



Electronic Console

DESCRIPTION

The Laminar/Viscous Flow Heat Transfer Unit (TFLVB) is an unit at laboratory scale, designed to study heat transfer between hot oil flowing in laminar flow through an internal tube and cold water that flows through the annulus (ring-shaped area).

Oil circuit (hot fluid):

The hot oil flows along of a closed circuit. An electric resistance, placed into to the heater tank, heating the oil. The oil goes out of the tank and is pumped by the pump. A flow meter measures the oil flow. In the inlet of the tank there is a regulation valve for the hot oil. The oil is cooled along of the exchanger and then return to the heater tank, starting a new cycle.

Water circuit (cold fluid):

The cold water comes from of the water supply. In the water circuit there are a regulation valve and a flow meter. The water comes in to the exchanger, and it increases its temperature. After the water goes out of the system.

The cold water can come in to the exchanger by both extreme (co-current or counter-current). This depends of the valves position (open or close).

Heat Exchanger:

Hot oil flows through the internal tube and cooling water flows through the annulus between the internal and external tube.

The unit has 7 temperature sensors distributed strategically:

- to measure the temperature in the heater tank.
- to measure the cold water temperature.
- to measure outside wall of the internal tube temperature.
- to measure the oil temperature.

SPECIFICATIONS

Bench-top unit.

Anodized aluminium structure and panels in painted steel. Main metallic elements in stainless steel.

Diagram in the front panel with similar distribution to the elements in the real unit.

Heat exchanger constituted by two concentric tubes with hot oil flowing through the internal tube and cold water flowing through the ring-shaped area.

Exchanger length = 0.92 m.

Internal tube:

Internal diameter: $D_{int} = 10 \times 10^{-3} \text{ m} = 10 \text{ mm}$

External diameter: $D_{ext} = 12 \times 10^{-3} \text{ m} = 12 \text{ mm}$

Depth = $10^{-3} \text{ m} = 1 \text{ mm}$

Heat transfer internal area: $A_h = 0.0289 \text{ m}^2$

Heat transfer external area: $A_c = 0.0347 \text{ m}^2$

External tube:

Internal diameter: $D_{int,h} = 16 \times 10^{-3} \text{ m} = 16 \text{ mm}$

External diameter: $D_{ext,h} = 18 \times 10^{-3} \text{ m} = 18 \text{ mm}$

Depth = $10^{-3} \text{ m} = 1 \text{ mm}$

Stainless steel heater tank, equipped with:

Electric resistance.

Temperature sensor for measure oil temperature.

PID temperature control.

Pump suitable for pumping hot oil.

2 Flow meters: One for oil and another one for water.

7 Temperature sensors:

1 Temperature sensor to measure the temperature in the heater tank.

2 Temperature sensors to measure the cold water temperature.

2 Temperature sensors to measure outside wall temperature of the internal tube.

2 Temperature sensors to measure oil temperature.

Control valves to control cold water and oil flow.

Ball valves that may provide co-current or counter-current flow in the exchanger, according to how they may be set (control of direction of control water flow).

Electronic Console:

Metallic box.

Connectors for the temperature sensors.

Sensor digital display for temperature sensors.

Sensor selector for temperature sensors.

Pump controller.

Heater resistance controller.

Cables and accessories, for normal operation.

Manuals:

This unit is **supplied with the following manuals**: Required Services, Assembly and Installation, Starting-up, Safety, Maintenance, & Practices Manuals.

EXERCISES AND PRACTICAL POSSIBILITIES

Some Practical Possibilities of the Unit:

- 1.- Demonstration of a concentric tube heat exchanger with co-current and counter-current flow in laminar/viscous flow.
- 2.- Energy balance for the heat exchanger.
- 3.- Determination of surface heat transfer coefficients on the oil and water sides and determination of the overall heat transfer coefficient.
- 4.- Relationship between Nusselt Number and Graetz Number for Reynolds Numbers up to 1400.

REQUIRED SERVICES

- Electrical supply: single- phase, 220 V / 50 Hz. or 110 V/ 60 Hz.
- Water supply and drainage.

DIMENSIONS & WEIGHTS

TFLVB:

- Unit:
 - Dimensions: 1000 x 770 x 670 mm. approx.
 - Weight: 80 Kg. approx.
- Electronic Console :
 - Dimensions: 490 x 330 x 310mm. approx.
 - Weight: 10Kg. approx.

* Specifications subject to change without previous notice, due to the convenience of improvements of the product.



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REPRESENTATIVE:

