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''An Experimental Investigation of Pump Operating in Turbine Mode''

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ABSTRACT:- Pump-as-Turbine (PAT) technology is taking the field in different small-hydro or energy recovery applications. These machines can be installed in water distribution grids to have pressure levels adjustment and electrical energy production. The function of a PAT is comparable to that of any turbine, to convert kinetic and pressure energy of the fluid into mechanical energy of the runner

Unlike other conventional machines which require being manufactured according to the client's specifications, pumps are a very common piece of equipment widely available in different sizes and functionality anywhere around the globe. When used as a turbine, the rotor moves in the opposite direction, or in reverse, as to when it is operating as a pump. In this manner, it allows the motor may generate electrical power.

1. INTRODUCTION

It is of urgent demand for energy source with rapid economy development, and hydropower is one of the most stable renewable energy up to now. Large hydropower stations have achieved great success in many countries and regions However, the building cost and public affair can restrict their broader application, since huge reservoir is necessary and it may induce human rehabilitation. Hence, the small hydropower station is an alternative for exploitation and utilization of hydropower source. Commonly, the hydraulic turbine in hydropower station should be specifically designed with professional knowledge. In recent decades, the pump as turbine (PAT) has attracted much attention for energy production in small hydropower station in amount of their low cost and wide application.

2. LITERATURE REVIEW

(A) GUIDED PUMP-AS-TURBINE: DESIGN AND DEVELOPMENT FOR PICO-LEVEL ENERGY GENERATION By RITESH SINGH, P M V SUBBARAO

• Integral pump and motor can be used as a turbine and generator set

• Available for a wide range of heads and flows

• Available in a large number of standard sizes

• Short delivery time

• Spare parts such as seals and bearings are easily available Easy installation - uses standard pipe fittings

Turbines are custom made, hence, expensive and out of question for the rural poor. However, if we use a pump (which is mass produced and hence, pretty cheap) we have a clean, green and a sustainable solution for the power needs of the rural people. The scale of generation is targeted to household uses and hence ranging from 400w-5kw

(B) The research paper by A.A.Williams has been summarized as follows:

• Turbine tests on 35 pumps of various types and sizes

• Relative merits and demerits of eight different methods for theoretical analysis of pumps used as turbine are compared. Although, all of them are based on the data for pump performance at best efficiency, there is a lot of variability in results.

• Guide vanes have not been used.

• It has been concluded that Sharma's method matches the experimental results most closely. Though, even after using Sharma's method, the predictions were outside the acceptable limits, for about 20 per cent of the pumps for which test data were available

(C) Numerical optimization of guide vanes and reducer in pump running in turbine mode

V A Patel, S V Jain, K H Motwani, R N Patel

One of the reasons for poor part load efficiency of pump running in turbine mode is absence of flow regulating mechanism, which can be improved by some low cost modification like by providing the fixed guide vanes in the casing. To create the space for the installation of guide vanes in the casing, it was proposed to use 200 mm dia. impeller in place of 250 mm dia. impeller. To determine the optimum angle of fixed guide vanes, CFD analysis of casing was carried out with NACA-4418 guide vanes by varying the guide vane angle between 45° and 80°. At an angle of 75°, the loss in kinetic energy in the casing was found to be minimum, as the fluid enters tangentially in the runner blades, which has suggested availability of more energy for the power generation to the runner. Hence, it was recommended to use 200 mm dia. impeller along with 8 numbers of fixed guide vanes angle at an angle of 75° for the PAT. To decide the size and location of reducer in the piping system, CFD analysis of piping system was carried out by considering two diffusers i.e. short reducer between service pump and PAT and long reducer at PAT inlet. With long reducer, the loss in static and dynamic pressures in the piping system was found to be 55.55% and 72.73% less than that with the short reducer. Hence, use of long reducer was recommended at the inlet of PAT.

3. CONCLUSION

We hope to conclude the project with a pump as turbine (PAT) which will cause a significant amount of energy produce and cost savings for the people

4. REFERENCES

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