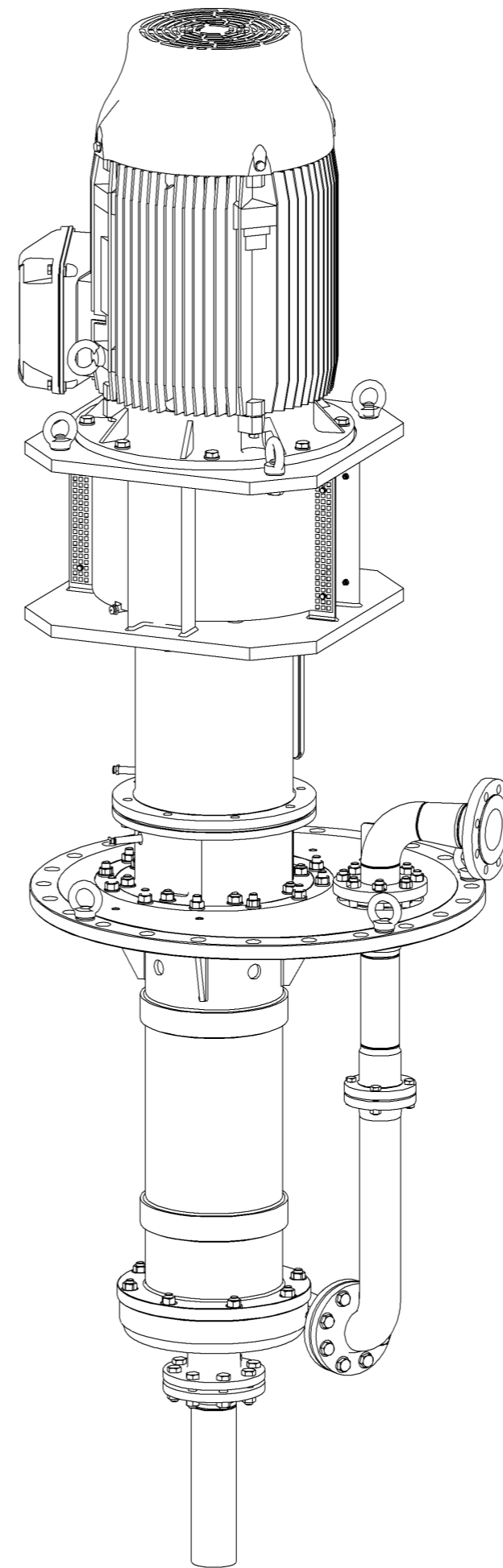


**PAUL BUNGARTZ GMBH & CO. KG**

Düsseldorfer Straße 79  
40545 Düsseldorf, Germany  
T +49 211 577905-0  
F +49 211 577905-12  
[www.bungartz.de](http://www.bungartz.de)  
[pumpen@bungartz.de](mailto:pumpen@bungartz.de)

TP/21\_e



**BUNGARTZ**  
CENTRIFUGAL PUMPS  
SEMI-SUBMERSIBLE  
PUMPS

## CONTENTS

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PUMP TYPE	IMPELLER SHAPE	MAGNETIC COUPLING	POSSIBLE SECONDARY SHAFT SEAL	FLUID PROPERTIES	SOLIDS CONTENT	GAS CONTENT low: up to 5% higher: up to 10% high: up to 20 - 40%	BOILING	ATEX ZONE
<b>T</b>	open		A, B, C, D	1, 2	x	higher		2
<b>T-AN</b>	open		A, B, C, D	1, 2, 3	x	high		2
<b>F-T (AN)</b>	free flow		A, B, C, D	2, 3	x	high	x	2
<b>VKT</b>	open	in special design	A, B, C, D, E, (F)	1, (4)	x	higher		1, 2
<b>VB</b>	open	in special design	C, D, (E), (F)	2, 3, (4)	until muddy	high	in special design	1, 2
<b>TCC-GS</b>	closed		C	1	low	low		1, 2
<b>TCC-OS</b>	open		C	2	x	higher		1, 2
<b>TCC-AN</b>	open		C	1, 2, 3	x	high		1, 2
<b>MPCT</b>	open	x	F	2, 4	x	higher	x	1, 2
<b>MPCT-AN</b>	open	x	F	2, 3, 4, 5	x	high	x	0

**DEEPLY INVOLVED.**  
**BUNGARTZ**  
**SUBMERSIBLE PUMPS.**

Semi-submersible pumps made by BUNGARTZ are specially designed for difficult pumping tasks. In the basic version, all pumps have a hydrodynamic seal which prevents the secondary seal (such as a gland, double mechanical seal etc.) from being in direct contact with the pumping medium. All models, even those with magnetic coupling, are ideally suited for dry-running. The reason: grease-lubricated roller bearings that are not in contact with the product are used in all cases. This reduces the probability of failure to the calculable service life of this specific roller bearing. As a result, the overall arrangement is guaranteed to prove highly reliable in operation.

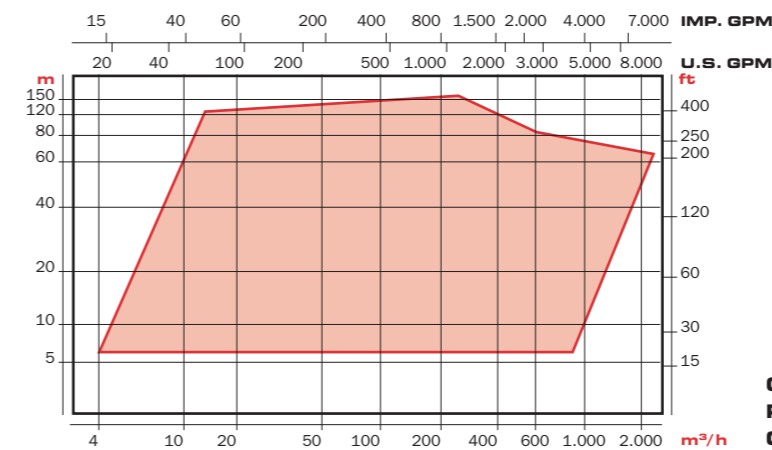
The detailed table provides an overview of the requirements and items on offer. It enables the selection of media properties, pumping medium, ATEX zone, immersion depth and the type of shaft seal required – please see the legends.

**SECONDARY SHAFT SEAL.**

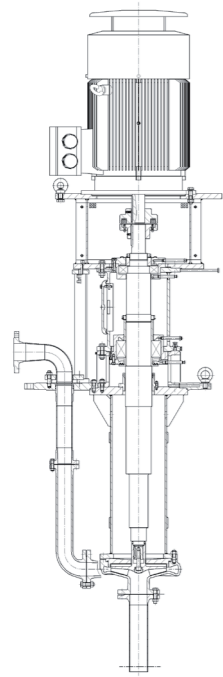
- A** open shaft gap
- B** throttle bushing
- C** lip seal
- D** gland
- E** double mechanical seal
- F** dry-running magnetic coupling

**MEDIA PROPERTIES.**

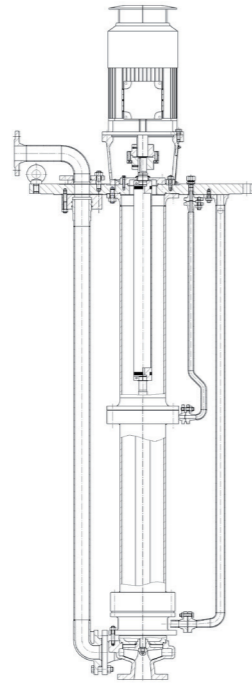
- 1** normally contaminated or clean pumping media
- 2** pumping media with higher solids content
- 3** gas-laden, boiling-critical and contaminated liquids
- 4** toxic liquids for which hermetic sealing is desired
- 5** toxic liquids which are also boiling-critical or gas-laden, or for applications where self-regulation is meaningful or the emptying of residues is desired (e.g. slop tanks in refineries)



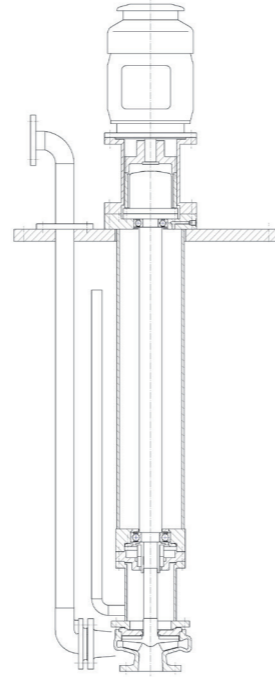
**GENERAL PERFORMANCE OVERVIEW**



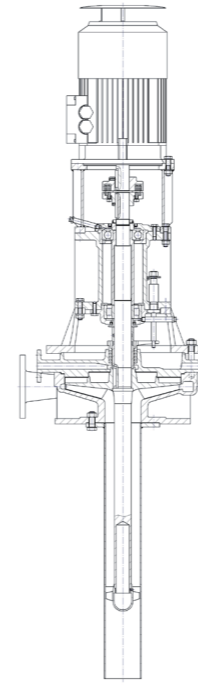
**T / T-AN / F-T**



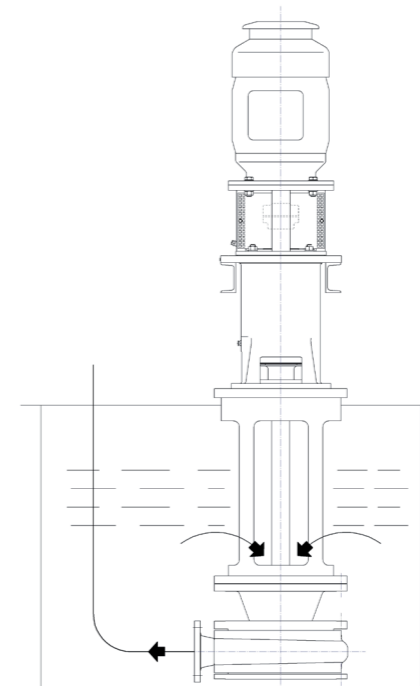
**TCC / TCC-AN**



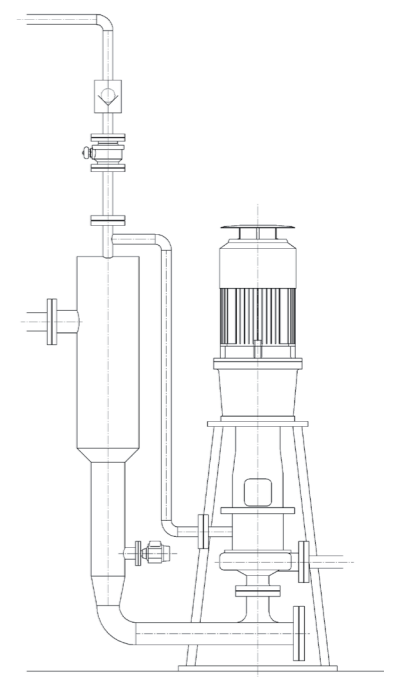
**MPCT / MPCT-AN**



**VKT**



**VB**



**ALTERNATIVES**

**T / T-AN / F-T**

- cantilever design without bearing or seal in the liquid
- in the basic version with maintenance-free, hydrodynamic shaft seal
- permanently safe to run dry
- very reliable, as there are no components that are subject to wear except for roller bearings
- immersion depths up to 1.5 m
- deeper suction by means of suction tube extension or suction device
- available in different impeller shapes, also for boiling liquids

> further information on **page 6**

**TCC / TCC-AN**

- for large immersion depths of up to 5.5 m
- gas-sealed shaft seal for media according to TA Luft
- safe to run dry
- very reliable, as there are no components that are subject to wear except for roller bearings
- available in different impeller shapes, also for boiling liquids

> further information on **page 10**

**MPCT / MPCT-AN**

- ideal for slop, which can be solid-laden, boiling and toxic
- for large immersion depths of up to 5.5 m
- hermetic shaft seal with dry-running magnetic coupling
- safe to run dry
- very reliable, as there are no components that are subject to wear except for roller bearings
- available in different impeller shapes, also for boiling liquids
- also suitable for zone 0

> further information on **page 14**

**VKT**

- ideal for small installation openings
- in the basic version with maintenance-free, hydrodynamic shaft gap seal
- also available with dry-running magnetic coupling
- safe to run dry
- very reliable, as there are no components that are subject to wear except for roller bearings
- can be combined with suction devices such as injectors, so that this is an alternative to the classic semi-submersible pump for high vessels

> further information on **page 18**

**VB**

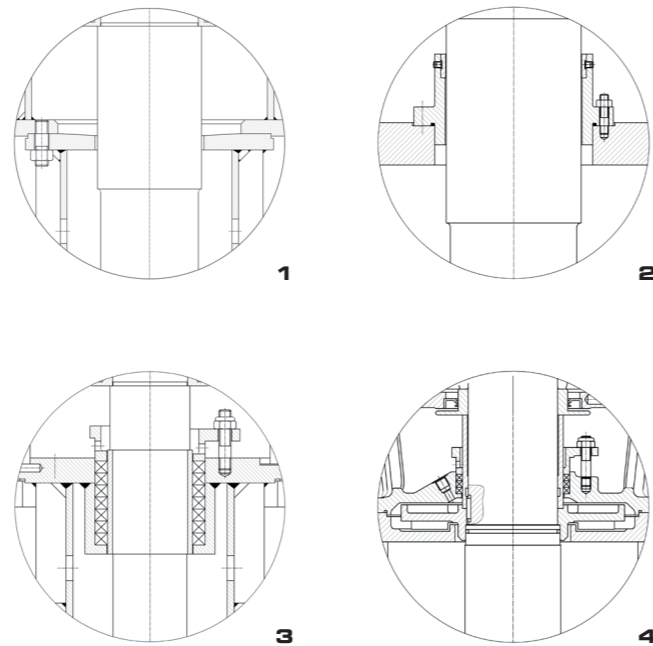
- ideal for very small suction heads, also for dry installation in the chemical industry
- for waste water plants
- in the basic version with maintenance-free, hydrodynamic shaft seal
- safe to run dry
- very reliable, as there are no components that are subject to wear except for roller bearings

> further information on **page 22**

**ALTERNATIVES TO SEMI-SUBMERSIBLE PUMPS**

Depending on the requirement, a semi-submersible pump is not always the ideal choice. This is because the safety aspect is decisive in every case – and cost reasons can also speak in favor of alternative approaches. As usual, BUNGARTZ finds the perfect solution for every challenge – no matter how complex it is.

> further information on **page 26**



**SEAL VARIATIONS**  
 1 open shaft gap 2 throttle bushing  
 3 gland 4 seal expeller

**PROFOUNDLY ACTIVE.**  
**TYPE T / T-AN / F-T.**

In pumps of this design, the back vanes of the impeller provide a hydrodynamic seal against the delivery pressure. There is no liquid in the shaft tube during operation.

If the pump is switched off, the liquid is diverted into the vessel through relief holes below the support plate. In the case of non-toxic media this makes any additional shaft seal practically superfluous. The consequence: maximum operational dependability.

**IMMERSION DEPTH A.**

How do you determine the possible immersion depth A, measured from the bottom roller bearing to the impeller? On the one hand by the deflection of the shaft under operating conditions, and on the other hand by the critical rotational speed. This is the speed at which the natural frequency of vibration of the shaft coincides with the rotational speed of the shaft. And this frequency has at least a 20% safety margin from the desired operating speed.

How are potential immersion depths determined? Demand-specific! They can reach up to 1.5 m, depending on the rotational speed. Depending on the level of the liquid, it may also be possible to use the area of the bearing bracket. Furthermore, deeper suction can be carried out by means of a suction tube extension.

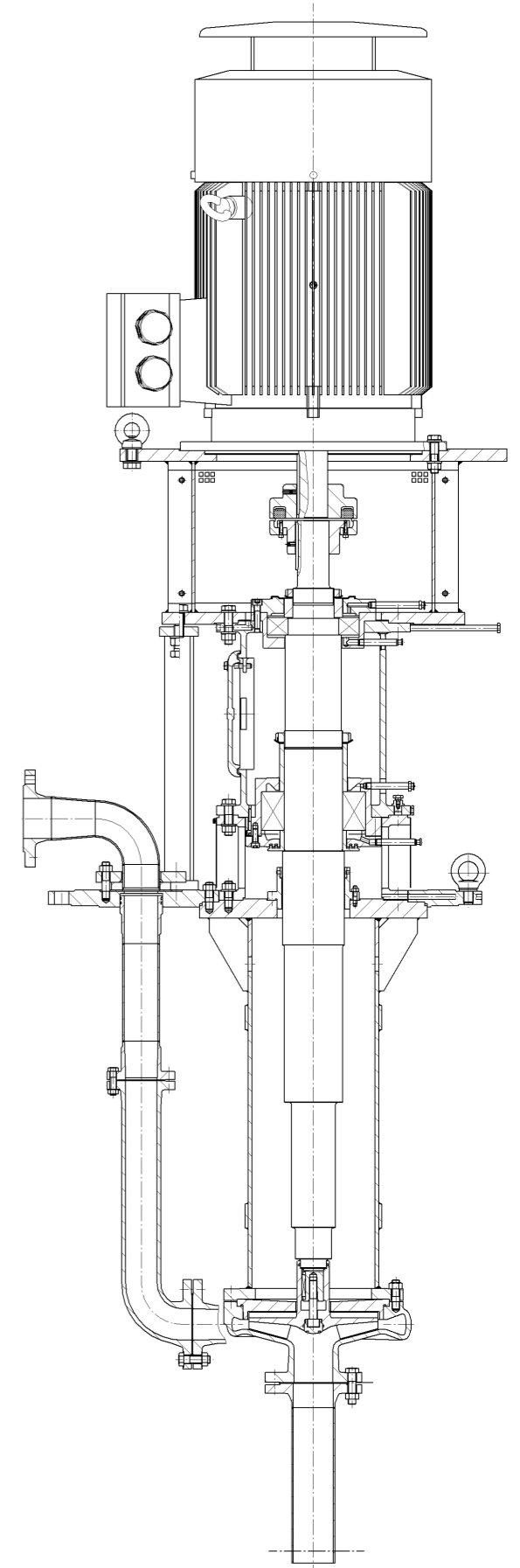
**SUCTION DEPTH H<sub>s</sub>.**

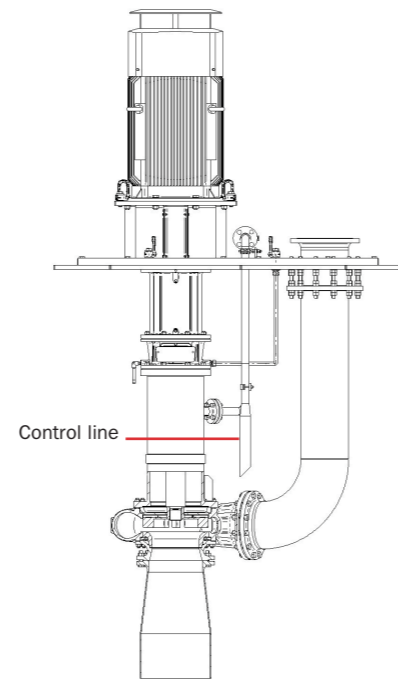
When the impeller of the pump is submerged, this enables the liquid level to fall deeper, even to below the impeller. The possible suction depth H<sub>s</sub> with additional suction pipe (see page 8/9, installation 1 and 3) is essentially determined by three factors: the density, the vapor pressure and the NPSH value of the pump.

$$H_s = \frac{P_{VESSEL} - P_{VAPOUR}}{\rho} - NPSH_R$$

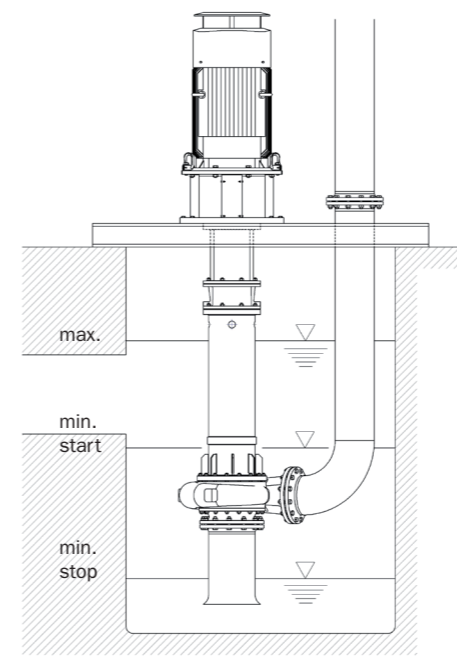
**THE FOLLOWING ADDITIONAL SEALS ARE POSSIBLE:**

- **PACKING GLAND**
- **THROTTLE BUSHING**
- **SEAL EXPELLER**  
 (if there is a negative pressure in the support tube)

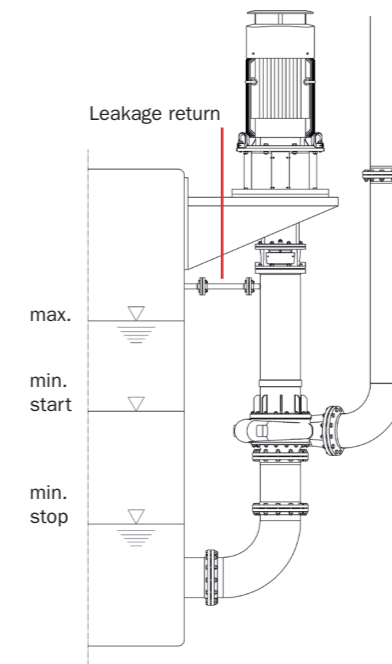




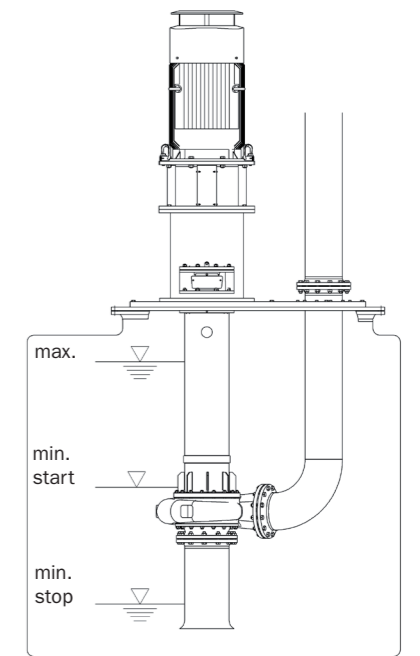
**T-AN**



**1**



**2**



**3**

**SIMPLY GOOD  
THREE TIMES OVER.**

**TYPE T / T-AN / F-T.**

**INSTALLATION TYPE 1.**

This is mainly used for open pits. In order to increase the immersion depth, it also uses the bearing bracket. The lubrication lines of the roller bearings are led out of the pit. Here, the maximum liquid level must not be exceeded under any circumstances.

**INSTALLATION TYPE 2.**

This extends the functionality of the pump system. Is a semi-submersible pump required, for example, to ensure protection against leakage and also take advantage of outdoor installation (for better monitoring, for example). Then this variant allows the pump to be installed high enough to safely return the backflow volume above the maximum liquid level.

**INSTALLATION TYPE 3.**

This is suitable for closed containers. In this case, the bearing bracket is located outside the mostly corrosive atmosphere.

**THE FOLLOWING APPLIES TO ALL  
INSTALLATION TYPES:**

The level of the liquid can be lowered to deeper than the housing by means of a suction tube.

**TYPICAL  
INSTALLATIONS:**

**1 MINE PUMP**

- no bearing in the pumped liquid
- without a shaft seal,  
with overflow opening for backflow relief

**2 EXTERNAL ATTACHMENT PUMP**

- no bearing in the pumped liquid
- without frictional shaft seal
- standpipe with overflow connection

**3 VESSEL INSTALLATION PUMP**

- no bearing in the pumped liquid
- without frictional shaft seal
- with pressure pipe and support flange

**EXAMPLES OF IMPLEMENTED  
APPLICATIONS AND PUMPED MEDIA:**

**PUMPED MEDIUM: AMMONIUM NITRATE.**

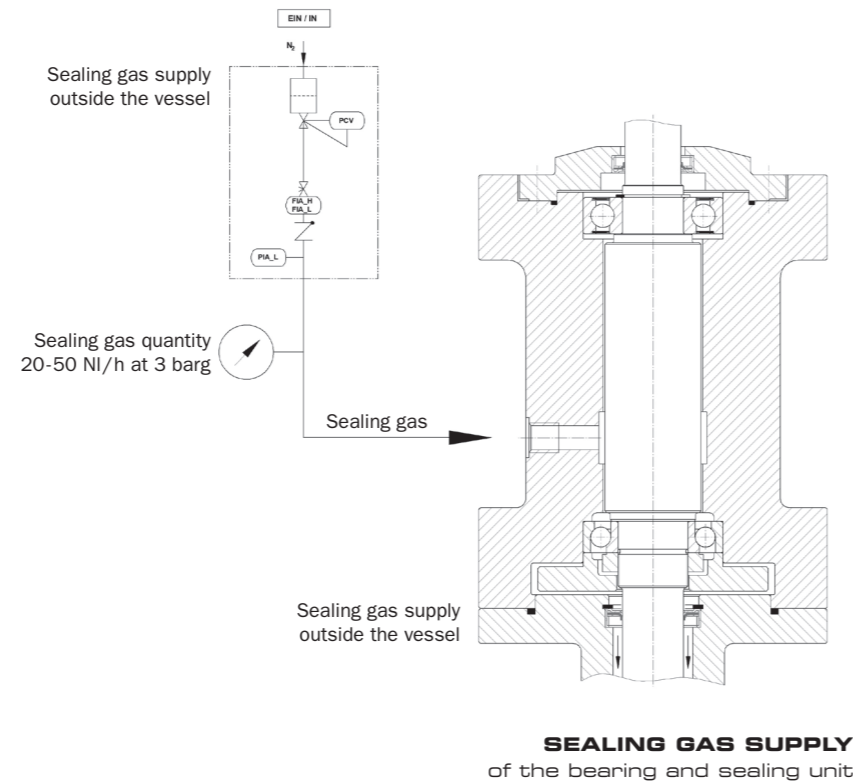
When highly concentrated, ammonium nitrate is an explosive medium. Only pumps with a hydrodynamic seal can be used for pumping it. Friction seals and product-lubricated slide bearings are not permitted. For intrinsic safety, only a throttling gap is used as secondary seal, and the pump is installed as shown in Fig. 3.

- > AN Concentration 95 %,  
140 – 150 °C, Density 1,42 kg/dm<sup>3</sup>,  
45 m<sup>3</sup>/h, 83 m, 2950 1/min

**PUMPED MEDIUM: CHEM. WASTEWATER.**

Since wastewater volumes fluctuate greatly, the self-regulating pump with an additional control line is used. This enables the pit dimensions to be minimized. Depending on the water level, a control system will increase the rotational speed from 980 rpm to 1470 rpm when there is plenty of wastewater (see Fig. T-AN).

- > Chemical waste water, 50 °C,  
300 – 900 m<sup>3</sup>/h, 20 – 30 m



**GIVING IT SOME GAS.**  
**TYPE TCC / TCC-AN.**

Pumps of this type rely on a gas-sealed lip seal. The gas injection provides mechanical relief and ensures that they operate without friction. The positive effect: it therefore achieves the properties of a gas-locked double mechanical seal.

The bearing arrangement consists of maintenance-free roller bearings. This concept allows the sealing and bearing unit to operate independently of the pumping medium. This makes it safe to run dry.

In the case of the hydraulics, you have a choice. The pump is available with open or closed impellers, as well as in the version with a very low NPSH (type TCC-AN). This is practical even in applications with boiling liquids.

Thanks to the modular bearing concept in versions A, B and C, overall lengths of up to 5.5 m can be created – with only 4 roller bearings.

**VERSION A:**

Base unit with 2 roller bearings for immersion depths of up to 2.8 m

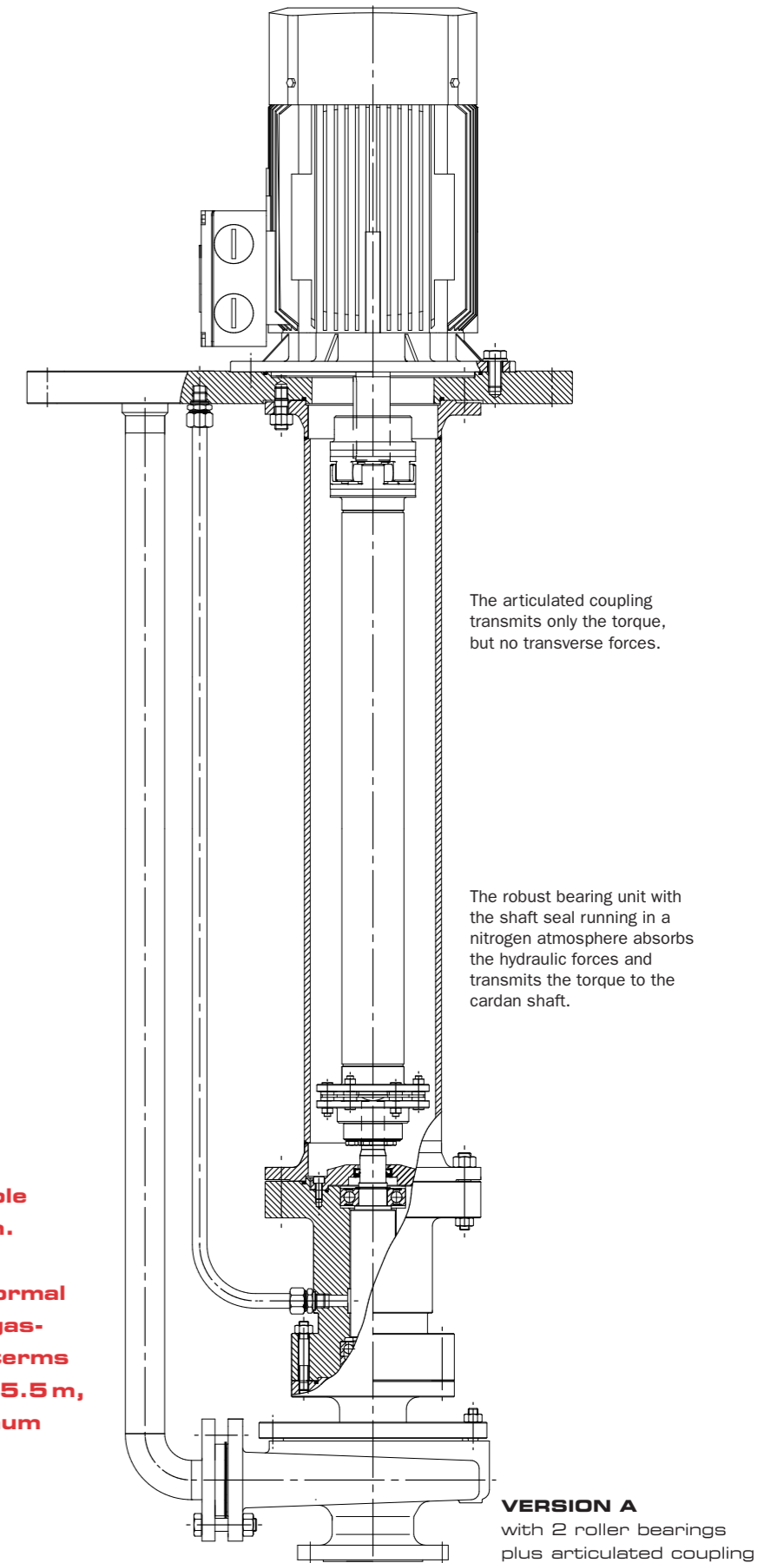
**VERSION B:**

with 4 roller bearings for immersion depths of up to 4 m

**VERSION C:**

with 4 roller bearings and 2 articulated couplings for immersion depths of up to 5.5 m

**The concept of the TCC submersible pump is based on a modular design. This applies not only in the field of hydraulics, which is available for normal to solid-laden, boiling-critical and gas-laden liquids. It also impresses in terms of overall length. Because even at 5.5 m, it operates correctly with a maximum of 4 roller bearings.**



## A WELL-OILED SYSTEM.

### TYPE TCC / TCC-AN.

When production liquids are pumped from high storage tanks, it must be possible to access them from any liquid level. Pumps with suction tubes are not suitable here. This is because the impeller has to reach to the bottom of the vessel. The TCC is then the solution of choice. This is because it functions with roller bearings that are lubricated for life and a shaft seal that is superimposed by sealing gas without friction. Depending on the requirements, semi-open or closed impellers are needed here. For boiling liquids, the pump is equipped with the tried and tested AN hydraulics and pressure equalization line.

#### EXAMPLES OF IMPLEMENTED APPLICATIONS:

##### PUMPING MEDIUM CONDENSATE WITH TCC-AN.

Condensates such as water condensate or hydrocarbons are often close to the boiling point. Then the NPSH value is 0 and standard pumps require a minimum suction head of 1 – 2 m. This is not necessary for type TCC-AN, thanks to the internal pressure balance between the impeller inlet and vessel pressure. In this way the liquid level can be lowered to the pump casing with

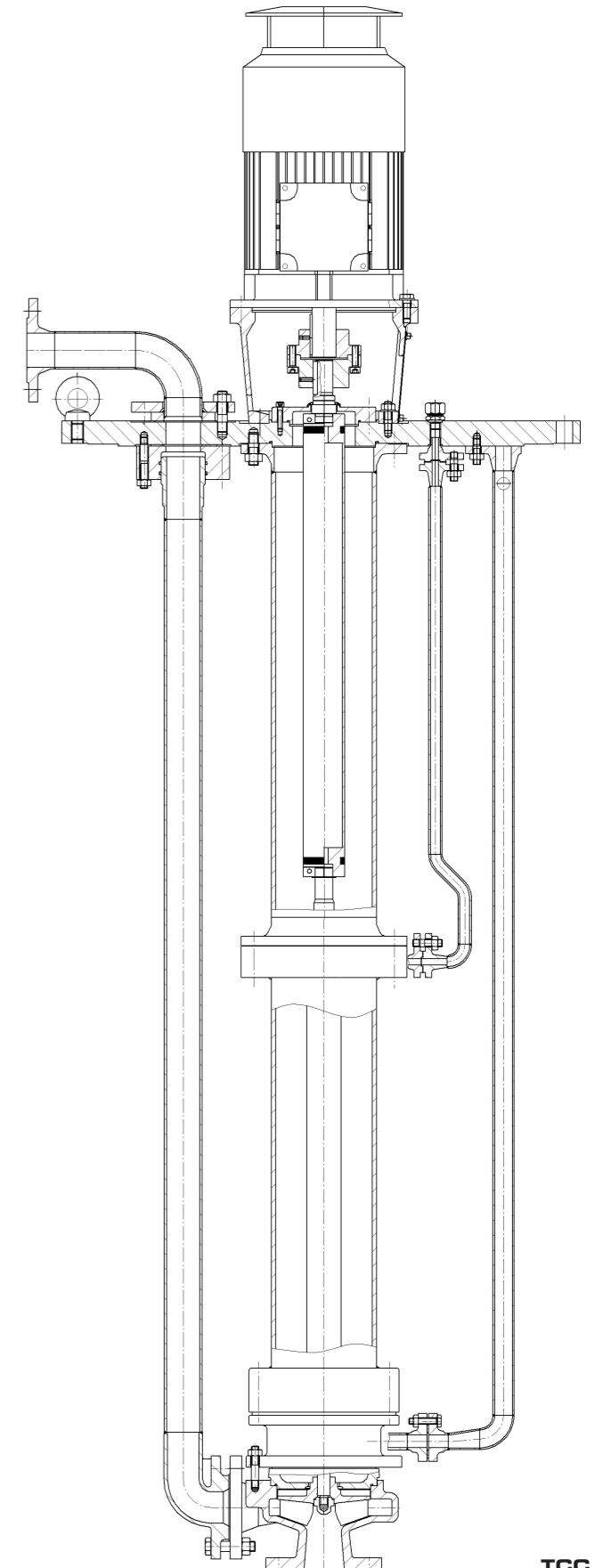
these pumps even under boiling conditions – without cavitation.

#### ANOTHER PLUS:

with the TCC-AN, all forms of regulation can be dispensed with. This is because the delivery rate below a suction head of 1 m is automatically reduced. This means that there is no risk of cavitation or dry-running even in the event of a shortage of liquid.

#### CHEMICAL WASTEWATER WITH SOLIDS.

Classical submersible pumps with slide bearings cannot do the job in the case of chemical wastewater (slops) containing solids or other admixtures. Here the TCC type is the better choice. As it is designed without product-lubricated bearings and with a frictionless gas-sealed lip seal, it is also approved for zone 1 use. And if boiling media are fed into the tank, the version with a very small NPSH value – the TCC-AN – is ideal.





## PLAYING IT SAFE. TYPE MPCT / MPCT-AN.

This pump has a similar bearing arrangement to the TCC / TCC-AN version. It consists of maintenance-free, grease-lubricated roller bearings that operate independently of the pumping medium.

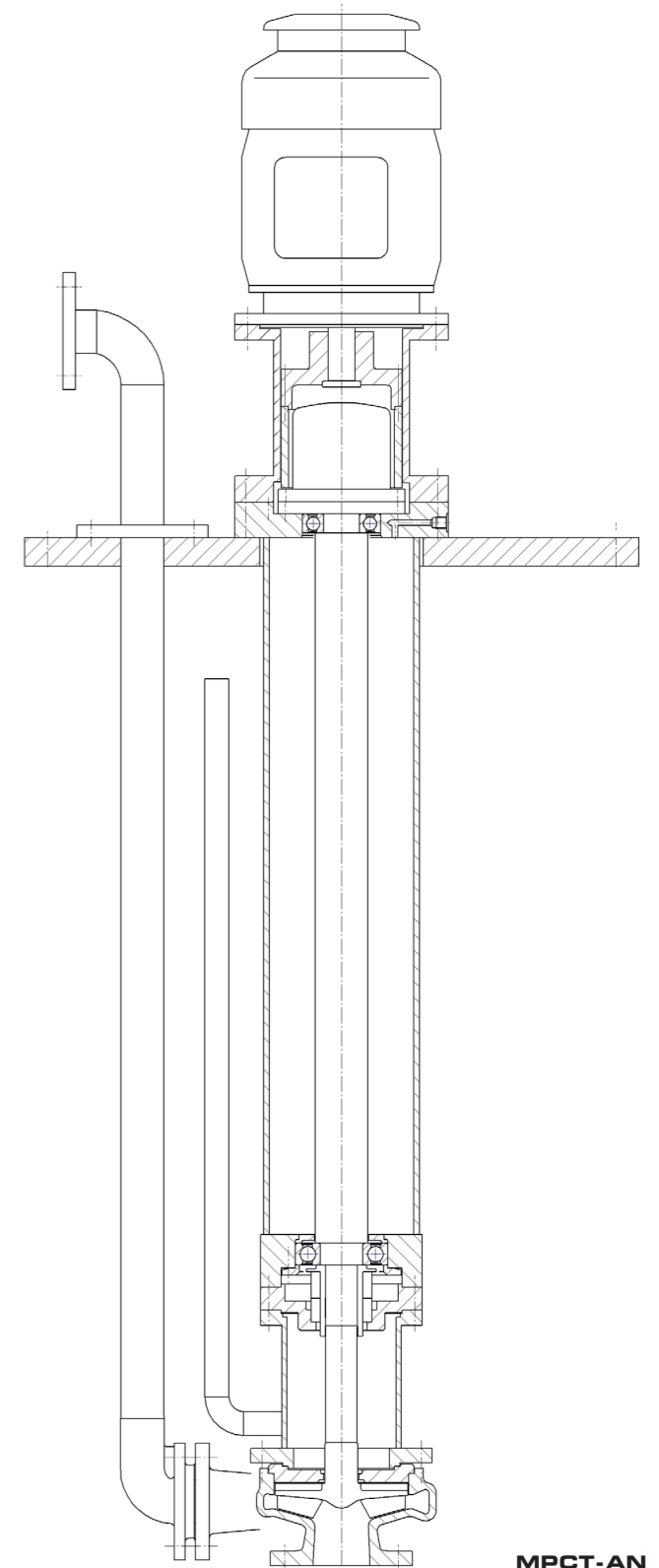
However, the shaft gap seal stands out here with its particularly advanced safety concept. This is due on the one hand to the lip seal unit, which is relieved of the pumping pressure by impeller back vanes. The pump is opened towards the product side with a sealing gas pressure. As a result, its operation is friction-free and ensures that the bearing runs in a clean atmosphere. On the other hand, an eddy current-free magnetic coupling is used here, whose containment can provide a hermetic seal against the atmosphere.

Even if the sealing unit consisting of a lip seal and magnetic coupling is closed towards the product and the surrounding environment, the operating situation can be monitored at all times – quite simply through the targeted monitoring of the sealing gas flow rate in the sealing gas system.

### SHAFT GAP CONCEPT.

- complete hydrodynamic sealing by means of impeller back vanes
- gas barrier to protect the bearing unit from the penetration of product vapors
- bearing and sealing unit permanently dry-running
- hermetic seal ensured by eddy current-free magnetic coupling that is always dry-running

**The triple safety system means that vapors or liquids never escape - even if there are malfunctions in the bearing or in individual sealing components.**



MPCT-AN

## BRING ON THE CHALLENGES.

### TYPE MPCT / MPCT-AN.

Pumps of this type are mainly used as a slop application in refineries. This is an extremely demanding field of application. This is because so-called hydrocarbons often occur together with boiling-critical media such as water under atmospheric conditions at high temperatures – and often accompanied by solids. The advantage of this powerful pump: the semi-open, self-venting impeller is capable of perfectly satisfying all of these requirements.

The MPCT-AN version is designed to have a roller bearing that is independent of the medium and a dry-running magnetic coupling. This means that it is guaranteed to be safe to run dry even in ATEX zone 0 applications. Depending on the media properties, the focus is on the hydraulics. These work perfectly in the AN version even under boiling conditions.

### IMPLEMENTED APPLICATIONS AND PUMPING MEDIA:

#### PUMP FOR DIFFICULT APPLICATIONS.

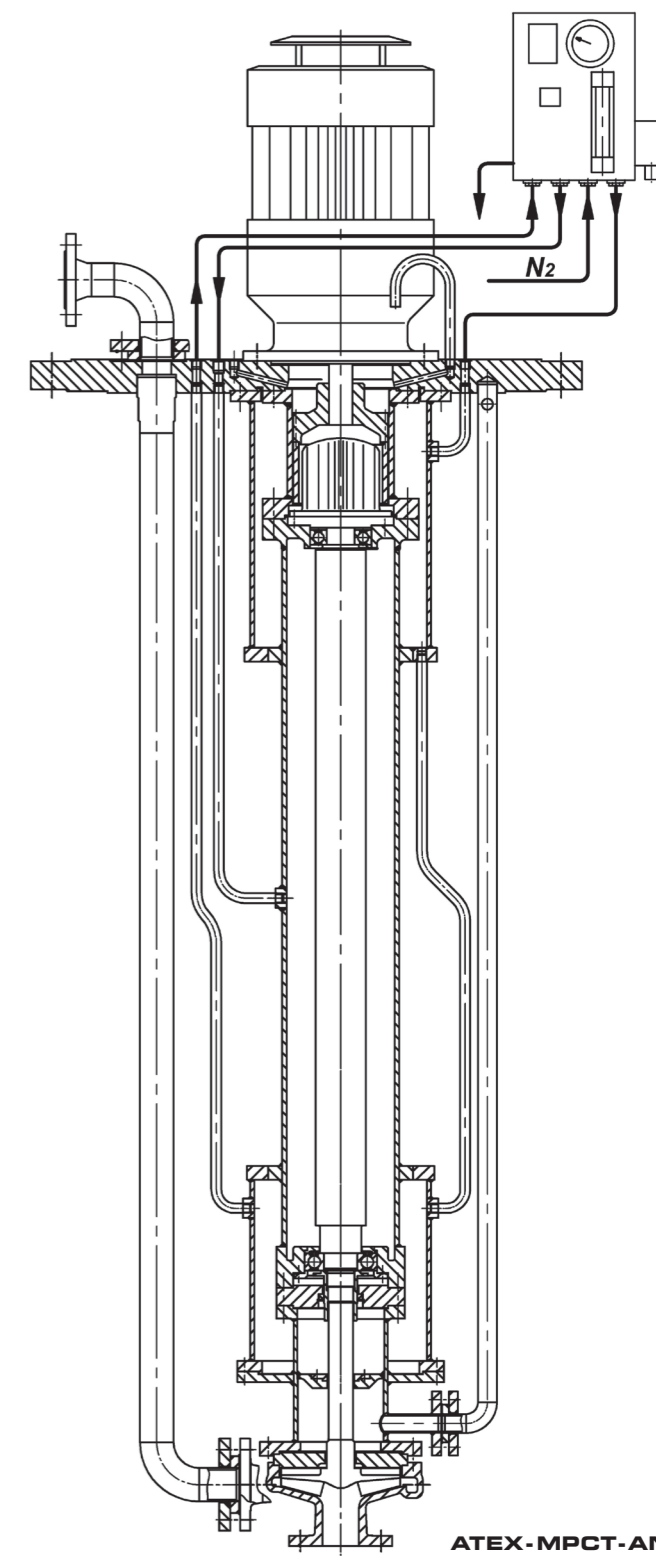
This type of pump is perfect for toxic media, boiling or gas-laden, solid-laden or hot liquids. The hermetic seal provided by the dry-running and eddy current-free magnetic coupling facilitates pumping without restriction.

#### SPECIAL DESIGN.

Approved as a special design, this pump can also be used for ATEX zone 0.

#### VERY HOT LIQUIDS.

In order to cope with hot liquids, the pump is provided with a protective jacket. In the case of pumps with slide bearings, this would lead to the problem of temperature expansion. But this is precisely what is prevented by a special suspension of the pump and the use of roller bearings.



ATEX-MPCT-AN

## MAKE WAY! TYPE VKT.

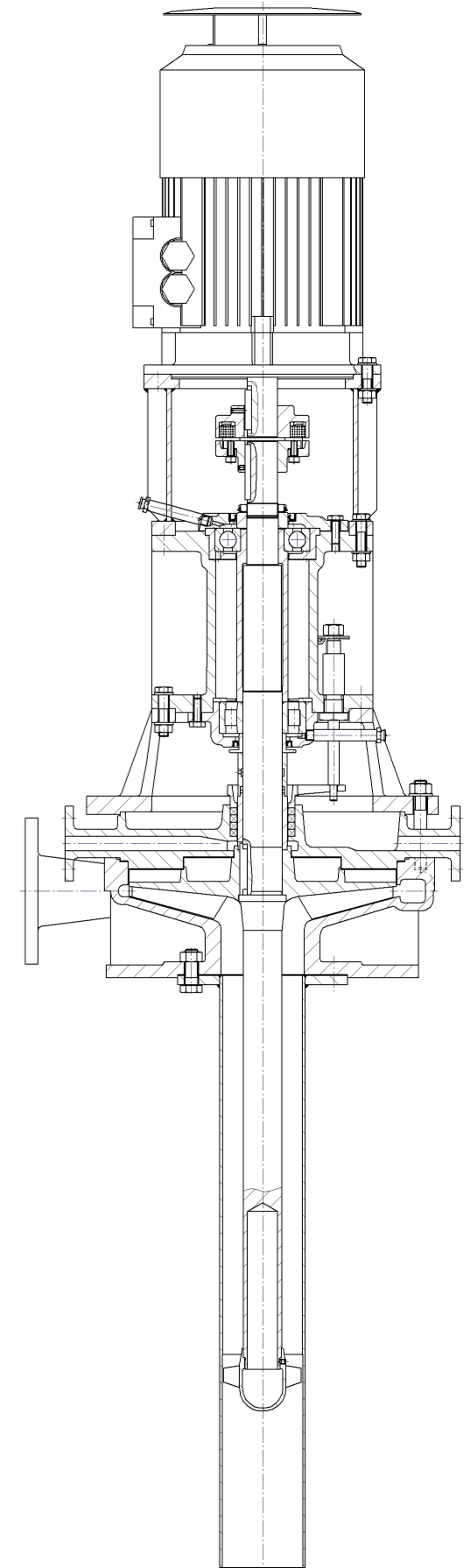
A VKT-type pump is satisfied with little space. As a rule, a pipe flange of nominal size DN 150 to DN 250 is sufficient.

Only the small axial propeller which lifts the product to the radial impeller is immersed in the pumped liquid. The impeller is then used for the actual pressure increase.

The bearing of pumps of this design also consists of grease-lubricated, long-life roller bearings. This is provided by a hydrodynamic seal plus an additional labyrinth bushing. If leakage occurs, it is returned to the vessel via a return line. One particularly pleasing aspect is the fact that the pump in this basic version proves to be practically maintenance-free. Depending on the medium, the secondary seal can be installed downstream of the friction-free seal. Whether in the form of a gland, a double mechanical seal, a gas-sealed lip seal or, as a special case, a dry-running magnetic coupling – many things are feasible here.

### SHAFT GAP CONCEPT.

- complete hydrodynamic sealing by means of impeller back vanes
- return labyrinth to provide relief for the secondary seal
- bearing and sealing unit permanently dry-running
- secondary seal, designed as a gland, double mechanical seal or dry-running magnetic coupling, depending on requirements
- for immersion depths of up to approx. 1.2 m



## IN A TIGHT SPOT. TYPE VKT.

A VKT-type pump is called for when things get tight. Its main field of application is therefore the space-saving vessel installation with low suction heads. Thanks to the external bearing, the pump represents an extremely reliable solution. The reason for this is that its condition can be effortlessly monitored all the time.

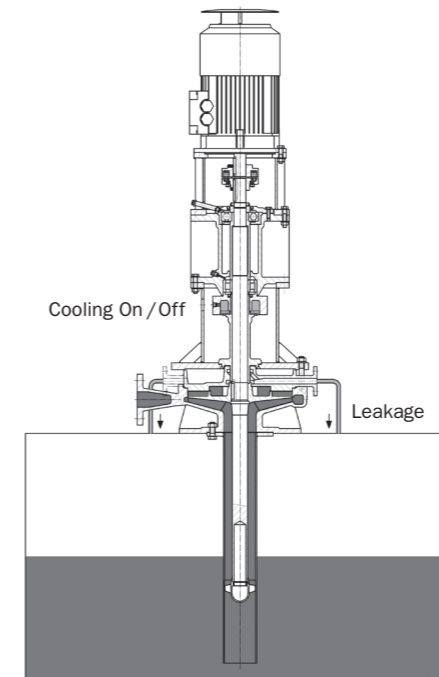
The powerful pump proves its worth both as a production pump and in the circulation loop. The external bearing and seal mean that it is ideally suited to higher temperatures as well as solid-laden liquids.

### TYPICAL INSTALLATIONS:

- molten salt crucible, up to 400 °C
- emptying system for high storage tanks

### IMPLEMENTED APPLICATIONS AND PUMPING MEDIA:

- molten salt at 400 °C
- circulation/circulating pump with little inflow
- emptying system with injector



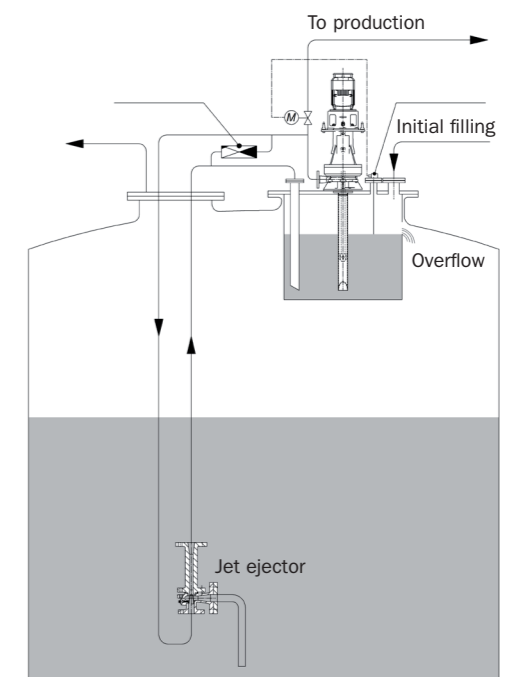
**MOLTEN SALT CRUCIBLE**  
at 400 °C

### MOLTEN SALT CRUCIBLE.

In the melting crucible, pumps with slide bearing had been used up to now. But damage often occurred in the process. A VKT-type pump can provide an effective remedy in this situation. It solves the problems by having the bearing arrangement in the form of a roller bearing outside the crucible.

Only the suction propeller is immersed in the hot melt. This minimizes the heat input into the structure. A heat barrier above the pressure port reduces the bearing temperature to below 60 °C.

A shaft seal, such as a mechanical seal, is replaced by the combination of a hydrodynamic seal and leakage return line.



**EMPTYING SYSTEM**  
for high storage tanks

### EMPTYING SYSTEM.

Long submersible pumps have a hard time with storage tanks that are up to 12 m high and contain toxic production materials. Their use is critical. The way out: a short pump inserted in a small container, combined with a jet pump. Should the pump ever need to be removed for maintenance reasons, the container can simply be drained.

The jet pump is supplied by the centrifugal pump with a driving flow under a higher pressure. This supplies an additional useful flow rate, which is metered into the system by means of a control valve. If too much liquid is pumped, this will conveniently flow back into the storage tank via an overflow.

This intelligent combination results in a solution that is both reliable and low-maintenance.

## HIGHS AND LOWS. TYPE VB.

The VB type is adaptable. On the one hand, it can be supplied as a submersible pump when very low suction heads are required – e.g. when pumping from a channel. On the other hand, it is available as a dry-mounted pump with an integrated vessel. The feed tank is then no longer needed.

The VB is particularly suitable for solid-laden, foaming or gas-laden liquids. The medium enters the impeller of the pump, which is open on the drive side, from above. This is precisely why the supply line can run completely empty.

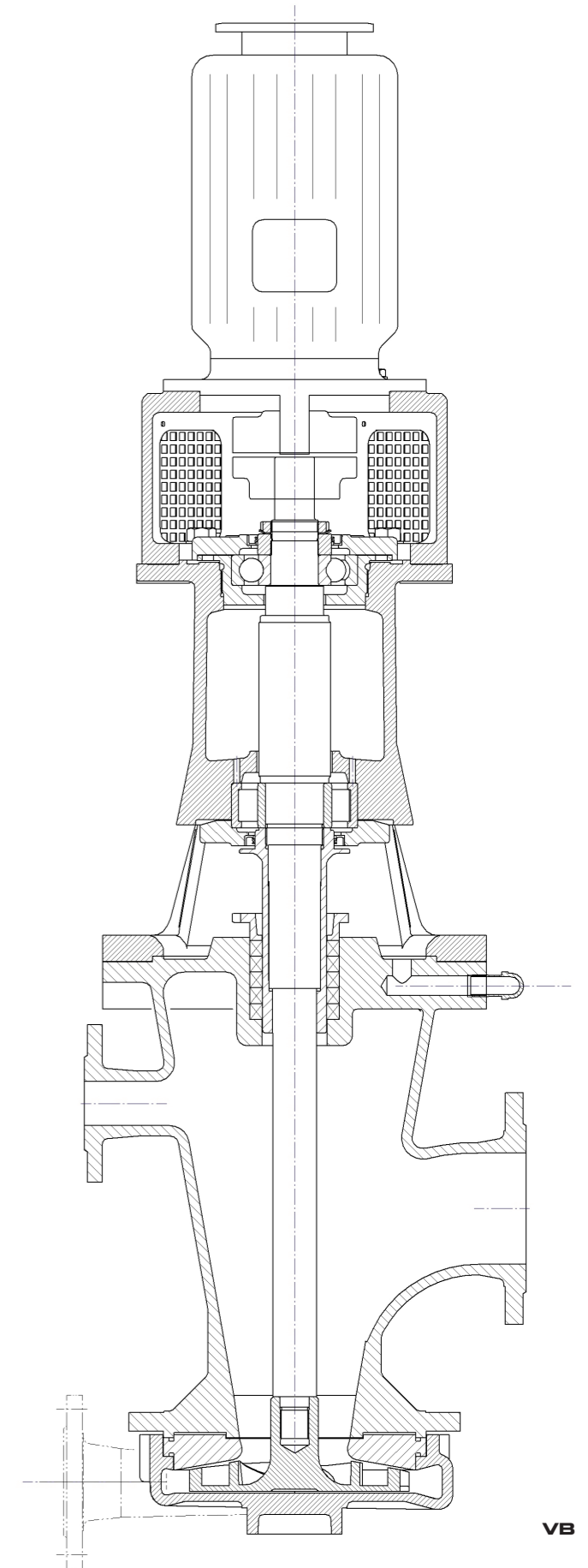
Similar to the V-AN vertical pump, the VB also offers the advantage of self-venting and self-regulating properties. For wastewater pumping, for example, it does not require any additional dry-running protection. This special pump concept opens up completely new fields of application, including use as a conveying and mixing pump with multiple inlets.

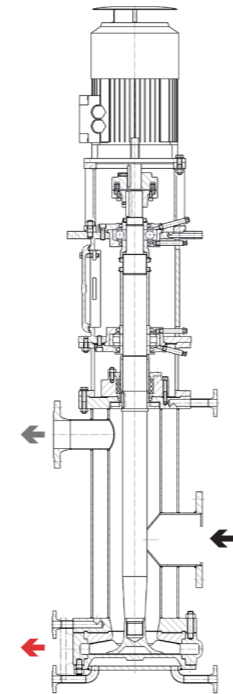
### SHAFT GAP SEALING.

Due to the special impeller arrangement, the shaft opening only has to be sealed against the inlet pressure. Powerful alternatives are available for this purpose: gland (with sealing gas connection on request), seal expeller bladed on one side, seal expeller bladed on two sides as a hydrodynamic seal, as well as a double mechanical seal.

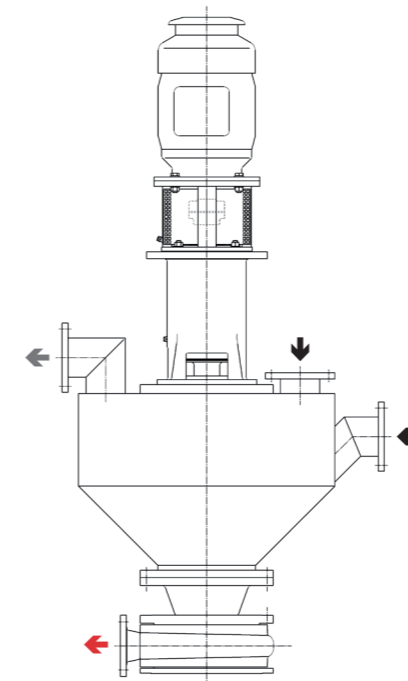
### PROPERTIES.

- robust, single-stage vertical pump with or without tank for dry
- without bearing in the liquid
- safe to run dry
- semi-open special impeller
- inlet from above
- intake vessel possible according to individual requirements (however, the maximum distance between the impeller and bearing block depends on the pump size and speed)
- additional nozzle for gas equalization

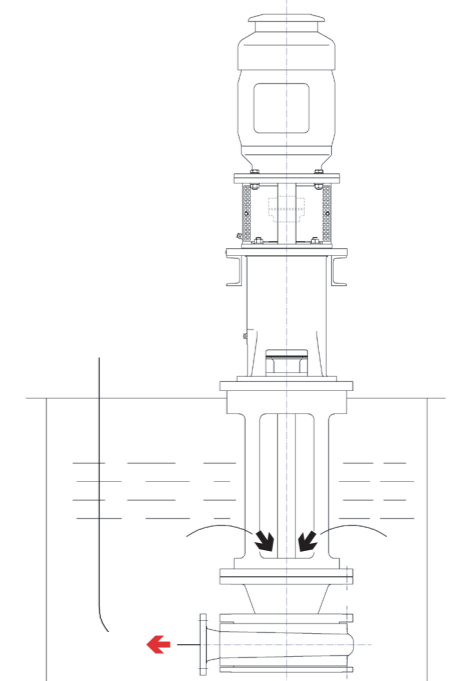




**1 CONVEYANCE OF WASTEWATER / DMT**  
in a steam-heated version



**2 CONVEYANCE**  
with simultaneous mixing of the various  
feed streams 1 (powder) and 2 (liquid)



**3 CHANNEL OVERFLOW**  
in the pigment area  
with a low suction head

## ALWAYS ON TOP. TYPE VB.

The type VB pump impresses with its impeller pressurization from above. Thanks to this property, the liquids can be fed in even in the case of low suction heads.

Production wastewaters without pits can be discharged from the VB without any problems – see Fig. 1. For this purpose, the pump is equipped with steam heating. This is required when liquids are pumped close to the crystallization point.

However, the liquid can also be drawn off from a channel with a suction head of only a few 100 mm – see Fig. 3.

In the case of a dry installation, the vessel is dimensioned in such a way that several inlets can be connected at the same time – see Fig. 2. The pump can therefore also be used for product mixing.

### TYPICAL APPLICATIONS:

- conveying solid-laden liquids
- conveying foaming liquids
- combining and subsequent conveyance away of powdery and liquid components

### IMPLEMENTED APPLICATIONS AND PUMPING MEDIA:

- channel overflow
- mixing liquid and powder
- wastewater containing DMT
- wastewater pump in pharmaceutical use (e.g. insulin production)

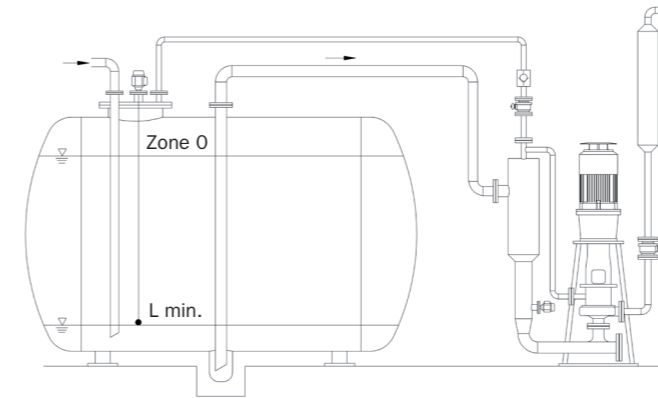
- ← VENTING
- ← INFLOW
- ← OUTFLOW

**FIRST CHOICE.  
ALTERNATIVES TO  
SEMI-SUBMERSIBLE  
PUMPS.**

Semi-submersible pumps are used for various reasons. The decisive factor is always the safety aspect. This determines whether a vessel is to be emptied from below (via a pump connected to the vessel bottom) or from above (by means of a pump lowered into the vessel).

In pit applications, the volume is essentially determined by two factors: the existing fluctuation of the wastewater flow and the permissible switching times of the motor. Here, the self-regulating pump of V-AN type knows many ways to minimize or completely bypass the pit dimensions.

However, before the choice falls in favor of the use of a semi-submersible pump, other options should be considered, as they may turn out to be more cost-effective or more reliable and easier accessible. At all events, BUNGARTZ has a wide range of alternatives on offer.

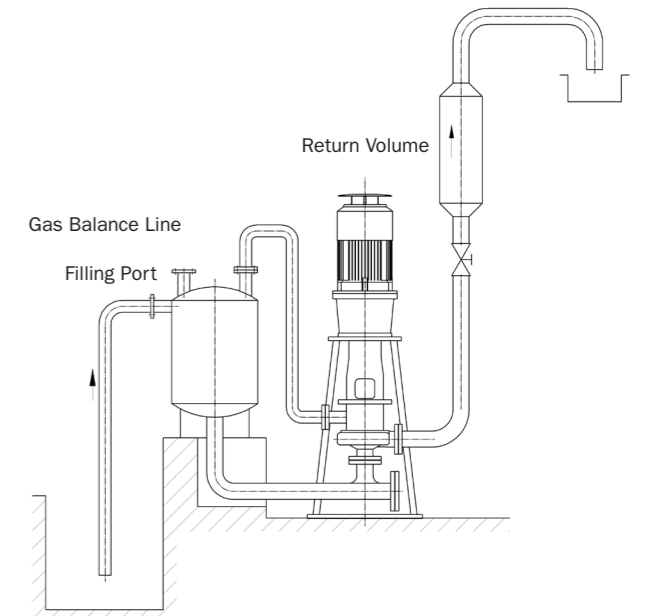


**1 REMOVAL**  
from ATEX zone 0 vessels

**REMOVAL FROM  
ATEX ZONE 0 VESSELS.**

For example, effectively bypassing the challenging zone 0 setup is possible with a semi-submersible pump. It makes use of a special emptying system consisting of a self-regulating pump and suction system. In this case, the pump with suction vessel is simply set up outside of ATEX zone 0 – as in the case of tanker unloading from above. The vessel then has a ATEX zone 1 or 2. A level sensor ( $L_{min}$ ) ensures that the suction lance in the ATEX zone 0 vessel will not emerge (Fig. 1).

The consequence: the gas from the vessel does not enter the emptying system. It is thus not possible for an explosive mixture to enter the suction vessel. This is now zone 2. A pump with a dry-running magnetic coupling is recommended here: the MPCV-AN type with nitrogen blocking. The sealing gas provides additional safety and guarantees that the suction vessel always remains inert.



**2 SUCTION**  
of dirty wastewaters / slops

**SUCTION OF WASTEWATER.**

In Fig. 2, a self-regulating pump of V-AN type goes into action together with a suction vessel.

This version makes it possible to save on large-volume wastewater pits. A further advantage of this installation compared to the use of a self-priming pump: the insensitivity to solids.

The vertical pump with additional pressure equalization also manages to lower the pressure in the receiving vessel to the boiling pressure of the medium during the suction process. This allows large suction heights to be achieved even with heavy liquids such as sulfuric acid. In addition to the pit emptying system shown, this arrangement is also reliably suitable for tanker unloading from above.

**PRODUCT RANGE.****Horizontal pumps**

with hydrodynamic shaft seal  
up to the dry-running magnetic coupling

**Vertical pumps**

- for dry installations, short design
- for wet installations,  
without bearings in the liquid
- for wet installations,  
with roller bearings independent of product
- with feeder propeller  
for space-saving installation

**Vessel pumps**

with intake from above

**Horizontal- and vertical pumps**

- with semi-open impellers
- with closed impellers
- with torque flow impellers

**Downstream seals**

for pumps with hydrodynamic relief of the shaft gap

- gland packing
- mechanical seal
- magnetic coupling
- special solution for problem cases
- lip seal

**Comprehensive information about each type of pumps is featured in individual product brochures.**

**MATERIALS.**

- all castable and weldable stainless steel qualities
- castable and weldable special alloys
- grey cast iron, rubber lined
- special materials such as titanium, zirconium, SiC etc.

**REAL SPECIALISTS.  
THE CENTRIFUGAL  
PUMPS AT A GLANCE.**