HYDRAULIC CHARACTERISTICS OF STEPPED PLUG ENERGY DISSIPATER IN FLOOD DISCHARGE TUNNEL

ZHONG TIAN

Ph.D. Candidate, State Key Hydraulics Lab. of High Speed Flows,
Sichuan Univ., Chengdu, 610065, China
(Tel: +86-28-8540-1781, Fax: +86-28-8540-5148, e-mail:scutz@163.com)

Recently, model tests (Liu et al., 2002) and Computational fluid dynamics(CFD) simulations (Dong et al. ,2002; Xia et al., 2003) showed that single plug dissipater in pressure tunnel is an efficient energy dissipater for the reduction of velocity in pressure tunnel, but the minimum pressure was very low when this type of energy was applied in the pressure tunnel with 200m operation head.

To increase minimum pressure in plug dissipater and reduce the risk of cavitation occurrence, the author developed a stepped plug energy dissipater that was composed of an auxiliary plug and a main plug. Hydraulic experiment and CFD simulation were conducted with both single plug dissipater and stepped plug dissipater to determine their head loss coefficients and minimum pressure coefficients. The experimental results showed that, for the stepped plug dissipater, comparing with the single plug dissipater, the minimum pressure in the plug increases distinctively although the energy dissipation rate decreases more or less. The ratio of auxiliary plug diameter to main plug diameter equals to 1.1 and the ratio of auxiliary plug length to pipe's diameter equals to 0.4 may a good choice for the stepped plug dissipater design. The CFD simulation showed that the reason why the stepped plug can increase the minimum pressure is that the auxiliary plug lessens the intensity of votex near the inlet of the main plug. As far as hydraulic characteristics are concerned, the stepped plug dissipater is better than single plug dissipater.

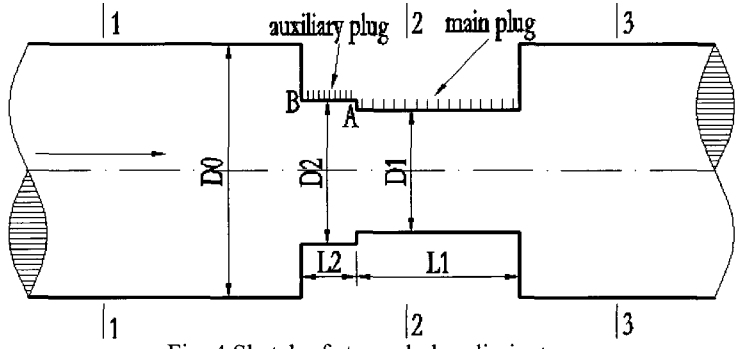

Fig. 4 Sketch of stepped plug dissipater

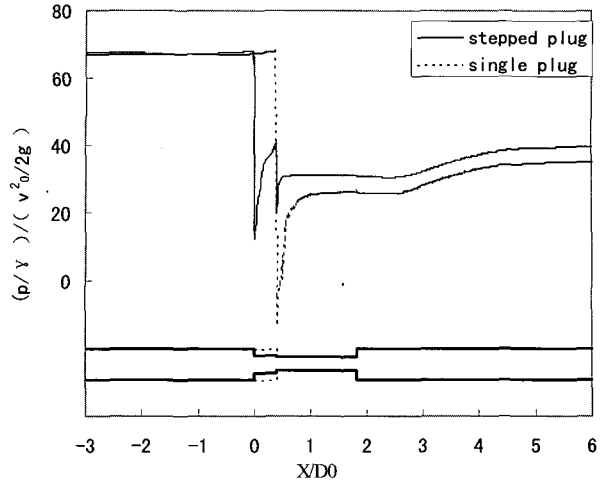

Fig. 9 Pressure distribution along top wall of single plug and stepped plug for D2/D1=1.1 and $v_0 = 0.889$ m/s

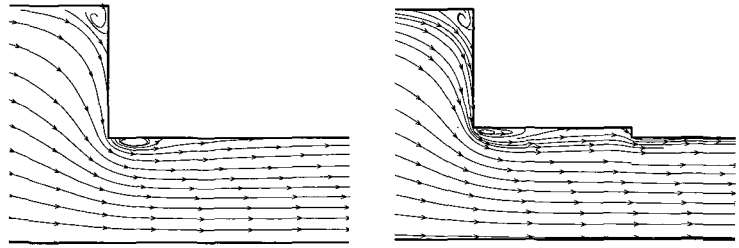

Fig. 10 Streamline plots of single plug and stepped plug for $v_0 = 0.889$ m/s

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