

### Features

- Designed to demonstrate operation forced draught cooling tower & investigate its performance.
- Comprehensive Instrumentation Panel with all necessary measuring instruments.
- Optional Real time Data Acquisition System with graphical display.
- Optional Multi-media Inter-active learning software: SCI-CALS

Tesca Water Cooling Tower 32294 has been designed to allow engineering students to get familiarized with all the processes related to industrial force draught cooling tower. The basic unit can be used with other columns to further assist students in the study Refrigeration & Air conditioning, Heat & Mass Transfer.

It consists of a Packed cooling tower with blower fan at bottom. Hot water is sprayed at the top & cold water is collected at bottom of tower. Air is forced from bottom of the tower & leaves from the top. A hot water tank generates hot water & a pump supplies this hot water to the cooling tower. Measuring Instruments are included to measure temperature of water & air at different points, Flow rate of water & air. All the sensors are connected to the Data Acquisition System & the acquired data is processed by the software. The software displays the data & results are shown in tabular format.

Detailed Operation & Maintenance Manual is provided along with the trainer.



### Specifications

- Stainless steel structure, table-top dimensions
- Cooling Tower: Height 600mm transparent cooling tower of Plexiglas, with demister
- Centrifugal fan for cooling
- Stainless steel tank for hot water: 10 liters capacity, including 3 electrical heaters (500 W)
- Reserve: Plexiglas tank for water, 1 liter capacity.
- Water pump: max. flow 3m<sup>3</sup>/h, max height 5 m H<sub>2</sub>O approx
- Instrument:
- 6 digital LCD thermometers (2 for dry bulb, 2 for wet bulb, 1 for the water input and 1 for the output water)
- Calibrated orifice flow-meter range 20-200 l/h approx.,
- Inclined manometer 0-60 mm H<sub>2</sub>O approx,
- Digital thermostat
- 3 packings/Cooling Towers available, with different surfaces
- Data Acquisition System & the acquired data is processed by the software (optional)
- Electrical control panel, IP55 protection grade with electrical diagram under CE standards, including contactors, ELCB, start/stop pushbuttons, indicating lamps, fan controls etc.

### Technical Specifications

- Water propeller pump, computer controlled, maximum flow of water: 120 l./h.
- Air propeller with a fan with speed control from the computer (PC), (145 m<sup>3</sup>/h max., 3000 rpm).
- Heating element, computer controlled, (60° C. max.).
- Water tank (14 l. capacity).
- Level switch in the tank.
- Flow sensor, range: 0.25 - 6.5 l./min.
- 2 Differential pressure sensors, range: 0 - 1" H<sub>2</sub>O.
- Up to 16 temperature sensors type "J" (of wet bulb, dry 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: 650 mm. Density Area/volume: 58 m<sup>2</sup>/m<sup>3</sup>.

### Optional

#### 'Sci-Cal' Computer Control Software

Note: Specifications are subject to change.

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- PID Computer Control + Data Acquisition + Data Management.
- Compatible with actual Windows operating systems. Graphic and intuitive simulation of the process in screen. Compatible with the industry standards.
- Registration and visualization of all process variables in an automatic and simultaneous way.
- Flexible, open and multi-control software, developed with actual windows graphic systems, acting simultaneously on all process parameters.
- Analog and digital PID control.
- Menu for PID and set point selection required in the whole work range.
- Management, processing, comparison and storage of data.
- Sampling velocity up to 250 KS/s (Kilo samples per second).
- Calibration system for the sensors involved in the process.
- It allows the registration of the alarms state and the graphic representation in real time.
- Comparative analysis of the obtained data, after the process and modification of the conditions during the process.
- Open software, allowing to the teacher to modify texts, instructions. Teacher's and student's passwords to facilitate the teacher's control on the student, and allowing the access to different work levels.
- This unit allows the 30 students of the classroom to visualize simultaneously all results and manipulation of the unit, during the process, by using a projector or an electronic whiteboard.
- This module requires Control Interface Module and Data Acquisition.

### **Interface In-built Module:**

- This control interface is common for the 'Sci-tech' trainers and can work with one or several trainers.
- The Control Interface is part of the SCADA system.
- Control interface with process diagram on the front panel.
- The unit control elements are permanently computer controlled.
  - Simultaneous visualization in the computer of all parameters involved in the process.
  - Calibration of all sensors involved in the process.
  - Real time curves representation about system responses.
  - All the actuators' values can be changed at any time from the keyboard allowing the analysis about curves and responses of the whole process.
  - Shield and filtered signals to avoid external interferences.
  - Real time PID control with flexibility of modifications from the computer keyboard of the PID parameters, at any moment during the process.
  - Real time PID control for parameters involved in the process simultaneously.
  - Proportional control, integral control and derivative control, based on the real PID mathematical formula, by changing the values, at any time, of the three control constants (proportional, integral and derivative constants).
  - Open control allowing modifications, at any moment and in real time, of parameters involved in the process simultaneously.
  - Three safety levels, one mechanical in the unit, another electronic in the control interface and the third one in the control software.

### **Experiment Capabilities**

- To study the water flow pattern and distribution.
- To measure all "end states", and flow rates of water air and make-up water.
- To plot the end states on a psychometric chart and to draw up energy balances using the steady flow equation.
- To study the performance at different range of cooling loads and inlet temperatures.

### **Services Required**

- Electric Supply 220 - 240V AC, 16 A, Single Phase, Earthed.
- Tap water supply & Drainage.
- **Cables and Accessories**, for normal operation.
- **Manuals:** Required Services, Assembly and Installation, Interface and Control Software, Starting-up, Safety, Maintenance, Calibration & Practices Manuals.

### **Cooling Column Type 2 : Order Code - 32294A**

#### **Features**

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- Cooling column contains large wet deck surface

Cooling columns contain wet deck surfaces. The cooling capacity of a cooling column is determined by the surface of these wet deck surfaces.

Tesca Cooling Column Type 2 32294A contains a large wet deck surface. The cooling column type 3 is placed into 32294 instead of the column type 2. The cooling capacity of both columns is compared.

On top of the cooling column, a nozzle is mounted. The hot water is sprayed at the top of the cooling tower, trickles from the top to the bottom along the wet deck surface and is cooled in the process. The air enters the column from the bottom and flows upwards.

The cooling column is fitted with connections for differential pressure measurement at its inlet and outlet.

### Specifications

- Additional cooling column for the wet cooling tower 32294
- Cooling column made of transparent plastic
- Wet deck surface made of plastic
- Connections to measure the pressure loss with 32294

### Technical Specifications

- Specific surface of the wet deck surface:  $77\text{m}^2/\text{m}^3$
- Cross-section: 150x150mm

### Experiments

- - Determination of the cooling capacity

### Cooling Column Type 3 : Order Code - 32294B

#### Features

- Cooling column contains large wet deck surface

Cooling columns contain wet deck surfaces. The cooling capacity of a cooling column is determined by the surface of these wet deck surfaces.

Tesca Cooling Column Type 3 32294B contains a large wet deck surface. The cooling column type 3 is placed into 32294 instead of the column type 1. The cooling capacity of both columns is compared.

On top of the cooling column, a nozzle is mounted. The hot water is sprayed at the top of the cooling tower, trickles from the top to the bottom along the wet deck surface and is cooled in the process. The air enters the column from the bottom and flows upwards.

The cooling column is fitted with connections for differential pressure measurement at its inlet and outlet.

### Specifications

- Additional cooling column for the wet cooling tower 32294
- Cooling column made of transparent plastic
- Wet deck surface made of plastic
- Connections to measure the pressure loss with 32294

### Technical Specifications

- Specific surface of the wet deck surface:  $200\text{m}^2/\text{m}^3$
- Cross-section: 150x150mm

### Experiments

- Determination of the cooling capacity

### Cooling Column Type 4 : Order Code - 32294C

#### Features

- Cooling column contains large wet deck surface
- Use of wet deck surfaces of your own design

Note: Specifications are subject to change.

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Tesca Cooling Column Type 4 32294C contains a cooling column without a wet deck surface. The cooling column type 4 is placed into TH 038 instead of the column type 1. The heat transfer in the free water drop can be studied using this cooling column. It is also possible to insert wet deck surfaces of your own design into the cooling column. The cooling capacity of the different columns is compared.

On top of the cooling column, a nozzle is mounted. The hot water is sprayed at the top of the cooling tower, trickles from the top to the bottom along the wet deck surface and is cooled in the process. The air enters the column from the bottom and flows upwards.

The cooling column is fitted with connections for differential pressure measurement at its inlet and outlet.

### Specifications

- Additional cooling column for the wet cooling tower 32294
- Cooling column made of transparent plastic
- Wet deck surface made of plastic
- Connections to measure the pressure loss with 32294

### Technical Specifications

- Packing density:  $0\text{m}^2/\text{m}^3$
- Cross-section: 150x150mm

### Experiments

- - Determination of the cooling capacity



### Cooling Column Type 5 : Order Code - 32294D

#### Features

- Cooling column contains large wet deck surface
- Use of wet deck surfaces of your own design

Cooling columns contain wet deck surfaces. The cooling capacity of a cooling column is determined by the surface of these wet deck surfaces.

Tesca Cooling Column Type 5 32294D contains divided wet deck surfaces. The cooling column type 5 is placed into 32294 instead of the column type 1. It is possible to variably arrange the wet deck surfaces. Additionally, plates are fitted into the cooling column. The cooling capacity of both columns is compared.

On top of the cooling column, a nozzle is mounted. The hot water is sprayed at the top of the cooling tower, trickles from the top to the bottom along the wet deck surface and is cooled in the process. The air enters the column from the bottom and flows upwards.

The cooling column is fitted with connections for differential pressure measurement at its inlet and outlet. A temperature sensor measures the water temperature at the plates. The values are processed and indicated in 32294.

### Specifications

- Additional cooling column for the wet cooling tower TH 038: @ 900mm
- Cooling column made of transparent plastic
- Wet deck surface made of plastic, variably arranged
- Cooling column fitted with plates
- Sensor to measure the water temperature
- Connections to measure the pressure loss with TH 038

### Technical Specifications

- specific surface: variable
- Number of plates: 3
- Cross-section: 150x150mm

### Experiments

- Determination of the cooling capacity



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