MVR-400 Compact open-loop high-temperature heat pump
Tocircle Industries

Summary of technology
Tocircle’s MVR (Mechanical Vapor Recompression) system MVR-400 can directly compress steam, e.g. waste/excess steam from industrial processes, up to 12 bar(a) / 188°C. Input steam temperature can be down to 90°C, and the MVR-400 can also be combined with a bottom cycle to recover heat from sources with even lower temperatures, such as cooling water. The system handles wet and dirty steam and is well suited for e.g., low-quality waste steam applications.

The MVR system is delivered as a plug-and-play unit on site and may be fully covered and insulated for outdoor/indoor installation.

Dimensions (mm): 5000/2000/2300 (L/W/H)
Weight: 8,000kg

SV-400 COMPRESSOR
Tocircle’s SV-400 compressor, a rotary positive displacement machine based on the rolling piston principle, is the heart of the MVR-400 system.

It is a simple and robust machine, capable of achieving a high-pressure ratio, meaning that for most industrial applications only one compression stage is necessary to achieve a high-pressure lift. Because it can handle a high liquid content in the working fluid, liquid droplets in the feed stream are not a hurdle and expensive pre-treatment systems are not required. This 2-phase capability allows injection of liquified working fluid directly into the compression chamber, keeping it in the two-phase region during compression. The discharged steam is saturated or slightly superheated, if required. It’s a more efficient process than dry compression for which the compressor and downstream system are exposed to high temperatures.

APPLICATIONS/INDUSTRIES
Tocircle’s proprietary MVR-400 is a breakthrough waste heat recovery solution for industrial processes requiring high operating temperatures (>150°C).
Food & beverage, petrochemical, waste management and metal production are relevant energy-intensive industries for the technology.

DEVELOPMENT STATUS
Extensive testing in Tocircle’s facility and a full-scale pilot project with a key industrial player in Norway have been successfully carried out. The MVR-400 is brought to market.

TRANSPORT MEDIA
There are no limitations for the transport media in the sink and source. The MVR-400 can be combined with a condenser at the heat sink, to transfer heat to any chosen transport media. It can also be combined with a closed bottom cycle, to allow any transport media on the heat source side.

Table 1: Performance for steam compression in open cycles.

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* With the next compressor version (Q1, 2024), the expected COP for these specific operating conditions shall be around 4.

Project example
WASTE HEAT RECOVERY FROM SUPERHEATED STEAM DRYERS

In 2022, Tocircle’s MVR-400 has been successfully installed and operated in a bio-waste management plant to increase energy efficiency in a drying process. The MVR was fed with moisture evaporating from the waste while drying, in the form of atmospheric steam. The steam was then compressed up to 5 bara/152°C and delivered back to the dryer. The MVR became the only heat source, replacing the diesel-fired steam generator.

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All information were provided by the supplier without third-party validation. The information was provided as an indicative basis and may be different in final installations depending on application specific parameters.