Electrical Faults in Air Conditioning Systems Unit

TEFA

Engineering and Technical Teaching Equipment

INTRODUCTION

Air conditioning, or cooling, use energy to take heat away. The most common air conditioning system uses a compression cycle to transfer heat from houses to the outdoors.

Usually there is a compressor on the outside filled with a special fluid called a refrigerant. This fluid can change back and forth between liquid and gas. As it changes, it absorbs or releases heat, so it is used to "carry" heat from one place to another, such as from the inside of the refrigerator to the outside.

The Electrical Faults in Air Conditioning Systems Unit, "TEFA", has been designed by EDIBON in order to show the most important electrical faults in air conditioning systems, the simulation of a simple air conditioning system with compressor, fan and thermostat and investigations of key electrical components from air conditioning technology.

GENERAL DESCRIPTION

The Electrical Faults in Air Conditioning Systems Unit,"TEFA", is designed in a simple way in order to transmit comprehensible knowledge about how identify electrical faults in air conditioning systems. For this purpose, concepts are included to provide experience in the design and operation of the individual electrical components and reading circuit diagrams.

This unit is clearly designed to give the students the most realistic knowledge of air conditioning systems demonstrating how electrical circuits of these systems work. The air conditioning system mainly consists of a refrigerant compressor and fan at the air cooler. This part of the system is simulated (compressor and fan) and the "TEFA" unit is focused in the control circuits of air conditioning systems. The unit includes a thermostat to switch on/off the compressor. On the other hand, via ballast, the fan motor speed can be switched in two stages. In addition, the unit includes a star-up relay and a star-up capacitor to control the start of the motor compressor. Besides, the unit includes protection devices similarly to the air conditioning systems such as circuit breakers and overheat protection to complete the air conditioning electrical circuit.

All the components are connected on terminal blocks and they are arranged on a front panel such that they are all accessible and very visible. In addition, through the cables and electrical elements included in this unit it is possible to set-up many circuits correctly and operationally and this allow simulate 16 different typical faults in air conditioning systems.

One important thing is that the state of the simulated components such as compressor and fan is indicated via lamps in the circuit diagram of the unit´s front panel.

The unit´s front panel includes jack connections in order to check with the included multimeter voltages and resistances for faults detection such as coil fracture in the motor or faulty switching contact.

The unit´s front panel clearly depicts the real circuit diagram to facilitate the allocation of the measurement points.

The following are the most important objectives and experiments which can be carried out with this unit:

   Electrical design and principle of operation of air conditioning systems.

   Read and understand electrical circuit diagrams.

   Fault finding in electrical components in idle state and under mains voltage.

   Design and operation of electrical components in an air conditioning system: Start-up capacitor, Start-up relay, Overheat protection, Main contactor, Automatic fuse, On/off switch, Speed switch and Thermostat.

SPECIFICATIONS

Anodized aluminum frame and panels made of painted steel.
The unit includes wheels to facilitate its mobility.
Main metallic elements made of stainless steel.
Diagram in the front panel with distribution of the elements similar to the real one.
Experimental unit for the training of apprentices in the refrigeration field.
Simulation of the electrical circuit of an air conditioning system for cooling.
Real control circuits with electrical components and simulated load circuits.
Electrical simulation of compressor and fan.
Temperature control with thermostat and compressor.
Fan with two adjustable speeds.
Operating states of the simulated components indicated via lamps in the circuit diagram.
Circuit diagram depicted on the front panel.
Identification of 16 faults with the aid of multimeter measures voltages or resistances at the lab jacks.
Main Components of circuit:
   Main contactor:
      2 x 3NO, 1NC.
      3 x 4NO.
   Main switch.
   Automatic fuse.
   Start-up capacitor.
   Start-up relay.
   Overheat protection (bimetallic).
   Lamps for simulated compressor and fan.
   Fan electrical components:
      On/off switch.
      Speed switch.
   Lab jacks.
   Thermostat: -5 °C to 35 °C.
   Digital Multimeter:
      Digital multimeter of about 3 ½ digits, with double-jack ending cables of about 4 mm to facilitate interconnections.
      With this digital multimeter we will be able to measure:
         Voltage.
         Current.
         Resistance.
         Capacitors capacity.
         Temperature.
Technical details of main components of circuit:
   Simulated compressor start-up current: >3A.
   Thermostat: -10 to 25 °C.
   Power: 200 VAC – 240 VAC/50 Hz or 110 VAC – 127 VAC/60 Hz., single-phase.
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

1.- Simulation of the electrical circuit of an air conditioning system.

2.- Real control circuits with electrical components with simulated load circuits.

3.- Electrical simulation of compressor and fan.

4.- Temperature control with thermostat and compressor.

5.- Fan with two adjustable speeds.

6.- Operating states of the simulated components indicated via lamps in the circuit diagram.

7.- Fault finding in electrical components without voltage.

8.- Fault finding in electrical components with mains voltage.

9.- Fault locations in the fan.

10.-Fault locations in the power supply.

11.-Fault location in the star-up relay.

12.-Fault location in the overheat protection.

13.-Fault location in the star-up capacitor.

14.-Identification of 16 air conditioning typical faults.

REQUIRED SERVICES

- Electrical supply: single-phase 200 VAC – 240 VAC/50 Hz or 110 VAC – 127 VAC/60 Hz.

DIMENSIONS AND WEIGHTS

TEFA:

 -Dimensions: 850 x 450 x 700 mm approx.

 (33.46 x 17.71 x 27.55 inches approx.)

 -Weight: 35 kg approx.

 (77.16 pounds approx.)

TEFA/ICAI. Interactive Computer Aided Instruction Software:

With no physical connection between unit and computer, **this complete software package consists of an Instructor Software (EDIBON Classroom Manager -ECM-SOF) totally integrated with the Student Software (EDIBON Student Labsoft -ESL-SOF).** Both are interconnected so that the teacher knows at any moment what is the theoretical and practical knowledge of the students.
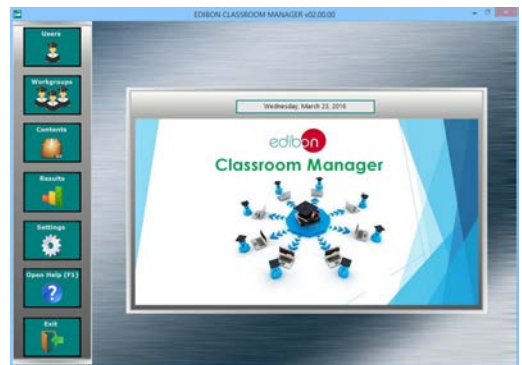

Instructor Software

### - ECM-SOF. EDIBON Classroom Manager (Instructor Software).

ECM-SOF is the application that allows the Instructor to register students, manage and assign tasks for workgroups, create own content to carry out Practical Exercises, choose one of the evaluation methods to check the Student knowledge and monitor the progression related to the planned tasks for individual students, workgroups, units, etc... so the teacher can know in real time the level of understanding of any student in the classroom.

Innovative features:

• User Data Base Management.

• Administration and assignment of Workgroup, Task and Training sessions.

• Creation and Integration of Practical Exercises and Multimedia Resources.

• Custom Design of Evaluation Methods.

• Creation and assignment of Formulas & Equations.

• Equation System Solver Engine.

• Updatable Contents.

• Report generation, User Progression Monitoring and Statistics.

ECM-SOF. EDIBON Classroom Manager (Instructor Software)
Application Main Screen
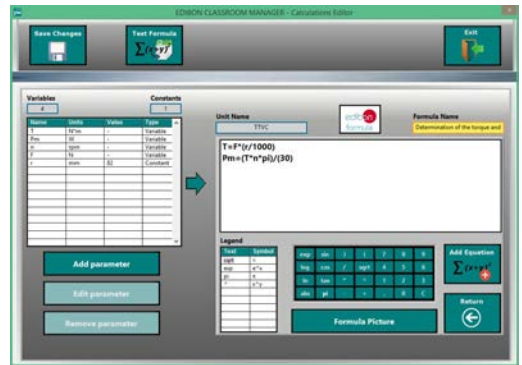
ECAL. EDIBON Calculations Program Package - Formula Editor
Screen
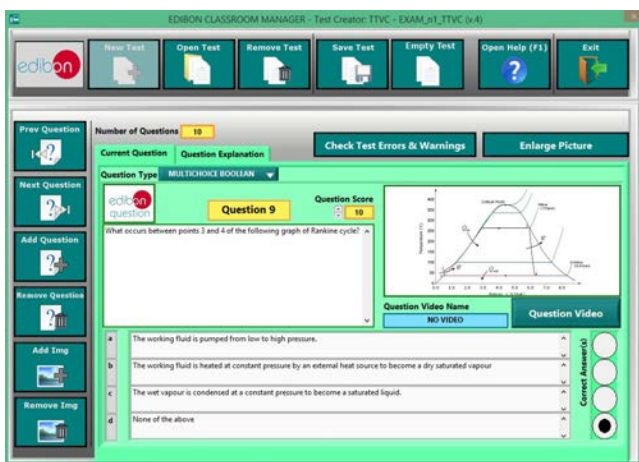
ETTE. EDIBON Training Test & Exam Program Package - Main Screen with
Numeric Result Question

ERS. EDIBON Results & Statistics Program Package - Student
Scores Histogram

Optional

Student Software

- ESL-SOF. EDIBON Student Labsoft (Student Software).

ESL-SOF is the application addressed to the Students that helps them to understand theoretical concepts by means of practical exercises and to prove their knowledge and progression by performing tests and calculations in addition to Multimedia Resources. Default planned tasks and an Open workgroup are provided by EDIBON to allow the students start working from the first session. Reports and statistics are available to know their progression at any time, as well as explanations for every exercise to reinforce the theoretically acquired technical knowledge.

Innovative features:

• Student Log-In & Self-Registration.

• Existing Tasks checking & Monitoring.

• Default contents & scheduled tasks available to be used from the first session.

• Practical Exercises accomplishment by following the Manual provided by EDIBON.

• Evaluation Methods to prove your knowledge and progression.

• Test self-correction.

• Calculations computing and plotting.

• Equation System Solver Engine.

• User Monitoring Learning & Printable Reports.

• Multimedia-Supported auxiliary resources.

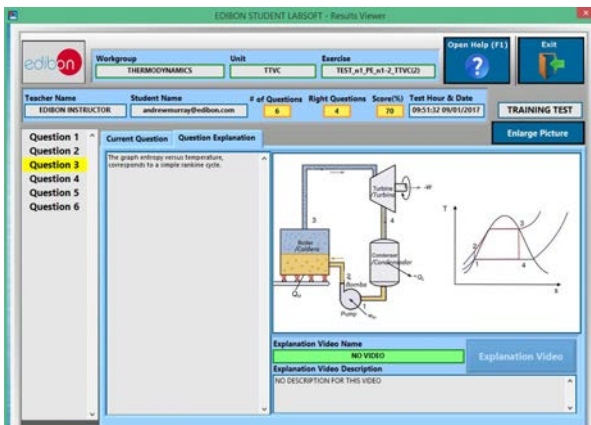For more information see ICAI catalogue. Click on the following link:
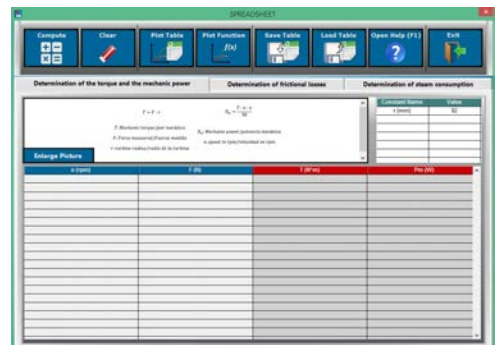www.edibon.com/en/files/expansion/ICAI/catalog

ESL-SOF. EDIBON Student LabSoft (Student Software)
Application Main Screen
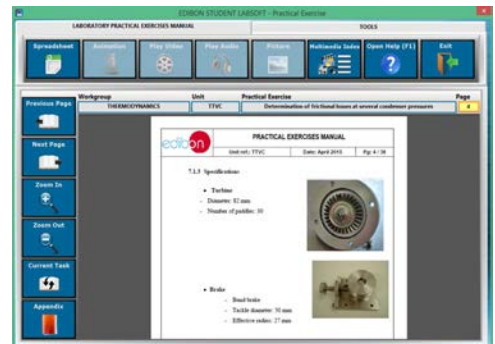
EPE. EDIBON Practical Exercise Program Package Main Screen

ERS. EDIBON Results & Statistics Program Package - Question Explanation

ECAL. EDIBON Calculations Program Package Main Screen

✱ Specifications subject to change without previous notice, due to the convenience of improvement of the product.

edibon INTERNATIONAL

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REPRESENTATIVE: