

PRODUCT RANGE.

Horizontal pumps

with hydrodynamic shaft seal

Vertical pumps

- for dry installations, short design
- for wet installations, without bearing in the liquid
- for wet installations, with slide bearing
- with feeder propeller for space-saving installation

Tank pumps

with in-feed from above

Horizontal and vertical pumps

- with half-open impellers
- with closed impellers
- with torque flow impellers

Downstream seals

for pumps with hydrodynamic relief of the shaft gap

- packed gland
- mechanical seal
- magnetic drive
- particular solution for problem cases

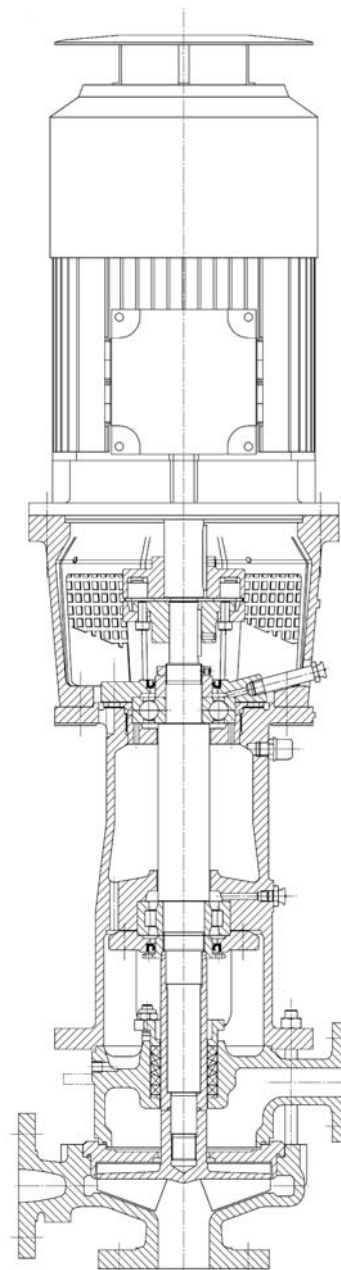
Comprehensive information about each type of pumps is featured in individual product brochures.

MATERIALS.

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

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BUNGARTZ
CENTRIFUGAL PUMPS
V-AN



Pars Marine Industry Co. official representative of Bungartz in IRAN

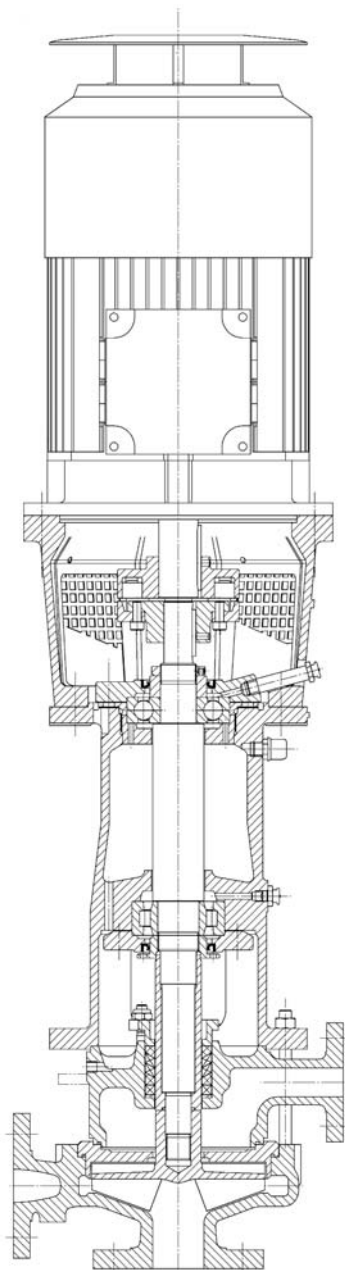
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DIFFERENT FROM OTHERS.

THE SELF-REGULATING CENTRIFUGAL PUMP V-AN.



ADVANTAGES.

- reduction of the plant costs
- low $NPSH_R$ -value ($< 0,1 \text{ m}$)
- self-regulating, i. e. no additional regulation required
- self-ventilating
- suitable for high gas fractions
- safe to run dry
- reliable
- no feed containers
- plant height reduction

APPLICATION AREAS.

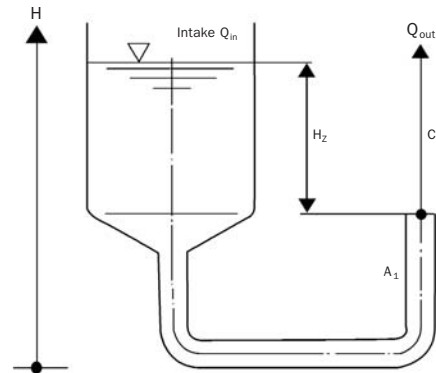
- media at boiling point
- fluctuating inlet flow rates
- gas containing media
- drainage of residue in vessels, e.g. tankers
- delivery and collection of condensates and distillates
- vacuum filters
- centrifuges
- distillation columns
- evaporation plants
- slop containers
- waste water pits

PERFORMANCE.

- Capacities: Q up to approx. $1.200 \text{ m}^3/\text{h}$
- Delivery height: H up to approx. 100 m

MATERIALS.

- all castable and weldable stainless steel qualities
- special alloys that can be caste or welded
- titanium
- zirconium
- cast iron, rubber lined



SIMPLE AND EFFICIENT.

THE FUNCTIONAL PRINCIPLES OF THE PUMP AN.

The velocity (C_1) with which something flows out of an open vessel is determined by the so-called Bernoulli equation.

The outflow conditions remain unchanged when a pump of type AN is installed at the outlet cross section (A_1).

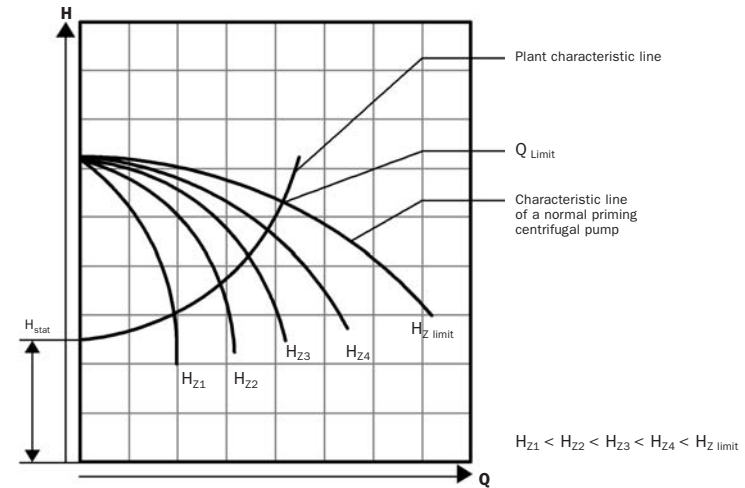
$$Q_{out} = K \cdot \sqrt{2gH_z} \cdot A_1 = Q_{in}$$

$$K < 1$$

$$K = f(\text{pump and rotation speed})$$

The liquid level rises when a medium flows into the vessel. It rises until the intake rate is exactly equal to the outflow rate. On condition that the vessel is high enough, an equilibrium will always be established.

This regulating principle is simple and ingenious. It functions without requiring any mechanical or electrical regulating device – also with pumps of type V-AN.



PRINCIPLE. The V-AN models operate in a self-regulating manner, depending on the intake rate. These pumps do not have any priming capability. Their capacities correspond to the volume intake rate. This determines the liquid column height H_z in the intake vessel.

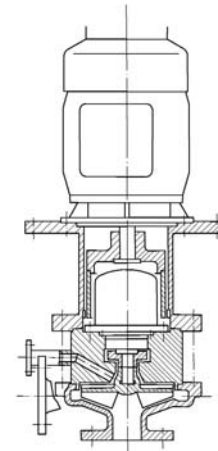
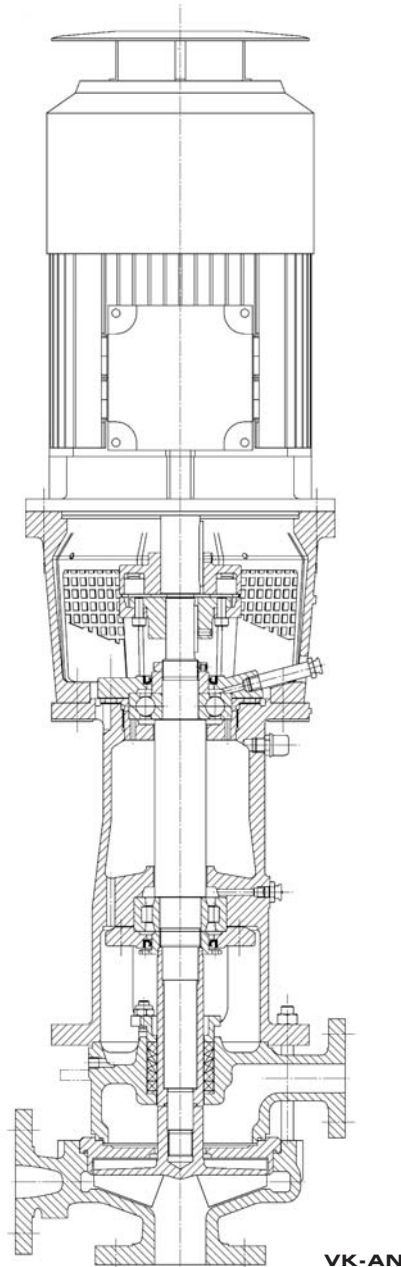
The manner in which the V-AN feeds the medium can be described by a family of curves (parameter $H_z = \text{constant}$). This family of curves is limited at the top by the characteristic line of a normal pump. The delivery height and the volume intake rate determine how high the liquid stands in the intake vessel. The working point on the plant characteristic line always lies between zero feed rate and Q_{limit} (Q_{limit} is the intersection point of the plant characteristic line and the characteristic line of the “normal priming” centrifugal pump). H_{zlimit} varies between 0.5 and 2.0 m – depending on the pump size and the rotation speed. With regard to H_{zlimit} the V-AN behaves like a normal sucking pump. Their NPSH value is 0. Thus they operate without cavitation, provided that undershoot of the vapour pressure in the intake vessel is avoided.

Gas bubbles entering the pump will be partly conveyed. But partly they will also be returned via a gas balance line into the intake vessel. If nothing flows into the priming container, the pump maintains the static head of the plant at zero delivery. As far as the technical prerequisites are concerned, the V-AN can be operated for any length of time with $Q = 0 \text{ m}^3/\text{h}$. Thereby the temperature increase of the pumping medium must not impair the corrosion behaviour of the material.

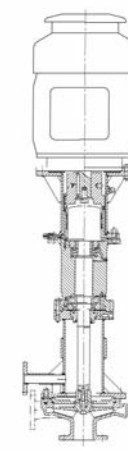
Impeller back vanes relieve the secondary sealing of the pump (e.g. gland packing or double mechanical seal DMS) completely, i.e. hydrodynamically. This is also the reason why in the variant with gland packing, medium can never escape via the shaft seal to the exterior. However, for this the pump must be started and stopped correctly. The V-AN can also be rinsed with flushing water fed in via the infeed connector before switching the pump off.

**VERY GREAT
DIVERSITY.**

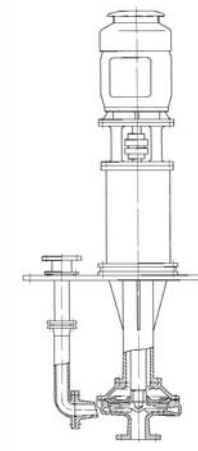
**THE VERSIONS AND
VARIANTS.**



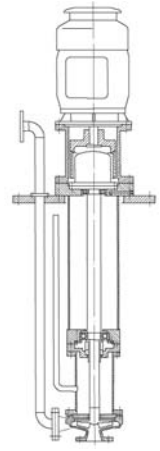
MPV-AN



MPCV-AN



T-AN



MPAT-AN

VK-AN, short constructional design

- standard variant for dry set-up
- sealing depending on the application with gland packing, seal expeller or double mechanical seal

MPV-AN, with magnetic drive

- dry set-up
- with magnetic drive and liquid lubricated slide bearings
- hermetically sealed
- zero feed rate safe

MPCV-AN, with magnetic drive

- dry set-up
- hermetically sealed
- no bearing in the pumping liquid
- safe to run dry

T-AN, cantilever shaft

- for installation in a pit or vessel
- no bearing in the liquid
- immersion depth up to 1.5 m

MPAT-AN, with magnetic drive

- for installation in a pit or vessel
- hermetically sealed
- no bearing in the pumping liquid
- safe to run dry
- immersion depth up to 5.5 m

FLEXIBLE UTILISATION. APPLICATIONS.

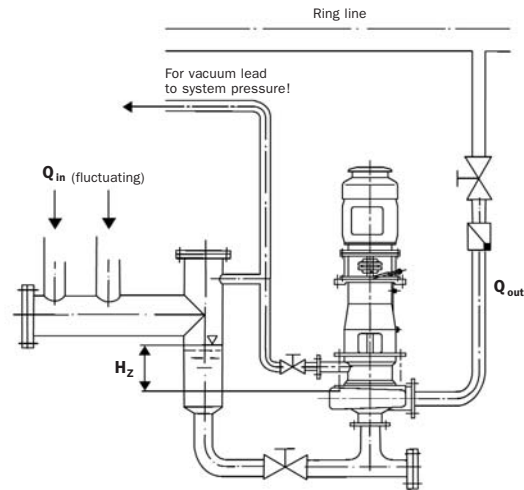
SHAFT SEALS.

- **VKS:** dry running self-lubricating gland packing
- **VKL:** gland packing with sealing water connection
- **VKD:** vacuum tight liquid seal, non-pressurised or choked sealing water required
- **VKA:** double gas lubricated mechanical seal with low gas seal pressure
- **VKG:** double liquid lubricated mechanical seal with low sealing pressure
- **MP:** dry running or liquid lubricated magnetic drives (see brochures for the types MPVAN, MPCV/MPAV, MPCT/MPAT)

METHOD.

While the pump is operating the shaft seal is relieved completely with regard to the pump feed pressure. It seals only the gas phase of the medium at intake side system pressure. When the pump is not running, the intake liquid height (H_2) is applied to the shaft seal.

APPLICATIONS			TYPICAL PER- FORMANCES $Q = m^3/h$ $H = m$ liquid column	TYPICAL MEDIA	RECOMMEN- DED SHAFT SEAL (PUMP TYPE)
Condensates, e.g. drainage of steam lines	atmospheric vacuum overpressure	approx. 100°C < 100°C > 100°C	$Q = 0 - 300$ $H = 10 - 80$	water / hydrocarbons	VKS VKD, VKG, VKA VKD, VKL, VKG
Tanker unloading	from below	environment	$Q = 0 - 50$ (100) $H = 10 - 40$ (100)	liquefied gases, H_2SO_4	MP, VKG, VKA
	from above	environment	$Q = 0 - 50$ $H = 10 - 40$	H_2SO_4 , oleum, up to densities of 2.3 kg/dm ³	MP, VKG
Residual emptying (stripping pump)	pipelines	environment	$Q = 0 - 10$ $H = 10 - 30$	liquid chemicals	VKG, VKA, MP
	vessel	environment	$Q = 0 - 350$ $H = 10 - 60$	refinery products, liquid chemicals	VKG, VKA
Belt filter	vacuum	environment	$Q = 0 - 75$ $H = 10 - 40$	liquid chemicals, also containing solids	VKD, VKG, VKA
Centrifuge / Decanter / Filter press	atmospheric	environment	$Q = 0 - 50$ $H = 15 - 40$	liquid chemicals, also containing solids	VKS, VKD, VKG, VKA
Columns	vacuum / overpressure	up to 300°C	$Q = 0 - 5$ $H = 10 - 30$		VKG, VKA, MP
Evaporation plant	vacuum / overpressure	up to 300°C	$Q = 60 - 100$ $H = 10 - 30$	fatty acid, liquid chemicals	VKG, VKA, MP
Chemical waste waters from the collecting vessel, e.g. thickener overflow, slag cooling water	vacuum to overpressure	up to 200°C	$Q = 0 - 500$ $H = 10 - 30$		VKS, VKG, VKA
Chemical waste waters in the pit	atmospheric	up to 100°C	$Q = 0 - 1.200$ $H = 10 - 30$		T-AN, Stopfbuchse, Wasserringsperre
Slop tank emptying	atmospheric	up to 250°C	$Q = 0 - 30$ $H = 10 - 60$		MPAT



HARDLY ANY SPACE. THE CONDENSATES.

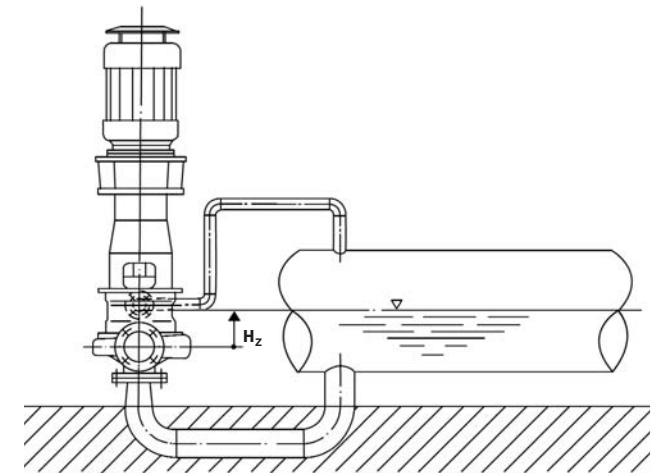
The self-regulating pump AN does not need much space. In contrast to conventional condensate return systems, a large collecting vessel is not required. Regulation and dry running protection are also superfluous.

ADVANTAGES.

- automatic adaptation to fluctuating intake rates and opposing pressures
- small pump, because operation with high rotation speeds is possible
- continuous operation without sudden pressure peaks
- able to run dry
- no condensate collecting vessel required
- no level control required

PERFORMANCE PARAMETERS.

- $Q = 0 \text{ — } 300 \text{ m}^3/\text{h}$
- $H = 10 \text{ — } 80 \text{ m}$



LOW INSTEAD OF HIGH. DRAINAGE OF STEAM LINES.

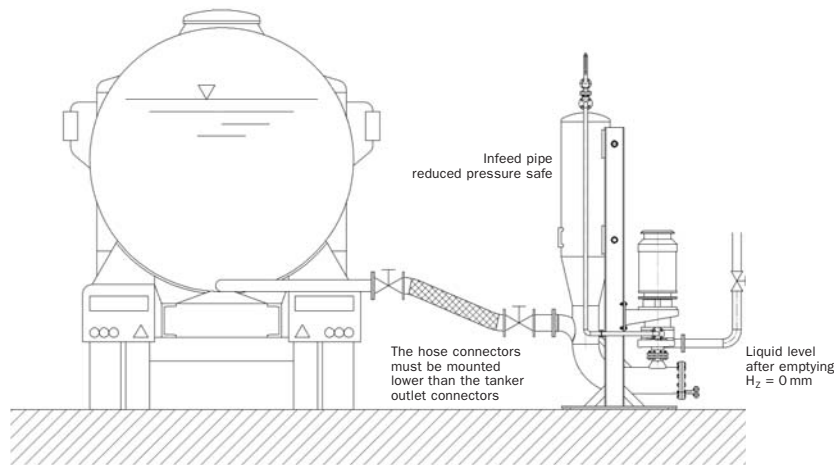
Intakeing and condensing steam can be fed directly out of the condensate network without cavitation. This is possible even in the case of greatly fluctuating influx flow. Very small suction heads can also be implemented.

ADVANTAGES .

- no NPSH problems
- low constructional heights are possible
- no regulating problems, not even with small feed rates
- safe to run dry

PERFORMANCE PARAMETERS.

- $Q = 0 \text{ — } 3 \text{ m}^3/\text{h}$
- $H = 40 \text{ m}$



STAY ON THE GROUND.

TANKER UNLOADING FROM BELOW.

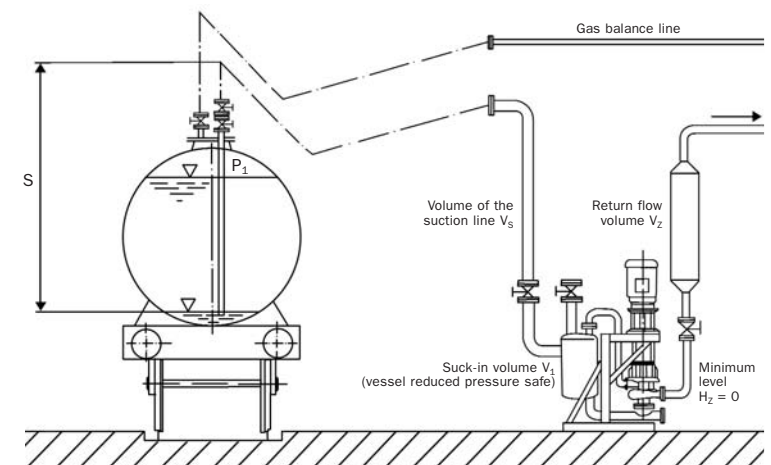
The NPSH values are very low when tankers with boiling liquids are emptied. This often makes it necessary to use pot pumps or pit installations. The self-regulating pump AN can be installed on ground level beside the tanker. It is then possible to empty the tanker and the hose connector completely without any problems.

ADVANTAGES.

- self-venting of the suction line
- insensitive with respect to gas bubbles
- complete emptying of the tanker, also with magnetic drive
- undisturbed operation, also in the final phase of emptying with increased gas fraction
- unproblematic emptying of several tank compartments without interruption
- media can be fed at the boiling point
- safe to run dry (zero feed rate safe for pumps with magnetic drive)

PERFORMANCE PARAMETERS.

- $Q = 0 \text{ — } 50 \text{ m}^3/\text{h}$
- $H = 10 \text{ — } 40 \text{ m}$



STANDING ABOVE THINGS.

TANKER UNLOADING FROM ABOVE.

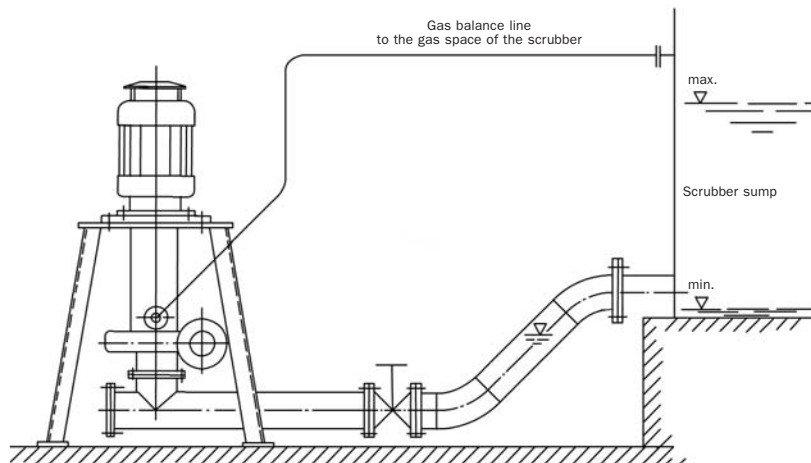
Even heavy media can be sucked out of the tanker from above – by virtue of the self-regulating pump AN and its collecting vessel. Repeated suction is possible because the pump reduces the gas pressure in the vessel. Thus the residual amount of liquid in the tanker is very small. A further advantage: the set-up occupies little space.

ADVANTAGES.

- “heavy” media can also be unloaded (up to 2.3 kg/dm^3)
- no dry running risk for pumps with magnetic drive when emptying residual liquid
- the suction pressure in the collecting vessel can be reduced to the vapour pressure at the working temperature (condition for onset of boiling)

PERFORMANCE PARAMETERS.

- $Q = 0 \text{ — } 50 \text{ m}^3/\text{h}$
- $H = 10 \text{ — } 40 \text{ m}$



NOTHING LEFT OVER. THE RESIDUAL LIQUID EMPTYING: STRIPPING PUMP.

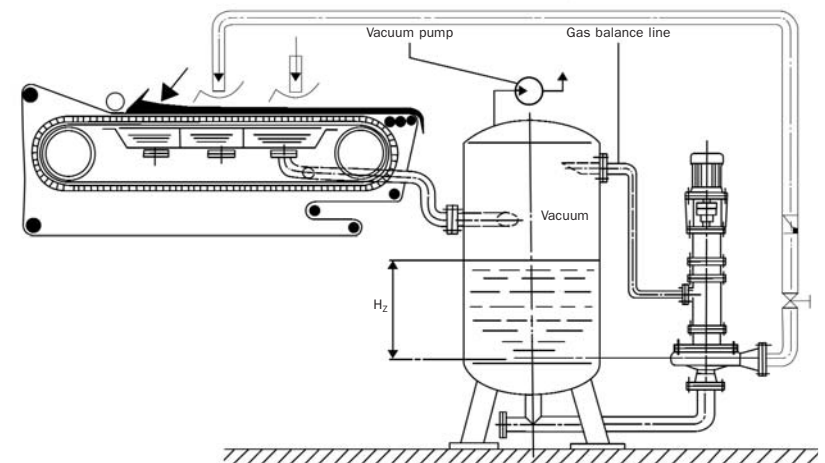
Conventional pumps have only limited suitability for complete emptying of large volume vessels or pipelines – this is due to the entailed gas burden. In contrast thereto, the self-regulating pump AN returns gas fractions via the gas balance lines. This enables complete emptying to the pump level. A priming vessel is utilised when lower situated pipeline systems are involved.

ADVANTAGES.

- starts with large feed quantity
- automatically reduces the feed quantity towards the end
- the level is reduced to the centre of the pump casing (complete emptying of the collecting vessel)
- safe to run dry

PERFORMANCE PARAMETERS.

- $Q = 0 \text{ — } 350 \text{ m}^3/\text{h}$
- $H = 10 \text{ — } 60 \text{ m}$



OUT OF THE VACUUM. THE BELT FILTER.

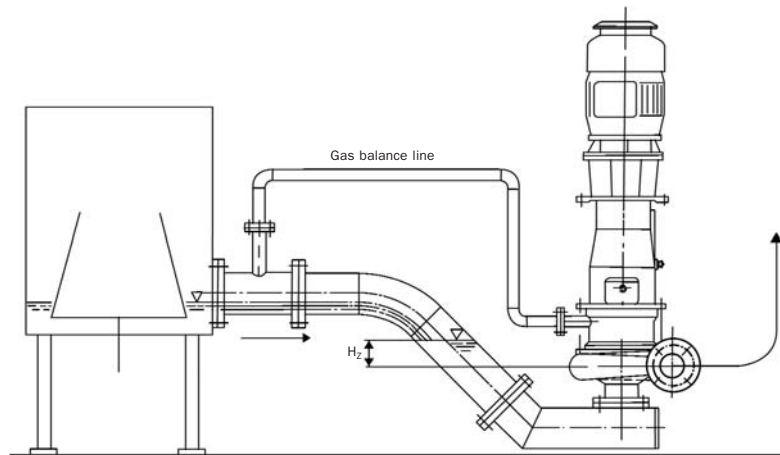
If it is desired to separate liquids and solids at the belt filter, normal priming pumps must usually be erected one floor level below the filter. The self-regulating pump AN operates differently. It is usually mounted by the belt filter manufacturer and feeds directly at the level of the filtrate separator.

ADVANTAGES.

- feeding is possible with $NPSH_A$ almost zero
- reduced constructional height of the complete plant
- no regulation entailing fluctuating product output
- no vessel required, infeed pipe suffices
- no regulation is required
- direct feed from the vacuum of the filtrate separator, i. e. the belt filter does not have to be positioned higher
- safe to run dry

PERFORMANCE PARAMETERS.

- $Q = 0 \text{ — } 75 \text{ m}^3/\text{h}$
- $H = 10 \text{ — } 40 \text{ m}$



FITTING BY ADAPTATION. THE CENTRIFUGE.

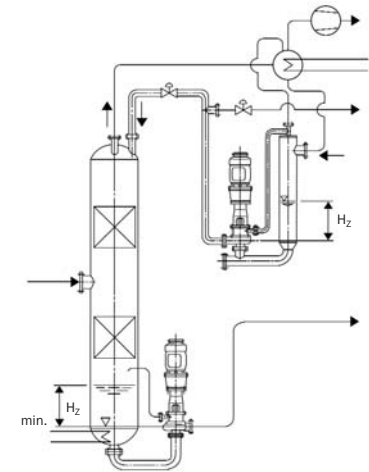
When liquids are separated the infeed fluctuates considerably. With conventional pump systems this requires a large collecting vessel with control system. In contrast thereto, the self-regulating pump AN feeds directly from the outlet cross section of the pipe. Alternatively, a small pipe collector without regulation (FSV) can be installed.

ADVANTAGES.

- self-adaptation to greatly fluctuating feed quantities
- safe to run dry
- small constructional height
- small collecting vessel or intake pipe

PERFORMANCE PARAMETERS.

- $Q = 0 \text{ — } 50 \text{ m}^3/\text{h}$
- $H = 15 \text{ — } 40 \text{ m}$



QUITE SMALL. THE COLUMNS.

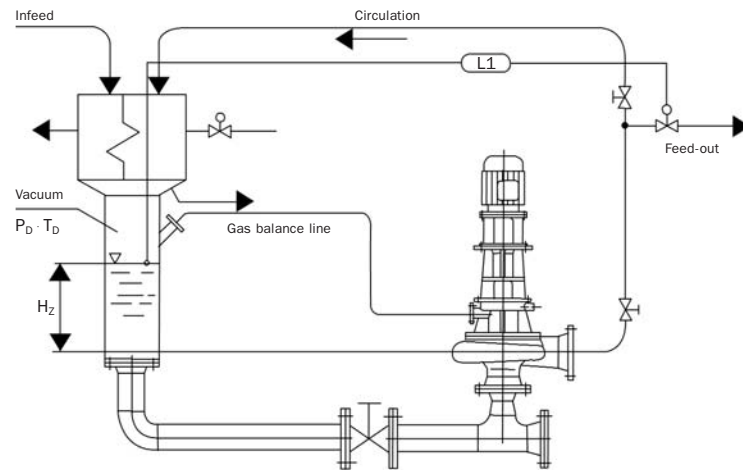
Pumps connected to columns are confronted with very small plant NPSH. This is so because they operate in the vicinity of the boiling point and in many instances also in the reduced pressure range. Due to the self-regulation of the pump AN, the NPSH value therewith is very small. It can be installed at the same level as the column even under vacuum.

ADVANTAGES.

- cavitation free fluid handling
- very small quantities can also be fed
- no barometric submersion is necessary
- safe to run dry

PERFORMANCE PARAMETERS.

- $Q = 0 \text{ — } 5 \text{ m}^3/\text{h}$
- $H = 10 \text{ — } 30 \text{ m}$



CIRCULATING EVENTS.

THE EVAPORATION PLANT.

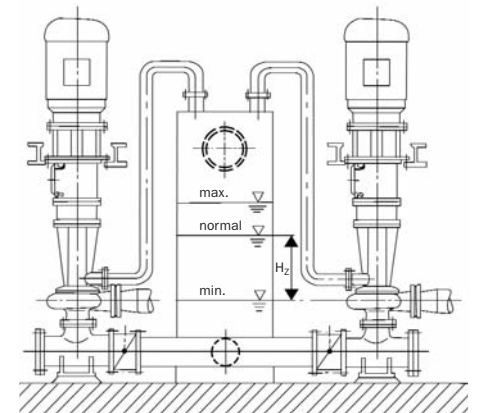
Since its NPSH value is very low, the pump AN can be installed on the same level as the evaporation plant. This reduces the constructional height of the plants. The pumps are ideally suited to outfeed and to recirculation.

ADVANTAGES.

- feed without cavitation
- height reduction
- no impairment of the feed process by liquids with gas burden
- safe to run dry

PERFORMANCE PARAMETERS.

- $Q = 60 — 100 \text{ m}^3/\text{h}$
- $H = 10 — 30 \text{ m}$



LEFT ON THE DRY.

THE CHEMICAL WASTE WATERS FROM THE COLLECTING VESSEL.

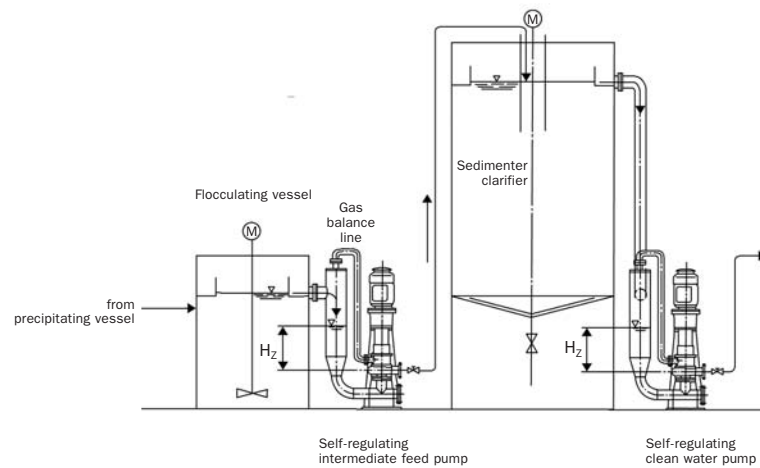
Waste waters from plants are usually collected in large pits. From there they are fed by pumps under level control. In contrast thereto, with the self-regulating pump AN a dry installation with small pipe collecting system is possible.

ADVANTAGES.

- no large volume pump collecting vessel
- no pump controller or regulation required
- no bearings coming into contact with the product
- no intermittent operation, i. e. smaller motor loading and no abrupt pressure increases in the piping system

PERFORMANCE PARAMETERS.

- $Q = 0 — 1.200 \text{ m}^3/\text{h}$
- $H = 10 — 30 \text{ m}$



CONTAINS WITHOUT VESSEL. THE THICKENER OVERFLOW.

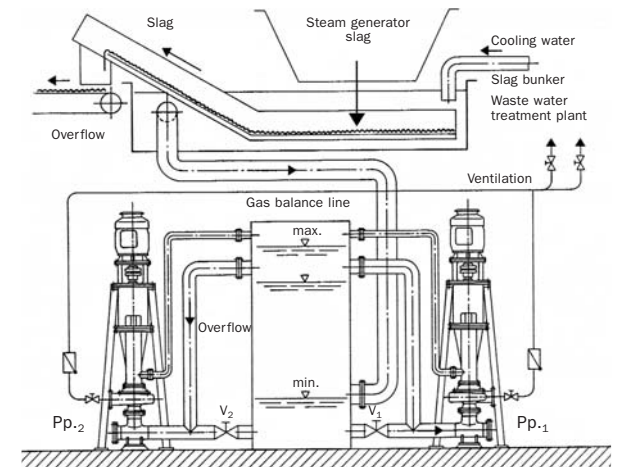
Thickeners have an overflow channel in the upper region. Here fluctuating amounts of waste water reach the pump. The pump AN can forward these continually varying amounts without requiring any control facilities – and without occupying much space.

ADVANTAGES.

- no infeed collecting basin is required
- no measuring and loop control devices are required, in spite of the greatly fluctuating feed quantities
- gas burdens of the liquid do not impair the feed process
- safe to run dry

PERFORMANCE PARAMETERS.

- $Q = 0 \text{ — } 500 \text{ m}^3/\text{h}$
- $H = 10 \text{ — } 30 \text{ m}$



PERFECT COLLECTING VESSEL. THE SLAG COOLING WATER.

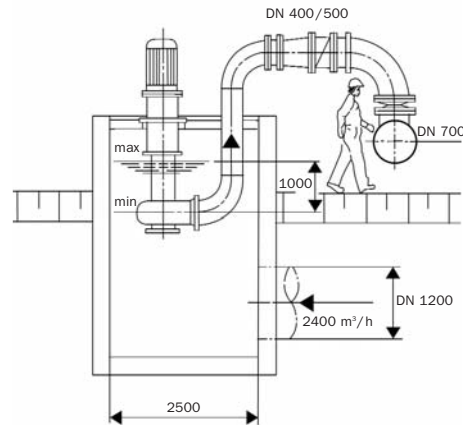
In slag cooling water feeding applications solids and liquids must be separated. The liquid thereby flows to the pump in temporally varying amounts. With ordinary centrifugal pumps it is collected in a large waste water pit. The pumping process is thereby controlled by liquid level measurements. With the self-regulating pump AN the waste water pit is not required. The liquid is then passed directly into a small pipe collecting device. The pumping process here takes place entirely without electrical or mechanical control components.

ADVANTAGES.

- suitable for fluctuating inlet quantities
- solid granulate is conveyed too
- considerable constructional savings (no slag water basin, a small collecting vessel suffices)
- safe to run dry

PERFORMANCE PARAMETERS.

- $Q = 100 \text{ — } 400 \text{ m}^3/\text{h}$
- $H = 10 \text{ — } 30 \text{ m}$



EVERYTHING UNDER CONTROL.

THE CHEMICAL WASTE WATERS IN THE PIT.

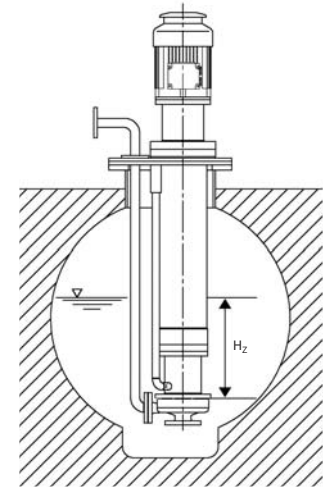
When a waste water pit is used, it can be made considerably smaller for the pump AN. This is due to the self-regulation which obviates the on/off switching operation.

ADVANTAGES.

- smaller pit dimensions
- no pump controller or regulation required
- safe to run dry
- no sudden pressure increased, because the pump is in continuous operation

PERFORMANCE PARAMETERS.

- $Q = 0 \text{ — } 1.200 \text{ m}^3/\text{h}$
- $H = 10 \text{ — } 30 \text{ m}$



FIT IN ALL FIELDS. SLOP TANK EMPTYING.

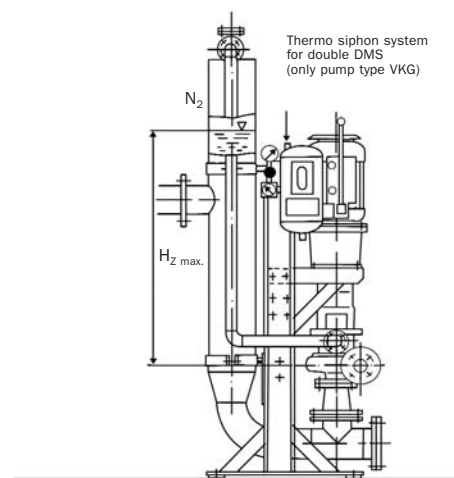
Waste waters appearing in refineries are often mixtures of boiling poisonous liquids with solid material burden. This slop must be removed out of the tank with hermetically sealed pumps and safely brought to the disposal facility. The self-regulating pump AN is very well equipped for such a task, because it is sealed with a dry running magnetic drive. Its pump bearings are rolling bearings which operate irrespective of the pumping medium.

ADVANTAGES.

- hermetically sealed
- safe to run dry
- maintenance-free
- complete emptying of the vessel
- all-purpose, even in strongly contaminated media
- also suitable for the Ex-Zone-0
- for immersion depths up to 5.5 mm

PERFORMANCE PARAMETERS.

- $Q = 0 \text{ — } 30 \text{ m}^3/\text{h}$
- $H = 10 \text{ — } 60 \text{ m}$



**AS COMPLETE AS
COMPACT.**

THE BUNGARTZ CONVEYOR SYSTEMS.

Bungartz conveyor systems (FSV) are extremely space-saving. They do not require control/regulation or additional monitoring.

A complete solution can be delivered for the medium performance ranges – consisting of the pump, the pump stand and the intake vessel (see the configuration in Figure ...). This system does not require monitoring, by virtue of the pumps safe to run dry. Even with zero feed rate there is no risk of overheating. The reason for this is the gas balance line which prevents pressure increase inside the pump.

ADVANTAGES.

- no additional control / regulation
- no collecting vessel
- no barometric submersion (with vacuum)
- no level monitoring of the intake vessel required

SYSTEM.

- pump type V-AN with motor
- pump stand
- infeed vessel with gas balance line
- sealing system for shaft sealing