

OPTIMIZATION TESTS OF BULB TURBINES

Optimization of double regulated water turbines consists in determining such the optimal relationship between the opening angles of both the guide vanes and the runner blades (optimal CAM) that the turbine will be operated with maximum energetic efficiency at a given head and flow rate.

For execution of optimization tests of bulb Kaplan turbines, the method of relative discharge measurements which is based on measuring the pressure difference in turbine flow system is very strongly recommended. The basic feature of such method used is that it does not require any time-consuming and expensive measurements of the absolute discharge through the turbine.

Implementation of the optimal CAM dependence can be directly interpreted as measurable benefits, not only connected with maximization of energy production from a disposable hydro-potential, but also with extension of the lifetime of the hydrounit structural components because of reducing dynamic loadings of turbine structure components.

The advantages of optimizing the hydrounit operation, in comparison with the relatively low costs of the tests and programming the optimal CAM dependence in the digital turbine governors, is the most important virtue of the offered approach.

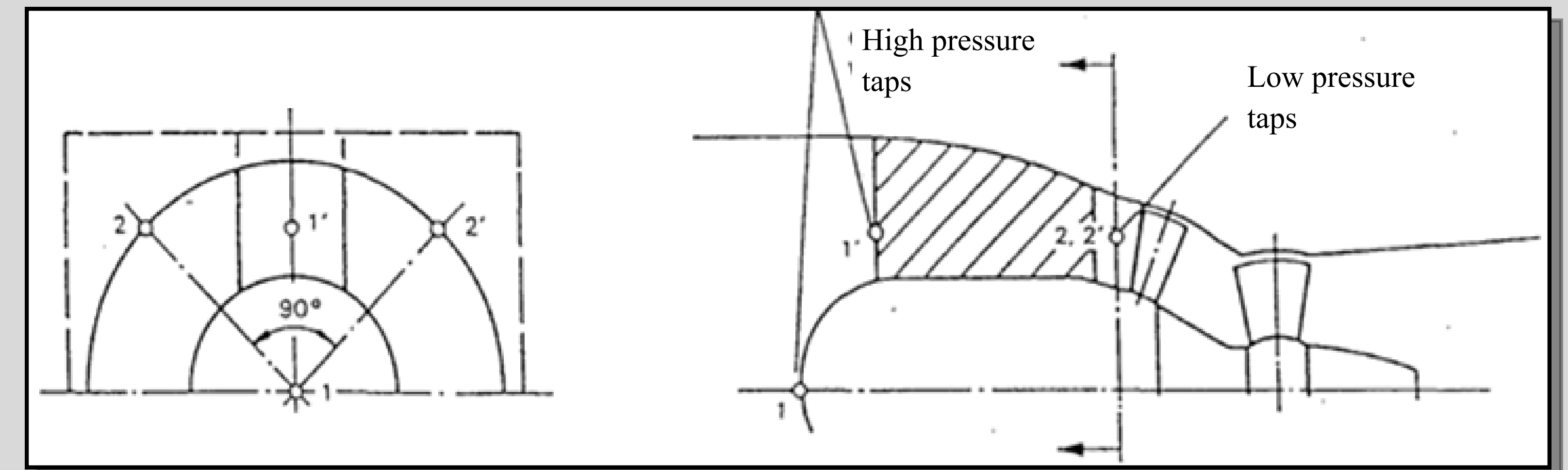


Fig.2. Location of taps for differential pressure method of discharge measurement through a bulb turbine - recommended by IEC 41.

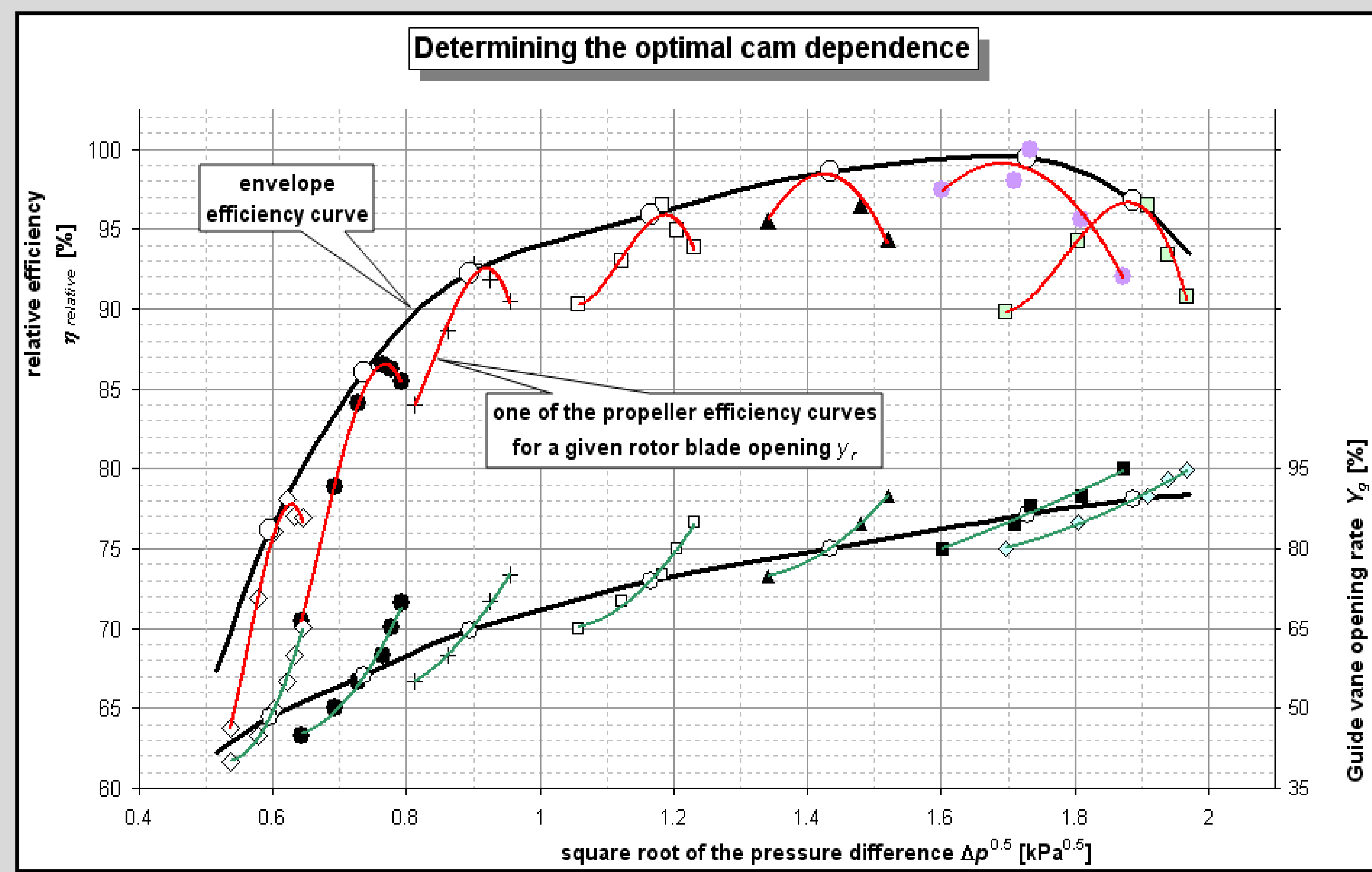


Fig.1. Example of propeller curves with their envelope curve determining the relative flow measurement using differential pressure method.

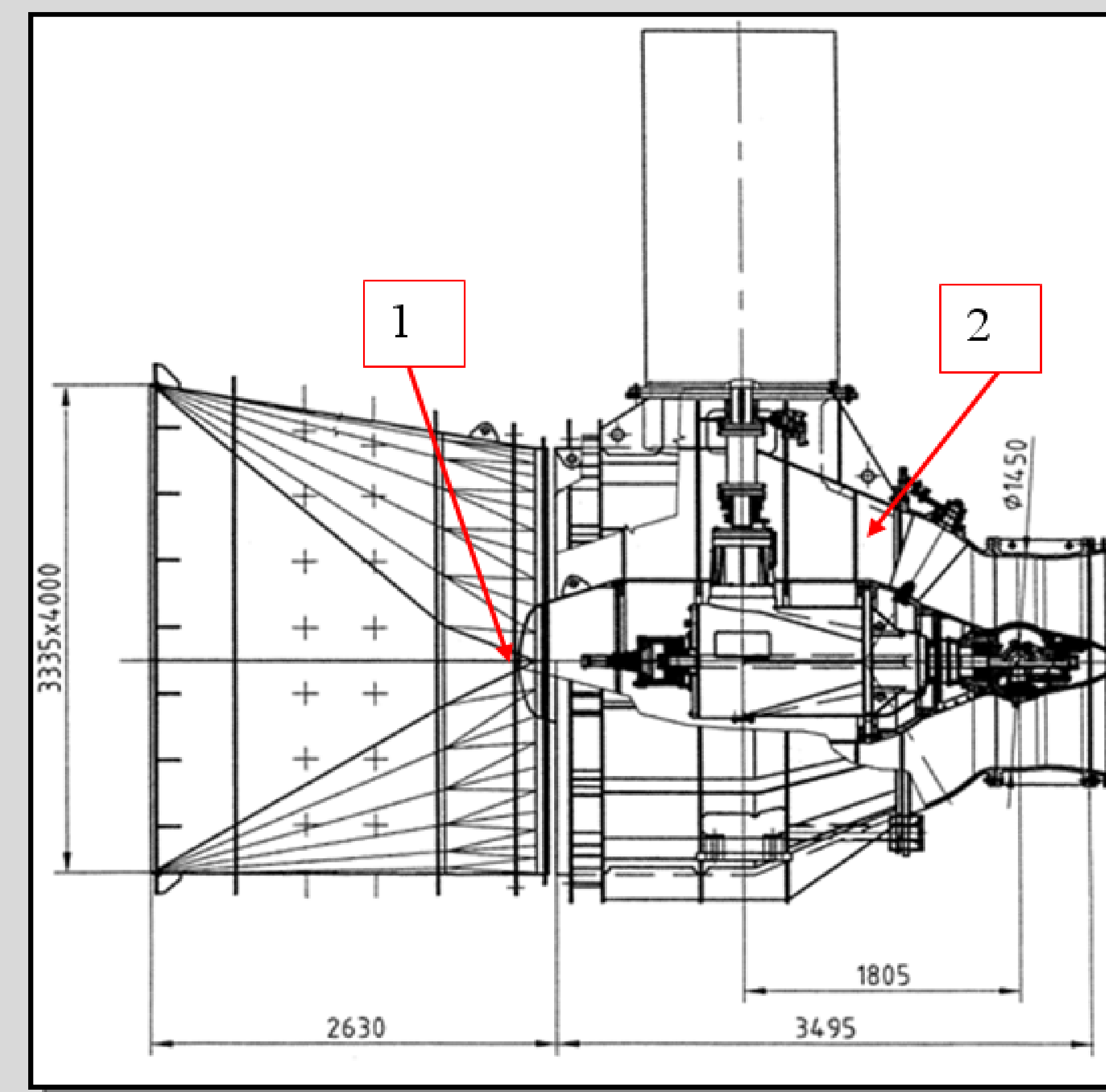


Fig.3. Flow system of bulb turbine in one of Polish hydropower plants. (High and low pressure taps are marked on with respectively 1 and 2).

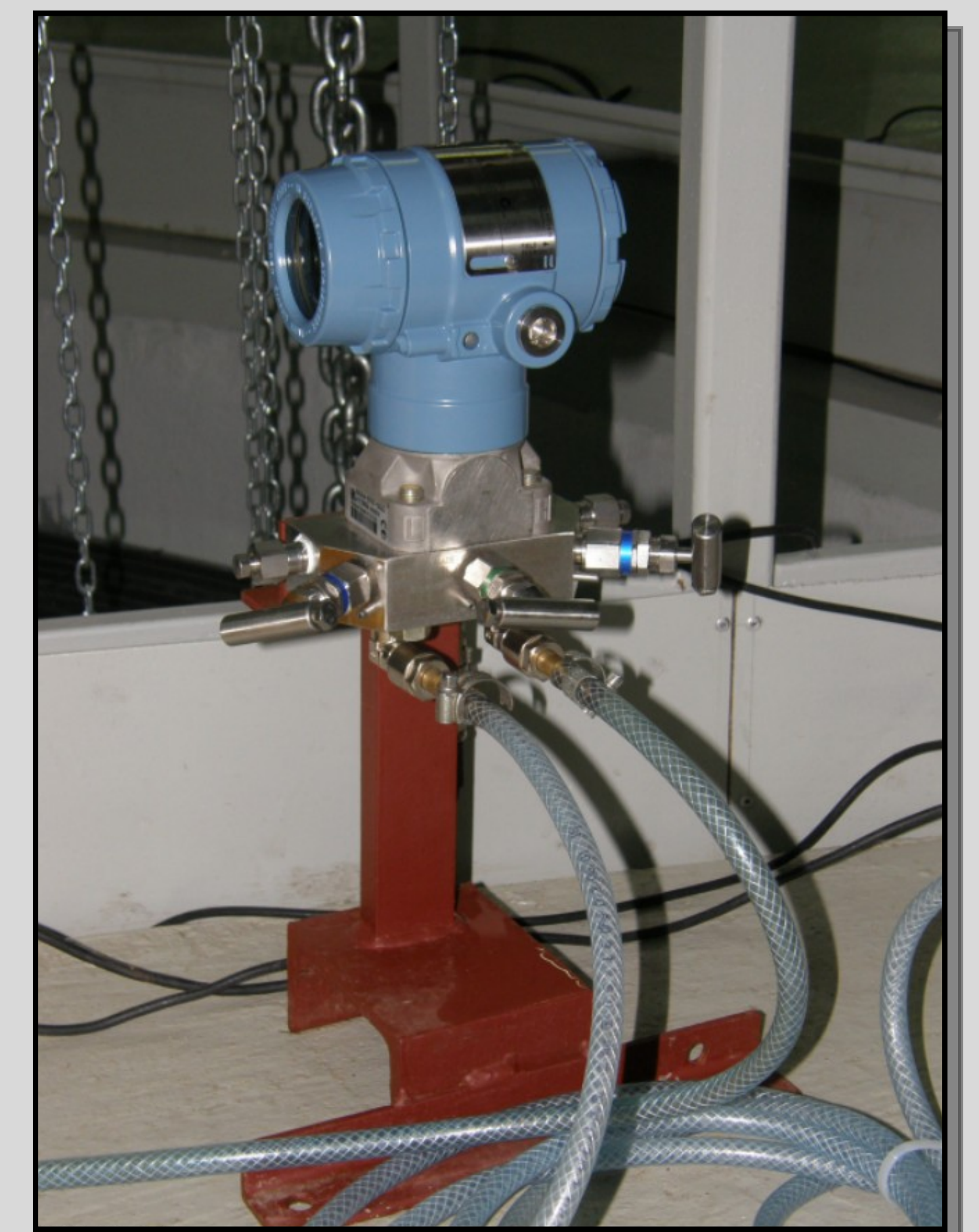


Fig.4. Differential pressure transducer.

References:

- Adamkowski A., Janicki W., Lewandowski M.: *Badania sprawdzające hydrozespołu Hz1 po naprawie awaryjnej i hydrozespołu Hz2 po naprawie gwarancyjnej w EW Rakowice. Sprawozdanie końcowe.* Oprac. IMP PAN, nr arch. 144/08, Gdańsk, 2008.
- Adamkowski A., Janicki W., Lewandowski M., Steller J.: *Badania gwarancyjne hydrozespołów Hz1 i Hz2 z turbinami rurowymi w EW Dobrzeń. Sprawozdanie końcowe.* Oprac. IMP PAN, nr arch. 402/09, Gdańsk, 2009.