ABSTRAK

Desain dari sebuah *draft tube* akan mempengaruhi kinerja dari sistem PLTMH turbin *hydrocoil* karena perbedaan karakterisitik aliran fluida pada *draft tube*. Kecepatan aliran air setelah keluar dari turbin *hydrocoil* masih relatif tinggi, sehingga masih banyak energi aliran yang terbuang sebelum dapat dikonversi. Sebagaimana turbin reaksi lainnya, turbin *hydrocoil* memerlukan *draft tube* agar dapat memaksimalkan proses konversi energinya. Dengan demikian, tujuan dari penelitian ini adalah menentukan jenis *draft tube* berdasarkan nilai *head recovery* dan kinerja turbin *hydrocoil* untuk sistem PLTMH yang telah dirancang. Proses penentuan ini melibatkan 3 tahap, yaitu: 1) evaluasi kinerja turbin *hydrocoil* yang telah dipasangi 3 jenis *draft tube*, yaitu *conical straight*, *curved elbow*, dan *simple elbow*, menggunakan metode *Computational Fluid Dynamics* (CFD), 2) perhitungan *head recovery* ketiga jenis *draft tube*, dan 3) penentuan jenis *draft tube terbaik* berdasarkan nilai *head recovery* dan kinerja turbin *hydrocoil*. Pada tahap satu, tipe analisis yang digunakan adalah *steady state* dengan model turbulensi SST k-ω, untuk menangkap turbulensi di pipa *penstock* dan di dekat *blade* turbin. Hasil yang didapatkan adalah efisiensi turbin *hydrocoil* tertinggi dengan ketiga jenis *draft tube* terpasang, berada di kecepatan putar N = 1100 rpm. Efisiensi tertinggi untuk turbin *hydrocoil* dengan *draft tube conical straight*, *curved elbow*, dan *simple elbow* masing-masing adalah 90,48%, 90,18%, dan 91,26%. Sementara itu, *head recovery* pada kecepatan putar N = 1100 rpm untuk *draft tube conical straight*, *curved elbow*, dan *simple elbow* masing-masing adalah 1,627 m; 1,866 m; dan 4,097 m. Dengan demikian, *draft tube simple elbow* adalah yang tepat untuk sistem PLTMH ini karena memiliki nilai *head recovery* dan efisiensi tertinggi.

Kata Kunci: Turbin *Hydrocoil, Draft Tube, Computational fluid dynamics* (CFD), Kinerja, *Head Recovery*

DETERMINATION OF DRAFT TUBE TYPE BASED ON HEAD RECOVERY VALUE AND TURBINE HYDROCOIL PERFORMANCE USING COMPUTATIONAL FLUID DYNAMICS METHOD

ABSTRACT

The design of a draft tube will affect the performance of the hydrocoil turbine MHP system due to differences in fluid flow characteristics in the draft tube. The velocity of the water flow after exiting the hydrocoil turbine is still relatively high, so there is still a lot of wasted flow energy before it can be converted. Like other reaction turbines, the hydrocoil turbine requires a draft tube in order to maximize its energy conversion process. Thus, the purpose of this research is to determine the type of draft tube based on the head recovery value and performance of the hydrocoil turbine for the designed MHP system. This determination process involves 3 stages, namely: 1) evaluation of the performance of the hydrocoil turbine that has been installed with three types of draft tubes, namely conical straight, curved elbow, and simple elbow, using the Computational Fluid Dynamics (CFD) method, 2) calculation of the head recovery of the three types of draft tubes, and 3) determination of the best type of draft tube based on the head recovery value and performance of the hydrocoil turbine. In stage one, the type of analysis used is steady state with the SST k-ω turbulence model, to capture turbulence in the penstock pipe and near the turbine blade. The results obtained are the highest hydrocoil turbine efficiency with all three types of draft tubes installed, at a rotational speed of N=1100 rpm. The highest efficiency for the hydrocoil turbine with conical straight, curved elbow, and simple elbow draft tubes are 90.48%, 90.18%, and 91.26%, respectively. Meanwhile, the head recovery at rotational speed N=1100 rpm for draft tube conical straight, curved elbow, and simple elbow are 1.627 m; 1.866 m; and 4.097 m, respectively. Thus, the simple elbow draft tube is the right one for this MHP system because it has the highest head recovery and efficiency values.

Keywords: *Hydrocoil Turbine, Draft Tube, Computational fluid dynamics (CFD), Performance, Head Recovery*