

Equipment's for Heat Transfer lab

Fig 1: Linear heat conduction unit

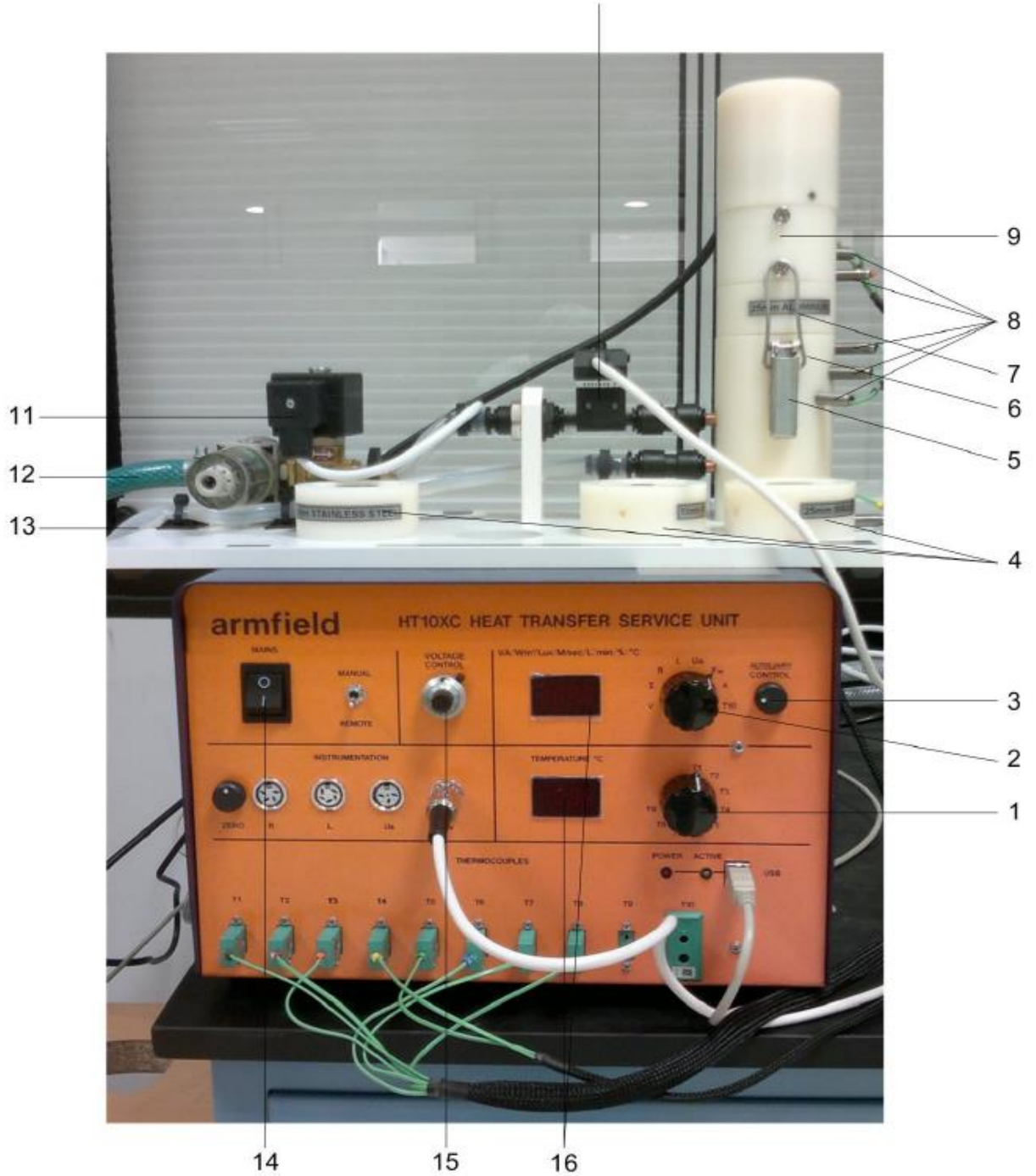


Fig: Linear conduction heat transfer unit

Technical Description

The linear conduction unit has two main units HT10XC which is basically heat transfer service unit and HT11C which is compatible Linear Head Conduction Accessory. The heat transfer service unit HT10XC has main switch (14) to turn on or off the system. The heat load is controlled using voltage potentiometer (15). The cooling water flow rate can be adjusted using auxiliary control knob (3). All measurements including voltage, current, cooling water flowrate, etc can be read manually through two digital panels (16) using two selector knobs (1 and 2) accordingly. Meanwhile, HT11C has metal specimens covered with insulator. The hot portion (9) is at the top next to the heater, while the cold portion (8) is placed at the bottom next to cooling water circulation. Both portions are clamped (5) to have a better contact. Cooling water is introduced and pumped (11) through inlet tube (12) and leaves the system through outlet tube (13). The intermediate portion (7) can be changed with different type of metals such as stainless steel and aluminum (4) for example. The thermocouples (8) are installed at certain distance starting from the top portion to the bottom one.

Fig 2: Schematic Temperature Distribution in a Composite Plane Wall

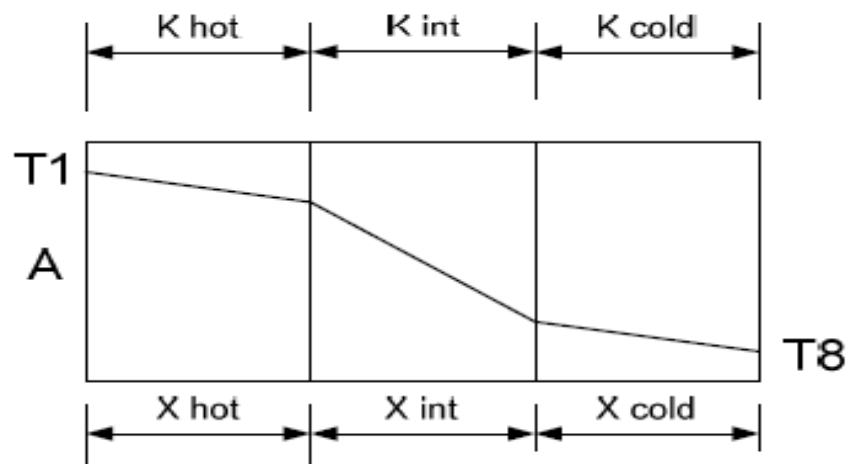


Fig 2: Temperature distribution in composite plane wall

Description

The heated, intermediate, and cooled sections are clamped tightly together, so that the end-faces are in good thermal contact.

Fig 3: Free and Forced convection unit

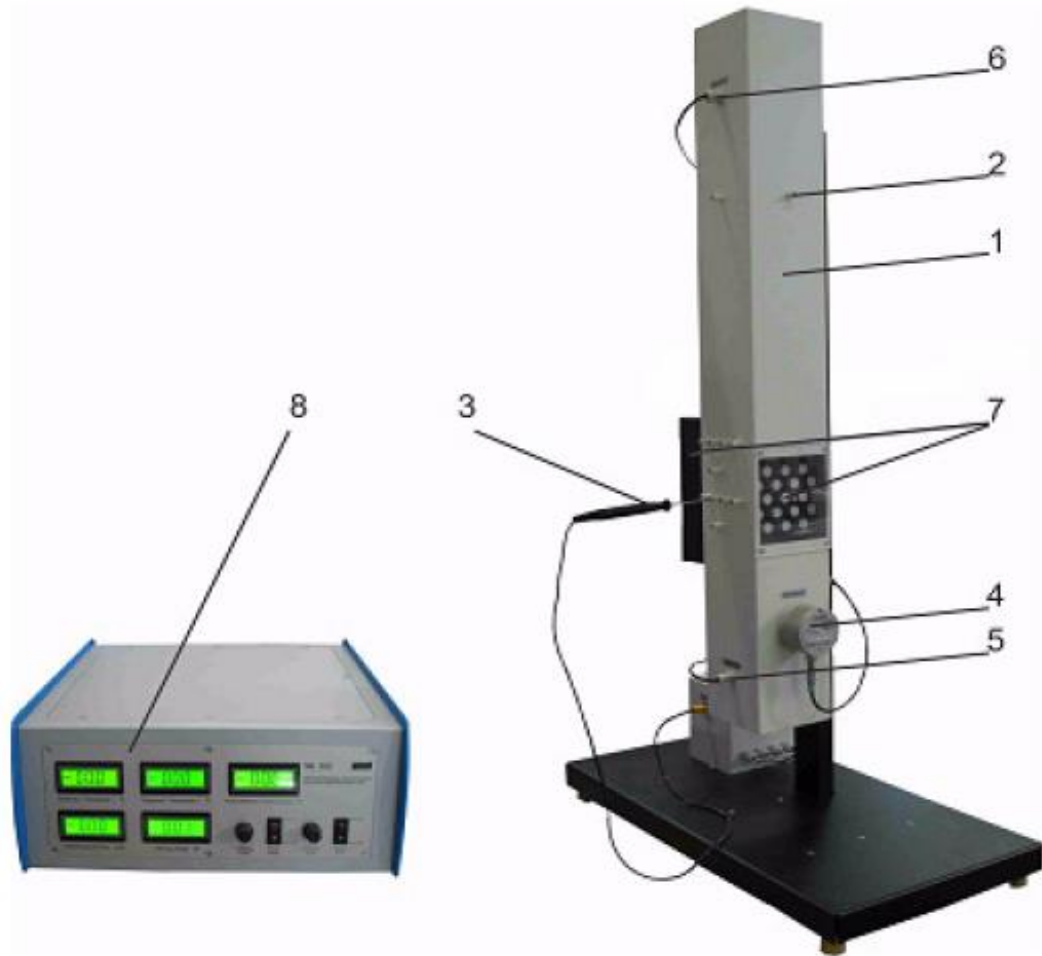


Fig 3: Free and forced convection unit

Technical description

The unit consists of mainly the air duct (1) with a flow cross-section of 120 mm x 120 mm and with a length of 1m. It has measuring glands (2) which allow it to detect the temperature at different points by inserting a thermocouple (3). In addition, flow sensor (4) is also available to record the entry velocity of the air. Temperature sensor (Pt100 element) (5,6) will record the inlet and outlet air temperatures. Different type of heater (7) can be inserted into the duct and each heater is operated

via four heating resistors with a maximum total output of approximately 170 W. Both power supply and air flow rate can be easily control using the control and display unit (8). It also displays all parameters being measured in the experiments.

Fig 4 Combined Convection and Radiation Unit

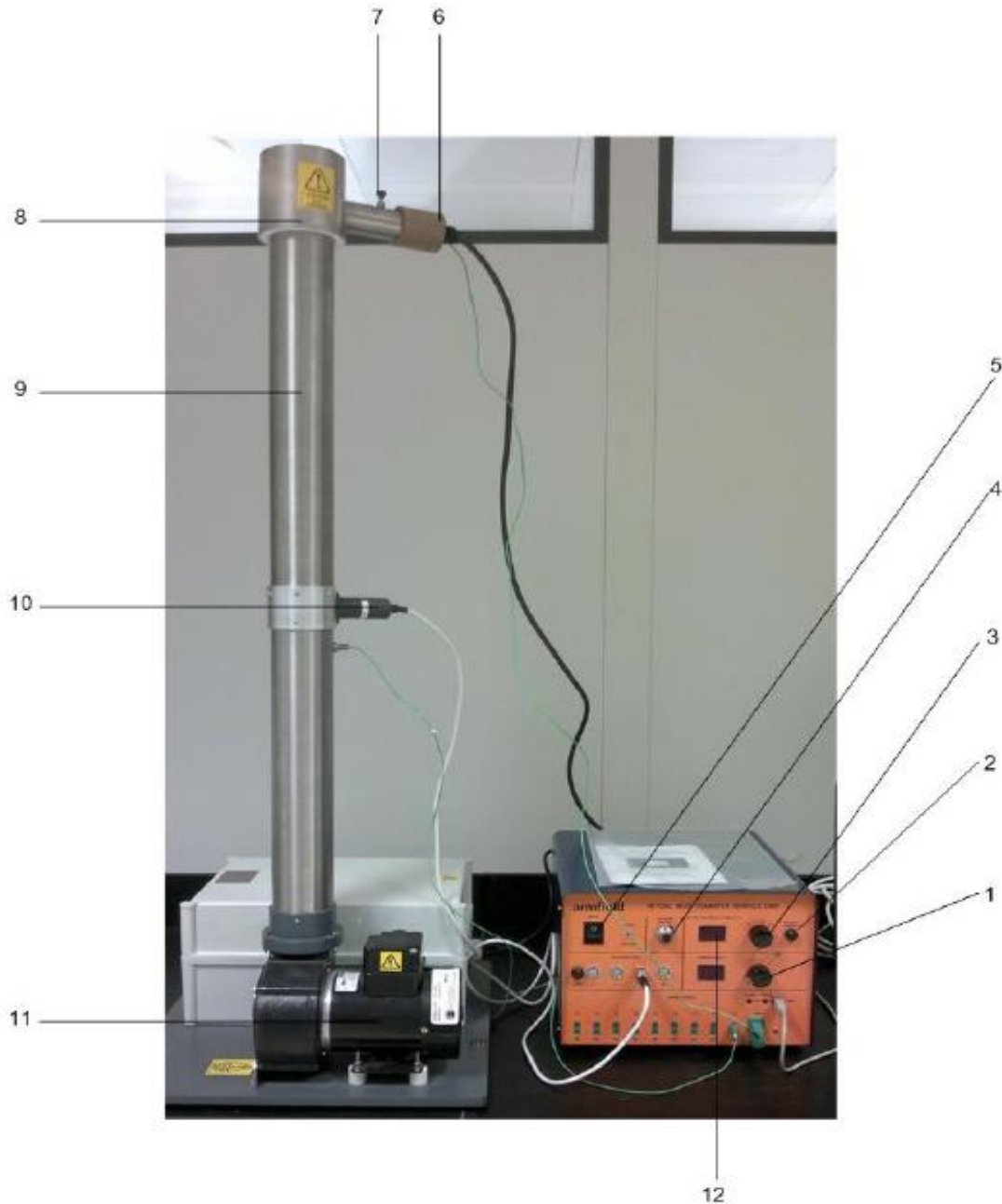


Fig 4: Combined convection and radiation unit

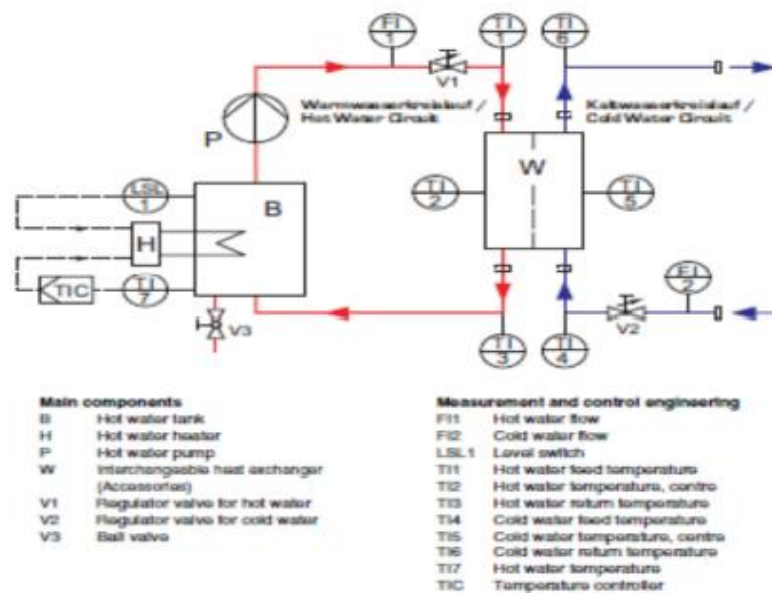
5) Service unit with tubular Heat Exchanger.



Fig 5: Tubular heat exchanger

The equipment consists of WL-110 series heat exchanger with service unit along with a water chiller. The master switch for the equipment is used for main on off (35) of the equipment. The liquid flow is controlled by pump controller (32). The temperature of the heater is controlled by temperature controller (28). The temperature of the inlet and outlet for cold as well for hot fluid fluids are displayed on the console.

6) Process schematic of Heat exchanger



**Fig 6 (a) Process schematic of Heat exchanger
6 (b): Control & Display unit**

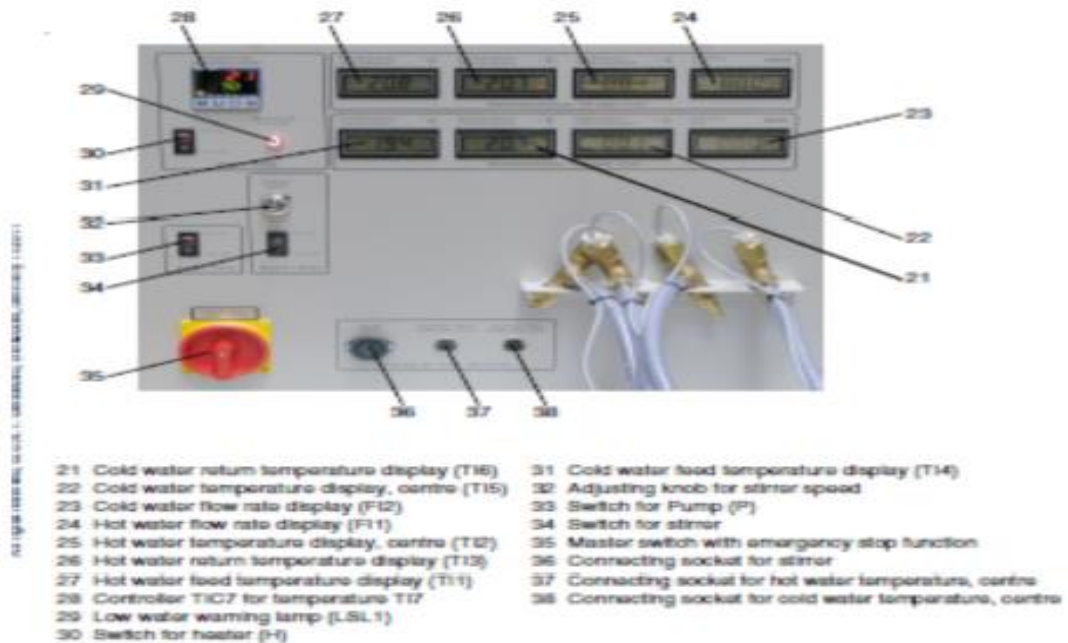


Fig 6 (b): Control & Display unit of Heat exchanger

1) Plate heat exchanger



Figure 2. Connection for plate Heat Exchanger

Fig 7: Connections for plate heat exchanger

2) Layout of the Boiling heat transfer unit



Fig 8: Nucleation and boiling unit

Technical description

The unit consists of mainly the glass cylinder (4) contains a water condenser (5) in the upper part and heater (19) in the lower part. Liquid, vapor and surface heater temperatures are measured by temperature sensor (7) and (8) and thermocouple (16) respectively. The vapor pressure inside the cylinder is also measured (11). For safety purpose, the cylinder is equipped with safety valve (10) for pressure. The condenser is connected to cooling water entering through the inlet pipe (1) and leaving through the outlet pipe (2). Its flow rate is measure by flow meter (6) and adjusted by valve (3). The liquid can be put into the cylinder through refilling screw (9) located on the top of cylinder. All parameters including temperature, pressure, and flow rate can be read from the digital displays (12). The unit has one main switch (15) and one switch (14) for heater separately. The heater power can be adjusted using heater power adjuster (13).

Technical Data

Heater : 250 W max., surface area : 0.001875 m²

Cooler : Surface area : 0.0578 m²

Liquid Name : Pentafluorobutane / perfluoropolyether

Trade name: Solkatherm SES 36

Molecular Weight : 184.5 g/mol

Liquid Density (25°C) : 1.363 g/cm³.

Vapor Density (25°C) : 0.0058 g/cm³.

Heat of vaporization : 117.8 J/g

Specific Heat Capacity : 1.25 J/g.K