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SCALE EFFECTS IN HYDRAULIC TURBINES: Status and further approach

by Torolf Pettersen, Division Hydraulic Design, Kværner Energy a.s. - Norway

In 1991 - after many years of work - the IEC 995 was published. It contains the rules and the agreements on how to determinate the prototype performance from model acceptance tests of hydraulic machines with consideration of scale effects. The work was supported by the IAHR Working Group (WG) on Scale Effects lead by Professor Osterwalder, Germany.

Almost at the same time a lot of discussions started regarding the relevance of the new scaling rules. Early 1992 a new IAHR WG lead by undersigned had a common kick-off meeting with IEC/ TC 4/ WG 18 in Zürich to restart the work to take care of the new ideas that was put forward. At that time we had already been presented to the comprehensive work by the Japanese on the same topic presented in the JSME Standard S008-1989.

Since 1992 it has been presented some papers acting more like proposals to adjustments of the existing IEC 995. Professor Ida, Japan proposed in 1994 a new scaling formulae which is not relying on the classical loss distribution coefficient V at all.

But the most significant contribution to another way of thinking was given by Professor Spurk, Germany and Grein, Sulzer Hydro in 1993 when they published "Performance predictions of hydraulic machines by dimensional considerations". The results coming out of this method look very promising.

Actually, the results are so good that for the first time it is relevant to start to discuss if the prototype measurements have a good enough accuracy to really distinguish the details we can follow through the design process of a machine by help of CFD and specially planned model tests adjusted to give input to the new scaling method by Spurk & Grein.

This is the connection between the scale effect discussions and the IGHEM Seminar traditionally dealing with prototype testing.

My presentation gives the status of the quality of the scaling methods we today are discussing. Further, it will be presented examples on how the different scaling methods work on the same test results where model and prototype measurements exist.

In the WGs it is proposed a task schedule for future work, and a lot of this work can only be fulfilled by contributions by everyone in the "hydraulic family" . And a lot of this work is both laboratory and field measurements. This list of tasks will be presented.

At the IGHEM Seminar the participants can have copies of the most relevant papers presented the last years regarding scale effects.

During the seminar I hope we will be able to discuss theoretical approaches, CFD methods, laboratory and field measurements on an equal basis; different tools to have the prototypes run in an optimum way.

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