

SKY

VESTAPOMP

Makes life comfortable

SKY THERMAL - OIL PUMPS WITH AIR COOLED

INSTRUCTIONS for INSTALLATION, OPERATION & MAINTENANCE



Pump Type	
Serial No	
Capacity	m ³ /h
Head	m
Motor Power	kW
Speed	rpm



BK SKY 00 06-11 EN

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This manual is intended to be a reference guide for users of pumps providing information on

- Pump installation and maintenance instructions,
- Pumps start-up, operation and shut - down procedures.

IDENTIFICATION OF SAFETY AND WARNING SYMBOLS



Safety instructions in this manual which could cause danger to life if not observed.



The presence of a dangerous electric current.



Non – observance to this warning could damage the machine or affect its functions.

GENERAL INSTRUCTIONS



- This manual should be kept in a safe place and ALWAYS be available to the QUALIFIED operating and maintenance personnel responsible for the safe operation and maintenance of the pumps.

- Qualified personnel should be experienced and knowledgeable of safety standards.
 - To avoid faulty operation and malfunctioning of pumps the instructions in this manual are to be CAREFULLY studied and followed at all stages of the pump installation and operating life.
 - The user is responsible for ensuring that inspection and installation are carried out by authorized and qualified personnel who have studied this manual carefully.
 - The pump should be used ONLY in the operating conditions given on the order for which the pump and materials of the construction have been selected and tested.
 - If the pump is to be used for a different application please contact sales office or representative of the manufacturer..refuses to assume any responsibility if the pump used for different applications without prior written permission.
 - If the pump is not to be installed and operated soon after arrival, it should be stored in a clean and dry place with moderate changes in ambient temperature. Extreme low or high temperatures may severely damage the pump unless suitable precautions are taken. The user is responsible for the verification of the ambient conditions where the pump will be stored or installed.
 - does not guarantee repairs or alterations done by user or other unauthorized personnel.
- The use of original spare parts and accessories authorized by manufacturer will ensure safety.
- This manual does not take into account any site safety regulation, which may apply.

SAFETY INSTRUCTIONS



Strictly obey to the following instructions to prevent personal injuries and/or equipment damages:

- Pump should be used only in the specified operating conditions.
 - Any weight, stress or strains on the piping system should not be transmitted to the pump.
 - Electrical connections on the motor or accessories must always be carried out by authorized personnel and in accordance to the local codes.
 - Any work on the pump should be only carried out when the unit has been brought to standstill.
-
- **Always disconnect the power to the motor and make sure not be switched on accidentally before working on the pump or removing the pump from installation.**
 - Any work on the pump should be carried out by at least two persons.
 - When approaching the pump always be properly dressed and/or wear safety equipment suitable for the work to be done.
 - Do not work on the pump when it is hot.
 - Do not touch the pump or piping with temperatures higher than 80 °C. User must take suitable precaution to warn the persons (e.g. using warning signs, barrier).
 - Always be careful when working on pumps that handling dangerous liquids (e.g. acids or hazardous fluids).
 - Do not work on the pump when the pump and piping connected to the pump are under pressure.
 - After completion of the work always fix the safety guards back in places previously removed.
 - Do not run the pump in the wrong direction of rotation.
 - Do not insert hands or fingers into the pump openings or holes.
 - Do not step on the pump and/or piping connected to the pump.

SKY PUMPS

A- GENERAL

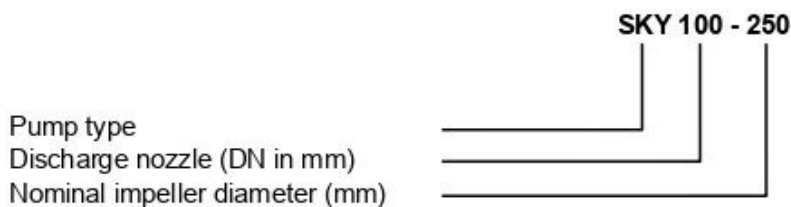
A1- Pump Description

- SKY series pumps are horizontal, radially split volute casing, single stage, end suction, air-cooled centrifugal pumps with closed impeller and mechanical seal for heat transfer circulating systems.

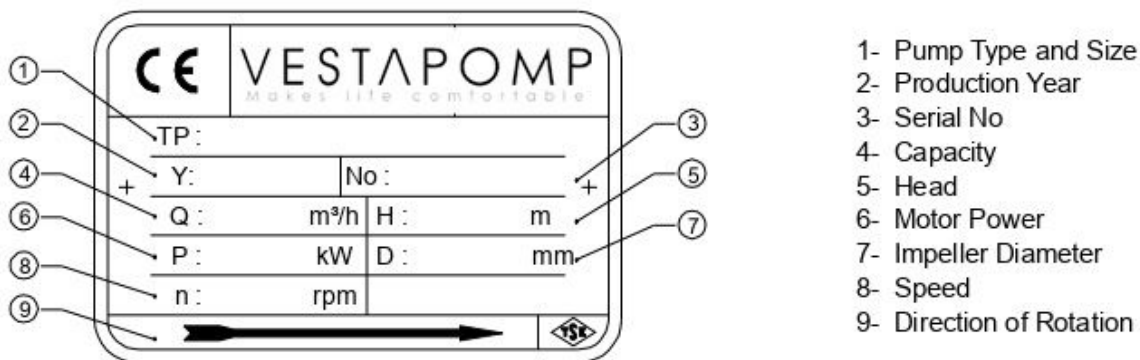
A2- Applications

- For the circulating of heat-transfer oils.
- At industrial plants, for transferring low viscosity industrial oil which does not chemically effect the pump material and does not contain abrasive solid particles.

A3- Pump Designation



A4- Pump Nameplate



A5- Technical Data

Speed	: up to 3600 rpm
Discharge Nozzle	: DN 32 up to 150 mm
Suction and Discharge Flanges	: EN 1092-2 / PN16
Operating Temperature	: up to 320° C
Ambient Temperature (max)	: 40° C
Casing Pressure (max)	: 16 bar
Cooling Method	: with air
Permissible Liquids	: See section A2
Bearings	: Grease-lubricated ball bearing
Shaft Sealing	: Mechanical seal

B- UNCRATING, TRANSPORT AND STORAGE

B1- Uncrating

- Upon receipt verify that the goods received are in exact compliance with that listed on the packing list.
- Check that no visible damage exists on the crate that could have occurred during transportation.
- Carefully remove the packaging material and check that pump and accessories (if any) are free from any markings, scratches and damages, which may have occurred during transportation.
- In the event of damage report this immediately to service department and to the transport company.

B2- Transport

B2.1- General recommendations



- Existing regulations for the prevention of accidents must be followed.
- Wearing of gloves, hard-toed boots and hard hats is obligatory for all transport works.
- Wooden cases, crates, pallets or boxes may be unloaded with fork-lift trucks or using hoisting slings, depending on their size, weight and construction.

B2.2- Lifting

- Prior to lifting and moving the pump or pump and motor on a common base plate find out the following:
 - Total weight and center of gravity
 - Maximum outside dimensions
 - Lifting points location
- The load-bearing capacity must be proper to the weight of the pump or the pump set.
- The pump or pump set must always be raised and transported in horizontal position.
- It is absolutely forbidden to stand beneath or nearby a raised load.
- A load should never remain in a raised position for longer than necessary.
- Accelerating and braking during the lifting process must be performed such that there is no danger to persons.

When lifting the pump or complete pump set lift them as shown in **Fig. 1a** and **Fig. 1b** respectively to avoid any distortion (especially do not use the motor eyebolt for carrying the complete unit).

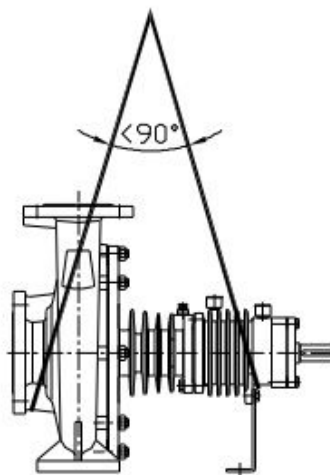


Fig. 1a Bare shaft pump

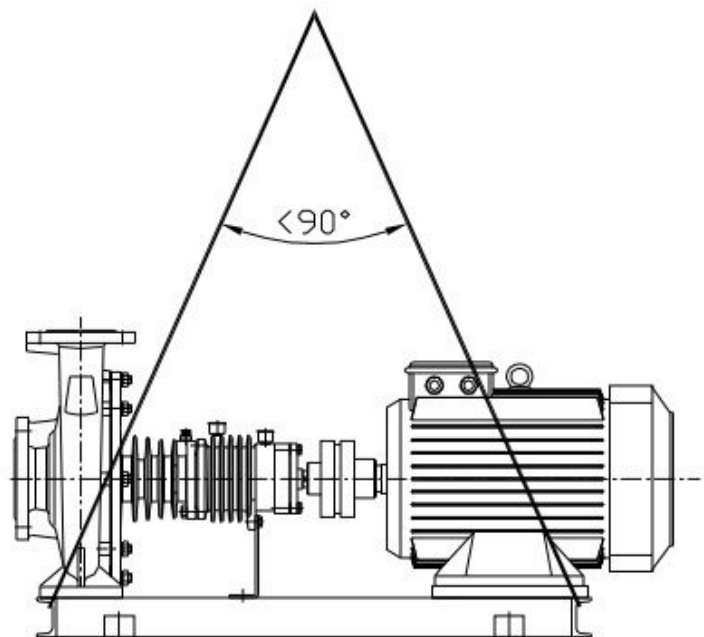


Fig. 1b Pump and motor on a common baseplate

B3- Storage

- If the pump is not to be installed and operated soon after arrival, store the pump in a clean, dry and frost-free place with moderate changes in ambient temperature.
- If the pump has regreaseable bearings, pump extra grease on bearings to prevent moisture from entering around the shaft.
- To prevent the pump from moisture, dust, dirt and foreign materials suitable steps should be taken.
- The pump shaft should be revolved periodically (e.g. once a week) to prevent pitting of the bearing surfaces and the pump from seizing up.

C- INSTALLATION ON SITE

ATTENTION Installation has to be carried out in accordance with EN 60204-1.

The pump should only be installed, levelled up and aligned by skilled personnel. Incorrect installation or defective foundation could result in troubles. This would not be covered by the warranty.

C1- Bare Shaft Pump

- If the pump has been supplied with bare shaft end it is required to prepare a proper base plate on which to mount the pump and motor assembly. The base plate must be properly designed and manufactured for enough rigidity to prevent vibrations and distortions.
- If the pump has been supplied without electric motor and coupling it is necessary to select a proper motor and coupling before proceeding to the installation of the unit.

The following considerations must be taken into account for selection of motor:

- Maximum power absorbed by the pump over the total operating range,
- Pump operating speed,
- Available power (frequency, voltage, etc.)
- Motor type (TEFC, exproof, etc.)

When selecting the coupling, nominal motor power and operating speed must be taken into account.

C2- Preparation for Installation

Before installing the pump

- Clean the suction and discharge flanges thoroughly.
- Remove the protective coating from the pump shaft.

C3- Installation Site

ATTENTION The pump must be installed in a frost and dust-free, well-ventilated and non-explosive environment.

- The pump should be installed such that there is space for access, ventilation, maintenance and there is sufficient space above the pump for it to be lifted.



- The volute casing and casing cover has almost the same temperature as the liquid handled. The casing cover and the bearing housing must not be insulated. User must take the necessary precautions to avoid burns.



- Electrical equipment operated in hazardous location must comply with the explosion protection regulations. This is indicated on the motor name plate. If the equipment is installed in hazardous locations, the applicable local explosion protection regulations and the regulations of the test certificate supplied with the equipment and issued by the responsible approval authorities must be observed and complied with. The test certificate must be kept close to the location of operation for easy access (e.g. foreman's office).

C3.1- Foundation

ATTENTION The greatest care must be taken in preparing the foundation and mounting the pumpset. Incorrect installation will result in premature wear of pump components and break down of the pump.

- The foundation should be heavy enough (at least 5 times the weight of the pump set) to reduce vibrations and rigid enough to avoid any twisting or misalignment. This is important in maintaining the alignment for a flexibly coupled unit. A concrete foundation on a solid base should be satisfactory. Foundation bolts of the proper size should be embedded in the concrete. A pipe sleeve larger in diameter than the bolt should be used to allow movement for final positioning of the bolts. Make sure the concrete foundation has set firm and solid before mounting the pumpset. The surface of the foundation should be truly horizontal and perfectly flat. (See fig. 2).

C3.2- Installation

- Place the pumpset on the concrete which is prepared before and by adding or removing the leveling shims under the baseplate align the discharge flange horizontally by using a spirit level on it as shown on **Fig.2** make sure it is completely horizontal.
- Slightly tighten the anchor bolts.
- Check the coupling alignment as explained in **section C4**.
- Fill in the pipe sleeve and the baseplate with concrete respectively. Make sure no air left in it and the baseplate is well integrated with concrete foundation.
- Wait until the concrete firmly set (minimum 3 days).
- Tighten the anchor bolts. **CHECK THE COUPLING ALIGNMENT AGAIN.**

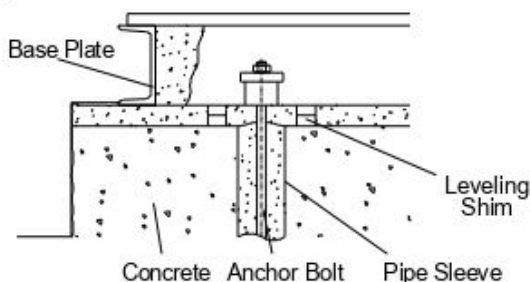


Fig. 2 Foundation, baseplate and fitting the shims

C4- Coupling Alignment

ATTENTION • For a trouble free service life of the pumping unit the most important factor is aligning the coupling properly. The main reason for vibration, noisy operation, warming bearings and overloading is an unaligned or misaligned coupling. Therefore the coupling should be correctly aligned and be checked frequently.

• A flexible coupling should never be expected to correct misalignment. A FLEXIBLE COUPLING IS NOT A CURE FOR MISALIGNMENT AT ALL AND IT DOES NOT COMPENSATE FOR EXCESSIVE MISALIGNMENT. A flexible coupling will only compensate for small amount of misalignment.

ATTENTION “Coupling Alignment” means to secure the motor and pump rotation axes on the same straight line. SKY series pumps are dispatched from our factory after the coupling alignment is precisely secured if supplied with driver and baseplate. A certain amount of deformation of the baseplate is possible during handling and transit. For this reason, regardless of the excellent alignment made at factory, THE PUMP AND DRIVER HAVE TO BE REALIGNED DURING INSTALLATION.

- Two pieces of minimum 100 mm long metal stripes with straight edge (steel ruler) and a precise calliper are needed to align the coupling (special instruments must be used for a very fine and precise alignment).
- There may be two forms of errors for coupling alignment:
 - a) Angular error,
 - b) Parallel sliding error,
- To check the angular error, the gap between the coupling halves must be the same at all points horizontally and vertically.

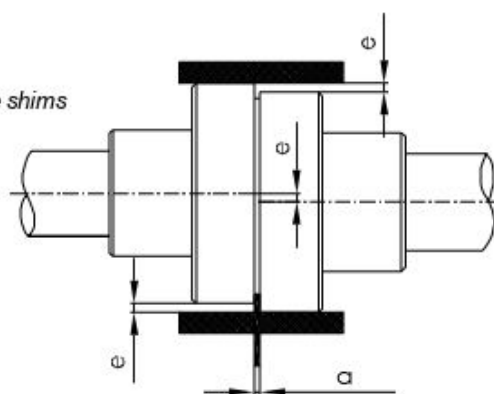


Fig. 3 Aligning a flexible coupling

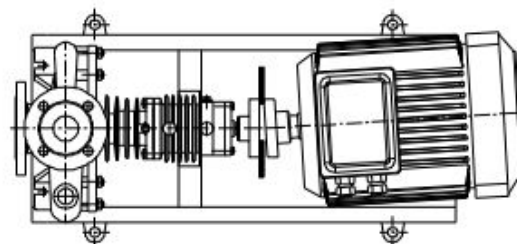


Fig. 4a Angle error in horizontal plane and to settle

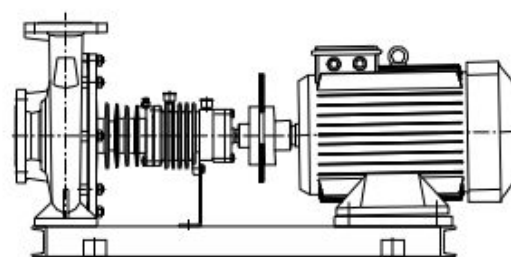


Fig. 4b Angle error in vertical plane and to settle

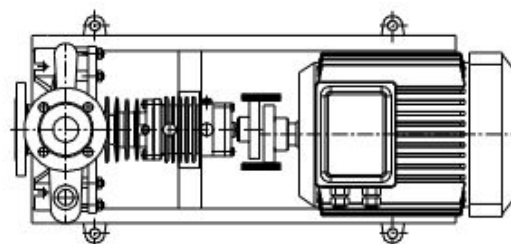


Fig. 4c Parallel sliding error in horizontal plane and to settle

- To control parallel sliding error, straight edged steel ruler is pressed down on one half of the coupling in parallel to the axis. It is checked against the other half. Straight edge must touch to the both half couplings completely same at all points in each vertical and horizontal planes (**Fig.3**).

- Alignment errors can be either on vertical plane or horizontal plane. On vertical plane alignment is corrected by inserting shims under the pump or motor foot, and on horizontal plane alignment is corrected by sliding the pump and/or motor horizontally sideways by using the gaps at mounting holes. *Fig. 4a, 4b, 4c, 4d* show alignment of coupling step by step.

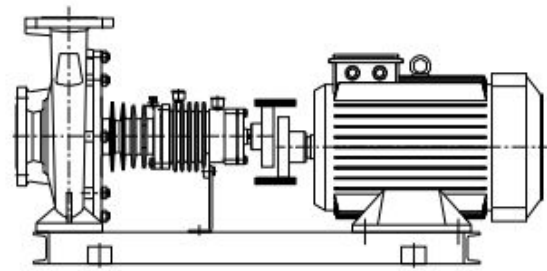


Fig. 4d Parallel sliding error in vertical plane and to settle

ATTENTION Following any alternation, each alignment should be rechecked because any movement due to an adjustment in one direction may cause misalignment in another.

C5- Connecting the Piping

C5.1- General

Never use the pump as an anchorage point or as a carrier for the piping.

- The pipelines should be supported very near the pump. It must be checked that any weight, stress or strains on the piping system should not be transmitted to the pump. Therefore after completing the piping installation, the bolt and connection on the suction and discharge nozzles must be loosened to ensure that there is not any stress on the piping system transmitted to the pump.

The piping-induced forces and moments acting on the pump nozzles (e.g. due to torsion and/or thermal expansion) must not exceed the permissible forces and moments given in **section K**.

An excessive, impermissible increase in the pipeline forces may cause leaks on the pump where liquid handled can escape into the atmosphere. Danger of life when hot liquids are handled.

- The nominal sizes of the pump suction and discharge nozzles are no guide to the correct sizes of the suction and discharge piping. The nominal bores of the pipes should be same as or greater than those of the pump nozzles. Never use pipes or accessories which have smaller bore than the pump nozzles.
- Pipe joints should be by means of flanges with flange gaskets of proper size and material. Flange gasket must be centered between the flange bolts in a such way that there is no interference with the flow of the liquid.
- Thermal expansions of the pipework and excessive vibrations should be accommodated by suitable means so as not to impose any extra load on the pump **Fig. 5**.

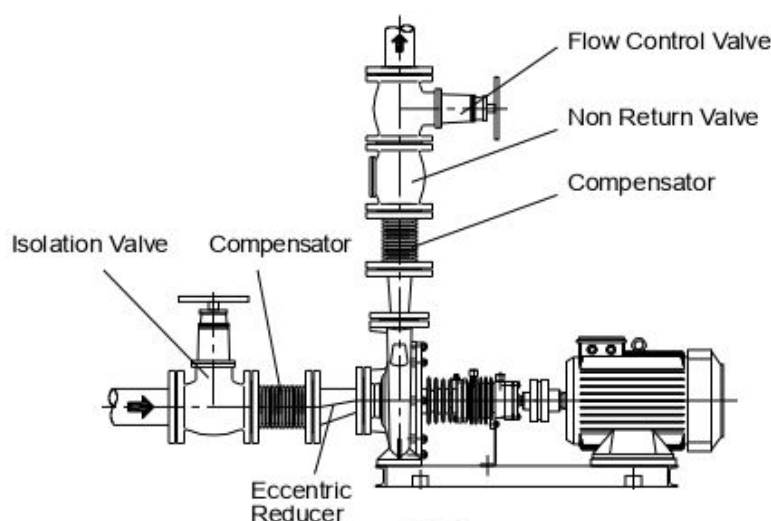


Fig. 5

- Prevent impurities such as welding beads, scale, sand and tow might be left in pipes while production of the piping system harms the pump. Seal the pump nozzles by means of blind gasket to stop impurities get in the pump. After assembling the system all the piping parts must be disassembled, thoroughly cleaned, painted and reassembled again. It is recommended to install a strainer on the suction side of the pump to prevent impurities from entering the pump and it must be cleaned after several days of operation. The total cross section of the holes in the strainer must be at least three times the cross section of the pipe in order to avoid excessive pressure loss across the strainer due to clogging.
- The suction piping must not present any features likely to promote the formation of air pockets. Therefore the suction piping should have a slight downward slope towards the pump (**Fig. 5**).
- An isolating valve should be installed in the suction pipe as close to the pump as possible. This valve should always remain fully open while the pump is running and must not be used to regulate the flow (**Fig. 5**).
- A control or shut-off valve should be installed in the discharge pipe, as close to the pump as possible, to

C5.2- Auxiliary Connections

Depending on the application auxiliary pipe connection (drainage etc. necessary for the pumping system) and/or accessories to check the operating conditions (pressure gages, temperature gages etc.) may be made up and laid.

- Pressure and vacuum gauges must be properly anchored and connected at the measuring points located on the pipes approximately 2D close to the flanges with approximately 8 mm diameter tubing with pig tail configuration to lessen pressure fluctuation. For safety purposes isolating and vent valves should be fitter before the gauges (**Fig. 6**).
- Every pump is fitted with connection on the pump casing to drain the pump (**Fig. 7**). If required the pump drain can be piped to a suitable reservoir. The pump draining piping must be fitted with an isolating valve and both must be suitable for the maximum operating pressure of the pump.

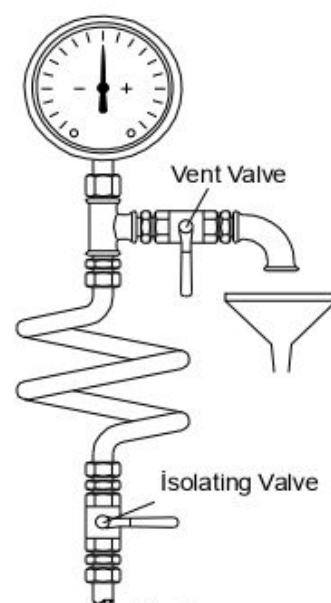


Fig. 6

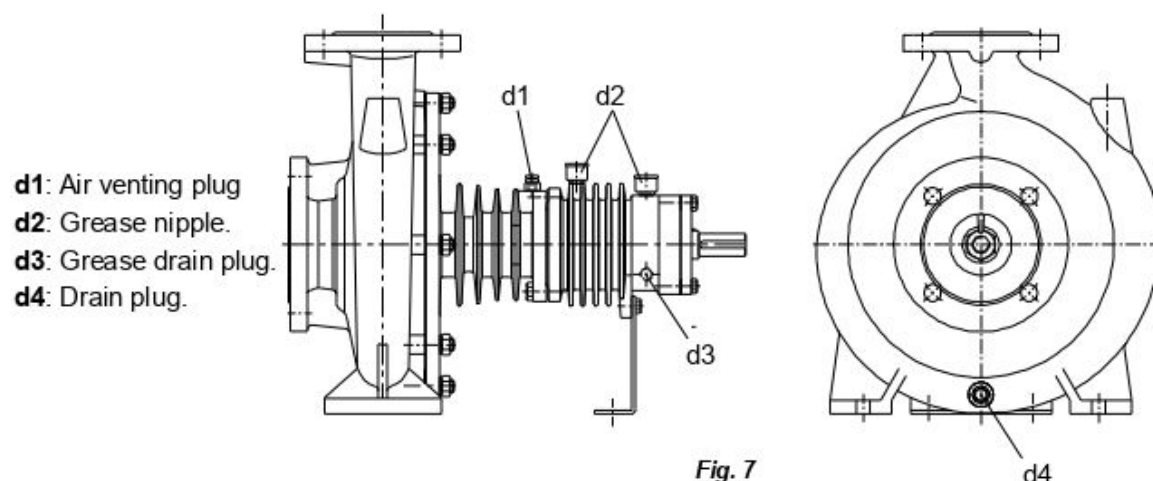


Fig. 7

C5.3- Minimum Flow

If there is a possibility of the pump having to operate at zero flow (against a closed discharge valve) or near the closed valve with almost no flow, then a minimum flow valve (or a by-pass check valve) must be installed on the discharge nozzle or on the discharge piping right after the pump but before the flow regulating valve. A minimum flow of approximately 30% of nominal flow has to be ensured during this interval. In cases where there is no such a valve operating the pump against close valve for a long time causes considerable damage on the pump since almost all the motor power is transformed into thermal energy which is absorbed by the pumped liquid.

C5.4- Electrical Connections

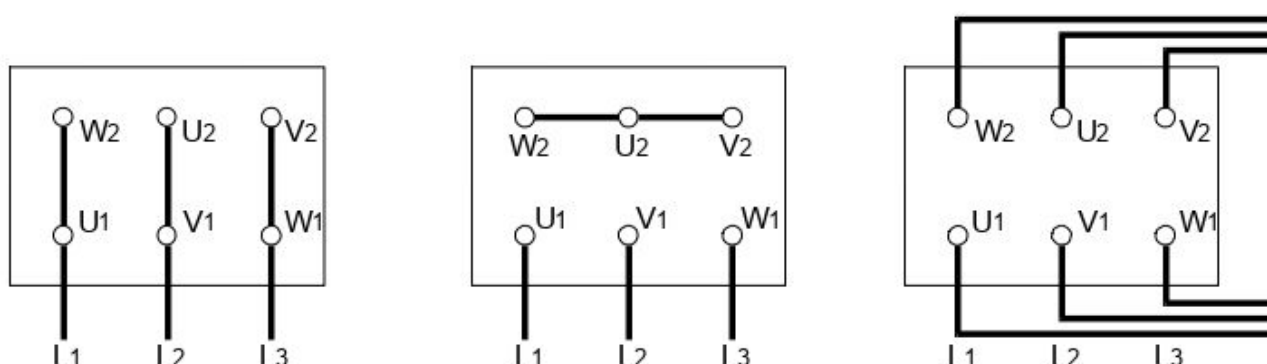


• The electrical motors have to be built in accordance with EN 60034-1.
• Enclosures of electrical motors and control systems on the pump unit shall as a minimum give protection in accordance with EN 60529 IP22. But in determining the degree of protection of enclosures of electrical motors and control systems on the pump unit the operating and environmental conditions must be taken into consideration.

- Electrical connection should be done by a qualified electrician. Current national regulation and motor manufacturer's instructions must be observed.
- Take all safety precautions listed in "**Safety Instructions**". Disconnect all power supplies prior to doing any work.
- The supply cable must be laid in such a way that it never touches the pipework, pump and motor casing.
- Check voltage, phase and frequency on motor nameplate with the mains.
- The electric motor must be protected against overloading by means of circuit breakers and/or fuses. Circuit breakers and fuses must be selected in accordance with full load amperage of the motor appearing on the motor rating plate.
- It is recommended to use PTC (passive thermal control) on motor, but this is optional depending on customer requirement. In case of using PTC, these should be connected via corresponding terminals in the terminal box and the PTC should be connected to the thermal trip mechanism.
- Prior to connecting the electrical wiring rotate the pump shaft by hand to make sure rotor rotates easily.
- Connect the electrical wiring in accordance with local electrical codes and make sure to ground the motor.
- The connection diagram can be found in the terminal box of the motor or in the instruction manual.
- The mains connection on the tagboard depends on the nominal power of the motor, the power supply and the type of connection. The necessary connection of the bridges in the terminal box is shown in the following (Table 1. and Fig. 7a, 7b, 7c).

Table 1

Type of switch	Motor Power $P_N \leq 4 \text{ kW}$	Motor Power $P_N > 4 \text{ kW}$
	power supply 3 ~ 400 V	power supply 3 ~ 400 V
direct	Y – connection (12b)	Δ – connection(12a)
Y / Δ - start	Impossible	Remove connecting bridges (13c)



ATTENTION In the case of three-phase induction motors with Y – Δ – connection it must be ensured that the change-over points between star and delta follow on from one another very quickly. **Longer change-over times may result in pump damage (Table 2).**

Table 2

Motor Power	Y – set time
$\leq 30 \text{ kW}$ $> 30 \text{ kW}$	$< 3 \text{ sec}$ $> 5 \text{ sec}$

C5.5- Final check

- After completion all the above process check the coupling alignment once more as described in **C4**. Correct if there is a fault. Rotate the pump rotor several times by hand. Make sure rotor rotates easily. Fix the safety guards in places then run the unit until it warms up and normal operating conditions are reached. Now shut it down and make final alignment by shimming driver only. **Final alignment should be made at operating temperature.**



Fix the coupling guard back in place. Do not operate the pump before doing so. This is a necessity for security and job safety.

D- START UP / SHUT DOWN

D1- Preparation

D1.1- Lubrication control

- Grease lubricated bearings are factory packed with grease enough for one year operation before dispatch. Before initial start up the pump it should be ascertained that no dirt has penetrated inside the bearing during transport or installation on site. Otherwise, the bearings should be cleaned out and repacked with fresh grease before start up.
- *See E* for lubricating.

D1.2- Venting and priming

- Make sure that the pump and suction pipes are completely filled up with the liquid to be handled. If there is a valve on the suction line, it must be opened first. Then vent and prime the volute casing by opening the discharge side shut-off valve. Vent and prime the casing cover and mechanical seal chamber by removing the air venting plug (231). Rotate the shaft several times during priming to be sure that the mechanical seal chamber is completely vented and filled up with the liquid to be handled. After priming screw the air venting plug into its place.



While the pump is running or the system is hot and under pressure do not remove the air venting plug. **Danger of scalding** depending on the system pressure and the temperature of the liquid pumped.

ATTENTION

Make sure the pump never runs dry.

D1.3- Checking the direction of rotation

SKY type pumps rotate in clockwise when it is looked from coupling to the pump. This direction is already indicated on the pump nameplate by an arrow. Check this by switching the pump on, then off again immediately. Fit the coupling guard back in place if you took it out.

D2- Start up the Pump

- Check if the shut off valve in the suction line is open and the shut off valve in discharge line is closed.
- Switch on the circuit breaker and run the motor.
- Wait until the motor reaches the full speed (on star-delta running motors wait until it switches on delta).
- Open the discharge valve slowly.
- When the valve is if fully open, check the pressure on the manometer and see it is the same with the duty point pressure. If the pressure on the pressure gauge is lower than duty point pressure brings them to the duty point value by slightly closing the valve. If it is higher value, check your installation, particularly head again.



Do not touch the pump, risk of burning! Do not operate the pump at the temperature and pressure exceeding those specified in the section A4.

ATTENTION

The pump should be shut down at once and the trouble should be corrected if the pump is running at it rated speed and found any of the following faults:

- Pump doesn't deliver any liquid,
- Pump doesn't deliver enough liquid,
- Flow is going down,
- Discharge pressure is not enough,

- Driver overloaded,
- Vibration on pump,
- High noise level,
- Bearing overheating.

D3- Shut Down the Pump

- Slowly close the shut-off valve in the discharge line.
- You may shut down the pump without closing the shut-off valve if there is a device for water hammer protection on the discharge line or the water hammer is not a considerable level.
- Switch off the driver. Ensure the pump set runs down smoothly and quietly to a standstill.
- If the set is to remain out of services for a long time close the shut-off valve in the suction pipe.

D4- Checks to be Made While The Pump is Running

- The pump must run smoothly, quietly and free from vibration at all times.
- The pump must never run dry.
- Never run the pump for along period against a closed discharge valve (At zero flow).
- The bearing temperature may exceed the ambient temperature by up to 50° C. But must never rise above 90 °C, (Measured on the outside of the bearing housing).
- SKY pump has a mechanical seal. It is maintenance free.
- The flexible coupling elements should be regularly checked and replaced as soon as they are shown signs of wear.
- Occasionally check the motor current. Stop motor if the amperage is higher than usual; there may be jamming or friction in the pump. Make the necessary mechanical and electrical checks.
- Stand-by pumps should be run for a short time at least once a week to ensure they are in constant readiness for operation.

E- LUBRICATION

- The bearings of SKY type pump are grease lubricated.
- Recommended grease: SKF LGHP 2/5 High Performance Polyurea.
- See the attached **Table 3** for bearing types and sizes.

Table 3

Pump Dimension Group*	Shaft end Diameter (Ø)	Bearing Type Number
A	24	2 x 6306 Z C3
B	32	2 x 6308 Z C3

Periods of Re-greasing

- The grease should be added to the bearings after about 1500 to 2000 operating hours or if, owing to repeated shut-downs, the number of operating hours is not reached with in one year regrease the bearings in intervals of approximately 12 to 15 months. Using shorter intervals might result in overheating and consequently shorten bearing life.

ATTENTION

The bearing temperature may exceed the ambient temperature by up to 50 °C. But never rise above 80 °C.

- Do not reuse the bearings following disassembly for maintenance purposes.

F- DISASSEMBLY, REPAIR AND REASSEMBLY

ATTENTION

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



The pump must have cooled down to ambient temperature, it must be drained and its pressure must be released.

- Follow the safety precaution measures outlined in "safety instructions".

F1- Disassembly

- Close all valves in the suctions and discharge lines, and drain the pump by opening the drain plug (230).
- Remove the coupling guard (See **section M** for coupling guard).
- Detach pump suction and discharge flanges and all auxiliary supply lines, disconnect the pump from the piping system. No need for this operation for the pumps where SPACER TYPE COUPLING is being used (back pull out design). For this application pump rotor assembly can be pulled out without dismantling the volute casing, (together with bearing housing and casing cover).
- Disconnect pump from the driver and detach from the baseplate (no need to dismantle the motor for the pumps which have spacer types of couplings).
- Unscrew the bolts which mount the volute casing (001) to the casing cover (046) and remove the volute casing.
- Unscrew the impeller nut (065) and take out the impeller (050) and impeller key (210).
- Detach the wear plate (018) from the casing cover (046) and remove the wear plate gasket (430.1 and 430.4).
- Detach the casing cover (046) from the bearing housing (030).
- Remove in sequence the circlip (220), spacer sleeve (067) and the rotating part of the mechanical seal (405).
- Remove the mechanical seal cover (048) together with stationary part of the mechanical seal.
- Dismantle the bearing cover (034) from the bearing housing (030).
- Take out the shaft (060) together with bearings (200) from the bearing housing (030).
- Pull off the bearings (200) from the shaft (060) by using a pull-off device.

F2- Reassembly

- Reassembly proceeds in reverse sequence to disassembly as described in **section F1**. 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.
- Never use the old gaskets, make sure the new gaskets are the same size as the old ones.
- Start mounting with the bearings (200.1-200.2). Place ball bearings on their places on the shaft (060) by slightly heating or by using press. Put this part into the bearing housing (030) from the coupling side.
- Mount the bearing cover (034) onto the bearing housing (030) at the coupling side end.
- Place the mechanical seal cover (048) to its place on the bearing housing (030).
- Place the stationary part of the mechanical seal into the mechanical seal cover (048).
- Slip the rotating part of the mechanical seal onto the pump shaft (060) and place the spacer sleeve (067) and circlip (220) to their places in sequence.
- Mount the casing cover (046) to the bearing housing (030). Do not forget to place the mechanical seal cover gasket (430.3) first.
- Place the wear plate gasket (430.1 and 430.4) to its place on the casing cover (046) and mount wear plate (018) to the casing cover (046).
- Place the impeller key (210) into keyway, slide the impeller (050) onto the shaft (060) and screw the impeller nut (065).
- Place the casing gasket (430.2) onto the casing cover (046).
- Mount the volute casing (001) to the casing cover (046).
- Place the pump on the baseplate, couple the motor. Connect the suction and discharge pipes as well as auxiliary pipes (if used). Take the unit into operation as it was indicated in **section D**.

F3- Shaft seal

SKY type pumps are with mechanical shaft seals.

- Follow the instructions of mechanical seal manufacturers and **NEVER RUN IT DRY!**
- Mechanical seal diameters are given in **Table 4**.

Table 4

Pump Dimension Group	Mechanical Seal Diameter $\varnothing$	Mechanical Seal Type
A	30	M37G4 Q12Q1VGG1
B	40	M37G4 Q12Q1VGG1

G- SPARE PARTS

- guarantees to supply the spare parts for SKY type pumps for 10 years.
You can provide any spare parts easily.
- Lets us know the following details on the name-plate, when you order spare parts.

Pump Type and Size	: (SKY 100 - 250)
Motor Power and Speed	: (11 kW - 1450 rpm)
Prod. Year and Serial Number	: (2010 - 1012345)
Capacity and Head	: (150 m ³ /h - 15 m)

- If you prefer to have spare parts in your stock, we recommend you to have the following quantities for a two years operation depending on the number of same type of pumps (*Table 5*).

Table 5

Part No	Part Name	Number of pumps in the system						
		2	3	4	5	6-7	8-9	10+
60	Shaft (Incl. keys)	1	1	2	2	2	3	30%
50	Impeller	1	1	1	2	2	3	30%
20	Wear rings (if any)	2	2	2	4	4	6	50%
200	Ball bearings	2	2	4	4	6	8	50%
30	Bearing housing	-	-	-	-	-	1	2 adet
430	Gasket (set)	4	6	8	8	9	12	150%
405	Mechanical seal	2	3	4	5	6	7	90%

H- FAULTS, CAUSES and REMEDIES

In this section you will find operating faults which may arise, and their causes (*Table 6*), and suggested remedies (*Table 7*).

ATTENTION Before remedying operating faults, check all measuring instruments used for reliability and accuracy.



The pump must have cooled down to ambient temperature and its pressure must be released before attempting to remedy faults on parts.

Table 6

FAULTS	POSSIBLE CAUSES
Pump does not deliver any water after start-up	1-5-7-10-11-13
Flow is going down or no flow at all	2-3-8-14
Driver overloaded	9-12-17-18-19-26-27
Bearings overheating	18-19-20-21-23
Vibration on pump	15-16-18-22-24
Noise level is high	4-6-25

Table 7

	POSSIBLE CAUSES	REMEDIES
1	There may be air existing in pump or piping.	Fill pump and piping completely with liquid and repeat the priming procedure.
2	Ingress of air through shaft seal, suction pipe or suction port. Pump lifts liquid with air	Check for leaks in suction pipe joints and fittings. Check shaft seal if necessary increase the pressure of sealing liquid. Check the dept of suction pipe or foot valve in the liquid and if necessary increase the depth of them.
3	Air pocket in the suction pipe.	Check the slope of the suction line make sure that there is no reason for formation of air pockets.
4	There is air in liquid	Suction pipe is not submerged enough creating vortex. Check liquid level in suction tank or increase the depth of suction pipe or foot valve in the liquid.
5	Too much suction lift	If no obstruction at inlet check the friction losses of suction line, larger piping may correct condition. If static lift is too high, the liquid level in the suction tank must be raised or the pump lowered.
6	Pump is working at cavitation conditions	NPSH available is too low. Check liquid level in suction tank, check suction line for excessive friction losses. Check isolating valve in suction line to make sure it is completely open. If necessary increase suction head on pump by lowering the pump.
7	Insufficient manometric head.	The actual total head is higher than that originally specified. Check the geodetic total head and friction losses in the discharge line. Larger piping may correct the condition. Check that valves are fully open.
8	Increase at total manometric head.	Check that valves are fully open. Check that there is any obstruction in piping.
9	Pump is operating at lower manometric head.	The actual total head is lower than that originally specified. Machine impeller outer diameter to size advised by supplier.
10	Reverse rotation.	Check motor rotation with directional arrow on pump casing or nameplate.
11	Speed is too low.	Check the supply voltage and frequency or motor may have open phase.
12	Speed is too high.	If possible decrease the pump rotational speed or turn down the impeller outer diameter to size advised by supplier.
13	Impeller or check valve or strainer is clogged.	Clean the impeller or check valve or strainer.
14	Impeller or strainer is clogged partially.	Clean the impeller or strainer.
15	Partially clogged impeller.	Clean the impeller.
16	Worn out and defected impeller.	Replace impeller.
17	Mechanical frictions inside the pump.	Check pump rotor for any rotor obstruction or deflection.
18	Bad coupling alignment.	Check the coupling rubber and realign the coupling.
19	Bearing covers are too tight.	Check and make necessary modification on the cover.
20	The pumped flow is less than the minimum flow required.	Increase the flow. If necessary use by-pass recirculating valve or line.
21	Existence of excess grease.	Remove excess grease.
22	Oblique shaft.	Check the shaft and replace it if necessary.
23	Insufficient lubrication or lubricating grease dirty, contaminated.	Check the amount of grease. Clean the bearings and bearing housing and relubricate
24	Unbalanced rotating parts.	Check the balance of the rotating parts.
25	Pump runs out of duty range	Check the values of operating point.
26	The density or viscosity of the liquid pumped is higher than that originally specified.	Use a more powerful motor.
27	Defects in motor.	Check any motor defects. The motor may not be ventilated properly due to a poor location.

I- TIGHTENING TORQUES

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

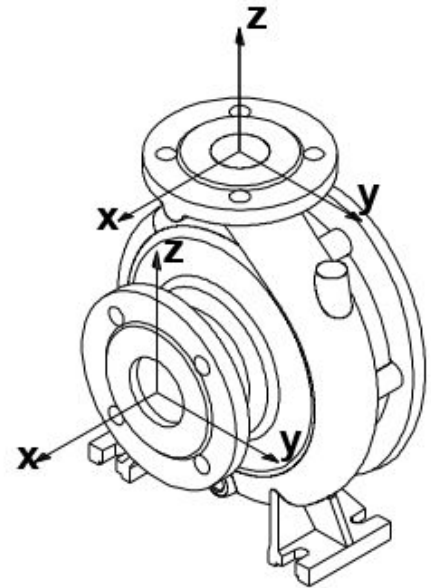
J- EXPECTED NOISE VALUES

Power of motor P_N (kW)	Sound pressure level (dB) *	
	Pump with motor	
	1450 rpm	2900 rpm
< 0.55	60	64
0.75	60	66
1.1	62	66
1.5	63	68
2.2	64	69
3	65	70
4	66	71
5.5	67	73
7.5	69	74
11	70	76
15	72	77
18.5	73	78
22	74	79
30	75	81
37	75	82
45	76	82
55	77	84
75	78	85
90	79	85
110	80	86
132	80	86
160	80	86

(*) 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.

K- PERMISSIBLE FORCES AND MOMENTS AT THE PUMP FLANGES AND WEIGHTS

Type	F _v	F _h	ΣF	ΣM _t
32-125	1100	830	1400	150
32-160				
32-200				
32-250				
40-125	1200	880	1500	180
40-160				
40-200				
40-250				
50-125	1200	880	1500	180
50-160				
50-200				
50-250				
65-125	1300	920	1600	240
65-160				
65-200				
65-250				
80-160	1600	1100	1900	390
80-200				
80-250				
100-200	2700	1600	3200	810
100-250				
125-250	3600	2300	4200	1200



* Forces are given in Newton [N] and moments are in Newton x metre [N.m]

** The values are given according to **Ductile Iron (EN-GJS-400-15 / GGG40)** with temperature of **20°C**. Higher values are permissible for steel construction pumps.

Attention: The real forces and moments which affects on flanges must be satisfied following equations;

$$|F_{z \text{ inlet}}| + |F_{z \text{ outlet}}| \leq F_v$$

$$[(F_{x \text{ inlet}})^2 + (F_{y \text{ inlet}})^2]^{1/2} + [(F_{x \text{ outlet}})^2 + (F_{y \text{ outlet}})^2]^{1/2} \leq F_h$$

$$[(M_{x \text{ inlet}})^2 + (M_{y \text{ inlet}})^2 + (M_{z \text{ inlet}})^2]^{1/2} + [(M_{x \text{ outlet}})^2 + (M_{y \text{ outlet}})^2 + (M_{z \text{ outlet}})^2]^{1/2} \leq M_t$$

$$\left(\frac{\sum |F_v|}{F_{v \text{ max.}}} \right)^2 + \left(\frac{\sum |F_h|}{F_{h \text{ max.}}} \right)^2 + \left(\frac{\sum |M_t|}{M_{t \text{ max.}}} \right)^2 \leq 1$$

Example: Calculations of forces and moments on flanges

Pump Type	Inlet Flange (DN)	Outlet Flange (DN)
SNT 100-250	125	100

Let the forces and moments be given as follows;

Inlet			Outlet			Inlet			Outlet		
F _x (N)	F _y (N)	F _z (N)	F _x (N)	F _y (N)	F _z (N)	M _x (Nm)	M _y (Nm)	M _z (Nm)	M _x (Nm)	M _y (Nm)	M _z (Nm)
250	350	-400	300	0	500	85	110	-150	100	0	90

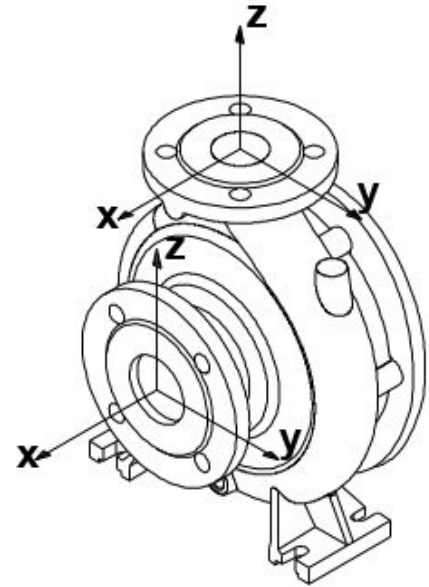
$$|-400| + |500| = 900 \leq 2300 \text{ N}$$

$$[250^2 + 350^2]^{1/2} + [300^2 + 0^2]^{1/2} = 730 \leq 1400 \text{ N}$$

$$[85^2 + 110^2 + (-150)^2]^{1/2} + [100^2 + 0^2 + 90^2]^{1/2} = 339 \leq 700 \text{ Nm}$$

$$[900 / 2300]^2 + [730 / 1400]^2 + [339 / 700]^2 = 0.66 \leq 1$$

Type	Fv	Fh	ΣF	ΣM _t
32-125	940	720	1200	130
32-160				
32-200				
32-250				
40-125	1000	750	1300	150
40-160				
40-200				
40-250				
50-125	1000	750	1300	150
50-160				
50-200				
50-250				
65-125	1100	790	1400	210
65-160				
65-200				
65-250				
80-160	1400	940	1700	340
80-200				
80-250				
100-200	2300	1400	2700	700
100-250				
125-250	3100	2000	3700	1100



* Forces are given in Newton [N] and moments are in Newton x metre [N.m]

** The values are given according to **Ductile Iron (EN-GJS-400-15 / GGG40)** with temperature of **300°C**. Higher values are permissible for steel construction pumps.

Attention: The real forces and moments which affects on flanges must be satisfied following equations;

$$|F_{z \text{ inlet}}| + |F_{z \text{ outlet}}| \leq F_v$$

$$[(F_{x \text{ inlet}})^2 + (F_{y \text{ inlet}})^2]^{1/2} + [(F_{x \text{ outlet}})^2 + (F_{y \text{ outlet}})^2]^{1/2} \leq F_h$$

$$[(M_{x \text{ inlet}})^2 + (M_{y \text{ inlet}})^2 + (M_{z \text{ inlet}})^2]^{1/2} + [(M_{x \text{ outlet}})^2 + (M_{y \text{ outlet}})^2 + (M_{z \text{ outlet}})^2]^{1/2} \leq M_t$$

$$\left(\frac{\sum |F_v|}{F_{v \text{ max.}}} \right)^2 + \left(\frac{\sum |F_h|}{F_{h \text{ max.}}} \right)^2 + \left(\frac{\sum |M_t|}{M_{t \text{ max.}}} \right)^2 \leq 1$$

Example: Calculations of forces and moments on flanges

Pump Type	Inlet Flange (DN)	Outlet Flange (DN)
SNT 100-250	125	100

Let the forces and moments be given as follows;

Inlet			Outlet			Inlet			Outlet		
F _x (N)	F _y (N)	F _z (N)	F _x (N)	F _y (N)	F _z (N)	M _x (Nm)	M _y (Nm)	M _z (Nm)	M _x (Nm)	M _y (Nm)	M _z (Nm)
250	350	-400	300	0	500	85	110	-150	100	0	90

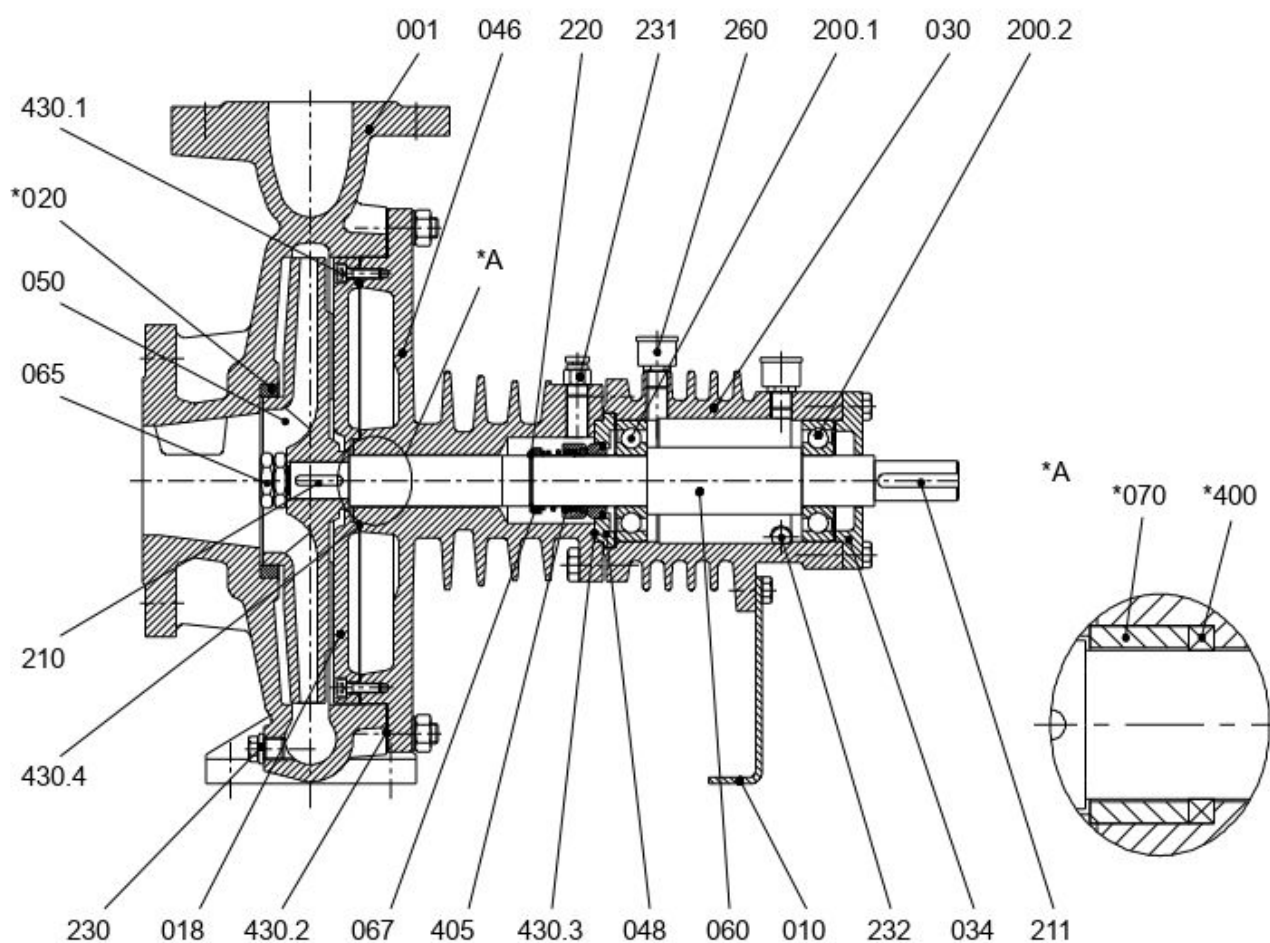
$$|-400| + |500| = 900 \leq 2300 \text{ N}$$

$$[250^2 + 350^2]^{1/2} + [300^2 + 0^2]^{1/2} = 730 \leq 1400 \text{ N}$$

$$[85^2 + 110^2 + (-150)^2]^{1/2} + [100^2 + 0^2 + 90^2]^{1/2} = 339 \leq 700 \text{ Nm}$$

$$[900 / 2300]^2 + [730 / 1400]^2 + [339 / 700]^2 = 0.66 \leq 1$$

L- SECTIONAL DRAWINGS

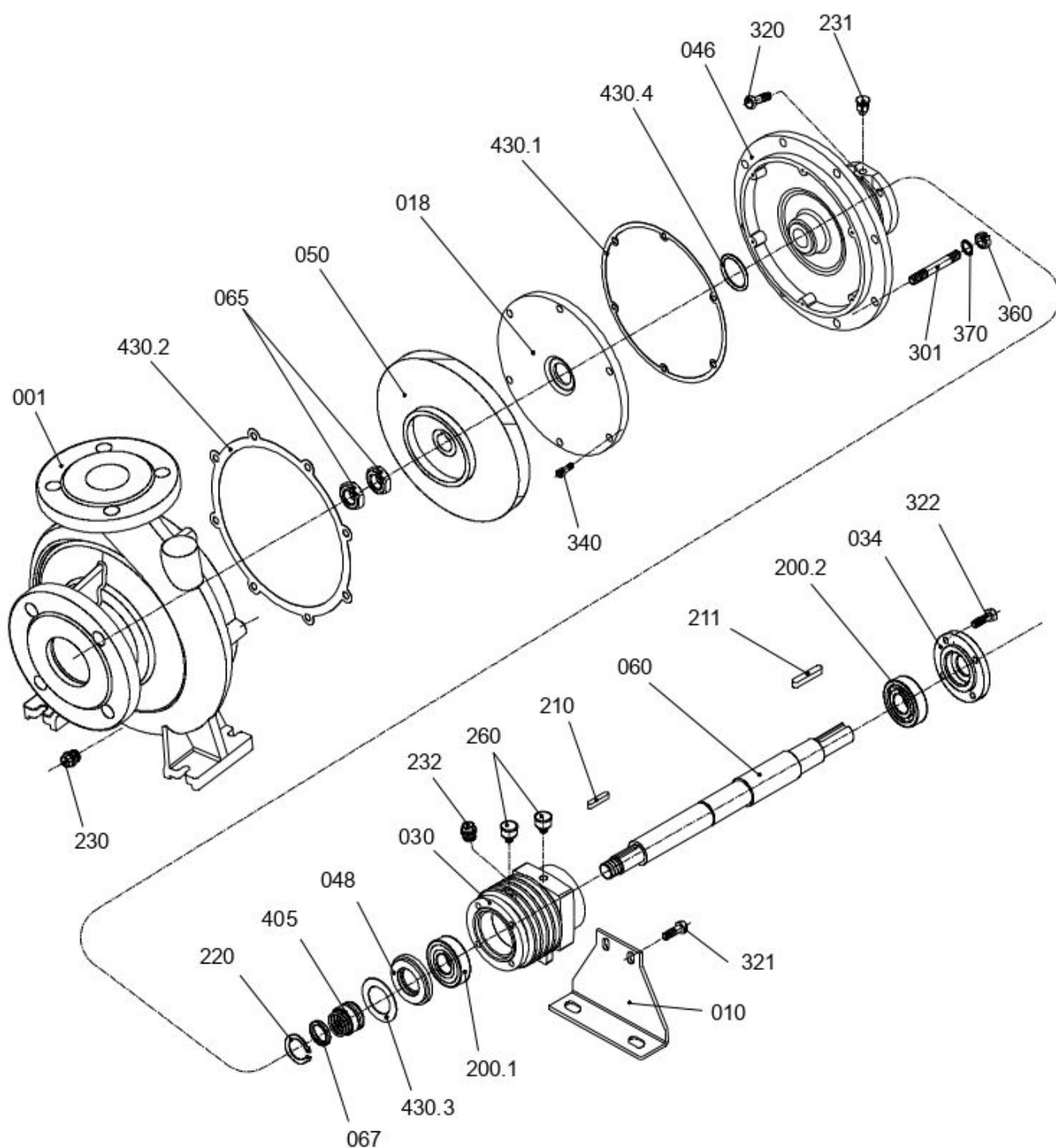


PARTS LIST

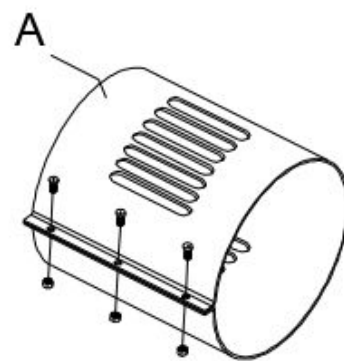
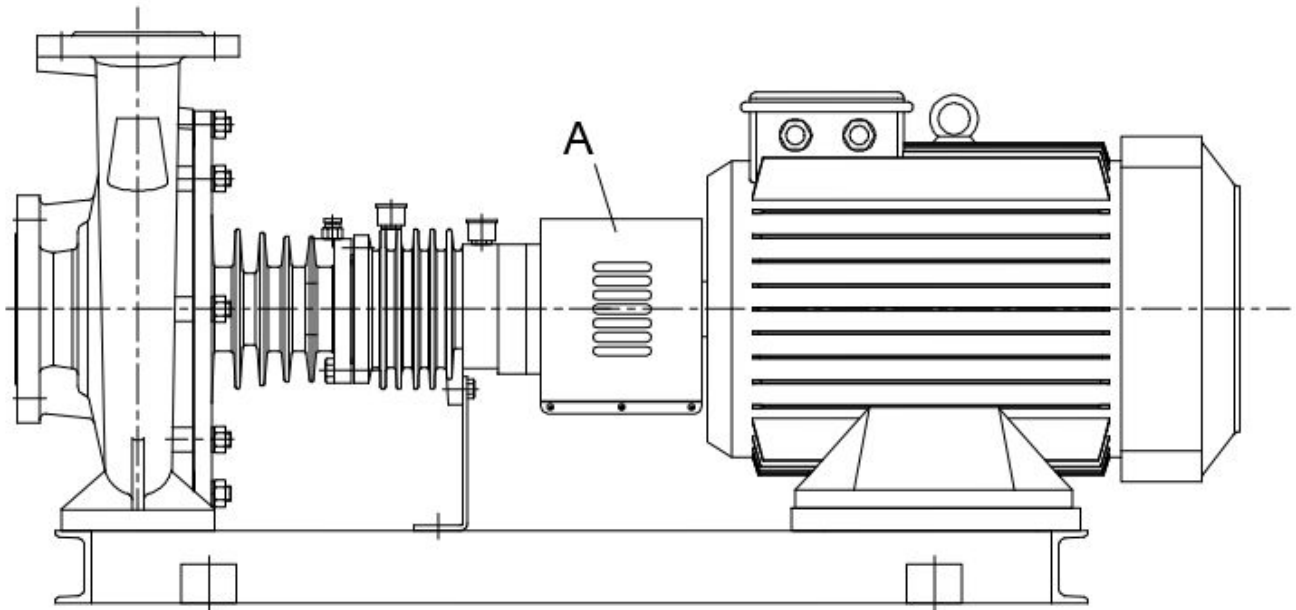
001	Volute casing	210	Impeller key
010	Support foot	211	Coupling key
018	Wear plate	220	Circlip
*020	Wear ring	230	Drain plug
030	Bearing bracket	231	Air venting plug
034	Bearing cover	232	Grease drain plug
046	Casing cover	260	Grease nipple
048	Mechanical seal cover	*400	Soft packing
050	Impeller	405	Mechanical seal
060	Shaft	430.1	Gasket (wear plate)
065	Impeller nut	430.2	Gasket (casing)
067	Spacer sleeve (mechanical seal)	430.3	Gasket (mech. seal cover)
*070	Spacer sleeve (soft packing)	430.4	Gasket (wear plate)
200	Ball bearing		

* Optional

M- DISASSEMBLY DRAWINGS



N- COUPLING GUARD



Coupling guard

Note : All guards are conforming to EN 294