Proceedings of

HYDRO, October, 2015, Bordeaux, France

# Validation of the CFD-Calculation of a Complete Hydro-Generator by Measurements

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**Abstract**

This paper presents a cooling assessment of a 110 MVA hydro-generator based on measurements and calculations. The considered machine is a salient-pole type with horizontal arrangement and symmetrical cooling. Measurement are done during commissioning of the machine, they include static pressure at various locations inside the machine, as well as temperatures and flow rates.

The evaluation of the air-flow distribution inside the machine is done by means of numerical CFD (computational fluid dynamics) calculations. Aim of the CFD calculation, which is done in cooperation with T-plus Engineering, is to provide information about the flow distribution within the generator and for verification of the analytical in-house calculation software. The studied geometry models a horizontal hydro generator, which is symmetrically ventilated by two fans at both rotor ends. ICEM-CFD and ANSYS Meshing are chosen for the grid generation and ANSYS CFX is the CFD-code employed for the parallel computation. The computational power of a multi-core processor with 64 cores and 512GB RAM is required for the flow calculation on the approximately 160 million nodes and 800 million cells computational mesh. The flow rate through the generator is chosen according to the flow rate measurements on site. A velocity distribution after the axial fan is imposed as inlet boundary condition. This velocity profile is as well obtained by means of a CFD model. In some parts of the machine, the results of the CFD-calculation show relative good agreement with the flow measurements. Other parts show remarkable differences and are still subject of further refinement and improvement.

A subsequent numerical computation of the temperature field inside stator and rotor is done with a three-dimensional automated finite difference algorithm. The flow distribution obtained from the CFD calculation supplies the necessary cooling data and allows for iterative determination of dissipated power losses and local air temperatures. A comparison with measured temperatures shows a good agreement.