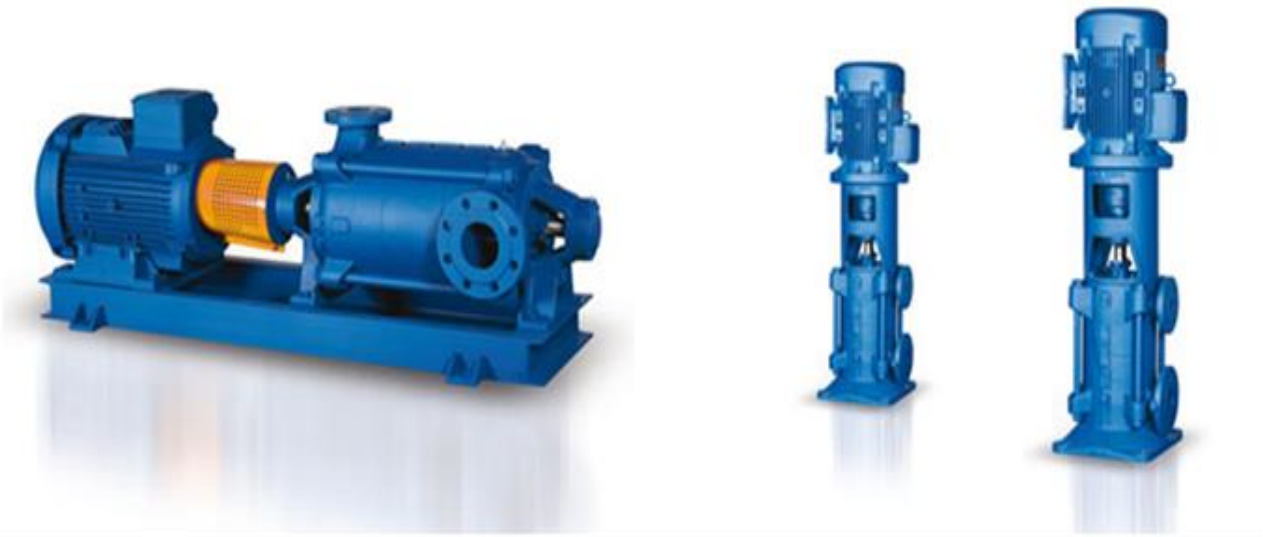
Vertical and Horizontal High Pressure Multistage Centrifugal Pumps

OMK & OMK-V SERIES

OMK & OMK-V Series
ATEX Version



OPERATING MANUAL

Mas Grup

Revision No: 02

June/2018

EC DECLARATION OF CONFORMITY

AT UYGUNLUK BEYANI

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

Address / *Adres* : Aydınlı Mah. Birlik OSB. 1.No'lu Cadde No:17 Tuzla - İSTANBUL / TÜRKİYE

Name and address of the person authorised to compile the technical file
Teknik Dosyayı Derleyen Yetkili Kişi ve Adresi
Vahdettin YIRTMAÇ
Aydınlı Mah. Birlik OSB. 1.No'lu Cadde No:17
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.*

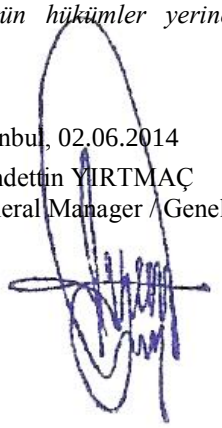
Equipment / *Ürün* : Vertical and Horizontal High Pressure Multistage Centrifugal Pumps / *Yatay ve DikeyYüksek Basınçlı Çok Kademeli Santrifüj Pompalar*
Seri / *Model-Tip* : OMK and OMK-V Series – *OMK ve OMK-V Serisi*

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

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

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

Place and date of issue / Yer ve Tarih **:** İstanbul, 02.06.2014
Name and position of authorized person **:** Vahdettin YIRTMAÇ
Yetkili Kişinin Adı ve Görevi General Manager / Genel Müdür
Signature of authorized person **:**
Yetkili Kişinin İmzası



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INTRODUCTION

- This manual contains instructions for the installation, operation and maintenance of the OMK and OMK-V type horizontal and vertical, high pressure, multistage centrifugal 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

OMK and OMK-V series pumps having horizontal and vertical shaft are high pressure, multistage centrifugal pumps. They are used in:

For pumping of clear and slightly contaminated liquids,

- Drinking water systems
- Booster sets in high rise buildings and industry
- Water treatment plants
- Fire extinguishing systems
- Sanitary and cleaning installations
- Industrial applications
- water distribution systems
- Shipbuilding, Mining, Power Stations
- Irrigation plants

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

CAUTION

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

Technical specifications of OMK & OMK-V type pumps

Suction Flange	: DN 50 – DN 125 (PN 40)
Discharge Flange	: DN 32 – DN 80 (PN 40)
Operating Pressure	: 40 Bar
Operating Temperature	: -10 – 140 ^{0}C
Number of Stages	: 2 – 14
Capacity	: 5 – 220 m^3/h
Head Range	: 30 – 400 m
Speed	: 1450 – 3500 rpm.

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

Minimum Efficiency Index for MAS OMK-V Pump Series is shown on the pump label.

MEI values of MAS OMK-V Pump Series are shown on the pump characteristic curves.

Minimum Efficiency Index for MAS OMK-V Pump Series; Minimum 0.4. (MEI≥0,4)

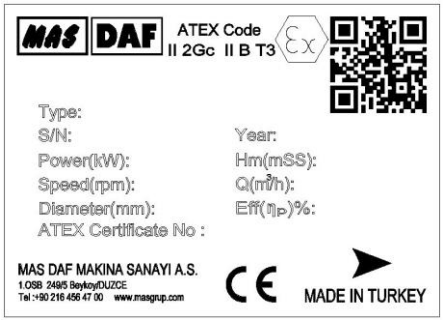
'Vertical multistage water pump' (MS-V) means a glanded multi stage (i>1) rotodynamic water pump in which the impellers are assembled on a vertical rotating shaft, which is designed for pressures up to 25 bar, with a nominal speed of 2900 rpm and a maximum flow of 100 m^3/h.

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

OMK-V Series water pumps, the pump efficiency can be achieved more than fix speed in case of variable speed control.

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

Figure 1: 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 operating pressure. 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 II 2G /D c Tx (85 ^{o}C – 200 ^{o}C)

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

OMK and OMK-V pumps are non self-priming, multistage, horizontal and vertical radially split ring section pumps. While OMK series have horizontal shaft, OMK-V series have vertical shaft.

4.1.1. Locations of Flange – Flanges

In OMK series, as a standard, discharge casing is at motor side on the top and suction casing is at dead end side on the right viewed from. Direction of rotation of the pump is clockwise viewed from driver.
In OMK – V series as a standard, discharge flange is at the motor side on the top and suction flange is on the bottom. When viewed from driver it turns clockwise.

4.1.2. Auxiliary Fittings

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

4.1.3. Impeller

The impellers are balanced dinamically and they are close type and with single entry in both series.

4.1.4. Shaft

The shafts of OMK and OMK-V series multistage pumps are manufactured from chromium alloy stainless steels. The pump shaft has the same diameter along the shaft. With its special design and by using precision manufacturing methods, factors what to constitute notch effect on the shaft are kept to a minimum.

4.1.5. Bearing

In OMK series, the shaft carring the impellers is supported between bearings on both sides. In OMK-V pumps, there is a carrier bearing and radial and axial loads are carried by it. Also there is a journal bearing on bottom side with water lubricated.

Pompa Type	Bearings on Suction and Discharge Sides	
	Number	Size
OMK 32	2	6405 (C3)
OMK 40	2	6405 (C3)
OMK 50	2	6406 (C3)
OMK 65	2	6407 (C3)
OMK 80	2	6409 (C3)

Pompa Type	Bearings on Suction and Discharge Sides	
	Number	Size
OMK-V 32	1	6405 (C3)
OMK-V 40	1	6405 (C3)
OMK-V 50	1	6406 (C3)
OMK-V 65	1	6407 (C3)
OMK-V 80	1	6409 (C3)

4.1.6. Seals

One of the following sealing types can be used:

4.1.6.1. Design With Soft Packing

The packed stuffing box without external block must always have a slight leak for discharging the frictional heat.

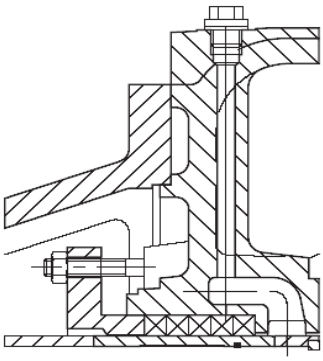


Figure 2: Packed stuffing box on the discharge side (standard)

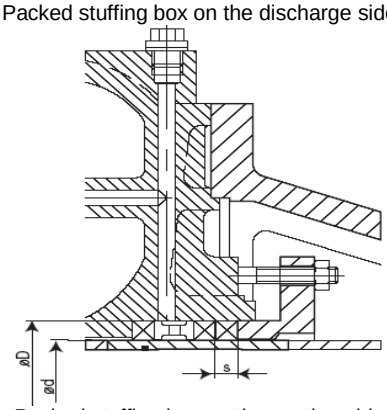


Figure 3: Packed stuffing box on the suction side (standard)

4.1.6.2. Design With Mechanical Seal

Stationary seal rings will always show some function-related drip leakage.

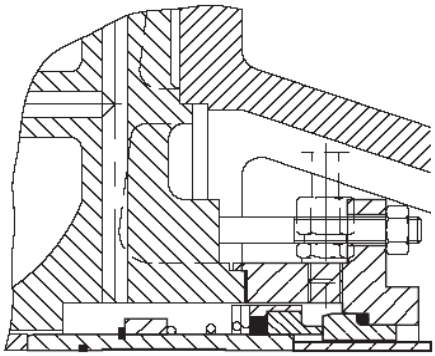


Figure 4: Mechanical Seal

4.2. Construction of Pump Group

4.2.1. Drive

TEFC (Totally Enclosed Fan Cooled) 3 phase, squirrel caged, in accordance to DIN 42673, for horizontal type IMB3, for vertical type IMB5 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;
İsolation Class : F
Protection Class : IP 54-IP 55
Frequency : 50 Hz.
Running Type : S1
Start-Up Type : Up to 2 kW 1x220V (Monophase)
Up to 4 kW 3x380V (Y)
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 953+A1 in case of the pump group includes the coupling and chassis.

Pump can only be run with a couplingguard in accordance with EN 953+A1 according to safety instructions.
If there is no coupling cover, it is provided by the operator.

4.2.3. Base Plate

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

5. TRANSPORT AND STORAGE

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

5.1. Transport

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

CAUTION

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

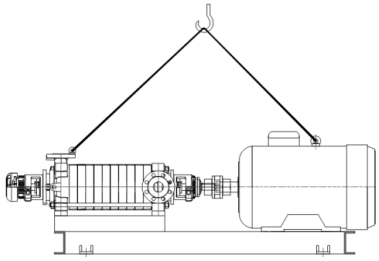


Figure 5: Transport of Pump Group (Horizontal Version)

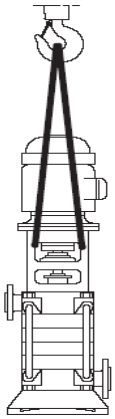


Figure 6: Transport of Pump Group (Vertical Version)

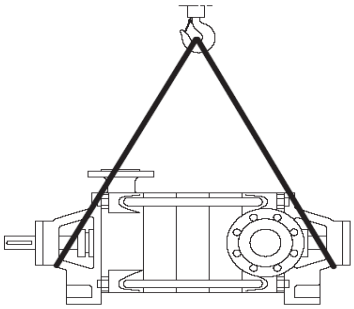


Figure 7: Transport of Pump Group (The Pump)

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. Add small amount of antifreeze inside the pump casing if it is not possible to empty it completely. Rotate the pump shaft by hand to mix the antifreeze.
5. Close the suction and discharge exits with gasket
6. Spray an anti-corrosive into the pump casing.
7. Rotate the pump shaft by hand once in every month, in order to protect it from freezing and to lubricate the bearings.

6. ASSEMBLY / INSTALLATION

6.1. Installation

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

6.1.1. Location of Installation

Pump shall be installed in a location where the control and the maintenance of the pump are easily made. The pump room shall be suitable for operation of lifting systems such as freight elevator, forklift, etc.
The pump group should be installed in the lowest possible location of the pumping system in order to achieve the highest suction pressure.

6.1.2. Location of Installation- Local Ambient Temperature

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

6.2. Type of Connection

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

6.3. Piping

6.3.1. General

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

6.3.2. Specification of Work in Piping Installation

In installation of pipes, follow the procedures below certainly.

- Take out the guards (placed by the manufacturer) from suction and discharge openings of the pump.
- Close the suction and discharge flanges with rubber gaskets. This precaution is important to avoid the undesired substances (weld crust, weld slag, sand, stone, wood piece etc.) get into the pump. Do not take off this gasket until the installation is completed.
- Start the installation of piping from the pump side. Do the necessary assembling and welding of the parts in a successive order.
- In these operations, do not neglect to put the necessary supports in their respected locations.
- Following above procedure, complete all piping system at suction side up to the suction tank (or foot valve if available), at discharge side up to do discharge collector and discharge pipe.
- When all installation and welding process is done and the heat dissipated by welding is removed, dismantle all the bolted connections from the suction tank to discharge pipe. Take out all demountable parts.
- Clean these parts and then paint body coat completely inside and outside.
- Mount the parts again in their intended places. However, this time start from the discharge line and move downward to the pump. In this instance, do not forget to check the flange gaskets. If needed, (for example deformation during welding) replace them.

- Concerning the connection of the pump flanges to piping, in case of misalignment of axis and flange holes, do not force the system to eliminate the misalignment. Forcing the system may cause difficult-to-correct problems.
- If there is an axial misalignment between the flanges of the pump and the pipe, due to the welding or any other reasons, cut the pipe from a suitable location in order to fix the problem. Connect the pipe (pump side) to the pump. After carrying out the necessary correction, connect the parts again by welding.
- Dismantle and clean the last welded part. Repaint again and mount on its place.
- After all these processes are accomplished, remove the rubber gasket from the suction and discharge openings. Open their holes and mount them again on their intended place.

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

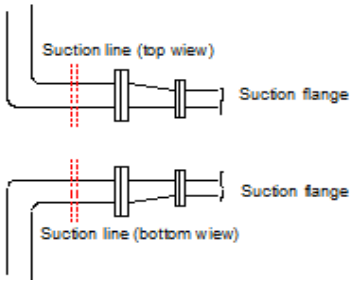


Figure 8: Piping System

An illustrative piping system is shown in Figure 16 or 17. Appropriate manometers shall be mounted on suction and discharge pipe lines.

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

6.4. 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.

6.4.1. 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.

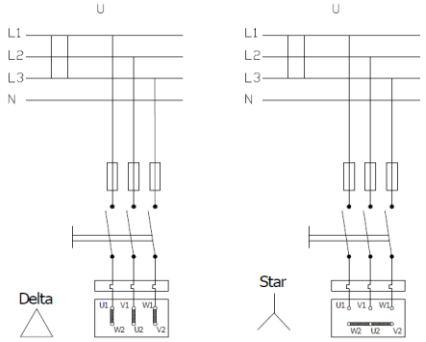


Figure 9: Motor Connection Diagram

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

6.4.2. 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.

6.5. Coupling Alignment

6.5.1. 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.

6.5.2. 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 11 – Figure 13)
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 12 – Figure 14)
In order to control the angular misalignment, the distance between the two halves of the coupling is measured in both horizontal and vertical planes. Measurements taken at four points shall be in agreement for the alignment.
Misalignments can be in horizontal or vertical planes. Misalignments in horizontal plane can be fixed by placing sheet iron at the bottom of the pump or motor base, while misalignments in vertical plane can be fixed by sliding the pump or the motor in horizontal plane.

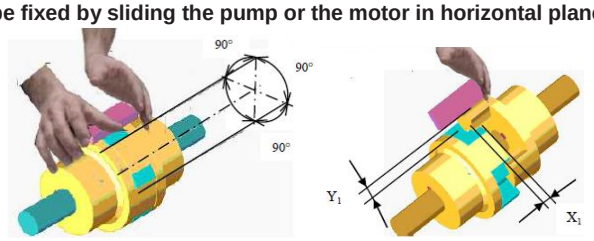


Figure 10: The Control of the Coupling Alignment in Horizontal and Vertical Planes

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

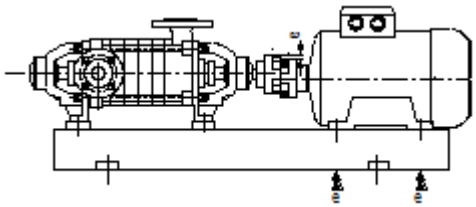


Figure 11: Paralel Axis Misalignment in Vertical Plane and Its Correction (OMK)

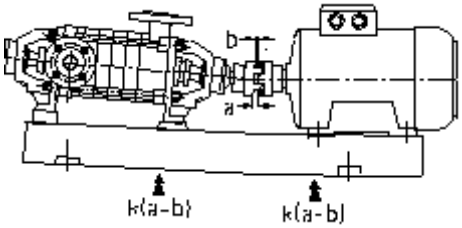


Figure 12: Angular Misalignment in Vertical Plane and Its Correction (OMK)

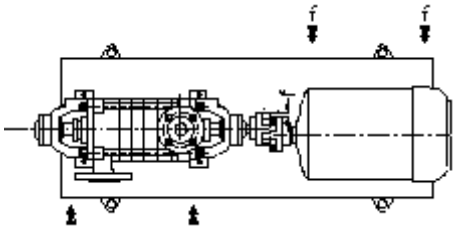


Figure 13: Parallel Axis Misalignment in Horizontal Plane and Its Correction (OMK)

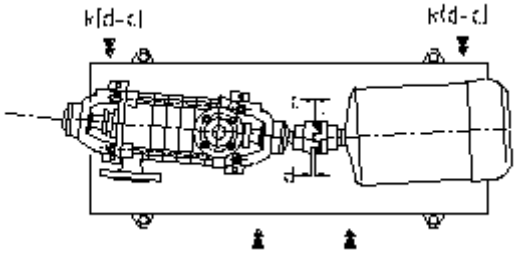


Figure 14: Angular Misalignment in Horizontal Plane and Its Correction (OMK)

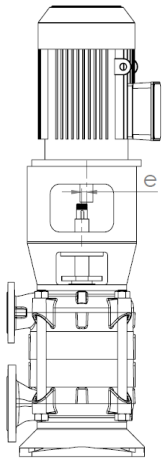


Figure 15: *Paralel Axis Misalignment in Horizontal Plane and Its Correction (OMK-V)*

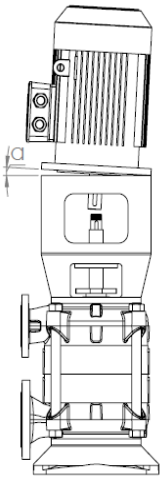


Figure 16: *Angular Misalignment in Vertical Plane and Its Correction (OMK-V)*

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

6.5.3. 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 6.5.2.
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.

7. COMMISSIONING, START UP AND OPERATING

7.1. Preparations Before Start Up

OIL CHECK: Pump is provided from both sides with high temperature resistant, life long lubricated (oil), care-free (2RS type) rolling bearings

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

CAUTION

Do not start your pump dry (WITHOUT WATER)!

7.2. Checking The Direction of Rotation

CAUTION

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

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

7.3. Start up Procedure

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

CAUTION

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

7.4. Shut Down Procedure

CAUTION

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

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

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

CAUTION

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

8. MAINTENANCE

CAUTION

- Maintenance operations must be done by authorized personnel with protective clothing only. The personnel must also beware of high temperatures and harmful and/or caustic liquids. Make sure that the personnel read carefully the manual.
- The instructions in Safety Precautions must be executed during maintenance and repair.
- Continuous monitoring and maintenance will increase the engine's and pump's lives.

8.1. The Checks During the Operation

- Pump must never be operated without water.
- Pump must not be operated for a long time with the discharge valve closed (zero capacity).
- Bearing temperature must never exceed 90°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.
- Water must drop from the glands of stuffing boxes (20-30 drops per minute)
- Gland nuts must not be tightened too much. If the amount of water increases after a long operation time, the nuts may be tightened by 1/6 turns.
- If the pump has mechanical sealing, there is no need for excessive maintenance. Water leakage from the mechanical sealing indicates the fact that the sealing is worn out and therefore needs to be replaced.
- If the system consists of a substitute pump, keep it ready by operating it once a week. Check also the auxiliary systems of the substitute pump.
- 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.

8.1.1. Component Check

CAUTION

To make possible the visual control, one must be able to reach the pump from any direction. Especially, to be able to dismount the internal units of the pump and the engine, sufficient free space must be created around them for maintenance and repair. Furthermore, one must make sure that the piping system can easily be dismounted.

8.1.1.1. Bearing and Lubrication

OMK series pumps are provided from both sides with high temperature resistant, life long lubricated, care-free 6300 or 6400 series 2RS-C3 type bearings.
In OMK-V series pumps, there is a journal bearing (Graphite-Carbon) carrying radial loads on the bottom of the pump with water lubricated. Besides there is a 6400 series 2RS-C3 type bearing carrying radial and axial loads on the motor side.

8.1.2. Shaft Seal Maintenance

8.1.2.1. 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.

8.1.2.2. Mechanical Seal

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

Mechanical seal;

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

8.1.3. Coupling

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

Worn out elastic bands must be replaced.

8.1.4. Drive

Apply to the operating instructions of the motor manufacturer.

8.1.5. Auxiliary Components

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

8.2. Maintenance Instructions in ATEX Version Pumps

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

8.3. Service

Our Customer Service Department offers after-sale service. Manager should employ authorized and trained personnel for mounting/dismounting procedures. Before these procedures, one must make sure that pump interior is clean and empty.
This criterion is also valid for the pumps which are sent to our factory or to our service points.

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

8.4. Spare Parts

The spare parts of OMK and OMK-V type pumps are guaranteed for 10 years by **MAS DAF MAKINA SANAYI A.Ş.**

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

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

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

Part Name	Pump number (including stand-by pump)						
	2	3	4	5	6-7	8-9	>9
Shaft (+keys) (60)	1	1	2	2	2	3	30%
Impeller (set) (20)	1	1	1	2	2	3	30%
Ball Bearing (set) (200)	1	1	2	2	3	4	50%
Teflon (440)	1	1	2	2	3	4	50%
O-ring (set) (400)	4	8	8	8	9	12	150%
Mech. Seal (set) (250)	2	3	4	5	6	7	90%
Soft Packing (set) (240)	4	6	8	8	9	12	150%
Space Sleeve (68)	1	1	2	2	3	4	50%
Shaft Sleeve (70)	2	2	2	3	3	4	50%
Spacer Sleeve (67)	2	2	2	3	3	4	50%

Table 1: Spare Part List

9. NOISE LEVEL AND VIBRATION

The reasons which increase the noise level are indicated below:

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

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

9.1. Expected Noise Values

Measurement conditions:

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

Motor Rated Power Requirements PN [kW]	Measuring surface noise pressure level LpA [dB]* for pump with motor	
	1450 d/d	2900 d/d
0.75	50	58
1.1	53	62
1.5	55	62
2.2	56	63
3	58	65
4	60	66
5.5	64	70
7.5	65	71
11	68	73
15	69	74
18.5	69	74
22	70	75
30	71	75
37	72	76
45	73	77
55	73	79
75	74	81
90	74	82
110	75	83
132	76	84

Table 2: Sound Pressure Level

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

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

10.DISASSEMBLY, REPAIR AND REASSEMBLY

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

Fallow the safety precautions outlined in “Safety instructions”.

10.1. Disassembly

- Close all valves in the suctions and discharge lines. Drain the water in the pump.
- Remove coupling guard and other safety guards.
- Unscrew the bolts of the suction and discharge flanges and pump foot. Seperate the pump from the installation.
- Disconnect the pump from the motor and from the base plate.
- Seperate the coupling from the shaft and dismantle the coupling key by using a pull-off device.

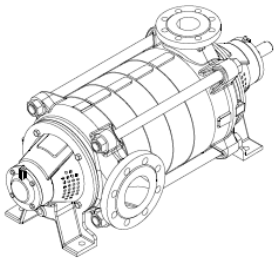
- Before starting to disassemble the pump, brand suction, discharge and stage casing and mark confronting locations for the purpose of convenience during installation.
- Unscrew the nuts of the connection bolts and remove the bolts.
- Continue the process from the suction end for easy disassembly.
- Dismantle the bearing cover on the suction end.
- Unscrew the shaft nut in front of the bearing.
- Unscrew the nuts connecting suction side bearing housing to the suction casing and remove bearing housing together with ball bearing.
- Remove suction casing off stage casing group.
- Remove spacer sleeve and seal sleeve and take out split sleeve parts.
- Remove in sequence space sleeve, impellers, stage casings together last stage diffuser.
- Unscrew the nuts connecting discharge casing to the discharge side bearing housing and remove the discharge casing.
- Remove the bearing cover.
- Remove the bearing nut and spacer sleeve behind of bearing Pull off the discharge side bearing housing together with bearing from the pump shaft, using a pull-off device.
- Clean all the parts, replace damaged or worn-out ones.

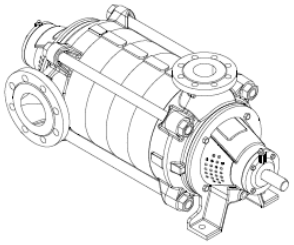
10.2. Reassembly

- Reassembly proceeds in reverse sequence to disassembly as described in section. 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 reassembling the pump from the discharge end. Put split sleeve halves in position and slip seal sleeve and space sleeve on position.
- Mount the discharge casing to discharge side bearing housing and stuffing box and insert the shaft and bearing in its place. Screw shaft nut.
- Reassemble the last stage diffuser and impeller. Make sure discharge opening side of the impeller corresponds exactly to the center of the diffuser.
- Reassemble the other stages in sequence carefully. Make sure that O-rings are placed correctly and do not turn.
- Put suction side split sleeve parts in position and slip seal sleeve and space sleeve on it.
- Fit the casing studs and tighten them slightly, after placing suction side bearing housing and ball bearing, then screw the bearing nut on the shaft.
- Put the pump on a horizontal flat place and by this way arrange the pump foot in a line. As tightening the casing studs carefully and uniformly rotate the rotor by means of coupling. It is necessary to rotate the rotor by hand without any stresses and compulsion.
- Place the pump on the baseplate, mount the electric motor, and connect the suction and discharge pipes and auxiliary pipes. Start up the system as shown on part 7.

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.





11. 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 FAILURES	CAUSES	SOLUTIONS
Pump is not pumping!	Impeller out of balance or clogged.	Disassemble pump and inspect for dry-running damage. Clean the impeller.
	Suction line and/or discharge line closed at fitting.	Open the fitting.
	Suction pipe cross-section too narrow.	Increase cross-section. Remove encrustations from suction pipe. Open the fitting completely.
	Transport cover still in place.	Remove transport cover. Disassemble pump and inspect for dry-running damage.
	Suction pipe not bled properly or not filled up completely.	Fill completely and bleed pump and/or piping.
	Suction line contains air enclosures.	Mount fitting for bleeding. Correct the piping layout.
	Air sucked in.	Seal the source of malfunction.
	Excessive amount of gas: Pump cavitated.	Consult with manufacturer.
	Discharge pipe blocked.	Clean the discharge piping.
	Pump running in the wrong direction.	Swap any two phases at the motor.
	Motor speed insufficient	Compare required motor speed with specification on pump type plate. Replace motor if necessary. Increase adjustable motor speed if applicable
Pumping rate insufficient!	Impeller out of balance or clogged.	Disassemble pump and inspect for dry-running damage. Clean the impeller.
	Hydraulic components of the pump dirty, clotted or encrusted.	Disassemble pump. Clean the components.
	Motor running on 2 phases.	Check fuse; replace fuse if necessary. Check cable connections and insulation.
	Suction line not fully opened.	Open the fitting.
	Suction pipe cross-section too narrow.	Increase cross-section. Remove encrustations from suction pipe. Open the fitting completely.
	Suction head too high: NPSHpump larger than NPSHinstallation	Increase supply pressure. Consult with manufacturer.
	Air sucked in.	Seal the source of malfunction.
	Excessive amount of gas: Pump cavitated.	Consult with manufacturer.
	Pumped medium temperature too high: Pump cavitated.	Increase supply pressure. Lower the temperature. Inquire with manufacturer.
	Viscosity or density of the pumped medium outside the specification range for the pump.	Consult with manufacturer.
	Geodetic pump head and/or pipe flow resistance too high.	Remove sediments in pump and/or pressure pipe. Install larger impeller; consult with manufacturer.
	Discharge-side fitting not opened sufficiently.	Open the pressure-side fitting.
	Discharge pipe blocked.	Clean the discharge piping.
	Pump running in the wrong direction.	Swap any two phases at the motor.
	Motor speed insufficient	Compare required motor speed with specification on pump type plate. Replace motor if necessary. Increase adjustable motor speed if applicable
	Pump components worn.	Replace had worn pump components.
Pumping rate too high!	Discharge-side fitting opened too wide.	Throttle down at pressure-side fitting. Mill down the impeller. Consult with manufacturer and adjust impeller diameter.
	Geodetic differential head, pipe flow resistance and/or other resistance lower than specified	Throttle down flow rate at pressure-side fitting. Observe the minimum flow rate limit. Mill down the impeller. Consult with manufacturer and adjust impeller diameter.
	Viscosity lower than expected	Mill down the impeller. Consult with manufacturer and adjust impeller diameter.
	Motor speed excessively high	Compare required motor speed with specification on pump type plate. Replace motor if necessary. Reduce adjustable motor speed if applicable.
	Impeller diameter too large	Throttle down flow rate at discharge-side fitting. Observe the minimum flow rate limit. Mill down the impeller. Consult with manufacturer and adjust impeller diameter.

Pumping pressure too low!	Impeller out of balance or clogged.	Disassemble pump and inspect for dry-running damage. Clean the impeller.
	Hydraulic components of the pump dirty, clotted or encrusted.	Disassemble pump. Clean the components.
	Motor running on 2 phases.	Check fuse; replace fuse if necessary. Check cable connections and insulation.
	Suction line not fully opened.	Open the fitting.
	Suction pipe cross-section too narrow.	Increase cross-section. Remove encrustations from suction pipe. Open the fitting completely.
	Suction head too high: NPSHpump larger than NPSHinstallation	Increase supply pressure. Consult with manufacturer.
	Air sucked in.	Seal the source of malfunction.
	Excessive amount of gas: Pump cavitated.	Consult with manufacturer.
	Pumped medium temperature too high: Pump cavitated.	Increase supply pressure. Lower the temperature. Inquire with manufacturer.
	Viscosity or density of the pumped medium outside the specification range for the pump.	Consult with manufacturer.
	Geodetic differential head, pipe flow resistance and/or other resistance lower than specified	Throttle down flow rate at discharge-side fitting. Observe the minimum flow rate limit. Mill down the impeller. Consult with manufacturer and adjust impeller diameter.
	Pump running in the wrong direction.	Swap any two phases at the motor.
	Motor speed insufficient	Compare required motor speed with specification on pump type plate. Replace motor if necessary. Increase adjustable motor speed if applicable
	Pump components worn.	Replace had worn pump components.
	Discharge-side fitting opened too wide.	Throttle down at discharge-side fitting. Mill down the impeller. Consult with manufacturer and adjust impeller diameter.
Pumping pressure too high!	Discharge-side fitting not opened sufficiently.	Open the discharge-side fitting.
	Discharge pipe blocked.	Clean the discharge piping.
	Viscosity lower than expected	Mill down the impeller. Consult with manufacturer and adjust impeller diameter.
	Motor speed excessively high	Compare required motor speed with specification on pump type plate. Replace motor if necessary. Reduce adjustable motor speed if applicable.
	Impeller diameter too large	Throttle down flow rate at discharge-side fitting. Observe the minimum flow rate limit. Mill down the impeller. Consult with manufacturer and adjust impeller diameter.
Pump running roughly!	Impeller out of balance or clogged.	Disassemble pump and inspect for dry-running damage. Clean the impeller.
	Hydraulic components of the pump dirty, clotted or encrusted.	Disassemble pump. Clean the components.
	Antifriction bearing in bearing bracket defective.	Replace antifriction bearings.
	Pump distorted.	Check pipe connections and pump fixation. Check coupling alignment. Check support foot fixation.
	Coupling not properly aligned.	Align coupling.
	Coupling packets worn.	Replace coupling packets and realign.
	Motor running on 2 phases.	Check fuse; replace fuse if necessary. Check cable connections and insulation.
	Suction pipe cross-section too narrow.	Increase cross-section. Remove encrustations from suction pipe. Open the fitting completely.
	Suction head too high: NPSHpump larger than NPSHinstallation	Increase supply pressure. Consult with manufacturer.
	Suction pipe not bled properly or not filled up completely.	Fill completely and bleed pump and/or piping.
	Suction line contains air enclosures.	Mount fitting for bleeding. Correct the piping layout.
	Excessive amount of gas: Pump cavitated.	Consult with manufacturer.
	Pumped medium temperature too high: Pump cavitated.	Increase supply pressure. Lower the temperature. Inquire with manufacturer.
	Discharge-side fitting not opened sufficiently.	Open the discharge-side fitting.
	Discharge pipe blocked.	Clean the discharge piping.
	Pump running in the wrong direction.	Swap any two phases at the motor.
	Pump components worn.	Replace had worn pump components.
	Discharge-side fitting opened too wide.	Throttle down at discharge-side fitting. Mill down the impeller. Consult with manufacturer and adjust impeller diameter.
	Geodetic differential head, pipe flow resistance and/or other resistance lower than specified	Throttle down flow rate at discharge-side fitting. Observe the minimum flow rate limit. Mill down the impeller. Consult with manufacturer and adjust impeller diameter.
	Motor speed excessively high	Compare required motor speed with specification on pump type plate. Replace motor if necessary. Reduce adjustable motor speed if applicable.
	Impeller diameter too large	Throttle down flow rate at discharge-side fitting. Observe the minimum flow rate limit. Mill down the impeller. Consult with manufacturer and adjust impeller diameter.

Antifriction bearing temperatures too high!	Antifriction bearing in bearing bracket defective.	Replace antifriction bearings.
	Antifriction bearing in motor defective.	Replace antifriction bearings.
	Lubricant: too much, too little or unsuitable.	Reduce or top up or replace lubricant.
	Pump distorted.	Check pipe connections and pump fixation. Check coupling alignment. Check support foot fixation.
	Coupling not properly aligned.	Align coupling.
	Pump components worn.	Replace had worn pump components.
	Motor speed excessively high	Compare required motor speed with specification on pump type plate. Replace motor if necessary. Reduce adjustable motor speed if applicable.
Pump leaking!	Connecting screw or bolts not tightened correctly.	Tighten connecting screws and bolts.
	Mechanical seal worn.	Replace mechanical seal.
	Casing seal defective.	Replace casing seal.
	Shaft sleeve is infiltrated.	Replace the shaft sleeve and/or O-rings.
	Pump distorted.	Check pipe connections and pump fixation. Check coupling alignment. Check support foot fixation.
Motor power uptake excessive!	Antifriction bearing in bearing bracket defective.	Replace antifriction bearings.
	Pump distorted.	Check pipe connections and pump fixation. Check coupling alignment. Check support foot fixation.
	Motor running on 2 phases.	Check fuse; replace fuse if necessary. Check cable connections and insulation.
	Viscosity or density of the pumped medium outside the specification range for the pump.	Consult with manufacturer.
	Discharge-side fitting opened too wide.	Throttle down at discharge-side fitting. Mill down the impeller. Consult with manufacturer and adjust impeller diameter.
	Geodetic differential head, pipe flow resistance and/or other resistance lower than specified	Throttle down flow rate at discharge-side fitting. Observe the minimum flow rate limit. Mill down the impeller. Consult with manufacturer and adjust impeller diameter.
	Motor speed excessively high	Compare required motor speed with specification on pump type plate. Replace motor if necessary. Reduce adjustable motor speed if applicable.
	Impeller diameter too large	Throttle down flow rate at discharge-side fitting. Observe the minimum flow rate limit. Mill down the impeller. Consult with manufacturer and adjust impeller diameter.

Table 3: Table of Possible Failures, Causes and Solutions

12. PUMP DIMENSIONS TABLE AND WEIGHT

OMK SERIES

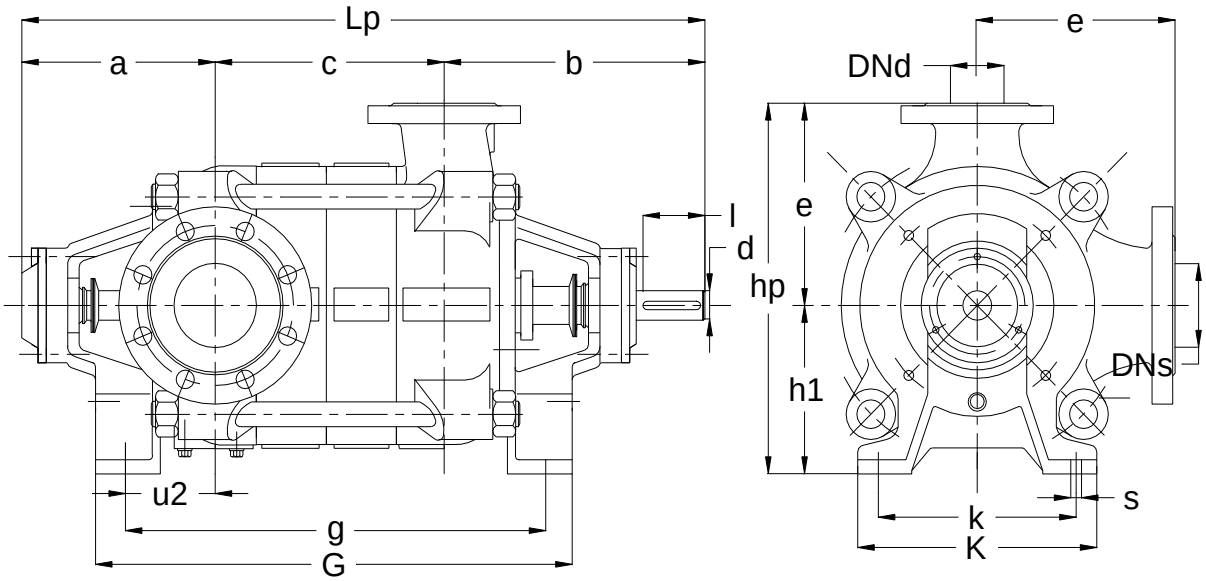


Figure 17: Pump Dimensions (Horizontal Design)

Pump Type	DN s	DN d	a	b	Lp	g	G	u2	h1	e	hp	d	l	k	K	s
	mm ø	mm ø														
OMK 32	50	32	190	260	C+450	C+167	C+247	79	150	160	310	25	60	175	220	14
OMK 40	65	40	196	259	C+455	C+170	C+250	85	150	180	330	25	60	175	220	14
OMK 50	80	50	224	304	C+538	C+204	C+286	98	180	210	390	28	70	220	270	19
OMK 65	100	65	229	324	C+553	C+210	C+300	100	200	240	440	32	80	240	290	19
OMK 80	125	80	259	377	C+636	C+258	C+338	121	230	270	500	42	100	270	320	19

Table 4: Table of Pump Dimensions (Horizontal Design)

"C" Dimension According To Stage Number

Pump Type	2	3	4	5	6	7	8	9	10	11	12	13	14
OMK 32	124	178	232	286	340	394	448	502	556	610	664	718	772
OMK 40	133	191	249	307	365	423	481	539	597	655	713		
OMK 50	188	266	344	422	500	578	656	734	812	890			
OMK 65	193	278	363	448	533	618	703	788	873	958			
OMK 80	250	360	470	580	690	800	910	1020	1130				

Table 5: Table of "C" Dimension According to Stage Number

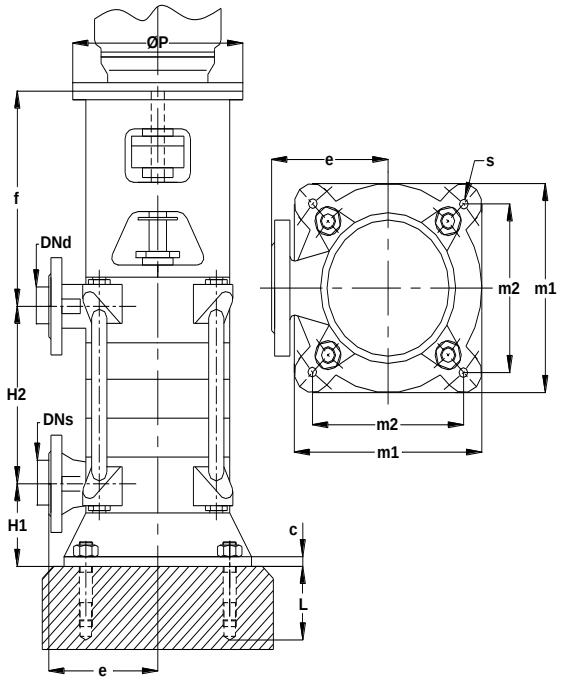


Figure 18: Pump Dimensions (Vertical Design)

Pump Type	Dn s mm ø	Dn d mm ø	H1	e	m1	m2	c	s	L
OMK-V 32	50	32	124	160	300	248	20	19	300
OMK-V 40	65	40	130	180	300	248	20	19	300
OMK-V 50	80	50	160	210	400	332	30	19	300
OMK-V 65	100	65	162	240	400	332	30	19	300
OMK-V 80	125	80	185	270	450	375	30	13	300

Table 6: Table of Pump Dimensions (Vertical Design)

Pump Type	2	3	4	5	6	7	8	9	10	11	12	13	14
OMK-V 32	124	178	232	286	340	394	448	502	556	610	664	718	772
OMK-V 40	133	191	249	307	365	423	481	539	597	655	713		
OMK-V 50	188	266	344	422	500	578	656	734	812	890			
OMK-V 65	193	278	363	448	533	618	703	788	873	958			
OMK-V 80	250	360	470	580	690	800	910	1020	1130				

Table 7: Table of "H_2" Dimension According to Stage Number

OMK-V 32			OMK-V 40		
ØP	m	f	ØP	m	f
200	40	323	200	40	320
200	50	323	200	50	320
250	60	333	250	60	330
300	80	353	300	80	350
350	110	383	350	110	380
400	110	383	400	110	380
450	110	383	450	110	380

OMK-V 50			OMK-V 65			OMK-V 80		
ØP	m	f	ØP	m	f	ØP	m	f
250	60	393	250	60	397	250	60	433
300	80	413	300	80	417	300	80	453
350	110	443	350	110	447	350	110	483
400	110	443	400	110	447	400	110	483
450	110	443	450	110	447	450	110	483
550	140	473	550	140	477	550	140	513
			650	140	477	660	140	513

"H2" Dimension According To Stage Number

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 8: Table of Tightening Torques

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:

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

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

Pump Type	DN Flange		Forces						Moments	
			Suction Flange			Discharge Flange			Suction Flange	Discharge Flange
	Suction	Discharge	in N			in N			in Nm	in Nm
			F y	F z	F x	F y	F z	F x	M	M
OMK 32 / OMK-V 32	50	32	471	386	429	243	300	257	543	385
OMK 40 / OMK-V 40	65	40	600	486	529	286	357	314	595	490
OMK 50 / OMK-V 50	80	50	714	586	643	386	471	429	648	543
OMK 65 / OMK-V 65	100	65	957	771	857	486	600	529	735	595
OMK 80 / OMK-V 80	100	80	857	957	771	643	586	714	735	648

Table 9: Table of Forces and Moments at the Pump Flanges

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

15. SAMPLE PLUMPING SYSTEM

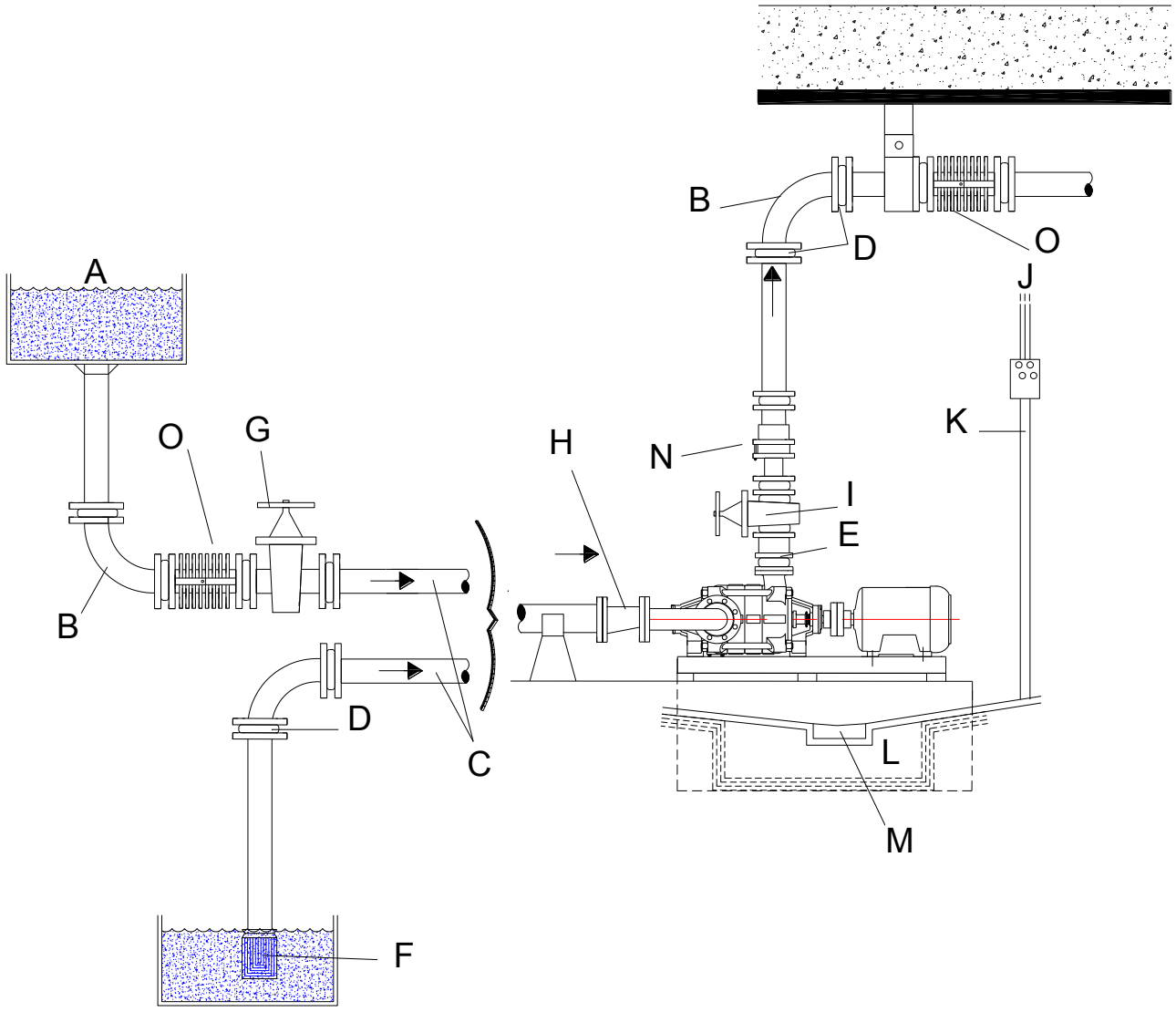


Figure 19: OMK A typical piping

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

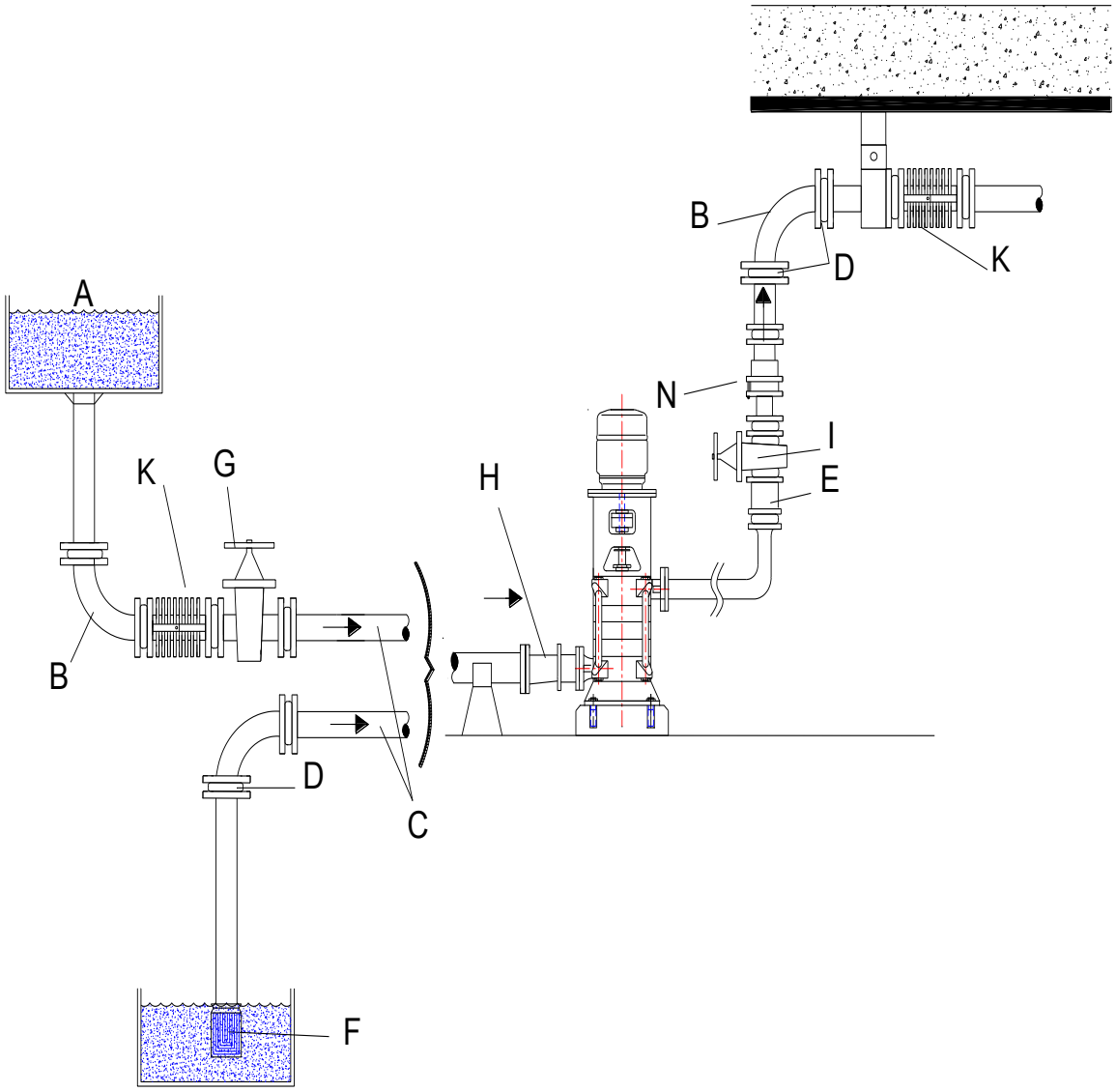


Figure 20: OMK-V A typical piping system

A. Tank
B. Large radius elbow
C. Minimum slope is 2 cm/m
D. Fittings, flanges etc.
E. Non-return valve
F. Foot valve and strainer
G. Suction valve
H. Reducer
İ. Discharge valve
J. Compansator

16. OMK SECTIONAL DRAWING AND PART LIST

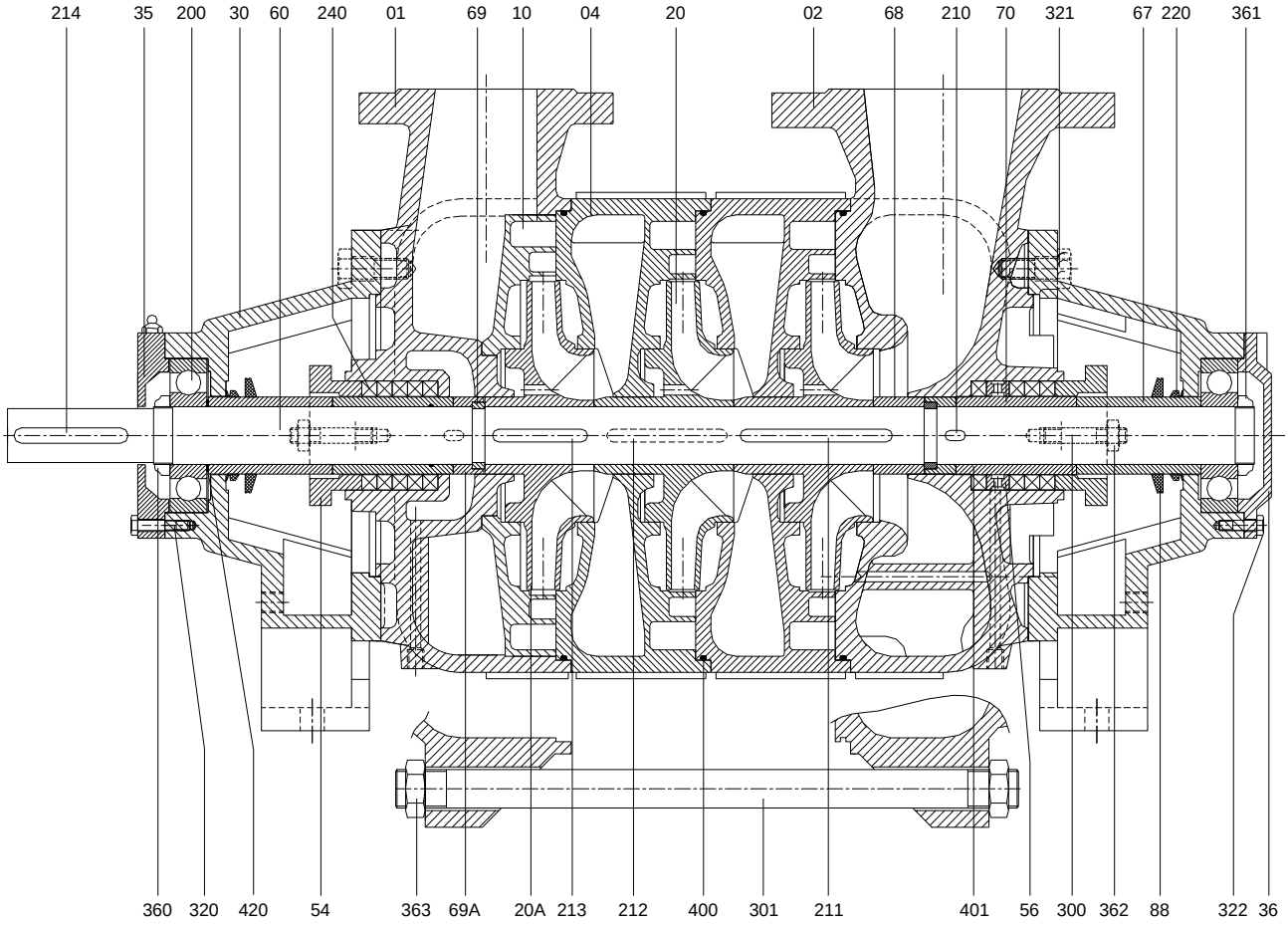
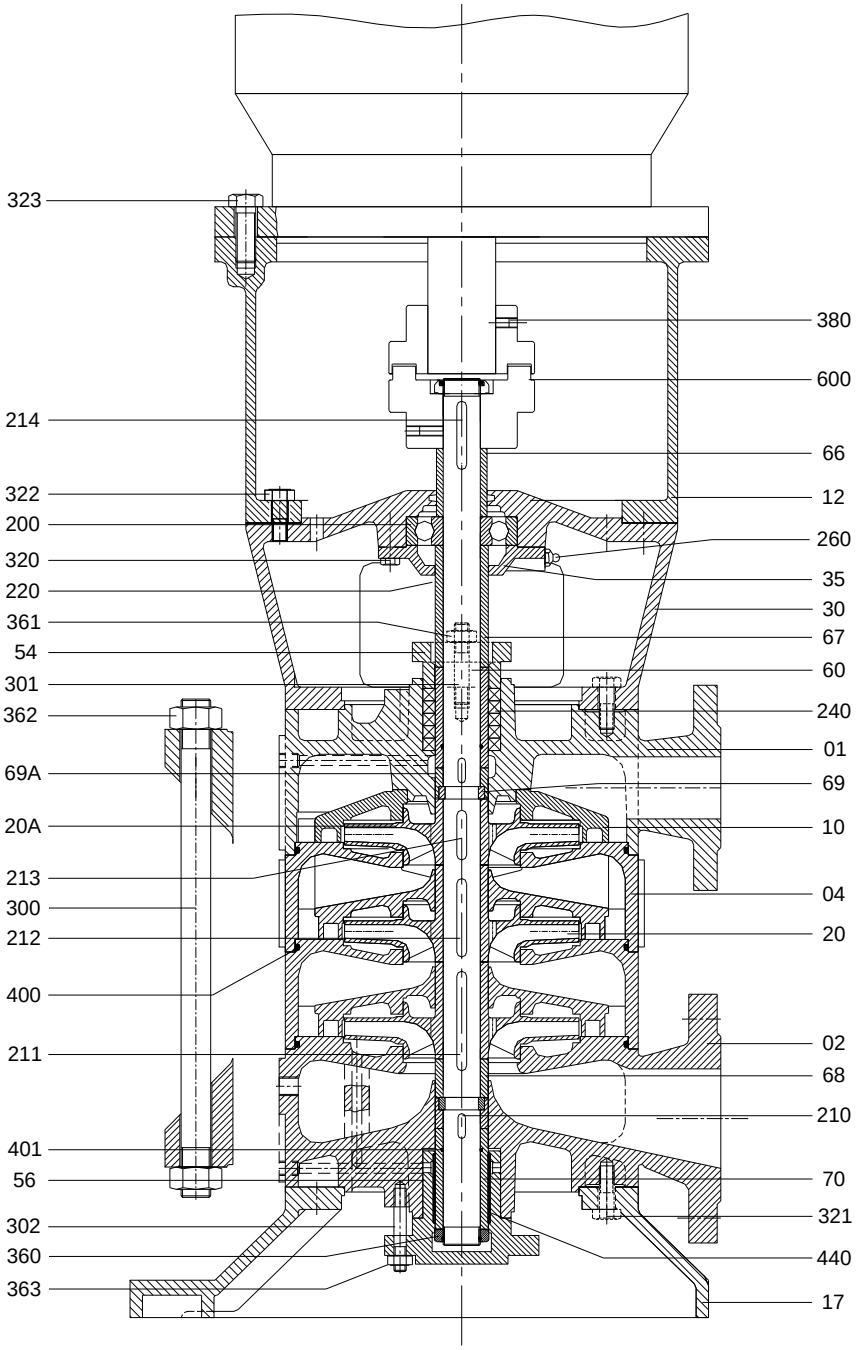


Figure 21: OMK Sectional Drawing

Part List

No		No	
01	Discharge Casing	210	Key, Sleeve
02	Suction Casing	211	Key, First Stage Impeller
04	Stage Casing With Diffuser	212	Key, Standard Impeller
10	Last Stage Diffuser	213	Key, Last Stage Impeller
20	Impeller	214	Key, Coupling
20A	Last Stage Impeller	220	V-Ring
30	Bearing Housing	240	Soft Packing
35	Bearing Cover (Discharge Side)	300	Stud For Gland
36	Bearing Cover (Suction Side)	301	Casing Stud
54	Gland	320	Bolt, Bearing Cover
56	Lantern Ring	321	Bolt, Bearing House
60	Pump Shaft	322	Bolt, Bearing Cover
67	Space Sleeve	360	Shaft Nut
68	Space Sleeve	361	Shaft Nut
69	Split Ring	363	Nut, Casing Stud
69A	Retaining Ring	400	O-Ring (Stage Casing)
70	Seal Sleeve	401	O-Ring (Seal Sleeve)
88	Thrower	420	Supporting Ring
200	Ball Bearing (6400 Series)		

17. OMK-V SECTIONAL DRAWING AND PART LIST

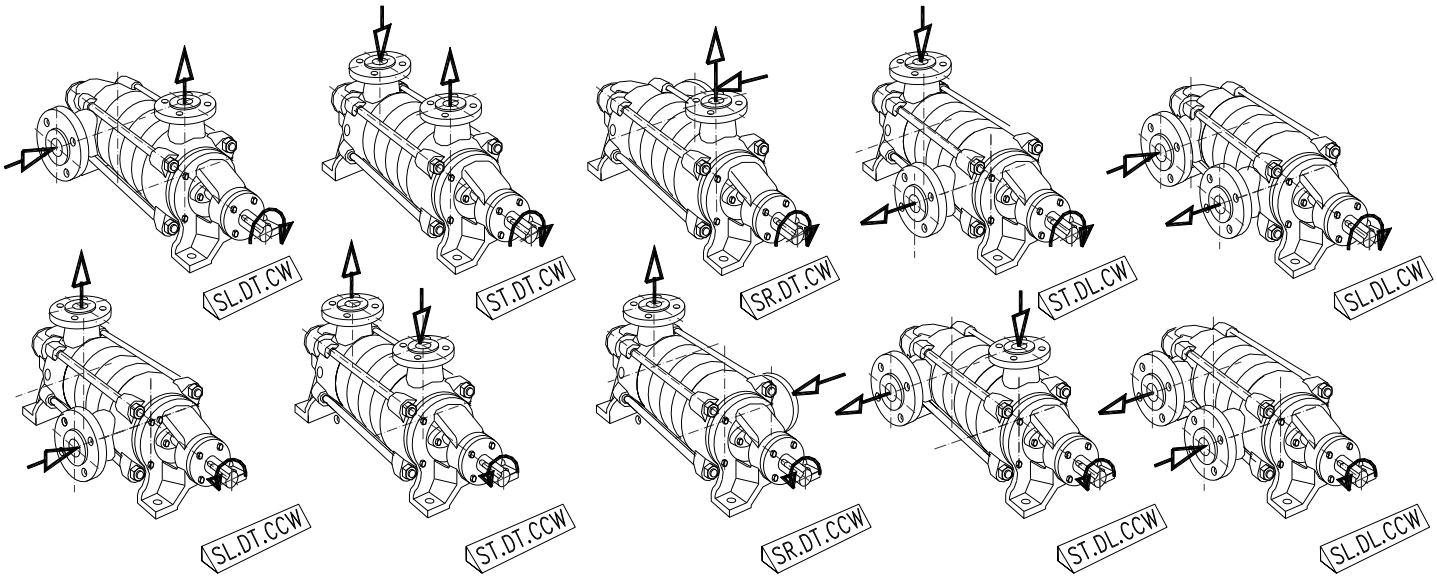


No	Part List
01	Discharge Casing
02	Suction Casing
04	Stage Casing With Diffuser
10	Last Stage Diffuser
12	Adapter
17	Base Plate
20	Impeller
20A	Last Stage Impeller
30	Bearing Housing
35	Bearing Cover
54	Gland
56	Teflon Bearing Gland
60	Pump Shaft
66	Coupling Sleeve
67	Space Sleeve
68	Space Sleeve
69	Split Ring
69A	Retaining Ring
200	Ball Bearing (6400 Series)
210	Key for sleeve
211	Key for First Stage Impeller
212	Key For Standard Impeller
213	Key For Last Stage Impeller
214	Key For Coupling
220	V-Ring
240	Soft Packing
260	Greaser
301	Stud and Nut For Gland
302	Stud
320	Bolt for Bearing Cover
321	Bolt for Suction Casing
322	Bolt for Adapter
323	Bolt for Motor
360	Shaft Nut
361	Nut For Gland Stud
362	Nut For Casing Stud
363	Nut
380	Set-Screw
400	O-Ring
401	O-Ring
440	Teflon (Bearing Shell)
600	Coupling

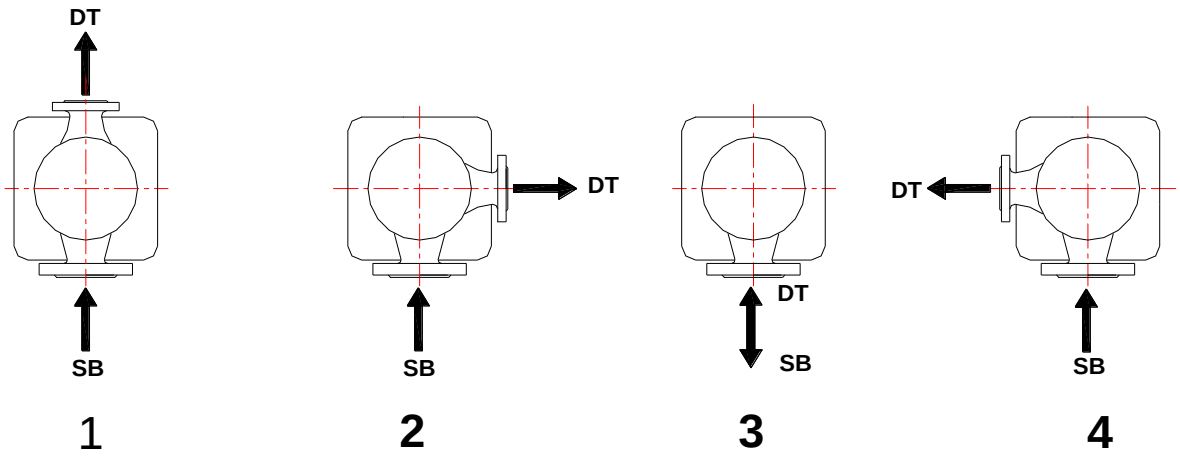
Figure 22: OMK-V Sectional Drawing

18. DIFFERENT INSTALLATION APPLICATIONS

Standard Manufacturing



Example: SL-DT-CW → **SL** = **S**uction **L**eft – **DT** = **D**ischarge **T**op – **CW** = **C**lock **W**ise



(**SB**: **S**uction **B**ottom) **–** (**DT: D**ischarge **T**op)

Figure 23: Different Installation Applications

19. OMK-V SERIES MEI VALUES TABLE

	2900 RPM MEI VALUES
OMK-V 32	≥ 0,7
OMK-V 40/2	≥ 0,7
OMK-V 40/3	≥ 0,7
OMK-V 40/4	≥ 0,7
OMK-V 40/5	≥ 0,7
OMK-V 40/6	≥ 0,7
OMK-V 40/7	≥ 0,7
OMK-V 50/2	≥ 0,7
OMK-V 50/3	≥ 0,7
OMK-V 50/4	≥ 0,7
OMK-V 50/5	≥ 0,7
OMK-V 65/2	≥ 0,6
OMK-V 65/3	≥ 0,6
OMK-V 65/4	≥ 0,7

Table 10: Table of OMK-V MEI Values

20. FIGURE LIST

21. TABLE LIST

Mas Grup

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Ankara Regional Directorate:
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