

**Features:**

- Characteristic variables of water turbines and centrifugal pumps
- Pelton turbine 32017 and Francis turbine 32022 extend the scope of experiments
- Pumped storage plant

Turbo-machines such as pumps and turbines are energy converters. Turbines convert flow energy into mechanical energy and pumps convert mechanical energy into flow energy.

Tesca Characteristics Variables of Hydraulic Turbo-machines Apparatus 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 32017 and 32022.

The closed water circuit comprises a tank, a standard centrifugal pump with variable speed, and a flow control valve to adjust the backpressure.

The speed is detected contact-free by means of an inductive displacement sensor on the motor shaft. To determine the drive power, the drive motor is mounted on swivel bearings and

equipped with a force sensor to measure the drive torque. Pressures at the inlet and outlet of the pump are measured. The flow rate is measured by means of an electromagnetic flowmeter. The measured values are displayed digitally and processed further on a PC. The PC is used to calculate the power output data of the examined turbo-machine and to represent them in characteristics.

One of the turbines 32017 or 32022 can also be placed on top of the storage tank. The centrifugal pump supplies the turbine with water. The measured values of the turbine are transferred via cable to 32116. A special feature of 32116 is the ability to operate the pump and turbine at the same time. Relevant measured values are recorded contemporaneously at both turbo-machines. Thus the trainer can be used as a pumped storage plant.

**Specifications:**

1. Determining characteristic variables of a centrifugal pump
2. Determining characteristic variables of water turbines together with the accessories 32017 & 32022

Note: Specifications are subject to change.

**Tesca Technologies Pvt. Ltd.**

IT-2013, Ramchandrapura Industrial Area, Sitapura Extension,  
Near Bombay Hospital, Vidhani Circle, Jaipur-302022, Rajasthan, India,  
Tel: +91-141-2771791 / 2771792; Email: info@tesca.in, tesca.technologies@gmail.com  
Website: www.tescaglobal.com

3. Experiments on a pump in a closed water circuit with storage tank and flow control valve to adjust the backpressure
4. Experiments on turbines: closed water circuit for supplying turbines
5. Pipes and fittings made of PVC
6. 3-phase AC motor for a pump with variable speed via frequency converter
7. Non-contact speed measurement at the turbine shaft and force sensor at the brake for measuring the torque
8. Digital displays for pressures, flow rate, speed, and torque
9. Software for data acquisition via USB under Windows 7, 8.1, 10

- Recording characteristics at various speeds
- Determining the efficiency

With accessories Pelton turbine 32017 or Francis turbine 32022

- Measuring torque and speed
- Determining the efficiency of the turbine
- Recording characteristics
- Demonstration of a pumped storage plant

**Requirements:**

- Mains Power 220 – 240V @ 50Hz, 1Ph

**Technical Specifications:**

Standard centrifugal pump

- Max. head: 23,9m
- Max. flow rate: 31m<sup>3</sup>/h

Drive motor with variable speed

- Power output: 2,2kW
- Speed range: 0...3000min<sup>-1</sup>
- Storage tank: 250L

Measuring ranges

- Pressure: 2x 0...4bar abs.
- Flow rate: 0...40m<sup>3</sup>/h
- Torque: 0...20Nm
- Speed: 2x 0...4000min<sup>-1</sup> Experiments:

**Experiments:**

Centrifugal pump

- Measuring inlet and outlet pressures of the pump
- Determining the delivery height
- Determining the hydraulic output
- Determining the mechanical output

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