# STUDY ON HYDRAULIC CHARACTERISTICS OF MULTIFUNCTION SURGE TANK

ZONGFU FU[1], ZHONGMIN YAN[2], MINGMING LIU[3] and NAN HU[4]

[1]Junior Professor, College of Water Conservancy and Hydropower Engineering
Hohai Univ., Nanjing 210098, China
(Tel: +86-25-86082810, Fax: +86-25-83731332, e-mail: fzfxb@263.net)
[2]Professor, College of Water Conservancy and Hydropower Engineering
Hohai Univ., Nanjing 210098, China
(Tel: +86-25-86082907, Fax: +86-25-83731332)
[3]Junior Professor College of Water Conservancy and Hydropower Engineering
Hohai Univ., Nanjing 210098, China
(Tel: +86-25-86082912, Fax: +86-25-83731332)
[4]Graduate Student, College of Water Conservancy and Hydropower Engineering
Hohai Univ., Nanjing 210098, China
(Fax: +86-25-83731332)

Surge tank is an important construction in a pressure tunnel system. Generally, the main function of surge tank is to reflect the water hammer using amplified section and the free water surface when water-turbine generator increase or discard load, restrict water hammer wave entering the pressure pipe, reduce water hammer pressure in pressure pipe, keep away from the influence of the water hammer pressure on the whole, and improve quality of power supply and the operating condition when load of water-turbine generator is alterant. While water-turbine generator is on stable operation, the surge tank is almost cut no ice, so the present relation researches are mostly aimed at the reflection characteristic of water hammer wave, the surge and the head loss in surge tank and so on. In this paper, according to experiment of hydraulic model and numerical computation of the downstream river of FUZILING pumped-storage power station, the hydraulic characteristics of multifunction tailrace surge tank such as the discharge ratio, overflowing characteristic, safety water depth etc were comprehensively analyzed and studied. This surge tank is also used to partake discharge when water-turbine generator is on stable operation except the basic function as common surge tank, that means, when lower reservoir water level is higher than the top elevation of overflow weir, a part of water flows in and out from the inlet and outlet of the lower reservoir, another part flows in and out from the overflow weir of the surge tank, the inflow and outflow partly take place of the main tailrace tunnel, so it can reduced effectively diameter of main tailrace tunnel, lower project cost and save investment, or in the case of certain main tailrace tunnel diameter the velocity in the main tailrace tunnel can be reduced, the head loss is decreased, and the energy output and benefit are increased.

It can effectively decrease the size of the model, save the cost of experiment; improve the efficiency to calculate the rate of diversions using the method to combine numerical simulation and experiment of hydraulic model.

The rate of diversions under power generation and pumping case is increased with the raising of water level upstream the dam. The total discharge has some influence on rate of diversions, but with the raising of water level upstream the dam, the influence will lessen

gradually. Under same total discharge and water level upstream the dam, the rate of diversions in the case of power generation is bigger than that in the case of pumping and the difference between them would increased with the raising of water level upstream the dam.

The weir flow coefficient shows good consistency under higher submerged degree though the inflow side weir height is very different under power generation and pumping case

The safety water depth of surge tank with the function of discharge diversion should be considerd synthetically all operating cases. Applying the method of this paper to calculate safety water depth, surge tank and water-turbine generator will operate safer.

## RFERENCES

Guixia Du, Jianguo Ru, Fumeng Ye etc., 1994. Experimental Study on Patterns of Surge Chamber on Tailrace of Hydropower Station, Water Resources and Hydropower Engineering, p25-29.

Changfu Song, Fulin Cai, Jianxu Zhou, 2003. About the Water Head Loss Coefficients of Throttled Surge Tank, Jinxi Hydraulic Science & Technology, p129-132.

Ming Hu, Fulin Cai, Qing Cao,2000. Model for Optimization of Bottom Shape of Rectangular Orifice Tail Surge Tank, Journal of Hohai University, p92-95.

Changxi Mao, Mingde Zhou, Gongchun Cai, 1995. Engineering Hydraulics of Aboideau & Design and Management, Water Conservancy and Electric Power Press of China, p121-123.

Criterion of Peoples Republic of China, 1997. Specifications for Design of Surge Chamber of Hydropowerstations, p7-9.