

How DESMI Addresses the Challenges of Alternative Fuel Pumping:

Design solutions for reliability, impurities, and long-term operation.

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Agenda

- DESMI Marine Portfolio
- DESMI Gas Pumps Timeline
- DesFuel – Market Driven Design Process
- DesFuel – Solutions
- DESMI Gas Pumps Portfolio



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Marine Solutions

Multistage Centrifugal Pumps



Mag-drive Centrifugal pumps



Engine Room Pumps, Centrifugal



Digitalization & Energy Saving System



Scrubber Pumps



Ballast Water Management System



Engine Room Pumps, Gear



Fine-Fog Fire Fighting



Submerged Lubrication Oil Pump



Cargo Pumps, Liquified Gas



Triple Screw Pumps



Deepwell Fuel Pumps, Alternative Fuels



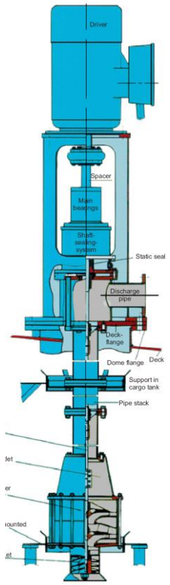


DESMI Gas Pumps Timeline

DESMI Founded

1834

First DESMI DeepWell Cargo pumps installed on Penelope for the shipowner Polsteam



1995

173 Cargo pumps delivered

2012



Updated Design for DesCargo (NDW) and booster pump (NDB). Better maintenance and higher efficiency

2022



Development of DesFuel - Deepwell Pump for alternative fuels starts, based on the proven DesCargo design

2024

DesFuel – Deepwell Pump September 2026 installation to ferry operating with LNG.

First commercial project to be delivered Q4 2026, MPV NH3 fueled

2026



















DesFuel – Market-Driven Design Process

1. Market Feedback

Gathering operational experience with existing alternative fuel pumps

Fuel impurities

Particles causing filter clogging and bearing failures in submerged pumps

Low Flow and NPSH

Limited pump options, liquid recirculation and increased boil-off gas (BOG)

Foot valve tightness

Challenges maintaining tightness with footvalves

Bearing oil lubrication

Challenges with bearing oil when handling fuels such as LPG and ammonia

2. Concept Design

Developing design concepts to address the identified challenges

3. Industry Feedback

Reviewing concepts with experienced gas contractors and fuel gas system suppliers



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DesFuel – Technical Solutions

- Design fit for purpose
  - Five pump sizes optimized for different vessel and application requirements
  - Ready-to-install solution for all major alternative fuels

- Reliable operation
  - Optional EX-certified heater to prevent condensation of high-pressure fuels such as LPG and NH_3
  - Side valve type foot valve reducing challenges caused by impurities

- Optimized installation
  - Intermediate pipe and shaft sections available from 500–3000 mm for flexible installation
  - Optimized pump cylinder height enabling lower cryosump designs
  - Static seal design operated with low-pressure N_2



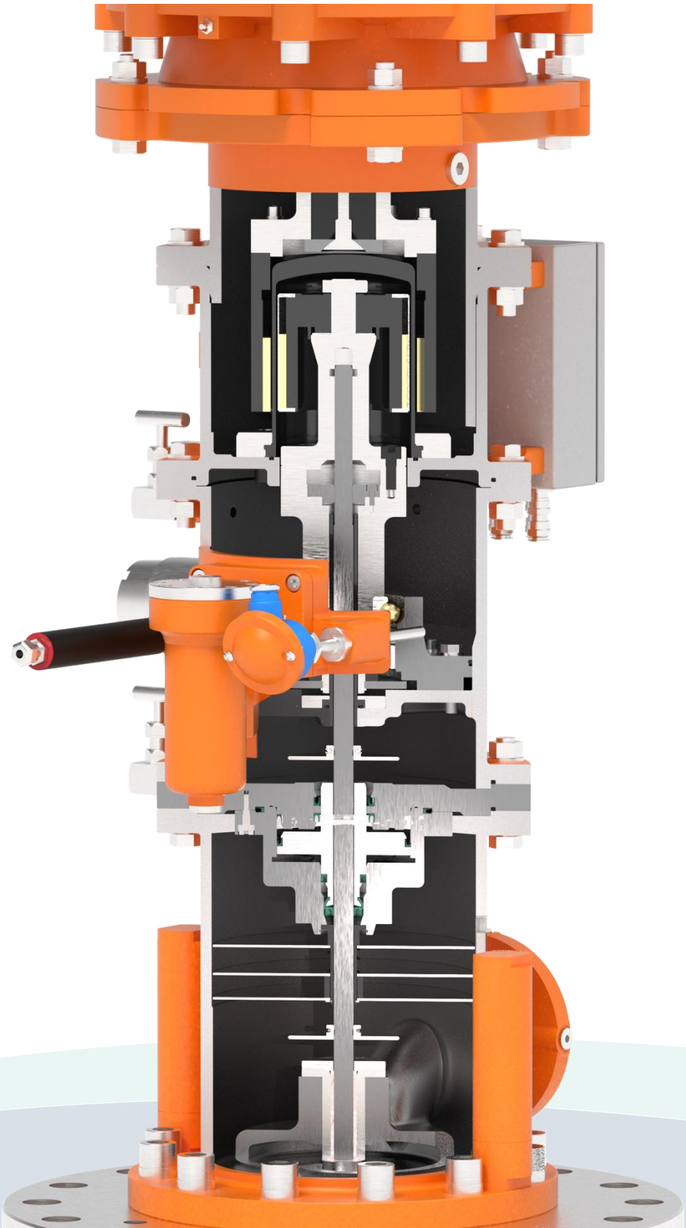


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DesFuel – Design Fit for Purpose

- One pump platform – ready for all alternative fuels
  - Designed for LNG, LPG, NH_3 and Methanol/Ethanol
  - All wetted materials selected for compatibility with ammonia, eliminating the need for future material upgrades
  - Robust magnetic coupling design accommodates higher torque requirements from increased fuel density, flow, and head requirements

- Suitable for all vessel types and fuel system configurations
  - Optimized product range for different applications
  - Five pump sizes covering a wide range of flow requirements and enables optimized pump selection without oversizing
  - Optimized minimum flow = minimizing BOG



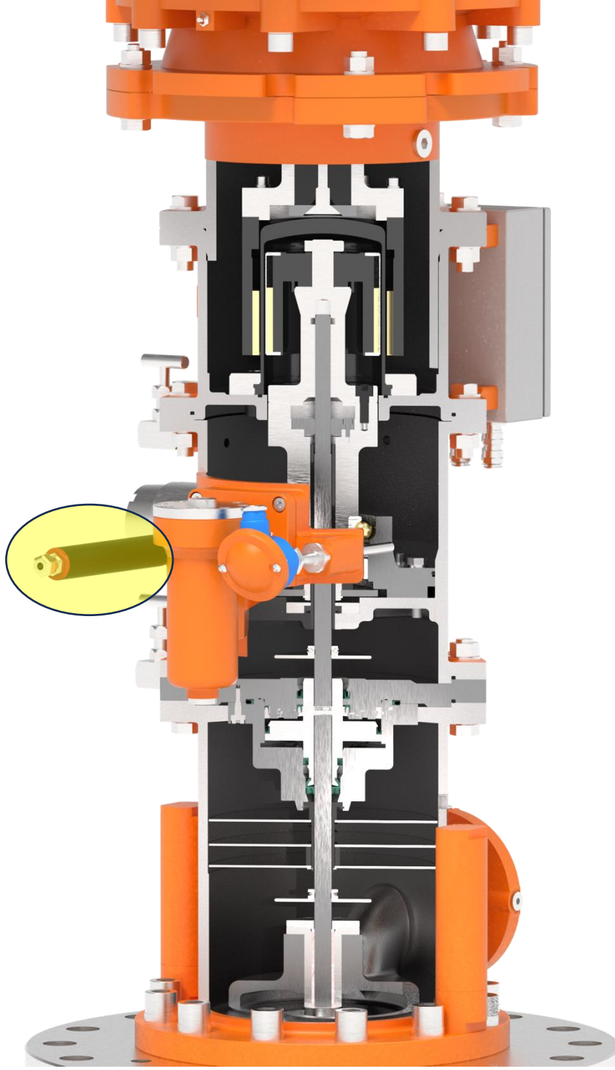
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DesFuel – Reliable Operation

- Controlled operating conditions for high-pressure alternative fuels
  - Optional EX-certified heater maintains controlled temperature conditions in the bearing area
  - Prevents condensation of fuels such as LPG and NH_3 during idle periods
  - Ensures stable lubrication performance, and reduces the risk of operational disturbances

- Robust design for challenging fuel environments
  - Side valve type foot valve reduces sensitivity to fuel impurities





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Heater

During operation,

- Pump maintains the bearing area at an elevated temperature, ensuring it remains above the saturation temperature of LPG or NH_3 → preventing condensation.

Idle condition and risk of condensation

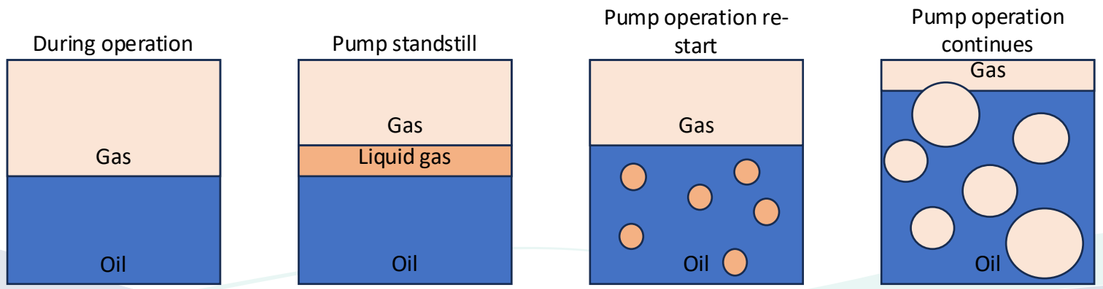
- When the pump is connected to a high-pressure tank but not in operation, the temperature in the bearing area may decrease toward the gas saturation temperature.
- If this occurs, gas can condense into liquid within the bearing housing.

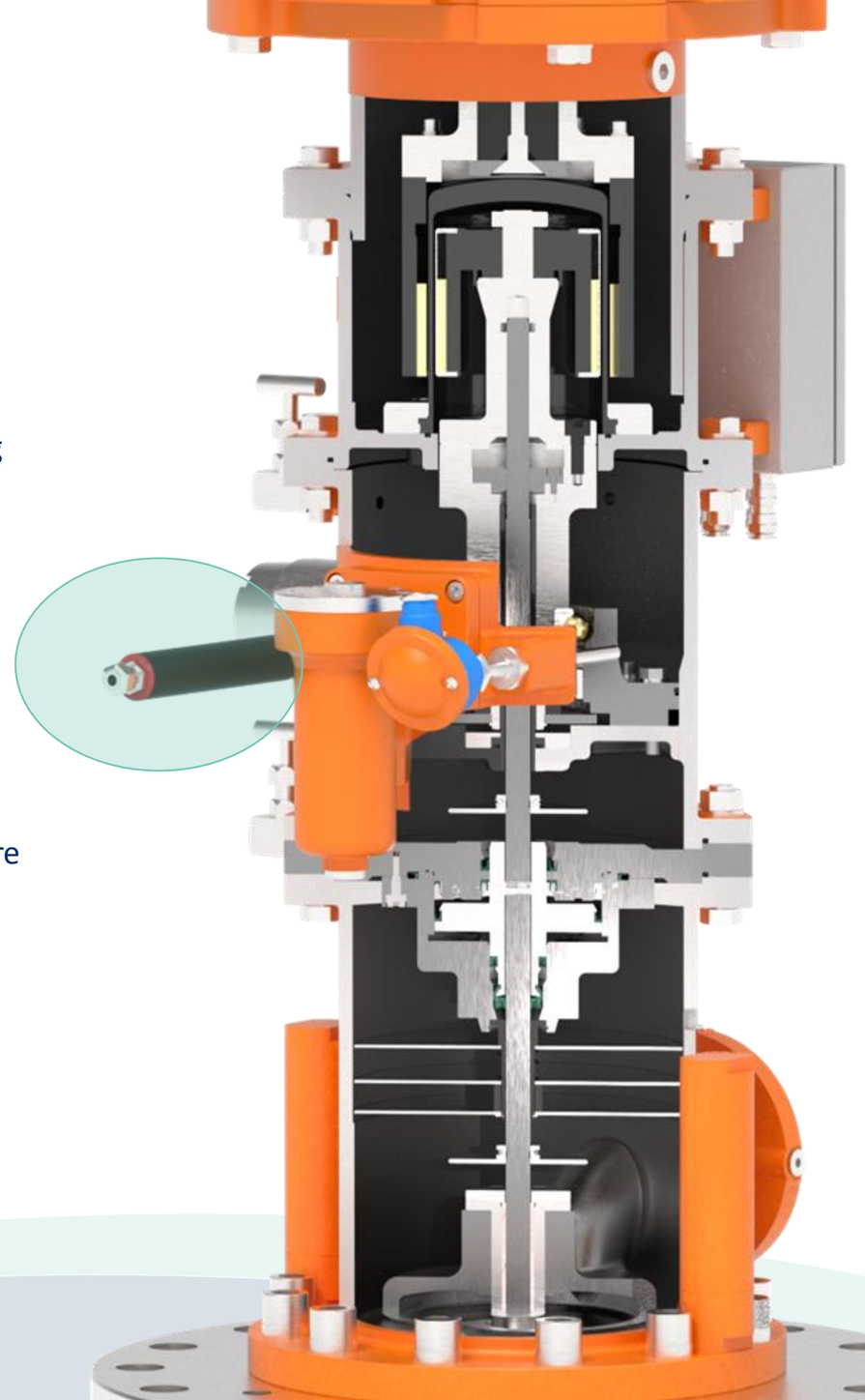
Start-up and operational risk

- Upon pump start-up, any condensed liquid may mix with the lubricating oil.
- As temperature increases during operation, the liquid can re-vaporize, forming gas bubbles in the oil.
- This may lead to impaired lubrication performance and/or leakage of oil from the main bearing chamber.

Mitigation

- By equipping the pump with a heater, the bearing area can be maintained above the saturation temperature under all conditions.
- This prevents condensation and ensures stable lubrication and safe operation.

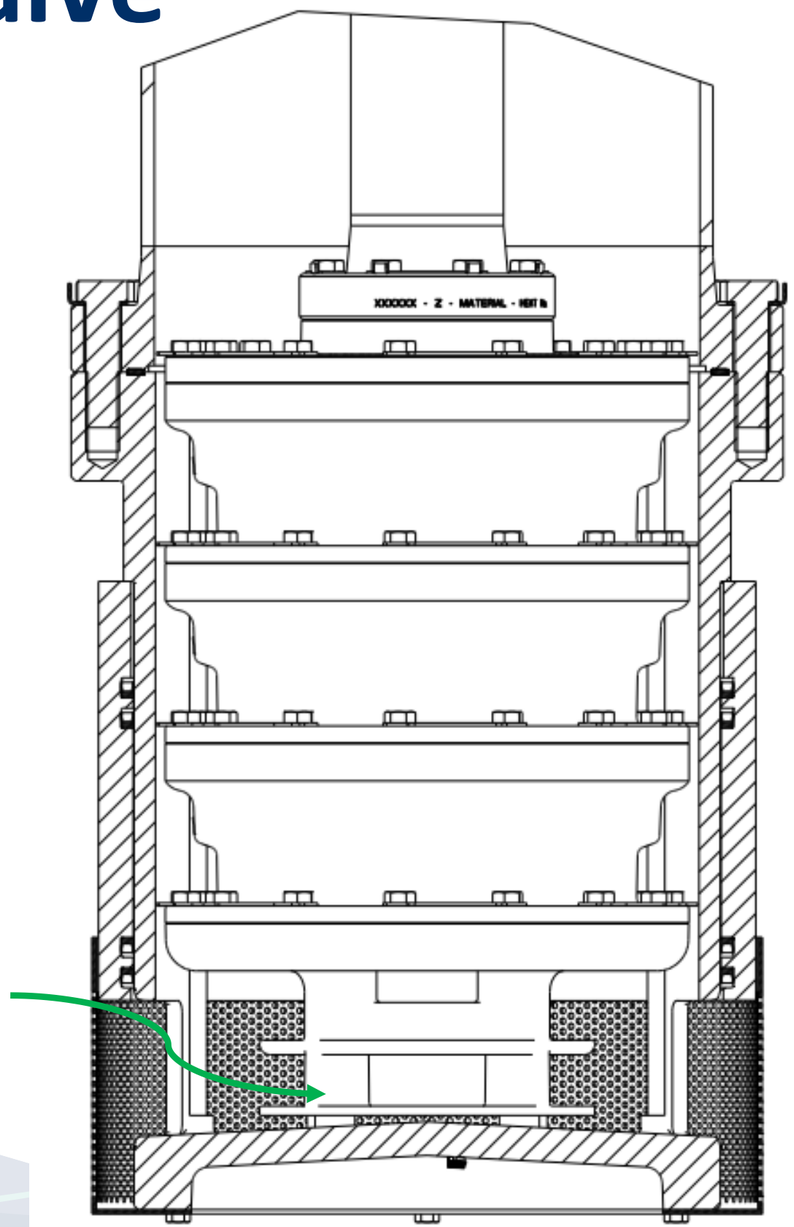




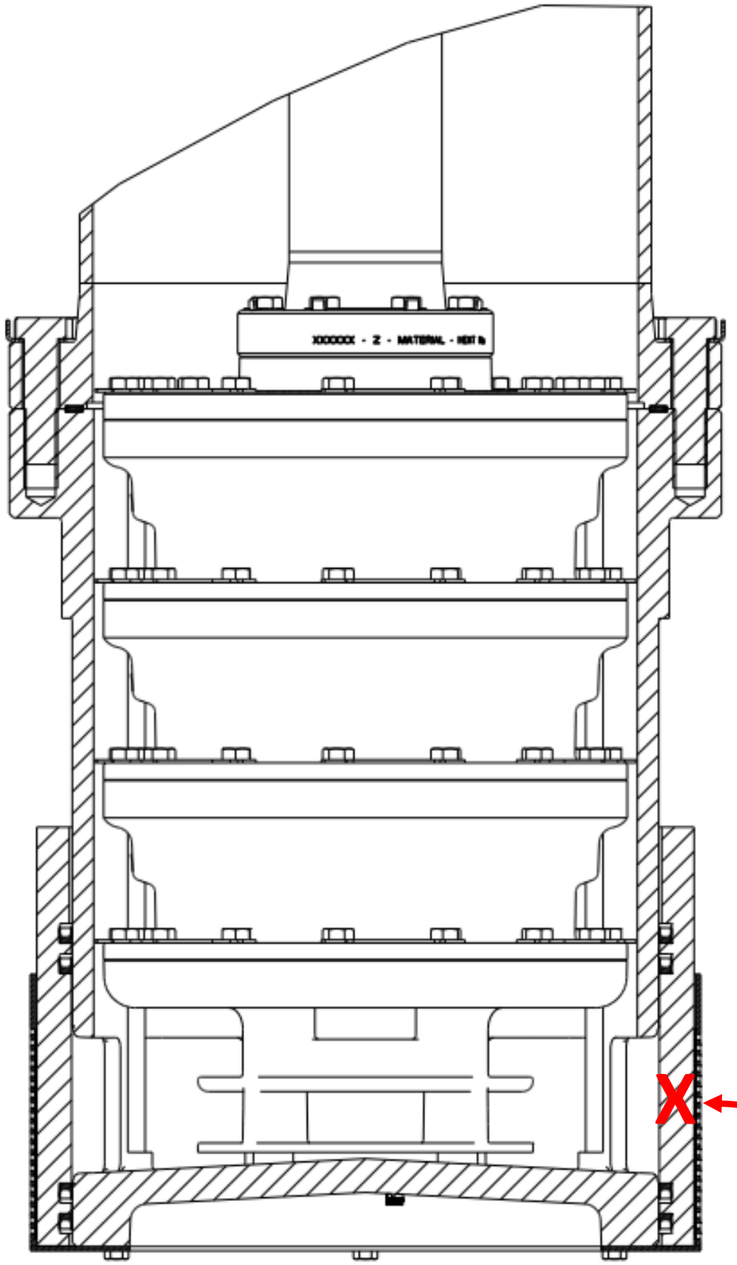
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Foot valve

Foot valve open:
Liquid has access to caisson pipe



FOOTVALVE: OPEN



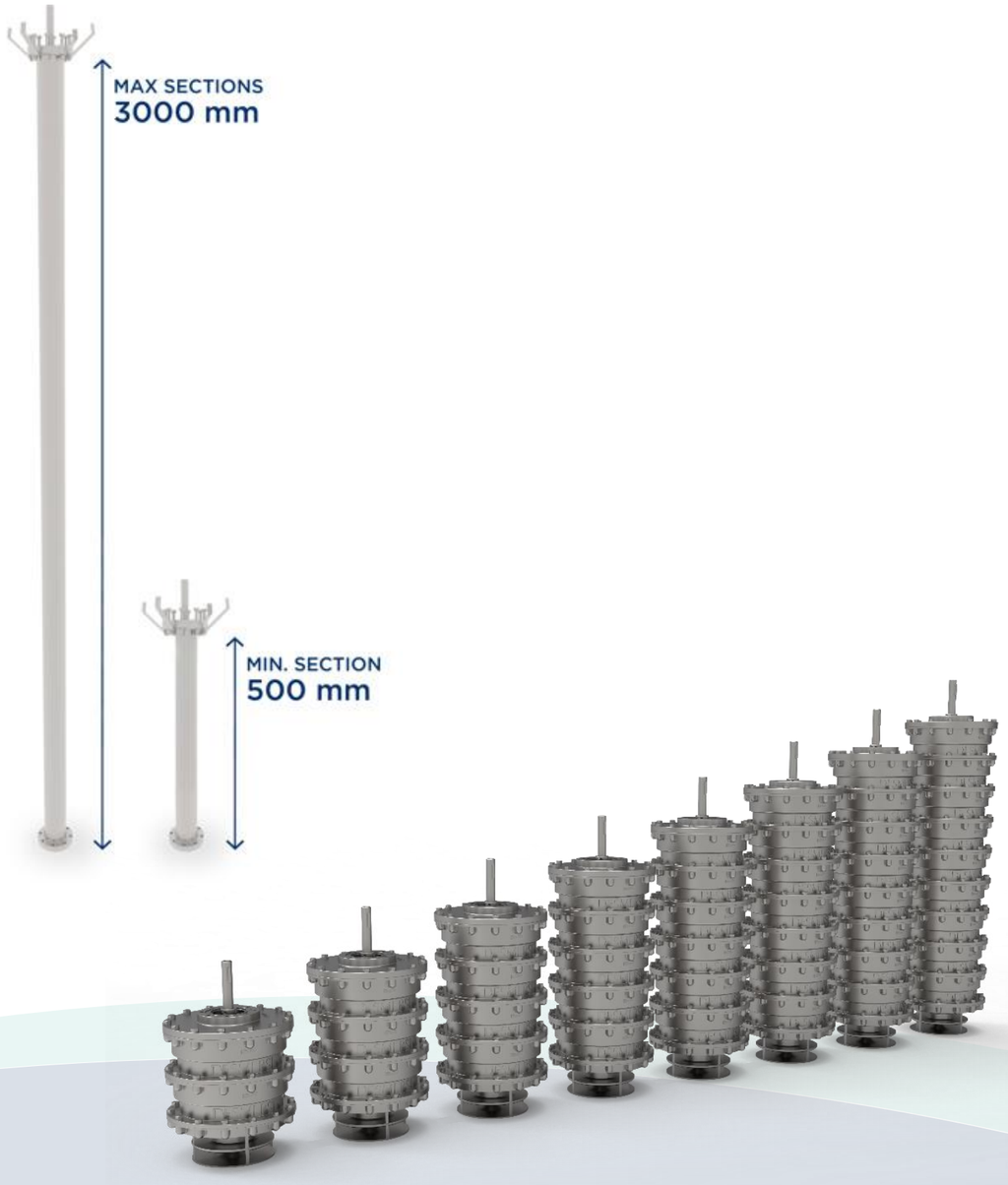
FOOTVALVE: CLOSED

Foot valve closed:
Liquid blocked from caisson pipe

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DesFuel – Optimized Installation

- Flexible installation design
  - Intermediate pipe and shaft sections 500–3000 mm for adaptation to different vessel layouts
  - Optimized pump height for deck and TCS installations
  - Reduced number of shaft and pipe sections simplifies installation and reduces shipyard work
- Optimized for modern vessel designs
  - Reduced pump cylinder height enables lower cryosump designs suitable for installations with limited Tank Connection Space (TCS) height
- Service-friendly design
  - Low-pressure N_2 static seal simplifies operation and maintenance
  - N_2 closing pressure 4-6 bar (4 bar up to 10 bar tank pressure, 10 bar up to 20 bar tank pressure)

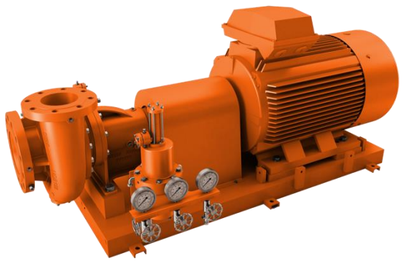


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Portfolio – DESMI Gas Pumps

DesCargo – Deepwell Pump
- Multicargo design: LPG, NH_3, LNG, LCO_2, VCM, MeOH etc.
- Multistage, mechanical seal, static seal
- From ~60 m3/h to ~1200 m3/h
- Optimized stripping performance

DesCargo – Booster pump
- Up to 850 m3/h
- Single stage

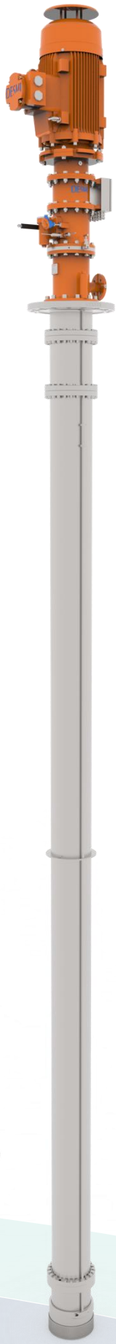


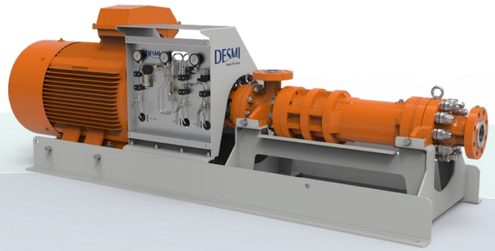


DesFuel – Deepwell Pump
- Fuel and/or spray/stripping pump
- Same design for all alternative fuels: LNG, LPG, NH_3, and MeOH
- Multistage, magdrive, static seal, caisson and footvalve
- From ~0,5 m3/h to ~70 m3/h
- High efficiency and optimized $NPSH_r$ in low flow conditions

DesFuel – SERO by DESMI
- Booster pump for LPG and NH3 2-stroke engines
  - LPG ~55 bar outlet pressure
  - NH3 ~85-90 bar outlet pressure
- Side channel pump







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