1.3 THEORETICAL AND EXPERIMENTAL STUDY OF THE INLET AND OUTLET CAVITATION IN A MODEL OF A FRANCIS TURBINE

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DISCUSSION

M Wegner (Neyrpic, Grenoble)

When doing cavitation tests, each constructor has chosen comprehensive procedures concerning dimensions of model, quality of water, test head, visualization and acoustic means. After these choices, the constructor has not realized a scientific similarity between model and prototype but he realized an analogy between an observation on the model and a point of erosion on the prototype.

Therefore I present my question.

Are you intending to build a new similarity between observation on model and a hypothetic observation on prototype, or are you intending to build a calculated modelization to finally obtain the erosion power on prototype?

Prof. J Raabe (Technical University of Munich)

The developed cavitation shown at the standard σ value in my opinion cannot be described by a simple bubble model.

Moreover the omission of heat transfer and evaporation in assumption (d) seems to be too much of a simplification.

AUTHOR'S RESPONSE

P Henry to M Wegner

I agree with your comment concerning the manufacturer's practice to predict cavitation erosion on the prototype based on model test results. This prediction is actually fully empirical and very different from one manufacturer to another. Some manufacturers base their predictions principally on careful observations of the cavitation location and extent on the model.

This practice requires that the test conditions (test head, water quality etc) be kept very constant for all tests.

Other manufacturers base their predictions on careful measurements of standard σ and by applying a safety coefficient depending on experience.

The comparison of these different methods of evaluation by the customers and consulting engineeers is therefore very difficult.

In our opinion the only way to solve this problem is to develop new similitude laws based not only on σ but also on water properties, and particularly nuclei content. The idea is to give recommendations which could ultimately be included in test codes; in this way it will be possible to compare the test results coming from different laboratories.

Our final goal is to predict prototype cavitation erosion with accuracy on the basis of model testing. We know that it is an ambitious program and that we are only at the beginning.

P Henry to Prof. Raabe

It is well known that the Rayleigh-Plesset equation does not take into account all the physical phenomena involved in the transient bubble dynamics.

By neglecting the interaction between bubbles we tried to use such a zero-order approximation model to established scaling laws for the influence of head and water nuclei content on the cavitation appearance in the runner; and then we found a good agreement between the numerical results and the observations.

Concerning the omission of heat transfer and evaporation from the assumption, the so-called thermodynamic effects were shown to be involved only in the last stage of the bubble collapse which were out of our interest in this study.