



New and MAGnificent CRN sealless drive



Figure 1: The sealless CRN is designed for situations where pumped liquid must never leak.

The world's most reliable and most efficient inline centrifugal pump just got a little bit more unbeatable.

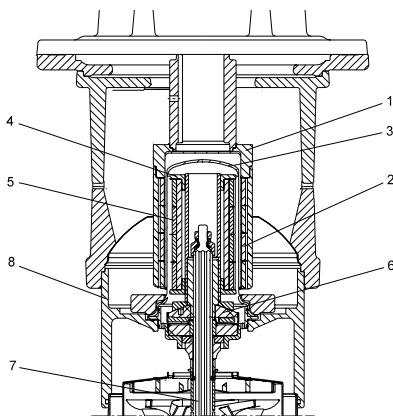
The new sealless variant of the Grundfos CR, the CRN MAGdrive, is perfect for situations where liquid or vapours must not escape from the pump. This could apply to toxic, explosive or otherwise hazardous liquids. In situations where abrasive or corrosive liquids create such extensive problems for mechanical seals, a sealless solution can eliminate the need for frequent seal replacement. CRN MAGdrive also offers unique assurances in environments that under no circumstances can tolerate leakage, such as a water-cooled environment containing IT or medical equipment.

The new magnetic drive is so efficient that you don't need to derate the pump motor to maintain performance. And it is so inherently reliable that we just put the usual safety precautions on to be absolutely sure – and because you wouldn't believe us otherwise.

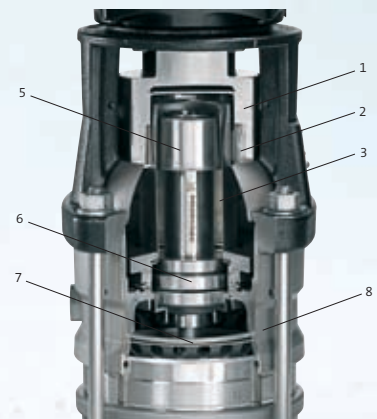
In this article we are going to run you through the technicals that make the new Grundfos CRN MAGdrive the only right choice for pumping liquids that must never be able to leak into the surrounding environment.

The Grundfos CR is the world's most energy-efficient pump of its kind. It comes with a motor in the highest energy class (EFF 1). So of course the new magnetic drive has to live up to the same standard. The same can be said of its reliability. No pump of this kind can match the reliability of a Grundfos CR. So given the types of liquids that the MAGdrive is intended for, reliability is in focus in every aspect.

We have gone to great lengths to ensure that we are sending a genuinely reliable and efficient sealless solution onto the market. This has resulted in ten new patents.



Pos.	Designation
1	Outer drive
2	Outer magnets
3	Can
4	Inner drive
5	Inner magnets
6	Bearing system
7	Drive/pumps shaft
8	Pump head



To start with the basics, a magnetic drive replaces the shaft seal, which is the most high-maintenance component on a pump of this kind. This effectively prevents a Grundfos CRN from leaking. Where the seal would normally be, the pump is hermetically sealed by a stainless steel can.

Instead of the usual direct coupling, an outer magnet fixed to the motor shaft transfers power across the can to an inner magnet fixed to the pump shaft.

Quality testing

We have weighted safety and reliability very highly. The MAGdrive is made of the same AISI 316 steel as all other CRN components in contact with the pumped media. And it is designed to withstand pressure and temperature conditions beyond those of the pump itself. For example, a CRN is designed to withstand continuous operation at a maximum of 120°C. The MAGdrive magnets can tolerate a maximum temperature of 150°C.

We have also done what we can to test the new coupling to its limits. Nothing is left to chance. CRN MAGdrive has been subjected to 1 million start/stops without any damage. A water hammer test of 600,000 cycles at 40 bar resulted in zero damage. The inner can has been static pressure tested to 100 bar. And the axial bearing system is tested to a load of 5500 kg. Again no damage.

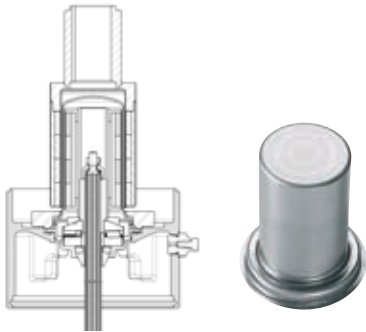


Figure 3. To reduce the efficiency loss to a minimum, the wall of the can is deep drawn and rolled to an ultra thin 0.4 mm. Strain hardening ensures that it retains its strength.

Maintains high efficiency

With a Grundfos MAGdrive, losses are as low as 2-5 % in motors from 1.1 to 22 kW. In the smallest CRN motors (0.37 – 0.75 kW) these losses are between 8-16%, which is still almost half that of alternative magnetic drives. In almost all situations a Grundfos CRN can continue to deliver the same performance without derating the motor.

It is the ultra-thin (0.4mm) wall of the inner can that minimises the efficiency loss. To give such high efficiencies and still maintain strength and integrity, the can is strain hardened in a unique deep-draw and rolling process.

Unique ways to protect the bearings

An unavoidable by-product of a magnetic coupling is heat, which increases the risk of overheating and damaging the bearings. The risk has been reduced considerably by achieving such a high degree of efficiency. This in itself minimises the heat generated around the MAGdrive. In fact, so little heat is generated that a heat sensor is superfluous.

Until now, it has been a serious challenge to design a suitably reliable means to deal with the heat that inevitably does arise around the magnet. To overcome this challenge, we made two novel design changes. These have increased reliability to a level that is now unmatched by other magnetic couplings.

The first novel design change was to move the bearings out of the danger zone. The bearings have been placed below the level of the can itself. This has two effects:

1. the bearings are as far away from the heat source as they can be
2. the bearings are always submersed in the pumped media.

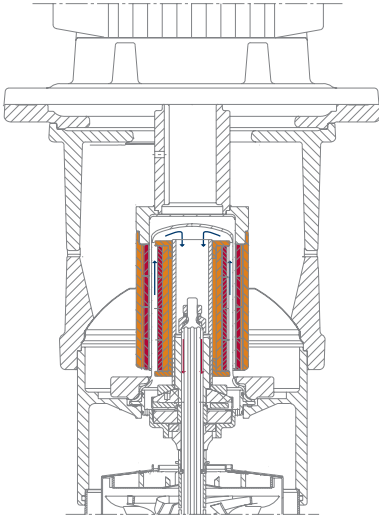


Figure 4. Differential pressure causes pumped liquid to circulate around and cool the CRN MAGdrive. The arrows indicate the flow of liquid cooling the drive.



Figure 6. The outer and inner magnets respectively. A stainless steel cover protects the magnet from corrosion. The cover is seamless (no welds) which further increases corrosion resistance.

Cooling the drive

The second novel design change was to create a low pressure zone at the very top of the pump. This ensures that a small amount of pumped media circulates around and through the drive. The differential pressure draws media up the inside wall of the can to the top of the pump. The media is returned through the centre of the inner magnet. Every second spline in the drive shaft is used to channel the liquid back down again, cooling the upper bearings at the same time. (see Figure 5)

In summary, the heat issue was effectively resolved by three means:

1. By significantly reducing the amount of heat generated
2. By effectively removing the heat that is generated.
3. By moving heat sensitive parts away from the heat source

Our thinking could be then directed at other ways of increasing reliability.



Figure 5. The cooling system channels pumped liquid along every second spline to aid magnet cooling.

Bearing design

To increase bearing lifetime and simplify maintenance, the radial bearing and axial bearings have been combined into a single unit. This ensures that the parts are positioned correctly in relation to each other for optimal effect and longer lifetime. For maintenance, the bearing is removed and replaced as a single component.

To protect the ceramic bearings, the upthrust bearing is positioned firmly against the stationary axial bearing. Under upthrust conditions, such as water hammering, the parts are so firmly lodged together that the bearing parts are protected from impact damage.

The upthrust bearing itself can also act as a safety bearing in case the radial bearing is damaged.

Corrosion-proofing the magnets

The magnets themselves are by nature highly susceptible to corrosion. Since the environment around a CRN MAGdrive is expected to be hostile, the magnets are encapsulated in stainless steel. This is unique to CRN MAGdrive and gives it an unparalleled long lifetime.

Customised solutions

The CRN MAGdrive takes its place in the world's most flexible range of customised industrial pumps. The choices of motor configuration, seal solutions and pump modules are so wide that at last count the overall CR range exceeded one million variants. In effect, a CR customer can order a custom-built pump that exactly fits very specific requirements and receive it within a normal delivery timeframe.

Like all components in the CR range, Grundfos has specifically designed the MAGDrive to fit on a "standard" CRN without changing other components. In contrast to other magnetic couplings, the CRN MAGdrive is designed for vertical operation.

The CR range includes a wide selection of solutions that can further increase safety and reliability. The range of motors offers customers:

- special supply voltages
- extreme operating conditions
- special motor protection
- specific approval
- special motor design

The pumping situation or the characteristics of the pumped liquid can make it relevant to consider some of the options highlighted here in the table.

Situation	Customised solution
Flammable atmosphere	ATEX-approved A full range of special explosion proof and dust ignition-proof motors is available with ATEX-approved pumps.
Risk of cavitation	Low NPSH pump For applications involving poor inlet conditions, special low NPSH versions are available to reduce net positive suction head and prevent cavitation.
Aggressive liquids	Rubber materials Pumps fitted with chemical resistant FXM (Fluoraz®) or FFKM (Kalrez®) rubber O-rings are available for applications where the liquid may damage standard O-ring materials, EPDM, FKM, (Viton®).
Corrosive atmosphere	All stainless steel version

Certificates

A wide range of pump and material certificates are available for the CRN MAGdrive, including:

- material specification
- duty point verification
- vibration test
- motor test
- ATEX
- inspection certificates

Read more about it

The CRN MAGdrive gives you more than just a sealless multistage industrial pump. The safety features and unique design add an even higher degree of reliability to the pump by addressing all the areas where a pump can wear or be damaged. At the same time this has been achieved while maintaining a comparatively very high level of efficiency.

For more information about CRN MAGdrive, go to www.grundfos.com/CR. The site offers a product leaflet and a datasheet that includes technical documentation and specifications for Grundfos' new magnetic coupling.