Dismantling Part List

13. EXPLODED VIEW

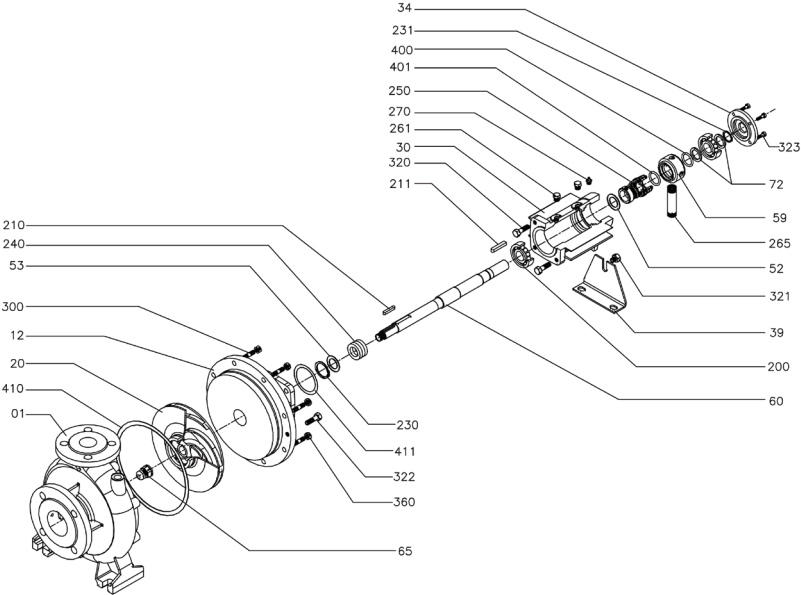


Figure 14: Exploded View

Part List:

Part No	Part Name	Part No	Part Name
01	Pump Casing	230	Ring
20	Impeller	231	Ring
12	Adapter	240	Gland Packing
34	Bearing Housing Cover	261	Plug
30	Bearing Housing	270	Greaser
39	Support Foot	300	Stud
52	Mech. Seal Front Ring	320	Hexagonal Bolt
53	Packing Retaining Ring	321	Hexagonal Bolt
59	Mechanical Seal Housing	323	Hexagonal Bolt
60	Pump Shaft	250	Mechanical Seal
65	Impeller Nut	360	Hexagonal Nut
72	Retaining Ring	400	O-Ring
200	Ball Bearing	401	O-Ring
210	Key, Impeller	410	Gasket
211	Key, Coupling	411	Gasket

Table 8: Exploded View Part List

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