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CONTINUOUS CONDENSATE QUANTITY MEASURING SYSTEM

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Technical task:
Measuring the amount of condensate is an important factor in fuel cell development and ultimately in the technical design of the overall system. Condensate, also described as process water in the following, is primarily produced during the electrochemical conversion of hydrogen and oxygen inside a fuel cell. In addition to the electrical energy produced, a considerable amount of process water is produced as a by-product. Part of the development task is to leave part of this process water in the system for membrane humidification as well as to separate unwanted parts from the system. The person entrusted with the task must measure the process water leakage in the anode and cathode circuit of the fuel cell system continuously and depending on the operating point.

Initial situation:
The process lines mentioned are gas-carrying and pressurized lines which must remain closed during measurement for operational reasons. As a rule, the process water is discharged from the circuits at a suitable point and collected by means of discontinuously operating water separators which operate according to the siphon or floating body principle. After separation, the process water is collected and measured in a downstream tank with weighing device. Under the condition of stationary operating points, the quantity measurement per time unit can only be carried out using a time-balancing procedure. Disadvantage: The described measuring procedure is time-consuming and uncomfortable. The flow rate value of interest per time unit is not available. Likewise, the measurement data cannot be made available directly to the measurement and application systems used via an interface.

Solution:
The continuously operating condensate flow measurement system shown in Figure 1 (short: CQMS) can be used in both the anode and cathode systems in the same way. As described above, the condensate is discharged at a suitable point from the gas-carrying process sections of the system to be investigated. The previous separator with floating body principle is replaced by a vessel with analog level probe and high linear resolution. An electronically controlled shut-off valve automatically opens and closes the tank outlet. In the measuring phase, the associated small controller determines the change in level and determines the flow rate per time unit. The controller can evaluate various interval or gate times and convert them to millilitres or litres per minute. The working or evaluation range of the measuring system is between a minimum and maximum level. If the maximum level is reached during operation, the accumulated condensate is drained down to the minimum level. This remaining water cushion is necessary to achieve a system separation between gas and water and to keep the process sections closed. The discharged process water quantities are determined by the small controller of the CQMS and made available as balanced measurement data including some status information via a CAN interface. The data can thus be evaluated and displayed by a higher-level measurement or application system. The CQMS is designed for integration into hydrogen-bearing pipelines with Ex-zone requirements and the expected maximum gas pressure.

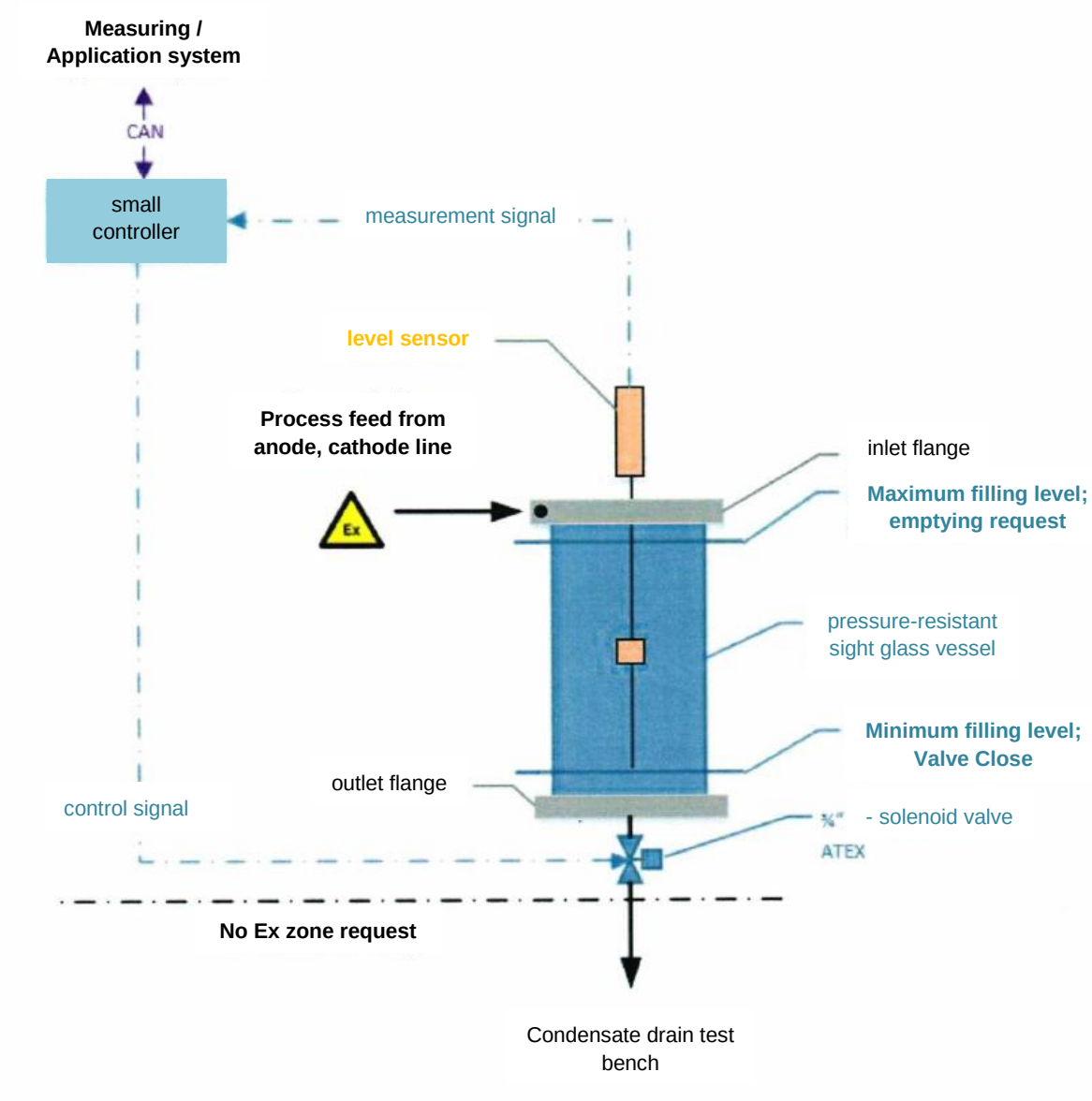

Figure 1: CQMS construction principle

Advantages:
- Automatic measuring instrument
- Available flow rate value per time unit
- Transfer of measurement data to measurement and application systems
- Saving of time