APPLICATION NOTE

Data Centre

Heat and cold measurement in a data centre

- Measurement of energy flows for cooling and heating purposes
- Complete instrumentation package to guarantee availability and sustainability
- Coverage of various heat transfer fluids
- Custody transfer heat flow measurement to feed the district heating grid

1. Background

Due to their rapid growth, data centres are becoming significant energy consumers. With the global energy transition and increasingly stringent local regulations, operators are under growing pressure to enhance energy efficiency, pushing their Power Usage Effectiveness (PUE) targets towards 1.5 or lower in the future. PUE serves as a key technical indicator that relates the total energy consumption of a data centre to the energy used by its IT infrastructure. One of the most significant opportunities for optimisation lies in liquid cooling systems, particularly in their effectiveness at dissipating heat from IT equipment. Cooling systems alone often account for around 30% of a data centre's total energy consumption.

When constructing a new facility in Finland, a major data centre operator chose to leverage this potential by prioritising on energy-efficient cooling from the outset, aiming to keep both the PUE and the carbon footprint as low as possible from the very start.

2. Measurement requirements

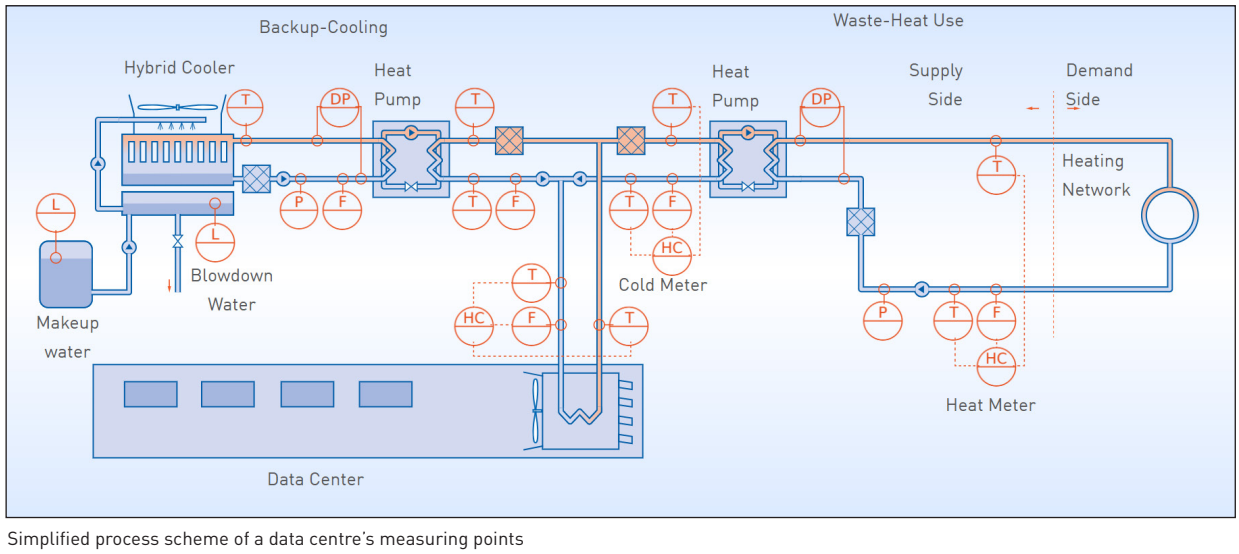
The data centre requires substantial cooling to ensure the safe and reliable operation of its computing infrastructure. Cooling is one of the most critical aspects of data centre management, as excessive heat can damage servers, reduce performance and cause costly downtime. To address this, the operator uses liquid cooling delivered via hybrid coolers. The client has also implemented an advanced thermal management system to prevent the uncontrolled release of heat. In addition to recovering waste heat, the company employs a coordinated setup of energy storage and district heating to supply regional consumers with hot water for heating purposes.

KROHNE

To ensure efficient heat extraction and utilisation, all measuring points were thoroughly analysed and incorporated into the planning process. Efficient data centre operation requires coordinated process instrumentation for measuring flow, pressure, and temperature. The applications include pipelines ranging from DN100 to DN500 and various cooling and heat transfer liquids, from glycol-water mixtures to conditioned, low-conductivity hot water.

3. KROHNE solution

As a company with many years of experience in the fields of energy measurements, metering of cold, and legally required district heating measurements, KROHNE was entrusted with providing the instrumentation for the data centre. Project management – from consulting and design to installation and after-sales service – was handled by Tecalemit Flow Oy, KROHNE's long-standing and experienced service and sales partner in Finland.



Simplified process scheme of a data centre's measuring points

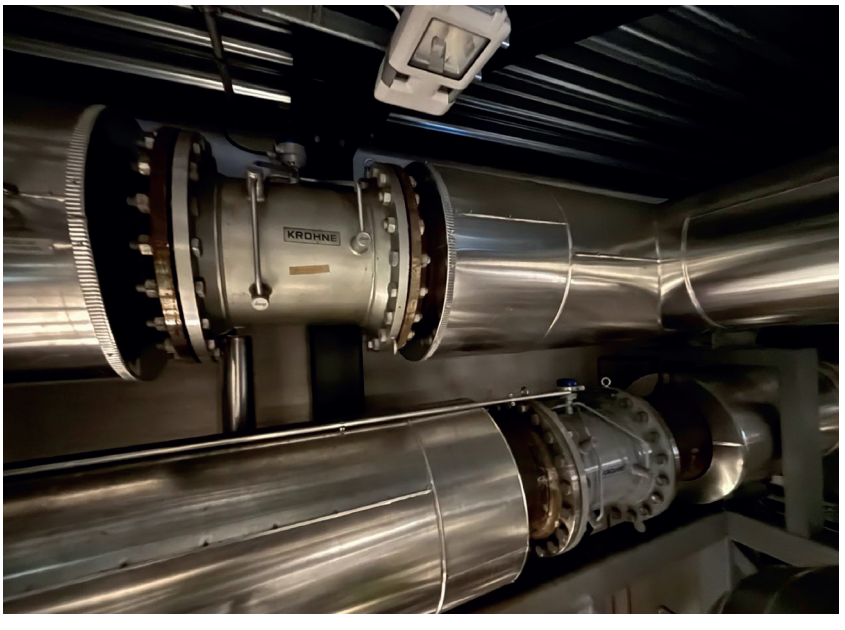
Thanks to the comprehensive portfolio of flowmeters, the most suitable measuring device could be selected for each measuring point. For accurate measurement of the glycol-water mixture used for heat dissipation, the customer uses around 40 OPTIFLUX 4100 electromagnetic flowmeters (EMF). These robust inline flowmeters feature chemically resistant liners and electrodes designed for long-term use in cooling circuits. In this project, the meters are installed in pipelines ranging from DN100 to DN250.

In addition, more than 25 OPTISONIC 6300 ultrasonic clamp-on flowmeters were installed in the data centre and at pumping stations throughout the network. These reliable, non-invasive clamp-on devices offer excellent repeatability and flow turndown. They are used throughout the data centre wherever measurement robustness is critical and the measurement accuracy is sufficient. In particular, where electromagnetic flowmeters are limited by the conductivity of the medium – such as demineralised water – or where magnetite scaling could cause drift, ultrasonic flowmeters were selected as the instrumentation of choice.

Engineer from KROHNE service partner in Finland with installed flowmeters

For the flow measurement of conditioned hot water used to sustainably supply adjacent communities with thermal energy, the data centre operator also required flow instrumentation for fiscal metering in accordance with the European Measuring Instruments Directive (MID) MI-004. Since even small deviations can result in significant financial differences here, the OPTISONIC 3400 District Heating ultrasonic flowmeter was chosen. This device offers the highest accuracy class 1 and was installed redundantly as part of a heat metering system.

In addition, over 200 robust OPTIBAR PM 5060 pressure transmitters as well as OPTITEMP TRA-S34 and OPTITEMP TRA-T30 temperature assemblies were supplied for the numerous pressure and temperature measuring points in the data centre.



OPTISONIC 3400 District Heating for custody transfer measurement of heat flow from the data centre

4. Customer benefits

The comprehensive supply of instrumentation from a single source enables the operator to achieve safe, efficient cooling performance, precise monitoring of heat storage, and accurate fiscal metering to support the sustainable feed-in of excess heat into the district heating network. In this way, the company meets its PUE targets while remaining in compliance with legal requirements.

With KROHNE's tailored portfolio of flow measurement solutions – offering up to six different flow technologies – the most suitable technology can be selected for each specific application, without limitation to a single measuring principle. All flowmeters feature advanced device diagnostics and self-check routines to ensure long-term, reliable and accurate operation. The strengths of each technology are applied where they deliver the greatest value: whether for custody transfer measurements according to standards such as MI-004 or OIML R75, monitoring of conductive or non-conductive media, non-invasive installations or installations with limited space that lack inlet and outlet runs. KROHNE has been equipping data centres and other facilities with thermal energy and HVAC-specific process instrumentation for many years, delivering dependable solutions for demanding applications.

5. Products used

OPTIFLUX 2100

- Electromagnetic flowmeter for conductive cooling liquids in heat exchanger and other thermal energy applications
- Chemically resistant liner materials
- Flange: DN25...1200 / 1...48", max. PN40 / ASME Cl 300

OPTISONIC 3400 District Heating

- Ultrasonic flowmeter for district heating applications
- 3-path meter for thermal energy measurement and heated water
- CT: OIML R75, MID MI-004 (Class 1, 2, 3)
- Flange: DN25...2000 / 1...80", max. PN40 / ASME Cl 3003)

OPTISONIC 6300

- Ultrasonic clamp-on flowmeter for flow measurement of liquids
- Stationary device, for installation at any location without process interruption or need to cut pipes
- Robust stainless steel sensor rail for pipes DN15...4000 / ½...160"

OPTIBAR PM 5060

- Pressure transmitter for process pressure and level applications
- Rugged design with fully welded metallic diaphragm suited to high pressure ranges and hygienic requirements
- 100 mbar...1000 bar / 1.45...14500 psi

OPTITEMP TRA-S34

- Resistance (RTD) temperature assembly for use in existing thermowells or machinery
- Thread connection or union nut
- DIN-style, without thermowell

OPTITEMP TRA-T30

- Resistance (RTD) temperature assembly for higher flow velocities and pressures
- Weld-in connection
- DIN-style based on form 4, barstock thermowell with tapered tip

Contact

Would you like further information about these or other applications?
Do you require technical advice for your application?
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Please visit our website for a current list of all KROHNE contacts and addresses.

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