

## RH440

# "Hydropower – Pelton and Francis hydroturbines" Laboratory complex Experiment Set



This set is designed for studying and determining the characteristic parameters of a centrifugal pump and Pelton and Francis hydroturbine.

Francis turbine is one of the important reaction type turbines. In Francis turbine the pressure energy is converted to the kinetic energy. The set contains guide vanes. The angle of these vanes can be set. The water flows in the system and turns the wheel. So kinetic energy is produced. On this experiment set the amperage and voltage of the output electrical current, the rotational speed, the flow and pressures are measured and read.

### The students can make with this experiment set:

- determination of mechanical output,
- efficiency and characteristic curves and investigation of the influence of the guide vane position on the power output experiments.

Pelton turbine is one of the important impulse type turbines. In Pelton turbine the pressure energy is converted to the kinetic energy. The set contains a wheel and blades. The water flows in the system from a needle nozzle toward the wheel and turns the wheel. So kinetic energy is produced. On this experiment set the amperage and voltage of the output electrical current, the rotational speed, the flow and pressures are measured and read.

### **The students can make with this experiment set:**

- design and function of a Pelton turbine,
- determination of torque,
- power and efficiency and graphical representation of characteristic curves for torque,
- power and efficiency experiments.

### **Description**

- Characteristic variables of waterturbines and centrifugal pumps
- Pelton turbine and Francis turbine extend the scope of experiments
- Pumped storage plant Turbomachines such as pumps and turbines are energy converters. Turbines convert flow energy into mechanical energy and pumps convert mechanical energy into flow energy.

Characteristic variables of hydraulic turbomachines can be used to investigate a centrifugal pump. Experiments can be performed on two key water turbine designs: Pelton and Francis turbine, available as accessories pelton turbine and Francis turbine

### **Learning objectives/experiments**

## **centrifugal pump**

- measuring inlet and outlet pressures of the pump
- determining delivery height
- determining hydraulic output
- determining mechanical output
- recording characteristics at various speeds
- determining the efficiency

## **with accessories Pelton türbine or Francis turbine**

- measuring torque and speed
- determining efficiency of the turbine
- recording characteristics
- demonstration of a pumped storage plant

## **Specification**

- determining characteristic variables of a centrifugal pump
- determining characteristic variables of water turbines together with the accessories Pelton türbine and Francis turbine
- experiments on a pump in a closed water circuit with storage tank and flow control valve to adjust the back pressure
- experiments on turbines: closed water circuit for supplying turbines pipes and fittings made of PVC
- 3-phase AC motor for pump with variable speed via frequency converter
- non-contact speed measurement at the turbine shaft and force sensor at the brake for measuring the torque
- digital displays for pressures, flow rate, speed and torque
- software for data acquisition via USB under Windows 7, 8.1, 10

## Technical data

Standard centrifugal pump

- max. flow rate: 31m<sup>3</sup>/h

Drive motor with variable speed

- power output: 2,2kW
- speed range: 0...3000min<sup>-1</sup> ±5%

Storage tank: 250L

## Measuring ranges

- pressure: 2x 0...4bar abs.
- flow rate: 0...40m<sup>3</sup>/h ±5%

The equipment comply with applicable standards.

The equipment is convenient in operation and ensure safety of the maintenance personnel during operation.

Operating conditions: Indoors only at ambient temperatures from +10 to +30°C; relative humidity is up to 80% (non-condensing).

The equipment is provided with a technical description and operation manual in Uzbek and Russian.