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Clamp-on Flow Metering in Areas with High Magnetic Radiation

Four Ultrasonic Meters KF150 in a high temperature application of a fusion reactor

Eletta Flow celebrated its 75th anniversary in 2022. No wonder, because the swedish company is market and technology leader for flow monitoring in all applications that are prone to megnetic or nuclear radiation.
All particle accelerators rely on the robustness and longevity of the Eletta products, and so, we also got the inquiry for the Wendelstein 7-X fusion reactor.

Fusion energy has the potential to supply unlimited clean energy to mankind, without the limits of raw material supply. We are porud that our clamp on flow meters now contribute to the operation of an ambitious research project, the Wendelstein 7-X in Greifswald, a so-called Stellarator.
In conjunction with the Tokamak project ITER in Southern France, it will span a bridge to the first fusion power plants.
The deciding factor was the resistance of our flow meters against massive magnetic fields that enclose the high energy plasma.
Wendelstein 7-X is a ring of approximately 14m diameter. External magnetic coils generate a twisted magnetic field that enclose a hydrogen plasma. The necessary temperatures are generated by an antenna in a so-called Ion Cyclotron Resonance Heating ICRH) system. This system generates radio waves (like a microwave oven) that are absorbed by the plasma and heat it up to 150 million degrees C! This high temperature, together with the particle density and a sufficient insulation of the plasma are the three preconditions for a successful lab experiment With a Stellarator field.

Important parts of the ICRH antenna are eight cooling circuits, in order to keep the temperatures on the right level. The water temperature is 150 deg C at max. 26bar pressure and a constant flow of 5.400l/h.
Initially, the scientists tried to measure the flow with variable area flow meters. Hewre, the influence of the magnetic fields was too strong so that this technology failed. Therefore, the scientists of LPP-ERM/KMS, Max-Planck-Institut für Plasmaphysik (IPP) and Forschungszentrums Jülich had to find another technology. Due to the deionized water that is used in the cooling circuit, the selection criteria for the measurement technology was also to find a solution for non-conducting media.
Finally the ultrasonic clamp-on flow meter KF150 fulfilled all requirements for this unique high-temperature application. With the Profibus DP connection and the temperature measurement, the scientists can

- Verify that the cooling circuits work with the right flow rate
- Measure the temperature loss
- And thus calculate and assess the energy of the radiation.

Project partners:
Laboratory for Plasma Physics, Ecole Royale Militaire-Koninklijke Militaire School (LPP-ERM/KMS),
Trilateral Euregio Cluster (TEC), Brussels
Forschungszentrum Jülich GmbH, Institut für Energie- und Klimaforschung - Plasmaphysik,
Trilateral Euregio Cluster (TEC)
Forschungszentrum Jülich GmbH, Zentralinstitut für Engineering, Elektronik und Analytik
Max-Planck-Institut für Plasmaphysik (IPP), Greifswald