

Mixers and flowmakers

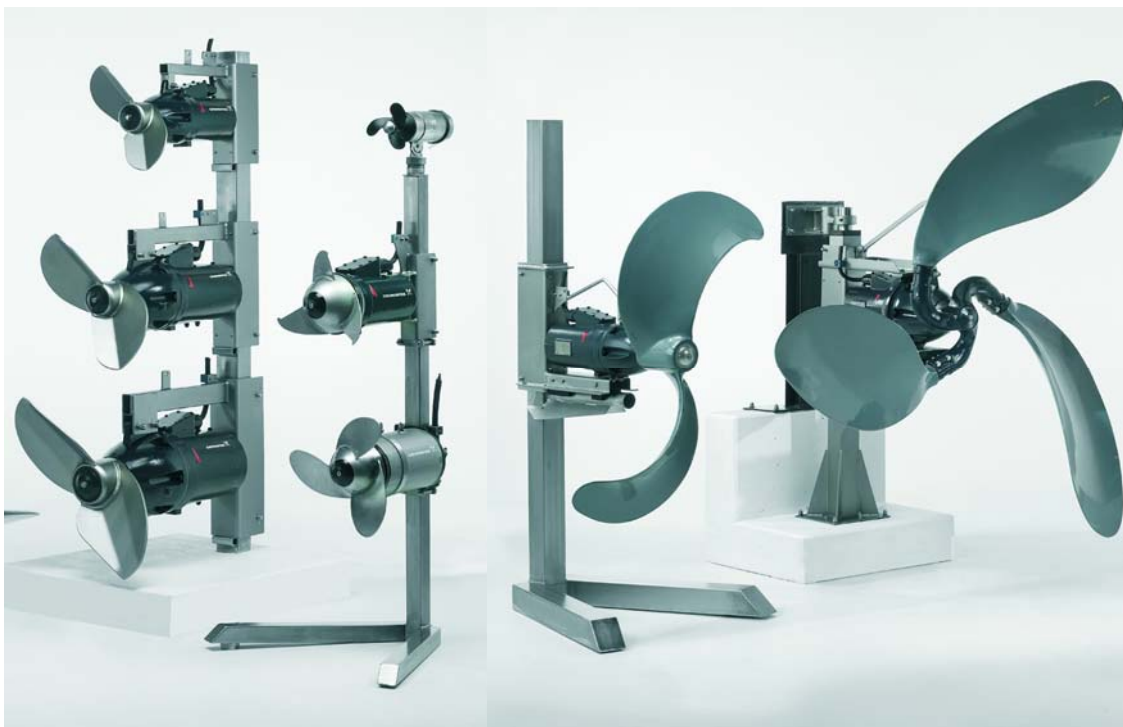


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1 Safety regulations

1.1 General description

These operating instructions contain fundamental information that must be complied with during installation, operation and maintenance. Therefore this operating manual must be read and understood both by the installing personnel and the responsible trained personnel / operators prior to installation and commissioning, and it must always be kept close to the operating location for easy access.

Not only must the general safety instructions given in this paragraph be complied with, but also the safety instructions outlined under specific headings.

1.2 Safety instructions for the operator/user

Guards that are fitted to prevent accidental contact with moving parts must not be removed while the machine is in operation. Electrical hazards must be eliminated (refer to VDE and the local energy supply company for details).

1.3 Safety instructions for maintenance, inspection and installation

The operator is responsible for ensuring that all maintenance, inspection and installation work is performed by authorized and qualified personnel who are thoroughly familiar with the manual.

Work on mixers and flowmakers must be carried out only during standstill and when the mains supply is switched off. The shutdown procedure described in the manual for taking the machine out of service must be adhered to without fail.

Immediately following completion of the work, all safety/protective devices must be re-installed and /or re-activated.

Please observe all instructions set out in the chapter 8. *Installation* before returning the machine to service.

1.4 Unauthorized modification and manufacture of spare parts

Modifications or alterations of the machine are only permitted after consultation with the manufacturer. Original spare parts and accessories authorized by the manufacturer ensure safety. The use of other parts can invalidate any liability of the manufacturer for damage or warranty.

1.5 Unauthorized modes of operation

Any warranty of the operating reliability and safety of the mixer/flowmaker supplied is only valid if the machine is operated in accordance with its designated use as described in the following sections. The limits stated in the data sheet must not be exceeded under any circumstances.

1.6 Marking of instructions in the manual



The safety instructions contained in this manual whose nonobservance might cause hazards to persons are specially marked with the general hazard sign “safety sign in accordance with DIN 4844-W9”

This sign is to introduce safety instructions whose non-observance may lead to damage to the machine and its functions.

Note

Advice

Draws attention to supplementary information to make the work easier and ensure troublefree operation



You will find this sign for security instructions for explosion-proof mixers and flowmakers.

Instructions attached directly to the machine, such as:

- Arrow indication the direction of rotation
- Marking for fluid connections

Must always be complied with and be kept in legible condition at all times.

1.7 Personal qualification and training

All personnel involved in the operation, maintenance, inspection and installation of the machine must be fully qualified to carry out the work involved. Personnel responsibilities, competence and supervision must be clearly defined by the operator.

1.8 Non-compliance with safety instructions

Non-compliance with safety instructions can jeopardize the safety of personnel, the environment and the machine itself. Non-compliance with these safety instructions will also lead to forfeiture of any and all rights to claims for damages.

In particular, non-compliance can, for example, result in:

- Failure of important machine functions
- Failure of prescribed maintenance and servicing practices
- Hazard to persons by electrical or mechanical effects

1.9 Safety awareness

It is imperative to comply with the safety instructions contained in this manual, the relevant national and local health and safety regulations and the operator's own internal work, operation and safety regulations.

2 General description

The mixers and flowmakers of ARNOLD AG are designed for applications involving the mixing, i.e. the homogenization and suspension, of liquids of

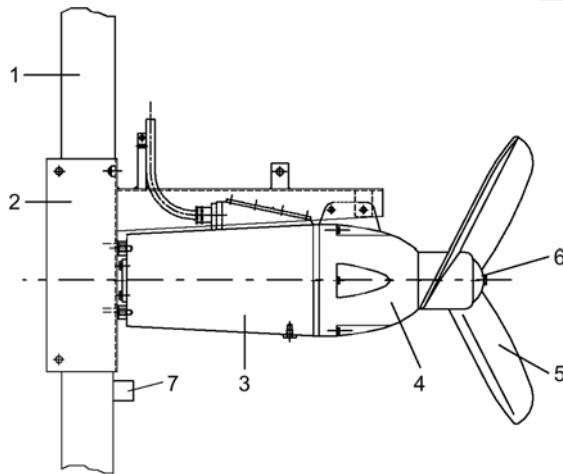


Fig. 1

low to medium viscosity (≤ 500 mPas). The mixers are fitted with motors of 1.5 to 18.5 kW. The flowmakers are fitted with motors of 1,5 to 4,0 kW. This manual also includes specific instructions for explosion-proof mixers and flowmakers.

Pos.	Description
1	Column profile tube
2	Motor bracket
3	Motor housing
4	Gearbox (MDD: shaft seal housing)
5	Propeller
6	Hub
7	Depth blocker

2.1 Application

Mixers and flowmakers of ARNOLD AG are designed for mixing applications in:

- municipal and industrial wastewater treatment,
- industrial processes,
- sludge treatment,
- agriculture.

In order not to overload the mixers and flowmakers and expose them to corrosion, the following liquid limitations must be observed.

Liquid temperature	5 to 40°C
pH-value	4 to 10
Maximum sludge index	125 ml/g
Maximum dynamic viscosity	500 mPas
Maximum density	1060 kg/m ³
Chloride content	≤ 200 mg/l (for stainless steel 1.4306)
Chloride content	≤ 1000 mg/l (for stainless steel 1.4404)

In special cases, the mixers can be used in a liquid with a temperature up to 60°C.

For the mixing of liquids with a dry solid content (DS) exceeding the values stated below or the liquid temperature of 40°C, please contact ARNOLD AG.

Mixers

Mixers are suitable for applications involving sludge with a typical dry solids content as stated in the table below.

Mixers are also suitable for a wide range of other applications involving similar liquids such as slurry and paper pulp.

Activated sludge	0.5 % DS
Selector zones	0.5 % DS
Anoxic zones	0.5 % DS
Bivalent zones	0.5 % DS
Anaerobic zones	0.5 % DS
Primary sludge	≤ 3 % DS
Secondary sludge	≤ 6 % DS
Digested sludge	≤ 8 % DS
Pump sump without screen	≤ 2 % DS
Pump sump with sand	≤ 2 % DS

Flowmakers

Flowmakers are suitable for activated sludge with a typical dry solids content of 0.5 to 1.0 % and for other liquids with a dry solids content of maximum 1.5 %.

2.2 Technical data

Voltage tolerance	+ 6 / -10 % of nameplate value
	Ex-versions: +/- 5 %
Enclosure class	IP 68
Insulation class	F
Maximum installation depth	20 metres below liquid level
Maximum number of starts per hour	20
Supply cable length	10 metres (standard)
Wire length on all winches	10 metres (standard)

The mixers and flowmakers are designed for continuous operation (S1).

2.3 Potentially explosive environments



Use explosion-proof mixers and flowmakers in potentially explosive environments.

Ex The explosion protection class of the mixers and flowmakers allows applications in ex zones 1 + 2.

The classification of the installation (according to directives ATEX 137) must in each individual case be approved by the local authorities.

Designation:

CE₁₂₅₈ **Ex** II 2G, EEx de IIC T4

(Underlined data according to the following table and/or name plate)

The mixers with designation **EEx de IIC T4** are allowed to be used in gas groups IIA, IIB und IIC, which are potentially explosive through flammable substances in temperature classes T1 to T4.



Type	Ex class
MDDX160R D 1.5 kW	EEx de IIC T4
MDDX160R D 2.5 kW	
MDDX160R D 3.5 kW	
MDDX160R D 4.5 kW	
MDDX160R 2.0 kW	
MDDX160R 3.0 kW	
MDDX160R 4.0 kW	
MDX50 1.5 kW	EEx e ck ib IIC T3
MDX50 2.2 kW	
MDX50 3.0 kW	
MDX50 4.0 kW	
MDX160 5.5 kW	
MDX160 7.5 kW	
MDX160 11.0 kW	
MDX160 9.0 kW	
MDX250 15.0 kW	
MDX250 18.5 kW	
MDX250 16.0 kW	
MDX52 1.5 kW	
MDX52 2.2 kW	
MDX52 3.0 kW	
MDX52 4.0 kW	
MDX162 1.3 kW	
MDX162 1.8 kW	

MDX162 2.4 kW	EEx e ck ib IIC T3
MDX162 3.7 kW	
MDX162 1.5 kW	
MDX162 2.2 kW	
MDX162 3.0 kW	
MDX162 4.0 kW	

3 Type key and nameplates

3.1 Type key

Example	M	D	D	X	160	R	D	1.5kW
Type range								
- = Gearbox								
D = Direct drive								
- = Standard								
X = Explosion-proof version								
Motor dimensions								
- = Standard								
R = Stainless steel								
- = Sludge								
D = Denitrification								
Power output P ₂								

3.2 Nameplate

All mixers and flowmakers can be identified by means of the nameplate on the motor housing. The details on the nameplate are required for ordering of spare parts

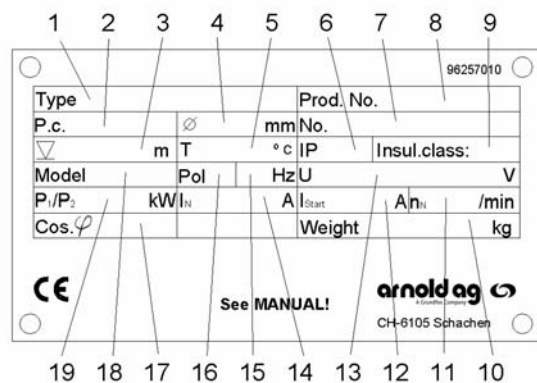


Fig. 2

Pos.	Description
1	Type designation
2	Production code
3	Maximum installation depth
4	Propeller diameter
5	Maximum temperature
6	Enclosure class according to IEC
7	Serial number
8	Product number
9	Insulation class
10	Weight
11	Rated speed (propeller)
12	Locked-rotor current
13	Rated voltage
14	Rated current
15	Frequency
16	Number of poles
17	Power factor
18	Model
19	Motor power, P ₁ /P ₂

d	Flameproof according to EN 50018
c	Constructional safety according to EN 13463-5
k	Liquid immersion according to EN 13463-8
i	Intrinsically safety according to EN 50020
IIC	Group of gas, also suitable for IIB and IIA
T2	Maximum surface temperature of the motor is 300°C
T3	Maximum surface temperature of the motor is 200°C
T4	Maximum surface temperature of the motor is 135°C
NAT	Switch-off temperature (PTC)

4 Safety

4.1 General safety instructions



These safety instructions as well as the instructions in each individual section must be followed when transporting, storing, handling and operating the mixer or flowmaker.

The mixer or flowmaker must be installed, connected, started up and serviced by qualified persons.

Beware of rotating parts.

It must be ensured that persons cannot accidentally fall into the tank, e. g. by installing a cover or railing.

4.2 Explosion-proof versions

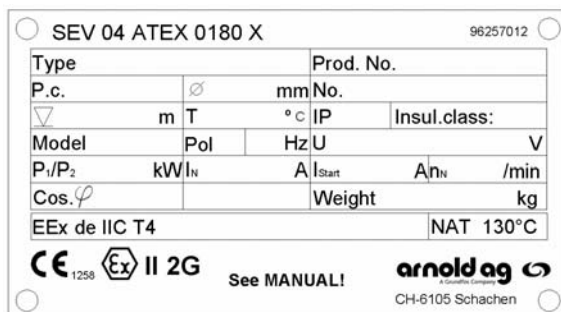


When using explosion-proof mixers or flowmakers, the following safety regulations must also be observed.

Mixers and flowmakers are delivered with one extra nameplate which shall be installed in sight at the assembly site.

3.3 Ex certification and classification

The mixers and flowmakers for application in potentially explosive environments (Ex versions) are supplied with a nameplate with certification details. See Fig. 3.



Type		Prod. No.	
P.c.	∅	mm	No.
▽	m	T	°C
Model	Pol	Hz	U
P ₁ /P ₂	kW	I _n	A
Cos.φ		A _{start}	A _n
			/min
EEx de IIC T4		NAT 130°C	
CE 1258 Ex II 2G		See MANUAL!	
		arnold ag	
		CH-6105 Schachen	

Fig. 3

Key to certification details:

II	Designed for application in potentially explosive environments, except for mines
2G	Category 2, suitable for applications in ex zones 1 and 2
EEx	Motor explosion-proof according to European standard
e	For increased safety according to EN 50 019

Equipotential bonding

If two or more mixers or flowmakers are installed in the same tank, they must be interconnected by means of a copper cable of min. 4 mm² via the equipotential bonding terminals on the back of the motors.

The cable must be fixed in such a way that it cannot be caught in the propeller during operation.

Leak sensor

Together with the ARNOLD AG relay, Type ALR 20/A (Ex), the leak sensor is a part of the explosion protection of the mixer. The relay must therefore always be installed together with explosion proof mixers and flowmakers. The relay must be ordered separately.

The instructions for the relay ALR 20/A (Ex) can be found in enclosure E and should be read carefully.

The relay must be ordered separately.

Order number: 96489569.

Temperature monitoring

The motor temperature must always be monitored via the built-in PTC sensors. A correspondingly certified relay for interpretation has to be used for this

purpose (See example in enclosure C). It has to be incorporated into the motor control. In case of release it must not reactivate automatically but has to be acknowledged manually.

Supply cable

The factory-fitted supply cable must not be shortened.

Flowmaker

The propellers of the flowmakers are made of composite and can charge statically. Therefore they must never be in direct contact with explosive atmospheres. The propeller must always be submerged in water. If installation work is done it must be ensured that the atmosphere is not explosive.

Frequency converter

An explosion-proof mixer or flowmaker can be operated by a frequency converter. Depending on the type of protection not every converter is suitable.

For class “e” increased safety the only frequency converter allowed is “Danfoss VLT5000”.

All relevant parameters must be set according to the specifications given.

Some of the mixers with explosion-protection „de“ flameproof/increased safety can be operated by a frequency converter as described in enclosure D. Specifications must be kept.

Accessories

The mixers or flowmakers must only be used together with accessories supplied and approved by ARNOLD AG.

Maintenance, service and repair

The mixers and flowmakers must only be dismantled by ARNOLD AG or an authorized service workshop. This also applies to the cable entry.

It is only allowed to use components produced by ARNOLD AG for repair purposes.

The oil level in the gearbox must be checked before starting up the mixer. (see section 8 Start-up).



5 Transportation and storage

5.1 Storage

Mixers and flowmakers must be stored in a dry location in which the temperature is not subject to major fluctuations. If the mixer or flowmaker has to be stored for more than one year, the gearbox oil must be changed. The oil must be changed even if the unit has never been in use. This is necessary because of mineral oil lubricants.

5.2 Transportation

The individual components of the mixer or flowmaker must be packed carefully to prevent any damage to the surface protection during transportation.

6 Installation

The mixer or flowmaker must only be lifted when using the suspension point.

The lifting equipment supplied with the unit as well as the chain or wire used for lifting and lowering the mixer or flowmaker into the tank must not be used as universal lifting equipment.

Note

Never hang the mixer or flowmaker by the power cable.

See section 11 *Technical data* for details about weight.

6.1 Positioning

Correct positioning of mixers and flowmakers is essential to ensure trouble-free operation and long-life.

The following guidelines must be observed:

Mixers

The mixer should be submerged as deep as possible.

- The mixer should be placed in such a way that a good mixing of the liquid in the entire tank is obtained. If more mixers are installed in the same tank, the mixers must not generate opposite flows.

- The distance between the propeller tip and the bottom of the tank should be 20-40 cm, H_{MIN} in fig. 4.
- The distance from the propeller tip to the liquid surface should be at least half the propeller diameter, H_{ABOVE} in fig. 4.
- The distance between the propeller tip and the wall behind the mixer must be at least twice the propeller diameter, L_{MIN} in fig. 4.

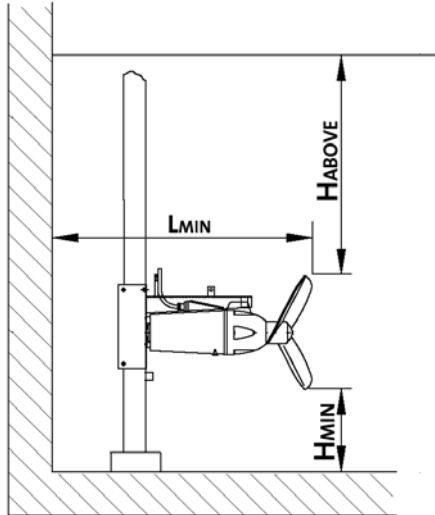


Fig. 4

Flowmakers

The flowmaker should be submerged as deep as possible.

- The distance between the propeller tip and the bottom of the tank should be 40-50 cm, H_{MIN} in fig. 5.
- The distance from the propeller tip to the liquid surface should be at least 0.75 times the propeller diameter, H_{ABOVE} in fig. 5.
- The distance between the propeller tip and the wall behind the flowmaker must be at least twice the propeller diameter, L_{MIN} in fig. 5.
- The sideways distance between the propeller tip and the tank wall must be at least 0.5 metres.
- If two or more flowmakers are installed in parallel, the distance between their propellers must be larger than half the propeller diameter.
- The distance to tank bends should be at least twice the propeller diameter.
- The distance from the propeller to aeration areas should be at least 1 – 2 times the propeller diameter.

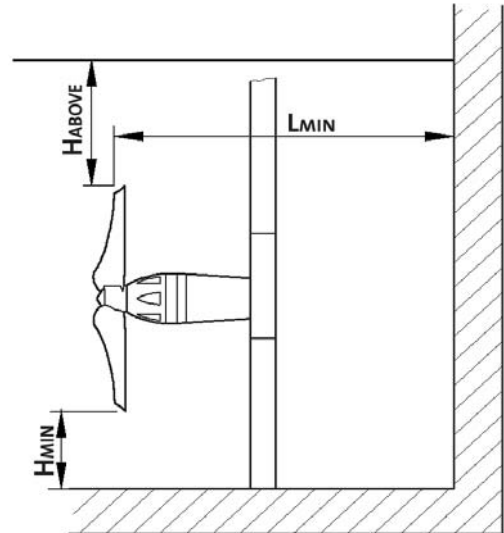


Fig. 5

- In round tanks, the flowmaker should be placed 30% of the tank radius, R_{TANK} , from the wall and it should be turned 25° from the radius, $R_{FLOWMAKER}$, towards the centre, see fig. 6.

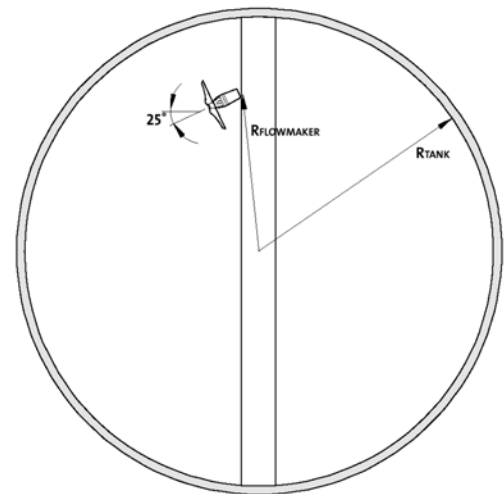


Fig. 6

6.2 Installation instructions

Two types of installation are possible:

- Open installation (without a cover on top of the tank).
- Sealed installation (with a cover on top of the tank).

Fig. 7 shows an open installation.

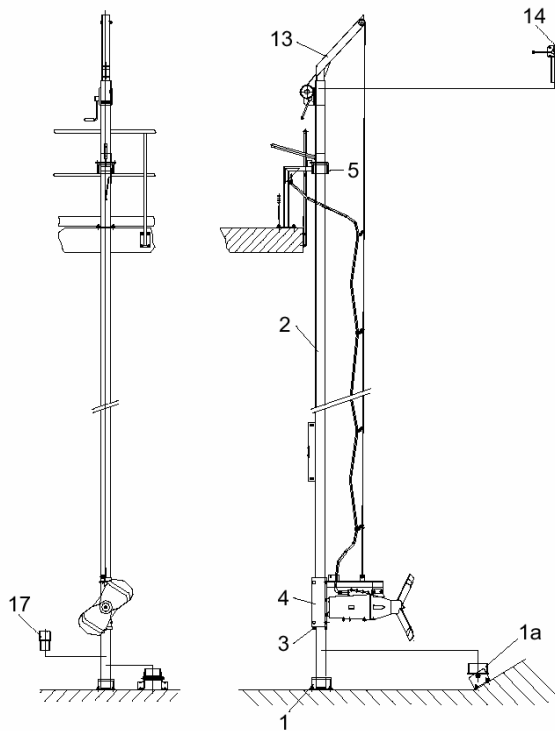


Fig. 7

Fig. 8 shows a sealed installation with pull and safety chain and crane with chain hoist.

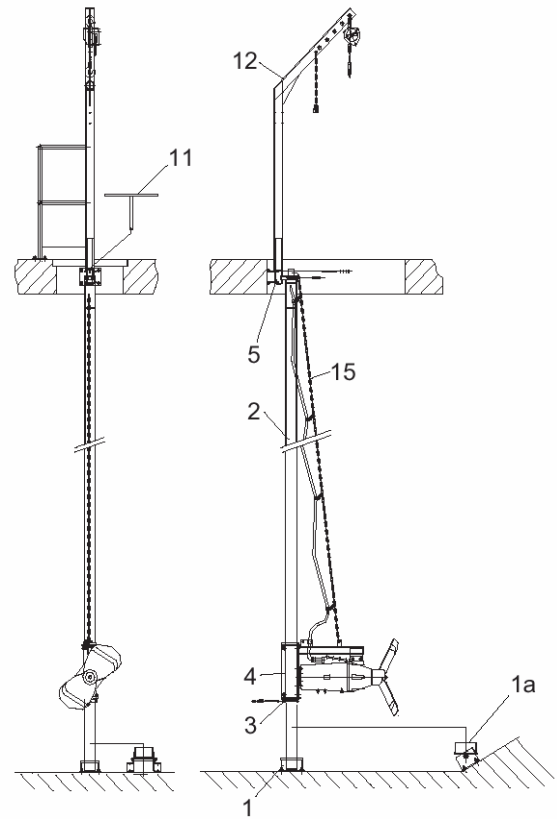


Fig. 8

Explanation to figures 7 and 8:

Pos.	Description
1	Bottom fixation, horizontal
1a	Bottom fixation, horizontal/inclined (0-90°)
2	Column profile tube
3	Depth blocker
4	Motor bracket
5	Top fixation
11	Turning key
12	Crane with chain hoist and chain
13	Crane boom with winch
14	Stand with winch
15	Pull and safety chain
17	Reduction piece (120/100mm)

6.2.1 Torques

All nuts and screws used for the installation must be in AISI 316L. All stainless steel threads **must** be greased in advance, e.g. by an ALU-paste.

All stainless steel nuts and screws should be tightened to the following torques:

	Screws F-Class 70	Screws F-Class 80
M6	8.8 Nm	11.8 Nm
M8	21.4 Nm	28.7 Nm
M10	44 Nm	58 Nm
M12	74 Nm	100 Nm
M16	183 Nm	245 Nm
M20	370 Nm	494 Nm

6.2.2 MDD and MD mixers

See Fig. 7 and 8 and section 6.2.1 *Torques*.

Proceed as follows:

1. Drill the holes for the mounting screws for the top fixation in the concrete.
2. Fit the top fixation. Insert the screw, but leave loose.
3. Place the bottom fixation in the right position using a plummet.
4. Drill the holes for the mounting screws for the bottom fixation.
5. Fit the bottom fixation. Insert the screws, but leave loose.
6. Position and align the column profile tube with a plummet. Shorten it to the correct length:

In the case of an open installation with a railing and a crane boom with winch, cut the column profile tube approx. 600 mm above the railing.

In the case of an open installation with a railing and a stand with winch, cut the column profile tube approx. 300 mm above the railing.

In the case of a sealed installation, cut the profile tube so that the collar of the epoxy insulator does not touch the top fixation. Adapt the outside of the square epoxy insulator to the inside of the column profile tube. The epoxy insulator must fit tightly inside the column profile tube.

7. Fasten the depth blocker in the right position.
8. Tighten the screws for the top fixation.
9. Align the column profile tube and tighten the screws for the bottom fixation.
10. Position the turntable for the column profile tube. It must be ensured that the mixer cannot be turned so much that the propeller touches the tank wall.
11. Position the crane over the column profile tube.
12. Lift the complete mixer (motor bracket with motor) with the crane, slide it over the column

profile tube and tighten the fixing screws. Check that the fixing screws and spacing pipes are fitted correctly and tightened, see fig. 11.

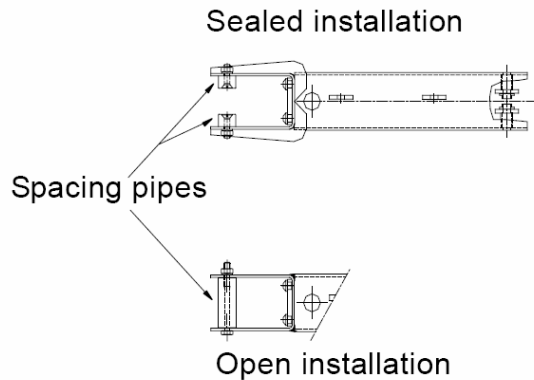


Fig. 9

Lifting equipment is absolutely necessary for lifting the motor bracket onto the column profile tube. The weight of the individual unit can be found in the table on page 22 to 26.

13. Slowly lower the mixer into the tank using the crane and the pull and safety wire. Fit all the cable clamps and wire clamps one after the other. Attach the cable to the wire or chain at one-meter intervals. Attach the upper snap lock hook to the top fixation.

Attach the power cable to the wire or chain 800 mm above the mixer so that the cable cannot fall down and be caught in the propeller during operation.

- On the drum of the winch at least three turns of wire must remain, otherwise the wire may break loose from the drum fixation.
- The power cable must under no circumstances be under tension. This also applies when the mixer is swung out.
- As a principle the power cable should be laid out in a large circle during installation to avoid sharp bends (breaking) of the cable.
- The pull and safety wire should be used as a relief for the power cable. For this reason, it must always be pre-tensioned to approx. 250 N (~25 kg).

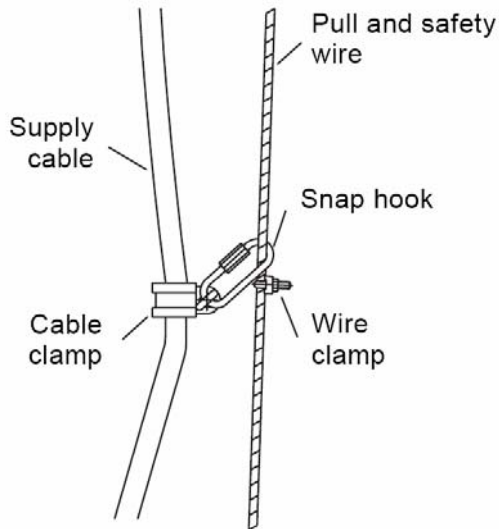


Fig. 10

14. When the motor bracket rests on the depth blocker, the distance between the propeller and the wall and the bottom of the tank must be checked. The mixer must under no circumstances touch other installations, neither from the bottom nor from the wall. This also applies when the mixer is swung out.
15. In the case of a sealed installation, position the mixer by fixing the turntable or tightening the screws of the clamp. For this installation type, 1.5 metres extra chain must be available for lifting the mixer.

6.2.3 Flowmakers

See Fig. 7 or 8 and section 6.2.1 *Torques*.

Proceed as follows:

1. Drill the holes for the mounting screws for the top fixation in the concrete cover.
2. Fit the top fixation. Insert the screws, but leave loose.
3. Place the bottom plate in the right position using a plummet.
4. Drill the holes for the mounting screws for the bottom plate in the bottom of the tank and insert the screws.
5. Shorten the column profile tube to the correct length so that the collar of the epoxy insulator does not touch the top fixation. Adapt the outside of the square epoxy insulator to the inside of the column profile tube. The epoxy insulator must fit tightly inside the column profile tube.
6. Place the depth blocker in the right position and weld it on the column profile tube in a workshop.
7. Install the column profile tube.
8. Tighten the screws for the top fixation and the bottom plate.

9. Fit the top fixation to the column profile tube by means of the clamps.
10. Position the crane over the column profile tube.
11. Lift the complete flowmaker (motor bracket with motor) with the crane, slide it over the column profile tube and tighten the fixing screws.

Lifting equipment is absolutely essential for fitting the motor bracket onto the column profile tube. The weight of the individual unit can be found in the table on page 22 to 26.

12. Fit the relief wire for the power cable to the motor bracket.
13. Slowly lower the flowmaker into the tank using the crane and the pull and safety wire. Fit all the cable clamps and wire clamps one after the other. Attach the cable clamps at approx. one-metre intervals.

- On the drum of the winch at least three turns of wire must remain, otherwise the wire may break loose from the drum fixation.
- The power cable must under no circumstances be under tension. This also applies when the flowmaker is swung out.
- As a principle, the power cable should be laid out in a large circle during installation to avoid sharp bends (breaking) of the cable.
- The power cable must under no circumstances be shortened. It must be installed in its original length. If another cable length is required, please contact ARNOLD AG.

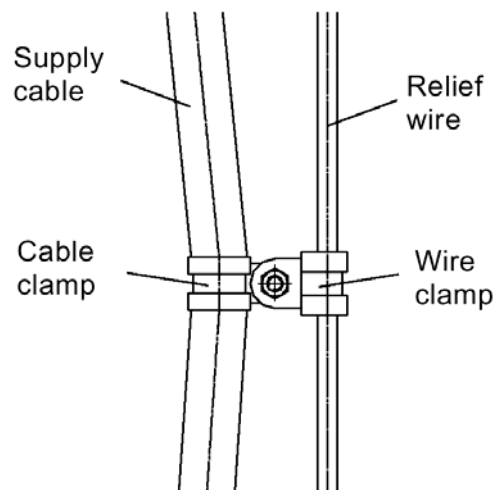


Fig. 11

14. When the motor bracket rests on the depth blocker, the distance between the propeller and the wall and the bottom of the tank must be checked. See section 6.1 *Positioning*.

Note Remember to remove the hook when the flowmaker has been submerged in the tank, otherwise the cable might be caught by the flowmaker.

15. Fasten the relief wire to the top fixation and pre-tension the wire to approx. 250 N (~25 kg).

7 Electrical connection

All electrical connections must be carried out by a qualified electrician in accordance with local regulations.

All currently valid national and local regulations relating to safety and accident prevention must be observed.



Before making any electrical connections, make sure that the fuses have been removed or the mains switch has been switched off. It must be ensured that the electricity supply cannot be accidentally switched on.



The explosion protection classification of the mixers and flowmakers is EEx e ck IIC T3 or EEx de IIC T4 for the ex zones 1+2. In explosive atmosphere only tested and certified material in accordance with the type of protection listed in CENELEC-standard EN 50014, section 1.1 and 1.2 can be used to connect the power cable.

The classification of the installation must in each individual case be approved by the local authorities. The safety instructions in section 4.2 *Explosion-proof versions* must be observed.

The supply voltage and frequency are marked on the mixer or flowmaker nameplate. Make sure that the mixer or flowmaker is suitable for the electricity supply available at the installation site.

The mixers and flowmakers are supplied complete with a power cable of 10 metres (standard length, suitable for tanks up to 6 metres deep).

Note the following:

- If the motor is marked with 230/400 V, it must be connected in star if the mains voltage is 400V.
- If the motor is marked with 400/690 V, it must be connected in delta if the mains voltage is 400 V. It can be started in star/delta.

Three-phase motors

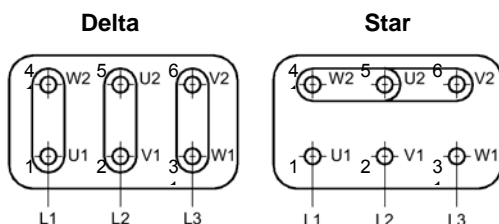


Fig. 12

7.1 Motor protection

The mixers and flowmakers are provided with the following type of motor protection:

Standard mixers incorporate three bimetallic PTO thermal switches (PTO = Positive Temperature Opener), see fig. 14.

Explosion-proof mixers and **all** flowmakers incorporate three PTC sensors (temperature sensors) according to DIN 44 081, see fig. 15.

The cable designation indicates what thermocouples are on hand (see section 7.6 *Wiring diagrams*).

7.1.1 Function of thermal switches

The motor is protected against overheating by three thermal switches connected in series, one switch in each winding.

When the maximum winding temperature is reached, the switch will open the circuit and stop the motor.

When the windings have cooled to normal temperature, the switch will close the circuit and the motor can be restarted. Manual restarting is necessary.

See wiring diagram in fig. 14, section 7.6 *Wiring diagrams*.

Thermal switches can usually be directly integrated in the control circuit.

F6: Thermal switches

- 2 leads, terminals 11 and 12
- Maximum switching current: 2,5 A
- Maximum operating voltage of switch: 250 V
- Cutting-out temperature: 150°C.

7.1.2 Function of PTC sensors

When overheated, the motor will stop. Automatic restarting is not permitted in such cases. This requires a thermistor trigger unit with a reconnection suppressor in the control circuit of the motor contactor.

See wiring diagram in fig. 15, section 7.6 *Wiring diagrams*

91, 92, 93: PTC sensors:

- 2 leads, terminals 31 and 32
- Maximum voltage at the terminals:
 $U_{max.} = 2,5 \text{ V (AC/DC)}$,
- Resistance between terminals:
 - at room temperature $R = 150 \text{ to } 750\Omega$
 - at cutting-out temperature (130°C) $R \geq 4000\Omega$

Note

For transmission tests at terminals 31 and 32, the test voltage must not exceed 2.5 V (AC/DC). Use an ohmmeter for the test.



Explosion-proof mixers must be protected against too high temperature by means of PTC sensors. The sensors must be connected to a certified signal converter. See enclosure C for examples.

7.2 Gearbox/shaft seal housing protection

The gearbox/shaft seal housing is monitored for the ingress of water by a leak sensor incorporated in the gearbox/shaft seal housing.

If the monitoring function is required, the leak sensor must be connected to an Arnold relay, type ALR 20/ A. The ALR 20/A relay must be ordered separately. Part number: 96489569

When the ALR 20/A relay is connected, a current of up to 10 mA will flow through the leak sensor (terminals 21 and 22) in case water penetrates into the oil chamber. The relay triggers an alarm signal and/or switches off the motor.

See wiring diagram in fig. 14 or 15, section 7.5 *Wiring diagrams*.

B: Leak sensor

- 2 leads (terminals 21 and 22),
- Maximum operating voltage: approx. 12 V DC
- Maximum current: 1 up to 10 mA.

To adjust the sensitivity of the ALR 20/A, proceed as follows:

1. Turn the adjustment screw on the relay until the indicator light illuminates.
2. Turn the adjustment screw in the opposite direction until the indicator light goes out.
3. Continue to turn the adjusting screw 60°C (same direction as under point 2).

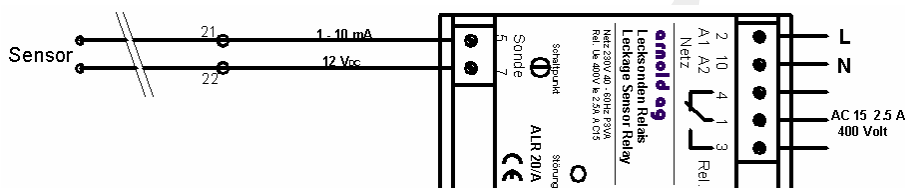


Fig. 13

7.3 Leak sensor relay for explosion-proof products

For mixers and flowmakers with explosion protection EEx e ... "increased safety" gearbox monitoring is mandatory. The relay that has to be used for this purpose ALR 20/A (Ex) is different to a standard relay. The relay must be ordered separately. Part number: 96489569.

See enclosure E for safety instructions for relay ALR 20/A (Ex) The instructions must be read and observed.

7.4 Overload relays

The motor must be protected against overload via a thermal delay relay according to local regulations. The relay must be adjusted to the rated current I_N stated on the nameplate.

In case of star-delta starting, the adjustable value is to be $I_N \times 0.58$.

All six mains leads (U_1, V_1, W_1 and U_2, V_2, W_2), electro-thermal all-pole triggers are to be incorporated.

7.5 Starting method

7.5.1 Mixers

Continuous operation:

Direct starting can be used for motors of 1.5 to 3.0 kW.

Star-delta starting is recommended for motors of 4.0 kW and up.

Intermittent operation:

Star-delta starting is mandatory throughout the entire power range.

7.5.2 Flowmakers

It is recommended to start flowmakers via softstarter.



7.6 Wiring diagrams

7.6.1 Three thermal switches (PTO)

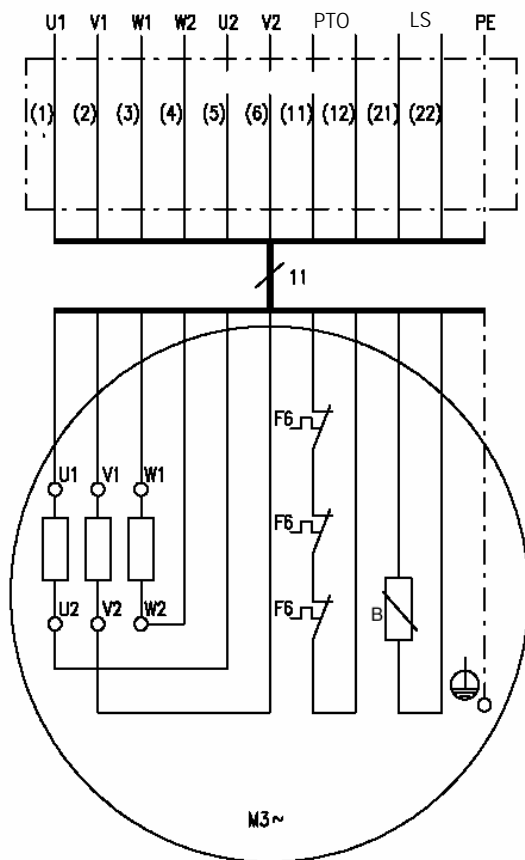


Fig. 14

Terminals	Description
1, 2, 3, 4, 5, 6	Ends of the three stator windings (U1, U2, V1, V2, W1, W2)
11, 12	Thermal switches (F6)
21, 22	Leak sensors in gearbox (B)

7.6.2 Three PTC sensors

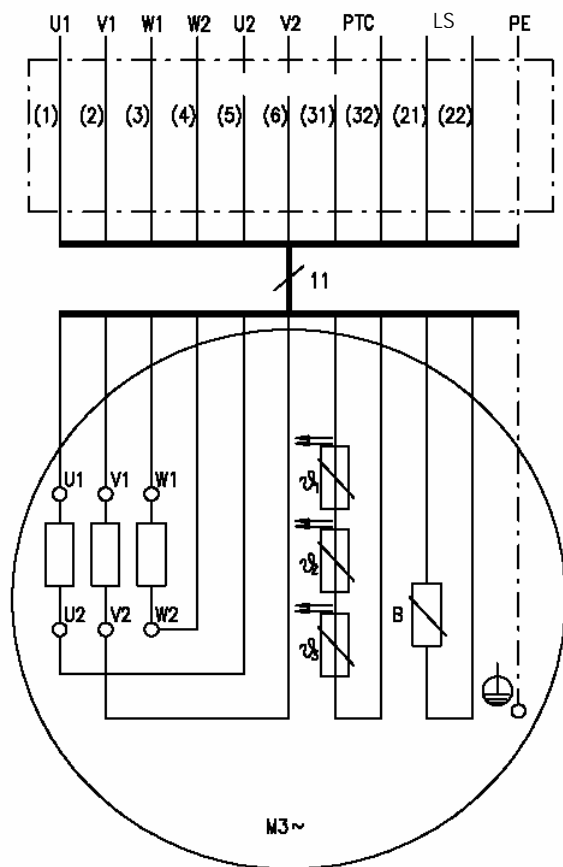


Fig. 15

Terminals	Description
1, 2, 3, 4, 5, 6	Ends of the three stator windings (U1, U2, V1, V2, W1, W2)
31, 32	PTC sensors (according to DIN 44 081) (switches 91, 92, 93)
21, 22	Leak sensors in gearbox (B)

7.7 Direction of rotation

When the electrical connections have been carried out, it must be ensured that the mixer or flowmaker propeller is rotating in the correct direction (when viewed from the motor, the propeller should rotate clockwise). An arrow on the motor housing shows the correct direction of rotation.

If the mixer or flowmaker propeller rotates in the wrong direction, interchange two phases of the mains supply (L1, L2, L3).

7.8 Protection from electro-chemical corrosion

Two different metals or alloys cause electro-chemical corrosion if they are connected by an electrolyte. This applies if more than one mixer or flowmaker are

installed in the same tank. The following additional protection is therefore recommended:

- galvanic separation of the earth lead from the neutral lead or
- galvanic separation of the mains supply by means of isolation transformer.

It is important that the earthing function as well as the function of the potential equalisation persist.

The earth lead must be separated in such a way as to ensure that no direct current can flow through it. It must still function as a protective lead. This can be achieved with a limiting unit (polarization cell or anti-parallel diode) or an isolation transformer.

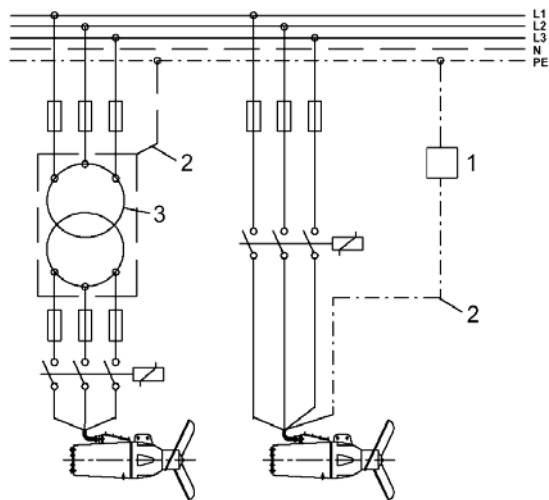


Fig. 16

Pos.	Description
1	Limiting unit
2	Earth lead
3	Isolation transformer



When using an isolation transformer, the ratio between starting current and rated current (I_A / I_N) must not be altered.

8 Start-up

Before starting up the mixer or flowmaker, the oil level in the gearbox/shaft seal housing must be checked. Remove the oil level screw (pos. 3, fig. 17) and check the oil filling hole (pos. 2).



When slackening the oil level screw, note that pressure may have built up in the chamber. Do not remove the screw until the pressure has been fully relieved.

If required, fill oil into the gearbox/shaft seal housing through the oil filling hole (pos. 2). For oil quality and quantity, see section 9.4 *Oil*.

It is necessary to remove the impeller of MDD to check the oil level.

If the mixer or flowmaker has been in stock for a period before start-up, maybe the oil has to be changed.

See section 9.3 *Service chart*.

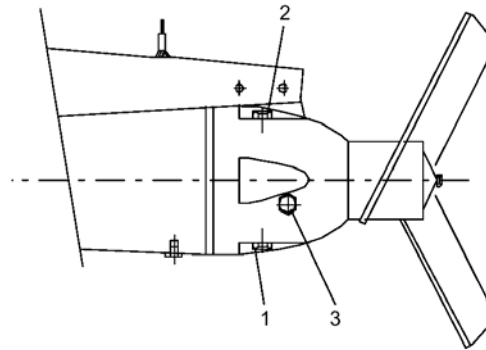


Fig. 17

Before start-up,

- check that the propeller is rotating in the correct direction, see section 7.7 *Direction of rotation*.
- make sure that the mixer or flowmaker is completely submerged in the liquid to be mixed.

Note

The mixer or flowmaker must always be completely submerged during operation.

- make sure that there are no solid objects in the tank.
- make sure that no persons can fall into the tank.

9 Service



Before starting any work on mixers or flowmakers, make sure that the fuses have been removed or the mains switch has been switched off. It must be ensured that the electricity supply cannot be accidentally switched on.

All rotating parts must have stopped moving.




All regulations applying to mixers or flowmakers installed in potentially explosive environments must be observed.

It must be ensured that no work is carried out in potentially explosive atmosphere.

Before starting any work on mixers or flowmakers used to handle liquids which could constitute a hazard to health, thorough cleaning/venting of mixer or flowmaker, tank, etc. must be carried out according to local regulations.

9.1 Explosion-proof mixers and flowmakers

 Explosion-proof mixers or flowmakers must be serviced and repaired by Manufacturer or by a service partner appointed by Manufacturer.

Spare parts

Damaged mixer/flowmaker parts should always be replaced by new approved parts. Motor parts must not be reconditioned by machining, retapping, welding, etc.

9.2 Contaminated mixer or flowmaker

Note

If a mixer or flowmaker has been used for a liquid which is injurious to health or toxic, the mixer will be classified as contaminated.

If Manufacturer is requested to service the mixer or flowmaker, Manufacturer must be contacted with details about the liquid, etc. before the mixer or flowmaker is returned for service. Otherwise Manufacturer can refuse to accept the mixer or flowmaker for service.

Possible costs of returning the mixer or flowmaker are paid by the customer.

However, any application for service (no matter to whom it may be made) must include details about the liquid if the mixer or flowmaker has been used for liquids which are injurious to health or toxic.

9.3 Service chart

	Type	Service instructions	Lubrication	Inspection
Electric motor	All	Keep the motor housing clean (otherwise cooling is affected). The motor housing may only be dismantled by Arnold AG.	The roller bearings are maintenance-free. They should be replaced if they get noisy.	Oil level check and oil change are not required for motors filled with dielectric oil.
Supply cable	All			The supply cable must be checked twice a year for surface damage, strain, kinks, etc. If damaged, the cable must be replaced by Manufacturer
Shaft seal housing	MDD		Change the oil every 8'000 operating hours. Minimum every two years.	
Gearbox	MD	Check the gearbox for leaks twice a year.	Change the oil after 500 operating hours. Then every 8'000 operating hours of after one year of operation.	Check the oil level twice a year, see section 9.4.2 <i>Oil quantity</i> . If refilling is required, see section 9.4.1 <i>Gearbox and shaft seal housing – oil quality</i> .
Propeller	All			Check the propeller blades regularly for wear and tear. Remove any material wound around the blades, such as ropes, threads, etc. which may cause uneven running and oscillation of the installation. In case of strong turbulence, cleaning is absolutely necessary.
Winch	All	Spray the winch with a protective coating of oil at regular intervals (to prevent corrosion).	The gear teeth and the bearing bushes must be lubricated twice a year with all-purpose grease.	
Pull and safety wire	All	Regular oiling or greasing increases the life of the wire.		Check the wire regularly and always before using the winch. Replace the wire, if required.
Screws	All	Always check that all screws in the motor bracket are properly tightened. Check the screws in the fixation base/bottom plate every time the tank is empty.		

9.4 Oil

9.4.1 Gearbox and shaft seal housing – oil quality

Gear oil, designation according to DIN 51 502.

- MDD: ISO VG 150.

- MD: ISO VG 220.

E. g. Brands for ISO VG 220

Ambient temperature	0°C to + 40°C
DIN 51 502 designation	CLP lubricating oil ISO VG 220
ARAL	DEGOL BG 220
BP	ENERGOL GR-XP 200
CALYPSO	UK-ECUBSOLOEL 7050
DEA	FALCON CLP 220
MOBIL	MOBIL GEAR 630
SHELL	OMALA OIL 220
ESSO	SPARTAN EP 220
FUCHS	23°
KLÜBER	RENEP COMPOUND 106
ASEOL	KLÜBER-OIL1 GEM 220
TRIBOL	MIPRESS 220
TRIBOL	TRIBOL 1100 ISO 220

9.4.2 Motor – oil quality

Shell Fluid 4600.

The motor oil should only be changed if the motor is dismantled for service or repair.

9.4.3 Oil quantity / oil level

Type	Gearbox/ shaft seal housing [l]	Motor [l]	Oil level measured from oil filling hole min./max. [cm]
MDD50	0.25	1.7	Oil level screw
MDD160R	0.25	-	Oil level screw
MD50 1.5 kW, 2.2 kW	0.7	2.5	7.6 / 4.4
MD50 3.0 kW 4.0 kW	0.7	2.0	7.6 / 4.4
MD160 5.5 kW 7.5 kW	1.5	6.5	10.5 / 5.5
MD160 11.0 kW	1.5	4.5	10.5 / 5.5
MD250 MD52 1.5 kW 2.2 kW	2.5	7.0	12.5 / 7.5
MD52 3.0 kW 4.0 kW	1.0	2.5	7.6 / 4.4
MD52 3.0 kW 4.0 kW	1.0	2.0	7.6 / 4.4
MD162 1.3 kW to 2.2 kW	1.9	2.5	10.5 / 5.5
MD162 2.4 kW to 4.0 kW	1.9	2.0	10.5 / 5.5

9.5 Oil change

MDD

To change the oil in the shaft seal housing, proceed as follows:

1. Remove the propeller
2. Remove the filling and oil drain screws.
3. Let the oil stand in a glass for approx. 10 minutes and check if it contains water. If the oil contains water, the shaft seal must be replaced.

Note Used oil must be disposed of in accordance with local regulations.

4. Fill with oil, see 9.4.3 Oil quantity / oil level
5. Fit the propeller.

MD

To change the oil in the gearbox, proceed as follows:

1. Place the mixer or flowmaker in a horizontal position on supports and place a pan underneath to collect the oil.



When slackening the oil level screw, note that pressure may have built up in the chamber. Do not remove the screw until the pressure has been fully relieved.

2. Remove the screw (pos. 2), see fig. 18
3. Remove the oil drain screw (pos. 1) and allow the oil to drain from the chamber. Let the oil stand in a glass for approx. 10 minutes and check if it contains water. If the oil contains water, the shaft seal must be replaced.

Note: Used oil must be disposed of in accordance with local regulations

4. Slacken and remove the oil level screw (pos. 3).
5. Refit the oil drain screw (pos. 1).
6. Fill oil into the oil chamber through the filling hole (pos. 2) until it is level with the oil level screw (pos. 3)
See also sections 9.4.1 Gearbox and shaft seal housing – oil quality and 9.4.3. Oil quantity / oil levels.
7. Refit the screw (pos. 2) and the oil level screw (pos. 3).

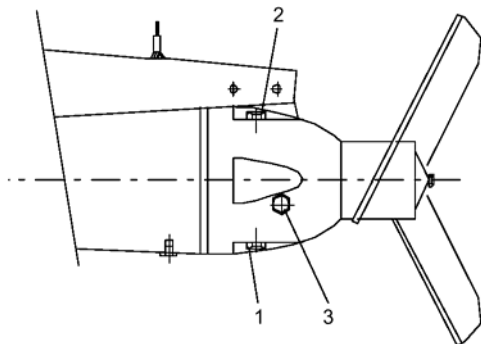


Fig. 18

10 Fault finding



Before starting any work on mixers or flowmakers, make sure that the fuses have been removed or the mains switch has been switched off. It must be ensured that the electricity supply cannot accidentally be switched on.

All rotating parts must have stopped moving.

All regulations applying to mixers or flowmakers installed in potentially explosive environments must be observed.



It must be ensured that no work is carried out in potentially explosive atmosphere.

Keep a service log.

10.1 Fault finding chart

Fault	Cause	Remedy
1. Mixer or flow-maker does not start.	a) No electricity supply or supply failure.	Check the electrical installation. Call in an electrician.
	b) Supply cable is faulty.	Call in an electrician.
	c) Control system is faulty.	Call in an electrician.
	d) Propeller not free to rotate.	Cut out the mixer or flowmaker. Make sure that it can not be restarted by mistake. Clean the propeller blades and check manually that the propeller can rotate freely.
	e) Stator windings are faulty.	Contact Supplier
	f) Motor cut out because of overheating	Wait until the motor has cooled and attempt to restart the mixer or flowmaker.
	g) Different phase voltages.	Call in an electrician.
	h) Overload relay is set too low or is faulty	Check the overload relay. Set the relay to the rated current, see section 7.4 <i>Overload relays</i> .
	i) Leak sensor has cut out the mixer or flowmaker	Contact Supplier
	j) Humidity in motor.	Contact Supplier
2. Mixer or flow-maker starts but stops immediately.	a) Stator windings are faulty.	Contact Supplier
	b) Different phase voltages.	Call an electrician
	c) Overload relay is set too low or is faulty	Check the overload relay. Set the relay to the rated current, see section 7.4 <i>Overload relays</i> .
	d) Leak sensor has cut out the mixer or flowmaker.	Contact Supplier
	e) Humidity in motor.	Contact Supplier
3. No or inadequate circulation produced even if the motor is running	a) Propeller rotates in the wrong direction.	Interchange two phases of the mains supply.
	b) Mixer or flowmaker runs on two phases.	Replace faulty fuses. Call in an electrician. Check the electrical connections.
	c) Internal parts are worn.	Contact Supplier
	d) Propeller blades are dirty or damaged.	Clean the blades and inspect for any wear
4. Mixer or flow-maker runs unevenly and is noisy.	a) Internal parts are worn.	Contact Supplier
	b) Propeller blades are dirty or damaged.	Clean the blades and inspect for any wear.
	c) Faulty motor or gearbox roller bearings.	Contact Supplier
	d) Oscillations caused by the installation (resonance).	Check installation design.

5. High current and power consumption.	a) Wrong voltage supply or supply failure.	Check the electrical installation. Call in an electrician.
	b) Supply cable is faulty.	Call in an electrician.
	c) Control system is faulty.	Call in an electrician.
	d) Propeller not free to rotate.	Cut out the mixer or flowmaker. Make sure that it can not be restarted by mistake. Clean the propeller blades and check manually that the propeller can rotate freely.
	e) Stator windings are faulty.	Contact Supplier
	f) Mixer or flowmaker runs on two phases.	Replace faulty fuses. Call in an electrician. Check the electrical connections.
	g) Internal parts are worn.	Contact Supplier
	h) Faulty motor or gearbox roller bearings.	Contact Supplier

DUPAGRO

11 Technical data

11.1 Motor

MDD50, MD50/160/250/52/162	
Protective system	IP 68 to 20 m
Insulation class	F
Sealing	Radial shaft seal ring
Material, motor housing	Cast iron, grade 25 (EN-GJL-250)

MDD160R	
Protective system	IP 68 to 20 m
Insulation class	F
Sealing	Mechanical shaft seal
Material, motor housing	Stainless steel (1.4404)

MD50/160/250	
Number of blades	2
Propeller diameter	417, 452, 480, 505, 525, 580, 680
Propeller design	Self-cleaning
Material	Stainless steel (1.4404)

MD50/160/250	
Number of blades	2
Propeller diameter	417, 452, 480, 505, 525, 580, 680
Propeller design	Self-cleaning
Material	Stainless steel (1.4404)

11.2 Gearbox

MD50/160/250/52/162	
Type	Planetary gearbox
Gears	Hardened and ground steel
Seal monitoring	Leak sensor incorporated in gearbox
Drive end bearings	2 taper roller bearings
Material gear casing	Cast iron, grade 25 (EN-GJL-250)

MD52	
Number of blades	2
Propeller diameter	1340
Propeller design	Self-cleaning, optimum flow design
Material	Moulded polyamide with stainless steel hub

11.3 Shaft seals

Sealing against ingress of surrounding liquid	
MD50/160/250 MD52/162	2 lip seals and 1 mechanical shaft seal made of tungsten carbide/tungsten carbide
MDD50/160R	1 mechanical shaft seal made of SiC/SiC

MD162	
Number of blades	2, 3
Propeller diameter	1800, 2300
Propeller design	Self-cleaning, optimum flow design
Material hub	Cast iron (EN-GJS-400-15)
Material propeller blades	Epoxy resin (Baydur) with cast iron reinforcement

11.4 Propeller

MDD50/160R	
Number of blades	3
Propeller diameter	320, 390 and 450 mm
Propeller design	Self-cleaning, optimum flow design
Material	Stainless steel (1.4404)

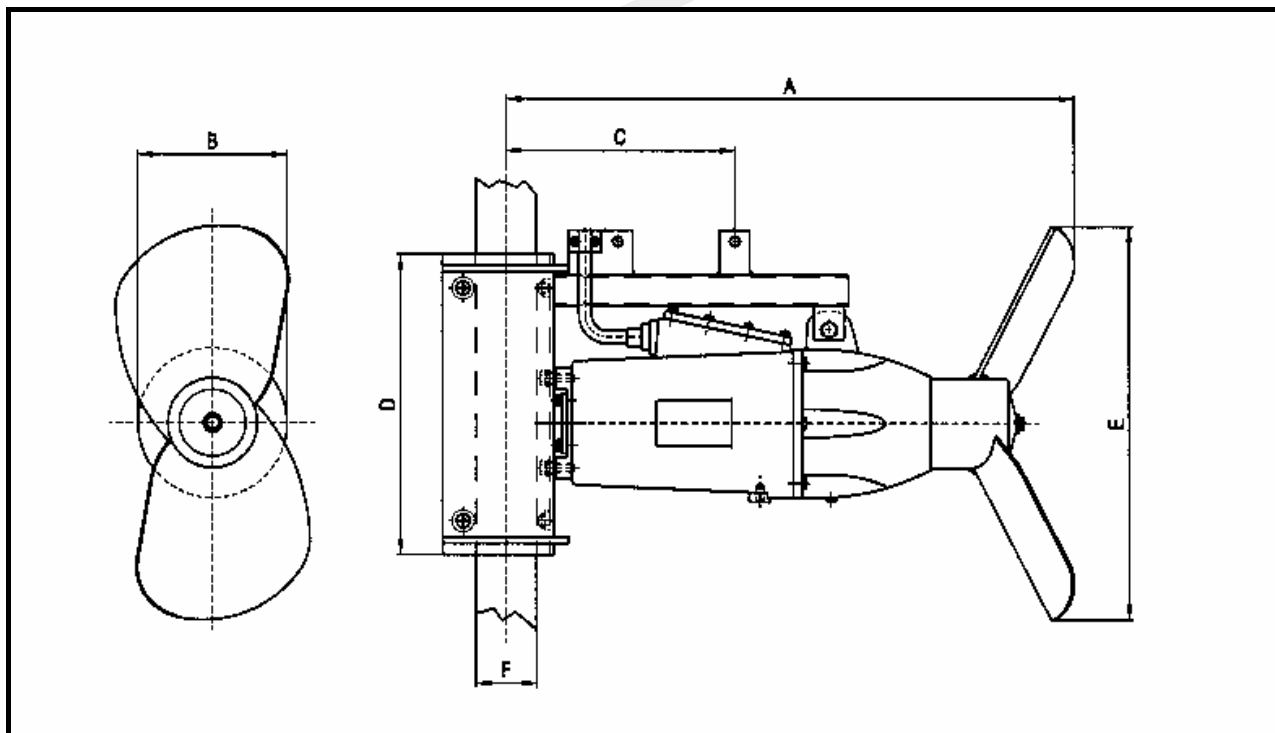
11.5 Sound pressure level

The sound pressure level of the mixer or flowmaker is lower than the limiting values stated in the EC Council Directive 98/37/EEC relating to machinery.

12 Disposal

This product or parts of it must be disposed of in an environmentally sound way:

1. Use the public or private waste collection service.

A.3 MD50/160/250


Type	P ₂ [kW]	A [mm]	B [mm]	C [mm]	D [mm]	E [mm]	F [mm]	Weight (incl. motor bracket) [kg]
MD50 1.5kW	1.5	720	200	305	400	417	80	76
MD50 2.2kW	2.2	735				452		76
MD50 3.0kW	3.0	750				480		83
MD50 4.0kW	4.0	760				525		86
MD160 5.5kW	5.5	980	270	455	500	505	100	167
MD160 7.5kW	7.5	990				580		171
MD160 11.0kW	11.0	1010				680		182
MD250 15.0kW	15.0	1160	315		630	730	120	278
MD250 18.5kW	18.5	1180				780		278

B Circuit scheme for mixer control

