VDAS® ONBOARD

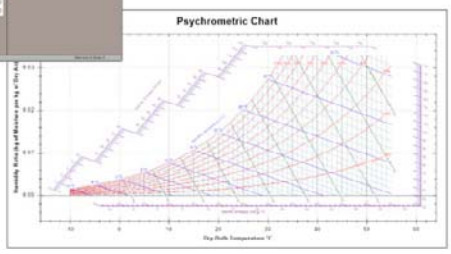
EC1550V

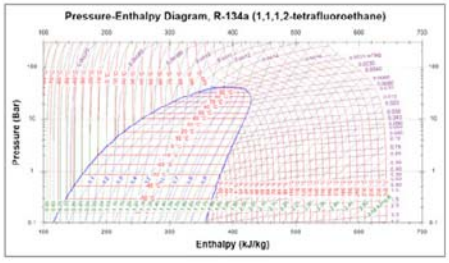
ADVANCED HVAC & R TRAINER

FIVE YEAR QUALITY TECQUIPMENT SINCE 1958 WARRANTY

A versatile, floor-standing unit for the in-depth study of heating, ventilation, air conditioning and refrigeration (HVAC & R) systems. Facilitates the analysis of individual and combined psychrometric processes commonly used in air conditioning. Also allows study of the vapour compression refrigeration cycle, including the use of pressure enthalpy (P-h) charts.

EC1550 BASE UNIT (EC1550V)





SCREENSHOTS OF THE VDAS® SOFTWARE

TECQUIPMENT LTD, BONSALL STREET, LONG EATON, NOTTINGHAM NG10 2AN, UK
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TECQUIPMENT

VDAS® ONBOARD EC1550V

ADVANCED HVAC & R TRAINER

KEY FEATURES

- Temperature and humidity readings are taken around the air duct for each air conditioning process
- Two probes are supplied for air flow velocity measurements at stages around the system
- Pressure, temperature, refrigerant mass flow and compressor electrical power consumption measurements taken around the refrigeration circuit
- Variable-speed fan allows performance comparison of psychrometric processes at different air flow rates
- Electric pre-heater and re-heater equipped with independent PID controls for precise temperature control, as well as performance comparisons at different power inputs
- Direct-injection steam humidifier demonstrates the heat of vaporisation given up by steam to the air stream and the absorption process that increases the energy content of the air
- Water-to-air heat exchanger supplied by a variable-speed DC pump in order to allow air cooling performance comparisons at different flow rates
- Hermetic reciprocating compressor – this is used to chill water for use with the water-to-air heat exchanger which provides cooling to the air handling unit. The vapour compression cycle is fully instrumented and the mass and energy balance across components is calculated
- Temperature controlled chilled water tank allows reciprocating compressor performance comparisons at different loads and/or set points
- In-duct high-pressure spray humidifier (air washer) connected to the chilled water tank in order to analyse the effect of water temperature on evaporation of a mist sprayed from a nozzle
- Reaches stability rapidly after a change in operating conditions
- Includes TecQuipment's Versatile Data Acquisition System (VDAS® Onboard), featuring data acquisition via USB
- LCD display of all measured parameters
- VDAS® software allows students to visualise monitored and calculated variables as well as psychrometric and pressure-enthalpy charts in real time

ADVANCED HVAC & R TRAINER

LEARNING OUTCOMES: AIR HANDLING UNIT

- Investigation of psychrometrics, definitions, relations and psychrometric charts
- Understanding of an air handling unit's electro-mechanical components and their function
- Investigation of psychrometric processes including:

SINGLE STAGE PROCESSES

a) Sensible heating

b) Sensible cooling

c) Sensible and latent cooling and dehumidification

d) Adiabatic humidification (evaporative cooling via air washer)

e) Steam humidification

MULTIPLE STAGE PROCESSES (TYPICAL EXAMPLES)

f) Heating and humidification

g) Cooling and humidification

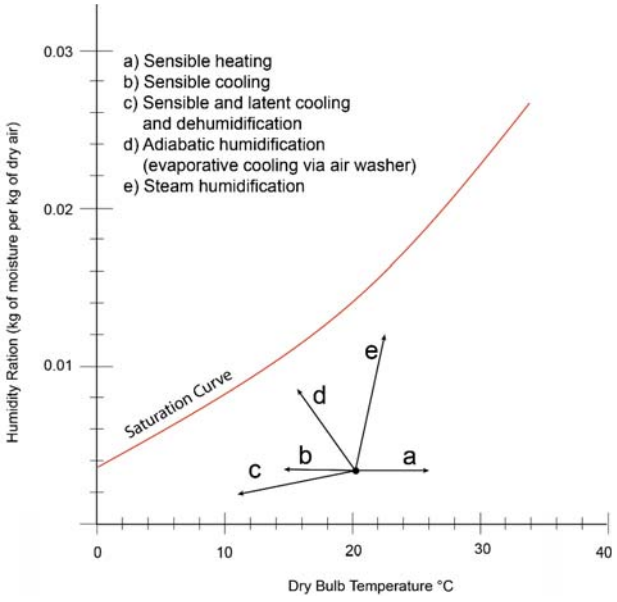
h) Cooling, humidification and heating

- Observation of the effect of varying the fan speed, pump flow rates and temperature settings for all the above psychrometric processes and combinations
- Calculation of the sensible heat ratio and dew point
- Evaluation of the heat transfer across the water-to-air heat exchanger and the log mean temperature difference (LMTD) driving force
- Determination of the mass flow and energy balance across the refrigeration cycle

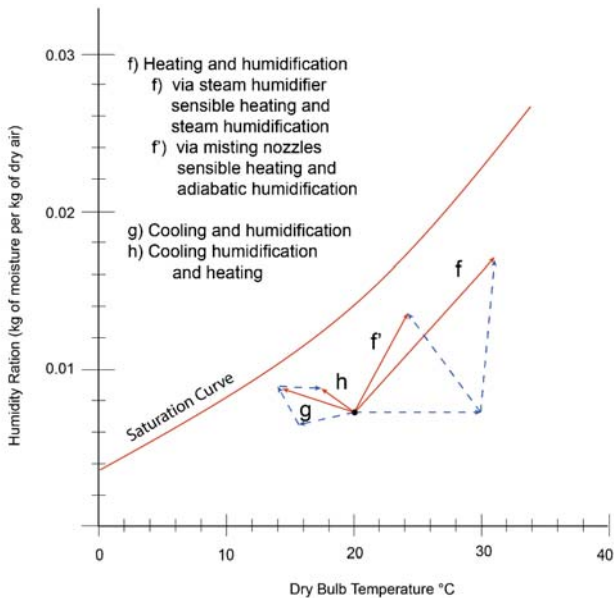
LEARNING OUTCOMES: WATER CHILLER

- Understanding of refrigeration components and their function
- Investigation of the vapour compression refrigeration cycle including:
  - Real-time plotting of the P-h thermodynamic cycle for refrigerant R134a
  - Calculation of superheat, subcooling, pressure ratio, saturated evaporating temperature and saturated condensing temperature
  - Calculation of the isentropic efficiency of the compressor
  - Calculation of the heat balance, mass flow rate and theoretical power of the saturation cycle
  - Understanding the effect of suction temperature and condenser temperature on the refrigeration effect and CoP
  - Calculation of the effect of varying the load on the refrigeration cycle
- Determination of the mass flow and energy balance across the refrigeration cycle

SINGLE STAGE PROCESSES



MULTIPLE STAGE PROCESSES



ADVANCED HVAC & R TRAINER

DESCRIPTION

The EC1550V has two distinct systems; these are commonly known as an air handling unit and a water chiller. The air handling unit conditions the air by using one or more air processes.

The water chiller cools the water in the tank so it can be pumped to the water-to-air heat exchanger in the air handling unit to provide sensible cooling or combined cooling and dehumidification.

The unit is fitted with lights and windows so that the components of each air process can be clearly identified. At the end of each air process, a temperature and humidity sensor is provided so that the performance of the process can be tested individually as well as collectively.

The control panel allows the adjustment of key components such as air flow velocity, temperature and water flow rate, allowing performance comparisons at different set points. Furthermore, it offers VDAS® connectivity, a USB cable (supplied) connects the unit to a suitable PC (not supplied) running TecQuipment's VDAS® software that captures, records and displays data.

The inlet of the unit is covered by a grille and air filter for safety and air quality, followed by a variable-speed axial fan providing a maximum of 1200 $m^3.h^{-1}$ of air to its outlet.

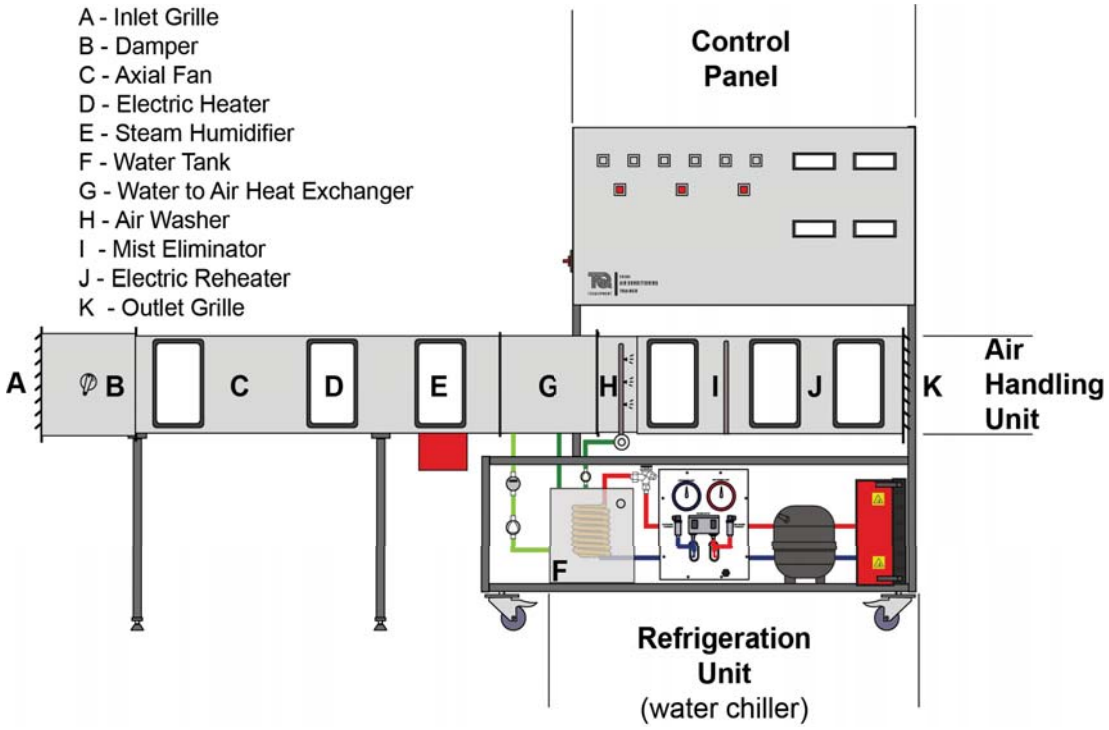
The first psychrometric process is sensible heating and this is achieved via a 1.5 kW PID controlled electric heater.

The next subsystem is a steam humidifier followed by a 300 mm x 300 mm water-to-air heat exchanger that provides dry cooling to the air stream. The next subsystem along the stream is the air washer. It uses water pumped at high pressure (60 psi) through misting nozzles. Water is supplied from the chilled water tank so experiments can be performed with either water at room temperature or chilled. The final component in the main duct is a 1.5 kW PID-controlled electric re-heater.

Contained on the bottom shelf of the unit is a complete refrigeration system. The refrigerant R134-a cools the water in the tank. The chilled water serves two purposes within the unit. Primarily, it cools the air via the water-to-air heat exchanger. Additionally, it provides chilled water to the air washer, enhancing the experiment's range.

The core components of the refrigeration unit are the high back pressure condensing unit, the thermostatic expansion valve and the helicoidal evaporator contained inside the water tank. In addition, other components such as a suction line accumulator, filter dryer, liquid receiver, pressure switches and rotolock service valves are incorporated for safety, maintenance and to prevent damage to the unit.

The refrigeration cycle includes high and low-pressure gauges and transducers, thermocouples on each line, a refrigerant flow meter and a Watt transducer allowing students to analyse the performance of the cycle and compare experimental results and calculations with theory.



EC1550V BASE UNIT MAIN PARTS AND PROCESS LOCATIONS

ADVANCED HVAC & R TRAINER

RECOMMENDED ANCILLARIES

RECIRCULATION DUCT (ECI550A):

A recirculation duct can be fitted. Air flow through the recirculation unit can be varied via the manually controlled dampers allowing a wide range of experiments.

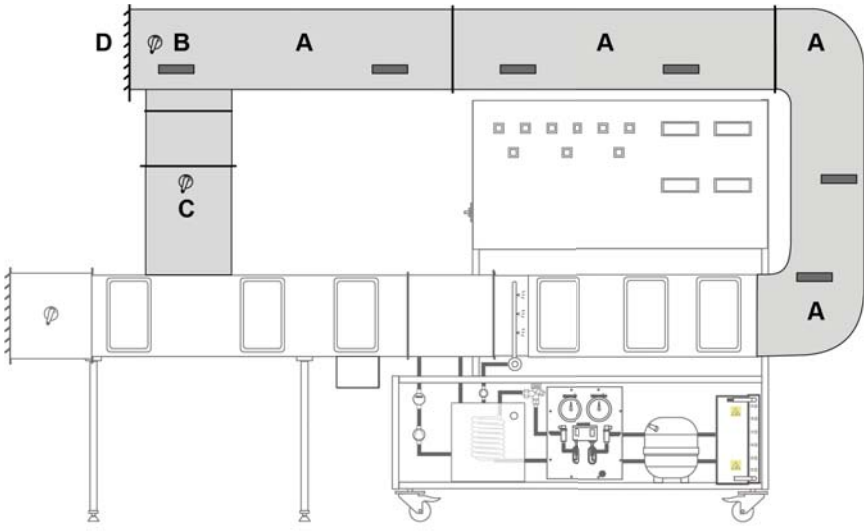
KEY FEATURE:

- Recirculation duct fitted with dampers allows the mixing of air streams at different mass flow rates

LEARNING OUTCOMES:

- Determination of the mass flow and energy balance across the whole unit
- Adiabatic mixing of air streams

ECI550V BASE UNIT WITH OPTIONAL RECIRCULATION DUCT (ECI550A)



RECIRCULATION DUCT

A - Return Duct
B - Damper
C - Damper
D - Outlet Grille

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ENVIRONMENTAL CHAMBER (EC1550C):

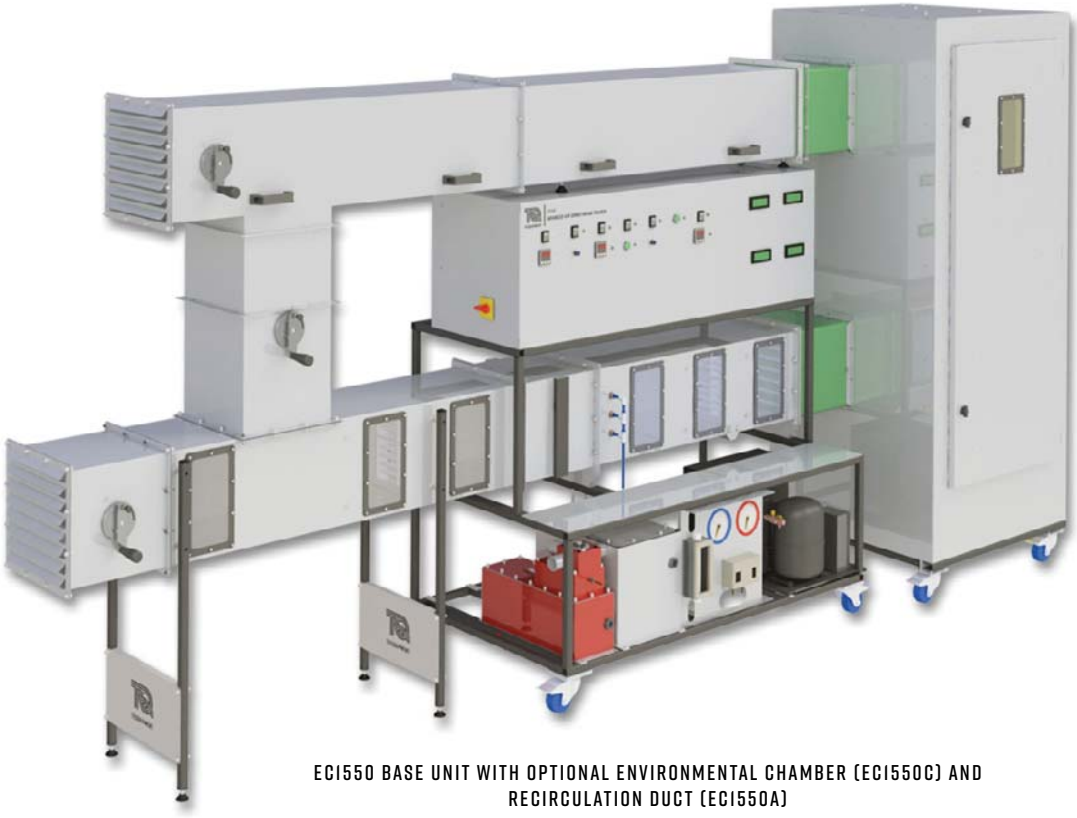
Complimentary to the air duct, a 2 m^3 environmental chamber can be used to mimic a room. This is designed to accommodate a student, allowing them to stand within an environment conditioned by the EC1550V, they can assess their comfort level and compare this with the calculated mean vote.

KEY FEATURE:

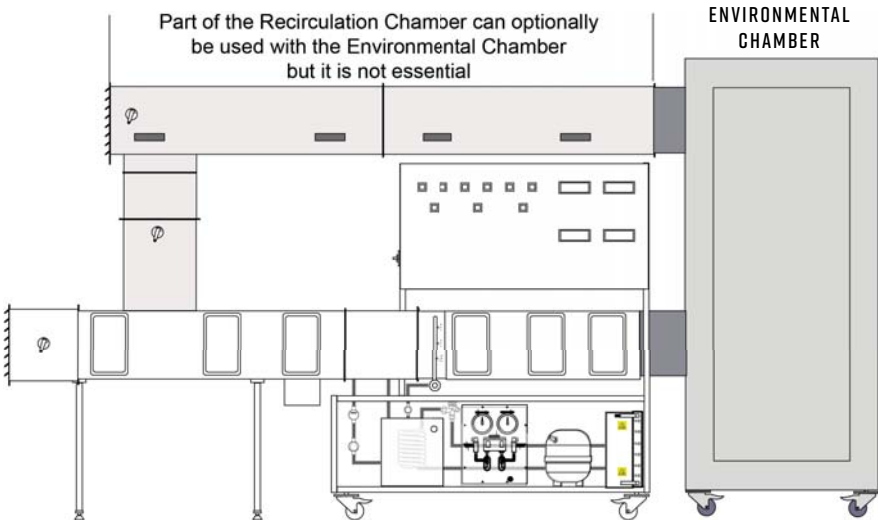
- Environmental chamber allows the investigation of thermal human comfort

LEARNING OUTCOMES:

- Investigation of HVAC for human comfort applications. Calculation of the Predicted Mean Vote (PMV) and Percentage of People Dissatisfied (PPD).



EC1550 BASE UNIT WITH OPTIONAL ENVIRONMENTAL CHAMBER (EC1550C) AND RECIRCULATION DUCT (EC1550A)



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STANDARD FEATURES

- Supplied with comprehensive user guide
- Five-year warranty
- Made in accordance with the latest European Union directives
- ISO9001 certified manufacturer
- VDAS® software

RECOMMENDED ANCILLARIES

- Recirculation Duct (EC1550a)
- Environmental Chamber (EC1550c)

SPECIFICATIONS

TecQuipment is committed to a programme of continuous improvement; hence we reserve the right to alter the design and product specification without prior notice.

OPERATING CONDITIONS

OPERATING ENVIRONMENT:

Laboratory

STORAGE TEMPERATURE RANGE:

–25°C to +55°C (when packed for transport)

OPERATING TEMPERATURE RANGE:

+5°C to + 45°C

OPERATING RELATIVE HUMIDITY RANGE:

80% at temperatures < 30°C

ESSENTIAL SERVICES

APPROXIMATE MINIMUM OPERATING SPACE NEEDED:

EC1550V BASE UNIT ONLY:

5 m (width) x 2 m (depth) x 2 m (height)

(See note and diagram below)

NOTE: In use, the apparatus requires at least 1 m clearance at the inlet in a relatively spacious room. Please contact TecQuipment for further details.

ELECTRICAL SUPPLY (SPECIFY ON ORDER):

Three phase, 220 - 240 VAC, 60 Hz, 20 Amps

OR

Three phase, 380 - 415 VAC, 50 Hz, 20 Amps

APPROXIMATE NETT DIMENSIONS AND WEIGHT:

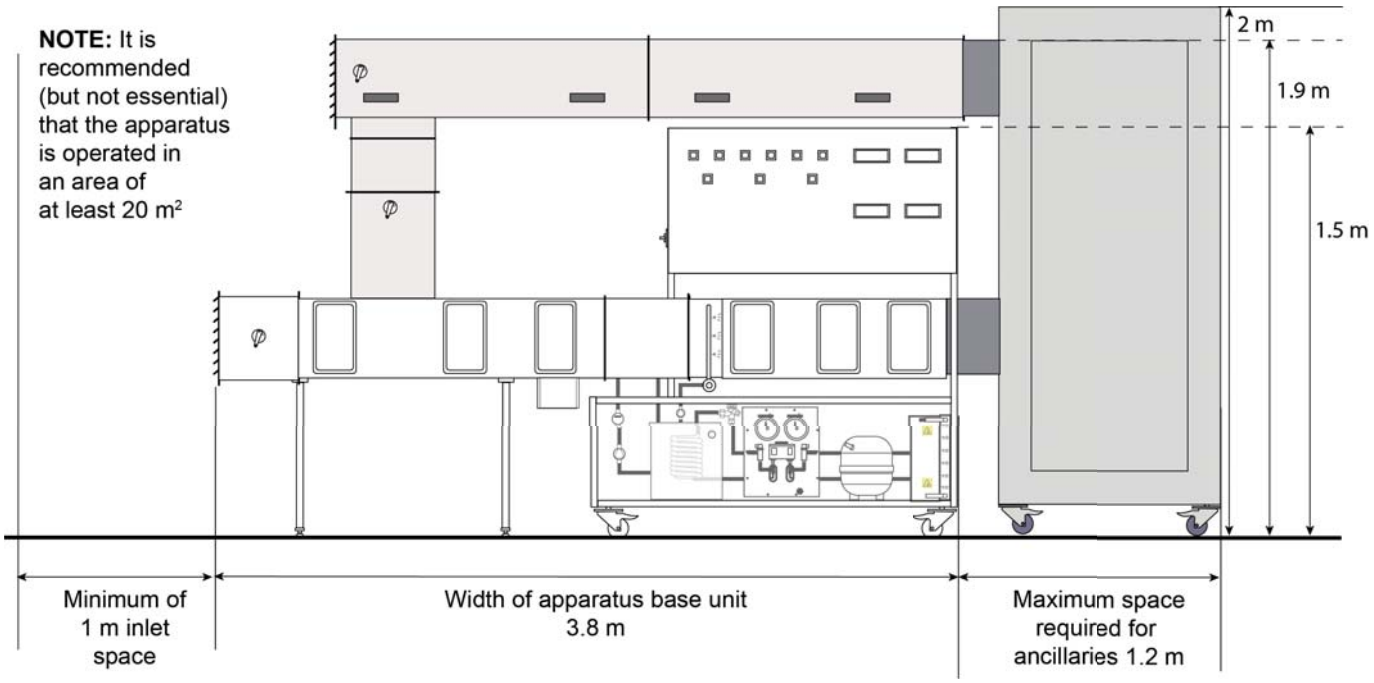
BASIC UNIT

4 m (width) x 0.7 m (depth) x 1.5 m (height)

VDAS® SOFTWARE

PC running Windows 8 or newer, required for optional VDAS® software

APPROXIMATE OPERATING SPACE REQUIRED



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