



DIDACTIC SYSTEM FOR THE STUDY OF PUMPS HBTV-S



Main experiments related to hydraulic pumps:

1. Characteristic curve of a centrifugal pump with acrylic device, suitable for simulating and visualizing the phenomenon of cavitation.
2. Characteristic curve of a peripheral centrifugal pump, fitted with an acrylic tube to visualize changes in flow.
3. Characteristic curve of a gear pump, circulating oil from a dedicated tank of approximately 60 liters.
4. Characteristic curve of a submerged pump.
5. Head, flow, power, and torque measurements.

Main consumption experiments in:

1. Electric energy calculation,
2. Hydraulic power calculation.

The didactic bench has as objective the study and training in maintenance and assembly of different types of pumps in the range of 6 to 170 liters per minute with a maximum speed of 1750 RPM, in the range of 350 Watts. The workbench uses a water tank and an oil tank.

Supplied with a three-phase multimeter providing active and reactive power, consumed current and applied voltage. The multimeter comes with a USB interface for data acquisition to be displayed on a PC with Excel spreadsheets, in these spreadsheets the measured values can be displayed, and the desired curves can be plotted. Each pump is controlled by an inverter which regulates the speed and measures the developed torque independently.

The bench was designed to perform experiments with various types of three-phase hydraulic pumps, with an inverter located inside the panel. The frequency converter allows speed and torque measurement to be adjusted. The system aims to raise and compare the pump curves. The teaching bench also allows the analysis of the hydraulic power by means of flow and head measurements; it contains a rotameter that measures the flow of the selected pump. The bench has an HMI to operate and control the entire system. All steel parts are sandblasted, phosphated and painted by an electrostatic process, and pressure glass parts are borosilicate.

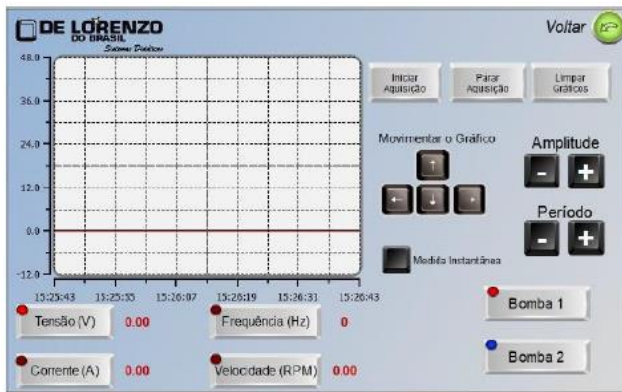


MAIN ELEMENTS OF THE SYSTEM

- One gear, three-phase 0.5 HP pump, 4 poles with a head of 0-40 MCA and a flow rate of 0-12 L/min (0-0.72 m³/h).
- One submerged, three-phase 0.5 hp pump, 2 poles with a head of 0-10 MCA and a flow rate of 0-166 L/min (0 to 10 m³/h). It is housed within an acrylic oil tank of approximately 60 liters and 10 mm thick.
- A centrifugal, 0.5 hp, 2-pole pump, three-phase, with a head of 0-20 MCA and a flow rate of 0-66 L/min (0-4 m³/h).
- Centrifugal turbine-type 0.5 hp pump, 2 poles, with a head of 0-20 MCA and a flow rate of 0-40 L/min (0-2.4 m³/h).
- The panel contains a 7" HMI to control the entire system, an emergency button, a multimeter, a rotary switch to allow selection of the motor pump to be measured and a red LED to indicate when the panel is energized.
- Single-phase and three-phase, bi-directional and four-quadrant electric magnitude multimeter, with inductive and capacitive reactance indication. The module measures various types of electrical quantities, such as line and phase voltage, current, active, reactive, apparent, three phase, frequency and demand power, and provides THD measurements. It can measure up to 500 VAC voltage and 5 A current and provides an RS-485 communication port.
- 7-inch color touchscreen HMI with Type RS485 data buses and Ethernet, both with MODBUS communication. It has a USB port to connect a pendrive for data transfer.
- A gauge to display the engine torque in Nm.
- 04 (four) frequency converters, each pump is controlled by a converter which regulates speed and measures torque independently. The frequency converter allows the measurement of speed and torque to be adjusted, they are located inside the panel.
- A VG-68 or similar stainless steel oil storage tank; capacity, approximately 50 liters for hydraulic system recirculation, with positive displacement gear pump.
- A water storage tank, with a capacity of approximately 190 liters for the recirculation of the hydraulic system, with positive displacement centrifugal pumps.
- Four rotameters for flow measurement in m³/h. It has a measuring scale with display of up to 8m³/h, to measure the pump flow of each pump, with pointer-type valves and pressure gauges (manometer).
- A rotameter to measure oil flow.



SOFTWARE SCREENS



Technical specifications:

- Approximately 190-liter water tank.
- Approximately 60-liter oil tank.
- Bench dimensions: 2.0 x 1.8 x 0.8 meters.
- Three-phase power supply
- Safety: Bypass system with relief/safety valve.

Operation panel

The operation panel allows the product to be fed, one or more pumps to be activated directly via the HMI and the individual consumption or even the set of pumps in use to be measured. Each pump can be characterized in terms of voltage and current, as well as power and energy, by checking the power factor (PF) imposed on the power line. In addition, a selector switch allows the torque of each pump that is activated to be read.

Documentation provided

- Experiment Manual.
- Instrument operation manuals and pump characteristics.
- Software.