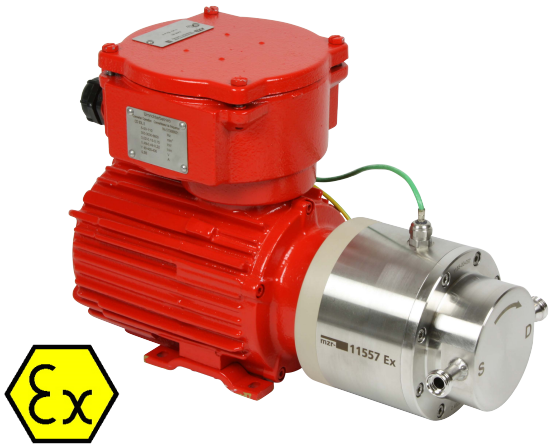
HNP Mikrosysteme

Operating manual for micro annular gear pump
mzr-11557 Ex



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Impressum
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This manual has been prepared with care. HNP Mikrosysteme does assume no liability for any errors in this manual and resulting consequences. Likewise, no liability is assumed direct or subsequent damages arising from an incorrect use of the devices.

While using micro annular gear pumps, the relevant standards regarding the specifications of this manual have to be followed.

Subject to change without notice.

Contents

1 General information

This operating manual contains basic instructions to be followed during integration, operation and maintenance of a mzr® micro annular gear pump. For this reason it is necessary to read it carefully before any handling of the device. The present manual should always be kept at the operation site of the micro annular gear pump.

In case assistance is needed, please indicate the pump type visible on the housing.

1.1 Application scope of the pumps

The micro annular gear pumps described in this manual are suitable for continuous delivery and discrete dosage of watery solutions, solvents, methanol, oils, lubricating liquids, paints and varnishes as well as many other liquids.

If you intend to treat any aggressive, poisonous, or radioactive liquids, you must conform to safety measures as according to the regulations in force. Any project concerning handling of corrosive liquids should be previously discussed with the pump manufacturer.

The micro annular gear pumps *must not* be used for invasive medical applications, in which the liquid having had contact with the pump is re-introduced to the body.

The micro annular gear pumps *must not* be used in aircrafts and spacecrafts or other vehicles without prior consent of the manufacturer.

Micro annular gear pumps exclusively are provided for use in the industrial area. A private use is excluded.

The data concerning resistance of the pumps to manipulated liquids is elaborated according to the best of HNP Mikrosysteme's knowledge. However, operating parameters varying from one application case to another, no warranty for this information can be given.

Information given in this manual does not release the customer from the personal obligation to check the integrity, correct choice and suitability of the pump for the intended use. The use of the micro annular gear pumps should be conform with technical norms and regulations in force.

If you wish to receive more information than comprised in this operating manual please contact directly HNP Mikrosysteme.

1.2 Product information

The present operating manual is valid for the micro annular gear pump type mzr-11557 Ex manufactured after 2011 by HNP Mikrosysteme GmbH, HNP Mikrosysteme GmbH, Bleicherufer 25, 19053 Schwerin, Germany.

The date of release of the present manual figures on the cover.

The micro annular gear pumps described in the operation manual are conform to the applicable EC standards and are permitted to bear the CE mark.

1.3 Technical data of the micro annular gear pump mzr-11557 Ex

	mzr-11557 Ex	**Unit [UOM]**
Explosion-protection		
Ex-certification	CE Ex II 2G c IIB T3	
Temperature class	T3	
Installation place	Ex-area zone 1, 2	
Protection categories	c, d (Ex-motor)	
Measurements		
Displacement volume	192	µl
Leervolumen	18,2	ml
Internal volume	17,8	ml
Pump head diameter	0,4	ml
Coupling	Magnetic coupling	
Pump case material	alloy C22 (2.4602), optional: stainless steel 316L	
Rotor material	partially stabilized ZrO_2, optional: tungsten carbide Ni-based	
Shaft	sintered silicon carbide	
Wetted functional parts	Al_2O_3	
Bearing material	Al_2O_3	
Static sealing	FFKM (Kalrez® Spectrum™ 6375), optional: FKM, EPDM	
Fluid connection	3/8" NPT internal thread, lateral	
Weight	approx. 25	kg
Length (without fluid connector)	345	mm
Width	146	mm
Height	224	mm
Specification		
Flow rate (at 0 bar)	58 – 1152, (29 - 576 *)	ml/min
Smallest dosage volume	100	µl
Max. system pressure **Standard Version**	60 bar (840 psi) (inlet pressure+differential pressure)	bar
Max. system pressure **+p Version**	200 bar (2900 psi) (inlet pressure+differential pressure)	
Differential pressure range	0 – 20 bar (290 psi) with 1 mPas 0 – 40 bar (580 psi) with 16 mPas	bar
Speed range	300 – 6000	rpm
Viscosity range of pumpable liquids	0.3 – 1000	mPas
Precision	< 1 % Coefficient of Variation CV	
Pulsation	6	%
Liquid temperature	-5 … +40 °C (-20 … +100 °C *)	°C
Ambient temperature	-20 … +40 °C (-55 … +60 °C *)	°C
Storage temperature	-5 … +40	°C

*) Differing specifications on request

Table 1 Technical data micro annular gear pumps mzr-11557 Ex

Warning The material properties of a liquid (e.g. viscosity, lubricating property, particle content, corrosiveness) impacts the technical data and the lifetime of pumps. Under appropriate conditions the characteristic values may be increased or decreased.

Warning If you intend to operate the pump out of the range of the above given specification, please consult the manufacturer. Modifications may be necessary to ensure successful operation. Otherwise the pump or the system may be damaged seriously.

Warning Starting the pump in dry condition might lead to damage of functional components of the pump. Therefore, it is necessary to have the pump primed (prefilled), and also in further operation please ensure a continuous supply of liquid. Dry running of the pump has to be avoided.

The user is liable for damages caused by, any consequence with the non-compliance of this instruction.

1.4 Measurements

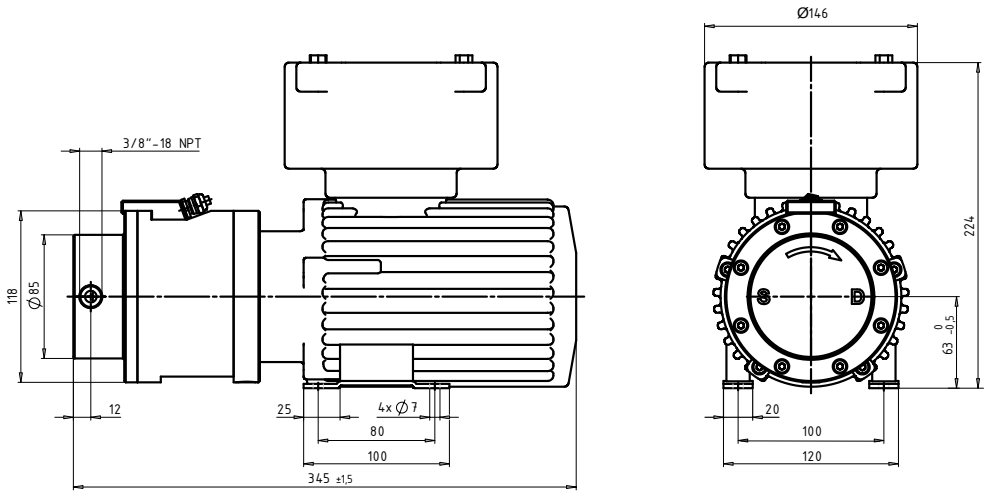


figure 1 Dimensions of the micro annular gear pump mzr-11557 Ex (total length depends on the motor type)

1.5 Flow charts

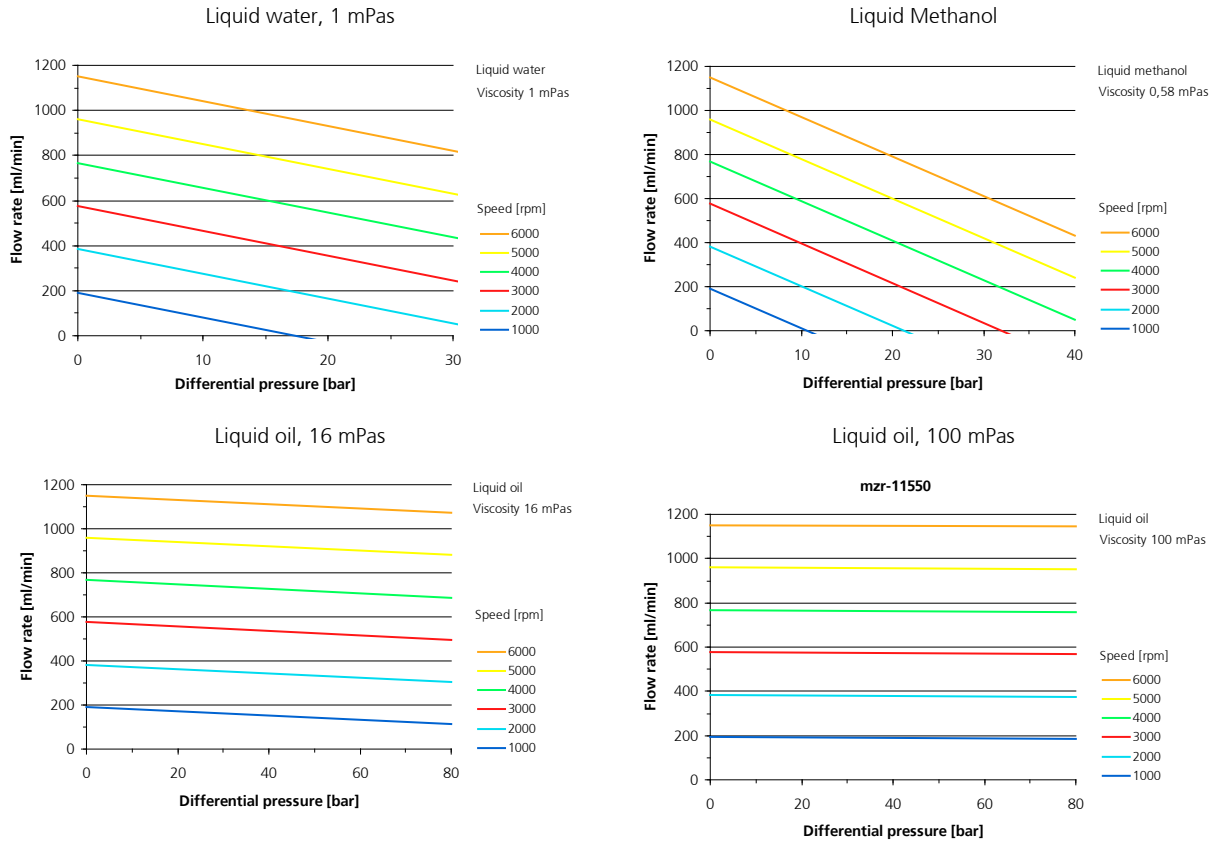


figure 2 Flow charts of the micro annular gear pump mzr-11557 Ex

1.6 Technical data of the Ex-drive

The micro annular gear pump mzr-11557 Ex is provided with an actuator equipped with an Ex-motor. The motor can be ordered with four different maximum speeds. The AC-motor uses a high dynamic and is recommended for operation of the micro annular gear pump.

The micro annular gear pump mzr-11507 Ex is provided with an actuator equipped with an Ex-motor. The motor can be ordered with four different maximum speeds. The AC-motor uses a high dynamic and is recommended for operation of the micro annular gear pump.

Data of capacity of CD63M2-2	
Type	CD63M2-2 (old CD 63L-2)
Manufacturer	ATB Motorentechnik GmbH Fertigungsstätte Nordenham Helgoländer Damm 75 D-26954 Nordenham Germany
Ex-Parameter	EX II 2G EEx de IIC T4
Certification	PTB 99 ATEX 1051
Pole	2
Power	0.25 kW
Nominal voltage	400 V AC
Nominal frequency	50 Hz
Max. continuous current	0.67 A
Peak current during start I_A/I_N	5.8
Stall torque at 50 Hz	490 mNm
Power by at Hz	150 W
No load speed at 50 Hz	2860 rpm
Operation range	300 – 6000 rpm
Safety	IP 55
Weight	16 kg
Ambient temperature range	-20 ... +40 °C
Storage temperature	+5 ... +30 °C

table 2 Technical data of the motor CD63M2-2 of the micro annular gear pump mzr-11557 Ex

The 4 poles motor CD 63M2-4 can alternatively be delivered.

Data of capacity of CD 63M2-4	
Type	CD 63M2-4 (old CD 63L-4)
Manufacturer	ATB Motorentechnik GmbH Fertigungsstätte Nordenham Helgoländer Damm 75 26954 Nordenham
Ex-Parameter	EX II 2G EEx de IIC T4
Certification	PTB 99 ATEX 1051
Pole	4
Power	0.18 kW
Nominal voltage	400 V AC
Nominal frequency	50 Hz
Max. continuous current	0.67 A
Peak current during start I_A/I_N	4.7
Stall torque at 50 Hz	790 mNm
Power at 50 Hz	110 W
No load speed at 50 Hz	1415 rpm
Operation range	300 – 6000 rpm
Safety	IP 55
Weight	16 kg
Ambient temperature range	-20 ... +40 °C
Storage temperature	+5 ... +30 °C

table 3 Technical data of the motor CD 63M2-4 (optional)

The 2 poles motor CD 71M1-2 can alternatively be delivered.

Data of capacity of CD 71M1-2	
Type	CD 71M1-2 (old CD 71K-2)
Manufacturer	ATB Motorentechnik GmbH Fertigungsstätte Nordenham Helgoländer Damm 75 D-26954 Nordenham Germany
Ex-Parameter	EX II 2G EEx de IIC T4
Certification	PTB 99 ATEX 1051
Pole	2
Power	0.37 kW
Nominal voltage	400 V AC
Nominal frequency	50 Hz
Max. continuous current	0.89 A
Peak current during start I_A/I_N	5.2
Stall torque at 50 Hz	740 mNm
Power at 50 Hz	220 W
No load speed at 50 Hz	2800 rpm
Operation range	300 – 6000 rpm
Safety	IP 55
Weight	17 kg
Ambient temperature range	-20 ... +40 °C
Storage temperature	+5 ... +30 °C

table 4 Technical data of the motor CD 71M1-2 (optional)

The 4 poles motor CD 71M2-4 can alternatively be delivered.

Data of capacity of CD 71M2-4	
Type	CD 71M2-4 (old CD 71L-4)
Manufacture	ATB Motorentechnik GmbH Fertigungsstätte Nordenham Helgoländer Damm 75 D-26954 Nordenham Germany
Ex-Parameter	EX II 2G EEx de IIC T4
Certification	PTB 99 ATEX 1051
Pole	4
Power	0.37 kW
Nominal voltage	400 V AC
Nominal frequency	50 Hz
Max. continuous current	0.95 A
Peak current during start I_A/I_N	3.9
Stall torque at 50 Hz	1.9 Nm
Power at 50 Hz	220 W
No load speed at 50 Hz	1380 rpm
Operation range	150 – 3000 rpm
Safety	IP 55
Weight	17 kg
Ambient temperature range	-20 ... +40 °C
Storage temperature	+5 ... +30 °C

table 5 Technical data of the motor CD 71M2-4 (optional)

2 Safety instructions

Comply with the general safety instructions listed in the safety section as well as with the special safety instructions listed under the other main sections. All legal and corporate safety instructions have to be obeyed.

2.1 Safety symbols in this operating manual

The safety instructions listed in this operation manual are specially labeled. It can cause danger for persons, if they are not complied with.

Danger symbol		Non-compliance poses danger for persons.
High voltage symbol		Non-compliance poses danger of electrical shock.
Ex-symbol		These instructions must be complied with in full for explosion-protection.

The type plate mounted on the pump must be complied with and has to be maintained in a clearly readable condition.

Please pay attention to items marked with the following symbols. Pump or system damage is possible if these warnings are ignored.

Warning

Information plates attached directly to the pump head for example name of the fluid inlet/outlet, sign with the direction of rotation must be observed and preserved.

2.2 Staff qualification and training

The staff operating, servicing, inspecting and assembling the pumps must evidence the appropriate qualification for these works. Areas of responsibility and competence as well as monitoring of the staff must be precisely regulated by the decision maker. If the personnel do not have the necessary knowledge, they must be trained and instructed accordingly. If necessary, this can be implemented by the supplier or the manufacturer on behalf of the operator. Furthermore, the operator in charge must ensure that the content of the present manual has been fully understood by the personnel.

2.3 Safety-conscious work

The safety instructions listed in this operating manual, applicable national regulations concerning accident prevention as well as internal work, operation and safety regulations of the operator must be complied with.

2.4 Safety instructions for the operator

The surface temperature of the motor under full load may exceed 60 °C. If needed, this surface should be protected on site against contact in order to avoid skin burns.

The drive should be protected against dust, water vapor condensation, humidity, splash water, aggressive gases and liquids. Please provide for adequate air ventilation and thus cooling of the motor.

Possible leaks of dangerous liquids (for example from the shaft sealing) should be guided away in a way not to represent any danger for the personnel and the environment. The pump should be regularly checked for possible leakage. All legal requirements in this matter should be followed.

The existing protections against contact for the moving parts of the pump (such as for example the coupling) must not be removed during operation.

Take care that all risks resulting from the electric energy are excluded. (For details please refer to the instructions provided by the authorities in charge or your power supplier.)

Warning Please insure, that the totality of the liquid supply accessories such as tubes, hoses, filters etc. are free from dust or dirt particles. Impurities such as metal, plastic or glass particles may impair or damage the pump leading to its failure.

Warning Please, operate the pump with a filter featuring 10 µm or smaller pores. It will protect the pump.

2.5 Safety instructions for maintenance, check and assembly of the pump

As a rule all maintenance work on the device should be performed when the device is at a standstill. The shutdown procedure described in this manual must be followed. Pumps delivering liquids hazardous to health must be decontaminated. Immediately after the work had been completed all safety equipment and protection measures should be applied.

Before starting the operation, please take into notice the instructions listed in the chapter 6.

Warning Should a malfunction of the pump occur, do not dismantle the pump on your own but contact one of HNP Mikrosysteme's service staff for professional assistance.

2.6 Unauthorized pump conversions and spare part manufacture

Conversions or modification to the device are only permitted with prior consent of the manufacturer. Original spare parts and accessories authorized by the manufacturer ensure safety. The use of other parts will annul the liability of the pump manufacturer for any resulting consequences.

2.7 Improper modes of operation

The safety of operation of the delivered device can only be insured by correct use, as described in chapter 1. The limit values given in this manual must not be exceeded in any case.

2.8 General safety instructions

Please observe the following safety instructions

The pump may operate at high pressures. For this reason please use only the delivered accessories and ensure that the employed fittings and tubing have been prescribed and approved for these pressures.

In order to decrease the pressure, provide the system with a *pressure control valve* directing the excess liquid to the storage tank or back to the suction side. In the case of blockage of the pressure side the operating pressure can multiply, this can lead to the damage of downstream components.

At a standstill, the liquid may flow through the pump in the direction of the falling pressure. In order to avoid this unwanted movement, please integrate *non-return valves* (see accessories).

Protect the micro annular gear pump and the electric drive against strokes and shocks.

Under normal working conditions the shaft sealing rings integrated in the pump prevent the liquid from leaking out of the device. The micro annular gear pumps are "technically leak-proof" however not "hermetically sealed" which means it may occur that gases or liquids enter to or escape from the pump.

The allowed operating parameters of the drive should not be exceeded. In particular an *incorrect polarity setting* of the supply voltage may lead to damage of the control unit.

Warning

Please insure, that the totality of the liquid supply accessories such as tubes, hoses, filters etc. are free from dust or dirt particles. Impurities such as metal, plastic or glass particles may impair or damage the pump leading to its failure.

Warning

Please operate the pump with a filter featuring 10 µm or smaller pores. It will protect the pump.

3 Transport and intermediate storage

3.1 Shipment of the pumps and protection measures

The pumps leaving the factory are secured against corrosion and shocks. The inlets and outlets of the pumps are protected with plastic plugs in order to prevent any foreign bodies from penetrating into the device.

3.2 Transport

In order to avoid any damage related to transport, the package must be protected against shocks. HNP Mikrosysteme guarantees, that all goods leave the factory in the best condition. Any noticed damage should be reported to the concerned forwarding agent, authorized dealer or to HNP Mikrosysteme, as manufacturer.

3.3 Intermediate storage

Following points concerning pump storage should be observed:

- Necessary conservation procedure (see also chapter 8.7.1)
- The protective plugs must be left screwed in
- The pump should not be stored in humid places
- For storage temperature - refer to chapter 1.3 of the present manual

4 Description of the micro annular gear pump

4.1 Operating principle of the micro annular gear pump

Micro annular gear pumps are positive displacement pumps. They contain two rotors, bearing slightly eccentrically to each other; an externally toothed internal rotor and an annular, internally toothed external rotor (see figure 3). Due to their cycloid indenting, the rotors remain interlocked at any time, forming during rotation a system of several sealed pumping chambers. As the rotors revolve around their offset axis, the pumping chambers increase on the induction (suction) side and simultaneously decrease on the delivery side of the pump (see figure 4). A homogenous flow is generated between the kidney-like inlet and outlet.

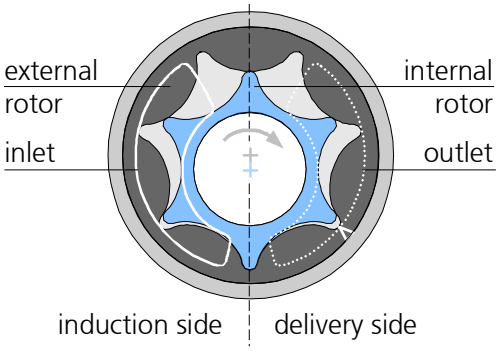


figure 3 Principle of the micro annular gear pump

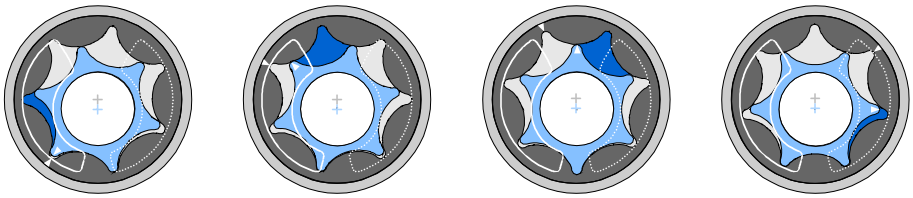


figure 4 Operating principle of the micro annular gear pump

In the case of rotary displacement pumps, the delivered amount of liquid may be easily calculated form the displacement volume V_g of the pump and the number of revolutions of the rotor n. Displacement volume stands for the volume of liquid that is moved within one revolution of the rotor. This relationship is illustrated by the following formula:

$$Q = \eta_{Vol} \cdot V_g \cdot n$$

The volumetric efficiency η_{Vol} shows the relationship between the actual and the theoretical flow rate. The existing differences result from internal movement of the liquid during the operation.

Example: The pump head mzr-11557 Ex has a displacement volume of 192 µl. On the assumption that the volumetric efficiency is 100%, the flow rate at a speed of 3000 rpm would be 576 ml/min, according to the above formula.

The following table shows the volumetric displacement, dependent on the number of revolutions (η_{Vol} = 100 %).

RPM	**Q** [ml/min]	**Q** [l/h]
300	57.6	3.456
500	96	5.76
1000	192	11.52
2000	384	23.04
3000	567	34.02
4000	768	46.08
5000	960	57.60
6000	1152	69.12

table 6 Theoretical flow rate of the micro annular gear pump

Pressure generated by the pump is determined by the configuration of the fluid delivery system and results from both the hydraulic pressure and the hydraulic resistance (tubing, narrow passes etc.). The *volumetric efficiency* of a pump decreases when the differential pressure rises.

The *viscosity* of the manipulated liquid has an important impact on the volumetric efficiency. The volumetric efficiency increases for higher viscosity values because the *internal leakage* values go down.

Cavitation is an effect which, starting form a certain limit speed value, may reduce the volumetric efficiency of a pump. In the case of highly viscous liquids this limit speed value is lower. That happens because of the liquid-specific drop of vapor pressure in the suction tube which leads to gas formation inside the pump.

The particularity of the mzr-pumps is their highly precise construction, which provides for both high operating pressures and a high dosage precision. The gap between both rotors and between the rotors and the adjacent case parts lies in the range of a few micrometers. This precision is the key factor enabling to achieve volumetric efficiency close to 100%.

4.2 Construction

The micro annular gear pump is composed of the pump head, the coupling unit, the drive and the bracket (see figure 5).

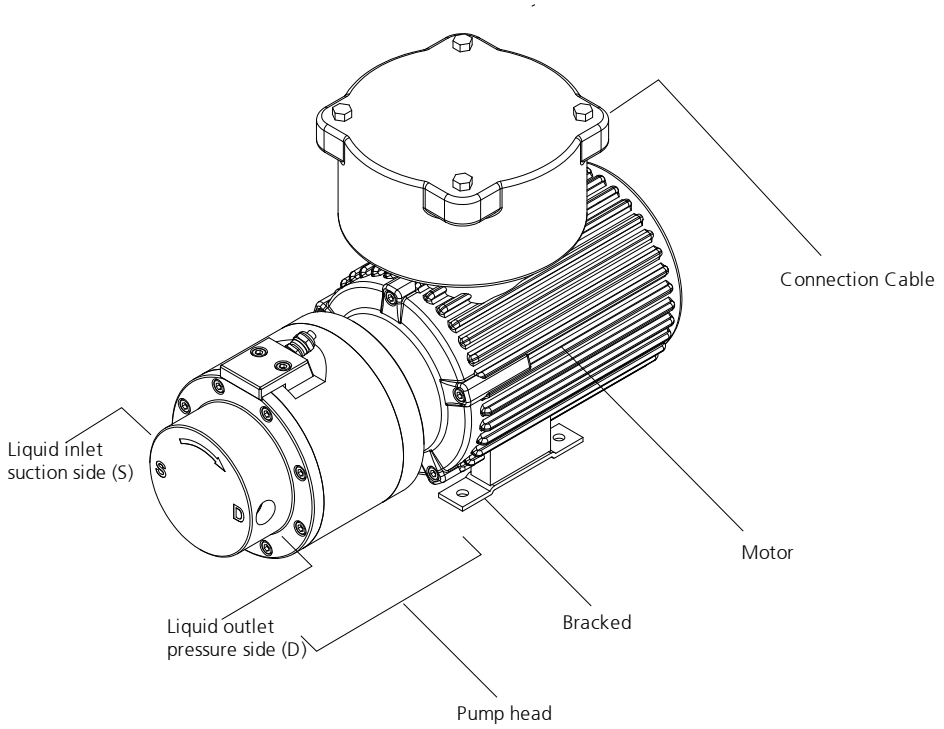


figure 5 Design of the micro annular gear pump mzr-11557 Ex

4.3 Construction materials

The micro annual gear pump mzr -11557 Ex is deliverable in four different material combinations which are listed in , table 7 and table 8.

Wetted parts	mzr-11557-hy	mzr-11557-hs
Rotor materials	tungsten carbide Ni-based	tungsten carbide Ni-based
Control plates	tungsten carbide Ni-based	tungsten carbide Ni-based
Pump case material	alloy C22 (2.4602)	stainless steel 316 L
bearing material	tungsten carbide Ni-based	tungsten carbide Ni-based
shaft material	tungsten carbide Ni-based	tungsten carbide Ni-based
Static sealing material	FFPM (Kalrez® Spectrum™ 6375)	FPM optional: FFPM (Kalrez® Spectrum™ 6375)
Distance washer	PTFE	PTFE

table 7 Construction materials of the wetted parts, rotor material tungsten carbide

Wetted parts	mzr-11557-hcy
Rotor materials	tungsten carbide Ni-based
Control plates	Al_2O_3 ceramics
Pump case material	alloy C22 (2.4602)
bearing material	sintered silicon carbide (SSiC), Al_2O_3 ceramics
shaft material	sintered silicon carbide (SSiC)
Static sealing material	FFPM (Kalrez® Spectrum™ 6375)
Distance washer	PTFE

table 8 Construction materials of the wetted parts, rotor material tungsten carbide

The resistance of the construction materials to the delivered liquids should be verified by the operator for each individual application.

Pumps handling non-lubricating liquids have shorter service lives.

4.4 Liquid supply

	mzr-11557 Ex
Liquid inlet/outlet	3/8" NPT lateral fluid connection
Tubing	AD 6 - 12 mm

table 9 Liquid supply

The micro annular gear pump head has an inscription on the front side. The liquid inlet connection is marked with the letter »S«, the liquid outlet connection with the letter »D«. An arrow indicates the inherent turning direction of the shaft.

Sealing plugs are inserted into the holes for the fluidic connections as protection against contamination during delivery. The sealing plugs have to be removed before assembly of the fluidic connectors. If the fluidic connectors are disassembled, please re-seal the threads with the cleaned sealing plugs as protection against particles.

5 Optional modules

The spectrum of applications of the high performance micro annular gear pump series may be expanded by using different additional modules. The modules allow for special applications, which could otherwise not be accomplished with a standard pump version. The modules may be combined with each other and with almost all available pump heads and motor versions.

– *Heating module* enables to regulate the temperature of the fluid-containing parts of the pump

– *+p variant allows:* a system pressure of 200 bar (on the input side inlet pressure + differential pressure)

The configuration of a given pump version should in each case be discussed with consideration to the specific requirements of the application. *Additional* customized modules may be designed on demand.

5.1 Fluidic heating- and cooling module

The fluidic heating and cooling module permits active heating or cooling of the pump head in the operating temperature range from -20 °C (-4 °F) to a maximum of 60 °C (124 °F). The module consists of a double casing covering the pump head and a thermoelectric couple type L, whose mode of integration varies depending on the pump size. Oil, water, superheated steam or adapted cooling liquids may be used as thermal liquids. If you are not sure, which heat transfer liquid is the best adapted in your case, HNP Mikrosysteme will help you find the suitable one. The thermal liquid ports for the heat transfer liquid are 2 x G1/8". The inlet for the heat transfer liquid is situated at the back and the outlet is in the front (see figure 6).

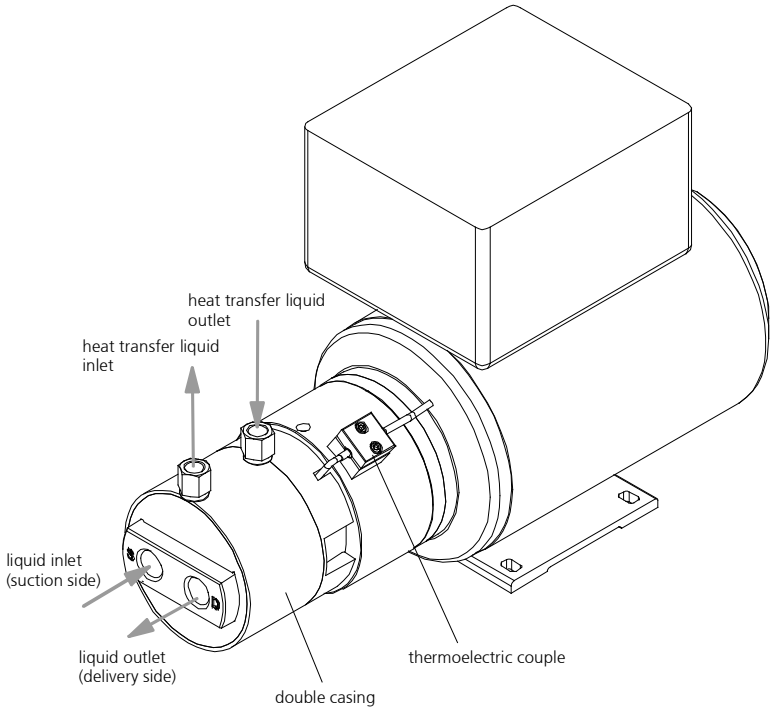


figure 6 Micro annular gear pump with integrated fluidic heating- and cooling module (example of mzr-11507 EX)

Earth the pump head additionally at the corresponding terminal clamp.

Before connecting the liquid supply, please observe the following technical data! The maximal pressure of the heat transfer liquid should not exceed 20 bar.

Thermal element	
Thermal element	Typ K (NiCr-Ni; Chromel-Alumel)
Temperature measuring range	-200 to 800 °C
Diameter of the sensing device	3.0 mm
Material	stainless steel 1.4306

Double jacket	**mzr-11557 Ex**
Length	72 mm
Diameter	85 mm
Double jacket material	stainless steel 316L
Inlet	2xG1/8“
Operating temperature range	-20 to 120 °C
Max. pressure	max. 20 bar
Flow rate	max. 0.5 l/min

table 10 Technical data of the heating and cooling module

6 System integration

6.1 Check before the first assembly

Inspect the pumps for potential damage during the shipment (see chapter 3.2).

Please check, if the right pump type has been delivered, as according to the following points:

- Compatibility with the delivered liquid
- Viscosity range
- Pump performance (displacement volume, dosage volumes, operating pressures)
- Operating temperature range

If you notice any difference between the required and the delivered pump type, please contact HNP Mikrosysteme. Do not put the pump into operation without prior approval.

You must check not only the type of protection of the pump, but also the type of protection of all attached components. The nameplates of the individual components are important. The type of protection for the component with the lowest category always applies for the operation of all components in hazardous areas.

6.2 Details place of operation

Pay attention to the place of operation, that you need an installation location for service and enough room for maintenance. The pump should be installed and reinstalled without problems.

The place of operation mustn't be wet or damp. Don't install the pump in aggressive atmosphere!

6.3 Mounting of the micro annular gear pump

The micro annular gear pump is mounted on an angle support with M6 screws. The favored mounting position of the micro annular gear pump is horizontal. However, if the pump has to be operated vertically, the motor must be located above the pump head in order to prevent the liquid from entering into the motor.

When mounting the motor, insulating elements must not be inserted between the pump head and the motor. The connecting screws between pump and motor must be made out of electrically conductive material (e.g. stainless steel).

Warning

Install the pump in such a way that in case of failure no liquid can enter the motor or controller.

Take precautions that in case of leakage no surrounding objects or environment will be damaged.

Install the micro annular gear pump only in places that fulfill the required conditions for safe pump operation.

The motor must be protected against humidity, dust or sweat.

Never install a pump in a small installation location without sufficient ventilation as the motor will be poorly cooled and can overheat.

6.4 General instructions for the assembly of the liquid supply network

Please always cut the tubing at a right angle with an adapted hose cutter. If metal tubes are used, an intensive cleansing procedure will be necessary. After machining the tubing has to be cleansed and flushed throughoutly. The smallest piece of swarf within the liquid delivery system may cause failure of the micro annular gear pump.

Please note that correct integration of the tubing with the pump head is a necessary condition to ensure the right direction of flow. If you wish to operate the pump in a reverse direction, please contact HNP Mikrosysteme, since it is not possible in every case.

In order to protect the interior of the pump from pollution, the pump heads are delivered with protective plugs. They should be put on when the pump is at a standstill.

For the best performance the suction tube should be as short as possible and have a large internal diameter.

Warning

In most cases the pump should be operated with a filter featuring pores that do not exceed 10 µm. The filter protects the pump from particles and dirt.

6.5 Electrical Connections

The electrical connection of the motors must be implemented according to VDE directives by skilled personnel. The operation manual supplied with the motors must also be complied with.

Carry out all work on the motor only in no power supply state! Ensure that there is no supply voltage to the motor!

Earth the motor using the terminal provided. Earth the pump head with heating module additionally at the corresponding terminal clamp.

6.6 Assembly instruction for tubing and accessories

Particles or soiling can block or impair the function of the micro annular gear pump.

Warning

Please check that all wetted parts of the fluidic system are clean. Clean these parts in case before mounting the pump.
Please check whether there are swarfs in the screw connections, pollution remaining in reservoirs or soiling in valves, pipe work or filters.

Assembly of the tubing and piping system

1. Please cut the tubing rectangular with a hose cutter. If metal pipes are used an intensive cleaning procedure is necessary. After machining the pipes have to be cleaned and flushed very carefully. Smallest swarfs within the fluidic system can cause failure of the micro annular gear pump.

2. Connect the 3/8" NPT fittings with the tubing respectively the pipe work according to the attached installation instruction.

Please note that the correct assembly of tubes respectively pipes with the pump head is a necessary condition to secure the right direction of flow. When you want to operate the pump in reverse direction please contact HNP Mikrosysteme since this is not possible in any application.

3. The thread of the fitting should be wrapped with 2-3 layers of PTFE tape and screwed in the NPT thread (see table 11). First manually, then tightened with ½ to ¾ wrench turns.

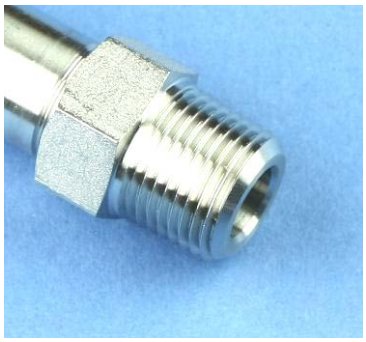
		
Clean the internal and external screw threads leaving no residues.	Make sure the internal and external screw threads are not dented or deformed.	Wrap the PTFE tape around the screw thread clockwise beginning with the second pitch of screw thread..
		
The PTFE tape should be wrapped tightly around the screw thread approx. two times (720°).	Cut the PTFE tape off and wind the end of the tape tightly around the screw thread.	The PTFE tape should not stick out over screw thread because pieces can be cut off and get into the system.

table 11 Use of PTFE Tape

4. The suction line should be installed ascending to the pump for better degassing. The suction line should be designed as short as possible. The inner diameter of the suction line should be large to guarantee good priming of the liquid. At the planning of the pipe system take care of possibilities for degassing.

5. Operate the micro annular gear pump always with a filter with a pore size of 10 µm or smaller. The filter prevents that particles or solids penetrate into the pump what can cause major damage.

6. Avoid dry running of the pump. Make sure that the liquid flow is not interrupted.

Warning

Dry running of a micro annular gear pump can *damage* bearings and dynamic seals especially. A short term dry running at the start-up of the pump does not cause problems.

Please check that all pipes, fittings and screw fittings are tight.

If there is leakage on the suction side it is possible that air penetrates into the pump. In this case priming will be difficult. At the discharge side the liquid comes out of the pump. Dry running causes the pump to heat up.

If the pump will be operated within an explosion proof area a check valve right must be integrated in the pressure line behind the liquid outlet port of the pump. The check valve has to prevent that the pump empties during shut-down time.

Behind the discharge port the discharge pipe should be installed ascending.

In case the pump operates against a closed system a safety valve has to be installed in the discharge pipe to release pressure. In this case the return flow pipe must go back to the reservoir and not directly to the suction line.

6.7 Filter selection and use

In majority of cases it is recommended to integrate a filter on the suction side of the micro annular gear pump to ensure its secure operation. The recommended filter pores or mesh size should not exceed 10 µm. The penetration of particles or swarf that could cause a blockage or damage to the pump can only be avoided by using an adapted filter.

HNP Mikrosysteme offers a choice of standard filters covering a broad spectrum of applications. You may count on our assistance for the selection of the most suitable one.

In order to select the best adapted filter, such operating parameters as flow rate, viscosity and degree of pollution of the liquid will be needed. An increase in at least one of the mentioned terms will require the use of a bigger filtering element or the pressurization of the delivered liquid. In case no suitable filter for high viscosity liquid can be found, it is possible to use a filter with slightly larger pore size. Prior discussion with HNP Mikrosysteme is here recommended. A filter with larger pores is still better than no filter at all. Alternatively an already filtered liquid may be used.

Warning Because filters have a large internal volume, it is recommended to fill in the filter and the suction tube with already filtered liquid in order to avoid a longer dry operation of the pump during the startup.

Warning Please control regularly the filtering elements for pollution. Cleanse regularly the filter or replace it with a new one. A polluted filter may considerably decrease the volumetric efficiency of a pump. Furthermore, because of the cavitation effects dosage imprecision and even pump damage may occur.

Warning A too small filter (too little filtering surface) may considerably decrease the volumetric efficiency of the micro annular gear pump. What is more, because of the cavitation effects dosage imprecision and even pump damage may occur.

7 Operation with frequency inverter

The motor of the micro annular gear pump mzr-11557 Ex is an asynchronous motor. For the operation of the pump a frequency inverter **must** be used.

In the case the micro annular gear pump was delivered together with a frequency inverter this is predefined already on an motor speed range of approx. 300 - 6000 rpm.

Without a frequency inverter you cannot run the micro annular gear pump mzr-11557 Ex with the max. flowrate of 1152 ml/min!

Please observe al instructions to the frequency inverter e.g. »Operation instructions« and »Mounting instructions«. A no observance of these instructions can destructed of the micro annular gear pump and the frequency inverter.

General indications for initial operation:

- Read the mounting Instructions and operating instructions before you start working!
- Please observe all safety information given!
- Please observe the technical data!
- When working on live controllers, the valid national regulations for the prevention of accidents (e. g. VBG 4) must be observed.
- The electrical installation must be carried out in compliance with the corresponding regulations (e.g. cable cross-sections, fuses, PE connection). Additional notes and information can be obtained from the corresponding Instructions.
- All operations must be carried out only by qualified and skilled personnel when the low-voltage machine is at standstill and when the machine is de-energized and protected against unintentional restart. This also applies to auxiliary circuits (e.g. brake, encoder, separate fan). Check safe isolation from the supply!
- Take the frequency inverter into operation!
- Parameterize the frequency inverter with the permitted parameter of the micro annular gear pump!
- Set the V/f-rated frequency 50 Hz.
- Save all changed parameter!
- Enable the controller!
- Setpoint selection e.g., changes the speed of the micro annular gear pump via potentiometer at terminals.
- If unknown faults appear or an uncertainty arises from appearing faults in the working with the pump, immediately shut down the micro annular gear pump at first!

8 Startup/shutdown of a mzr-pump

8.1 Preparing for operation

After the liquid supply system had been completed, please check once again the operating conditions of the micro annular gear pump as according to the following points:

- Are the inlet and outlet tubes correctly connected?
- Is the entire liquid supply system clean - that means free of particles, foreign bodies, pollution or swarf?
- Has a filter been installed on the suction side?
- Has a sufficient amount of the right liquid been supplied?
- The pump does not run the risk of a dry operation?
- The entire liquid supply system has been checked for leakage?
- Is it possible to stop the pump by an emergency switch if an unexpected malfunction occurs at the startup?

8.2 Startup of the micro annular gear pump

Switch on the voltage supply. The micro annular gear pump can now be put into operation by turning on the potentiometer knob or by sending a nominal external voltage signal.

Start the filling in of the pump at low or middle speed (1000 - 3000 rpm).

Starting the pump in dry condition might lead to damage of functional components of the pump. Therefore, it is necessary to have the pump primed (prefilled), and also in further operation please ensure a continuous supply of liquid. Dry running of the pump has to be avoided.

The user is liable for damages caused by, any consequence with the non-compliance of this instruction.

8.3 Re-start after dry run

After a short dry run (it is assumed that the pump is not yet damaged), you must ensure that the pump has cooled down to a temperature below its maximally allowed surface temperature. The pump and the pipes must be completely primed and filled.

Re-starting is prohibited after a longer dry run. The pump must be dismounted to check for damage and any damaged parts replaced. The pump may only be operated again after complete priming and filling and the restoration of the earth.

8.4 Operation of the micro annular gear pumps in different temperature ranges

Warning

Micro annular gear pumps are highly precise manufactured devices. *No contamination* may reach the inside of the pump since this can damage the pump. Make sure therefore, that all of the wetted parts are kept absolutely free of dirt, dust or chips since this can affect the function of the pump.

Flow monitoring is also required for operation in hazardous areas to securely prevent dry running. If the flow stops, the pump must be stopped immediately.

During operation in hazardous areas, particular attention must be paid to the heat input in the liquid as well as to the increase of the pump's surface temperature. To avoid temperatures above a critical surface temperature one of the following two measures has to be implemented (see 8.5). If the specified top temperature is exceeded, the pump must stop immediately. For the monitoring the compliance with standard prEN 13463-6 has to be respected.

Remove dust deposits regularly from the pump's surface, drive and connection pipes so as to prevent the formation of ignition sources. The cleaning interval must be determined by the level of dust precipitation by the operator.

The fluid connections mounted to the pump have to be checked immediately after putting into service and following to this in a six month cycle on tightness and leakage.

Monitor the operating sound of the pump. If grinding noise occurs, switch off the pump immediately. Check the pump for wear optically. Friction between metallic parts can lead to overheating or formation of sparks.

If the pump is used in hazardous areas, a flow sensor must be installed directly downstream of the pump. The flow sensor must not create a noticeable back pressure in case of damage. If the delivery rate of the pump falls to 20% of the theoretical flow rate, the pump must be stopped immediately.

For operation of the micro annular gear pumps in surroundings with Ex-zone request of temperature range T1; T2 and T3 additional temperature measure is necessary for monitoring.

The use of micro annular gear pump in environments with ex requirement temperature class T4, T5 and T6 is not allowed.

8.5 Monitoring of operation in the temperature range

Monitoring of surface temperature

Temperature range	
Max. surface temperature	60°C

Table 12 Max surface temperature

Monitoring liquid temperature on pressure side

Temperature range	
Max. liquid temperature	50°C

Table 13 Maximum liquid temperature

If the specified top temperature is exceeded, the pump must stop immediately. For the monitoring the compliance with standard prEN 13463-6 has to be respected.

8.6 Flushing procedure after use

After each service the micro annular gear pump should be carefully flushed with a non-corrosive, filtered and particle-free flushing liquid (see table 14 and table 15). During flushing procedure the pump should operate at a speed of about 3000 rpm and if possible against a low pressure (that can be obtained by using a restrictor, a capillary or similar). The flushing liquid must be compatible with the delivered liquid and suitable for solving the remaining liquid rests. Depending on the application for example water, or isopropanol may be used. If you have doubts whether a particular liquid is suitable for this function or not, please ask the manufacturer of the liquid or HNP Mikrosysteme.

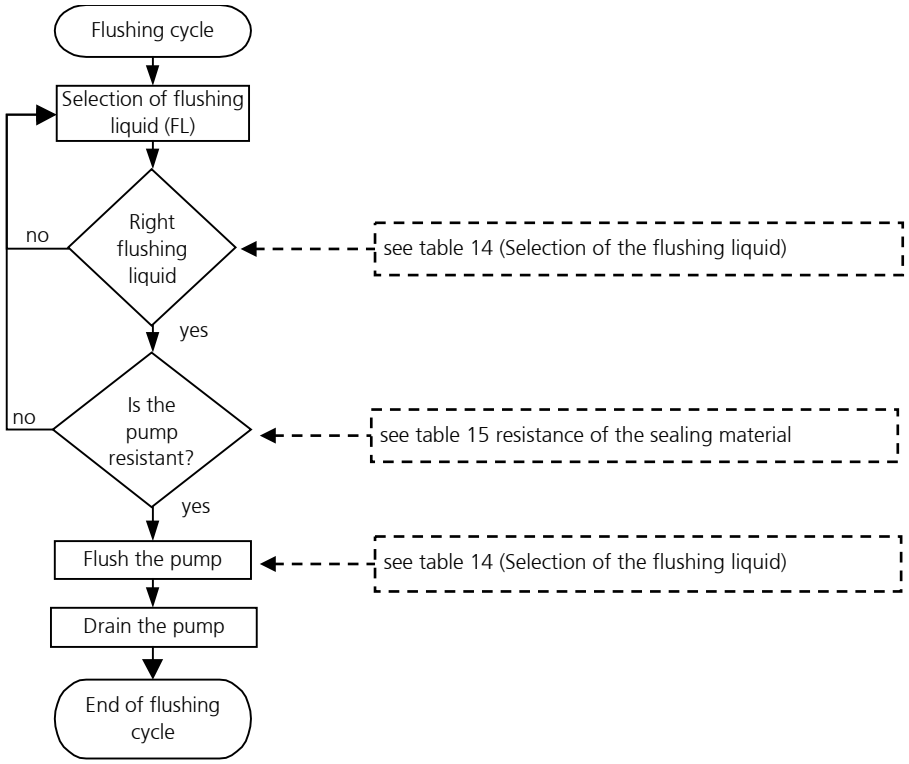


figure 7 Diagram of the flushing procedure

Warning Liquids that remain in the pump may crystallize, coagulate or lead to corrosion and as a consequence impair the work of the micro annular gear pump.

Warning Please make sure that the pump components and particularly O-rings and sealing are resistant to the employed flushing liquid. (see table 15).

Warning The flushing liquid (solvent) and the recommended duration of the flushing procedure depend on the delivered liquid (see table 14). The indicated flushing liquids are simple recommendations and should therefore be checked by the user as to their compatibility and suitability.

Regulations concerning use of substances dangerous to health should be followed!

	Nature of the delivered liquid	Flushing time [min]	Suitable flushing liquid
1	Oils, fats, plastifierss	15-20	isopropanol, ethanol, acetone, benzine/petroleum ether
2	Solvents (polar + nonpolar)	5-10	isopropanol, ethanol
3	Other organic liquids	10-15	isopropanol , ethanol
4	Refrigerating and cooling agents	15-20	isopropanol, ethanol
5	Neutral water/y solutions	20-25	isopropanol, ethanol
6	Basic solutions	25-30	DI-water (deionized water)
7	Organic acids	30-40	isopropanol, ethanol
8	Weak mineral acids	25-30	DI- water
9	Strong mineral acids	35-45	DI- water
10	Strong oxidizing liquids	35-45	DI- water
11	Paints, varnishes, adhesives	50-60	not specified - for further information please contact HNP Mikrosysteme.

table 14 Selection of the flushing liquid (solvent) and the duration of the flushing procedure depending on the delivered liquid.

Warning Please make sure that the pump components and particularly O-rings and sealing are resistant to the employed flushing liquid (see table 15).

	Shaft sealing		O-ring material		
Flushing liquid	PTFE (Teflon®), graphite-reinforced	UHMWPE	FPM (Viton®)	EPDM	FFPM
acetone	0	0	3	0	0
benzene	0	3	1	3	0
benzyl alcohol	0	-	0	2	0
butanol	0	-	1	0	0
dimethyl sulfoxide (DMSO)	0	0	3	0	0
ethanol	0	0	0	0	0
isopropanol	0	0	0	0	0
methanol	0	0	2	0	0
methylethylketone (MEK)	0	0	3	1	0
styrene	0	-	1	3	1
toluene	0	1	2	3	0
water	0	0	0	0	0
xylene	0	1	2	3	0
benzine/petroleum ether	0	0	0	3	0
oil / fine mechanics oil	0	0	0	3	0

Legend: 0 ... good suitability 1 ... suitability 2 ... conditional suitability 3 ... labile - ... not specified

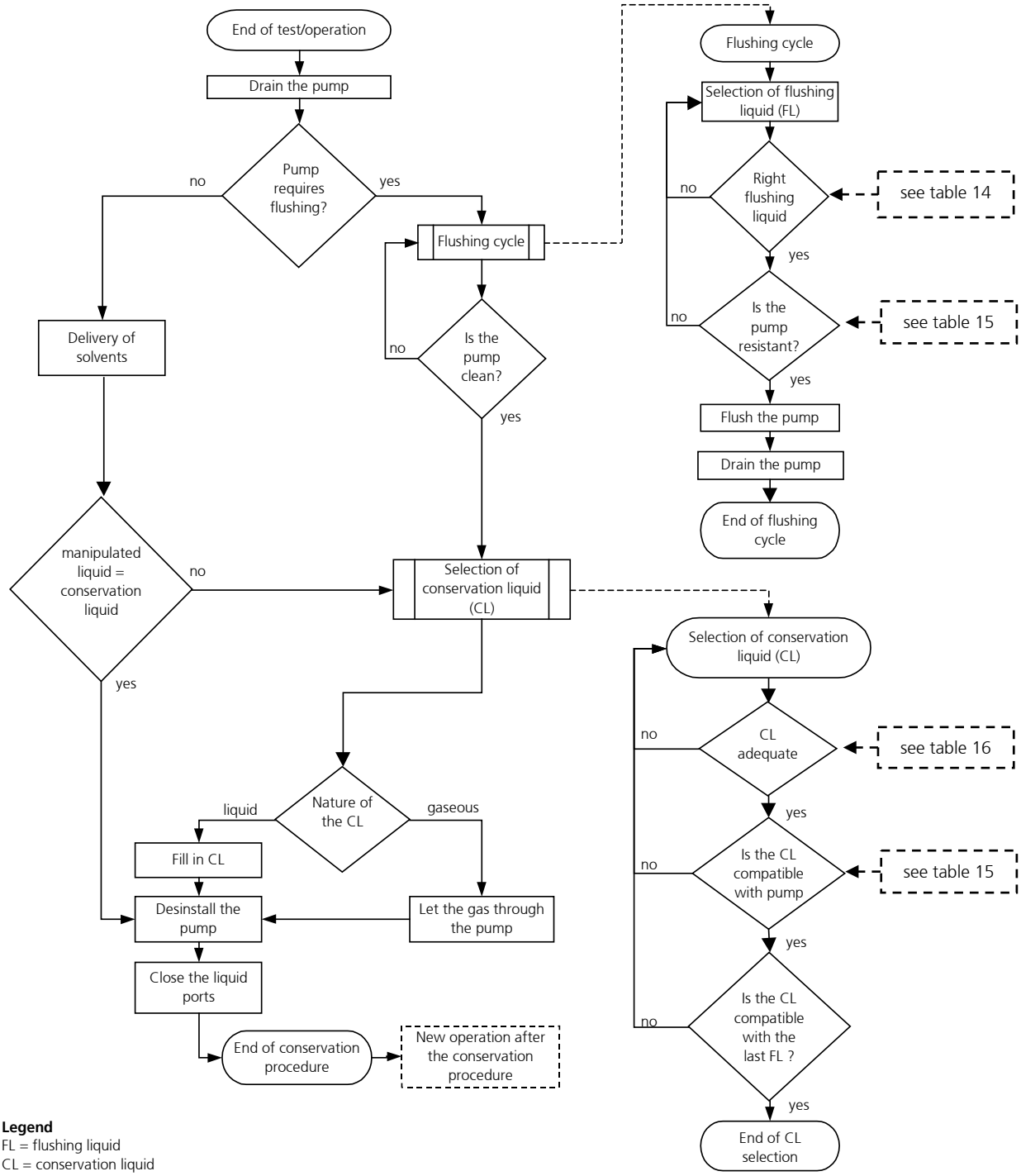
table 15 Resistance of the sealing materials depending on the flushing liquid (solvent)

8.7 Shutdown of the micro annular gear pump

In order to shut down a mzr-pump the following steps should be followed:

- Flush the pump with a filtered and particle-free flushing liquid (solvent) as described in the chapter 8.6.
- After the flushing procedure decrease speed of the pump to 0 rpm
- Fill the pump with a suitable conservation liquid (see chapter 8.7.1)
- Remove the pump from the system (see chapter 8.7.2)

By proceeding as shown in the diagram (see figure 8) you may prepare the pump for a longer standstill.



Legend
FL = flushing liquid
CL = conservation liquid

figure 8 Diagram of the shutdown procedure

8.7.1 Conservation

If the micro annular gear pump operates at irregular intervals or for other reasons should be put out of operation for a longer period, it should, after service and flushing procedure (see chapter 8.6), be filled in with a suitable conservation liquid.

The conservation liquid may be selected from the table 16 depending on the duration of the standstill and the resistance of the pump to the manipulated liquid. The indicated conservation liquids are simple recommendations and should therefore be checked by the user as to their compatibility and suitability. The figure 9 presents a diagram of conservation agent selection.

Remark: This diagram is repeated as a part of the figure 8 (shutdown procedure of the micro annular gear pump).

After the cleansing procedure the pump should be filled with a suitable conservation agent. You will find a choice of possible conservation agents in the table 16.

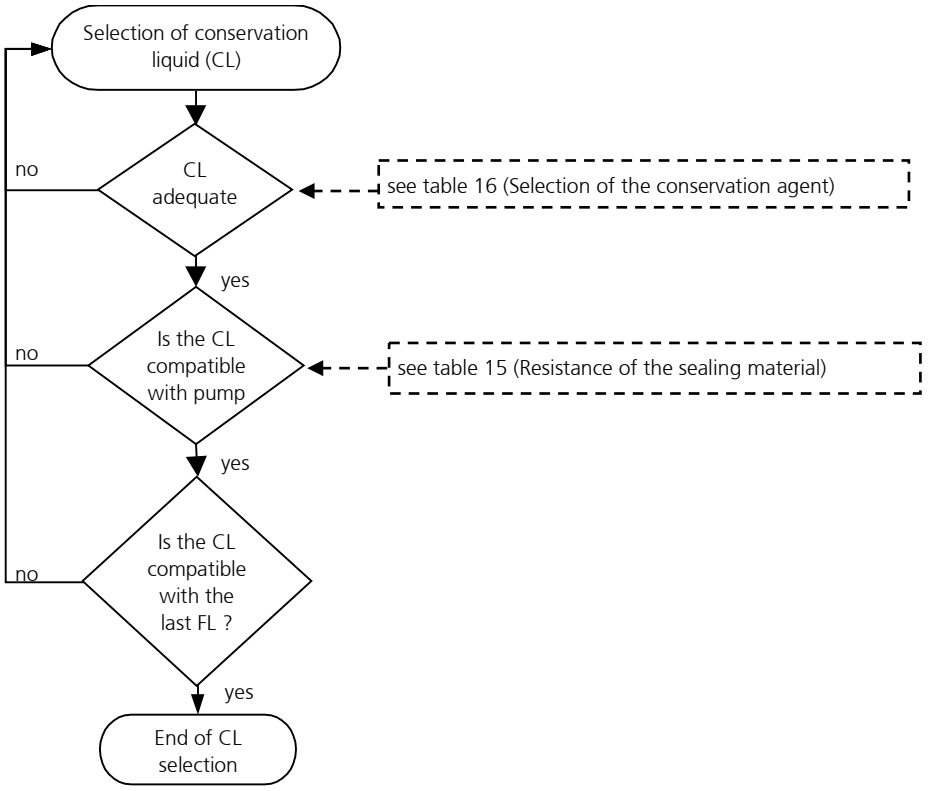


figure 9 Diagram - selection of conservation liquid (CL)

Liquids	Solubility in water	Compatibility with the delivered liquid	Duration of storage	Breakaway torque	Toxicology	Viscosity	Description
isopropanol	+	+	o	o	o	+	solvent for organic compounds, cosmetics, essential oils waxes, and esters, antifreezers, antiseptic agents
acetone	+	+	o	o	o	+	solvent for a number of organic compounds, unlimited solubility in water, dissolves natural and synthetic resins, fats, oils and commonly used plastifiers
ethanol	+	+	o	o	o	+	solvent for organic compounds, fats, oils and resins
DI-water	+	+	-	-	+	+	solvent for many organic and mineral liquids
fine mechanics oil	-	-	+	+	+	+	cleansing and protective action (dissolves fats, tar, rubber or adhesive substances, protects against corrosion).
hydraulic oil	-	-	+	+	+	-	lubricating and preserving properties (*Warning*: may resinate or deteriorate with time)
nitrogen	-	+	+	+	o	+	is not a solvent, may leave deposits after drying out
air / compressed air		+	+	+	+	+	is not a solvent, may leave deposits after drying out

Legend: + ... good/suitable o ... satisfactory; - ... bad/inadequate

table 16 Selection of the conservation agent

In order to prevent dust particles and foreign bodies from penetrating into the pump or the conservation agent from leaking out, please secure the liquid input and output openings with the delivered protective plugs or screws.

Warning Water or DI-water should not be used as conservative liquids. They germinate already after a few days and build a biofilm which can later block the pump.

8.7.2 Dismantling of the system

- Put the drive out of operation by turning down speed to 0 rpm and by switching off the voltage supply. Make sure that the procedure described in the chapter 8.6 has been completed.
- Now that the pump has been stopped you may remove it from the system.
- Protect the inlet and outlet openings of the pump with adapted protective plugs or screws.

8.8 Trouble shooting

If the pump stops operating abruptly or has difficulties with starting operation, please undertake the following steps:

Try to liberate the micro annular gear pump:

- by turning the potentiometer knob back and forth or by connecting an analog voltage
- via the control software
- by pressing with a syringe a suitable flushing liquid (see table 14 and table 15) through the micro annular gear pump
- by changing the operating direction of the pump.

If these measures turn out to be ineffective, please contact the service staff of HNP Mikrosysteme (see chapter 13) and send the pump back to the manufacturer for inspection.

Warning *You should under no condition* try to disassemble the pump by yourself. This may cause damage to the pump components and consequently annul your warranty claims.

8.9 Return of the micro annular gear pump to the manufacturer

For the return of a micro annular gear pump and components that have already been employed, please follow the instructions:

- drain any remaining rests of the delivered liquid from the pump
- flush the pump with an adapted solvent
- remove the filter elements from integrated or loosely delivered filters
- protect all openings against dust with the delivered protective plugs or screws
- return the pump in its original packing

The service personnel which carries out the repair should be informed about the condition of the already used micro annular gear pump. This is done by means of the "Declaration of media in contact with the micro annular gear pump and its components" (see chapter 18). This form may also be downloaded from the web site *www.hnp-mikrosysteme.de/download*.

The "Declaration of liquids in contact with the micro annular gear pump and its components" must imperatively be filled in. The nature of liquid which entered into contact with the micro annular gear pump and its components must be specified.
In case of non-compliance, the sender will be liable for any resulting injure to persons or any object damage.

9 Accessories for microfluidic systems

The accessory range for the liquid delivery systems of HNP Mikrosysteme comprises complementary equipment such as hoses, tubes, fluid fittings, filters and non-return valves that are best adapted to your micro annular gear pump. We will eagerly share our long date experience as far as component selection is concerned.

10 Non-liability clause

HNP Mikrosysteme GmbH shall not be liable any damage resulting form the non-respect of instructions comprised in this operating manual.

It belongs to the user to check the integrity, the correct choice and the suitability of the product for the intended use.

It remains at the responsibility of the user to conform to all laws, rules and regulations in force. This applies above all to the treatment of aggressive, poisonous, corrosive and other dangerous liquids.

11 Problems and their removal

Disturbance	Cause	Solution
1 The pump does not work.	No power supply	Check the power supply.
2 The pump does not pump the liquid.	No liquid in the primary tank	Fill the recipient/tank with liquid.
	Presence of air or gas in the pump	The pump cannot run dry against the system pressure. Fill in the pump at no pressure or at reduced system pressure.
	Malfunction of the liquid supply components (such as in the delivery tube, the needle or external non-return valve)	Check the components for possible disturbances to be eliminated. Cleanse the accessories where needed.
	Failure of the electric installation	Check the electric installation for the correct cable configuration, loose contacts, etc.
	The pump did not receive the start signal or start conditions are not fulfilled.	Check if the start condition have been fulfilled start signals (software control, PLC, start signal) and the programs.
	Motor disturbance: the red error LED is on.	Check the failure condition of the motor control with the Motion Manager software.
3 The pump does not start to operate.	The pump does not take in the liquid.	The tubing on the induction side is too long or has a too small internal diameter (a too low NPSHA value).
		The tubing or the fluid connection on the induction (suction) side are not tight. Please check the intake connection and the tubing.
		Air bubbles in the fluid system (tubes, valves, ...)
		If the viscosity of the liquid is too high, apply pressure on the suction side.
		Check the pressure exerted on the primary liquid tank.
		An external non-return valve does not open. Check the non-return valves.
		Submit the non-return valve to a higher pressure, so that the pump may fill in.
4 The motor turns, but the pump does not operate.	No liquid in the pump	Fill the pump with liquid.
	Air bubbles in the liquid supply system (tubing, valves, ...)	Fill the pump and the liquid supply system with liquid.
	The non-return valve does not open.	Rinse the non-return valve.
	Blocked delivery tubing or needle	Cleansing, flushing or exchange of the delivery tubing or dosage needle
	The coupling between the motor and the pump is out of position.	Return the pump to the manufacturer.
	The pump shaft is broken.	Return the pump to the manufacturer.
5 The pump is filled with liquid, but does not pump it.	Error indicator (the fault LED on the frequency inverter)	Try to liberate the pump by making it operate for 1 s in a reverse direction with -1000 rpm.
		Adapt the motor current to the control. Contact the manufacturer of the pump.
	Presence of particles in the delivered liquid or blockage of the pump.	Try to liberate the pump by making it operate for 1 s in a reverse direction with -1000 rpm.
		Return the pump to the manufacturer for cleansing. Use a filter, flush the liquid delivery system.
		Flush the pump with a syringe.
	The non-return valve does not open.	Rinse the non-return valve.

Disturbance	Cause	Solution
	Blockage of the delivery tubing or the needle.	Cleanse, flush or exchange the delivery tubing or the needle.
	Air bubbles in the liquid delivery system, (tubing, valves)	Fill in the pump and the delivery system with liquid.
6 Dosage volume does not correspond to the set values.	Air bubbles in the liquid delivery system, (tubing, valves ,...) and the pump	Vent the liquid delivery system and check for untight fluid connections.
	Pump shows cavitation.	Too long or too narrow intake tubing. Shorten the intake tubing or change the position of the pump.
	Polluted or too small filter	Change the filter to a new or bigger one.
	The non-return valve does not open.	Rinse the non-return valve.
7 Speed of the pump cannot be adjusted.	Defective electric installation	Check the electric installation for correct cable configuration and loose contacts.
	Defective drive control	Return the drive control to the manufacturer.
8 Liquid drops from the dosing needle.	The non-return valve does not close.	Rinse the non-return valve.
	Too high pressure on the primary liquid tank	Stop the delivery of compressed air on the primary liquid tank.
	The liquid tank is placed at a higher level than the dosing needle.	Place the liquid tank at the same or slightly lower level than the pump.
9 Liquid leaks from the fluidic seal.	The connection kit of the fluidic seal module is untight.	Check the assembly, tighten the threaded connections.
	Pressure on the induction tank of the fluidic seal liquid	Stop the delivery of compressed air on the sealing liquid tank Defective sealing - if necessary return the pump to the manufacturer.
10 The dosage volume decreases with time.	Polluted filter.	Exchange the filter.
	Deposits in the pump.	Flush the pump or return it to the manufacturer for dismantling and cleaning.
	The pump is worn after a long operating period or after use with abrasive liquids.	New definition of the calibration factor of the pump, by modifying the pump characteristics graph necessary.
11 Leakage from the pump	The sealing does not function correctly.	Return the pump to the manufacturer.
12 Leakage from the coupling assembly	Defective shaft seal	Return the pump to the manufacturer to change the shaft sealing.
13 Leakage from the fluid connections	Untight lock rings	Exchange or tighten the fluid connections, exchange the fluid connection fittings.
14 Air bubbles on the delivery side	Loose fluid connections (particularly on the induction side)	Check and tighten the fluid connections.
	The shaft seal is untight or worn.	Return the pump to the manufacturer.
15 Frequency inverter don't work	power supply switched off	Check the power supply
	power supply switched on	Switch off the power supply for 20 s, Switch on the power supply for restart of the frequency inverter
	Frequency inverter is faulty	Return the frequency inverter to the manufacturer.
16 Minimal leakage during standstill	No error, cause relative to the operating principle	Employ a non-return valve. Place the liquid tank at the same or slightly lower level than the pump
17 Excess temperature	The surface of the pump is hot.	Clean the surface of the pump, rinse the pump
	The pump operates with difficulty.	The pump should be flushed.
	Particles in the delivered liquid or deposits in the pump	The operation of the pump should immediately be stopped! Return the pump to the manufacturer for cleansing.
	Noise of beveling	The operation of the pump should immediately be stopped! Return the pump to the

Disturbance	Cause	Solution
		manufacturer for cleansing and repair.
	The motor surface or the motor interior are too hot.	High temperature indicator in the drive is on. The motor has been shut down by the thermistor. Return the pump to the manufacturer.
18 The pump is noisy	Wear out of the pump or defective components	Do not continue to operate the pump, return it to the manufacturer for maintenance.
19 Over current	Particles in the delivered liquid	Rinse the pump.
	The pump operates with difficulty.	Dosing needle is damaged. Needle should be cleansed, flushed or exchanged.
		Tubing on the delivery side, dosing needle or non-return valve is blocked. Cleanse, flush or exchange the components.
	Deposits inside the pump.	Flush the pump. If necessary return the pump to the manufacturer.

table 17 Problem shooting - causes and solutions.

If a disturbance that has not been mentioned in the above list, or that makes the use of the micro annular gear pump unsafe appears, please stop the operation of the pump without delay and contact the manufacturer.

12 Maintenance and service

12.1 Micro annular gear pumps

The first maintenance of the micro annular gear pumps has to take place after 4000 hours or after 6 month latest. If wear is low at the first inspection further maintenance intervals at the same operation conditions can be extended to 6000 hours or to a service interval of 12 month latest.

If there is increased wear at the first inspection the maintenance intervals have to be adapted according to the wear situation.

In case of maintenance and service please send the micro annular gear pump to your distributor or HNP Mikrosysteme directly. The address you may find on the front page of the manual or in section 1.

The micro annular gear pump is sealed. It is prohibited to open or disassemble the pump. The warranty will expire immediately in such a case.
HNP Mikrosysteme cannot give any warranty for replacing in case of damages to the pump which are related to faulty operation.

12.2 Metal bellow-type coupling

Maintenance of the standard metal bellow-type coupling is not necessary according to the enclosed manufacturer's data when assembled by HNP Mikrosysteme.

Within the maintenance intervals of the pump the screw tightenining torque must be checked after 6000 hours. If at the first inspection damage at the metal bellow-type coupling is found the maintenance intervals have to be adapted according to the operational data. This check must be part of the maintenance intervals of the micro annular gear pump.

12.3 Ex-Motor

The explosion proof motor itself is maintenance free. According to the manufacturer's instruction the explosion proof motor has to be checked 1-2 times per year regarding cracks and damages. This check must be part of the maintenance intervals of the micro annular gear pump.

13 EU Directive

A Directive or EU Directive is a legal instrument of the European Community addressing at the member states and forcing them to implement specific regulations or targets. Leastwise, micro annular gear pumps are covered, by the scope of application of the following Directives: The following directives are of importance for the user of the described micro annular gear pumps:

Low-Voltage Directive (2014/35/EU)

The Low-Voltage Directive is relevant for micro annular gear pumps described in this manual.

Machinery Directive (2006/42/EU)

A micro annular gear pump is a machine and is consequently covered by this Directive. However, it may be a part of a machine or installation.

EMC Directive (2014/30/EU)

The Directive on Electromagnetic Compatibility (EMC) applies to all electronic and electrical devices, installations and systems. Consequently, the Motion Controller of the micro annular gear pump is covered by the EMC Directive.

RoHS Directive (2011/65/EU)

To our knowledge our products delivered to you do not contain substances or applications in concentrations that are forbidden by this directive. No substances contain our products delivered to you after our current knowledge in concentrations or application, the placing on the market in products according to the valid requirements forbade to the Directive.

WEEE Directive (2002/96/EU)

Disposal of micro annular gear pumps has to be environmentally sound.

All materials and liquids haveto be recycled in accordance with the relevant regulations. Electrical parts can not be disposed of as household waste. They have to be delivered to designated collection points.

REACH regulation (EU) No. 1907/2006

HNP Mikrosysteme is not a manufacturer or importer of chemical substances subjected to registration, but in terms of regulation, a downstream user. As downstream user, we conduct the necessary communication with our suppliers to ensure future deliveries of all components necessary to us. We will notify you of all relevant, changes in our products, their availability and the quality of parts/products delivered by us within our business and coordinate the appropriate action in individual cases with you. Previous inspection did not show any limitation in the supply of material from our upstream suppliers.

13.1 Electromagnetic Compatibility (EMC)

Electromagnetic compatibility is defined as the ability of a electric or electronic device to function satisfactorily as intended in its electromagnetic environment without introducing intolerable electromagnetic disturbances in that environment.

14 Declaration of conformity - manufacturer's declaration

Pump	EU declaration / attestation of conformity (following Directive 2006/42/EEC)
	EU declaration / attestation of conformity (following directive 94/9/EEC)
Ex-motor	EU declaration / attestation of conformity
	EU approval / attestation of conformity (after directive 94/9/EEC)
	Data sheets Ex-motors

Table 18 Overview declarations of conformity and manufacturer's declaration

Special certification copies referring to the serial number of your Ex-motor can be obtained by the manufacture HNP Mikrosysteme!

HNP Mikrosysteme

EU-manufacturer's certificate
(following Machinery Directive 2006/42/EU)

We hereby declare that the following micro annular gear pumps of the high performance series:

mzr-11557 Ex

are intended for installation into another machinery/plant and that start of operation is forbidden until it is identified that the machinery/plant into which these micro annular gear pumps shall be installed corresponds to the regulations of the EU guidelines regarding safety and health requirements.

We confirm the conformity of the product described above to the following standards in terms of applied directives

– Machinery Directive (2006/42/EU)

Applied standards are particularly

DIN EN 809	DIN EN 60204-1	DIN EN ISO 13857
DIN EN ISO 12100 part 1		DIN EN 953
DIN EN ISO 12100 part 2		UVV

This statement does not warrant any characteristics in terms of product liability. Please note the safety instructions in the manual.

Mr. Lutz Nowotka, HNP Mikrosysteme GmbH, Bleicherufer 25, D-19053 Schwerin is authorised to compile the technical file according to Annex VII A.

Date: December 30, 2016

Signature manufacturer:

Dr. Thomas Weisener
CEO

HNP Mikrosysteme

EU declaration / attestation of conformity (following Directive 94/9/EEC) (ATEX 95)

As per the EU directive 94/9/EC, dated 23 March 1994, and the legislation arising from its implementation, we declares that the explosion protected product, described in the operation and safety instructions of the micro annular gear pump

mzr-11557 Ex

is a device in the sense of Article 1, (3) a) of Directive 94/9/EEC, and complies with the essential safety and health requirements as per Appendix II of Directive 94/9/EEC and the following harmonized directives:

– DIN EN 13463-1
– DIN EN 13463-5

The specified pump type falls into the explosion protection design classification „c ".An ignition hazard assessment is available. The pump carries the identification:

CE Ex II 2G c IIB T3

The technical documentation, in compliance with Article 8, (1)b)ii) of the directive 94/9/EEC,in combination with Appendix VIII, has been deposited with the following named body

DEKRA EXAM GmbH
Dinnendahlstraße 9
D - 44809 Bochum, Germany

Date: 23. August 2013

Signature manufacturer:

Dr. Thomas Weisener
CEO

HNP Mikrosysteme

MOTORENTECHNIK GMBH

under license of F&G

Erklärung der EG-Konformität
Declaration of EC-Conformity
Attestation de conformité CE

CE

Wir erklären in alleiniger Verantwortung, dass	We declare that it is our sole responsibility that	Nous attestons sous notre seule responsabilité
Drehstrommotoren	**Three-Phase-Motors**	**Moteurs á courant triphasé**
Typ CD 63 und 71	**Type CD 63 and 71**	**Type CD 63 et 71**
auf die sich diese Erklärung bezieht, den Bestimmungen der folgenden Richtlinie entsprechen	to which this declaration relates is in accordance with the provision of the following directives	se référant á cette attestation correspondent aux dispositions des directives suivantes
94/9/EG	**94/9/EEC**	**94/9/CEE**
und mit folgenden Normen übereinstimmen.	and is in conformity with the following standards.	et sont conformes aux normes.
EN 60079-0:2006 **EN 60079-1:2007** **EN 60079-7:2003** **EN 61241-0:2006** (nur bei II 2D) **EN 61241-1:2004** (nur bei II 2D) **EN 60034-1,5,6,7,8,9,12,14**	**EN 60079-0:2006** **EN 60079-1:2007** **EN 60079-7:2003** **EN 61241-0:2006** (only at II 2D) **EN 61241-1:2004** (only at II 2D) **EN 60034-1,5,6,7,8,9,12,14**	**EN 60079-0:2006** **EN 60079-1:2007** **EN 60079-7:2003** **EN 61241-0:2006** (seulement a II 2D) **EN 61241-1:2004** (seulement a II 2D) **EN 60034-1,5,6,7,8,9,12,14**
Kennzeichnung	Marking	Marquage

CE 0044 Ex **II 2 G Ex d IIC T3...T6** bzw. **Ex de IIC T3...T6 PTB 08 ATEX 1045 X**
oder wahlweise / or optional / ou au choix **II 2D Ex tD A21 IP6X T200 °C – T85 °C**

Das bezeichnete Produkt ist zum Einbau in eine andere Maschine bestimmt. Die Inbetriebnahme ist solange untersagt, bis die Konformität des Endproduktes mit der Richtlinie 2006/42/EG festgestellt ist.	The indicates product is intended for installation into a different machine. Operation is prohibited until the final product concurs with the 2006/42/EEC regulations.	Le produit indiqué est prévu pour être intégré dans une machine. La mise en service n'est autorisée que lorsque la conformité du produit final selon la directive 2006/42/CEE a été vérifiée.
Diese Erklärung ist keine Zusicherung von Eigenschaften im Sinne der Produkthaftung.	This statement does not warrant any characteristics regarding product liability.	Cette déclaration ne constitue pas une assurance des propriétés au sens de la responsabilité produit.
Die Sicherheitshinweise der Produktdokumentation sind zu beachten.	Safety instructions stated in the production records have to be adhered to.	Les consignes de sécurité rappelées dans la documentation du produit doivent être respectées.

Nordenham, den 13. Januar 2010, Ausgabe 4

ATB - MOTORENTECHNIK GMBH
HELGOLÄNDER DAMM 75

D-26954 NORDENHAM

W. Sobel

Wolfgang Sobel
Leiter Konstruktion

Figure 10 EC declaration / attestation of conformity for the Ex-motor after directive 94/9/EC

Physikalisch-Technische Bundesanstalt

Braunschweig und Berlin

PTB

EG-Baumusterprüfbescheinigung

(1)

(2) Geräte und Schutzsysteme zur bestimmungsgemäßen Verwendung in explosionsgefährdeten Bereichen - **Richtlinie 94/9/EG**

(3) EG-Baumusterprüfbescheinigungsnummer

PTB 08 ATEX 1045 X

(4) Gerät: Drehstrommotor Typ CD 63, CD 71

(5) Hersteller: ATB Motorentechnik GmbH

(6) Anschrift: Helgoländer Damm 75, 26954 Nordenham, Deutschland

(7) Die Bauart dieses Gerätes sowie die verschiedenen zulässigen Ausführungen sind in der Anlage und den darin aufgeführten Unterlagen zu dieser Baumusterprüfbescheinigung festgelegt.

(8) Die Physikalisch-Technische Bundesanstalt bescheinigt als benannte Stelle Nr. 0102 nach Artikel 9 der Richtlinie des Rates der Europäischen Gemeinschaften vom 23. März 1994 (94/9/EG) die Erfüllung der grundlegenden Sicherheits- und Gesundheitsanforderungen für die Konzeption und den Bau von Geräten und Schutzsystemen zur bestimmungsgemäßen Verwendung in explosionsgefährdeten Bereichen gemäß Anhang II der Richtlinie.

Die Ergebnisse der Prüfung sind in dem vertraulichen Prüfbericht PTB Ex 08-18159 festgehalten.

(9) Die grundlegenden Sicherheits- und Gesundheitsanforderungen werden erfüllt durch Übereinstimmung mit

EN 60079-0:2006 **EN 60079-1:2007** **EN 60079-7:2003**
EN 61241-0:2006 **EN 61241-1:2004**

(10) Falls das Zeichen „X" hinter der Bescheinigungsnummer steht, wird auf besondere Bedingungen für die sichere Anwendung des Gerätes in der Anlage zu dieser Bescheinigung hingewiesen.

(11) Diese EG-Baumusterprüfbescheinigung bezieht sich nur auf Konzeption und Prüfung des festgelegten Gerätes gemäß Richtlinie 94/9/EG. Weitere Anforderungen dieser Richtlinie gelten für die Herstellung und das Inverkehrbringen dieses Gerätes. Diese Anforderungen werden nicht durch diese Bescheinigung abgedeckt.

(12) Die Kennzeichnung des Gerätes muss die folgenden Angaben enthalten:

Ex **II 2 G Ex d IIC T3 - T6 bzw. Ex de IIC T3 - T6**
II 2 D Ex tD A21 IP6X T200 °C - T85 °C

Zertifizierungsstelle Explosionsschutz Braunschweig, 25. Juli 2008
Im Auftrag

Dr.-Ing. M. Theobens
Oberregierungsrat

Seite 1/3

EG-Baumusterprüfbescheinigungen ohne Unterschrift und ohne Siegel haben keine Gültigkeit.
Diese EG-Baumusterprüfbescheinigung darf nur unverändert weiterverbreitet werden.
Auszüge oder Änderungen bedürfen der Genehmigung der Physikalisch-Technischen Bundesanstalt.

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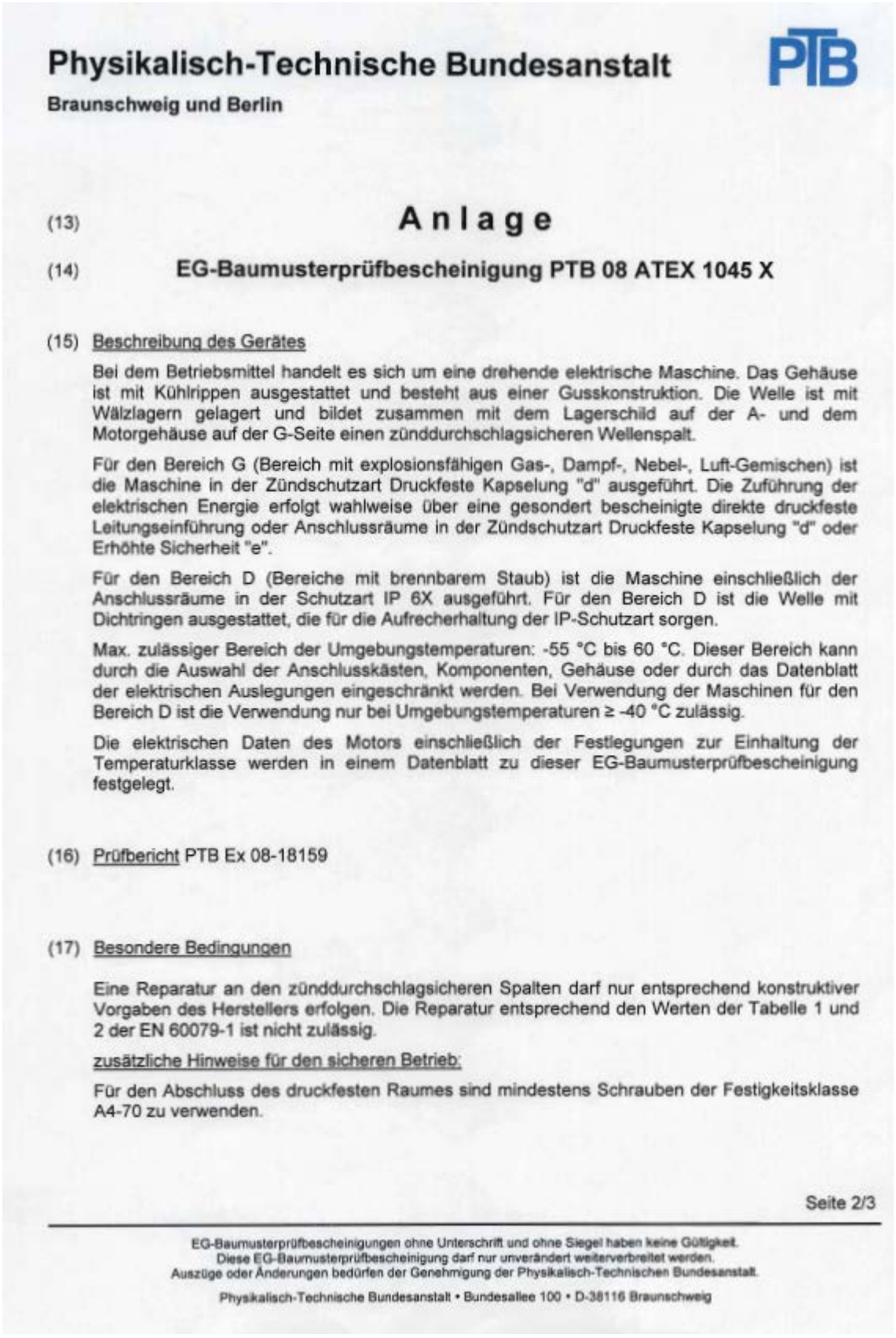
Figure 11 EG-Baumusterprüfbescheinigung after directive 94/9/EC, part 1



Physikalisch-Technische Bundesanstalt

Braunschweig und Berlin

(13) **Anlage**

(14) **EG-Baumusterprüfbescheinigung PTB 08 ATEX 1045 X**

(15) Beschreibung des Gerätes

Bei dem Betriebsmittel handelt es sich um eine drehende elektrische Maschine. Das Gehäuse ist mit Kühlrippen ausgestattet und besteht aus einer Gusskonstruktion. Die Welle ist mit Wälzlagern gelagert und bildet zusammen mit dem Lagerschild auf der A- und dem Motorgehäuse auf der G-Seite einen zünddurchschlagsicheren Wellenspalt.

Für den Bereich G (Bereich mit explosionsfähigen Gas-, Dampf-, Nebel-, Luft-Gemischen) ist die Maschine in der Zündschutzart Druckfeste Kapselung "d" ausgeführt. Die Zuführung der elektrischen Energie erfolgt wahlweise über eine gesondert bescheinigte direkte druckfeste Leitungseinführung oder Anschlussräume in der Zündschutzart Druckfeste Kapselung "d" oder Erhöhte Sicherheit "e".

Für den Bereich D (Bereiche mit brennbarem Staub) ist die Maschine einschließlich der Anschlussräume in der Schutzart IP 6X ausgeführt. Für den Bereich D ist die Welle mit Dichtringen ausgestattet, die für die Aufrecherhaltung der IP-Schutzart sorgen.

Max. zulässiger Bereich der Umgebungstemperaturen: -55 °C bis 60 °C. Dieser Bereich kann durch die Auswahl der Anschlusskästen, Komponenten, Gehäuse oder durch das Datenblatt der elektrischen Auslegungen eingeschränkt werden. Bei Verwendung der Maschinen für den Bereich D ist die Verwendung nur bei Umgebungstemperaturen ≥ -40 °C zulässig.

Die elektrischen Daten des Motors einschließlich der Festlegungen zur Einhaltung der Temperaturklasse werden in einem Datenblatt zu dieser EG-Baumusterprüfbescheinigung festgelegt.

(16) Prüfbericht PTB Ex 08-18159

(17) Besondere Bedingungen

Eine Reparatur an den zünddurchschlagsicheren Spalten darf nur entsprechend konstruktiver Vorgaben des Herstellers erfolgen. Die Reparatur entsprechend den Werten der Tabelle 1 und 2 der EN 60079-1 ist nicht zulässig.

zusätzliche Hinweise für den sicheren Betrieb:

Für den Abschluss des druckfesten Raumes sind mindestens Schrauben der Festigkeitsklasse A4-70 zu verwenden.

Seite 2/3

EG-Baumusterprüfbescheinigungen ohne Unterschrift und ohne Siegel haben keine Gültigkeit.
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Auszüge oder Änderungen bedürfen der Genehmigung der Physikalisch-Technischen Bundesanstalt.

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Figure 12 EG-Baumusterprüfbescheinigung after directive 94/9/EC, part 2

Physikalisch-Technische Bundesanstalt

Braunschweig und Berlin

Anlage zur EG-Baumusterprüfbescheinigung PTB 08 ATEX 1045 X

Für den Ein- und Anbau von Komponenten (Anschlussräume, Durchführungen, Kabel- und Leitungseinführungen, Anschlussteile) sind nur solche zugelassen, die dem auf dem Deckblatt angegebenen Normenstand technisch entsprechen, für die Einsatzbedingungen geeignet sind und eine gesonderte Bescheinigung besitzen. Die besonderen Bedingungen der Komponenten sind zu beachten und die Komponenten sind ggf. mit in die Typprüfung einzubeziehen. Dies gilt auch für die bereits in der technischen Beschreibung genannten Komponenten.

Die Kondenswasser-Ablaufvorrichtung darf während des Betriebs des Drehstrommotors nicht herausgeschraubt werden. Nach dem Abschalten des Drehsstromasynchronmotors muss eine Wartezeit von min. 10 Minuten vergehen, erst dann darf sie herausgeschraubt werden. Der Motor darf erst nach Einschrauben der Ablaufvorrichtung wieder in Betrieb genommen werden.

Überwachungseinrichtungen müssen den Anforderungen nach der Richtlinie 94/9/EG und EN 1127-1 genügen.

(18) Grundlegende Sicherheits- und Gesundheitsanforderungen

Durch die vorgenannten Normen abgedeckt.

Zertifizierungsstelle Explosionsschutz
Im Auftrag

Dr.-Ing. M. Thedens
Oberregierungsrat

Braunschweig, 25. Juli 2008

Seite 3/3

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Auszüge oder Änderungen bedürfen der Genehmigung der Physikalisch-Technischen Bundesanstalt.

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Figure 13 EG-Baumusterprüfbescheinigung after directive 94/9/EC, part 3

Physikalisch-Technische Bundesanstalt

Braunschweig und Berlin

Datenblatt 01 zur EG-Baumusterprüfbescheinigung PTB 08 ATEX 1045 X

der Firma **ATB Motorentechnik GmbH, 26954 Nordenham, Deutschland**

für Drehstrommotoren der Typenreihen CD 63 und CD 71

Elektrischen Daten

Die Motoren der Typenreihen CD 63 und CD 71 der ATB Motorentechnik GmbH, 26954-Nordenham, werden für die Bemessungsdaten bis zu folgenden Werten gefertigt:

	CD 63	CD 71	
Spannung:	1100	1100	V
Strom:	25	25	A
Leistung:	1,5	2,2	kW
Drehzahl (Umrichter):	30 000		min^{-1}
Frequenz (Netz):	max. 60		Hz
Frequenz (Umrichter):	1 - 500		Hz

Für jede Auslegung der Motoren ist die Einhaltung der geltenden Vorschriften durch eine Typenprüfung zu verifizieren. Hierbei ist das „Merkblatt für die elektrische Auslegung und Prüfung von Motoren in der Zündschutzart Druckfeste Kapselung im Rahmen der EG-Baumusterprüfbescheinigung" zu beachten.

Die Motoren dürfen nur in der Betriebsart und unter den Umgebungsbedingungen eingesetzt werden, für die sie der Typenprüfung unterzogen wurden. Das gilt auch für den Betrieb am Frequenzumrichter.

Zertifizierungsstelle Explosionsschutz
Im Auftrag
Dr.-Ing. M. Thedens
Oberregierungsrat

Braunschweig, 25. Juli 2008

Blatt 1/1

Figure 14 EC-Baumusterprüfbescheinigung after directive 94/9/EC, complement 1

MOTORENTECHNIK GMBH	Datenblatt für Drehstrom-Kurzschlußläufer-Motor Data sheet for three-phase induction motor Toleranz VDE 0530 tolerance VDE 0530		
Typ *Type*		CD 63L-2	
IEC Baugröße *IEC Size*		63	
Bauform *Mounting design*		B34 FT75	
Umgebungstemperatur *Ambient temperature*		-20 - +40	°C
Schutzart *Type of enclosure*		IP 55	
Ex-Schutzart *Ex-protection*		II 2 G EEx de IIC T4	
Wärmeklasse *Insulation class*		F	
Bemessungsleistung *Rated output*		0,25	kW
Betriebsart *Duty*		S1	
Bemessungsspannung *Rated voltage*		Y 400	V
Frequenz *Frequency*		50	Hz
Drehzahl *Speed*		2860	1/min rpm
Bemessungsstrom *Rated current*		0,67	A
Anlaufstrom *Starting current*	Ia/In	5,8	
Leistungsfaktor *Power factor*		0,77	
Wirkungsgrad *Efficiency*		70	%
Bemessungsmoment *Rated torque*		0,83	Nm
Anlaufmoment *Starting torque*	Ma/Mn	3,4	
Kippmoment *Breakdown torque*	Mk/Mn	4,7	
Gewicht *Weight*		16	kg

Figure 15 Data sheet Ex-Motor CD 63L-2

MOTORENTECHNIK GMBH

Datenblatt für Drehstrom-Kurzschlußläufer-Motor
Data sheet for three-phase induction motor

Toleranz VDE 0530
tolerance VDE 0530

Typ *Type*		CD 71L-4	
IEC Baugröße *IEC Size*		71	
Bauform *Mounting design*		B34 FT75	
Umgebungstemperatur *Ambient temperature*		-20 - +40	°C
Schutzart *Type of enclosure*		IP 55	
Ex-Schutzart *Ex-protection*		II 2 G EEx de IIC T4	
Wärmeklasse *Insulation class*		F	
Bemessungsleistung *Rated output*		0,37	kW
Betriebsart *Duty*		S1	
Bemessungsspannung *Rated voltage*		Y400	V
Frequenz *Frequency*		50	Hz
Drehzahl *Speed*		1380	1/min rpm
Bemessungsstrom *Rated current*		0,95	A
Anlaufstrom *Starting current*	Ia/In	3,9	
Leistungsfaktor *Power factor*		0,8	
Wirkungsgrad *Efficiency*		70	%
Bemessungsmoment *Rated torque*		2,56	Nm
Anlaufmoment *Starting torque*	Ma/Mn	2,2	
Kippmoment *Breakdown torque*	Mk/Mn	2,6	
Gewicht *Weight*		17	kg

Figure 16 Data sheet Ex-Motor CD 72L-4

15 Contact person

Development and application assistance , service and accessories

Mr. Sven Reimann
Phone +49| (0) 3871|451-349

Service and maintenance

Mr. Steffen Edler
Phone +49| (0) 3871|451-307

Drive and control technology

Mr. Lutz Nowotka
Phone +49| (0) 3871|451-346

16 Legal information

Marks

mzr® is a registered German trademark of HNP Mikrosysteme GmbH.

MoDoS® is a registered German trademark of HNP Mikrosysteme GmbH.

µ-Clamp® is a registered German trademark of HNP Mikrosysteme GmbH.

HNPM® is a registered German trademark of HNP Mikrosysteme GmbH.

Teflon® is a registered trademark of DuPont.

Viton® is a registered trademark of DuPont Dow Elastomers.

Kalrez® Spectrum™ is a registered trademark of DuPont.

PEEK™ is a registered trademark of Victrex plc.

HASTELLOY® is a registered trademark of Haynes International, Inc.

Aflas® is a registered trademark of ASAHI Glass Ltd.

Microsoft®, Windows® are registered trademarks of Microsoft Corporation in the USA and in the other countries.

Cavro® is a registered trademark of Tecan Systems, Inc.

Other product names or descriptions not mentioned above are possibly registered trademarks of related companies.

Patents

Micro annular gear pumps (and housings) are protected by assigned patents: EP 1115979 B1, US 6,520,757 B1, EP 852674 B1, US 6,179,596 B1, EP 1354135, US 7,698,818 B2. Patents pending DE 10 2011 001 041.6, PCT/IB2011/055108, EP 11 81 3388.3, US 13/884,088, CN 2011 8006 5051.7, HK 13 11 2934.9, DE 10 2011 051 486.4, PCT/EP2012/061514, EP 12 728264.8, US 9,404,492 B2, CN 2012 8003 8326.2. In the US, Europe and China additional patents are pending.

17 Safety information for the return of already employed micro annular gear pumps and components

17.1 General information

The operator carries the responsibility for health and safety of his/her employees. The responsibility extends also to employees not belonging to the company that have a direct contact with the micro annular gear pump and its components during repair or maintenance works. The nature of media (liquids) coming into contact with the micro annular gear pump and its components must be specified in the corresponding declaration form.

17.2 Declaration of liquids in contact with the micro annular gear pump

The staff performing the repair or maintenance works must be informed about the condition of the micro annular gear pump before starting any work on the device. The »Declaration of media in contact with the micro annular gear pump« should be filled in for this purpose.

The declaration should be sent directly to the supplier or to the company designated by the supplier. A second copy of the declaration must be attached to the shipment documents.

17.3 Shipment

The following instructions should be observed for the shipment of the micro annular gear pump.

- drain any remaining liquid from the pump
- flush the pump with an adapted flushing liquid
- remove the filter elements from the integrated or loosely delivered filters
- all the openings should be air-tight plugged
- return the pump in the original packing

18 Declaration of media in contact with the micro annular gear pump and its components

Type of the device

Pump type/article no.: _____

Serial number: _____

Operating hours/running time: _____

Reason of return: _____

_____

_____

Contact with media (liquids)

The micro annular gear pump was in contact with:

_____

and has been rinsed with:

_____

Product info sheet / Material Safety Data Sheet: ☐ yes* ☐ no

* Please attach file

or is available on the following web site: www. _____

If a pump which had contact with dangerous substances could not be properly cleansed prior to shipment, we reserve the right to entrust a specialized company with cleansing of the device. The return of the pump in original packing is advisable. It is necessary in order to protect the employees and delivery staff.

Nature of media contact:

☐ explosive	☐ oxidizing	☐ sensitive to moisture
☐ toxic (toxic byproducts)	☐ radioactive	pH-value: approx. ____ to ____
☐ carcinogenic	☐ microbiological	other: _____
☐ irritant	☐ corrosive	_____

Hazard (H-statements): _____ Precautionary (P-statements): _____

Declaration

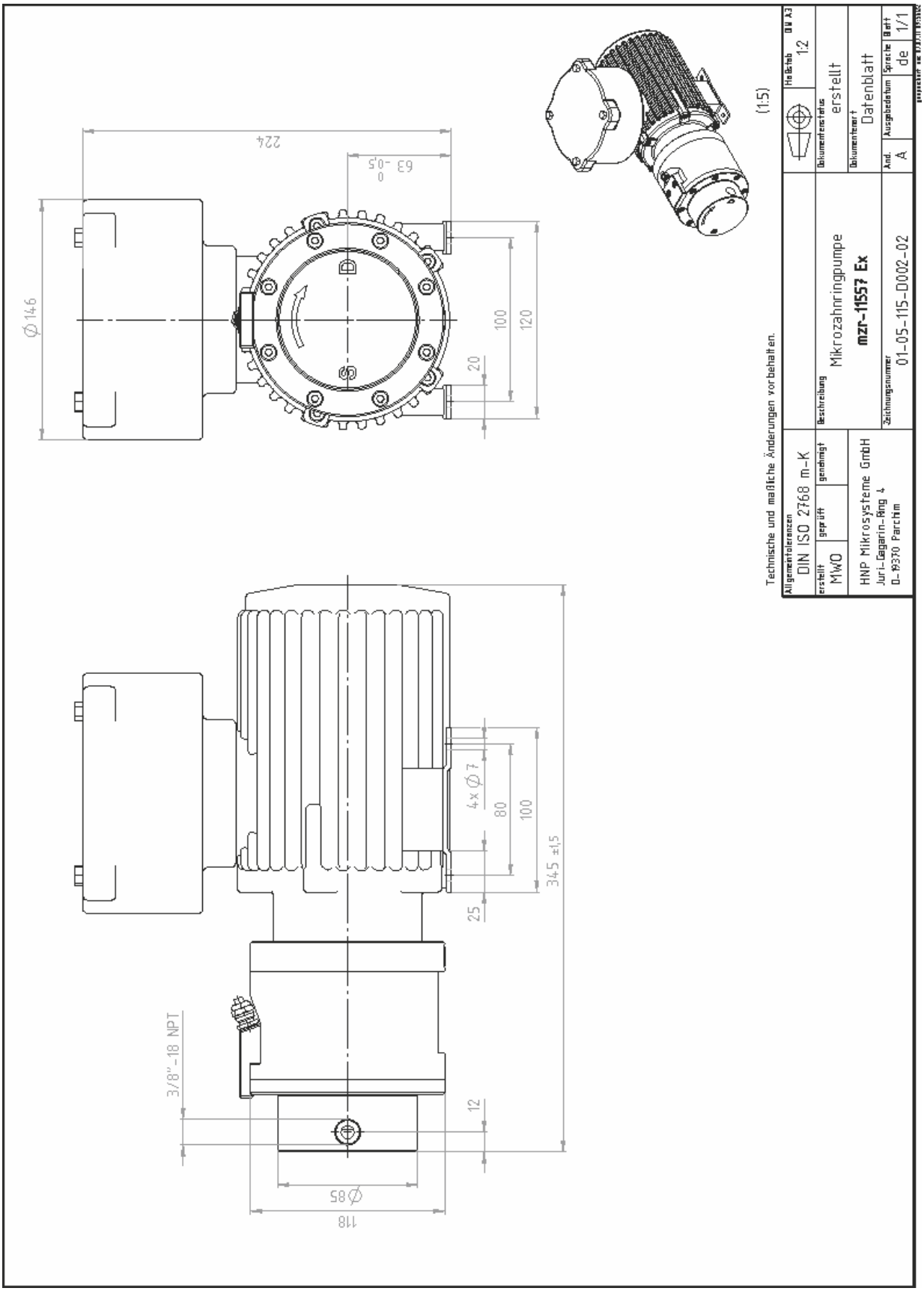
Hereby I/we affirm that the stated information is complete and correct. Micro annular gear pump and accessories are shipped in conformity with the applicable regulations.

company:	_____	☐ Mrs ☐ Mr	title: _____
division:	_____	name:	_____
street, no.:	_____	phone:	_____
ZIP/city:	_____	e-mail:	_____
country:	_____		

city, date: _____ authorized signature / company stamp:

19 Appendix

- Layouts
- Operating manual for the frequency inverter (optional)


(1:5)
Technische und maßliche Änderungen vorbehalten.
Allgemeintoleranzen
DIN ISO 2768 m-K
erstellt
MWO
geprüft
genehmigt
Bezeichnung
Mikrozahnringpumpe
mzr-11557 Ex
Datenblatt
HNP Mikrosysteme GmbH
Juri-Gagarin-Ring 4
D-19370 Parchim
Zeichnungsnummer
01-05-115-D002-02
Dokumentenstatus
erstellt
Dokumententyp
Datenblatt
Maßstab
1:2
DIN A3
Änd.
A
Ausgabedatum
Sprache
de
Blatt
1/1
224
63 -0,5
0
Ø146
100
120
20
4x Ø7
80
100
345 ±1,5
25
12
3/8"-18 NPT
Ø85
118