EXPERIMENTAL INVESTIGATION OF THE RELATION BETWEEN TIP LEAKAGE FLOW CAVITY AND CAVITATION NUMBER IN KAPLAN TURBINE

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Abstract: This paper presents the relation between the tip leakage flow cavity and cavitation number on the blade flange in Kaplan turbine by experimental investigation. The tip leakage flow cavity in Kaplan turbine by means of experimentation under different cavitation number and different operating conditions has been investigated. The analysis focuses on the leakage vortex's nucleation inception and growth under different cavitation number and operating conditions on the blade flange.

The result showed that the leakage flow through the clearance isn't a single flow types, it can be divided 4 regions (A, B, C, D) according to the direction of leakage flow in the flange clearance. Region A is at leading edge of the blade's flange, part lies in pressure side that from suction side to the pressure side, and other part lies in suction side; Region B is the middle region of blade flange within tip clearance where the leakage flow change its direction; Region C is tip leakage flow that direction of blade flange clearance turn to suction side; Region D is trailing edge vortex region of tip near the flange of blade. The flow pattern in flange clearance of Kaplan turbine was revealed.

The results also indicate the effect of clearance cavitation and the rise of cavitation number in the Kaplan turbine, conclusions are as follows:

1、Based on the experimental evidences, the location and size of meiobar in leaking vortex rope caused by clearance flow has not only relation with the cavitation number of Kaplan turbine, but also with runner blade angles and guide vane angles .

2、With augment of the guide vane opening, cavitation number of incipient bubbles , which are caused by clearance flow, begins to increase gradually.

3、When turbine runs at different unit speed, the max cavitation number, caused by the incipient bubbles of clearance cavitation erosion, is bigger than cavitation erosion coefficient of turbine, and leaking vortex rope caused by clearance cavitation has expanded enough to occupy blade edge before reaching to cavitation erosion coefficient of turbine. The facts mentioned above account for that the Kaplan turbine , at the tip of the pressure side , the outer edge of the foil and runner etc. are partially badly damaged in the mass of water plant.

Keywords : Kaplan turbine; Blade flange; Tip leakage flow cavity; Cavitation number

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