Technical Profile

ZeroLoss™

Composite Containment Shell

HMD Kontro

The elimination of induced eddy current losses gives the ZeroLoss™ containment shell its name. Heat dissipation can be an issue with magnetic drive pumps and the composite ZeroLoss™ shell provides a step change to this problem by eliminating inductive heating.

This significantly increases the margin-to-flash safety factor and is particularly important when pumping volatile and heat sensitive liquids.

Tests by HMD Kontro have shown that a 20% drop in power consumption is possible, leading to major operational cost savings. In many cases this allows the size of the coupling and motor to be reduced and precautionary soft start or variable speed drive solutions can be avoided, giving rise to significant capital cost reduction and efficiency savings. Additionally, smaller base plates can be specified, with reduced footprint and consequent space savings. The larger the pump the greater the benefit.

Five times lighter than steel but as strong, the ZeroLoss™ shell is engineered from a composite material of poly-ether-ether-ketone (PEEK) and carbon fibres. In addition to its higher specific strength, the material is tough and durable.

Applicable to Pump Ranges

(limited for operation up to 120°C)

GSA/GSI Frames 1 & 2	**GSP** Frames 1, 2 & 3	**GSPV** Frames 1 & 2
GSPVS Frames 1 & 2	**GSPLF** Frame 2	**LMV-801S**

Key Design Features

- High electrical resistivity (= zero losses)
- High strength
- Inert to a wide range of chemicals
- Excellent fatigue properties
- Does not suffer from brittleness at sub-zero temperatures
- Thermal shock resistant
- Tough, ductile and impact resistant
- Similar form factors to existing metallic shells

Benefits of ZeroLoss™

- Robust qualities allow more time for operator intervention during system upsets (partial flow, cavitation, blockages, gas entrainment)
- Improved handling of liquefied gases and heat sensitive liquids
- Energy efficiency reduces electricity running costs
- Environmentally friendly
- Potentially smaller base plates allow a reduced footprint and space savings
- Can be retrofitted to the pump ranges shown above

Retrofitable

Retrofit kits of the ZeroLoss™ containment shell and its associated magnetic coupling can be supplied for a variety of pump configurations. Retrofitting the ZeroLoss™ shell can be carried out for a range of reasons from improving system robustness through to energy saving, and HMD is happy to advise on the applicability and benefits available.

Design and Test

The ductile properties of the ZeroLoss™ containment shell help absorb shock and vibration. During the product development process these attributes were demonstrated by putting the shell through exhaustive analysis and testing.

Design Process

- Quadratic Failure Criteria Calculations, full structural analysis by Finite Element Analysis using 'classical' laminate theory

Non Destructive Examination

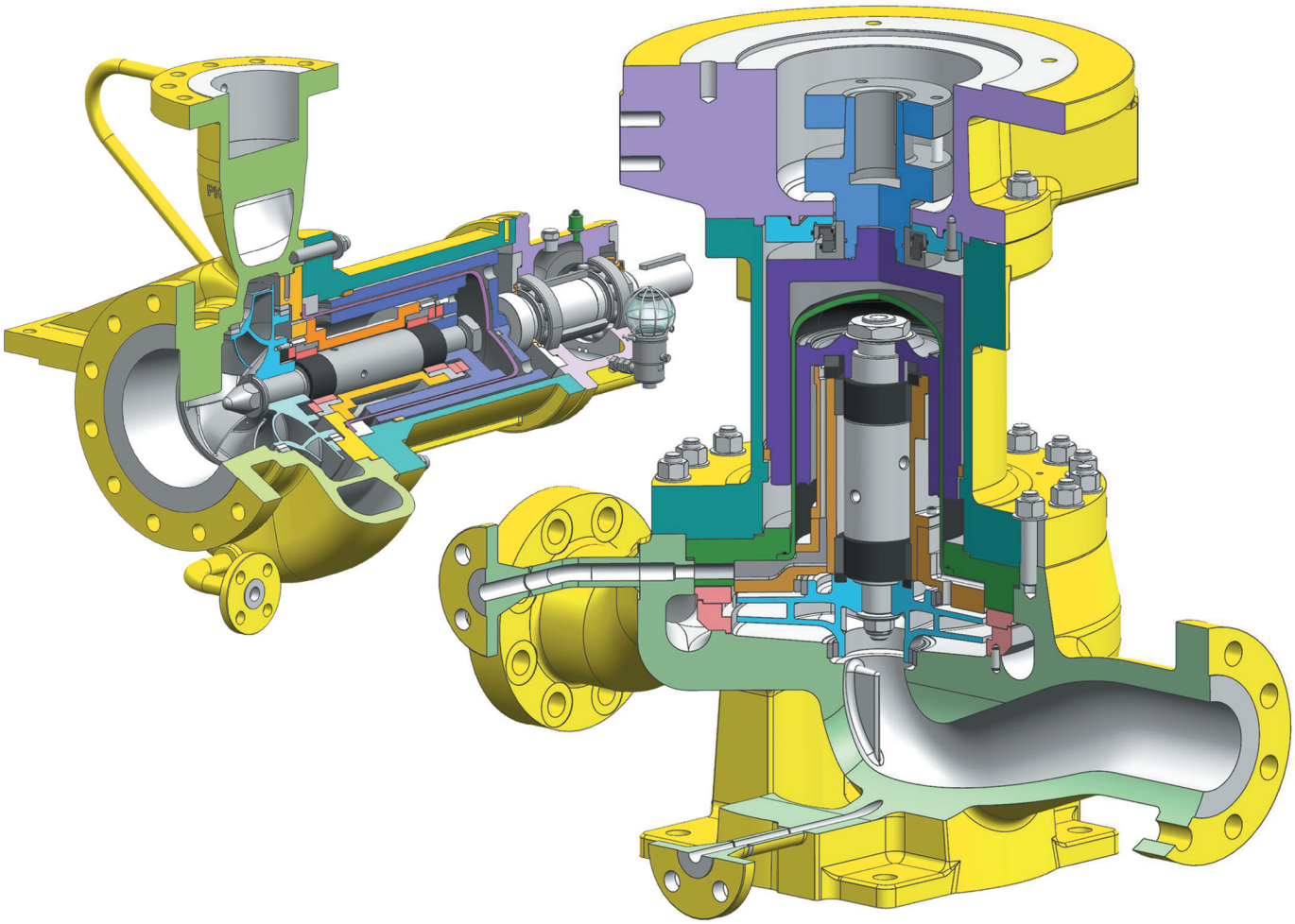
- Proof tested to 72 bar (80% above operating pressure)
- Helium leak tested (40 bar)

Expansion Testing (40 bar)

- Actual expansion due to internal pressure measured to verify theoretical expansion model

Burst Pressure Testing

- Greater than 95 bar Burst Pressure
- **ATEX Testing:** in accordance with EN 13463-1:2001 Section 7



Containment Shell Performance

The ZeroLoss™ containment shell itself is an engineered composite material and the nature of construction of the ZeroLoss™ shell eliminates the eddy current losses found in the traditional metal containment shell construction, improving efficiency and reducing heat.

The unwanted side effect of using a metallic containment shell is induction heating of the shell. In contrast these induction losses are zero in a PEEK composite containment shell due to the high electrical resistivity of this material. This phenomenon, where the eddy current losses are eliminated, is encapsulated in the ZeroLoss™ name.

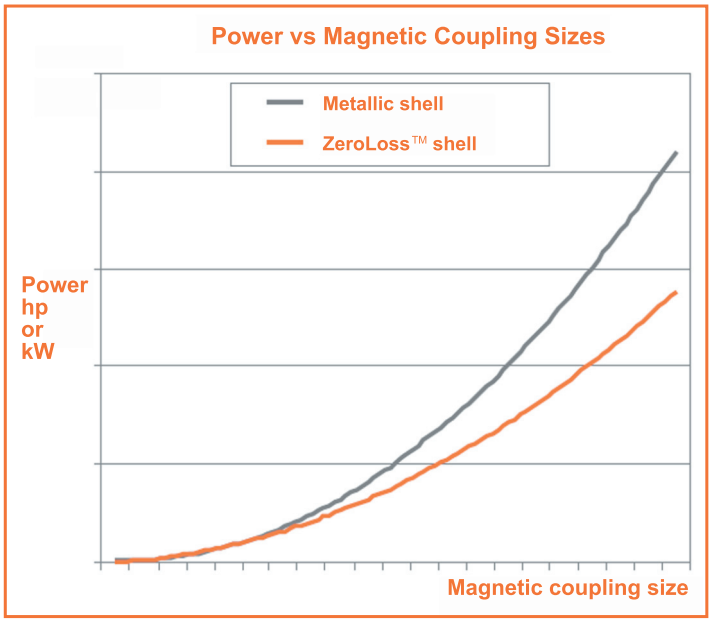
The amount of energy lost in any magnetic coupling is dependent on:

- The electrical resistivity of the shell material
- The thickness of the shell material
- The strength of the magnetic flux
- The diameter of the coupling
- The rotational speed of the coupling

In fact the losses are typically proportional to the square of the rotational speed.

Furthermore, as the magnetic coupling size increases, the parasitic eddy current losses increase making further increases in coupling size economically less viable.

This means that for larger coupling sizes the ZeroLoss™ solution is in a class of its own.



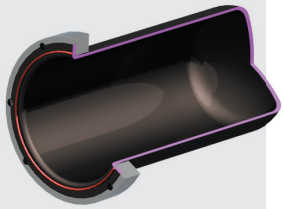
Margin-to-Flash

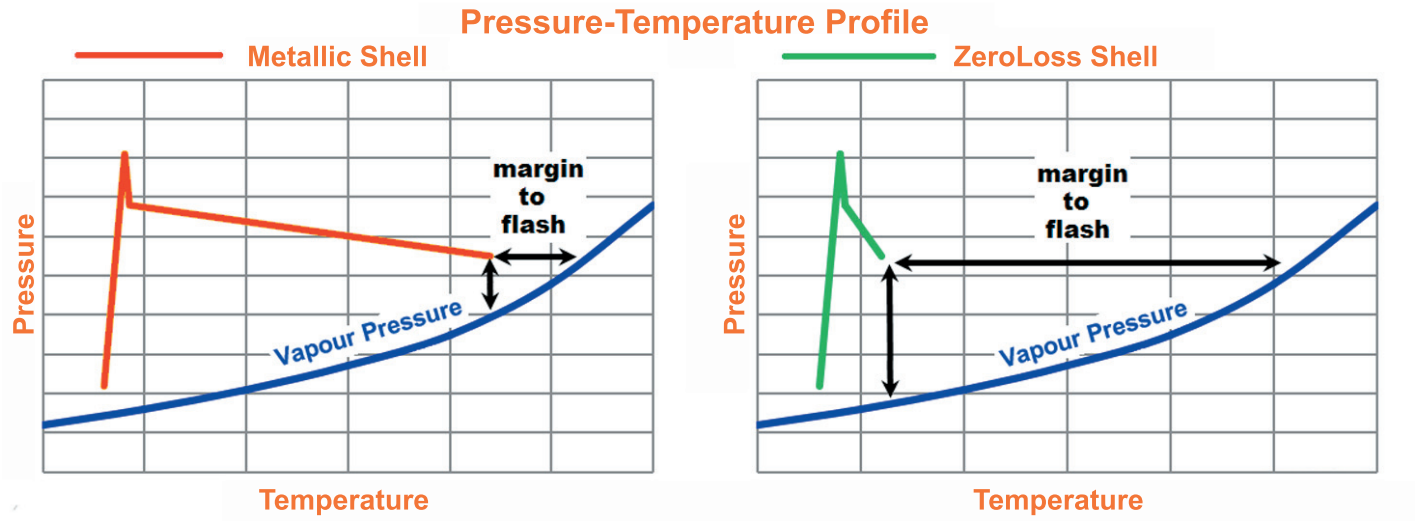
The elimination of eddy current heating in the ZeroLoss™ shell significantly increases the margin-to-flash safety factor (which is the difference between the Pressure-Temperature profile and Vapour Pressure curves. This is particularly important when applying magnetic drive pump technology to volatile and heat sensitive liquids.

At the rear of the containment zone, a greater margin is available before the flashpoint of the product is reached with the ZeroLoss™ shell when compared to the same curve for a metallic containment shell.

Suitable for:

- Volatile liquids with high vapour pressures
- Heat sensitive liquids with low specific heat
- Sub-zero liquid handling is improved
- Low viscosity and low density hydrocarbons
- Higher speed selection and larger magnetic couplings
- Marginal motor selections with tight service factors
- Low flow limit near thermo-mechanical minimums





Design Range Limits

- Temperature range from -100°C to 120°C / -150°F to 250°F
- Design Pressure: full vacuum to 40 bar / 580 psi
- Liquid Compatibility (*check with HMD for confirmation)

Typical applications

Light Hydrocarbons, Liquefied gases, Chlorosilanes and Refrigerants.

Liquids currently being pumped with ZeroLoss™ shells

Freon R-134a, Sour Water and NACE compliant applications, TEG, LPG, Hydrocarbon, Produced Water, Raffinate, Toluene, Benzene, Jet A-1, Cyclohexane, Hexane, Water, Aromatic Hydrocarbon, Phenol, Acetone, Methanol, Butane, Crude Oil, IsoButane, Propane, C4, Rich Amine, Lean Amine, MEA, Glycol Ether, TriChlorosilane, Silicon TetraChloride.

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