APPLICATION NOTE

Power Generation

Flow measurement in a condenser tube cleaning system

- Using balls to effectively clean the cooling pipes in turbine condensers
- Differential flow measurement to determine ball wear
- Optimising the fully automatic cleaning process

1. Background

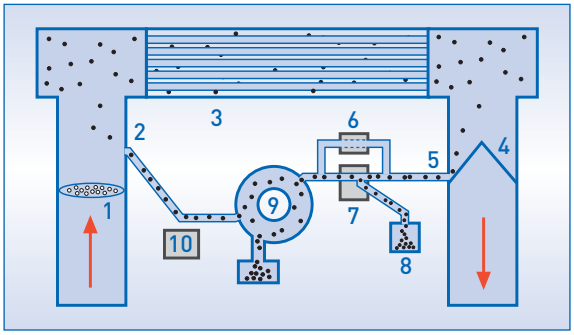
In power plants, contamination and blockages in the cooling pipes of turbine condensers disturb the heat transfer, resulting in power loss of the turbine. As a result, the plants capacity decreases and reduces the plant's economy. Clean condenser tubes and effective heat transfer are responsible for the condenser temperature and pressure and are thus pivotal for the overall efficiency of the Rankine cycle.

To minimise the extent of fouling of the condenser pipes, suitable cooling water filters are installed directly in front of the condenser. However, deposits and blockages can still accumulate in the condenser pipes.

2. Measurement requirements

The turbine condenser cooling pipes must be kept clean so that the efficiency of the power plant does not decline. Therefore, high performance condenser tube cleaning systems are nowadays used in many power plants.

The cooling water flows through a backwash filter system (**1**) in the inlet. Sponge rubber balls (**2**) with a diameter greater than that of the cooling pipes are added to the cleaned cooling water. The diameter and degree of hardness of the balls depend on the quality of the cooling water and the condenser design. The ball/water mixture then flows through the turbine condenser (**3**).



Process scheme of a condenser tube cleaning system

KROHNE

After the condenser, the balls are separated from the main stream of cooling water by a strainer (**4**) and are sent to quality control after the ball return (**5**). The speed of the cooling water without balls, measured using an electromagnetic flowmeter (**6**), and the speed of the water with the balls, measured using two light barriers (**7**), are compared. This comparison takes place using the control unit (**10**) by way of differential measurement. The cooling water without balls flows faster than that with balls. As the balls get increasingly worn and their diameter decreases, the speed of the water with the balls increases. The speed is thus a measure for the wear of the balls. Worn balls whose diameter is too small (**8**) are rejected by the appropriate filter or strainer. The next module (**9**) keeps the number of balls constant in accordance with the operator's requirements and, if necessary, adds missing balls. The balls then flow back into the cooling water circuit (**2**).

3. KROHNE solution

KROHNE provides the OPTIFLUX 1300 C electromagnetic flowmeter to perform the differential measurement used in these applications. The sandwich version simplifies installation in the pipeline. The comprehensive evaluation electronics housed in the IFC 300 converter simultaneously measure the flow velocity and actual flow and count the total volume. There are many diagnostic functions available. They can be used to immediately initiate counter measures should there be any deviations from the normal cooling process.

4. Customer benefits

Fully automatic cleaning equipment used for the cooling pipes in turbine condensers ensure permanent constant heat transfer from heat exchangers and condensers, increasing both efficiency and availability. The robust and reliable OPTIFLUX 1300 used within the high performance condenser tube cleaning system helps to maintain plant performance and efficiency. Primary energy costs stay low and the performance of the plant remains constantly high.

5. Product used

OPTIFLUX 1300 C

- Electromagnetic flowmeter (EMF) with lightweight wafer-style design
- Simple start-up and operation
- Maintenance-free
- Measurement of volume flow, mass flow, flow velocity and electrical conductivity
- Sizes DN10...150 and 3/8"...6"
- Measuring inaccuracy ±0.3% from the measured value
- Operating temperature with PFA liner up to +120°C / +248°F

Contact
Would you like further information about these or other applications?
Do you require technical advice for your application?
application@krohne.com

Please visit our website for a current list of all KROHNE contacts and addresses.

www.krohne.com