

# COMPUTERIZED FRANCIS TURBINE BENCH

## Mod. TUR-F/EV

### INTRODUCTION

The bench TUR-F/EV is a computerized table-top unit for the study of the technical characteristics of the Francis hydraulic turbine. The unit is real and totally operational: in fact, it allows to modify the operation conditions and to compare the practical data with the theory. A real-time data acquisition and analysis system is included that also features an automatic data acquisition for further in-depth study of the topic.

### TRAINING PROGRAM

The unit allows to vary the rotational speed to determine:

- Hydraulic power curve vs. rpm and shutter opening
- Electrical generator power vs. rpm and shutter opening
- Efficiency as a function of the rpm and shutter opening
- Axial torque characteristic

### TECHNICAL SPECIFICATIONS

**Hydraulic section:** a centrifugal pump elevates the flow to turbine, simulating the waterfall. The pump motor speed is frequency-controlled by an inverter. By measuring the water flow and pressure, it is possible to calculate the hydraulic power (Ph) supplied to the turbine.

**Mechanical section:** the turbine is coupled to a permanent magnets DC generator simulating a variable brake. The electrical power is dissipated in a resistive load. By measuring the generator electrical parameters (V, I, rpm) it is possible to calculate and plot the electrical power (Pe). The efficiency (%) is then calculated with Ph and Pe.

#### Electro-Hydraulic section:

- Centrifugal pump: 0,75 kW; 2900 giri/min; Q = 110 ÷ 250 l/min;  $\Delta H = 18 \div 14$  m
- Stainless steel tank, approx. 60 litres
- Flow transducer 25-250 l/min - 4...20 mA output
- Pressure transducer 0-4 bar - 4...20 mA output
- Pressure gauge with dial 0 ÷ 4 bar
- Guidable blades distributor
- Stainless steel Francis turbine
- Permanent magnets DC generator, performing as variable electrical brake. Nominal parameters: 48 V, 210 W at 3000 rpm
- Digital rpm transducer



#### Control section with signal conditioning and A/D conversion:

- Centrifugal pump supervision: programmable inverter for rpm control
- Electronic board with display to check: pump flow rate and pressure; DC generator electrical parameters: V, I, rpm; Ph, Pe and efficiency (the DC generator losses are provided by the manufacturer)
- Signals conditioning unit with 12 bit A/D conversion. The board is connected to a PC via USB port.
- Data acquisition and analysis software running under Windows: it automatically acquires data in real-time from the system transducers that are also used for fault simulation. The software can also display, save and print the unit performance diagrams.
- Resistive load for the DC generator

**Power supply:** 230 Vac 50 Hz single-phase - 1,3 kVA  
(Other voltage and frequency on request)

**Dimensions:** 1400 x 700 x 1000 (h) mm (main unit)  
600 x 400 x 400 (h) mm (control unit)

**Tot weight:** about 115 kg

### REQUIRED

**PERSONAL COMPUTER**  
- NOT INCLUDED -



### UTILITIES (PROVIDED BY THE CUSTOMER)

- Tap water: a sufficient quantity to fill the tank

### SUPPLIED WITH

**THEORETICAL - EXPERIMENTAL HANDBOOK**

