



## DEMONSTRATION CAPABILITIES

- > Demonstration of component function
- > Instrumented running conditions showing refrigeration pressures
- > Temperature gauges showing performance under running and fault conditions
- > Fault injection through built in refrigeration circuit and electrical faults

## FEATURES

- > Standalone desktop refrigeration system
- > Built-in temperature and pressure gauges as used by service technicians
- > Fault training through switchable fault condition switches
- > Low-voltage DC compressor and control circuit
- > Quiet operation for classroom use without the need for additional drive motors and noisy belt-driven compressors
- > No additional computers or diagnostic tools are required

The RA4 is a standalone desktop refrigeration demonstrator based on a vapour-compression refrigeration system (VCRS). The most common refrigeration system used today, this is where the refrigerant undergoes phase changes to absorb and reject heat in a controlled manner.



## DESCRIPTION

The RA4 is based on a vapour-compression refrigeration. Comprising a hermetically sealed refrigerant compressor it incorporates a brushless three-phase DC electric motor, driven by a variable-speed controller. The refrigerant passes through the condenser where it can reject absorbed heat. The cooled liquid then passes through a receiver/dryer with built-in sight glass, through a thermal expansion valve, which measures outlet temperatures and meters the amount of refrigerant entering the evaporator. We have used a refrigerant for air evaporation but the principle shown relates to any form of heat exchanger that may use vapour-compression refrigerant within its process.

The RA4 control panel comprises standard refrigeration gauges as used by a service technician. There are also indicators to show the status of the low-pressure, medium-pressure and high-pressure system safety switches. Indicators show the compressor running status. Three temperature displays indicate the air temperatures before and after the evaporator coil and show the condenser coil temperature.

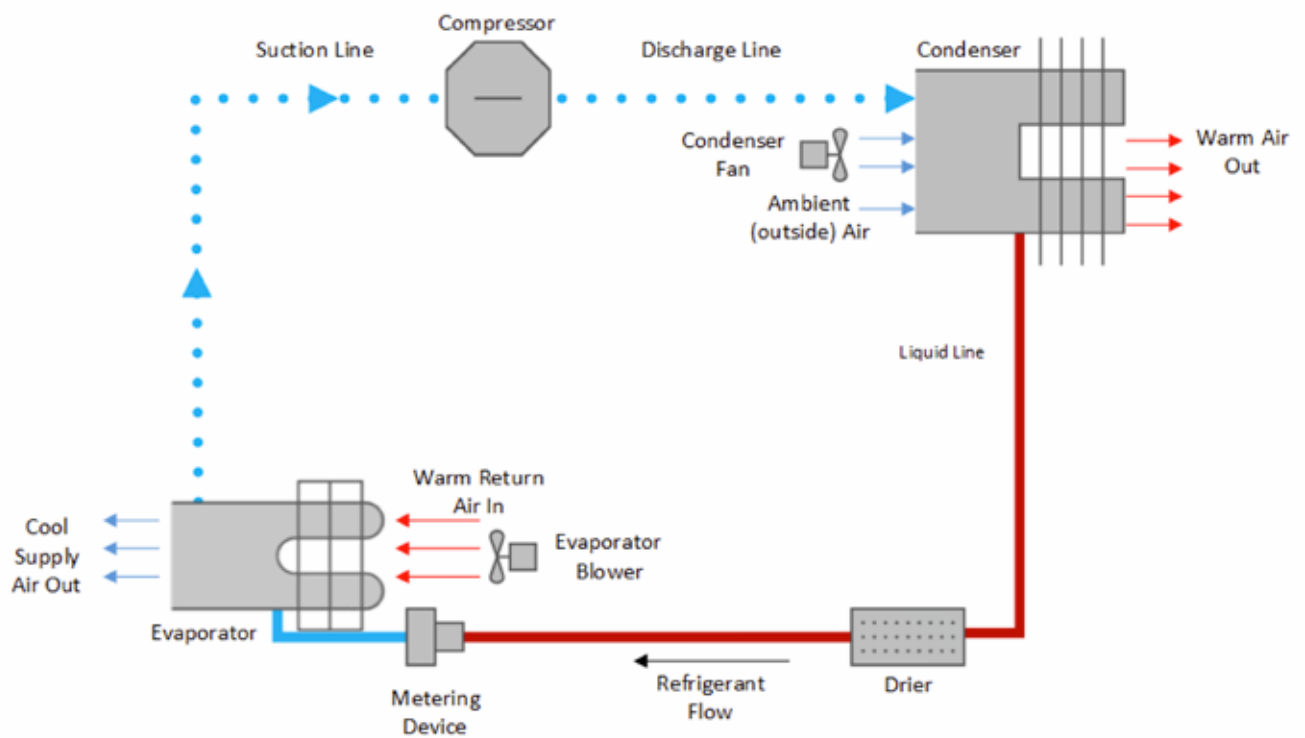
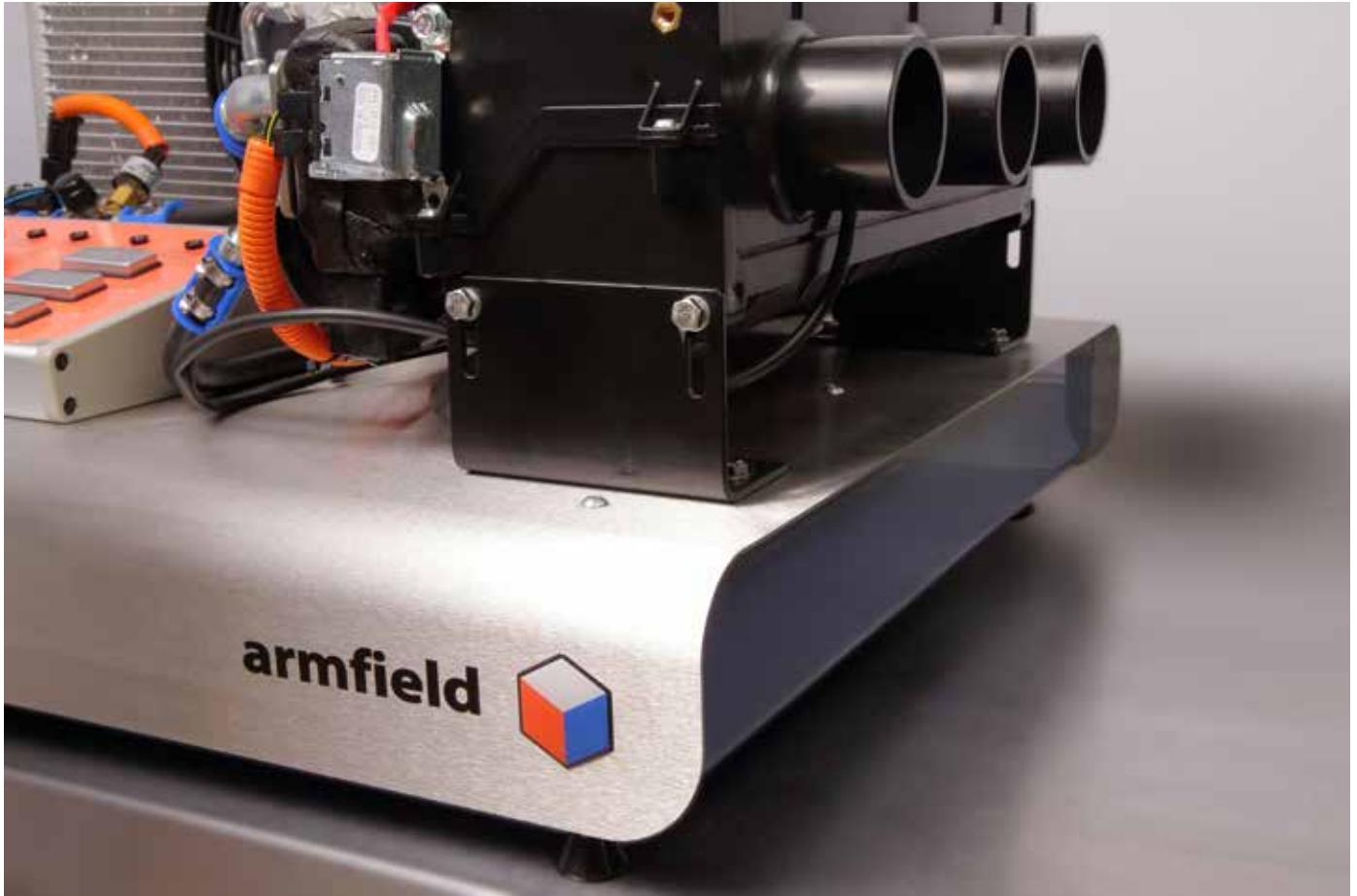
Many of the components used are automotive, but the process is the same in vehicle, building services and refrigeration units. A DC compressor has been selected to provide drive, due to its low-voltage, low-noise operation against an automotive-style belt-driven compressor typical of high-current AC motors.

Three switches are fitted to the system to demonstrate typical faults found in refrigeration or air-conditioning circuits. When any of the three switches are selected, the student can observe the displayed information on the control panel to diagnose the fault condition being demonstrated. The three faults that can be selected are:

- Block/restriction within the high-pressure circuit
- Blocked expansion valve
- Restricted condenser heat rejection



RA4 control console



## REQUIREMENTS

### Electrical supply:

RA4: 110-240V / 1ph / 50-60Hz

## TECHNICAL SPECIFICATION

- Refrigerant compressor with 24V, three-phase DC motor
- Built-in low-pressure gauge
- Built-in high-pressure gauge
- Three temperature displays

## OVERALL DIMENSIONS

Length: 0.90m

Depth: 0.50m

Height: 0.80m

## ORDERING CODES

RA4: 110-240V / 1ph / 50-60Hz

## SHIPPING SPECIFICATION

Volume: 0.24m<sup>3</sup>

Gross weight: 45kg

## ORDERING SPECIFICATION

- Desktop vapour pressure air-conditioning system for training using R134a refrigerant
- Hermetically sealed refrigerant compressor, with:
  - > Integral low-voltage three-phase DC motor
  - > Quiet and vibration-free operation
- Condenser assembly to cool the refrigerant, incorporating:
  - > Multi-pass condenser coil with aluminium fins
  - > DC cooling fan
- Evaporator assembly to cool and dehumidify the air, incorporating:
  - > Thermal expansion valve
  - > Evaporator coil with fins
  - > Centrifugal air blower with three switched speeds
- Three temperature displays indicating:
  - > Air temperature before evaporator coil
  - > Air temperature after evaporator coil
  - > Refrigerant temperature in condenser coil
- Built-in refrigerant Bourdon gauges on compressor suction and discharge lines with combined temperature and pressure scales
- System includes receiver, filter/dryer, sight glass and high/low-pressure cut-outs for safe operation
- High and low-pressure charging points enable operator training in addition to recharging
- Demonstration/analysis of faults injected in the refrigerant circuit via three selector switches:
  - > Blocked condenser
  - > Condenser fan failure
  - > Thermostatic expansion valve failure
- Three pressure switches with indicators showing low or high-pressure under fault conditions and medium pressure in normal operation
- No additional computer or diagnostic tools are required
- Operated from mains power supply, but all components are 24V DC for improved operator safety
- Comprehensive instruction manual with details of installation, operating procedures and sample teaching exercises including fault inserton and analysis



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