

## ORGANIC RANKINE CYCLE ORC-PROCESS

The Organic Rankine Cycle (ORC) is a method of generating energy that uses organic working fluids with a low boiling point instead of water. These media have special evaporation pressures and are potentially flammable, so they place high demands on sealing systems, material selection and the hydraulic design of pump systems.

ORC systems can be operated using various heat sources, including waste heat from industrial processes, geothermal energy, process heat from various industries and solar thermal energy. Major advantage of that technology is the efficient use of heat even at low temperatures compared to conventional steam turbine systems. This kind of energy generation is a major part of sustainable reduction in CO<sub>2</sub> emissions in the industrial sector. The flexible and wide range of energy sources that can be used for power generation, making the technology highly versatile and promising for the future.

## CUSTOMIZED SOLUTIONS FOR THE HIGHEST DEMANDS

### Expertise



Decades of experience and quick quotation preparation. Thanks to our modularised ORC pump portfolio and expert support throughout the entire project.

### Flexibility



Close customer cooperation ensures that tailor-made, flexible solutions optimally fulfil individual performance and integration requirements.

### Supply Chain



A European supply chain ensures consistent quality standards, short response times and a minimised carbon footprint.





# PUMP TECHNOLOGY

## FOR CLEAN AND AFFORDABLE ENERGY



### Range

Flow rates up to 3 000 m<sup>3</sup>/h      Delivery heads up to 550 m

Our ORC hydraulics are designed for maximum efficiency and have a low NPSHr. This optimisation ensures the client a compact plant layout (e.g. low Installation height of condenser, short installation depths for vertical pumps) and thus contributes to reducing investment costs.



### Typical ORC media

Organic Rankine cycle (ORC) applications often use isobutane, n-butane, pentane, cyclopentane or other hydrocarbons, as well as siloxanes such as MM and MDM, or ammonia. Our pump portfolio offers suitable solutions for all of these substances.



### Design and Equipment Features

- standardized, ORC-tested components for proven reliability
- modular design for flexible adaptation to project-specific process conditions
- sealing systems:
  - single or double mechanical seals
  - magnetic couplings for hermetic design
- bearings: oil or grease lubricated, with or without cooling/heating
- design according to different standards possible



### Materials

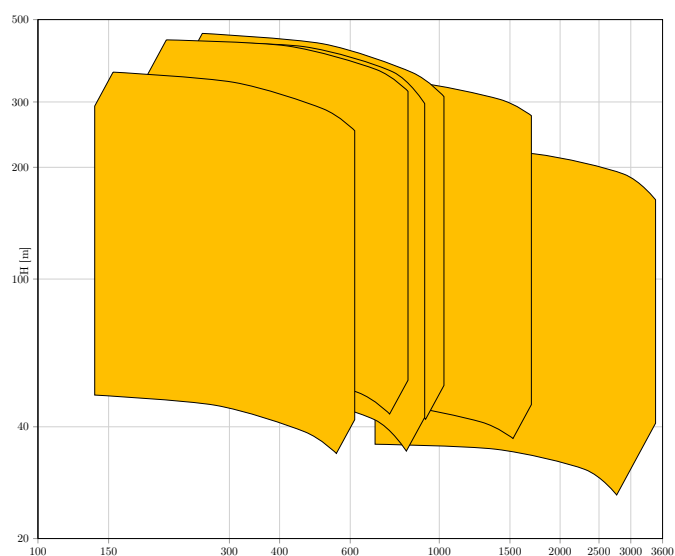
- durable, cost-effective materials for selected ORC media like 12% chromium steels and spheroidal graphite
- quality assurance is carried out in accordance with a variety of test procedures, standards and customer requirements



## GSTV Series

Vertical, multistage, high pressure process pump of can-type design with excellent hydraulic properties, an optimally matched performance range, and low NPSH values.

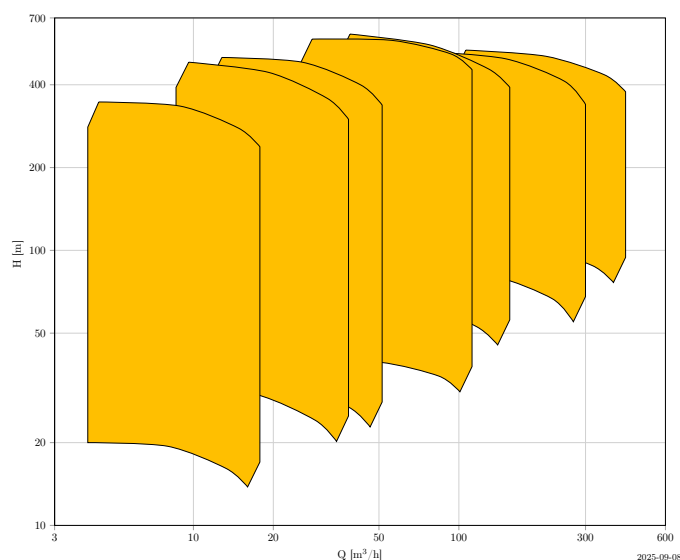
- optimised single-stage suction impeller has been developed to reduce suspension/foundation depth and installation effort
- bearing versions: liquid-lubricated radial plain bearings within the pump
- upper bearing at GSTV: combined radial-axial plain bearings with oil bath lubrication and antifriction bearings for radial and axial load
- nozzle position: in line with inlet and outlet casings or optionally suction nozzle at the can possible



## GM Series

The GM is a horizontal, multi-stage, high-pressure centrifugal pump with an NPSH-optimised impeller. The connection position can be selected according to requirements to optimally integrate the pump into various system designs.

- NPSH-optimised impeller with an axial inlet is ideal for difficult suction conditions
- variable connection positions can be adjusted in 90° increments for flexible integration into various system designs
- various versions available:
  - GM: horizontal pump with foot mounting
  - GMM: version with hermetic sealing by magnetic coupling
  - GMZ: version with NPSH impeller and axial inlet for reliable operation under demanding suction conditions





# INSTALLATIONS FOR DEMANDING APPLICATIONS

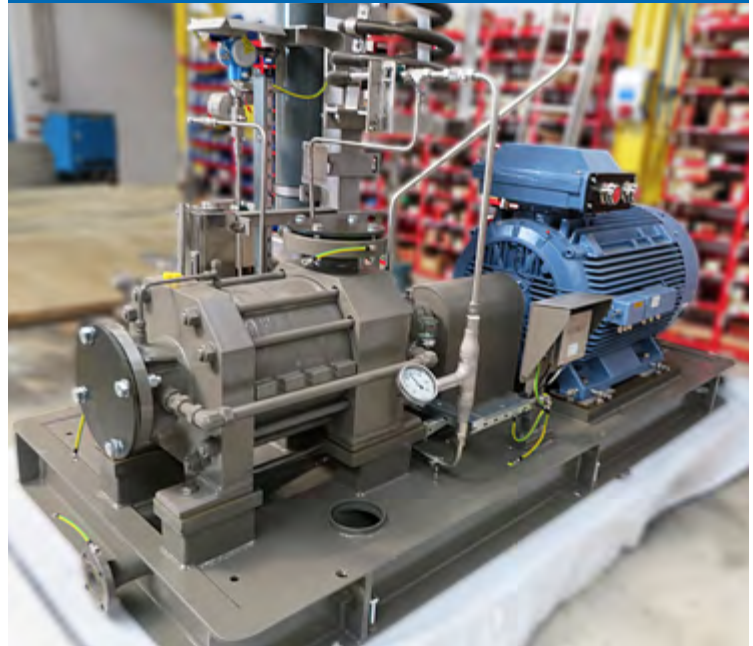
## ORC FEED PUMP at geothermal power plant

- APOLLO pump type: **GSTV-300I/1+4** a vertical, multistage, high-pressure pump of can-type design
- pumping 1 100 m<sup>3</sup>/h n-butane of 420 m with 1 MW motor power



## ORC FEED PUMP at geothermal power plant

- APOLLO pump type: **GMZ-100N/5** a multistage, horizontal, high-pressure pump with axial inlet
- pumping 110 m<sup>3</sup>/h cyclopentane of 340 m with 100 kW power



The products shown are suitable for demanding primary circuits in ORC systems.

At the same time, Apollo also offers customized solutions for other sustainable energy generation processes, for example, applications where maximum corrosion resistance is required or where high suction pressures prevail.

We offer you a personal consultation to find the optimal solution for your specific requirements.

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