

Operating Instructions

Vertical chemical pump of plastic material Type series NK_F

Including pumps designed according
to EC Council Directive 94/9 (ATEX)



WERNERT-PUMPEN



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1. General

1.1 Application of the pump

WERNERT chemical pumps of type series NKPF are vertical machines for pumping liquids and are installed outside the intake container. The pumps are always exclusively intended for installation in an appropriate plant. They are frequently used to deliver caustic or toxic liquids. It is therefore particularly important to observe the safety instructions contained in this Operating Instructions.

1.2 Validity of the operating instructions

These operating instructions only apply to pumps of the NK_F series in the standard designs. We reserve the right to make technical changes. In the case of special constructions and designs, the documentation specific to the order must be taken note of. If in doubt, please contact the manufacturer.

1.3 Declarations

1.3.1 Declaration of conformity for pumps in accordance with Directive 2006/42/EC for machinery

Sample of the contents

Declaration of Conformity

Manufacturer:

WERNERT-PUMPEN GMBH

Oberhausener Str. 67-79

45476 Mülheim an der Ruhr - Deutschland - Germany

Designation:

Type:

Serial No.:

Herewith we declare that the pump unit fulfils all the relevant provisions of the Directive 2006/42/EC relating to machinery of 17 May 2006.

In the event of maintenance or servicing, the pump and the aggregate must be inspected by the manufacturer or by the operating company and such inspection must be documented in order to ensure conformity with Directive 2006/42/EC.

Applied harmonized standards:

DIN EN ISO 12100-1:2004-04, DIN EN ISO 12100-2:2004-04,

EN 809:1998-10, DIN EN ISO 13857:2008-06,

DIN EN ISO 14121-1:2007-12, DIN EN 12162:2001-12

DIN EN 22858:1993-07

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Mülheim an der Ruhr, 23.12.2009

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Engineering and Sales Manager
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1.4 Technical design

The pump of type series NK_F are single stage submersible pump for container and tanks. The impeller driving shaft has got bearings just above the support plate, but not in the wetted part. Due to the hydrodynamic built up pressure on the back side of the impeller, no mechanical seal is needed. This is why the pump can run dry for a short period when emptying a tank.

The letter "D" is added to the type designation of pumps equipped with throttling bush. This throttling bush, which is not part of the pump, is centrally positioned on the discharge nozzle and secured between pump and the discharge pipework.

1.5 Type description

The type description is made up of a four letter code, the size of the pressure nozzle and the size of the nominal diameter of the impeller.

1st, 2nd and 4th letter Type series, here NK_F

3rd letter main material, here:

P = ultra high molecular low pressure polyethylene (UHMW-PE)

K = Polyvinylidenfluoride (PVDF)

L = UHMW-PE, conductive

T = Polytetrafluorethylene (PTFE) or Perfluoralkoxy (PFA)

5. and 6. letter Method of fastening:

T1 or T2	= Soleplate	Note:	1: Short design
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W1 or W2	= Mount fixing		2: Long design
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7. letter only optionally

D = throttling bush

F = semi-open impeller in torque flow model

Example: A pump of size 32-200 (with discharge nozzle DN32 and nominal diameter of the impeller 200), material UHMW-PE, Method of fastening soleplate, short design is described as type NKPF 32-200 T1.

1.6 Type plate

Every pump has a type plate attached to it. It lists the following details:

- Name and address of the WERNERT company as manufacturer
- Type description
- Serial number of the pump
- Impeller diameter, impeller blade height and number of blades
- Diameter of a possibly used throttling bush
- Designed volume flow [m³/h] and associated delivery head [m]
- Necessary coupling power and nominal power of driver [kW]
- Nominal speed
- Density of the liquid to be pumped
- Year of construction
- CE marking

The additional name plate for a pump according to EC Council Directive 94/9 (ATEX) contains the following data:

- Marking for the potentially explosive atmosphere with equipment group, equipment category, type of protection and temperature class TX and as additional marking the symbol "X" for the limited ambient temperature of "-10°C Ta +40°C"
- Tech. Doc.: Manufacturer's reference number for the Technical Documentation
- Year of construction

Explanations regarding the name plate can be found in Annex A to this operation manual.

1.7 Liability

No warranty is furnished for any damages due to the following reasons: Unsuitable or improper use, incorrect mounting and/or commissioning by the customer or any third party, natural wear and tear, incorrect or negligent treatment, unsuitable operational equipment, exchange materials, defective construction work, unsuitable subsoil, chemical, electro-chemical or electric influences unless attributable to a fault of the supplier's.

2. Safety

This operation manual contains basic hints to be observed during installation, operation and maintenance. Therefore, prior to mounting and commissioning, this operation manual must by all means be read by the fitter as well as the responsible expert personnel/user and must always be available at the place of installation of the machine/plant.

Not only are the general safety hints listed under this Section "Safety" to be observed, but also the special safety hints added to the other sections.

2.1 Marking of hints in the operation manual

The safety hints contained in this operation manual which, in case of non-compliance, may cause danger to personnel, are particularly marked with the general danger symbol



Safety sign according to DIN 4844-2



in case of warning against electric voltage with

Safety sign according to DIN 4844-2.

When employed in potentially explosive atmospheres, the safety hints to be additionally observed are marked with



Pumps which, corresponding to EC Council Directive 94/9, are employed in potentially explosive atmospheres, must be marked with this symbol and the CE sign on the name plate (please refer to Annex A).

For safety hints, with which non-compliance may cause danger to the machine and its functions, the word

ATTENTION! is added.

Hints directly attached to the machine such as

– rotation arrow

must by all means be observed and maintained in completely legible condition.

2.2 Personnel qualification and training

The personnel for operation, maintenance, inspection and mounting must have the corresponding qualification for these operations. Range of liability, competence and the supervision of the personnel must be exactly defined by the user. If the personnel do not have the required knowledge, same must be trained and instructed. If required, this may be effected by the manufacturer/supplier on behalf of the machine user. In addition, it must be ensured by the user that the contents of this operation manual and the operation manuals of the plant are fully understood by the personnel.

2.3 Dangers in case of non-compliance with the safety hints

Non-compliance with the safety hints may result not only in danger to personnel, but also to environment and machine. Non-compliance with the safety hints may lead to the loss of any claims for damages.

In detail, non-compliance may, for example, entail the following dangers:

- Failure of important functions of the machine/plant
- Failure of specified methods for maintenance and servicing
- Danger to personnel by electrical, mechanical, magnetic, thermal or chemical influences as well as by explosion
- Danger to the environment by leakage of dangerous substances

2.4 Responsible working

The safety hints mentioned in this operation manual, the current national rules for the prevention of accidents as well as any internal working, operating and safety regulations of the user must be observed.

2.5 Safety hints for the user/operator

If hot or cold machine parts lead to dangers, these parts must be protected by the user against accidental contact at the site according to DIN EN 13857. Protection against accidental contact with moving parts (e.g. coupling) must not be removed when the machine is in operation.

Leakages (e.g. of the shaft seal) of dangerous substances to be pumped (e.g. explosive, toxic, hot) must be discharged so as not to result in danger to personnel and the environment. Legal stipulations are to be observed.

Dangers by electrical energy are to be excluded (for details with regard hereto, please refer e.g. to the VDE regulations and the local energy supply associations).

If the pumps are used in potentially explosive atmospheres, any operating conditions must be avoided which may raise the surface temperature of the pump to an unacceptable degree or lead to sparking.



If safety devices, such as the guard to prevent accidental contact, have to be removed precautions must be taken to ensure that the motor cannot be started prior and during the assembly work.

2.6 Safety hints for maintenance, inspection and mounting operations

The user has to assure that all maintenance, inspection and mounting operations are performed by authorized and qualified expert personnel who have sufficiently informed themselves by thoroughly studying the operation manual. The pump must have taken ambient temperature and be depressurized and emptied. Pumps pumping media injurious to health must be decontaminated. Basically, operations at the machine may be performed during standstill only. The procedure for stopping the machines described in the operation manual must by all means be observed.

Immediately upon completion of the operations, all safety and protective devices must be mounted and/or made operational again. Prior to restarting, the items listed in Section "Initial operation" must be observed.

2.7 Unauthorized conversion and spare parts production


Conversion of or changes to the machine are only admissible on consultation with the manufacturer. Original spare parts and accessories authorized by the manufacturer serve safety purposes. The use of other parts may cancel the liability for the consequences resulting therefrom.

2.8 Inadmissible modes of operation

Safe working conditions of the machine supplied is ensured only in case of intended use in line with this operation manual. The service limits specified in order-related documents and under Item 0below must by no means be exceeded or fallen below. Order-related documents shall prevail.

2.9 Explosion protection



If pumps are used in potentially explosive atmospheres, it is imperative to comply with the measures and hints attached to the pump and described in the following paragraphs and the safety hints provided with the  symbol to warrant the explosion protection. Standard EN 1127-1 (explosion protection) must be complied with.

2.9.1 Identifying marking

Pumps which are intended to be used in potentially explosive atmospheres must be marked according to EC Council Directive 94/9 (please refer to Annex A.1.1), and the conformity declaration according to EC Council Directive 94/9 must be available. The marking only refers to the pump. Coupling and motor must be marked separately according to EC Council Directive 94/9 and their conformity declarations according to EC Council Directive 94/9 must also be available.

2.9.2 Modes of operation affecting the explosion protection

Dangers affecting the explosion protection have to be avoided. Unintended use may lead to exceeding the admissible surface temperature or to sparks, which may result in a possible ignition. Friction on non-conducting surfaces is to be avoided.



Operation with closed shut-off devices in the suction and/or discharge line is not admissible. In this state, there is a danger that - after a short period of time -, the medium pumped takes inadmissible temperatures and the maximum admissible surface temperature is exceeded. The specified minimum volume flow must by all means be maintained (please refer to 4.2.3 below).

2.9.3 Explosion protection group

Pumps with marking (please refer to 2.9.1 above) correspond to Group II, i.e. they are provided for employment in explosive atmospheres. In this group, the usage in underground plants of mines and their above-ground plants is excluded.

2.9.4 Equipment category

Pumps with identifying marking (please refer to 2.9.1 above) correspond to Category 2G, thus, they are intended for use in areas where occasional potentially explosive atmosphere of gases, vapours and fogs must be expected.

2.9.5 Temperature class

Possible temperature classes of pumps with marking according to 2.9.1 as follows:

Bearing lubrication	Medium temperature ¹⁾	approved for temperature class
Grease, with relubrication	≤ 115 °C	T3

1) The maximum admissible medium temperatures on the basis of the material of the pump housing (please refer to 2.9.5 and 4.2.1 below) are to be observed.

2.9.6 Temperature limits

The operation of the pump outside the admissible ambient temperatures is not admissible (please refer to 4.2.2 below). The maximum admissible temperature of the liquid pumped depends on the respective specified temperature class and the material of the pump housing (please refer to 4.2.1 below).

Temperature class as per EN 13463-1 for electric equipment of Group II	Maximum surface temperature °C	Maximum temperature of the liquid pumped NKPF	Maximum temperature of the liquid pumped NKKF
T1	450	90 °C	115 °C
T2	300	90 °C	115 °C
T3	200	90 °C	115 °C

Tab. 2.1 Temperature classes

2.9.7 Maintenance

Only a pump or aggregate appropriately maintained and kept in a technically proper condition assures a safe and reliable operation. The relubrication and exchange intervals (please refer to 7.1 below) of the bearing must be observed by all means.



The lubrication being insufficient or the bearings defective, there is a danger of the maximum admissible surface temperature being exceeded and even of sparking through friction.

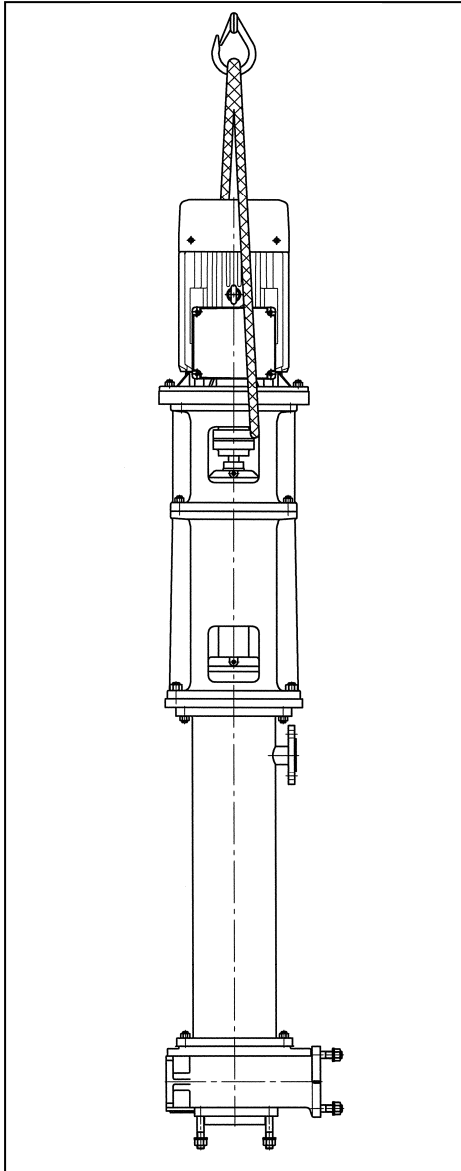
According to the environmental conditions, the bearing bracket must be cleaned at suitable intervals.

Note: Lubricants and/or coolants which are required to avoid explosive hot surfaces (here: medium pumped or sealing medium to cool and lubricate the mechanical seal) or mechanical sparks (please refer to EN 13463-8) must have an ignition temperature (please refer to IEC 60079-4) of at least 50 K above the maximum surface temperature of the equipment in which the liquid is used (EN 13463-5).

3. Transport and intermediate storage

3.1 Transport of pumps and pump aggregates

The pump or aggregate must be transported correctly. Make sure that the pump unit is kept in right position during transport and does not slip out of the transport suspension. The ring bolts on the motor must not be used to transport pump aggregates.



Pumps and pump aggregates must always be transported in such a way that the pump parts are not subjected to impact or shock.

Figs. 3.1 shows a possible point at which lifting gear can be attached during transport of an individual pump.

Fig. 3.1 Transport of a pump aggregate

3.2 Storage

The stability of the pump must be assured at all times during temporary or long-term storage.

The pump has to be stored in horizontal position.

We recommend to use the transport packing of the supplier as support. For the erection of the pump two scaffold anchors should be used.

3.2.1 Intermediate storage under normal environmental conditions

Under normal environmental conditions, i.e. within a temperature range of -10 °C to $+40\text{ °C}$, special provisions need not be made for an intermediate storage. By closing the pump openings with sealing caps or dummy flanges, it must be assured that pollutions or foreign bodies in lumps are prevented

from getting into the pump housing. The pumps must be placed in an intermediate storage so as not to be exposed to any shock or impact stresses. If this cannot be excluded, the pumps should be protected by means of solid wooden packings. The pumps should likewise not be exposed to any extraordinary weather and environmental influences.

Plastic pumps need not be filled with liquid preservatives. Acid or lye residues must not remain in the pumps as these crystallize out and lead to damages to the mechanical seal. Water must likewise not remain in the machines. Danger of freezing up.

3.2.2 Intermediate storage under normal environmental conditions

Particular environmental conditions are as follows:

- Ambient temperatures below $-10\text{ }^{\circ}\text{C}$ or above $+40\text{ }^{\circ}\text{C}$.
- Intermediate storage or installation in the open.
- Particularly high or very low air humidity (e.g. tropical or desert atmosphere).
- Intermediate storage in an environment with corrosive parts in the atmosphere (e.g. sea air or corrosive gases and aerosols)

The following are to be provided as protective measures:

- Special protection against shock and impact by using solid wooden crates.
- Storage in areas which are not subjected to direct climatic influences. Build protective roof if necessary.
- Pack the pumps separately in foil and always use moisture binding agents.
- Use paint resistant to corrosion on accessible metal parts which are open to the atmosphere.
- Close suction and discharge pump openings.

Always contact the manufacturer regarding measures for intermediate storage if pumps etc. are to be stored under special ambient conditions.

3.2.3 Long-term storage

If the pumps etc. are to be stored for more than one year, please ensure that they are sufficiently protected against mechanical and climatic stresses.

The suction and discharge openings must be kept closed. The state of the packaging (wooden crate, foil or similar) must be checked regularly, at least once a year, and if necessary repaired.

If moisture binding agents are used, they must be replaced at least once a year. Pump elements which are open to the atmosphere such as shaft and coupling must be covered with a coat of special paint to protect them against corrosion.

The state of bearing grease or oil must be checked before starting up a pump which has been stored for a longer period of time. After a storage period of two years, the bearing lubrication must be replaced.

If air humidity is very low, the elastic properties of bellows and sealing elements made of elastomeric materials such as FPM or CSM can be impaired. It is necessary to replace these parts after the pumps etc. have been stored for a number of years.

If the pump remains out of service for a period of six months or more, the pump shaft must be turned several times by hand every three months in order to move it into a different position and avoid pressure points on the roller bearings.

4. Description of product and accessories

4.1 General description

WERNERT plastic pumps of type series NK_F are vertical pumps for chemicals which are based on the familiar and established principle of a dual-pipe pump. They are designed as vertical one-stage radial centrifugal pumps with floating shaft.

Parts in contact with the liquid are made of plastic materials or other suitable materials selected in accordance with the specific chemical, thermal and mechanical loads occurring.

4.2 Application limits

4.2.1 Maximum temperature of the pumped liquid



The maximum permissible temperature of the pumped medium depends on the material used for the pump housing. The maximum admissible temperature of the liquid pumped also depends on the approved temperature class (please refer to 2.9.4 and 2.9.5).

Material of pump housing	Maximum temperature
UHMW-PE	90 °C
PVDF	115 °C

4.2.2 Admissible temperature range of the environment

The admissible range of the ambient temperature is -10 °C to +40 °C. The name plate for a pump according to EC Council Directive 94/9 receives the symbol "X" as additional marking for the limited ambient temperature.

4.2.3 Volumeflow of the liquid pumped

Unless specified otherwise in the characteristic curves or the documentation, the following shall apply:

$$Q_{\min} = 0,8 \times Q_{\text{rated}} \text{ (must not be undershot under any circumstances - not even briefly)}$$

$$Q_{\max} = 1,2 \times Q_{\text{rated}}$$

$$Q_{\text{rated}} = \text{Discharge flow for which the pump has been designed.}$$

4.2.4 Maximum dimensions of sporadic solid matters in the liquid pumped

The dimensions of sporadic solid matters in the liquid pumped must not exceed the dimension of half the blade height and/or half the nominal delivery branch diameter, whatever dimension is smaller.

4.2.5 Maximum speed

The maximum admissible speed must not be exceeded by mechanical transmission ratios or the employment of a frequency converter. For the maximum admissible speed for the respective pump size, please refer to Table B.1 of Appendix B.

4.2.6 Type of protection

The pump complies with type of protection IP 23.

Type of protection for contact against accidental contact and impurities (1st digit)

Digit	Protection against accidental contact	Protection against impurities
2	Protected against insertion of a finger	Protected against solid impurities (diameter over 12.5 mm)

Type of protection against water (2nd digit)

Digit	Protection against water
3	Protection against spray water falling at an angle of up to 60° from the vertical

The bearing must not be cleaned with a water jet, nor with a high-pressure or steam cleaner.

4.2.7 Maximum nozzle loading

Please refer to Appendix B.

4.3 Construction

The vertical chemical pump of type NK_F is manufactured from standard parts of the standard chemical pump series, type NE, and the vertical chemical pump series, type VK_F.

The delivery suspension can have various acid-resistant coatings (hard rubber or Halar®) or may be lined with acid-resistant plastic parts (PP or PVDF) on the inside. Figure 4.1 contains a sectional drawing of a pump with acid-resistant coating. Figure 4.2 contains a sectional drawing of a pump lined with acid-resistant plastic parts. These illustrations are characteristic of all sizes. The designations of the individual parts and the numbering correspond to DIN 24250.

The pump can be mounted in two different ways. One is to mount the pump on a wall via the support foot on the annular casing (Part 103) and a support foot (Part 183) secured to the soleplate (Part 893) (refer to Fig. 4.1). The other is to mount it on a cross-arm, for example, via the soleplate (Part 893) (refer to Fig. 4.2).

The pump has neither bearings nor shaft sealing below the soleplate. The shaft (Part 210) is therefore only borne by greased roller bearings (Part 321 and Part 322) outside the liquid area above the corrosion-proof soleplate (Part 893). The roller bearings are greased via the grease nipple (Part 636). The roller bearing in the thrust bearing lantern (Part 342) is protected against gases and vapours by a radial shaft seal ring (Part 421.1 and Part 421.2). A radial shaft seal ring with O-ring (Part 421.1) of polytetrafluoroethylene with carbon compound (PTFE/carbon) is used on the product side. The lips of the radial shaft seal rings seal against a shaft wearing sleeve (Part 524) which is made from resistant material. Within the liquid range, the shaft is protected against corrosion by a shaft sleeve (Part 523).

Half-open wheels are used as left-hand impeller (Part 233). They are made from solid plastic material. The shaft torque is taken up by a metal hub impressed in the impeller. The impeller is normally connected to the metal shaft (Part 210) via a screw thread. It is axially held on the shaft via a two-part spacer ring (Part 504). A spacer ring is not used for pumps of bearing size IV. In this case, the impeller rests on a shoulder of the shaft. Closed impellers can also be used in special cases. Closed impellers are used as standard design for pumps size IV. The torque mount of the shaft is connected via a feather key.

The part of the pump head in contact with medium, the pump casing (Part 101) and seal insert (Part 443), is metallically enclosed by the annular casing (Part 103) and the adapter (Part 145). The pump head is connected to the delivery suspension (Part 713) by means of bolts on the adapter

(Part 145). The backvanes on the left-hand impeller (Part 233) create a hydraulic relief. In addition to this hydraulic relief, a balancing line nozzle is integrated into the delivery suspension below the lower bearing and upstream gas seal. Any flow of liquid forming behind the impeller must be returned to the tank, for instance, in a defined manner via this overflow.

One of the advantages of this type of pump (when pumping solids) is that the pump is emptied when at a standstill.

The pump can also be designed as free-flow pump, in which case a modified pump casing is used and the distance between the vanes of the impeller and the head end of the pump casing is enlarged by an intermediate ring. Isolated solids in the pumped liquid must not exceed half the delivery port width in size.

4.4 Sectional drawing with parts designation

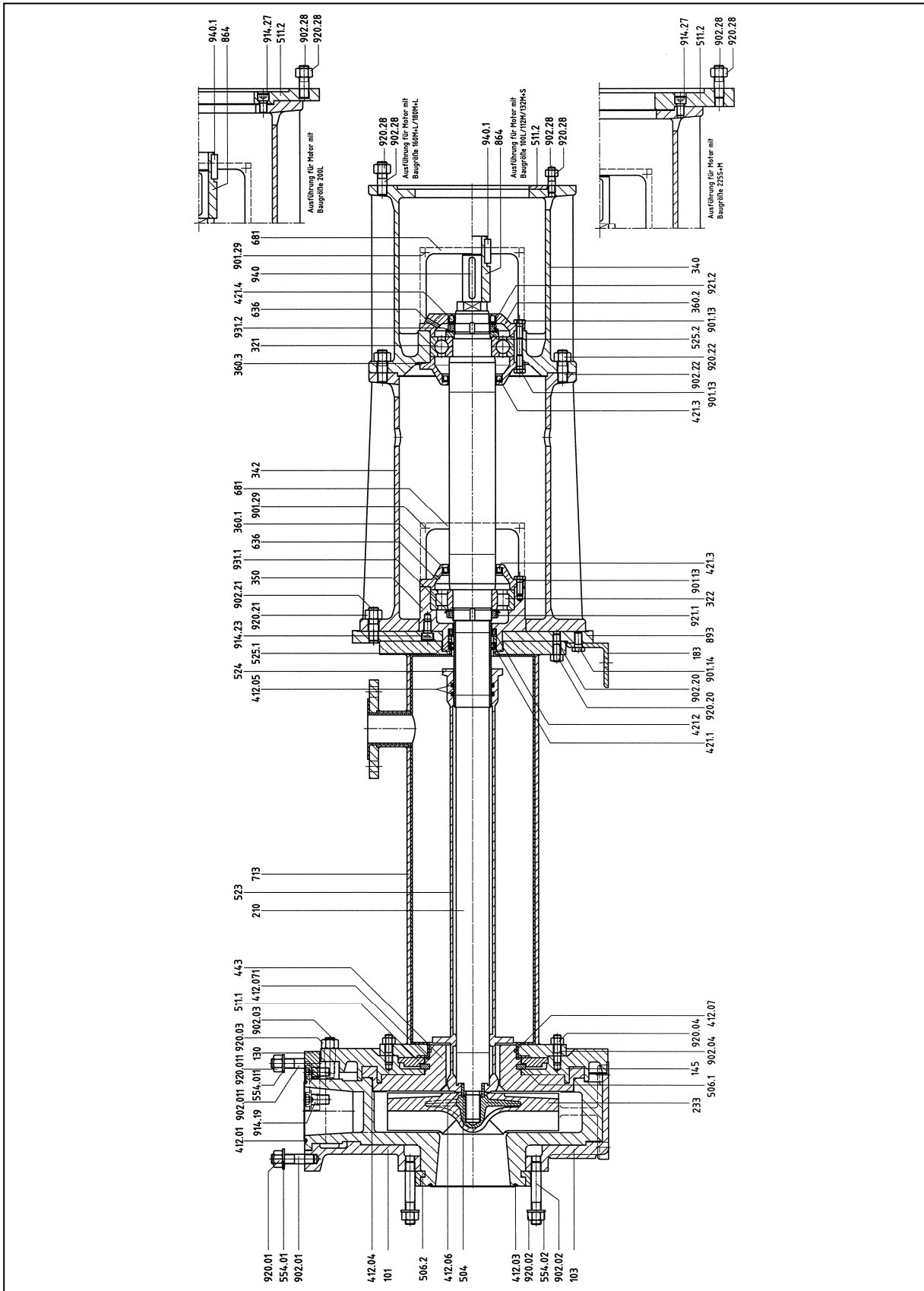


Fig. 4.1: Sectional drawing NKPF, delivery suspension with acid-resistant coating, wall-mounted

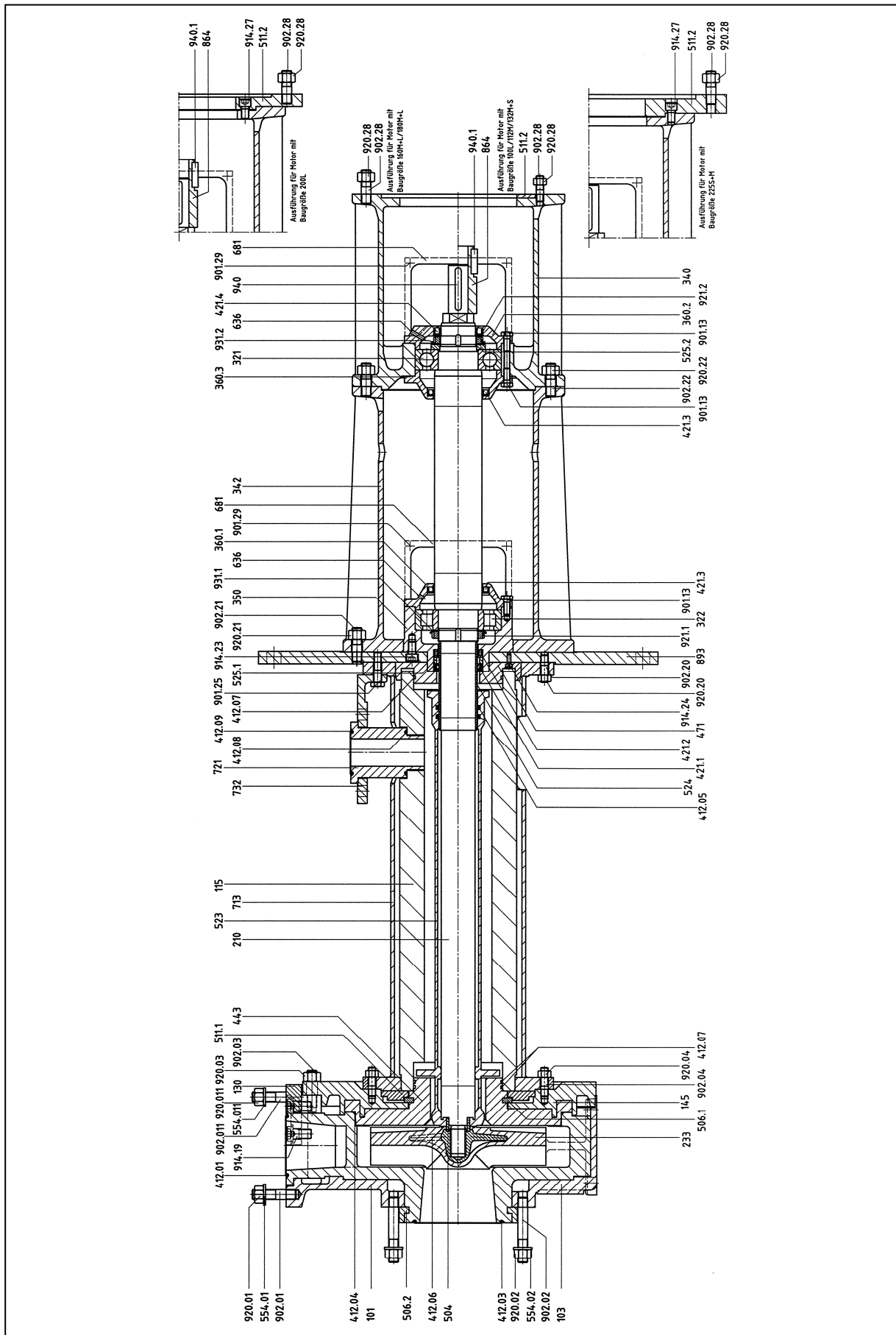


Fig. 4.2 Sectional drawing NKPF, delivery suspension lined with plastic parts, mounted on the soleplate

Parts No	Description	Parts No	Description
101	Pump casing	636	Grease nipple
103	Annular casing	681	Coupling guard
115 1)	Delivery casing	713	Delivery suspension pipe
130	Casing part	721 1)	Taper piece
145	Adaptor	732 1)	Holder
183 2)	Support foot	864	Coupling sleeve
210	Shaft	893	Soleplate
233	Counterclockwise impeller	901.13	Hexagon head bolt
321	Radial ball bearing	901.14 2)	Hexagon head bolt
322	Radial roller bearing	901.25 1)	Hexagon head bolt
340	Bearing lantern	901.29	Hexagon head bolt
342	Thrust bearing lantern	902.01	Stud
350	Bearing housing	902.01 1	Stud
360.1-3	Bearing cover	902.02	Stud
412.01	O-Ring	902.03	Stud
412.03	O-Ring	902.04	Stud
412.04	O-Ring	902.20	Stud
412.05	O-Ring	902.21	Stud
412.06	O-Ring	902.22	Stud
412.07	O-Ring	902.28	Stud
412.071	O-Ring	914.19	Hexagon socket head cap screw
412.08 1)	O-Ring	914.23	Hexagon socket head cap screw
412.09 1)	O-Ring	914.24 1)	Hexagon socket head cap screw
421.1	Radial shaft seal ring	914.27	Hexagon socket head cap screw
421.2	Radial shaft seal ring	920.01	Nut
421.3	Radial shaft seal ring	920.01 1	Nut
421.4	Radial shaft seal ring	920.02	Nut
443	Seal insert	920.03	Nut
471 1)	Seal cover	920.04	Nut
504	Spacer ring	920.20	Nut
506.1+2	Retaining ring	920.21	Nut
511.1+2	Centring ring	920.22	Nut
523	Shaft sleeve	920.28	Nut
524	Shaft wearing sleeve	921.1	Shaft nut
525.1+2	Spacer sleeve	921.2	Shaft nut
554.1	Washer	931.1+2	Lockwasher
554.011	Washer	940	Key
554.2	Washer	940.1	Key

Fig. 4.3 Numbering and denomination of parts

- 1) Not applicable for coated delivery suspension
 2) Not applicable for mounting via the soleplate

4.5 Special tools

The special tools described below are available from the manufacturer.

4.5.1 Impeller key (Part 051)

To disassemble and assemble semi-open impellers with screw attachment onto the drive shaft it is wise to use a so-called impeller key (**Fig. 4.4**). The inside of this key is shaped to be a negative of the impeller blades. The key is placed on the facing side of the impeller which is then removed from the shaft in the direction of rotation of the pump. The shaft must be fixed in order to prevent it turning too.

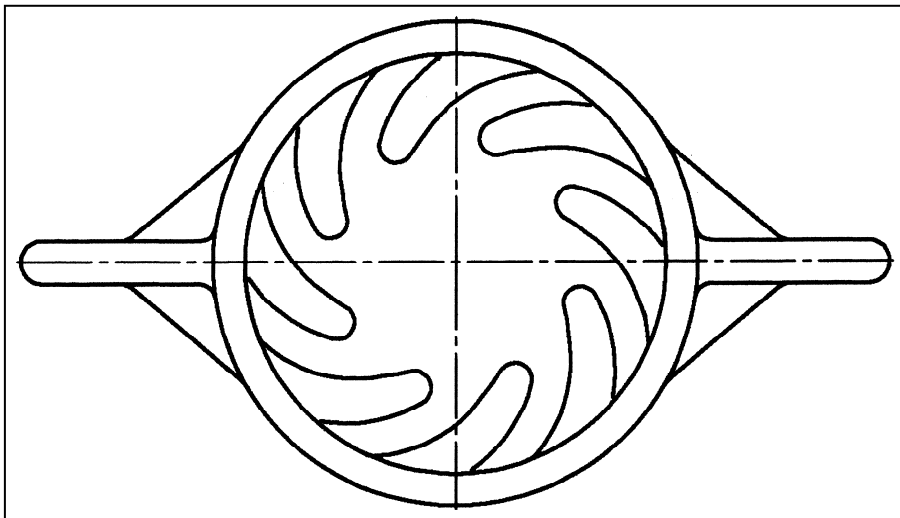


Fig. 4.4 Impeller key (Part 051)

4.6 Noise emission

Airborne noise emissions by the pump or an aggregate are determined in accordance with DIN EN ISO 20361:2008-10.

The sound pressure level can be inferred from the following tabel.

The A-weighted equivalent permanent sound level at a one meter distance from the reference cuboid is L_{pA} :

Sound pressure level L_{pA} in dB(A)							
	Pump only $L_{pA(P)}$ at speed				Motor only $L_{pA(M)}$ at speed		
Coupling power in kW	2900 1/min	1450 1/min	960 1/min	Nominal power in kW	2900 1/min	1450 1/min	960 1/min
1,5	55,0	53,0	51,0	1,5		49	49
2,2	56,5	54,5	52,5	2,2	60	53	52
3,0	59,0	57,0	55,0	3,0	62	53	54
4,0	60,5	58,0	55,5	4,0	63	53	54
5,5	62,5	60,0	57,5	5,5	68	58	56
7,5	65,5	63,0	60,0	7,5	68	62	56
11,0	68,0	65,0	62,0	11,0	70	66	61
15,0	70,5	67,5	64,5	15,0	70	66	61
18,5	73,0	69,5	66,0	18,5	70	63	62
22,0	74,5	70,5	67,0	22,0	70	65	62
30,0	76,5	72,5	68,5	30,0	71	65	63
37,0	77,5	73,5	69,5	37,0	73	60	63
45,0	78,0	74,0	70,0	45,0	74	62	65
55,0	79,0	75,0	71,0	55,0	75	65	65
75,0	80,0	76,0	72,0	75,0	73	67	68
90,0	80,5	76,5	72,5	90,0	74	70	68
110,0	81,0	77,0	73,0	110,0	78	72	68
132,0	82,0	78,0	74,0	132,0	78	72	68
160,0	82,5	78,5	74,5	160,0	82	73	68
200,0	83,5	79,5	75,5	200,0	82	76	68
250,0	84,0	80,0	76,0	250,0	82	75	68

Fig. 4.5 Sound pressure level for pump resp. motor

The total emitted sound pressure level of an aggregate is calculated as follows:

$$L_{pA_{ges}} = 10 \cdot \log \left(10^{\frac{L_{pA(P)}}{10}} + 10^{\frac{L_{pA(M)}}{10}} \right)$$

The values stated here apply for operation with cold water in the permissible range. Different noise emission values may be obtained in other operating modes or with other pumped media, especially when pumping media containing solids. If the values stated in order-related documents differ from those indicated here, the order-related documents shall prevail.

The emitted sound pressure level of the motor may differ from that stated here, depending on model and make. The sound pressure level of motors increases by +4 dB in 60 Hz operation.

4.7 Accessories

- Coupling: elastic coupling without intermediate coupling sleeve
- Special accessories as ordered

4.8 Dimensions and weights

Information on weights and dimensions can be found in the dimensioned drawing and installation drawing for the pump.

5. Erection

5.1 General information

To ensure faultless operation later on, it is very important that the pumps etc. are erected carefully and correctly. Incorrect erection can cause personal injuries and material damage as well as premature wearing of the pump. If the manufacturer does not erect the pump etc., any liability for erection faults and the consequences of ignoring safety instructions, is excluded.



The EC Council Directive 1999/92 on minimum regulations for the improvement of the health protection and safety of the employees who may be endangered by explosive atmospheres must be complied with. The EN 1127-1 Standard is to be observed (explosion protection).

If the pump aggregate is installed isolated, a separate earthing is to be provided in order to avoid potential differences.

5.2 Pipes

5.2.1 General

The pipe diameter and the layout of the pipes have usually been determined during the planning stage. The recommendations for pipeline layout can only be basic considering that the final laying of the pipes will have to take the specific local situation, which the pump manufacturer is usually not aware of, into consideration.

5.2.2 Connecting the pipes

Before aligning the drive, the pump must be connected to the pipes making sure that the pipes do not twist the pump. The admissible nozzle loads listed in Appendix B must not be exceeded!

The sealings to be attached between the pipings and the suction and pressure connecting pieces are usually accomplished by means of the enclosed O-ring type sealing rings.

ATTENTION! The use of additional gaskets can lead to deformations in the pump housing. Leakages may develop and/or the pump may be damaged by starting the impeller.

5.2.3 Notes on laying pipes

Make sure that the forces and moments of the pipelines acting on the pump branches do not exceed the admissible branch loads according to **Annex B**. This applies to both, the standstill of the plant and its operation. The pumps must in particular not serve as a fixed support within the pipeline system. If necessary, the pipelines must be supported by mounts so that they can neither distort the pump nor vibrate it during operation.

Any expansions of the pipelines caused by temperature differences and process-conditioned impacts must be compensated for by taking suitable measures. The installation of compensators in front of the suction and discharge nozzles of the pump is recommended. For any increased flow resistances to be avoided, compensators should have the nominal diameter of the respective pipeline.



If the permissible pipeline forces are exceeded, leaks may be caused at the pump resulting in the releasing of the medium pumped. Danger of life in case of toxic or hot media pumped.

Tightening connection screws on the pump flanges may not cause any twisting. Up to and including DN 125, the torque should be approx. 35 Nm and above that up to and including DN 250, approx. 70 Nm for each screw.

5.2.4 Suction pipe

Temperature, density and viscosity of the medium are of decisive importance for the intake capacity of the pump. The diameter of the suction pipe must be selected so that a flow velocity of 2 m/s of water

or of liquids of the same viscosity, is not exceeded. Greater losses in pressure due to long pipe lengths or baffles must be avoided.

The pipe must be completely leak-proof (pressure test) and must not contain any air sacs. Horizontal pieces of pipes should have an ascending gradient of at least 1% in the direction of the pump. Sharp corners and bends must be avoided in the pipes, as a rising then falling suction line.

5.2.5 Discharge line, throttling bush

The discharge line should not be smaller than the discharge nozzle of the pump. In addition, the diameter depends on economic aspects, however, the flow velocity should not be selected above 5 m/s. A shut-off and/or control instrument is to be installed as close as possible to the pump.

Pumps whose type designation bears the supplementary letter "D" are delivered with a throttling bush for location on the discharge nozzle. The throttle bush is delivered loose together with the required O-rings for location on suction and discharge nozzle. The throttle bush has to be positioned strictly centric on to the pumps discharge nozzle and is fixed between pump and discharge line. The working point of this pump has been designed with a throttling bush, therefore, the pump must be operated with the same.

ATTENTION! In case of not using the throttling bush, considerable damages to the pump must be expected.

5.3 Overflow branch

The overflow branch has to be connected to the liquid tank in order make sure that the liquid level above the impeller does not exceed the level of the overflow branch. The overflow has to be recirculated to the liquid tank. Constriction of cross section should be prevented.

5.4 Coupling protection

The pump may only be operated with a suitable coupling protection. Due to its strength, distance to the coupling and material, a coupling protection contained in the scope of supply of an aggregate corresponds to the employment in a potentially explosive atmosphere.

5.5 Electric connection



The electric connection may only be made by an electrical expert. The suitability of the motor for the available mains voltage is to be checked against the data on the name plate. A suitable circuit is to be selected. The employment of a protective



motor device is recommended. In potentially explosive atmospheres, DIN EN 60079-14 must be observed.

6. Starting up / Operation / Shutting down

6.1 Measures to be taken before starting up

6.1.1 Checking the direction of rotation



Only check that the direction of rotation of the motor is identical to the direction of rotation of the pump in an uncoupled state.

Each pump has been given an arrow to indicate the direction of rotation on the top of the thrust bearing lantern (part 342) by the factory.

ATTENTION! Even if the pump runs in the wrong direction for only a short time, it can be damaged!

6.1.2 Ensure bearing lubrication

Bearings are lubricated with suitable grease before delivery.

ATTENTION! It is not necessary to re-lubricate before starting up, in fact this could cause damage as too much lubrication can cause the bearings to overheat.

6.1.3 Safety devices for the protection of people



Please ensure that before starting up, rotating parts of the pump are not freely accessible.

Make sure that the protective device to prevent machinery being touched, must be attached above the coupling. If the pump is driven using belts, all respective safety devices must be fixed above the discs and the belts.

Electrical motors and other devices must be installed in accordance with the currently valid safety regulations.

6.2 Starting up the pump

1) **ATTENTION!** When starting the pump, the liquid level must be within the levels specified in Fig. 6.1.

2) The pump must not be started against a closed shut-off valve.

The minimum delivery rate Q_{min} (see 4.2.3) must not be undershot when starting – not even briefly – otherwise the bearing may be destroyed. Care must therefore always be taken to ensure that the fitting on the delivery side is open sufficiently wide when starting.

If the pump is being switched continuously (i.e. more than 3 switching on processes per hour) an auxiliary start-up device should be installed (star- triangle-switch, electronic smooth start up device, hydraulic clutch or similar) in order to reduce mechanical strain. The use of this type of device depends on the utilisation factor of the machine (coupling performance, speed, switching frequency) and should be discussed with the manufacturer.

6.3 Operating the pump

During operation see to it that due to changes no inadmissible operating conditions may occur. These are in particular:

- Discharge-side modifications, for example by opening or closing valves. In this context, see to it that the required minimum volume flow (please refer to 4.2.3) is maintained.



In this state, there is a danger that after a short time already, the medium pumped takes inadmissible temperatures and the maximum admissible temperature of the surface is exceeded.

- Suction-side modifications, for example by pollution of pipelines or in the medium as such lead to the reduction of the supply pressure. This can lead to a reduction of the flow and/or the differential height.
- Please keep the admissible liquid-levels (please refer to 6.5).
- The bearing must be controlled and maintained (please refer to 7.1 below).

The application limits mentioned under Section 4.2 above are to be observed.

6.4 Switching the pump off

- 1) The shut-down fitting must only be closed so far as to ensure that the minimum required delivery rate is not undershot (close completely after the motor has been stopped).
- 2) The drive machine is switched off.

ATTENTION! The maximum level must not be exceeded. It is shown in Fig. 6.2. The pump should be switched off when the liquid level has dropped to the height of the discharge nozzle in the tank.

A level switch must be installed for automatic operation of the vertical chemical pump.

6.5 Permissible liquid levels

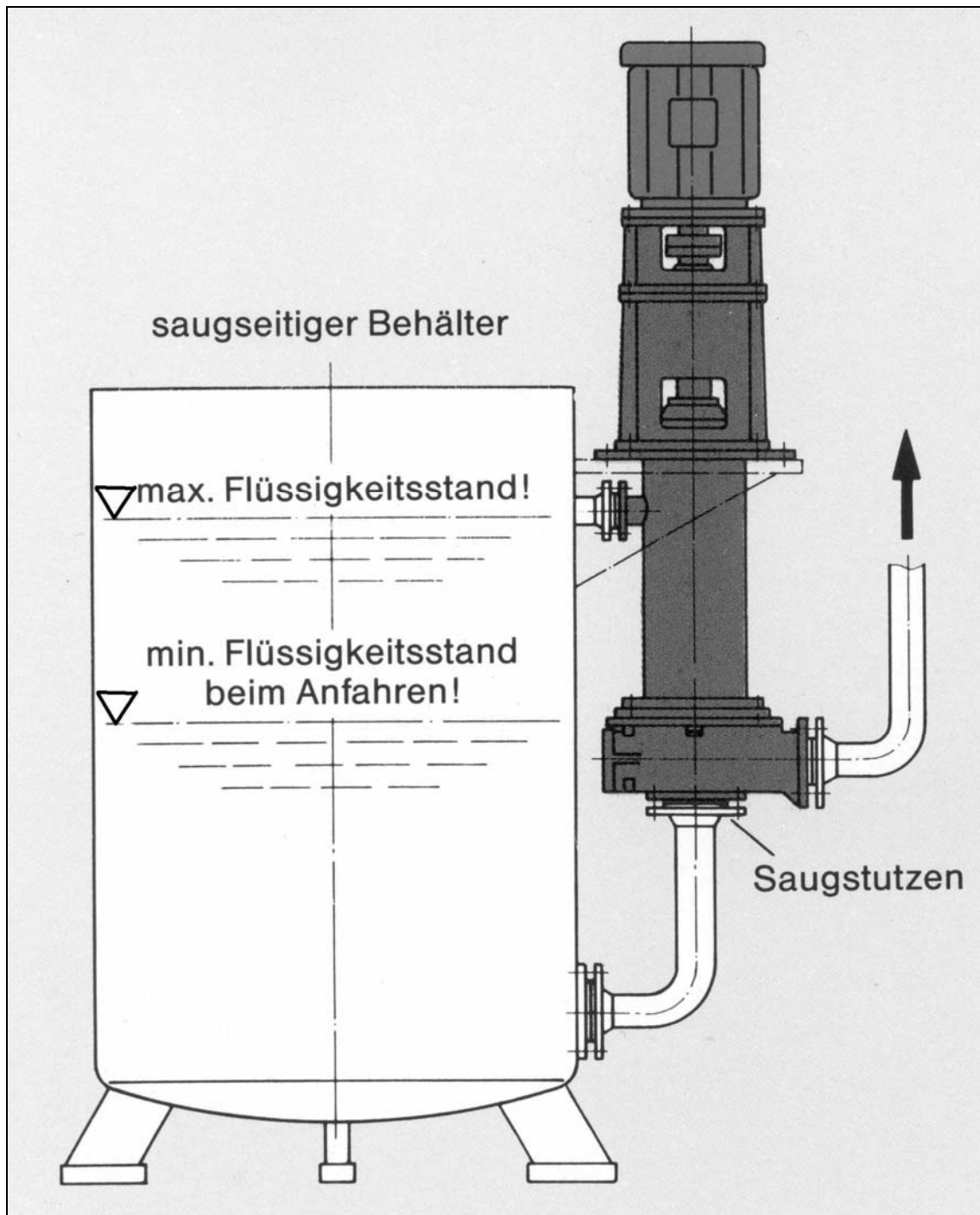
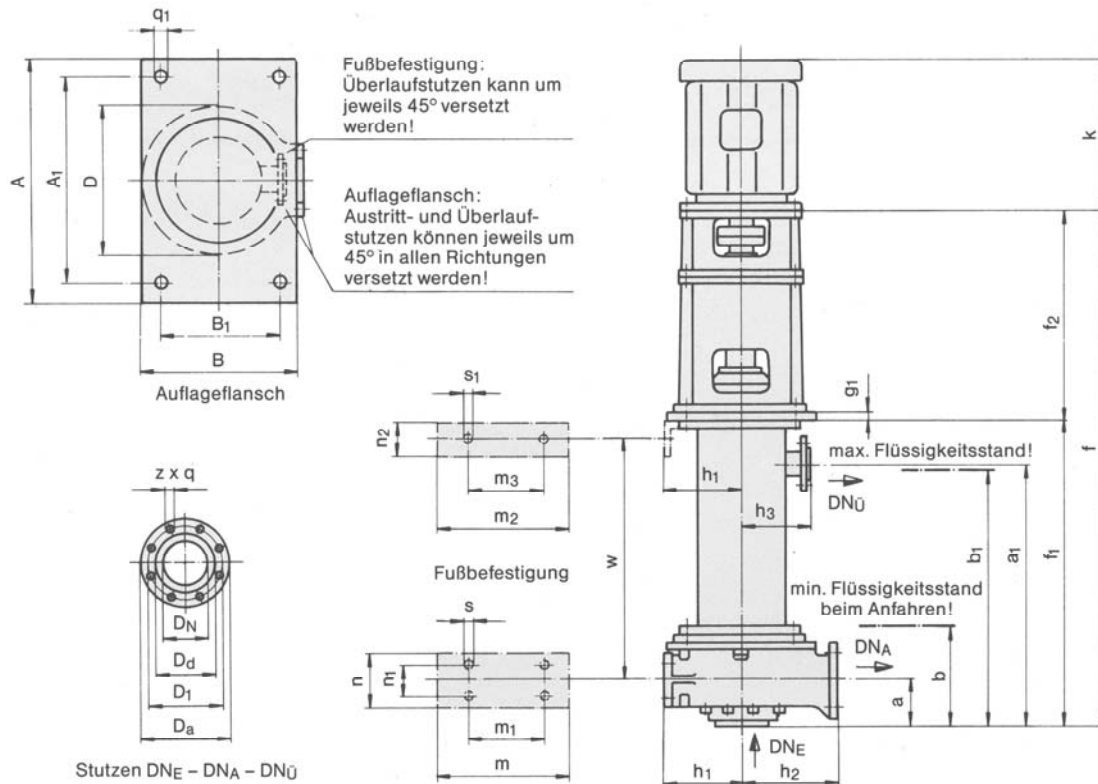


Fig. 6.1 Permissible liquid levels, dimensions see Abb. 6.2.

- 1) Maximum liquid level
- 2) Minimum switch-on level



Size	Dimensions of pump												Suction nozzle					Delivery nozzle					
	a	a1	b	b1	D	f	f1	f2	h1	h2	h3	DNE	Da	D1	Dd	q	z	DN	Da	D1	Dd	q	z
32-160	80	845	120	840	320	1695	957	738	160	160	145	50	165	125	107	M16	4	32	140	100	70	M16	4
32-200	80	845	120	840	340	1695	957	738	160	180	145	50	165	125	107	M16	4	32	140	100	70	M16	4
40-200	100	865	140	860	360	1715	977	738	160	180	145	65	185	145	127	M16	4	40	150	110	85	M16	4
40-250	100	740	150	735	400	1650	885	765	200	225	175	65	185	145	127	M16	4	40	150	110	85	M16	4
40-315	125	765	175	760	450	1675	910	765	200	250	175	65	185	145	127	M16	4	40	150	110	85	M16	4
50-200	100	865	140	860	360	1715	977	738	160	200	145	80	200	160	142	M16	8	50	165	125	85	M16	4
50-250	125	765	175	760	400	1675	910	765	200	225	175	80	200	160	142	M16	8	50	165	125	85	M16	4
50-315	125	765	175	760	450	1675	910	765	225	280	175	80	200	160	142	M16	8	50	165	125	85	M16	4
65-315	125	765	175	760	450	1675	910	765	200	250	175	100	220	180	162	M16	8	65	185	145	110	M16	4
80-200	125	765	175	760	450	1675	910	765	200	250	175	125	250	210	192	M16	8	80	200	160	130	M16	8
80-250	125	765	175	760	450	1675	910	765	225	280	175	125	250	210	192	M16	8	80	200	160	130	M16	8
80-315	125	1350	185	1345	560	2747	1497	1250	250	315	215	125	250	210	192	M16	8	80	200	160	130	M16	8
100-200	125	765	175	760	500	1675	910	765	200	280	175	125	250	210	192	M16	8	100	220	180	135	M16	8
100-315	140	1365	200	1360	560	2762	1512	1250	250	315	215	125	250	210	192	M16	8	100	220	180	135	M16	8
125-315	140	1365	200	1360	660	2762	1512	1250	280	355	215	150	285	240	215	M20	8	125	250	210	212	M16	8

Size	Overflow pipe						Soleplate						Fixing foot plate										
	DN	Da	D1	Dd	q	z	A	A1	B	B1	g1	q1	h1	m	m1	m2	m3	n	n1	n2	s	s1	w
32-160	32	140	100	78	18	4	500	450	320	270	20	23	160	320	280	320	212	100	70	80	14	14	840
32-200	32	140	100	78	18	4	500	450	320	270	20	23	160	240	190	320	212	100	70	80	14	14	840
40-200	32	140	100	78	18	4	500	450	320	270	20	23	160	265	212	320	212	100	70	80	14	14	840
40-250	50	165	125	102	18	4	650	600	400	350	20	23	200	400	360	400	280	140	95	100	14	14	735
40-315	50	165	125	102	18	4	650	600	400	350	20	23	200	345	280	400	280	125	95	100	14	14	735
50-200	32	140	100	78	18	4	500	450	320	270	20	23	160	265	212	320	212	100	70	80	14	14	840
50-250	50	165	125	102	18	4	650	600	400	350	20	23	200	400	360	400	280	140	95	100	14	14	735
50-315	50	165	125	102	18	4	650	600	400	350	20	23	225	345	280	400	280	125	95	100	14	14	735
65-315	50	165	125	102	18	4	650	600	400	350	20	23	200	360	280	400	280	160	120	100	18	14	735
80-200	50	165	125	102	18	4	650	600	400	350	20	23	200	440	390	400	280	140	95	100	14	14	735
80-250	50	165	125	102	18	4	650	600	400	350	20	23	225	400	315	400	280	160	120	100	18	14	735
80-315	80	200	160	138	18	8	800	750	500	450	25	23	250	400	315	500	315	160	120	120	18	18	1310
100-200	50	165	125	102	18	4	650	600	400	350	20	23	200	360	280	400	280	160	120	100	18	14	735
100-315	80	200	160	138	18	8	800	750	500	450	25	23	250	400	315	500	315	160	120	120	18	18	1310
125-315	80	200	160	138	18	8	800	750	500	450	25	23	280	500	400	500	315	200	150	120	23	18	1310

Fig. 6.2 Dimensions for short design, T1 and W1

7. Maintenance / Repairs

7.1 Monitoring and maintaining the shaft bearing

The pumps are equipped with roller bearings.

ATTENTION! The bearing temperature can exceed the environment temperature by up to 60°C in case of permanent use.

The bearings must be checked and/or controlled regularly.

The bearings are suitable for a nominal lifespan of 16.000 operating hours. After this period, a vibration test should be carried out, which must be repeated from time to time depending on the working conditions of the roller bearings. The vibration values according to DIN ISO 10816-7 should be respected.



For pumps which are employed in a potentially explosive atmosphere the following has to be applied to: Should the operating company not be able to carry out any appropriate bearing check, the bearings must be exchanged after the expiration of the nominal lifespan.

The bearings of pumps which are not employed in a potentially explosive atmosphere have to be checked after the expiration of the nominal lifespan, latest after 3 years, and if necessary to be replaced.



Pumps which are employed in a potentially explosive atmosphere must be classified according to DIN ISO 10816-7 of category I. They have to meet the vibration speed demanded in category I. In case of vibration speeds according to DIN ISO 10816-7, zone C or D, the bearings should be exchanged at short notice respectively immediately. In critical operation cases we recommend continuous vibration control. The nominal lifespan is based on continuous operation. In case of any deviation from the operation, as described above, the lifespan of the bearings may be seriously reduced.



Negligence of lubrication can lead to a non acceptable increase of temperature.

It may also reduce the lifespan of the bearings due to increased wear, and finally may destroy them.

Bearings lubricated using grease are filled with suitable grease at the manufacturer's. It is not necessary to re-lubricate before starting up, in fact this would even be damaging as it can lead to the bearing overheating.

New grease is applied in the spaces of the bearing cage. The grease chambers must only be one third full of grease as too much grease causes the bearings to overheat.

The greases which can be used have the following abbreviation according to DIN 51502: KP 2/3 N -15.

Attributes of the grease:

Basicoil:	Mineral oil	Basic oil viscosity at 100 °C:	19 mm ² /s
Soap:	Special-Calzium	Characteristic value of RPM:	400.000 mm/min
Temperature range:	-15 ... 140 °C	Flexing penetration at 25 °C:	245-275
Basic oil viscosity at 40 °C:	220 mm ² /s	Consistency class:	2/3

7.2 Disassembly and assembly of the pump

If the pump has to be disassembled and re-assembled in order to install spare parts, this may only be undertaken in accordance with the sectional drawing for the pump, as well as the corresponding parts list. Appropriate product training is provided by the manufacturer. Disassembly and re-assembly are described in the form of assembly steps. The tightening torques specified in Annex C must be maintained.

Figures 4.1 and 4.2 show sectional drawings of the NK_F series, which are representative for all sizes.

7.2.1 Disassembly of the pump



All electrical connections must be disconnected before starting any work on the machine. The pump unit must be secured to prevent inadvertent reactivation. The operating manual of the motor should be respected.



ATTENTION! Before disassembling the pump, it must be decontaminated and neutralized. Suitable protective clothing must be worn! Contact with the pumped medium must be avoided in all cases. When draining the pumped medium, care must be taken to ensure that other people and the environment are not endangered. Statutory regulations must be observed.



It is advisable not to assemble or disassemble the pump in a potentially explosive atmosphere. If the pump is assembled or disassembled in a potentially explosive atmosphere, the operator must ensure that electrostatic charges are not transmitted to non-conductive pump parts, e.g. due to friction.

Disassembly steps 1) to 17)

- 1) Disconnect electric motor from power supply, The operating manual of the motor should be respected.
- 2) Remove the hexagon bolts (part 901.29) and nuts (part 920.28). Remove safety guard and Motor.
- 3) Remove nuts (part 920.03). Annular casing (part 103) with casing part (part 130), pump casing (part 101) and separate retaining ring (part 506.2) from adaptor (part 145).
 - Remove Cylindric screws (part 914.19). Remove casing part (part 130).
 - Remove studs (part 902.02). Pull out the pump casing (part 101) from annular casing (part 103) after removing retaining rings (part 506.2) of the annular casing.
 - Remove o-rings (part 412.01 + 412.03).
- 4) Unscrew the semi-open impeller (Part 233) from the shaft (Part 210) with the impeller key, steadying the shaft at the same time.
- 5) Remove nuts (part 920.04). Separate adaptor (part 145) with seal insert (part 443), retaining rings (part 506.1) and centering ring (part 511.1) from delivery suspension (part 713).
 - Remove centering ring (part 511.1) from adaptor (part 145).
 - Pull out seal insert (part 443) after removing the retaining rings (part 506.1) from the adaptor (part 145).
 - Remove o-rings (part 412.04 + 412.07).
- 6) Remove shaft sleeve (part 523) with o-rings (part 412.05) from the shaft. Take o-rings out of shaft sleeve. Remove split spacer ring (part 504) from the shaft.
- 7a) Delivery suspension pipe with coating:
Remove nuts (part 920.20). Take delivery suspension (part 713) from the soleplate (part 893).
- 7b) Delivery suspension pipe with lining:
Remove nuts (part 920.20) and hexagon head bolts (part 901.25). Remove delivery suspension (part 713) with delivery casing (part 115), taper piece (part 721) and holder (part 732) from the soleplate (part 893).
 - Remove the adaptor (part 721) from delivery casing (part 115) and separate it from holder (part 732). Remove o-rings (part 412.08 + 09).
 - Take the delivery casing (part 115) out of the delivery suspension (part 713).
 - Remove cylindric screws (part 914.24). Take seal cover (part 471) away from soleplate.
 - Remove o-ring (part 412.07).
- 8) Take away nuts (part 920.21) and cylindric screws (part 914.23). Remove soleplate (part 893).
- 9) Loosen the grub screws from the coupling part and take coupling part off the shaft end. Take away the key (part 940).
- 10) Remove hexagon head bolt (part 901.13). Take away bearing cover (part 360.2) with radial shaft seal ring (part 421.4).

- 11) Press shaft (part 210) with bearing housing (part 350), bearing cover (part 360.1) und loose bearing cover (part 360.3) from the bearing lantern (part 340) und from the thrust bearing lantern (part 342) towards pump housing.
- 12) Remove nuts (part 920.22). Take away bearing lantern (part 340).
- 13) Take away and unscrew shaft nut (part 921.2) with lock washer (part 931.2) from the shaft. Remove radial ball bearing (part 321) from the shaft by means of pulling unit. Take loose bearing cover (part 360.3) with radial shaft seal ring (part 421.3) from the shaft.
- 14) Take away hexagon bolts (part 901.13) from bearing housing (part 350). Take away bearing cover (part 360.1) with radial ball bearing (part 421.3) from the shaft. Press bearing housing (part 350) away from radial roller bearing (part 322). Take radial shaft seal ring with o-ring (part 421.1) and spacer sleeve (part 525.1) out of the bearing housing.
- 15) Loosen and unscrew shaft nut (part 921.1) and lock washer (part 931.1) from the shaft.
- 16) Press radial roller bearing (part 322) away from the shaft.
- 17) Press radial shaft seal rings (parts 421.2, 421.3 and 421.4) away from bearing housing (part 350) and bearing covers (part 360.1, 360.2 and 360.3) by means of slight strokes with plastic hammer and pin.

7.2.2 Assembly of the pump

The assembly has to be carried out in the reverse order of the disassembly.

7.3 Spare parts

On principle, replacement parts should only be ordered according to a parts list belonging to the pump stating the identification number of the part and / or the serial number of the pump. On principle, every individual part can be supplied. Standard parts are always in stock at the manufacturer's or his representatives and this guarantees short delivery periods. However, we recommend that the client should also keep the parts listed below in his stores.

The following parts should be stocked for one year of operation (9,000 hours of operation):

Part-No.	Description	Part-No.	Description
233	Impeller	412.06	O-ring
412.01	O-ring	412.07	O-ring
412.03	O-ring	412.071	O-ring
412.04	O-ring	412.08 1)	O-ring
412.05	O-ring	412.09 1)	O-ring

The following parts are required for two years of operation (16,000 hours of operation):

Part-No.	Description	Part-No.	Description
101	Pump casing	421.3	Radial shaft seal ring
115 1)	Delivery casing	421.4	Radial shaft seal ring
210	Shaft	443	Seal insert
321	Radial ball bearing	471 1)	Seal cover
322	Radial rollerbearing	523	Shaft sleeve
421.1	Radial shaft seal ring	524	Shaft wearing sleeve
421.2	Radial shaft seal ring	721 1)	Taper piece

- 1) Not applicable at coated delivery suspension.

The manufacturer can at any time – if the serial number of pump is stated – provide an offer for the replacement parts required for the pump in question.

8. Faults; causes and remedies

Non-conforming use may give rise to faults during operation. These are listed below. Depending on the pumped medium, faults causing leaks in the pump can in particular cause considerable bodily injury and/or damage to the machine and the environment. Such faults are highlighted in particular.

Fault		Possible cause	Rectification
8.1 Pump not pumping even though motor is working	8.1.1	Fallen below minimum liquid level.	Top up minimum liquid level as shown in Figure 6.1.
	8.1.2	Pump sucking in additional air leads to stall.	Check suction pipe and shaft seal for leaks.
	8.1.3	The overall delivery head is greater than that stated.	Adapt plant to suit pump or vice versa, otherwise use different pump.
	8.1.4	Suction height too great leads to stall.	Position pump lower, and / or position liquid level higher.
8.2 Flow and / or delivery head to low	8.2.1	Direction of rotation of pump is incorrect.	Change direction of rotation of motor to ensure pump rotates in the right direction. Check pump for damage before starting up again.
	8.2.2	Plant conditions do not agree with pump design.	Adapt plant to suit pump or vice versa, if necessary use a different pump.
	8.2.3	Pipes or pump blocked.	Clean filter, pipes, fittings and pump.
	8.2.4	Suction height too great, therefore cavitation.	Position pump lower and / or position level of liquid higher.
	8.2.5	Temperature of liquid to be pumped too high, therefore cavitation.	Reduce temperature of liquid to be pumped and / or increase suction pressure.
8.3 Motor is overloaded	8.3.1	Pump cannot generate intended pressure due to system design. Actual operating point is reached at a higher flow than was intended with original design. This leads to increased power requirement.	Throttle valves on discharge side until intended pressure achieved. If no regulators have been fitted, pump must be adapted to suit actual system (Impeller correction, adjusting speed, install throttle bush).
	8.3.2	Density of liquid to be pumped greater than originally assumed.	Fit motor with greater power.
	8.3.3	Damage to pump. Therefore increased friction.	Repair pump.
8.4 Massive leaks	8.4.1	Wear: the casing may be penetrated.	Worn parts must be replaced. Specify suitable intervals for checking and replacing parts.
	8.4.1	Chemical corrosion: cracks may form.	Check the chemical resistance of the parts in contact with the pumped liquid and replace any corroded parts. Specify suitable intervals for checking and replacing parts.

Fault		Possible cause	Rectification
8.5 Pump is destroyed because it was rotating in wrong direction	8.5.1	Falsche Drehrichtung der Pumpe (Laufrad angelaufen, Nabengewinde im Laufrad ausgerissen, Ausfall der Förderung).	Motor umpolen, um die richtige Drehrichtung für die Pumpe zu erreichen. Pumpe instand setzen.
8.6 Increased bearing temperature.	8.6.1	Distances and clearance at coupling not correct.	Set the coupling distance according to the operating manual of the coupling. For type N-Eupex up to size 140: 2-4 mm size 160 ... 225: 2-6 mm
	8.6.2	Increased axial and / or radial forces because pump is being operated with flows which are too low or too high.	Operate pump with permissible flow.
	8.6.3	Not sufficient, too much, used or unsuitable grease or oil.	Correct this situation.
	8.6.4	Service life of radial ball bearings exceeded.	Replace radial ball bearings. Keep intervals according to 7.1.
8.7 Uneven running (noises, vibrations)	8.7.1	Coupling packets worn.	Replace coupling packets.
	8.7.2	Bearing is damaged.	Replace roller bearings and shaft seal rings.
	8.7.3	Cavitation.	Take measure to avoid cavitation: - reduce flow being pumped - increase suction pressure - reduce losses on suction side

9. Associated documentation

Each pump of the NK_F series is supplied with these operating instructions.

Other documentation which describes the pump is not included in delivery as standard. The scope of the documentation to be delivered is agreed for each order separately.

10. Annex A: Name Plate

10.1 Design of the name plate

The design of the name plate is explained by means of code letters a - q.

WERNERT-PUMPEN GMBH										
D-45476 MÜLHEIM AN DER RUHR										
Typ		a								
Type										
Fabr.-Nr.		b								
serial number										
CE		q		Baujahr		p				
		year of construction								
L ϕ	c	Sh	d	z	e	Db.	f			
Q	g		$\frac{m^3}{h}$	H	h		m			
n	i		$\frac{1}{min}$	P	k		kW	e	l	$\frac{kg}{dm^3}$
		m	n				o			

Figure A.1 Name plate with code letters

WERNERT-PUMPEN GMBH										
D-45476 MÜLHEIM AN DER RUHR										
Typ		NKPF 50-200 T1								
Type										
Fabr.-Nr.		09.0145/4								
serial number										
CE				Baujahr		2009				
				year of construction						
L ϕ	185/185	Sh	25	z	8	Db.	-			
Q	60		$\frac{m^3}{h}$	H	30		m			
n	2900		$\frac{1}{min}$	P	9,2/11		kW	e	1,1	$\frac{kg}{dm^3}$
							V			

Figure A.2 Exemplary name plate

Field a = Type designation with method of fastening

Field b = Serial number

Field c = Impeller: Diameter (main-/back-vanes) in mm

Field d = Impeller: Blade height in mm

Field e = Impeller: Number of blades

Field f = If applicable throttling bush: Diameter in mm

Field g = Nominal flow rate Q in m^3/h

Field h = Nominal delivery head H in m

Field i = Nominal speed in 1/min

Field k = Coupling power with density as per Field l / nominal drive power, each in kW

Field l = Liquid density in kg/dm^3

Field m = Not applicable, no entry

Field n = Not applicable, no entry

Field o = Material of the shaft sleeve

Field p = Year of construction

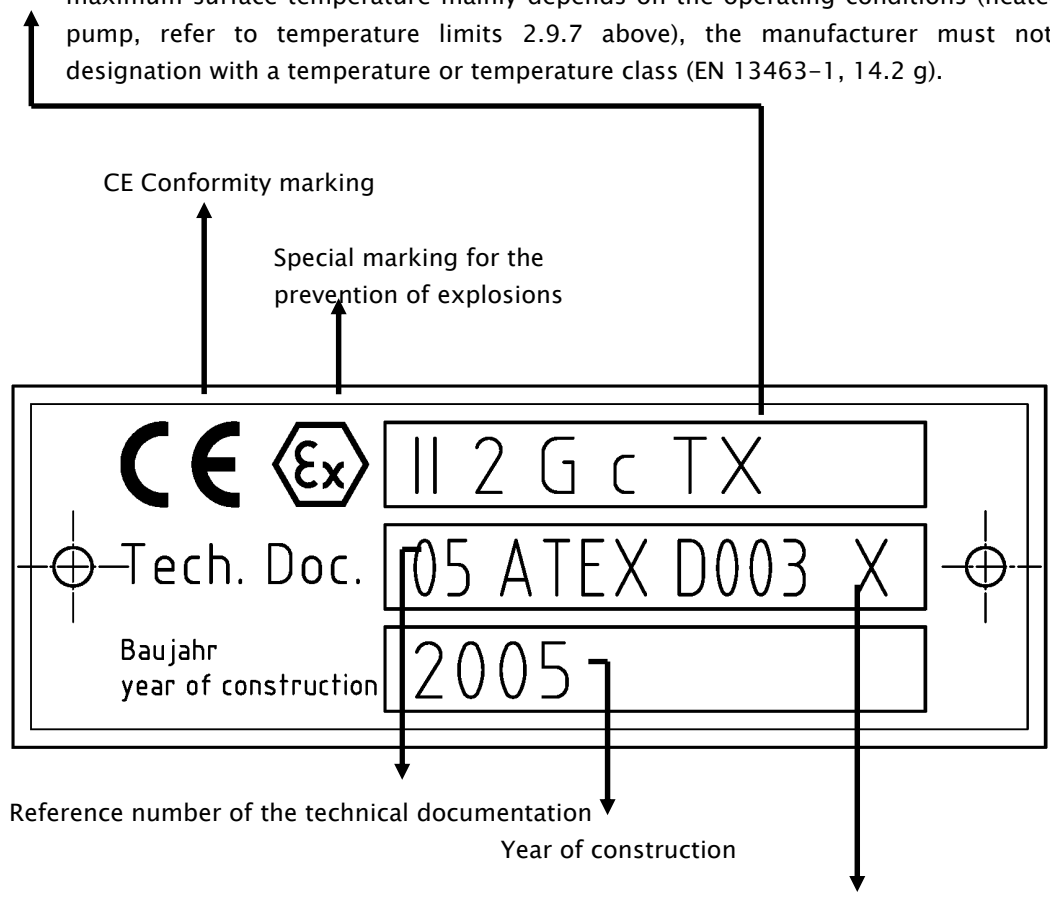
Field q = optional

10.1.1 Additional name plate for pumps according to EC Council Directive 94/9/EC



Degree of explosion protection

- II Equipment group II applies to equipment for application in areas which may be endangered by an explosive atmosphere. Except for underground workings of mines and their surface installations which may be endangered by fire damp and/or combustible dust.
- 2G Category 2 comprises machines of such a structural design that they can be operated in agreement with the characteristic quantities specified by the manufacturer assuring a high degree of safety. Machines of this category are intended for use in areas where an explosive atmosphere of gases, vapours, fogs may be occasionally expected. Even in case of frequent equipment troubles or fault conditions which are normally to be expected, the explosion protection measures of this category of equipment assure the required degree of safety.
- c Constructional-safety type of protection "c" is a type of explosion protection where structural measures are taken to assure protection against potential ignition due to hot surfaces, sparks and adiabatic compressions (EN 13463-5).
- TX Temperature classes T1 - T6 of which only temperature class T3 is currently admitted. As the maximum surface temperature mainly depends on the operating conditions (heated liquid in the pump, refer to temperature limits 2.9.7 above), the manufacturer must not provide any designation with a temperature or temperature class (EN 13463-1, 14.2 g).



X The admissible area of the ambient temperature is -10 °C up to +40 °C. Behind the number of the technical documentation, the name plate is provided with the symbol "X" as an additional marking for the limited ambient temperature.

11. Annex B: Admissible Nozzle Loads, Speeds

The admissible nozzle loads listed in **Table B.1** are in line with API 610. The x axis is coaxial to the pump shaft, the y axis is the vertical line, and the z axis the horizontal line. The forces and moments listed can be taken up irrespective of their direction. The admissible nozzle loads of the overflow branch are alike those values of the discharge branch of the same size.

Type series NK_F	Size Bearing housing/ Max. speed		Vertical forces		Horizontal forces		Moments		
	Size [-] / speed [1 / min]		Suction nozzle Fy [N]	Delivery nozzle Fy [N]	Suction nozzle Fx/Fz [N]	Delivery nozzle Fx/Fz [N]	Suction nz./ Delivery nz. Mx [Nm]	Suction nz./ Delivery nz. My [Nm]	Suction nz / Delivery nz. Mz [Nm]
32-160 W1/T1 32-160 W2/T2	1 / 3500 1750		±579	±690	±890/ ±712	±512/ ±401	±461 / ±271	±353 / ±210	±230 / ±129
32-200 W1/T1 32-200 W2/T2	1 / 3500 1750		±579	±690	±890/ ±712	±512/ ±401	±461 / ±271	±353 / ±210	±230 / ±129
40-200 W1/T1 40-200 W2/T2	1 / 3500 1750		±712	±779	±1113/ ±890	±579/ ±467	±705 / ±366	±664 / ±271	±353 / ±176
40-250 W1/T1 40-250 W2/T2	2 / 3500 1750		±712	±779	±1113/ ±890	±579/ ±467	±705 / ±366	±664 / ±271	±353 / ±176
40-315 W1/T1 40-315 W2/T2	2 / 3500 1750		±712	±779	±1113/ ±890	±579/ ±467	±705 / ±366	±664 / ±271	±353 / ±176
50-200 W1/T1 50-200 W2/T2	1 / 3500 1750		±890	±890	±1335/ ±1068	±712/ ±579	±949 / ±461	±719 / ±353	±475 / ±230
50-250 W1/T1 50-250 W2/T2	2 / 3500 1750		±890	±890	±1335/ ±1068	±712/ ±579	±949 / ±461	±719 / ±353	±475 / ±230
50-315 W1/T1 50-315 W2/T2	2 / 1750 1750		±890	±890	±1335/ ±1068	±712/ ±579	±949 / ±461	±719 / ±353	±475 / ±230
65-315 W1/T1 65-315 W2/T2	2 / 1750 1750		±1157	±1113	±1780/ ±1424	±890/ ±712	±1329 / ±705	±1003 / ±664	±678 / ±353
80-200 W1/T1 80-200 W2/T2	2 / 3500 1750		±1558	±1335	±2403 / ±1891	±1068 / ±890	±1763 / ±949	±1356 / ±719	±922 / ±475
80-250 W1/T1 80-250 W2/T2	2 / 3500 1750		±1558	±1335	±2403 / ±1891	±1068 / ±890	±1763 / ±949	±1356 / ±719	±922 / ±475
80-315 W/T	3 / 1750		±1558	±1335	±2403 / ±1891	±1068 / ±890	±1763 / ±949	±1356 / ±719	±922 / ±475
100-200 W1/T1 100-200 W2/T2	2 / 3500 1750		±1558	±1780	±2403 / ±1891	±1424 / ±1157	±1763 / ±1329	±1356 / ±1003	±922 / ±678
100-315 W/T	3 / 1750		±1558	±1780	±2403 / ±1891	±1424 / ±1157	±1763 / ±1329	±1356 / ±1003	±922 / ±678
125-315 W/T	3 / 1750		±2047	±2403	±3115 / ±2492	±1891 / ±1558	±2305 / ±1763	±1763 / ±1356	±1180 / ±922

Table B.1 Admissible nozzle loads and maximum speeds for Type series NK_F

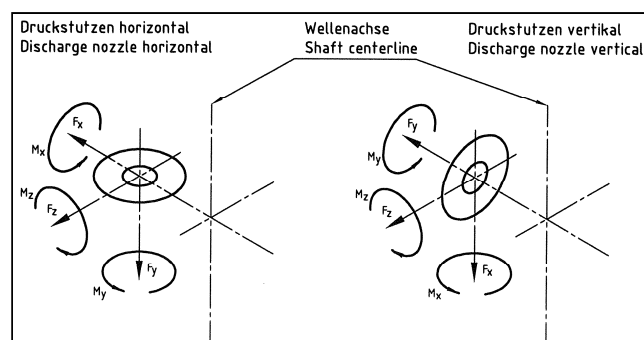


Fig. B.2 Orientation of forces and moments

12. Annex C: Tightening Torques

Thread size	Strength class	Tightening torque [Nm]	
		min.	max.
M6	8.8	6	9,5
M8	8.8	15	23
M10	8.8	30	46
M12	8.8	50	79
M14	8.8	90	125
M16	8.8	150	195
M18	8.8	225	280
M20	8.8	320	390
M22	8.8	440	530
M24	8.8	550	670
M27	8.8	810	1000
M30	8.8	1090	1350

Thread size	Strength class	Tightening torque [Nm]	
		min.	max.
M6	A2/A4 70	5	7
M8	A2/A4 70	9	14
M10	A2/A4 70	20	30
M12	A2/A4 70	33	50
M14	A2/A4 70	57	87
M16	A2/A4 70	84	120
M18	A2/A4 70	115	196
M20	A2/A4 70	190	275
M22	A2/A4 70	260	370
M24	A2/A4 70	330	476
M27	A2/A4 70	460	680
M30	A2/A4 70	650	930

Table C.1 Tightening torques for screw connections

Size of Bearing housing	Tightening torque [Nm]
Gr. 1	80 Nm
Gr. 2	195 Nm
Gr. 3	300 Nm

Table C.2 Tightening torques of the impellers