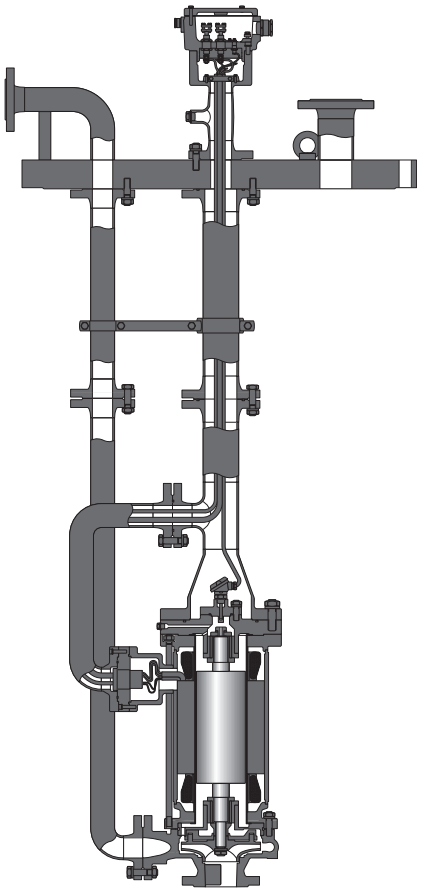
PRODUCT INFORMATION



Single- and multistage submersible pumps with canned motor

Model series TCN / TCAM

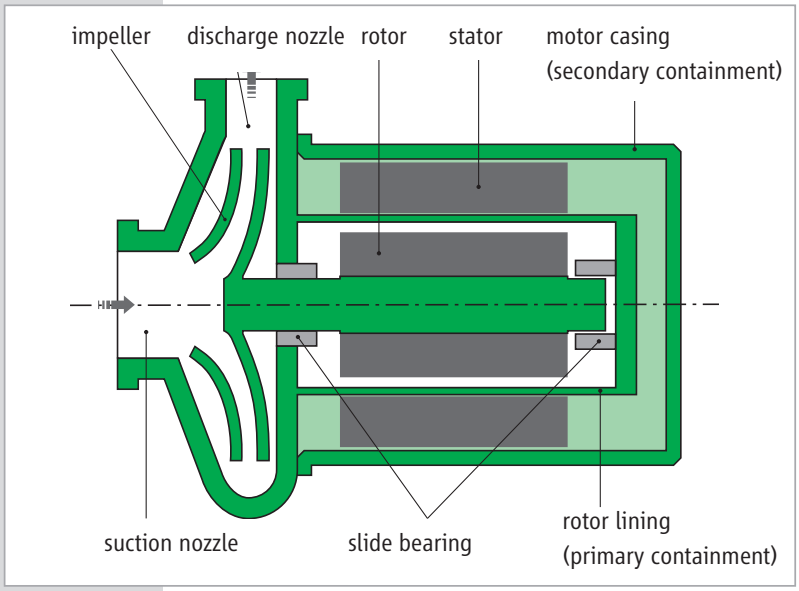
LEDERLE Hermetic

Contents

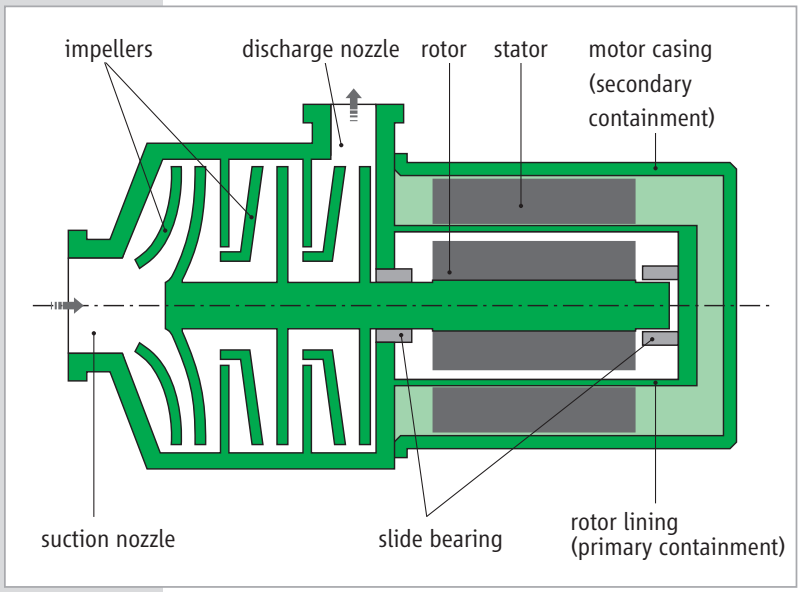
Description

General

Canned motor pumps are characterised by a compact, integrated unit without mechanical seal. The motor and pump form a unit with the rotor and the impeller fitted onto a common shaft. The rotor is guided by two identical, medium-lubricated slide bearings. The stator on the drive motor is separated from the rotor space using a thin stator liner. The rotor cavity itself, along with the hydraulic section of the pump, create a combined cavity which needs to be filled with pumping medium before commissioning. The heat loss from the motor is carried off by a partial flow between the rotor and the stator. At the same time, the partial flow lubricates both slide bearings in the rotor cavity. Both the can, which is a hermetically sealed component, and the motor casing are used as a safety containment. Because of that, canned motor pumps always ensure highest safety level when conveying dangerous, toxic, explosive and valuable media.



Single-stage canned motor pumps

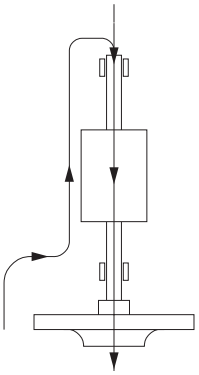


Multistage canned motor pumps

Function

TCN

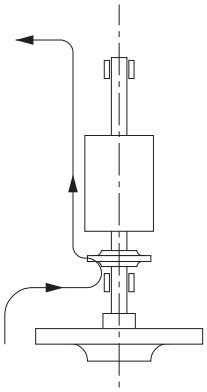
The partial flow for cooling the motor and lubricating the slide bearings is branched off at the periphery of the impeller and, after having passed through the motor, is carried back again through the hollow shaft to the suction side of the impeller.



Return of partial flow to suction side

TCNF [liquefied gas design]

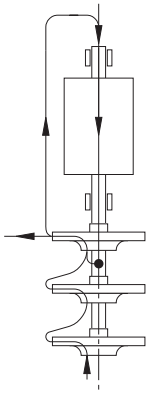
The partial flow for cooling the motor and lubricating the slide bearings will be branched off at the periphery of the impeller and, after having passed through the motor sealing cover, is carried back again to the pressure line via a connecting line. An auxiliary impeller serves to overcome the hydraulic losses encountered along the way. The connection line serves at the same time to vent the pump and motor.



Return of partial flow to motor side

TCAM

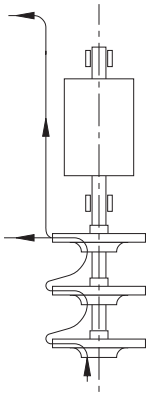
The flow rate is delivered through the impellers and diffusers arranged one behind the other to the pressure nozzles and in this way an increase in pressure is achieved depending on the number of stages. The partial flow for cooling the motor and lubrication the slide bearings is tapped off on pressure side after the last impeller and after flowing through the motor is lead out again through the hollow shaft between the stages.



Main and partial flow

TCAMF [liquefied gas design]

The flow rate is delivered through the impellers and diffusers arranged one behind the other to the pressure nozzles and in this way an increase in pressure is achieved depending on the number of stages. The partial flow for cooling the motor and lubrication the slide bearings is tapped off at the periphery of the impeller and after flowing through the motor it flows back to the motor cover via a connection line to the pressure line. At the same time, the connection line serves to vent the pump and motor.



Main and partial flow

Application and insertion

Model series TCN / TCAM

Application sector

Thanks to the EU guideline 96/61/EC (so-called IPPC guideline) as well as the Federal Immission Protection Law and the TA-Luft, emissions from pumps have been severely restricted. Today, as a consequence of these restricted regulations in environmental protection for toxic, explosive and liquefied gases, there has been an increasing tendency not to provide vessels and vessel drains with a lateral outlet or bottom outlet, i.e. with a drain nozzle installed in the range of the bottom.

Application sectors are tank farms, terminals chemical and off-shore plants, gas accumulators, and industrial plants. In addition to the optimum design for TCN and TCAM pumps there are various mounting options.

TCN / TCAM

For the delivery of aggressive, toxic, explosive, precious, inflammable, radioactive and slightly volatile fluids e.g. sulphuric acid, nitric acid, hydrofluoric acid, hydrocyanic acid, ethanoic acid, formic acid, NaOH, KOH, D_2O, solvent, etc.

TCNF / TCAMF

Liquid gases, e.g. ammonia, freone, carbon dioxide, amines, propane, butane, vinyl chloride, ethylene oxide, chlorine, phosgene, propylene, carbon bisulphide, hydrocarbon, diphenyl (> 250 °C) etc.

Application ranges

TCN / TCNF:	–160 °C to +250 °C
TCAM / TCAMF:	–160 °C to +250 °C

Canned motors

Power:	up to 300 kW at 1450 rpm [50 Hz]
	up to 400 kW at 2900 rpm [50 Hz]
	up to 336 kW at 1750 rpm [60 Hz]
	up to 448 kW at 3500 rpm [60 Hz]
Operation:	S1 to S10
Voltage:	400 / 690 V
	(special tensions possible)
Heat class:	H – 180
	C – 220 / C – 400
Frequency:	50 or 60 Hz
	(plus frequency converter operation
	on request)
Protections:	motor IP 68
	terminal box IP 65
Motor protection:	thermistor e.g.
	KL 180 (for H-winding)
	PT 100 (for C-winding)

Explosion protection

according to EC design test certificate in line with Directive 94/9/EG ATEX Ⓔx II 2 G EEx de II C T1 to T6 / Ⓔx II 2 G ck II C Tx

Documentation

Digital standard documents (CD-ROM) adapted to CE requirements include:

- sectional drawing
- dimensional drawing
- EC conformity declaration
- operating instructions

Inspections and guarantees

Standard inspections

Hydraulic inspection:

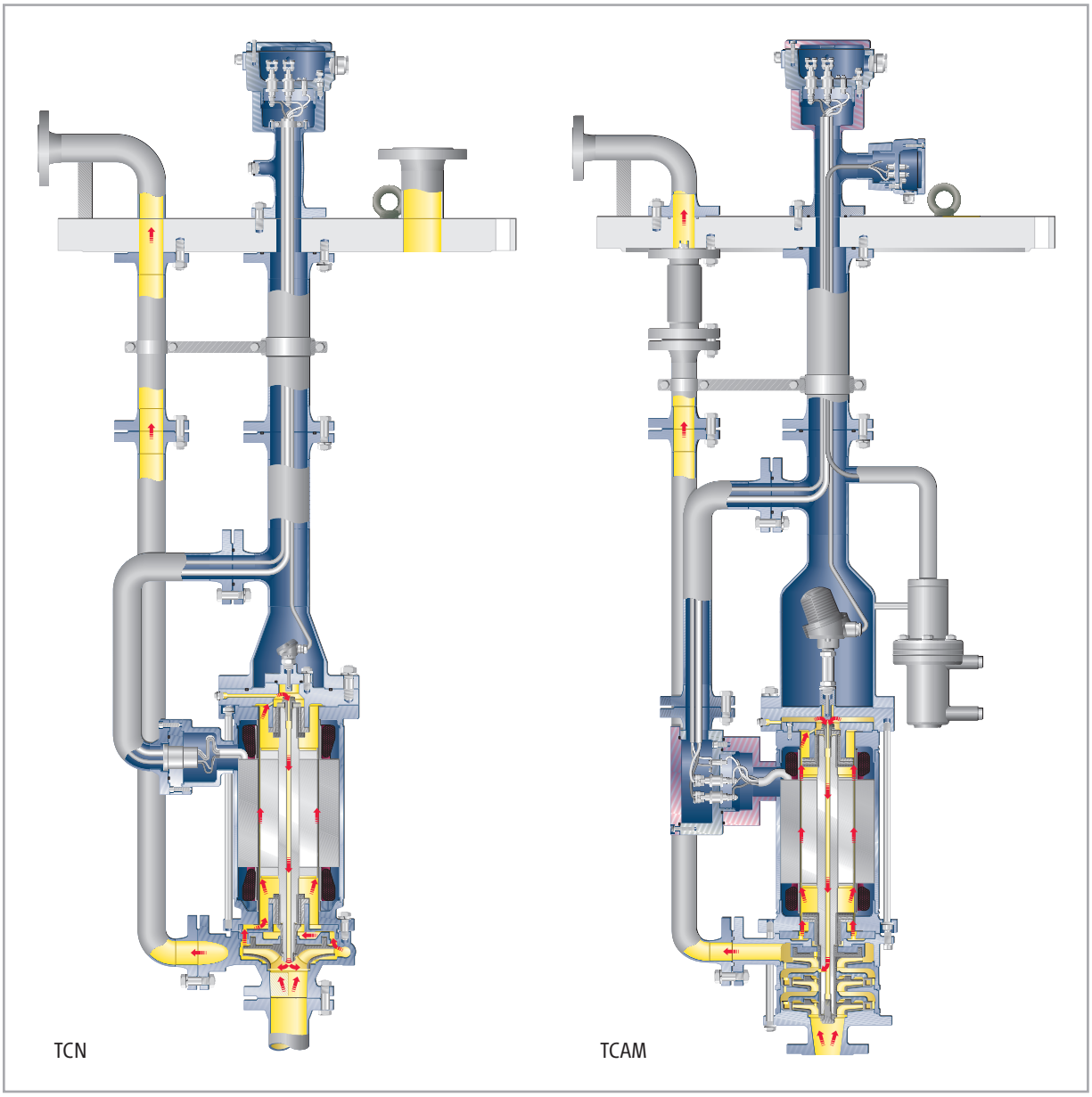
- each pump is subject to a test run and the operating point is guaranteed according to ISO 9906 – class 2 (5 measuring points)
- pressure test
- axial thrust measurement
- leak test

Additional inspections

The following inspections can be carried out and certified against additional price (e.g. NPSH test, Helium leakage test, vibration test, ultrasonic test, PMI test). Any further inspections and tests are according to the technical specification. The guarantees are effected according to the valid conditions of supply.

Functional principle

TCN / TCAM



Technical specification

	TCN	TCAM
Function / Design	single-stage, in vertical or horizontal design	multistage, in vertical or horizontal design
Capacity	max. 1600 m^3/h	max. 350 m^3/h
Head	max. 150 m	max. 1200 m
Viscosity	max. 300 mm^2/s	max. 300 mm^2/s
Pressure ratings	PN 16 to PN 100	PN 16 to PN 100
Materials (casing)	Nodular cast iron (JS 1025) Cast steel (1.0619+N) Stainless steel (1.4408) (special materials / higher pressure ratings are possible on demand)	Nodular cast iron (JS 1025) Cast steel (1.0619+N / 1.0460 / 1.0570) Stainless steel (1.4571 / 1.4581) (special materials / higher pressure ratings are possible on demand)

Advantages of hermetically sealed motor-driven submersible pumps

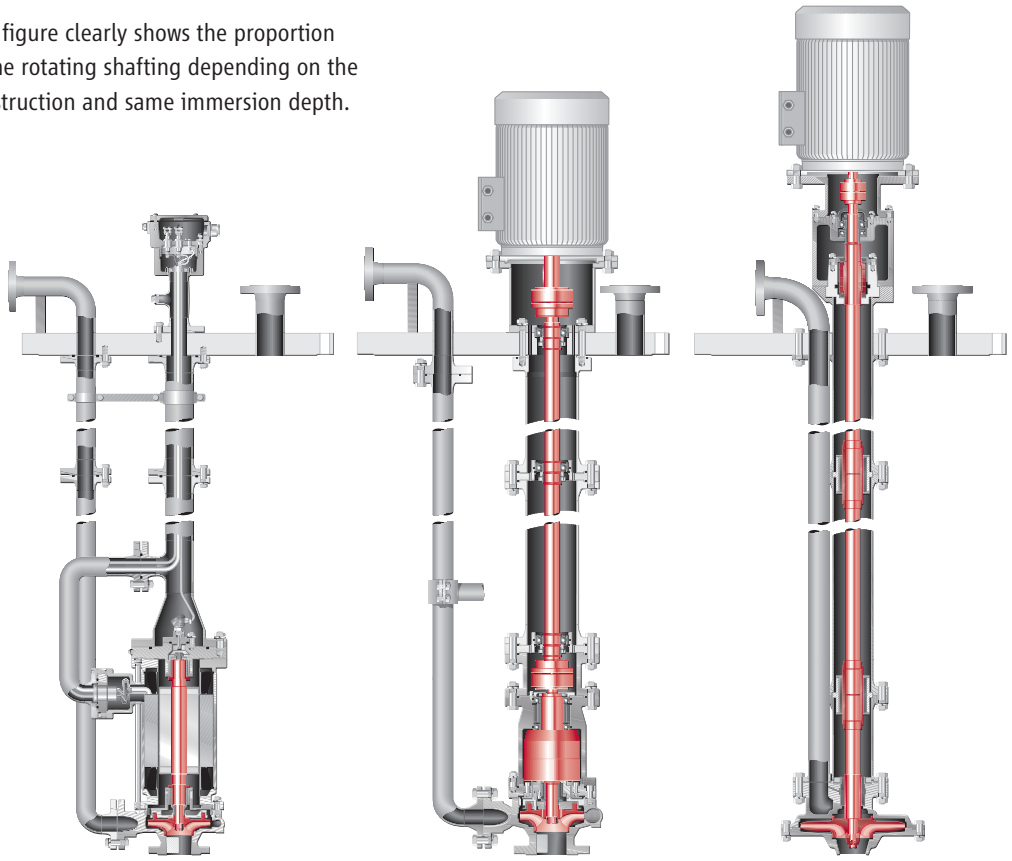
The hydraulic part is arranged above close to the vessel bottom. The pressure line is placed in parallel to the pump drive shaft via manhole door to the outside. The impeller is arranged at the shaft which is fixed by medium-lubricated guide bearings. Depending on the immersion depth several bearings will be required. The following reference value will apply: according to the pump size, one guide bearing per 1,2 m to 1,6 m is required. The bearings are installed in a support pipe that is fixed to the manhole door. The sealing to the atmosphere is effected by using a mechanical seal. The conventional drive motor is installed outside the vessel and can be used for every protection type according to the explosion requirements.

The basic and outer construction of a conventional pump with mechanical seal can be compared with the design of a submersible pump with magnetic drive. The difference of sealing to the atmosphere is the containment shell of the magnetic coupling that is directly installed to the pump component. The containment shell ensures an absolute leakage-free pump operation and can also be installed on the outside of the vessel.

Because of that, the drive shaft of this construction type is not medium-lubricated but operates in a dry place. The bearings used are prelubricated roller bearings which are placed in a support tube under dry conditions. The cable passage at the manhole door is sealed by a mechanical seal. According to the depth of assembly several bearings need to be installed here as well. Conventional electric motors can also be used here as a drive.

When installing canned motor pumps the drive shaft having a length according the immersion depth is no longer needed. The rotating parts of the pump shaft are placed in the canned motor pump and are therefore extremely short. The pump is fixed to a support pipe which is arranged at the manhole door. The single task of the support pipe is to carry the pump and to lead the cables to the outside. Medium-lubricated guide bearings or prelubricated roller bearings are not necessary since the usually used long drive shaft is not required for operational reasons. Therefore, in case of vertical submersible pumps with canned motor, the length of the drive shaft is irrespective of the immersion depth.

This figure clearly shows the proportion of the rotating shafting depending on the construction and same immersion depth.



Submersible pump with canned motor

Submersible pump with magnetically coupled drive

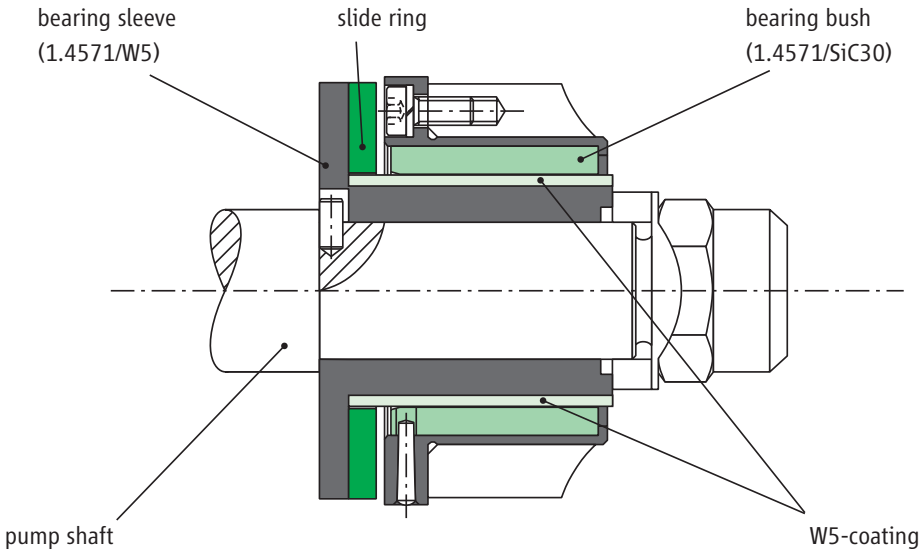
Conventional submersible pump

Bearing arrangement and monitoring systems

Bearing arrangement

The bearing in hermetically designed pumps must be located and immersed in the operating liquid. Therefore, in most cases, only the use of hydrodynamic slide bearings is required. The correct operating method ensures the advantage that no contact may be created between the bearing lining. Thus, they are constantly running free from wear and maintenance. Service life of 8 to 10 years can be easily achieved by using HERMETIC pumps.

The almost universal bearing combination based on tungsten carbide (W5) and silicon carbide (SiC30) has to be proved to be the best choice. These combinations consist of metallic shaft sleeves made of stainless steel (1.4571) and coated by tungsten carbide according to the "High Velocity Oxygen Fuel Procedure". Furthermore, they consist of a firm bearing bush made of ceramic material (SiC30) that is surrounded by a sleeve made of stainless steel. SiC30 is a mixed material of silicon carbide and graphite, combining the product advantages of both materials. Conditions of mixed friction, as they may arise for example during start-up and stopping phase of pumps, can be easily handled with SiC30. Moreover, this material is deemed to be thermal shock resistant (high resistance against changes in temperature), as well as chemically stable and blister resistant (no formation of bubbles at material surface) and abrasion resistant.



Monitoring

The most part of HERMETIC pumps are designed according to explosion protection requirements. The pumps comply with the requirements of the electrical as well as mechanical explosion protection.

Level monitoring

On condition that the rotor cavity as part of the process system is steadily filled with liquid, no explosive atmosphere may arise. In this case, no accepted explosion protection is required for the rotor cavity. If the operator is not able to guarantee for a steady filling, it is necessary to install level monitoring devices.

Temperature monitoring

The observance of the temperature class and the maximum admissible surface temperature of the canned motor, respectively, is ensured via thermistor in the stator winding and/or via a measuring point on the bearing cover (liquid temperature).

Monitoring of rotor position

The axial thrust balancing is mainly influenced by the operating method of the pump, plant conditions and by various physical data of the liquid to be conveyed. For early detection of the source of errors, it is recommended to install a rotor-position-monitoring device. This electronic protective gear monitors the axial shaft clearance of the rotor, as well as its direction of rotation during operation in a hermetic and seal-less way. Together with the level and temperature monitoring, an effective and automatic early detection of failures may be achieved.

Mounting systems

The HERMETIC canned motor submersible pump provides the optimum solution for difficult installations. Essentially there are two different installations in the tank and in the vessel:

a) direct placing in the tank (figure 1)
b) installation of the pump with the opportunity to separate the pump from the liquid in the vessel (figure 2)

Installation vessel pump

The direct placing of the submersible pump in the tank is recommended for small container volumes, e.g. for NPSHA improvement in vessel loading/unloading stations.

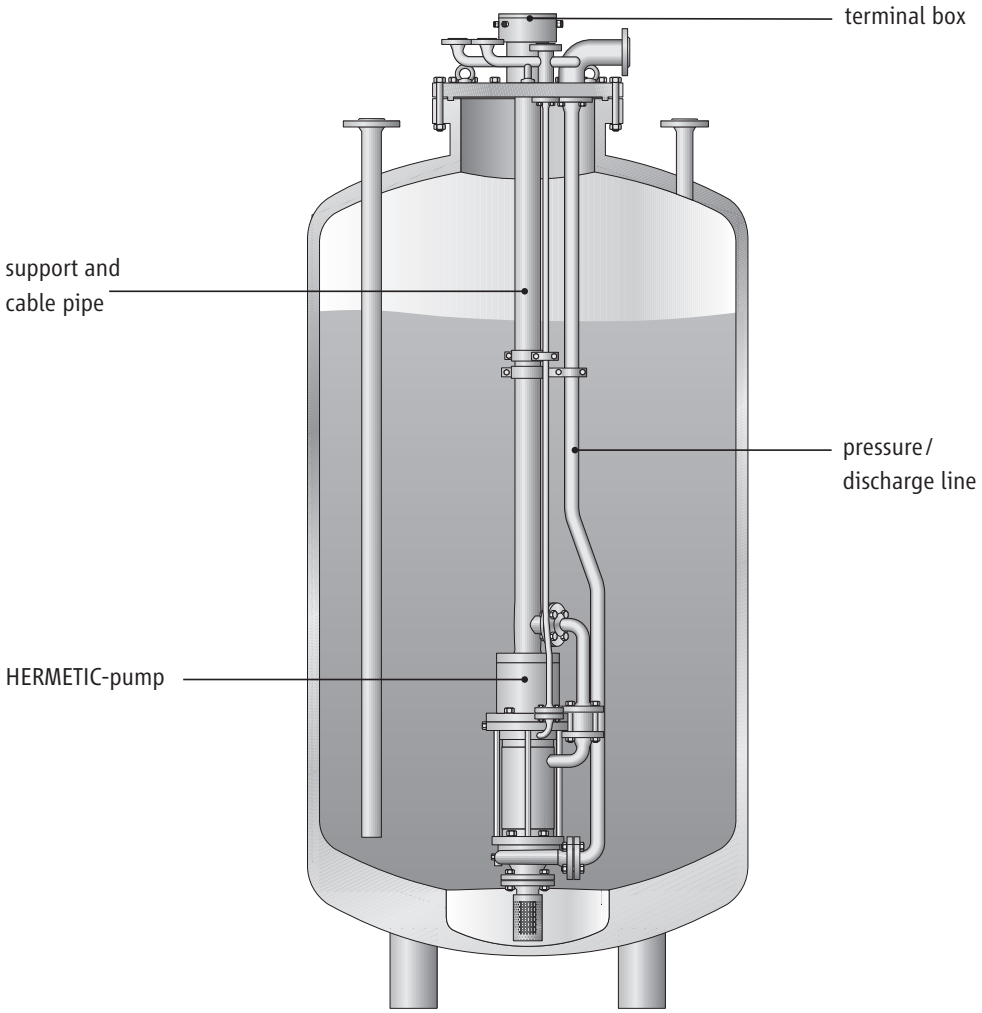


Figure 1

Installation pump with the opportunity to separate the pump from the liquid in the vessel

If it is necessary that the submersible pump with a filled tank is removed and reinstalled during a revision, the installation when the pump is separate from the liquid has proved to be the best optimum solution.

In this system, there is a shut-off valve close to the tank bottom, which can be operated with a gear or with a pressure medium run system.

The delivery medium can be pushed back into the tank by inertisation. After closing of the valve and releasing the pressure the submersible pump can be removed or installed without emptying the vessel.

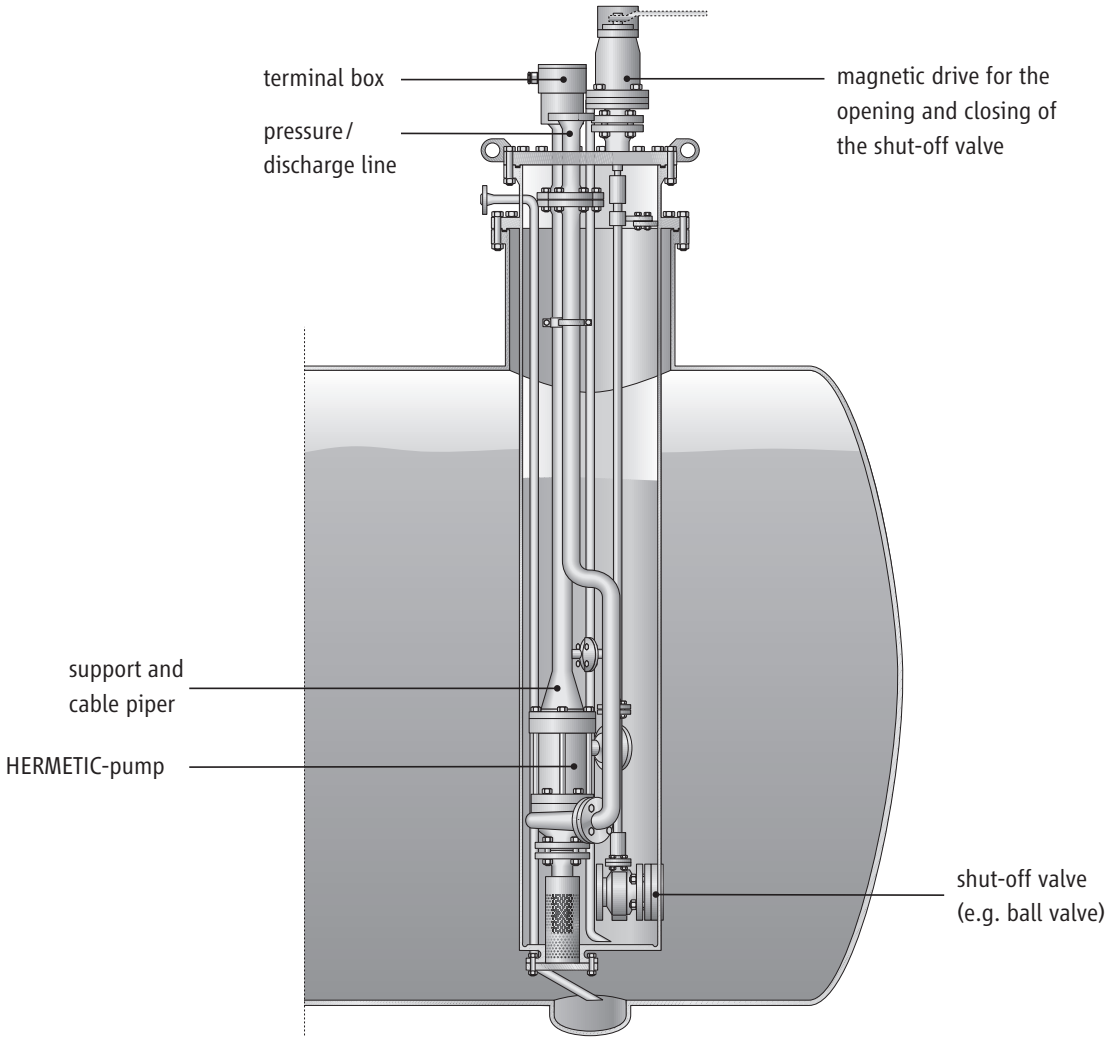
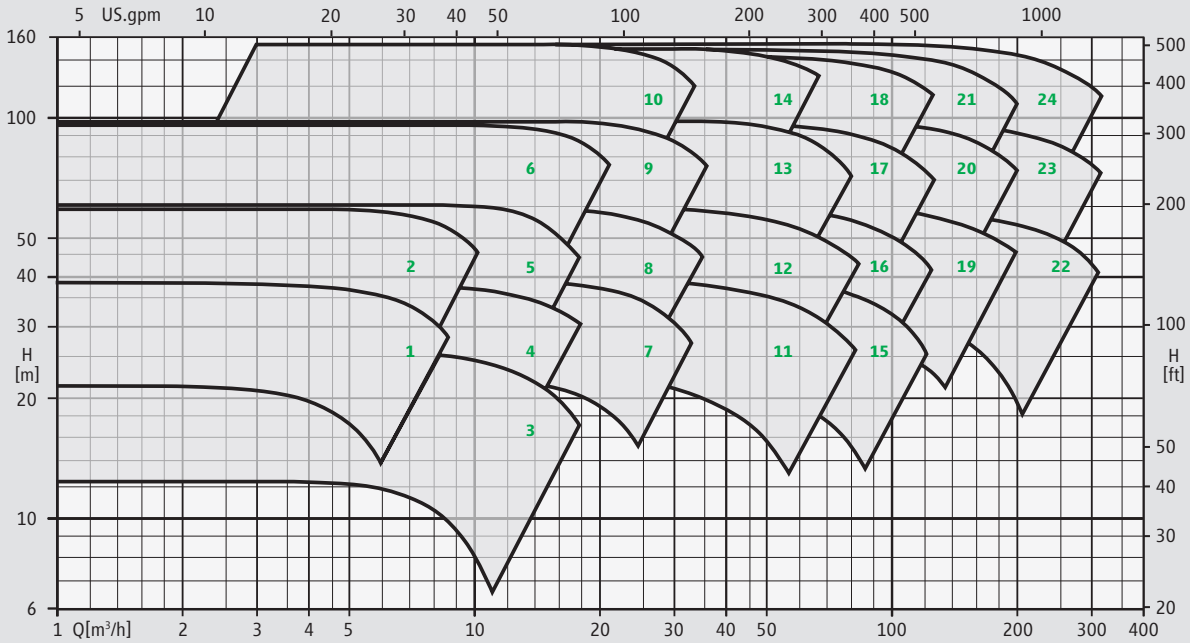


Figure 2

Characteristics diagram

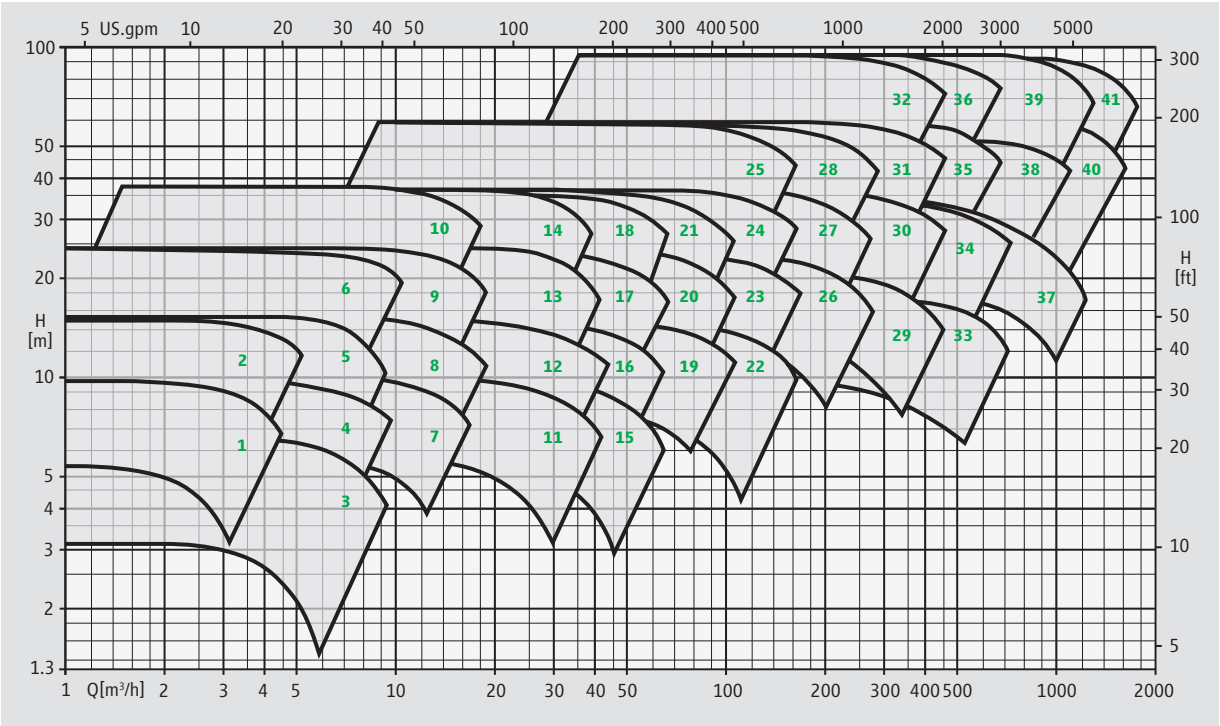
Characteristics diagram TCN – 2900 rpm 50 Hz



Denomination of hydraulics to the characteristics diagram

1 25-160
2 25-200
3 32-125
4 32-160
5 32-200
6 32-250
7 40-160
8 40-200
9 40-250
10 40-315
11 50-160
12 50-200
13 50-250
14 50-315
15 65-160
16 65-200
17 65-250
18 65-315
19 80-200
20 80-250
21 80-315
22 100-200
23 100-250
24 100-315

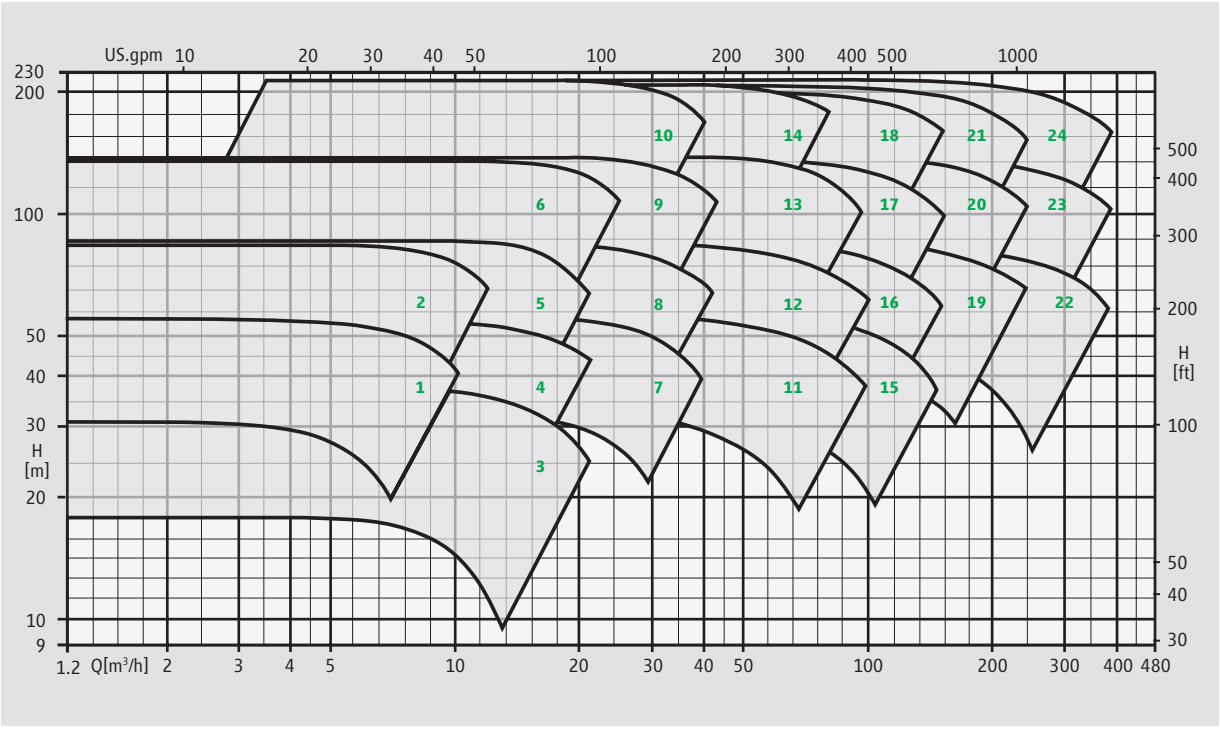
Characteristics diagram TCN – 1450 rpm 50 Hz



Denomination of hydraulics to the characteristics diagram

1 25-160	**10** 40-315	**19** 80-200	**28** 125-400	**37** 250-315
2 25-200	**11** 50-160	**20** 80-250	**29** 150-250	**38** 250-400
3 32-125	**12** 50-200	**21** 80-315	**30** 150-315	**39** 250-500
4 32-160	**13** 50-250	**22** 100-200	**31** 150-400	**40** 300-400
5 32-200	**14** 50-315	**23** 100-250	**32** 150-500	**41** 300-500
6 32-250	**15** 65-160	**24** 100-315	**33** 200-250	
7 40-160	**16** 65-200	**25** 100-400	**34** 200-315	
8 40-200	**17** 65-250	**26** 125-250	**35** 200-400	
9 40-250	**18** 65-315	**27** 125-315	**36** 200-500	

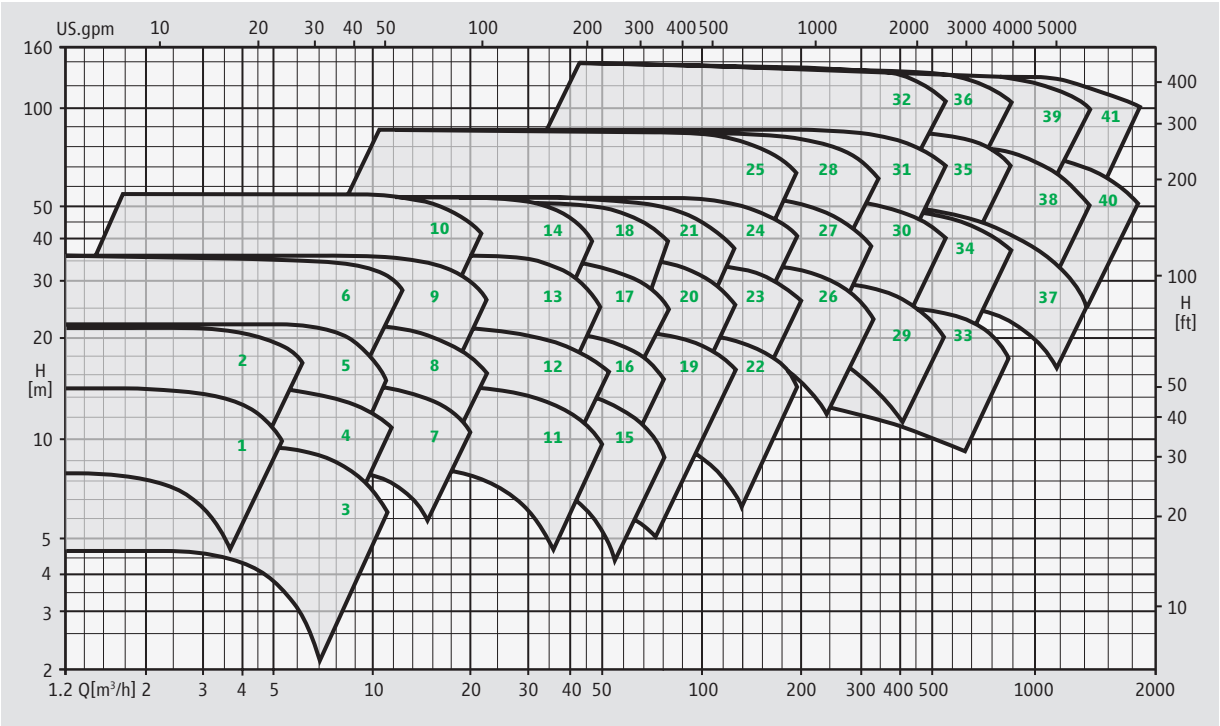
Characteristics diagram TCN – 3500 rpm 60 Hz



Denomination of hydraulics to the characteristics diagram

1	25-160	**10**	40-315	**19**	80-200
2	25-200	**11**	50-160	**20**	80-250
3	32-125	**12**	50-200	**21**	80-315
4	32-160	**13**	50-250	**22**	100-200
5	32-200	**14**	50-315	**23**	100-250
6	32-250	**15**	65-160	**24**	100-315
7	40-160	**16**	65-200		
8	40-200	**17**	65-250		
9	40-250	**18**	65-315		

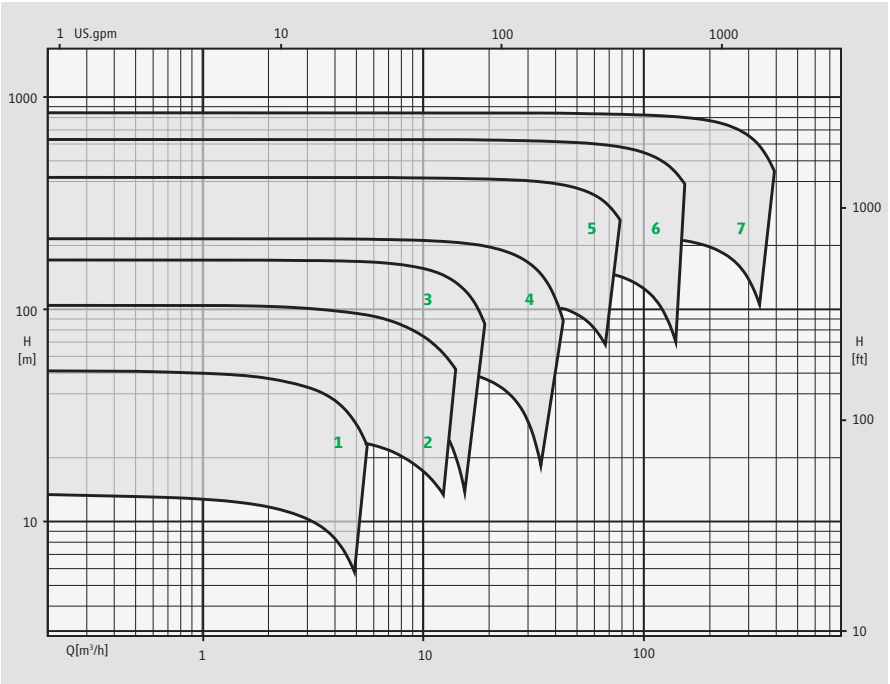
Characteristics diagram TCN – 1750 rpm 60 Hz



Denomination of hydraulics to the characteristics diagram

1 25-160	**10** 40-315	**19** 80-200	**28** 125-400	**37** 250-315
2 25-200	**11** 50-160	**20** 80-250	**29** 150-250	**38** 250-400
3 32-125	**12** 50-200	**21** 80-315	**30** 150-315	**39** 250-500
4 32-160	**13** 50-250	**22** 100-200	**31** 150-400	**40** 300-400
5 32-200	**14** 50-315	**23** 100-250	**32** 150-500	**41** 300-500
6 32-250	**15** 65-160	**24** 100-315	**33** 200-250	
7 40-160	**16** 65-200	**25** 100-400	**34** 200-315	
8 40-200	**17** 65-250	**26** 125-250	**35** 200-400	
9 40-250	**18** 65-315	**27** 125-315	**36** 200-500	

Characteristics diagram TCAM – 3000 rpm 50 Hz



Denomination of hydraulics to the characteristics diagram

1 TCAM 1 / 2-6 stages

2 TCAM 2 / 2-6 stages

3 TCAM 30 / 2-6 stages

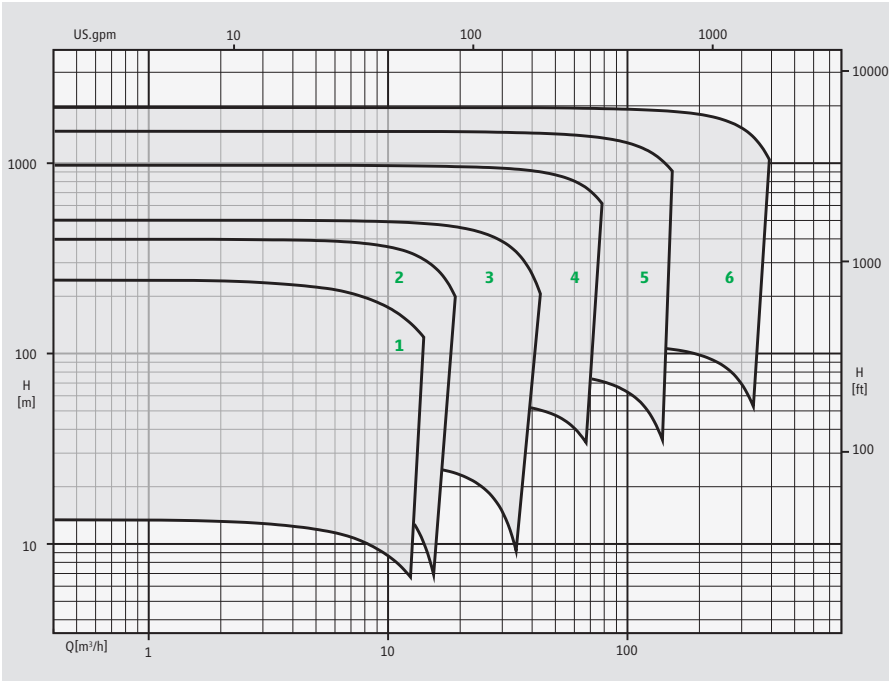
4 TCAM 32 / 2-6 stages

5 TCAM 44 / 2-6 stages

6 TCAM 52 / 2-6 stages

7 TCAM 64 / 2-6 stages

Characteristics diagram TCAM-Tandem – 3000 rpm 50 Hz



Denomination of hydraulics to the characteristics diagram

1 TCAM 2 / 1+0 to 7+7

2 TCAM 30 / 1+0 to 7+7

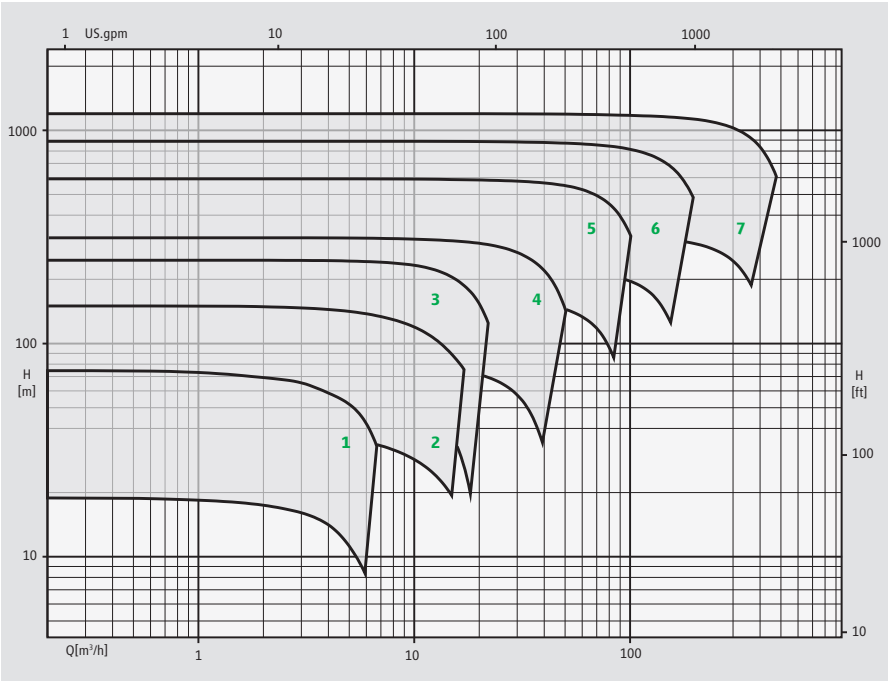
3 TCAM 32 / 1+0 to 7+7

4 TCAM 44 / 1+0 to 7+7

5 TCAM 52 / 1+0 to 7+7

6 TCAM 64 /1+0 to 7+7

Characteristics diagram TCAM – 3600 rpm 60 Hz



Denomination of hydraulics to the characteristics diagram

1 TCAM 1 / 2-6 stages

2 TCAM 2 / 2-6 stages

3 TCAM 30 / 2-6 stages

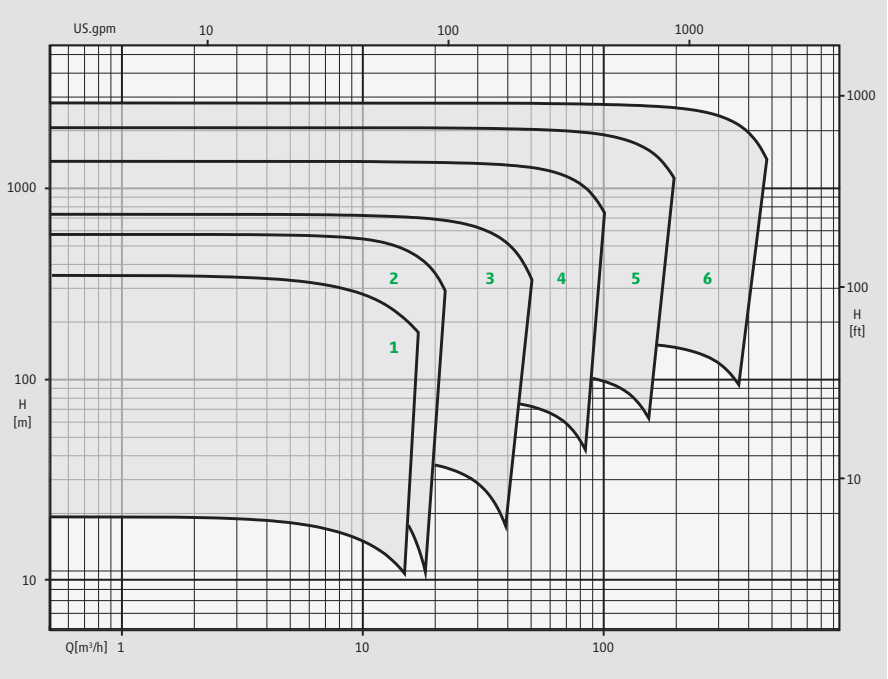
4 TCAM 32 / 2-6 stages

5 TCAM 44 / 2-6 stages

6 TCAM 52 / 2-6 stages

7 TCAM 64 / 2-6 stages

Characteristics diagram TCAM-Tandem – 3600 rpm 60 Hz



Denomination of hydraulics to the characteristics diagram

1 TCAM 2 / 1+0 to 7+7

2 TCAM 30 / 1+0 to 7+7

3 TCAM 32 / 1+0 to 7+7

4 TCAM 44 / 1+0 to 7+7

5 TCAM 52 / 1+0 to 7+7

6 TCAM 64 / 1+0 to 7+7

Our products comply with:

- Explosion protection acc. to ATEX / UL / CQST / CSA
- VOC directive 1999/13/EC
- TA-Luft
- IPPC directive
- CE
- RCCM, level 2
- Rosgortechnazdor

HERMETIC-Pumpen GmbH is certified acc. to:

- ISO 9001:2000
- GOST "R"
- ATEX 94/9/EG
- AD HP 0 / TRD 201
- DIN EN 729-2
- KTA 1401, QSP 4a

Convincing service.

Important features are readiness, mobility, flexibility, availability and reliability. We are anxious to ensure a pump operation at best availability and efficiency to our customers.

Installation and commissioning

- service effected on site by own service technicians

Spare part servicing

- prompt and longstanding availability
- customized assistance in spare part stockkeeping

Repair and overhauling

- professional repairs including test run executed by the parent factory
- or executed by one of our service stations worldwide

Maintenance and service agreement

- concepts individually worked out to increase the availability of your production facilities

Training and workshops

- extra qualification of your staff to ensure the course of your manufacture

LEDERLE Hermetic

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PRODUKTINFO
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