

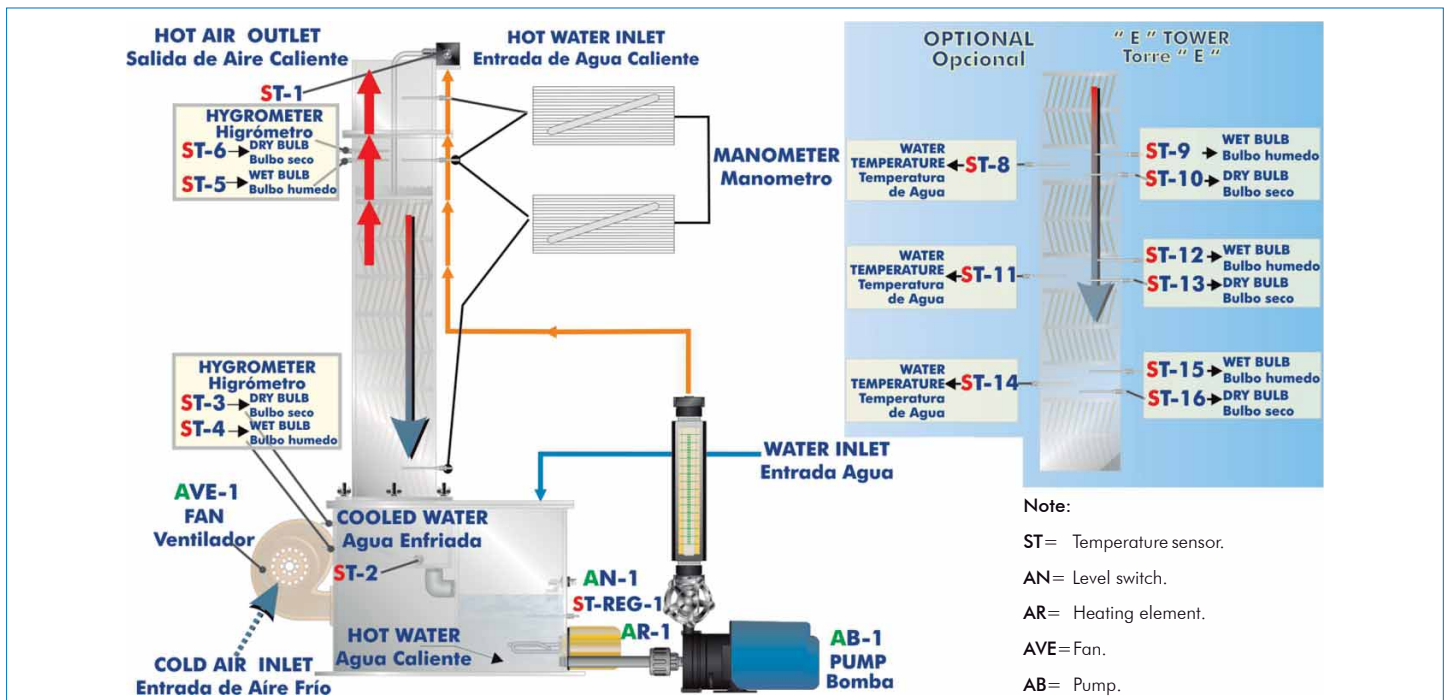
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Products  
 Products range  
 Units  
 ↳ 9.-Thermodynamics & Thermotechnics



Electronic console

## PROCESS DIAGRAM AND UNIT ELEMENTS ALLOCATION



ISO 9000: Quality Management  
 (for Design, Manufacturing,  
 Commercialization and After-sales service)



European Union Certificate  
 (total safety)



Certificates ISO 14000 and  
 ECO-Management and Audit Scheme  
 (environmental management)



Worlddidac Quality Charter  
 Certificate  
 (Worlddidac Member)

## INTRODUCTION

The Bench Top Cooling Tower (TTEB) has been perfectly designed to offer the students the opportunity of exploring the design, construction and operating characteristics of a modern water evaporation cooling system. The unit represents a good example of "open system" through which two currents of fluid (water and air) flow and where a mass transfer from one current to the other takes place.

With this unit the efficiency of the cooling system and the mass and energy balances will be studied, as well as the effects of:

Volume of air flow.

Volume of water flow.

Water temperature.

Cooling load.

Packing density. It will be necessary to have different types of columns with different packing factors for this study.

## GENERAL DESCRIPTION

The TTEB unit includes a pump that impels hot water from the tank (with level switch and heating element) to the manifolds located at the top of the cooling tower. Water flow can be adjusted by a manual needle valve.

A temperature sensor located at the top of the unit measures the temperature of the water just before entering the tower. Water cools down as it falls through the manifolds of the tower, and finally falls into the tank where its temperature is measured again.

A fan propels atmospheric air with an accurate control of the air flow introduced in the tower. The air passes through wet bulb and dry bulb sensors before entering the column.

As air flows through the column, its temperature and humidity rise. On the other hand, water temperature falls. At the upper side there are other two dry bulb and wet bulb temperature sensors.

## SPECIFICATIONS

Bench top unit.

Anodized aluminum 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.

Water propeller pump, maximum flow of water of 120 l./h.

Air propeller with a fan with speed control (145 m<sup>3</sup>/h. max., 3000 rpm).

Heating element (60° C. max.).

Water tank (14 l. capacity).

Level switch in the tank.

Flow meter, range: 0.2 - 2 l./min.

2 Inclined manometers, 300 mm. length.

Up to 16 temperature sensors, "J" type (of dry bulb, wet bulb and water temperature), according to the column supplied.

Column included:

Column type B: N° of levels: 8. N° of sheets by level: 10. Total surface: 1.013 m<sup>2</sup>. Height of packaging: 650mm. Density Area/volume: 58 m<sup>2</sup>/m<sup>3</sup>.

Electronic console:

Metallic box.

Temperature sensors connections.

Digital display for temperature sensors.

Selector for temperature sensors.

Heating element controller.

Pump switch.

Fan switch and fan 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.

Optional Columns: (NOT included in the standard supply)

Column type A: N° of levels: 8. N° of sheets by level: 19. Total surface: 1.915 m<sup>2</sup>. Height of packaging: 650 mm. Density Area/volume: 112.64 m<sup>2</sup>/m<sup>3</sup>.

Column type C: N° of levels: 8. N° of sheets by level: 7. Total surface: 0.680 m<sup>2</sup>. Height of packaging: 650 mm. Density Area/volume: 40.02 m<sup>2</sup>/m<sup>3</sup>.

Column type D: No packaging.

Column type E: (Packing characteristics column): with packing arranged to allow measurement of air and water properties within column. Fitted with temperature sensors in 3 points.

Sensors: Temperature sensors of dry bulb, wet bulb and water temperature sensors.

N° of levels: 8. N° of sheets by level: 19. Height of column: 1100mm. Height of packaging: 650 mm. Density Area/volume: 112.64 m<sup>2</sup>/m<sup>3</sup>.

See section "Optional Columns" in page 3.

## EXERCISES AND PRACTICAL POSSIBILITIES

- |  |   |
|--|---|
| <p>1.- Process observation inside a bench top cooling tower.</p> <p>2.- Determination of evaporation velocity.</p> <p>3.- Mass balance. Use of psychrometric charts.</p> <p>4.- Energy balance.</p> <p>5.- Effect of cooling load against "Wet bulb approach".</p> <p>6.- Relation between air velocity, wet bulb approach and head loss.</p> <p>7.- Determination of the cooling capacity.</p> <p>8.- Determination of the cooling capacity for different cooling towers.</p> | <p>9.- Thermodynamic properties.</p> <p>10.- Evaporation from a wet bed.</p> <p>11.- Observation of water flow pattern and distribution.</p> <p>Other possible practices:</p> <p>12.- Variation of specific enthalpy with pressure.</p> <p>13.- Properties of air.</p> <p>14.- Use of a psychrometric map.</p> <p>15.- Determination of water flow.</p> |
|--|---|

### REQUIRED SERVICES

- Electrical supply: 220V./50Hz or 110V./60Hz.
- Water supply.

### DIMENSIONS & WEIGHTS

- TTEB:
- |                      |   |
|----------------------|---|
| Unit:                | -Dimensions: 1000 x 450 x 1400 mm. approx.<br>(39.37 x 17.72 x 55.12 inches approx.). |
|                      | -Weight : 100 Kg. approx.<br>(220 pounds approx.)                                     |
| Electronic console : | -Dimensions: 490 x 330 x 310 mm. approx.<br>(19.29 x 13 x 12.20 inches approx.).      |
|                      | -Weight: 10 Kg. approx.<br>(22 pounds approx.).                                       |

### OPTIONAL COLUMNS

#### Column type A:

- Nº of levels: 8
- Nº of sheets by level: 19
- Total surface: 1.915 m<sup>2</sup>.
- Height of packaging: 650 mm.
- Density Area/volume: 112.64 m<sup>2</sup>/m<sup>3</sup>.



#### Column type C:

- Nº of levels: 8
- Nº of sheets by level: 7
- Total surface: 0.680m<sup>2</sup>.
- Height of packaging: 650 mm.
- Density Area/volume: 40.02 m<sup>2</sup>/m<sup>3</sup>.



#### Column type D:

- No packaging.



#### Column type E:

(Packing characteristics column):  
with packing arranged to allow measurement of air and water properties within column. Fitted with temperature sensors in 3 points.

- Sensors:
- Temperature sensors of Dry Bulb.
  - Temperature sensors of Wet Bulb.
  - Water temperature sensors.

- Nº of levels: 8
- Nº of sheets by levels: 19
- Height of column: 1100 mm.
- Height of packing: 650 mm.
- Density Area/volume: 112.64 m<sup>2</sup>/m<sup>3</sup>.



### AVAILABLE VERSIONS

-TTEB. Bench Top Cooling Tower.

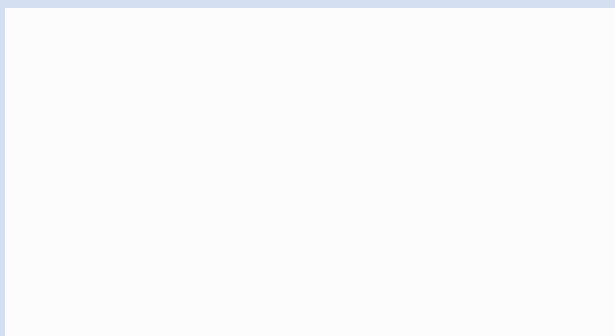
Offered in this catalogue:

-TTEC. Computer Controlled Bench Top Cooling Tower.

Offered in other catalogue:

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

REPRESENTATIVE:



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Issue: ED01/14  
Date: April/2014