

**PUMP GLOSSARY**

Axial thrust balancing in canned motor pumps

**LOCATION NEWS**

New building and relocation in the USA completed



HERMETIC-PUMPEN, for more than 150 years innovation leader in the field of pump technology and hermetically sealed pumps, takes into account decades of growth on international markets by expanding the production areas. With the construction of a new fifth hall, we have expanded the production area at the Gundelfingen site by 3,500 square metres. The height of the imposing new building ranges between 10 and 16 metres. Specially designed crane systems will enable us in future to produce and handle pumps with a weight of up to 32 tonnes and overhanging dimensions. In the newly installed high-tech test

bench, our specialists test and check pumps with a capacity of up to 1.6 megawatts.

The expansion of production areas is an important milestone for our company. We have repositioned our organisation and structure. Optimised processes enable us in future to advise and serve our customers even more comprehensively, more focused and faster. Regardless of whether these are customer-specific canned motor pumps or standardised solutions. HERMETIC focusses all pump technology competencies under one roof.



**Dear business partners and interested parties of our company,**

With our new customer magazine **HERMETIC 360°**, we would like to keep you up to date with developments on products, trade fairs and seminars. Project reports provide insights into technical details and specific applications in highly sensitive conveying and production areas. Please pass on HERMETIC 360° to colleagues, experts or other interested parties. Our magazine is also available for download on our website.

We invite you to subscribe to our customer magazine at [www.HERMETIC360.com](http://www.HERMETIC360.com). We look forward to your suggestions, requests or feedback to [HERMETIC360@hermetic-pumpen.com](mailto:HERMETIC360@hermetic-pumpen.com). We hope you enjoy reading the first issue

Nicolaus Krämer  
CEO



# The New Mathematics of Submersible Pumps

2 maintenance-free slide bearings + 1 metre shaft = 15 metres immersion depth

With the technology of the canned motor pump, HERMETIC offers a cost-effective alternative to conventionally sealed pumps and magnet-coupled installations with external drive. The decisive advantage is the elimination of long shafts or complex cooling and lubrication systems for mechanical seals.

The solution to a customer-specific problem was the installation of two 8-stage, HERMETIC canned motor pumps without shaft seals of series TCAM 30/4 + 4 in exchange for conventional submersible pumps. The real challenge in this project was to ensure the tailor-made fitting accuracy of the HERMETIC pumps supplied and used to match the existing system and the associated vessels of a customer from Switzerland. Thanks to the high-precision development and construction by HERMETIC's specialists, however, it was possible to insert the TCAM 30/4 + 4 pumps into the tanks with a diameter of 500 mm without any problems.

Our Swiss customer from the field of fine chemicals was enthusiastic as he could avoid a costly and time-consuming conversion of the existing installation of his production plant by installing the HERMETIC canned motor pump.

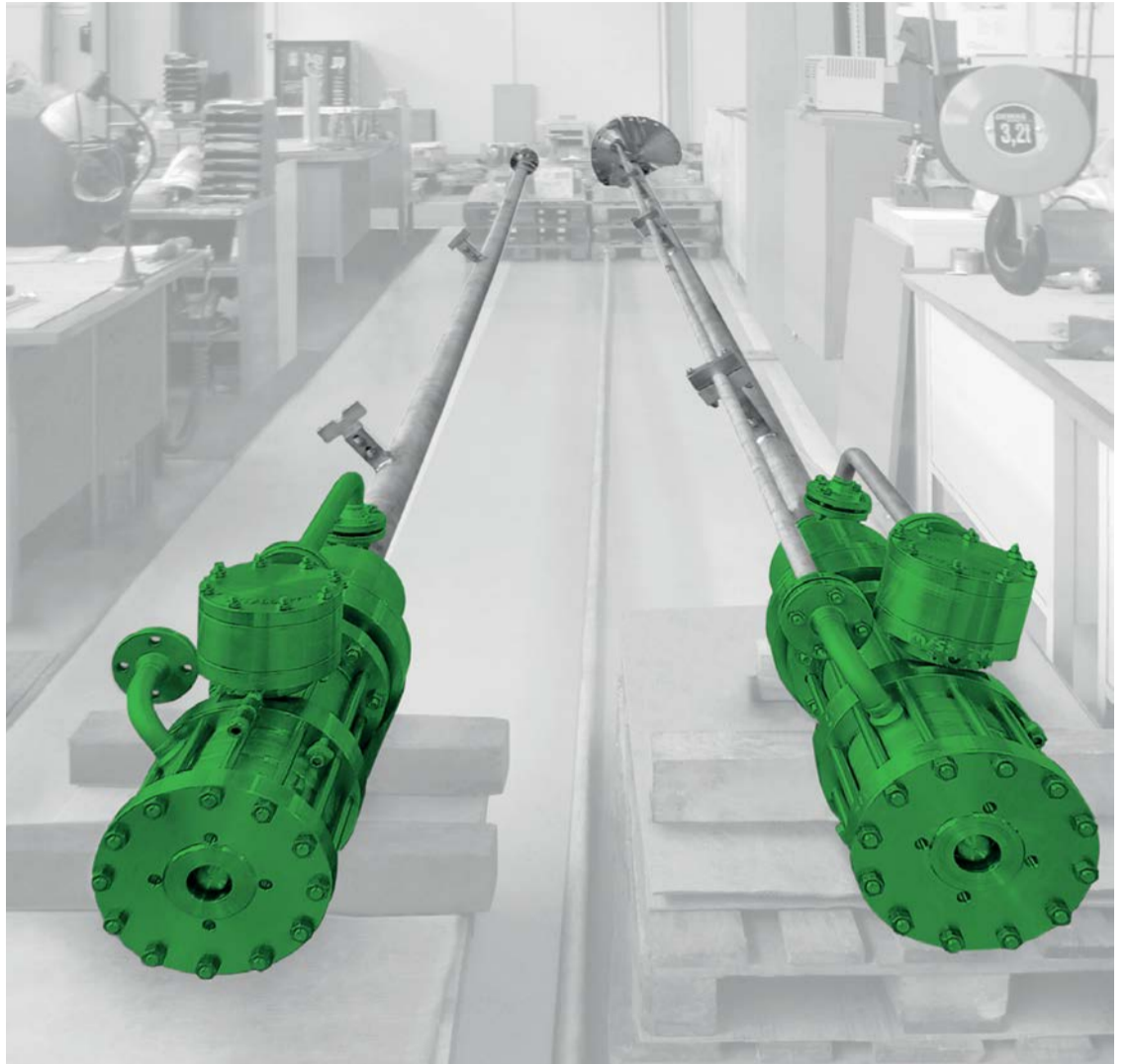
The submersible pumps used are the longest pumps ever manufactured by HERMETIC. The immersion depth of more than 15 meters with a pump shaft of only one meter proved to be a challenge particularly for the adaptation to the existing plant of the operator / owner as well as for internal and external logistics. At the customer's request, we manufactured the pumps in full length and delivered them using a special transport system.

## The pumps used

The supplied submersible pumps in tandem design convey the medium [NH<sub>3</sub>] at a temperature of -33 °C. The delivery head [H] is 260 m at a delivery rate [Q] of 12 m<sup>3</sup>/h. The pump units are designed for a nominal pressure of 40 bar and are suitable for operation with a frequency converter [30-60 Hz].

## The advantages for plant operators when using HERMETIC canned motor pumps are obvious:

- Installed HERMETIC canned motor pumps are reliable and in operation wear-free over many years without maintenance measures.
- Studies carried out at our customers show that the HERMETIC technology has a multiple of MTBFs compared to conventional installations.
- The customer saves installation, maintenance and repair costs.



Immersion depth: 15.70 m; shaft length of the pump: 1 m; slide bearing: 2 units

## Distinctive features of the technology

Thanks to the hermetically sealed construction, you can immerse the drive unit consisting of hydraulic system and motor completely in a boiler or tank. Only the pressure pipe and the electrical connection are routed out of the tank through the tank lid and manhole plate.

This offers the operator / owner considerable advantages: The slide bearings of the canned motor lubricated by the conveyed medium have a short shaft on which the rotating parts of the motor and the hydraulics are combined. The HERMETIC technology "ZART®" (Zero Axial and Radial Thrust) ensures that the rotor unit runs contact-free and wear-free.

Sensors incorporated in the HERMETIC canned motor pump monitor the safe and reliable operation of the pump.

In addition to monitoring operating temperature, fill level and motor load, it is also possible to integrate a MAP system specially developed by our company. This system monitors the position of the rotor continuously and is therefore a reliable indicator of unwanted operating conditions and wear.

Canned motor pumps prove their worth and demonstrate their strengths especially when used in cryogenic applications. The efficiency of electric motors decreases with increasing temperatures. The pumped medium cools the canned motor pump, keeps it at a low temperature and thus makes it particularly efficient.

As a low-maintenance and reliable drive unit, the canned motor is indispensable for driving submersible pumps especially for the chemical and petrochemical industry. Equipped with state-of-the-art monitoring devices and featuring a compact design, this technology often offers an efficient, cost-effective and particularly reliable alternative to conventional shaft seals or magnet-coupled versions of submersible pumps.

Do you have a specific application or a new project? Please contact us. We develop, design and produce hermetic pumps for conveying critical media. Our name stands worldwide for innovative top solutions, highest precision and excellent service.

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Dear readers, our glossary section in each new issue of HERMETIC 360° will give you an insight into the extensive HERMETIC expert knowledge gained over decades. Based on our product portfolio tailored precisely to many applications, we delve into a technical topic and explain key details. You are welcome to collect the contributions and build a comprehensive Pump Compendium.

Do you have a topic that interests you? Do you have an application with a specific technical requirement? We would like to present your suggestions to other pump specialists and users. Please contact us at: HERMETIC360@hermetic-pumpen.com

*The successful combination of high-quality slide bearings and comprehensive axial thrust balancing demonstrates the quest for absolute precision. This results in HERMETIC canned motor pumps running without contact and wear. Manufactured and tested to the highest quality standards in the factory, HERMETIC pumps guarantee long service life (MTBF) when used properly. Systems integrated into the pump, such as the MAP, monitor the position of the rotor and thus the axial thrust balancing. This ensures reliable operation of the entire system.*

Axial thrust is a challenge that must be met in almost all centrifugal pumps. The pump shaft is drawn in the direction of the suction side due to the pressure difference between the pressure and suction side. For example, bearings must absorb the resulting forces. Slide bearings are used in hermetically sealed pumps, such as magnet-coupled or canned motor pumps. This leads to specific requirements for axial thrust balancing.

The specific properties of the media that requires conveying exclude the use of mechanical thrust bearings in hermetically sealed pumps. Axial thrust balancing can therefore only be achieved by the hydraulic balancing of the rotor.

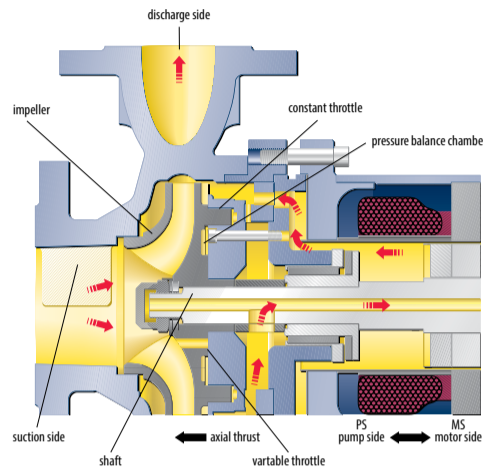
In HERMETIC canned motor pumps, the axial position of the pump shaft is controlled automatically during operation. The applied technology automatically creates a powerless state of equilibrium. No axial forces act on the thrust bearing collar of the slide bearings. A thin liquid film with high load-bearing capacity similar to aquaplaning between the rotating and the static part of the slide bearing causes the entire rotor to float.

This state of equilibrium, the so-called HERMETIC ZART® principle (Zero Axial and Radial Thrust), results from the fact that there is no contact between the rotating and stationary components. The non-contact running leads to wear-free normal operation with much longer service life (MTBF) compared to other designs.

**The technical design of axial thrust balancing depends on the size, number of stages and the medium to be conveyed of each pump used.**

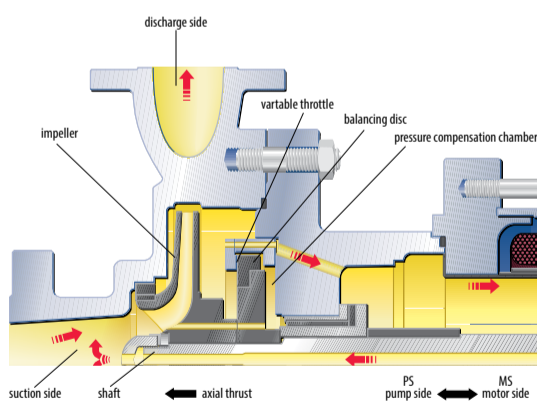
### Methods of axial thrust balancing

The hydraulic balancing system of canned motor pump series CN/CNF/CNK for the chemical industry, with hydraulic systems according to ISO 2858, consists of two main components: a fixed and a variable throttling device (Fig. 1).



**Fig. 1:** The interaction of a fixed throttling device (labyrinth gap) on the outer diameter of the impeller and a variable throttle in the region of the impeller hub creates axial thrust balancing in the hydraulic balancing device of series CN/CNF/CNK.

The interaction of a fixed throttling device (labyrinth gap) on the outer diameter of the impeller and a variable throttle in the region of the impeller hub creates axial thrust balancing. When the rotor shifts axially from the equilibrium position, the pressure in the pressure compensation chamber changes due to the valve action of the variable throttle gap and counteracts the displacement of the rotor self-regulating. The hydraulic balancing device of HERMETIC series CNP/CNPF/CNPK (according to API 685) and of multi-stage HERMETIC pumps (CAM series) is based on a variable throttling device on the cam disc. Depending on the axial position of the pump shaft, the pressure in the control chamber changes due to the valve action of the variable throttle gap and thus counteracts the axial thrust of the rotor (Fig. 2).



**Fig. 2:** The hydraulic balancing device of series CNP/CNPF/CNPK is based on a variable throttling device on the cam disc.

### Use of magnetic support bearings

For particularly critical applications and especially for canned motor pumps in vertical installation, magnetic support bearings are used in addition to the proven axial thrust balancing systems.

In normal operation, a cam disc will hydraulically balance the axial forces. When operating conditions are unstable or change, states may develop frequently that do not ensure complete axial thrust balancing. Examples are the operation of systems with frequent starts and stops, low speeds (such as operation with frequency converter) or extremely low viscosity of the conveying fluid (liquid gases, low boilers). If in these cases the hydraulic control system is too sluggish, or the restoring torque is not strong enough, magnetic support bearings will be used as well.

The magnet systems balance the rotor weight, hold the pump shaft in position and thus the axial thrust is compensated by magnetic forces even at a standstill and in unstable modes.

These systems have been in use at HERMETIC since 2001 and more than 400 HERMETIC pumps have been equipped with magnetic support bearings.

### Put to the acid test

Quality is our top priority. Therefore, we test every pump produced by HERMETIC in our new high-tech test bench before delivery. We check, record and log the following: characteristic curve, power requirement, NPSH3 value, HERMETIC ZART® principle and the hydrodynamic restoring forces as well by using a specially developed measuring device. When all quality standards guarantee the non-contact operation, the pump leaves our factory.

### Monitoring the axial thrust

Each canned motor pump used is the heart of a highly sensitive conveying system. The highest priority is their reliability and safety. To ensure reliability and safety over many years of use, HERMETIC has developed a series of special monitoring systems. One of these monitoring systems, we would like to introduce in this issue.

MAP Monitor Axial Position: Monitoring the position of the rotor and axial thrust balancing for early detection of possible sources of faults.

MAP is a measuring device based on the LVDT principle (Linear Variable Differential Transformer) for non-contact monitoring of the axial shaft position in a pump. MAP consists of a displacement sensor with supply cable and evaluation electronics accommodated in a glass-fibre reinforced polyester housing with IP 65 protection. A measuring pin with ferromagnetic core is located at the shaft end of the pump that requires monitoring. A sensor assembly records the movement of the pump shaft with high accuracy. The supplied electronic system evaluates the sensor signal that can be forwarded then to the control room where warning and shut-off values can be programmed.

This MAP system offers every plant operator / owner practical advantages: The rotor position can be determined reliably even when the pump is at a standstill and during operation with frequency converter.

## Acid Test for the New High-Tech Test Station

Canned motor pump of type CNKfH + D 350-400 tested successfully



We completed the installation of the high-tech test station in our new production hall just in time for the customer acceptance of our canned motor pump type CNKfH + D 350-400. We tested the pump with a throughput of more than 2000 m<sup>3</sup>/h. In the

presence of the international acceptance delegation, consisting of end customer, plant constructor and certified inspectors, both the pump and the test station demonstrated their functionality much to the satisfaction of the customer.

## New Company Building in Houston, USA

Continuous growth in the US and South American markets



HERMETIC-Pumps Inc., headquartered in Houston, USA, was founded just 17 years ago and has since witnessed impressive growth in the US and South American markets. To advise and serve our American customers even faster in the future, HERMETIC-Pumps Inc. moved into a new, company-owned building in Houston. The new building underlines the market orientation of HERMETIC pumps worldwide and our commitment to local markets. After a construction period of only five months, 1,500 square metres have been available for offices and warehousing since the relocation at the end of June 2017. The team has grown by a further five to a total of ten employees. HERMETIC-Pumps Inc. ensures the reliable and fast supply of HERMETIC spare parts and services locally. During a ceremony attended by

numerous customers and business partners, CEO Nicolaus Krämer and CCO Sebastian Dahlke handed over the building to the staff.

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أرامكو السعودية  
Saudi Aramco



## Certified successfully

SAUDI-ARAMCO / Aramco Overseas certifies HERMETIC as supplier

As part of an extensive certification process by Aramco Overseas, Saudi Aramco, the world's largest oil production company based in Saudi Arabia, has approved and awarded HERMETIC as a supplier of the following products:

- Canned motor pumps according to DIN EN ISO 15783
- Canned motor pumps according to API685

HERMETIC successfully fulfilled all of Aramco's requirements in terms of pump technology, quality, process flows as well as environmental and occupational safety. Aramco Overseas has thoroughly reviewed and evaluated the fulfilment of all requirements. HERMETIC accepted the supplier award as part of the successful certification and subsequently received an order for several hundred pumps.

## Dates

### Trade fairs

HERMETIC is represented at numerous trade fairs at home and abroad. We look forward to your visit. If you would like a personal meeting, please contact us in advance:  
[messen@hermetic-pumpen.com](mailto:messen@hermetic-pumpen.com)

- PUMP SYMPOSIA – Houston, USA  
12-14/12/2017
- STOC EXPO Europe – Rotterdam, Netherlands  
20-22/03/2018
- ACHEMA – Frankfurt, Germany  
11-15/06/2018
- CHILLVENTA – Nuremberg, Germany  
16-18/10/2018

### Training

With our training courses we turn you into a pump expert. Whether beginner or expert, whether plant operator / owner, project engineer or plant engineer. We adapt our training courses to your wishes and requirements.

- Seminar S01, 11/10/2018  
Die Spaltröhrenmotorpumpe in der Anlage und Explosionsschutz von Spaltröhrenmotorpumpen
- Seminar S02, 24+25/10/2018  
Instandhaltung von Spaltröhrenmotorpumpen
- Seminar S11, 07/11/2018  
The installed canned motor pump and explosion protection of canned motor pumps
- Seminar S21, 14+15/11/2018  
Maintenance of canned motor pumps

Further information is available at:  
[www.hermetic-pumpen.com/en/service/seminars](http://www.hermetic-pumpen.com/en/service/seminars). Registration documents are available at the same address.  
Please send any further question to:  
[seminare@hermetic-pumpen.com](mailto:seminare@hermetic-pumpen.com)

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