BUNGARTZ

Special Centrifugal Pumps

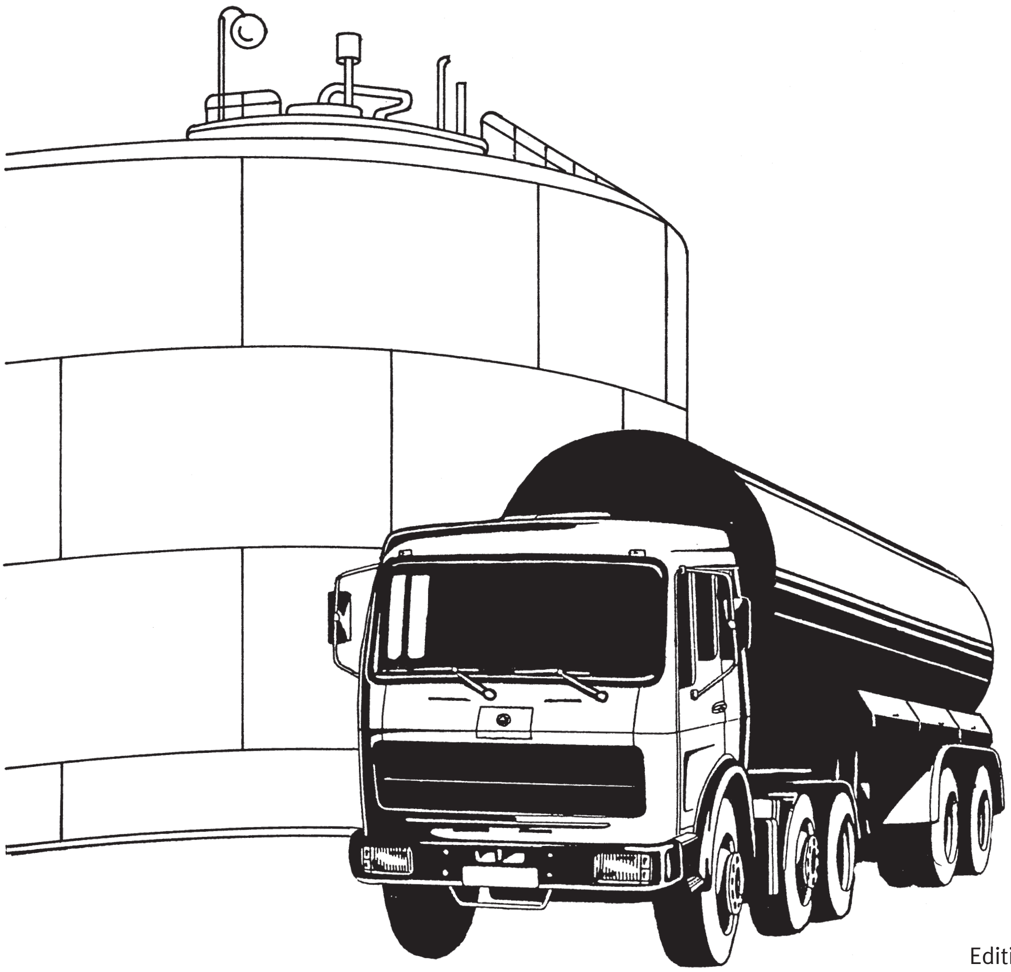
Tanker unloading

with vertical centrifugal pumps Type "V-AN"

Safe to run dry

Using a pump Type V-AN has the following advantages:

- trouble-free operation, even in the final unloading phase when there is a higher gas content
- very little residue
- no level monitoring with magnetically coupled pumps
- quiet operation and low wear on the shaft seal
- lowering of pressure until the boiling point is reached, without cavitation when of unloading from the top
- problem-free and continuous unloading of several tank compartments simultaneously.



Edition 4/98

Boiler and tanker unloading with design V-AN self-regulating centrifugal pumps

Tanker unloading from bottom outlet (Fig. 1):

As a general rule, the unloading of multicompartment tankers with a bottom outlet is performed using a centrifugal suction pump. The pump is primed by flooding the empty delivery pipe. After the pump has been switched on, it operates normally until more and more gas is carried over with the decreasing liquid level. The gas bubbles initially cause a drop in performance and noisy operation until the delivery flow is disrupted as the airfeed is still increasing. For other compartments to be emptied, the pump must be additionally ventilated if the delivery pipe is full.

For this area of application, Bungartz recommends design V-AN pumps with automatic de-airing during operation. The pumps are flooded before being switched on. If the delivery pipe is empty, the air is eliminated from the system through the same. If the delivery pipe is full, the gas enclosed in the inlet pipe is partially compressed by inlet pressure, enabling liquid to flow into the pump. If the pump is now started, it takes over the next stage of de-airing, during which the gas is added to the fluid.
The system is now ready to completely drain the tanker.
It is also possible to drain several tank compartments or tankers simultaneously.
When this happens, each empty chamber must be valved off in turn.

Tanker unloading from out of a tank top (Fig. 2):

In order to drain liquid from above out of a tank, the suction line must initially be evacuated.
(Suction pressure: $P_S = P_1 - H_S \times \rho_{FL} \times 9.81$)
Previously, this was carried out with self-priming magnetic-coupling or canned motor pumps which were unreliable if run dry. Therefore it is necessary to have a monitoring device to ensure that the pumps are turned off in time to prevent entrainment of the gas. If the pumps are operated according to specification, increasing amounts of residue will remain in the tankers.

Figure 2 shows a solution to this problem.
The system shown consists of a priming tank and a self-regulating, magnetically-coupled centrifugal pump.
Once the pump is started, a negative pressure is produced as a result of the lowering of the water level in the priming tank. This negative pressure is in equilibrium with the suction height HS. If this negative pressure is reached, the liquid is siphoned to the priming tank, which is then refilled. The pump is then operating at maximum output. According to the submerging depth of the suction lance, the self-regulating centrifugal pump used here enables the tanker to be almost completely drained without the requirement of monitoring the unloading process. The accompanying gas in the end phase is evacuated through the pump's pressure compensation pipe. Even with malfunctions in the suction line (interupting the flow), the system recovers because the negative pressure in the priming tank continues to be maintained.
The special magnetically-coupled pumps used here maintain a level of $H_Z = 0$ mm and do not require dry-run protection. Only when the pump is first started is it necessary to ensure that the priming tank is filled. The delivery pipe should be set up so that the priming tank is refilled after the pump has been switched off. The system is then capable of maintaining itself during further operation. Another advantage is the pump's small NPSH value (‹ 0.1 m head).
The NPSH value should be equated with a loss at suction height HS.

Tanker Unloading from bottom outlet

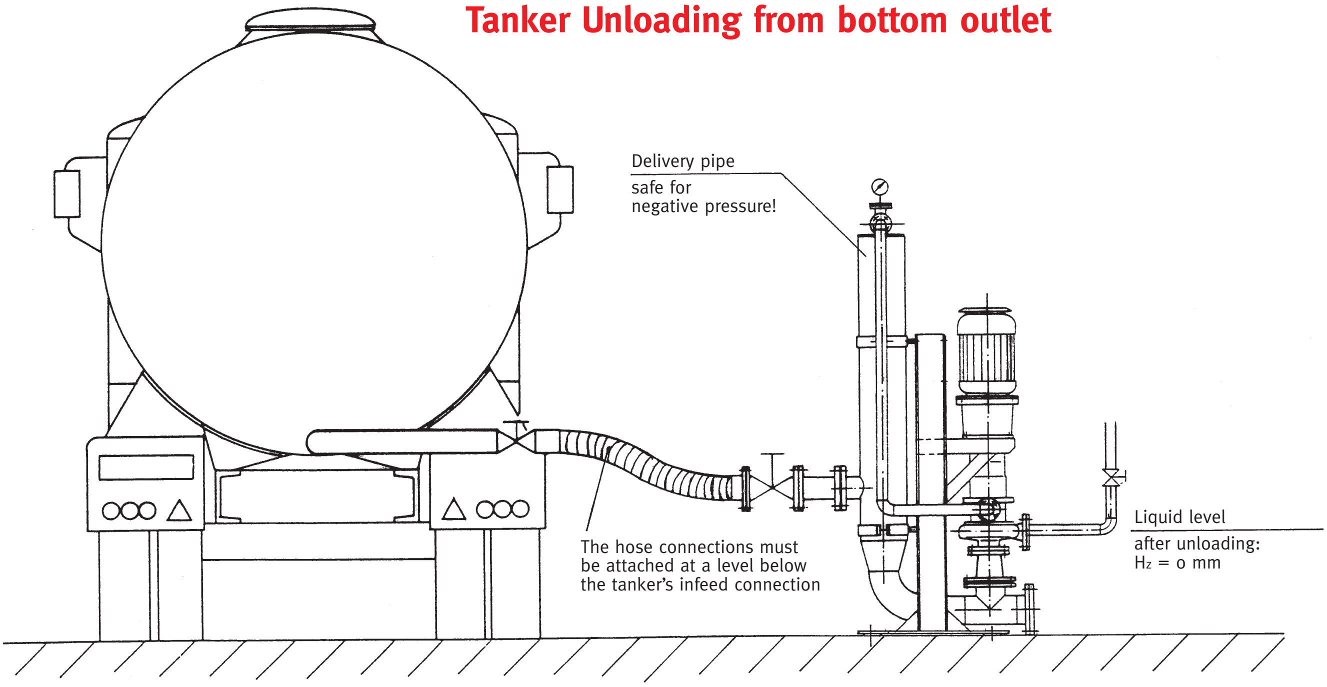


Fig. 1

Tanker Unloading From top

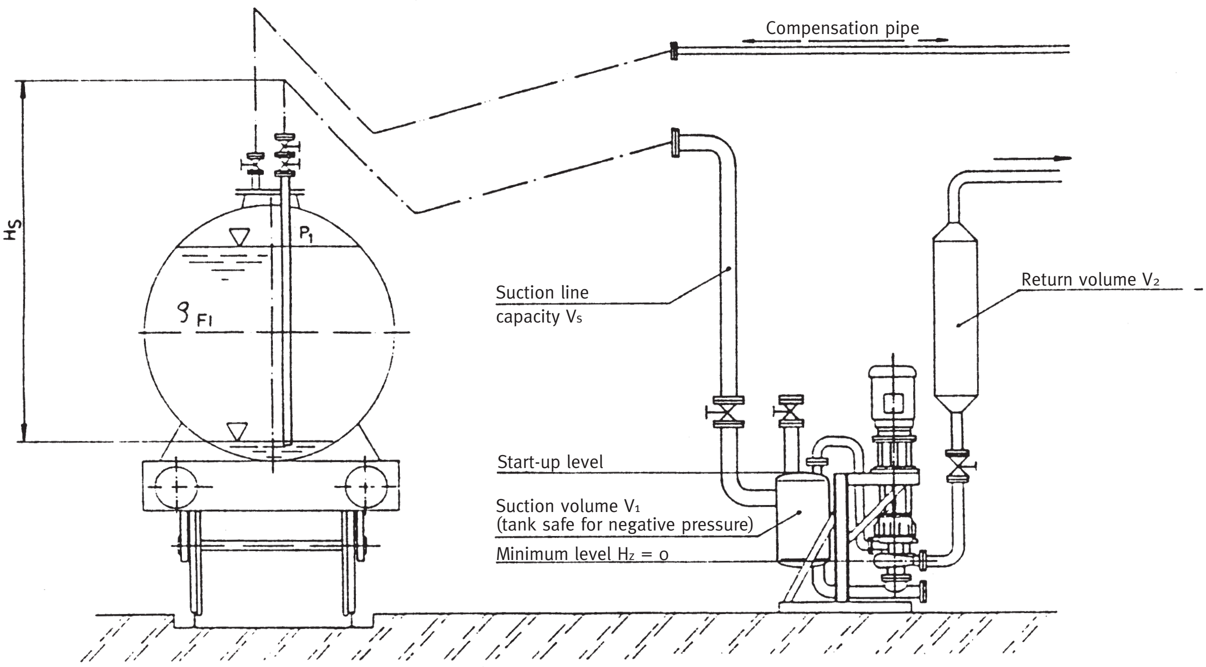


Fig. 2

Layout:

- required volume of priming tank: $V_1 = V_S \cdot \left(\frac{P_1}{P_1 - \rho_{FL.} \cdot H_S \cdot 9{,}81} - 1 \right) \cdot S$
- required backflow volume of delivery pipe: $V_2 \geq V_1$ (m^3)
- maximum possible suction height: $H_S \text{ max.} = \frac{P_1 - P_V}{\rho_{FL.} \cdot 9{,}81} - NPSH_{pump} - H_V$ (m head)

where: S = safety factor 1,5; P_1 = system pressure in priming tank before suction (Pa)

V_S = total volume of suction line (m^3), HS = suction height (m)

$\rho_{FL.}$ = density of fluid medium (kg/m^3), P_V = vapour pressure (Pa)

$NPSH_{pump}$ = zero, H_V = losses in the suction line (head in m)

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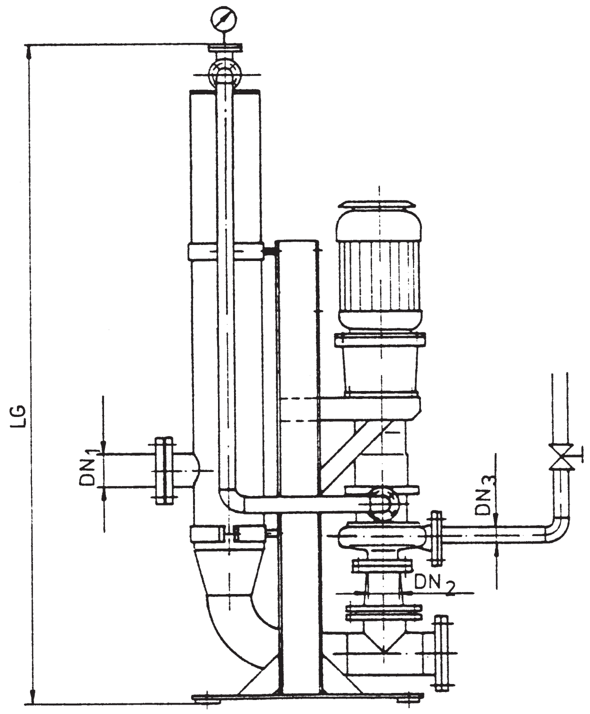
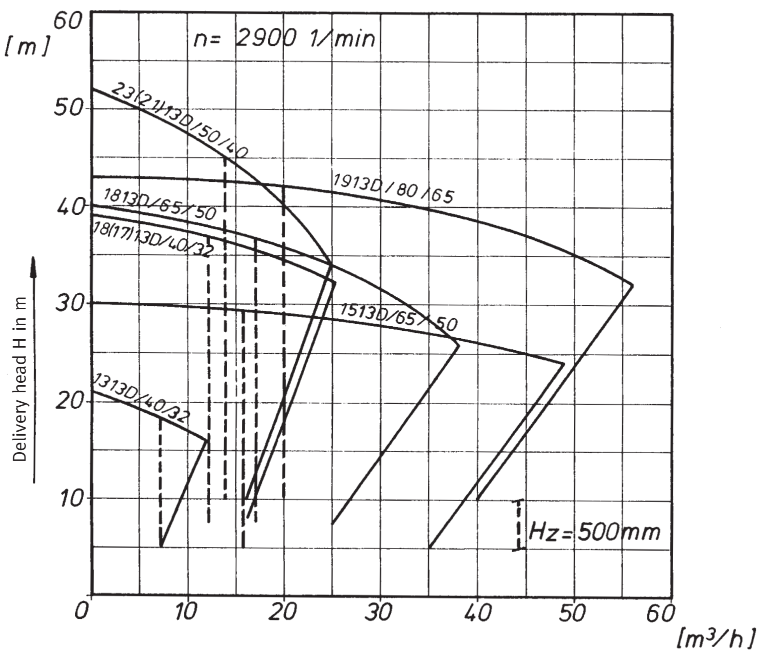
Tanker Unloading from buttom outlet

Measurements



Extraction system	Capacity	DN1	Lngth.	Pump vac. chamber	DN2	DN3
FSV-200	0-45 m³/h	125	2160	1513D/65/50	65	50
				1813D/65/50		
				19(17)13D/80/65	80	65
				1913D/80/65		
FSV-201	0-60 m³/h	125	2500	2220D/100/80	100	80

Pump Output Chart



Tanker Unloading from top:

Measurements and capacities are available on request.
Please supply the following data in addition to the discharge figures: Fluid medium, density, vapour pressure at working temperature, suction height Hs, approximate suction line capacity.