

# ET 174

## Electrical faults in full air conditioning systems



### Description

- simulation of the electrical circuit of a complex conditioning system with humidifying and heat pump function
- investigation of key electrical components from air conditioning technology
- simulation of 30 faults

Identifying electrical faults in air conditioning systems requires comprehensive knowledge. This knowledge includes the design and operation of the individual electrical components as well as the reading of circuit diagrams. ET 174 helps to acquire this knowledge.

ET 174 demonstrates the electrical circuit of a complex full conditioning system with heat pump function. The control circuits are actually present. The components in the load circuits are simulated (e.g. compressor, heater, four-way reversing valve).

The air conditioning system with heat pump function cools in the summer and heats in the winter. During heating operation the defrost timer introduces a hot gas defrosting by briefly switching the four-way reversing valve. At very low outdoor temperatures an electrical auxiliary heating is activated during heating operation. With low air humidity the hygrostat activates the humidifying function.

Typical protection devices, such as circuit breaker and frost protection monitor, complete the electrical circuit. The operating state of the simulated components is indicated via lamps in the circuit diagram on the front panel.

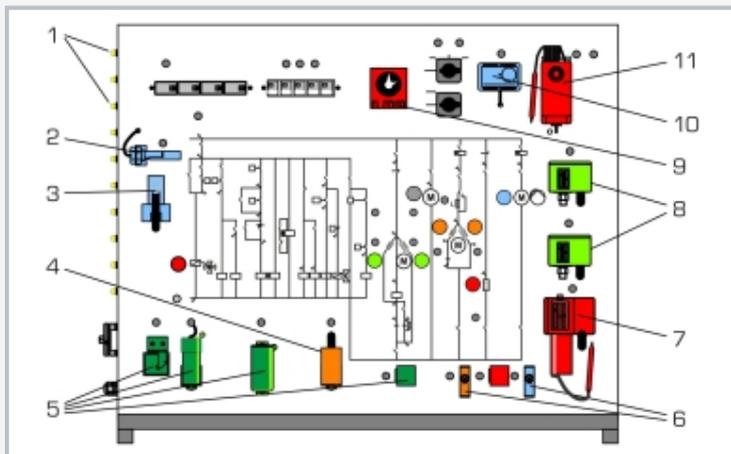
The simulation of 30 different faults, such as coil fracture in the motor or faulty relays, is possible. For fault identification the voltages or resistances at the lab jacks are checked with the multimeter. The depiction of the circuit diagram on the front panel facilitates the allocation of the measuring points.

### Learning objectives/experiments

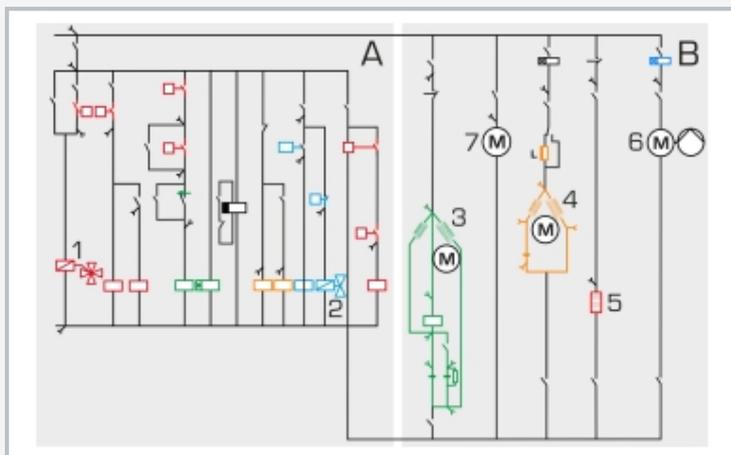
- electrical design and operation of full conditioning systems
- reading and understanding electrical circuit diagrams
- design and operation of electrical components in an air conditioning system
  - ▶ start-up capacitor
  - ▶ start-up relay
  - ▶ operating capacitor
  - ▶ overheat protection
  - ▶ Heinemann circuit breaker
  - ▶ solenoid valve
  - ▶ defrost timer
  - ▶ float switch
  - ▶ thermostat
  - ▶ hygrostat
  - ▶ frost protection monitor
- fault finding in electrical components
  - ▶ in idle state
  - ▶ under mains voltage

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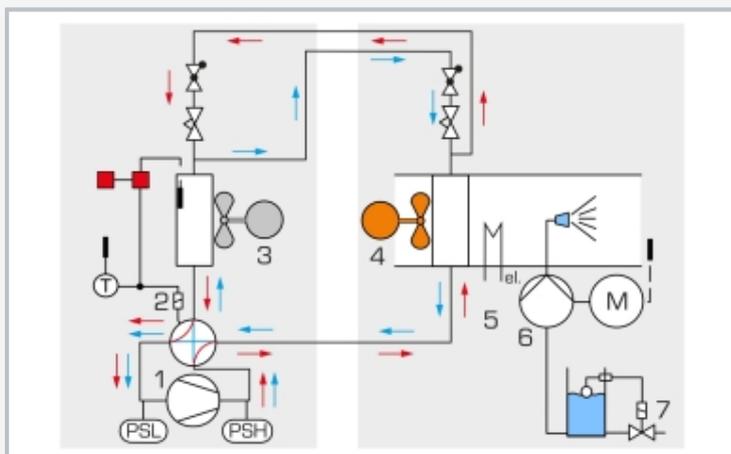
## Electrical faults in full air conditioning systems



1 buttons for faults, 2 float switch, 3 humidifier solenoid valve, 4 room air fan start-up capacitor, 5 electrical compressor components, 6 circuit breaker for room air fan and humidifier pump, 7 frost protection monitor, 8 compressor pressure switch, 9 defrost timer, 10 hygrostat, 11 thermostat



A control circuit, B load circuit; 1 four-way reversing valve heating/cooling, 2 humidifier solenoid valve, 3 compressor, 4 room air fan, 5 auxiliary heating, 6 humidifier pump, 7 outer air fan



Simulated air conditioning system: 1 compressor, 2 four-way valve heating/cooling, 3 outer air fan, 4 room air fan, 5 auxiliary heating, 6 humidifier pump, 7 humidifier solenoid valve

### Specification

- [1] experimental unit from the GUNT practical series for the training of mechatronics engineers for refrigeration
- [2] simulation of the electrical circuit of a complex conditioning system with humidifier and heat pump function for heating, cooling and humidifying
- [3] real control circuits with electrical components, simulated load circuits
- [4] electrical simulation of compressor, 2 fans (room air, outer air), four-way reversing valve, auxiliary heating
- [5] humidifier with hygrostat, solenoid valve and float switch (pump simulated)
- [6] hot gas defrosting by switching the four-way reversing valve
- [7] operating states of the simulated components indicated via lamps in the circuit diagram
- [8] circuit diagram depicted on the front panel
- [9] identification of 30 faults: multimeter measures voltages or resistances at the lab jacks

### Technical data

Thermostat to switch between heating/cooling  
 ■ measuring range: 1...60°C

Electrical compressor components  
 ■ start-up relay  
 ■ start-up capacitor  
 ■ operating capacitor  
 ■ overheat protection  
 ■ 2 pressure switches

Electrical components of room air fan  
 ■ start-up capacitor  
 ■ Heinemann circuit breaker

Humidifier components  
 ■ hygrostat: measuring range 30...100% r.h.  
 ■ float switch  
 ■ solenoid valve  
 ■ Heinemann circuit breaker

Defrosting components  
 ■ frost protection monitor: -10...12°C  
 ■ timer: switching time 10...60min

Circuit breaker for auxiliary heating

230V, 50Hz, 1 phase  
 230V, 60Hz, 1 phase; 120V, 60Hz, 1 phase  
 UL/CSA optional  
 LxWxH: 1050x400x860mm  
 Weight: approx. 48kg

### Scope of delivery

- 1 experimental unit
- 1 multimeter + set of accessories
- 1 set of instructional material

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Optional accessories

WP 300.09

Laboratory trolley