When energy increases in water, an increment of the activity between molecules is generated. This causes an increase of the number of molecules that escape from the surface, until the equilibrium state is reached. Such equilibrium state depends on the pressure between the water surface and the vapor. Molecules found in the water surface can escape more easily at a low pressure, requiring a smaller amount of energy to reach the equilibrium state (boiling point). The temperature at a given pressure at which the equilibrium is reached is known as saturation temperature. There is a single saturation temperature value for a saturation pressure and vice versa.

Tesca Computer Controlled Saturation Pressure Unit 32464, is a unit designed to demonstrate the water temperature behavior, as well as the change of the boiling point when there is a variation in pressure. Saturation curves can be obtained with this unit. Besides, the content of water in the wet steam generated by a throttling calorimeter can be determined (steam quality).
32464 consists of a water boiler, including a computer controlled immersion heating element, and a sight glass to observe the boiling patterns in the water surface and control the water level in the boiler.
The saturated steam formed in the boiler passes through a throttle valve and is expanded to atmospheric pressure in a throttling calorimeter with the purpose of determining the dryness fraction of the saturated steam.
The temperature and pressure are measured after the boiler to determine the properties of the saturated steam, and after the expansion in the throttling calorimeter. In addition, a force sensor measures the weight of the condensed water.
The unit includes all the safety measures required for a safe operation, such as relief valve and pressure switch to limit the working pressure, and transparent protection panels.
The Unit is optionally supplied with the Computer Control System Data Acquisition System, DAQ.

Sight Observation Glass

Note: Specifications are subject to change.

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Specifications

- Bench-top unit.
- Anodized aluminum structure and panels of painted steel.
- Main metallic elements of stainless steel.
- Diagram in the front panel with similar distribution to the elements in the real unit.
- Water boiler including:
- Heating element, power: 1000 W.
- Sight glass to observe the boiling patterns at the surface and control the water level.
- Throttling calorimeter with throttling valve.
- Water filling valve in the boiler.
- Valve for emptying the water.
- Two "J type" temperature sensors to measure the steam temperature at the boiler's outlet and the steam temperature in the throttling calorimeter.
- Two pressure sensors to measure the steam pressure at the boiler's outlet and the steam pressure in the throttling calorimeter, range: 0 - 10 bar.
- Force sensor to measure the weight of condensed water, range: 0 - 2 kg.
- Safety valve to limit the working pressure to 8 bars.
- High pressure switch.
- Graduated glass beaker, capacity: 1 l.
- This unit is protected by methacrylate sheets with orifices to allow handling the valves and collecting the condensed steam in a glass beaker.

Experiments

1. Measurement of the relationship between temperature and pressure of the saturated vapour in the outlet of the boiler.
2. Understanding the origin and use of steam tables.
3. Understanding saturation curves.
4. To study the characteristics of a two phase fluid.
5. Using a throttling calorimeter to determine the quality of wet steam.

Saturation Loop: (6 to 15)

6. Observation of the patterns of boiling at the surface of the water.
7. Measurement of the temperature of saturated steam over the range of pressures 0 to 8 bar gauge.
8. Comparison of the saturation curves obtained with those published in steam tables.
9. Determination of the describing equation and linearization.
10. Study the concept of the saturation line.
11. Determination of the percentage of error between experimental and theoretical data.
12. Effect of the rate of response on the accuracy of the measurement.
13. To study the characteristic behavior of a two phase fluid.
14. Gauge and absolute pressures.
15. Temperature scales.

Throttling Calorimeter: (16 to 19)

16. Determination of the dryness fraction (quality of the steam) produced by the saturation pressure unit at different operating pressure.
17. Use of steam tables.
18. Use of the steady flow energy equation.
19. Study the difference in enthalpy between phases - enthalpy of vaporization.
    Additional practical possibilities:
20. Sensors calibration.

Other possibilities to be done with this Unit:

21. Open Control, Multi-control and Real Time Control.
    This unit allows intrinsically and/or extrinsically to change the span, gains; proportional, integral, derivative parameters; etc, in real time.
24. This unit is totally safe as uses mechanical, electrical and electronic, and software safety devices.
25. This unit can be used for doing applied research.
26. This unit can be used for giving training courses to Industries even to other Technical Education Institutions.
27. Control of the 32464 unit process through the control interface box without the computer.
28. Visualization of all the sensors values used in the 32464 unit process.

Required Services

- Electrical supply: single-phase, 220V/50 Hz or 110V/60 Hz.
- Water supply and drain.
- Optional Computer (PC)

Note: Specifications are subject to change.

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