



WARRENDER, LTD.  
Seal-less Mag-Drive Pumps  
*From Stock or Built-to-**Spec**™*

Ammonia & CO<sup>2</sup>  
Circulation and  
Transfer Pumps

Providing environmentally safe seal-less magnetic pumps of the highest quality for over 30 years

Our company goal is to provide the solutions that protect our surroundings, raise the environmental awareness, and promote the growth of the community.



## Services

### Refrigeration Systems

- Ammonia, CO<sub>2</sub>
- Fluorocarbon refrigerants

### API & CPI Processes

- Liquefied Gases
- Petroleum By-Products
- Hydrocarbons
- Petrochemicals
- Chemical processing

### Thermal Transfer Systems

- High-temp synthetic oils
- Low-temp synthetic oils

**Zero Emissions**  
**Low Heat Load**  
**No Flashing**

# WARRENDER SEAL-LESS MAG-DRIVE PUMPS

## *Seal-less Pumps - Standard Motors™*

Warrender mag-drive seal-less pumps meet EPA zero emissions regulations with versatile magnetic coupling technology. Minimal heat loads, field serviceability and lower installation costs are significant process advantages. Solve your most challenging pumping problems with reliable and cost effective solutions.

### Zero Emissions and Maximum Safety

Benefit from a process free of leakage, contamination or toxic releases while avoiding constant monitoring and potential environmental fines. Eliminate all toxic and dangerous chemical releases including explosive and volatile liquids that can react with atmospheric contact.

### Advanced Technology and the Highest Quality for Long Pump Life

WARRENDER pump designs are built to the highest quality standards to protect your process, preventing costly maintenance and lost production time.

- Robust, high thickness pump casings
- High efficiency impellers with low NPSH requirements
- High strength, rare earth magnetic couplings suitable for extreme temperatures
- Heavy duty rear casings in single or double walled non-welded design
- Rugged internal bearing system withstands process upsets

### Performances to the Extreme

- Flows from 0.1 to 4500 gpm
- Pressures up to 7,250 psig
- Heads to 3,250 feet
- Temperatures from -238°F to +600° F
- Pump liquefied gases or liquids with low NPSH
- Compatible with VFD control systems



### Three Designs Provide Complete Hydraulic Coverage

- High head turbine for transfer systems
- High flow centrifugal for compressor circulation systems
- Low flow rotary vane for injection systems

### Typical Applications

- Liquid Ammonia, CO2 and Fluorocarbon Refrigerants
- All EPA monitored chemicals
- Dangerous, toxic, noxious and carcinogenic liquids
- Solvents, hydrocarbons, pyrophorics and other volatile liquids
- Heat transfer fluids (up to 650° F, 840° F w/ heat exchanger).
- Hot / super heated water
- Liquefied gases
- Cryogenic fluids (down to -150°C)
- High pressure circulation systems
- Pressurizing mechanical seal pots
- Sampling, metering or chemical injection systems





# Series WMTA-LN Regenerative Turbine

(high heads, low to medium flows)

## Transfer Pumps: Low NPSH - High Head, Seal-less Turbine

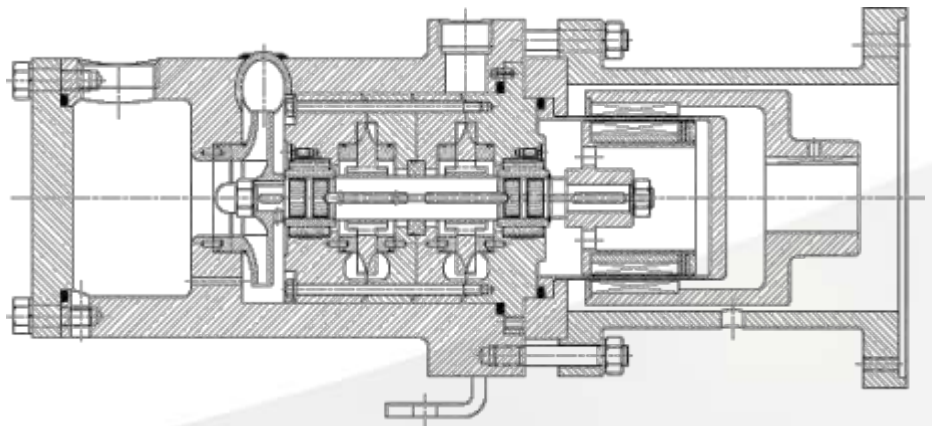
Series WMDAT-LN mag-drive regenerative turbine pumps safely meet high head, low NPSA system requirements. Dynamic turbine impeller pumping action handles entrained gases to resist vapor locking.

### WMTA-LN Features

- High head pumping with pulsation free performance
- Handles up to 20% entrained gas, resists vapor locking
- Dynamic design (avoid over pressurization w/ P.D. pumps)
- Low heat induction to avoid flashing

### WMTA-LN Performance Range

- Flows from 0.25 to 45 gpm (**0.5 - 10 m<sup>3</sup>/h**)
- Heads to 800 feet (**213 m**)
- System Pressures to 1450 psig (**100 bar**)
- Temperatures from -148 to +600 F (**-100 to +315 C**)
- NPSHr to 1'



Regenerative Turbine Pump - 3 Stage Cross-Section

# Low Flow Requirements



Low Flow Turbine Mag-Drive at C.E.R.N.'s Super Collider

## Rise to Shut-Off & Flow Control

Turbine pumps are rated for continuous duty in low flow – high head systems. Variations in differential heads have minimal effect on turbine pump flow due to the high rise to shut-off. Dynamic turbine pump characteristics accommodate control valve regulation without by-passing.

## Centrifugal Flow Ratings

The accepted guideline for centrifugal pumps is 10% to the right of BEP (Best Efficiency Point) and 20% to the left. This ensures optimal hydraulic efficiencies and prevents runout and high head cavitation. Recirculation frictional heat of process liquid within centrifugal pumps operating below minimum stable flows can lead to high head cavitation from the energy that is imparted into the liquid.



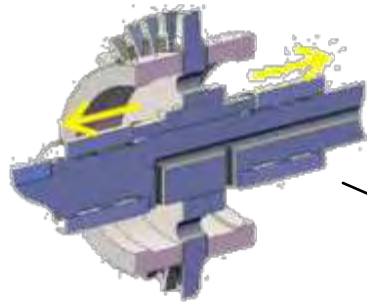
## WMTA Standard Turbine Mag-Drive Performances

- Continuous or intermittent low flow – high head pumping
- Handles up to 20% entrained gas and resists vapor locking
- Flows up to 45 gpm (10 m<sup>3</sup>/hr)
- Heads up to 3,250 feet (990 m)
- System pressures from vacuum up to 7,250 psig (500 bar)
- Temperature from -150°F/ -100°C to +650°F/ 343°C (840° F w/ heat exchanger)

“Barrel” construction, with back inserted volute rings, to have the best hydraulic alignment and the longest wear rings life. Available in 2 or 4 stages

The hydraulic barrier between stages is made of a special high pressure seal

Particular design of the hydraulic, with self balancing impeller to improve the wear ring life

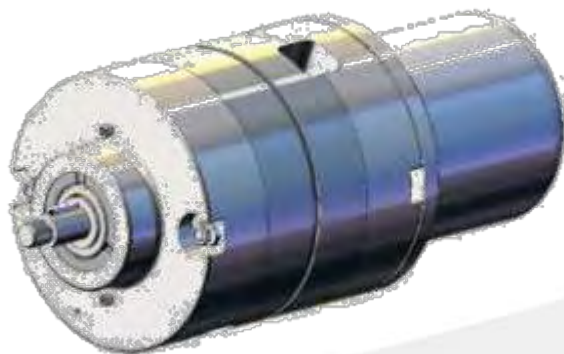


The range design is available in two or four stages, with or without centrifugal inducer to minimize the required NPSH to 1' - 2'

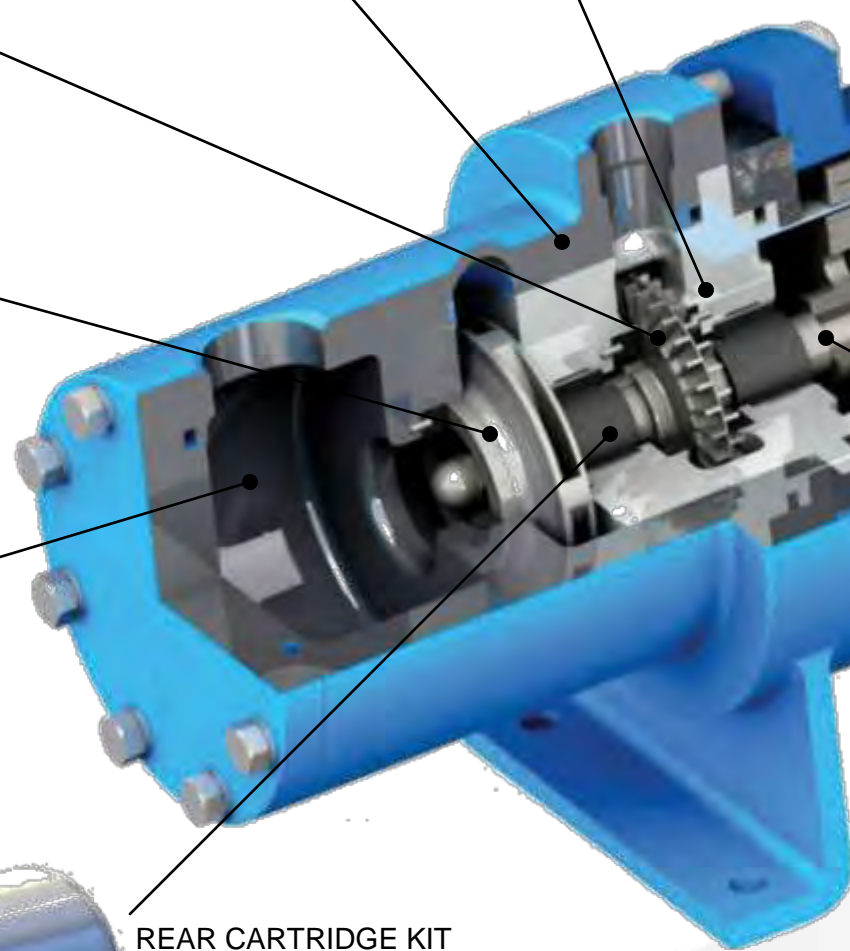
CF8M or WCB pump casing, cover & impellers High quality casting components

Other materials : Hastelloy C276, Incoloy825, Duplex, or others available on request

Drain plug (1/2"NPT)



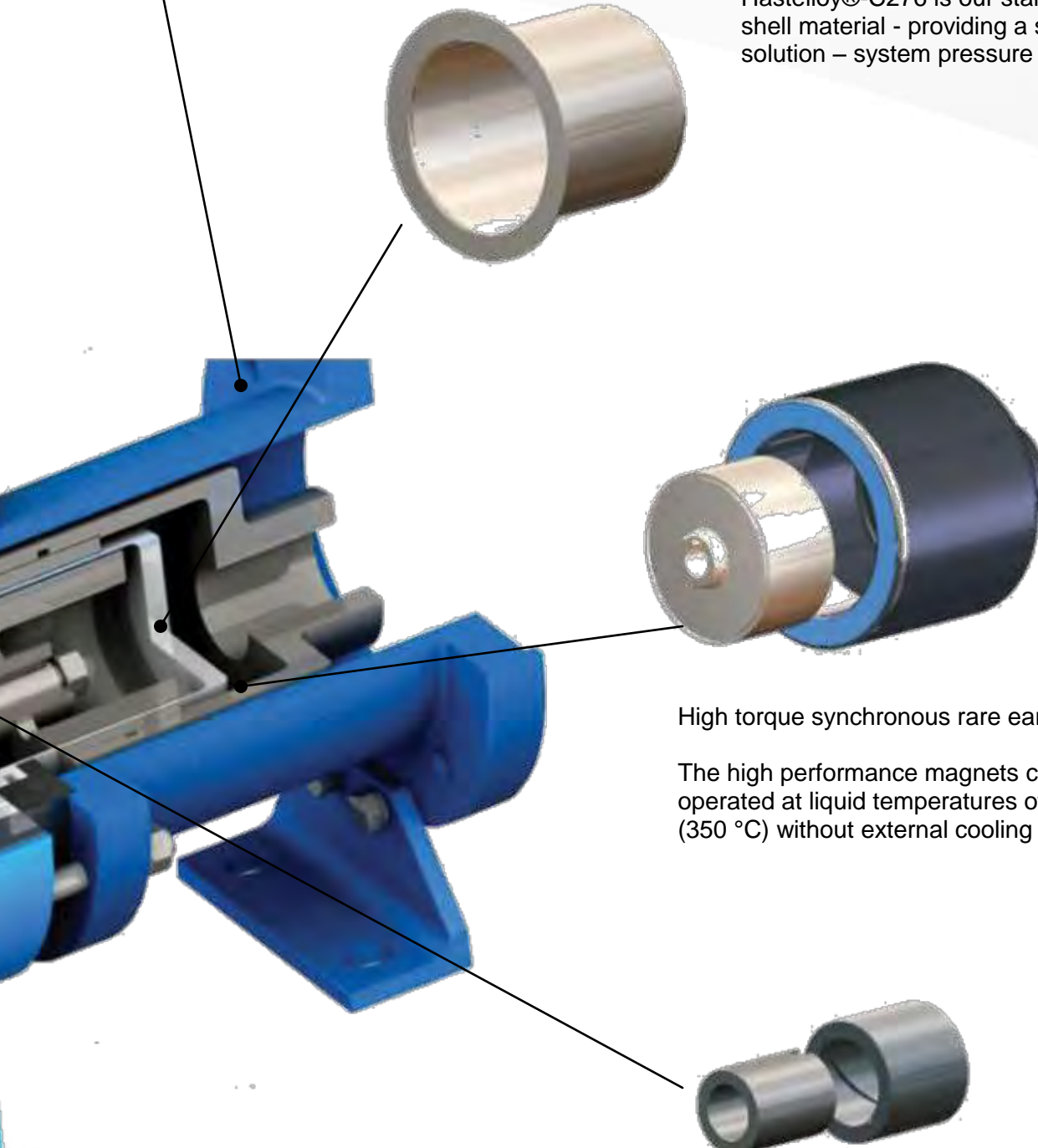
REAR CARTRIDGE KIT to ensure easy and fast maintenance retrofits



Epoxy primer and polyacrylic enamel water-based painting for optimal chemical resistance, yet environmentally friendly

Rear shell is made of one single piece, non-welded, with a convex profile to withstand higher pressures

Hastelloy®-C276 is our standard isolation shell material - providing a safe and efficient solution – system pressure max 100 BAR



High torque synchronous rare earth magnetic coupling

The high performance magnets can be operated at liquid temperatures of up to 662°F (350 °C) without external cooling

Confined casing gaskets prevents product leakage to atmosphere – different materials available:

- PTFE
- Graphoil type
- Garlock type
- Gylon type

Field servicing of the lubricated bearings does not require special tools

The Bearing materials are available in four different types to match each application: Silicon Carbide (SiC), Tungsten Carbide (TC), Carbon to allow intermittent dry running

The tolerance rings accommodate differential rates of thermal expansion and properly align the sleeve bearings

# Series WMCA ISO-2858 / API-685 Process Centrifugal (medium to high flows)



WMCA ISO-2858 / API-685 Process Centrifugal (medium to high flows)

## *Compressor Circulation Pumps: Low Heat Load Seal-less Centrifugal*

Series WMCA- ISO-2858 mag-drive centrifugal pumps are engineered for long-life, zero emissions pumping in the most arduous process conditions. Low heat induction avoids costly down-time and repairs due to flashing, in both ammonia and CO2 systems.



*ISO 3x2x8 Mag-Drive at C.E.R.N. Atomic Supercollider*



*ISO 8x6x13 High Capacity Refrigeration System @ -50° F*

## WMCA Features

- Low heat load avoids flashing
- Seal-less design free of mechanical seal maintenance
- Magnetic coupling design for process & inventory flexibility
- Standard NEMA motors meet UL and EXP requirements

## WMCA Performance Range

- Flows from 8 to 4500 gpm (**2-1000 m<sup>3</sup>/h**)
- Heads to 700 feet (**215 m**)
- System Pressures to 1,450 psig (**100 bar**)
- Temperatures from -238 to +600 F (**-150 to +315 C**)





# Series SR Close-Coupled Centrifugal (low to medium flows)



Compressor Circulation or Transfer: Versatile Seal-less Centrifugal

## SR Performance Range

- Flows from 2 to 150 gpm (**.5 - 34 m<sup>3</sup>/h**)
- Heads to 115 feet (**35 m**)
- System Pressures to 720 psig (**50 bar**)
- Temperatures from -148 to +450 F (**-100 to +232 C**)

Series SR compact mag-drive centrifugal pumps meet low flow requirements with comparable features of the WMCA design.

## Alloy Seal-less Pump Heat Induction Sources

### Heat Source

- 1) Motor Stator Windings\*\*
- 2) Eddy Current Losses\*
- 3) Motor Armature Slippage\*\*
- 4) Internal Recirculation
- 5) Internal Bushing Friction

### Warrender Mag-Drives

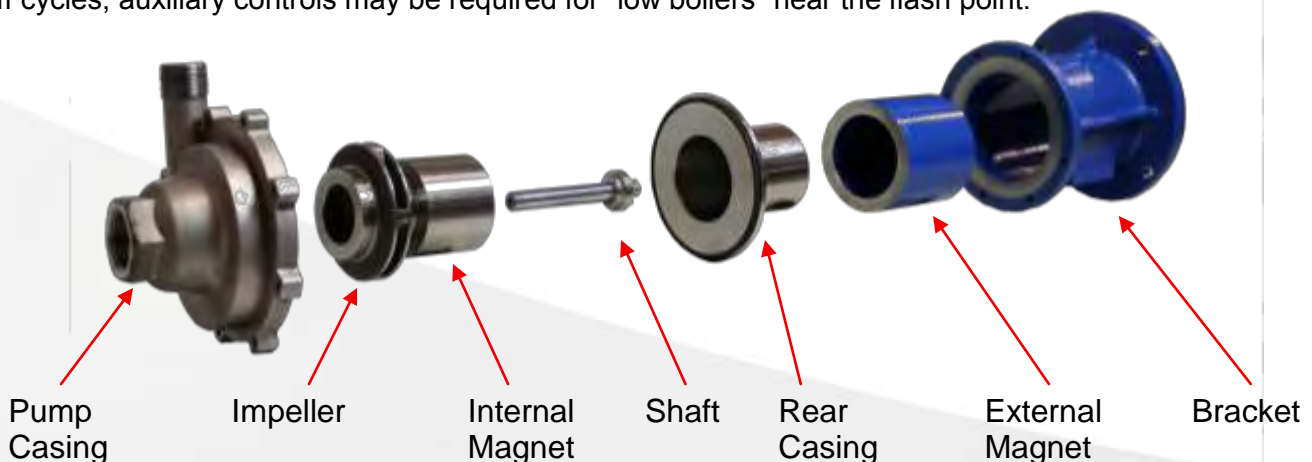
none - external motor  
 permanent magnetic field  
 none - external motor  
 per pump sizing  
 negligible

### Competition's Canned Motor

TENV motor stator  
 electromagnetic field  
 internal pump rotor  
 per pump sizing  
 negligible

Eddy current losses for both alloy mag-drive (rear casings) and canned motor pumps (isolation shells) reduce by the square of the speed (i.e., 1750 rpm pumps have 25% of the losses generated at 3500 rpm). Therefore, VFD controls can offer rapid ROI for energy savings alone.

Motor heat induction inherent to canned motor pumps is constant regardless of speed with residual heat present during off cycles; auxiliary controls may be required for "low boilers" near the flash point.



CF8M pump casing & impeller high quality casting components

Other materials : Hastelloy C276, Incoloy825, Duplex, Titanium, or others available on request

Epoxy primer and polyacrylic enamel water based paint system for a corrosion resistant coating, yet environmentally friendly.



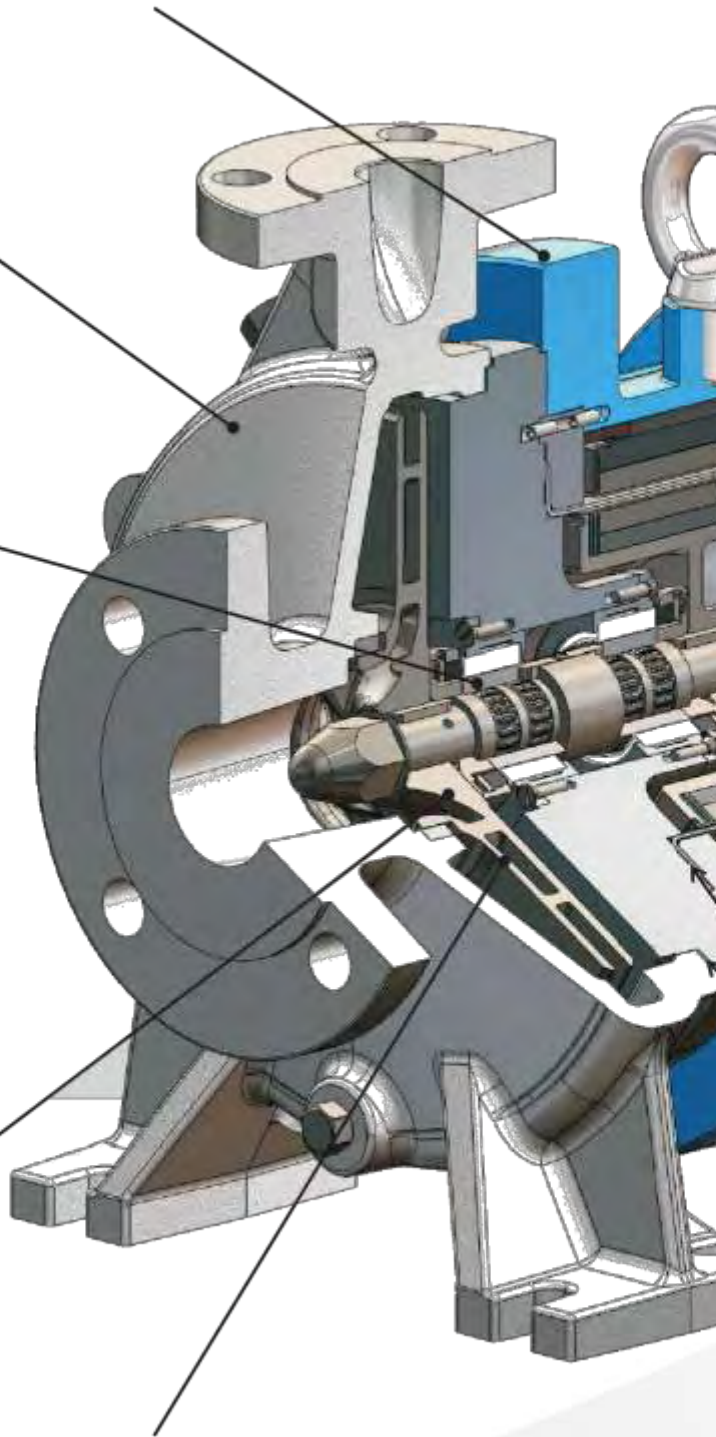
Field assembling of the product lubricated bearing arrangement does not require special tools. The bearing materials available in three different types to provide the best solution for each application: Silicon Carbide (SSIC), Tungsten Carbide (TC).

The use of tolerance rings reduces the sleeve and thrust bearing loads to guarantee many years of maintenance-free operation.

**REAR CARTRIDGE KIT**  
For quick retrofits



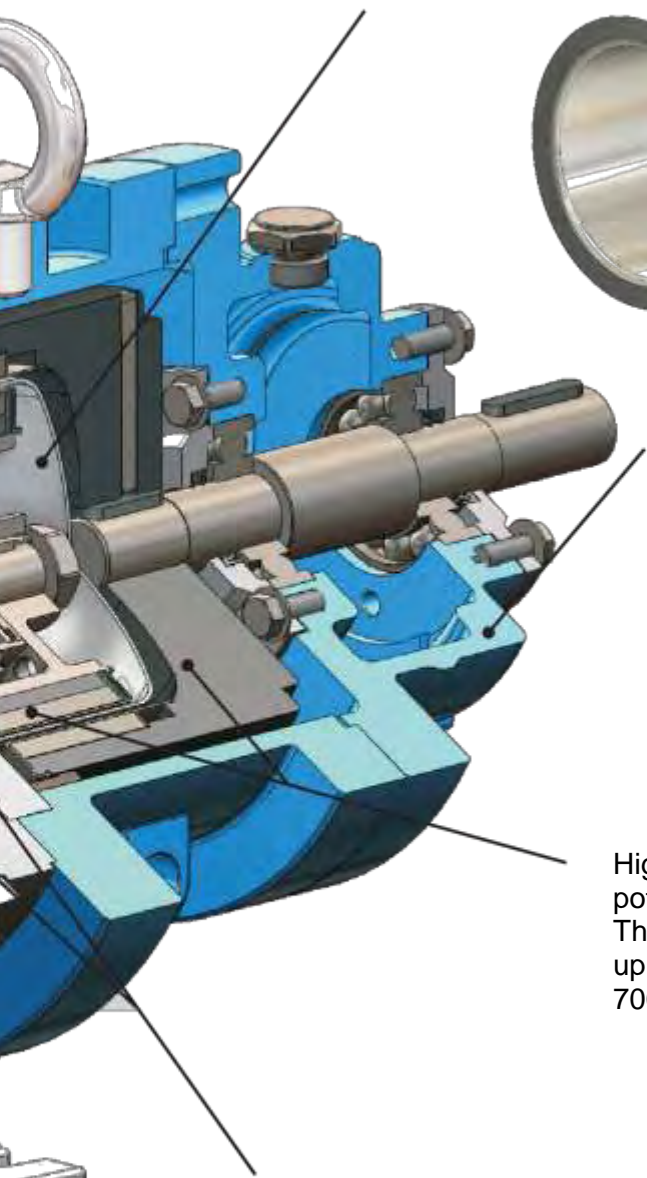
Closed impeller statically and dynamically balanced. The axial thrust loads are balanced by back vanes.



Rear containment shell is made of one single piece, non-welded, convex profile that has been studied to withstand higher pressures than conventional fabricated designs. Hastelloy®-C276 is the standard shell material - providing a safe and efficient solution.

Titanium Alloy is an upgrade when higher pressure ratings and increased efficiencies are required.

Double rear shell with tertiary monitoring on request.



Close coupled and bearing pedestal drive assemblies



High strength, synchronous magnetic couplings, are free of epoxy or potting materials, and fitted with samarium cobalt rare earth magnets. The high performance magnets can be operated at liquid temperatures up to 662 °F (350 °C) without external cooling. Power capability exceeds 700 HP / 520 kW.

Confined casing gaskets prevent leakage to the atmosphere – optional materials available:

- PTFE
- Graphoil type
- Garlock type
- Gylon type
- Flexitallic type





# Series WMPA Rotary Vane

(low flows - high pressure)

Injection Pumps: P.D. Seal-less Rotary Vane

## WMPA Features

- Seal-less magnetic coupling eliminates seals or packing glands
- No metal to metal contact for extended MTBF
- Capable of differential pressures up to 200 psig
- Self-priming up to 13 feet of dry lift, runs dry without damage

## WMPA Performance Range

- Flows from 0.1 to 11 gpm (**22 to 2500 l/h**)
  - Range 1° from 0.1 to 2.2 gpm
  - Range 2° from 2.2 to 5 gpm
  - Range 3° from 5 to 11 gpm
- Heads to 200 psig (**12 bar**)
- System Pressures to 350 psig (**24 bar**)
- Temperatures to 450 F (**232 C**)



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