

VICTRON VENTURE

PRODUCT CATALOG

THERMODYNAMICS (HVAC)

- ***TVET***
- ***STEM***
- ***Research & Development (R&D)***
- ***Laboratory equipments and apparatus***
- ***Industrial Revolution 4.0 (IR4.0)***
- ***Custom Fabrication***

HVAC SYSTEM

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C) THERMODYNAMIC (HVAC SYSTEM)



1 HP SPLIT UNIT AIR-CONDITIONING SYSTEM

Model: C3012

INTRODUCTION: Split system air conditioners are used to cool, dehumidify and also heat rooms. They consist of an inner and outer unit. In the inner unit, there is a heat exchanger with a fan working as an evaporator in the refrigeration circuit during cooling operation. During heating operations, it works as a condenser. The outer unit contains a compressor, another heat exchanger, expansion element (e.g. capillary tube) and an element enabling the change-over from cooling to heating operation.

FEATURES

- 1) Trainer from the Model C3012 practical series for the training of mechatronics engineers for refrigeration
- 2) Design and operation of a commercial split system air conditioner
- 3) Illustration of the split principle using a dividing wall
- 4) Various operating modes: heating, cooling, dehumidifying, ventilation, automatic, test
- 5) 3 additional functions configurable via remote control: sleep, swing, timer
- 6) 2 refrigerant manometers indicate the low and high pressure of the compressor

SPECIFICATIONS: Capacity (Cooling, Btu/hr): 9000 Btu/hr, Capacity (Cooling, Min - Max, Btu/hr): 3,000 ~ 11,500 Btu/hr, Capacity (Cooling, kW): 2.64 kW, Capacity (Cooling, Min - Max, kW): 0.88 ~ 3.37 kW, EER (Cooling, W/W): 3.77 W/W, EER (Cooling, Btu/hW): 12.86 Btu/hW, CSPF: 5.50, Noise Level (Indoor, High/Low, dBA): 39 / 20 dBA, Noise Level (Outdoor, High/Low, dBA): 48 dBA, Power Source (Φ/V/Hz): 1 / 220-240 / 50, Power Consumption (Cooling, W): 700 W, Operating Current (Cooling, A): 3.8 A, SmartThings: Yes, AI Auto Cooling: Yes, Filter Cleaning Indicator: Yes, Indoor Temp. Display: Yes, Display On/Off: Yes, Beep On/Off: Yes, 24-Hour Timer: Yes, Auto Restart: Yes

REFRIGERANT CYCLE TRAINING UNIT

Model: C3031

INTRODUCTION: Demonstration Refrigeration Cycle System is an air conditioning system that consists of two separate units: the water or air-cooled condensing unit and the air handling unit. In many ways, heat pumps are functionally the same as conventional air conditioners. The only real difference is that a heat pump can reverse itself so it can provide heating when needed. So basically, it's an air conditioner that can reverse itself.

FEATURES

-Fully instrumented for high- and low-pressure gauges for process variables.

Experiment capabilities included:

- A) Basic Refrigeration Vapor Compression System
- B) Representation Vapor Compression System on p-h Chart
- C) Refrigerating Effect and Cooling Capacity
- D) Energy Balance on Vapor Compression System
- E) COP (Coefficient of Performance) of Vapor Compression System
- F) Comparison of Capillary Tube and Thermostatic Expansion Device
- G) Comparison of Varying Length on Capillary Tube Expansion
- H) Effect of Varying Air Flow Rate on Air-Cooled Condenser

SPECIFICATIONS: Compressor

- Type : Non-Inverter
- Refrigerant : R404a
- Cooling Capacity : ½ HP

Refrigerant Receiver

- Connection Size : 3/8"

Refrigerant Accumulator

- Connection Size : 3/8"

Filter Drier

- Connection Size : 3/8" & 5/8" ◎

High Pressure Gauge

- Range : 0-400psi
- Connection Size : ¼" flare

Low Pressure Gauge

- Range : 0-400psi
- Connection Size : ¼" flare



MECHANICAL HEAT PUMP

Model: C3061

INTRODUCTION: The vapour compression refrigeration cycle is used in many industrial, medical and domestic situations throughout the world. It is essential therefore that student engineers intending to design or utilise such plant are fully aware of the parameters affecting the performance of the vapour compression refrigeration cycle.

FEATURES

- Understand the 1st and 2nd law of thermodynamic
- Understand the Carnot Cycle working principle
- Understand the Reverse Carnot Cycle working principle
- Understand the operating principle of HEAT PUMP system
- Understand the P-H Chart of HEAT PUMP system
- Understand the HEAT PUMP system component and its working principle.
- Understand the HEAT PUMP system fundamental design
- Understand the HEAT PUMP system compression cycle

SPECIFICATIONS: COMPRESSOR

- Type : Hermetic
- Refrigerant : R-141b
- Power : 1/4 hp

TEMPERATURE SENSOR

- Type : RTD Pt100, 3-wires
- Range : -20 ~ 200 °C
- Probe material : Stainless steel

CONDENSER

- Type : Water cooled
- Material : Industrial standard Brass
- Design : Plate type condenser

CONTROL VALVE

- Type : Proportional control valve
- Size : 1/2"
- Control signal : 4 ~ 20 mA

C) THERMODYNAMIC (HVAC SYSTEM)



REFRIGERATION CYCLE DEMONSTRATION UNIT Model: C3081

INTRODUCTION: The vapour compression refrigeration and heat pump cycle is of paramount importance in food and drug preservation, air conditioning, heat pumps as well as other industrial and commercial process. The importance of the efficient and safe use of refrigeration systems has now been added to by the problems of ozone depletion and global warming. It is therefore more essential than ever before that students have a thorough understanding of both the practical aspects of refrigeration and the thermodynamic processes affecting the performance of the cycle.

FEATURES :

Designed to provide demonstration and investigation of:

- Vapour compression refrigeration and heat pump cycle with visual observation of all-important processes.
- Investigation and demonstration of the pressure-temperature relationship during evaporation and condensation.
- Demonstration of:
- Charging
- Pumping over or pumping down the refrigerant charge into the condenser.
- The effect of air in refrigeration systems.

Determination of effect of evaporating and condensing temperatures on the refrigeration

- rate and condenser heat output.
- Investigation of the effect of compressor pressure ratio on system performance.
- Determination of overall heat transfer coefficient in a simple shell and tube type heat exchanger with the addition of the optional temperature indicator.
- Development of a refrigeration cycle diagram on a pressure - enthalpy chart with the addition of the optional digital wattmeter.

COMMERCIAL REFRIGERATION UNIT

Model: C3091

INTRODUCTION: This Refrigeration unit trainer model is designed to demonstrate the thermodynamic basic principal of refrigeration compression and expansion on industrial standard refrigerator and heat pump application. The trainer is desktop unit and it is designed to be self-contained, compact and fully instrumented.

FEATURES

- Familiar with plant start-up and process interlock
- Understand the thermodynamic cycle in the P-H diagram
- Familiar with characteristics of an heat exchanger and effect of heat exchanger to the system performance.
- Familiar about defrosting methods by using electric heater.
- Understand function and performance of cooling tower (optional)
- Understand effect of varying condenser water flow rate to system performance
- Comprehensive training material with step-by-step training procedures
- Industrial standard training equipment for electrical control panel
- Custom designed for **TVET** training

SPECIFICATIONS: Compressor

Type	: Hermatic
Refrigerant	: R-134a
Power	: 1/4 hp

Evaporator

Type	: Water cooled
Material	: Industrial standard Brass
Design	: Plate type evaporator

Working Pressure

Max. 20 bar

Working Temperature

Operating 10 ~ 50 °C

Condenser

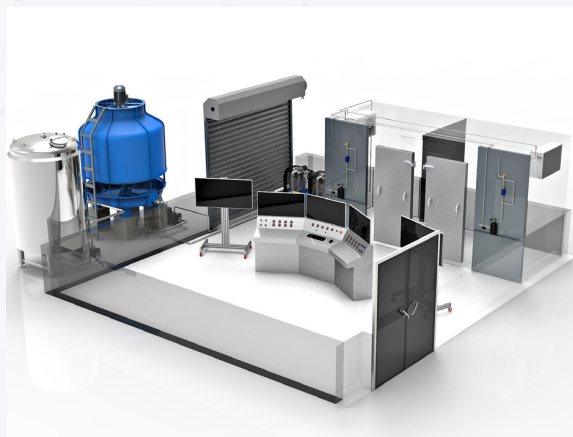
Type	: air cooled
Material	: Industrial standard Brass
Design	: Plate type condenser

Instrumentation

Compressor inlet & outlet temperature (RTD, Pt100), Condenser outlet temperature (RTD, Pt100), Condenser cooling water

Safety

Over pressure protection



MARINE REFRIGERATION (FREEZER & CHILLER ROOM) Model: C3131

INTRODUCTION: A ship's refrigeration plant is a contained system which comprises of several components that together ensure efficient running of the whole system. As the plant runs continuously, both at shore and at sea, its each part demands a through understanding of working and troubleshooting.

MAIN COMPONENTS OF MARINE REFRIGERTAION (FREEZER & CHILLER ROOM):

- Cold Panel Room
- Cooling Tower
- Water Tank
- Evaporator
- Compressor
- Condenser
- Receiver
- Filter Drier
- Expansion Valve
- Evaporator Unit
- Control Unit
- Suction Accumulator
- High / Low Pressure Switch
- Solenoid Valve

C) THERMODYNAMIC (HVAC SYSTEM)

COOLING TOWER BENCH UNIT

Model: C3141

INTRODUCTION: Cooling towers are used to dissipate heat arising during thermal processes, e.g. in steam power plants, air conditioning systems and process chillers.

FEATURES

- It is self-contained, compact and standalone unit
- Wide range of experiments. Able to perform various experiments on cooling tower with forced ventilation
- Thermodynamic principles of the wet cooling tower
- Transparent, easy interchangeable cooling column with wet deck surface
- Four (4) additional cooling columns available as optional
- Changes of state of the air in the h-x diagram
- Determination of the cooling capacity
- Energy balances
- Calculation of process parameters, such as maximum cooling distance, cooling zone width etc.



SPECIFICATIONS:

- Bench Top Unit
- Water Propeller Pump
- Air Propeller
- Water Tank
- Heating Element
- Instrumentation
- Column
- Control Panel
- Cooling Tower Structure

Size and Weight :

- Overall size : approx. 1,300 x 600 x 1430 mm (LWH)
- Weight : approx. 50 kg
- Power Supply : 240 VAC, 50Hz, 13A

REFRIGERATION LABORATORY UNIT

Model: C3151

INTRODUCTION: Model C3151 Refrigeration Laboratory Unit has been designed to help students to study the performance of a vapour compression cycle under various conditions of evaporator load and condenser pressure. Student will be able to monitor and control the unit just as if they are controlling and monitoring an industrial refrigeration and air conditioning plant.

STUDY FEATURES

- Energy balance for the refrigerator.
- Refrigerant training system with R134a
- Measurement and control using modular refrigerant ion training system with R134a.
- capillary tube system with R134a
- The effect of different condensing temperatures on refrigerator duty or cooling ability.
- Data logger online and offline for temperature and pressure
- Real data will display at the SCADA
- Performance of the thermostatic expansion valve.

SPECIFICATIONS:

- Evaporator
- Compressor
- Condenser
- Expansion Valve
- Instrumentation
- Safety

Size and Weight :

- Dimension : 1.12 x 0.65 x 1.4 m (LWH)
- Weight : 50 kg
- Power Supply : 240 VAC, 50Hz, 13A



REFRIGERATION WITH HEAT PUMP

Model: C3161

INTRODUCTION: This Refrigeration and Heat Pump Trainer model is designed to demonstrate the thermodynamic basic principal of refrigeration compression and expansion on industrial standard refrigerator and heat pump application. The trainer is desktop unit and it is designed to be self-contained, compact and fully instrumentated.

FEATURES

- Understand the 1st and 2nd law of thermodynamic
- Understand the Carnot Cycle working principle
- Understand the Reverse Carnot Cycle working principle
- Understand the operating principle of refrigerator and heat pump
- Understand the ideal vapor compression refrigeration cycle
- Understand the working principle of instrumentation for refrigeration system
- Understand the refrigeration system component and its working principle.
- Understand the refrigerator fundamental design

Working Temperature

Operating 10 ~ 50 °C

Safety

Over pressure protection



SPECIFICATIONS:

- Evaporator
- Compressor
- Condenser
- Instrumentation
- Safety
- Working Pressure**
Max. 20 bar

C) THERMODYNAMIC (HVAC SYSTEM)



RECIRCULATING AIR-CONDITIONING UNIT

Model: C3181

INTRODUCTION: Model C3181 Recirculating Air Conditioning Unit is custom designed to meet the hands-on practical exercise comply to TVET program as well as the theory study of the subject. Model C3181 consists of ducting fitted with various air conditioning components. Airflow is generated by an axial flow fan and in the airflow, heaters, cooling coil and steam humidifier connection is provided.

FEATURES

- Easy to visualise and understand of the basic of refrigeration process.
- Suitable for both vocational training and academic analysis of the thermodynamics principles involved.

Extensive range of experiments on refrigeration system studies:

- Demonstration of the processes and components used in heating, cooling, humidification and de-humidification of an airstream.
- Mass and energy balance across each process resulting in heating, cooling and humidity change using the instrumentation fitted.
- Determination of a complete refrigeration cycle diagram for the air-cooling plant plus an energy balance with different air flow across evaporator.

SPECIFICATIONS:

A) Refrigeration Unit

- Hermetic compressor
- Condenser and Receiver
- Expansion valve

- Filter/drier

- Temperature sensor (RTD Pt100)

- High/Low pressure control circuit

- High pressure line and low pressure line

B) Recirculation System

- Blower

- Pre-heater System

- Evaporator

- Humidifier

- Size and Weight :

Dimension : approx. 2,400 x 800 x

1,645 mm (LWH)

Weight : approx. 80 kg

■ Power Supply : 240 VAC, 50Hz, 13A

1~3 Ton RECIRCULATING AIR-CONDITIONING

UNIT Model: C3182

INTRODUCTION: Model C3182 1~3 Ton Recirculating Air Conditioning Unit

is custom designed to meet the hands-on practical exercise comply to TVET program as well as the theory study of the subject. Model C3182 consists of ducting fitted with various air conditioning components. Airflow is generated by an axial flow fan and in the airflow, heaters, cooling coil and steam humidifier connection is provided. Cooling circuit consists of a hermetic compressor; air cooled condenser, thermostatic expansion valve and evaporator.

FEATURES

- Compact, self-contained, standalone and floor stand unit
- Equipped with safety features to protect equipment and user
- Simple and easy to use
- Complex system with cooling and heating circuits
- Fully instrumented with temperature sensors at every stage of the process, plus an air flow sensor.
- Incorporated with cooling of atmospheric air, steam humidification, direct expansion refrigeration cooling and de-humidification and heating of atmospheric air.

SPECIFICATIONS: A) Cooling Circuit

- Hermetic compressor
- Instrumentation
- Energy Meter
- Condenser

B) Heating Circuit

- Air heater
- Humidifier/Steam generator
- Anaemometer
- Ducting

- Size and Weight :

Dimension : approx. 2,000 x 600 x 1,890 mm (LWH)

Weight : approx. 80 kg

■ Power Supply : 240 VAC, 50Hz, 13A



SPECIFICATIONS:

- Finned Heat Exchanger
- Plate Heat Exchanger
- Absorption Tank

- Generator Tank
- Cooling Compartment
- Instrumentation
- Safety

ABSORPTION TRAINING SYSTEM

Model: C3191

INTRODUCTION: Model C3191 Absorption Training System is designed to provide fundamental knowledge on the absorption refrigeration process and presents a comprehensive fundamental concept of the past efforts for the developing of this technology. This Model C3191 Absorption Training System can demonstrate various experiment to enhance the study of the subject.

FEATURES

- Compact, standalone and self-contained experiment apparatus
- Able to demonstrate the refrigeration process
- Able to demonstrate the vapour absorption refrigeration cycle and visualization of most important processes.
- Operation of the gas absorption refrigeration experiment unit is designed with an option using either an electrical element or LPG (optional) as heat source

- Size and Weight :

Overall space : approx. 1.0 x 0.6 x 0.8 m (LWH)

Total weight : approx. 30 kg

■ Power Supply : 240 VAC, 50Hz, 13A

C) THERMODYNAMIC (HVAC SYSTEM)



PORTABLE AIR COOLED CHILLER SYSTEM

Model: C3141

INTRODUCTION: Air cooled chillers are very common, especially in small to medium size commercial and office type buildings. They are usually located externally, either up on the roof or at ground level. This is because Air Cooled Chillers do not use cooling towers, instead they dump their heat into the ambient air and therefore need access to a lot of fresh air, in order to reject the unwanted heat from the building.

FEATURES

- Mounted on the mobile structure platform
- Able to demonstrate the air cooled chiller process
- Able to demonstrate the vapour absorption refrigeration cycle and visualization of most important processes.
- Measurement of power consumption to study efficiency of the system
- It is fully instrumented system
- Temperature sensors are installed at every important process area.

SPECIFICATIONS:

- Structure Platform
- Local Control Panel
- Compressor
- Air Cooled Condenser

- Evaporator
- Thermostatic Expansion Valve
- Chilled Water Pump
- Fan Coil Unit
- Pressure Switch

Size and Weight :

- Overall space : approx. 1.0 x 1.5 x 1.4 m (LWH)
- Total weight : approx. 100 kg
- Power Supply : 240 VAC, 50Hz, 13A

SHELL & TUBE CONDENSER

Model: C3151

INTRODUCTION: Shell and Tube Heat Exchangers are one of the most popular types of exchanger due to the flexibility the designer has to allow for a wide range of pressures and temperatures. There are two main categories of Shell and Tube exchanger:

1. Those that are used in the HVAC industry such as chilled water condensers.
2. Those that are used in the petrochemical industries, which tend to be covered by standards from TEMA, Tubular Exchanger Manufacturers Association (see TEMA Standards);
3. Those that are used in the power industry such as feedwater heaters and power plant condensers.

Model C3211 Shell and Tube Condenser is designed with the following component technical specification:

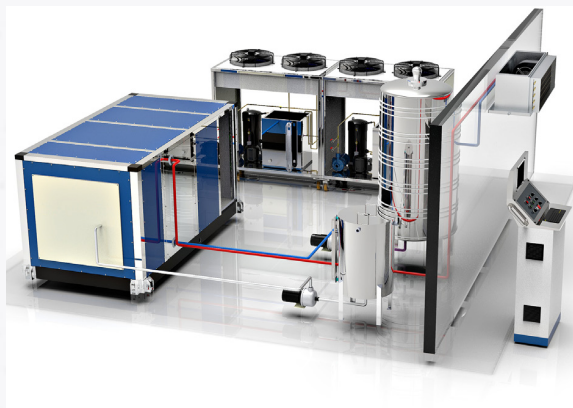
- Nominal horsepower : 3.5 - 5.5
- Pump down capacity : 12 - 17Lbs
- Water flow max GPM : 20.1
- Diameter : 6-5/8"

SPECIFICATIONS:

- Front Header
- Rear Header
- Tube Bundle
- Shell
- Bracket stand (trolley) for shell and tube condenser
- Four flexi custor wheels with lock
- Twelve copper brush complete with flexible stick

Size and Weight :

- Overall space : approx. 0.7 x 0.6 x 0.75 m (LWH)
- Total weight : approx. 35 kg



THERMAL ICE STORAGE CHILLER SYSTEM

Model: C3221

INTRODUCTION: TES systems are applicable in most commercial and industrial facilities, but certain criteria must be met for economic feasibility. A system can be appropriate when maximum cooling load is significantly higher than average load. High demand charges, and a significant differential between on-peak and off-peak rates, also help make TES systems economic.

FEATURES

- Compact, standalone and self-contained training and R&D equipment
- Able to demonstrate the TES system base on Air Cooled Chiller System
- Measurement of power consumption to study efficiency of the system
- It is designed with open control, multicontrol and real time control
- It is integrated with safety interlock to protect the equipment as well as the user.

- Understand the refrigerator fundamental design

Size and Weight

- Overall space : approx. 5.2 x 5.0 x 2.0 m (LWH)
- Total weight : approx. 2,000 kg

SPECIFICATIONS:

- Air Cooled Chiller System
- Fan Cooled Unit (FCU)
- Chilled Water Storage Tank
- Heat Exchanger (HEX)
- Ice Storage Tank
- Make-up Water Tank
- Make-up Water Pump

C) THERMODYNAMIC (HVAC SYSTEM)



VRV System Simulator Unit

Model: C3231

INTRODUCTION: Model C3231 VRV System Simulator System provides basic fundamental understanding of Variable Refrigerant Volume systems. This training model describes the basic VRV System and components required to make it work. It also defined the terminology related to absorption system, which can help the student not only the basic understand but equip the student to explore more advanced system theory in later stage for the study of the subject

FEATURES

- 1) Able to demonstrate the VRV refrigeration process
- 2) The efficiency and capacity of air-cooled systems reduce at extreme ambient conditions, causing systems to be oversized and increasing initial cost. Water cooled VRV operation does not get affected by outside air temperatures.
- 3) Water cooled VRV systems typically require less base refrigerant charge than that of a similar air cooled VRV system and thus can be used in applications with limited allowable refrigerant within the building.
- 4) No external operation sound produced by condensing units for cooled VRV systems.

SPECIFICATIONS:

- Indoor Unit A
- Indoor Unit B
- Outdoor System
- Intelligent Touch Manager
- Refrigerant Type: R410A or R32
- Control : Electronic Expansion Valve
- Electrical Control Switch Board
- Simulator design to demonstrate the operation and performance of Variable Volume (VRV) type air conditioning and refrigeration cycle.

AIR-CONDITIONING UNIT ROOFTOP TRAINER

Model: C3241

INTRODUCTION: Model C3241 Air-Conditioning Unit Rooftop Trainer demonstrates a complete rooftop packaged air conditioning. Commercially, rooftop HVAC units are packaged systems installed on rooftops that lie directly into a building's ductwork. In addition to lower installation costs, rooftop HVAC system offer more options and versatility than others found on the market.

FEATURES

Commercial rooftop heating and cooling units require professional maintenance at least once a year to reduce mechanical problems, ensure efficiency and prevent unnecessary wear and tear. When a commercial building has rooftop HVAC units, a technician has easy access to all the modules. There is no need for the professional to search for individual units throughout the property. He also does not need to enter the building to repair or maintain the equipment. Keep in mind that if you do not perform basic maintenance tasks on a monthly or quarterly basis (e.g., change the filters, check for leaks or clean the fins), you may need professional maintenance services more often.

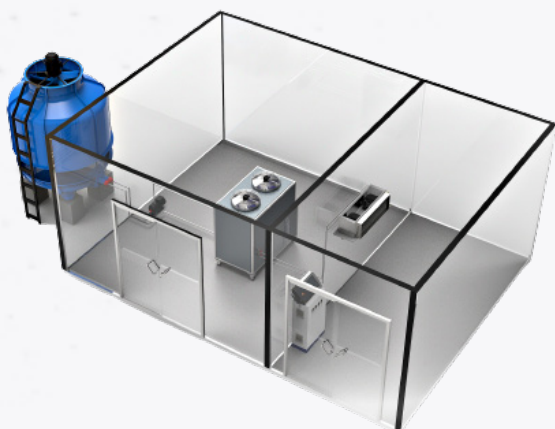
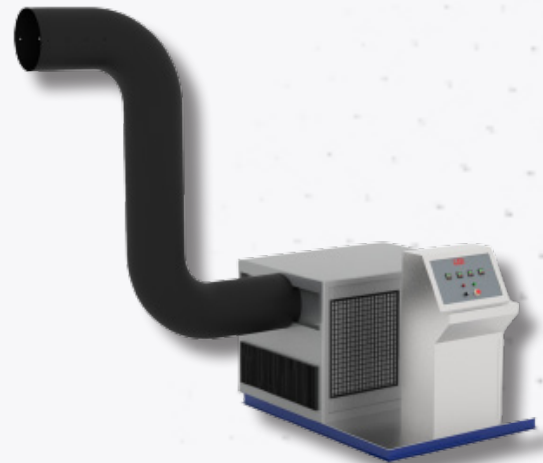
SPECIFICATIONS: Total cooling capacity:

- * Btu/hr : Approx. 150,000
- * Watt : Approx. 43,000 – 45,000
- ii. Total input power : Approx. 12,000 – 16,000 Watt
- iii. Total running power : Approx. 24.0 – 39.0 A
- iv. EER : Approx. 11.0 – 13.0 Btu/hr/W
- v. Air flow : Approx. 5,000 – 7,000 CFM

- vi. Sound pressure level: Approx. 65 – 90 dBA
- vii. Power source: Approx. 380 – 415/3/50 V/Ph/Hz
- viii. Compressor type : Hermetically sealed
- ix. Refrigerant type : R410A
- x. Control operation : Auto trans

Fabric Ducting

- i. Long distance approx. 152.7 ft (+/- 2 ft)
- ii. D-shape/half round type
- iii. Big fabric nozzles diffuser
- iv. Tensioner at blank end
- v. Pattern fabric ducting



CHILLER WITH SCREW COMPRESSOR TRAINER

Model: C3251

INTRODUCTION: Chillers are an evitable equipment of a Heating, Ventilation and Cooling (HVAC) system. It removes heat from the air of surroundings using refrigerant. In general, chillers can be classified into two types; air-cooled chiller and water-cooled chiller.

FEATURES

Model C3251 Chiller with Screw Compressor Trainer demonstrates a complete chiller with screw compressor of capacity of 12 tons. The chiller is a water-cooled type chiller and requires cooled water to cool down the refrigerant at condenser. Temperature sensors are used to detect the temperatures of cooling water, chilled water and refrigeration system itself. Compressor is a scroll type, which is very commonly used in air conditioning industry. Fan coil unit (FCU) is used to deliver the cooled air into the designated area. Chilled water will pass through FCU and heat exchange with the air in the room.

Size and Weight

Dimension : approx. 7,000 x 5,000 x 3,000 mm (LWH)

*Note: size and dimension is depend on the end user installed premises space.

Weight : 300 kg

SPECIFICATIONS:

- Screw Compressor
- Cooler
- Condenser
- Chiller Fan Coil Unit
- Cooling Tower
- Local Control Panel

C) THERMODYNAMIC (HVAC SYSTEM)

VRF AIR CONDITIONING TRAINER

Model: C3261

INTRODUCTION: Variable refrigerant flow (VRF) systems vary the flow of refrigerant to indoor units based on demand. This ability to control the amount of refrigerant that is provided to fan coil units located throughout a building makes the VRF technology ideal for applications with varying loads or where zoning is required.

FEATURES

Model C3261 VRF Air-Conditioning Trainer demonstrates a complete variable refrigerant flow (VRF) air conditioner. It consists of an outdoor unit with air handling unit (AHU). The VRF air conditioner can ease student to control means comfort. The key to providing comfort is to supply heating or cooling when and where it is required without swings in room temperature. In conventional systems, the compressor is either on or off, so even spaces that have individual controls experience fluctuations in room temperature as the compressor stops and then starts again to maintain the thermostat setting.



SPECIFICATIONS:

- System Restore
- High Efficiency Scroll Compressor
- Intelligent Monitoring System
- Building Automation System

ACCESSORIES:

- Expansion tank
- Water pump
- Ducted blower
- Air handling unit

■ Size and Weight :

- Dimension : approx. 6,000 x 6,000 x 3,000 mm (LWH)
- Weight : 300 kg
- Power Supply : 415VAC / 32A / 3-phase, 50Hz

CENTRIFUGAL FAN AND AIR DUCTING TRAINER

Model: C3271

INTRODUCTION: Model C3271 Centrifugal Fan and Air Ducting Trainer is custom designed to meet the hands-on practical exercise comply to TVET program as well as the theory study of the subject. Model C3271 consists of ducting fitted with various air conditioning components. Airflow is generated by an axial flow fan and in the airflow, heaters, cooling coil and steam humidifier connection is provided.

FEATURES

- Equipment parts are made with corrosion proof plastic, stainless steel, galvanised steel, brass or copper.

Extensive range of experiments on refrigeration system studies:

- Demonstration of the processes and components used in heating, cooling, humidification and de-humidification of an airstream.
- Mass and energy balance across each process resulting in heating, cooling and humidity change using the instrumentation fitted.
- Determination of a complete refrigeration cycle diagram for the air-cooling plant plus an energy balance with different air flow across evaporator.

SPECIFICATIONS: A) REFRIGERATION UNIT

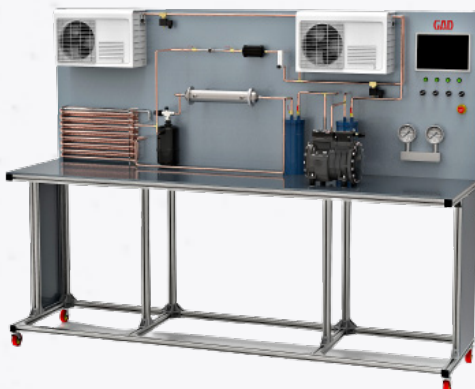
- Hermetic compressor, Condenser and Receiver
- Expansion valve, Filter/drier
- Temperature sensor (RTD Pt100)
- High/Low pressure control circuit
- High pressure line and low pressure line

B) RECIRCULATION SYSTEM

- Centrifugal Fan
- Pre-heater system
- Evaporator
- Steam Generator
- Temperature/Relative Humidity sensor



- Copper steam injection pipe system
- Clean tube heat transfer element (Heat Exchanger)
- Electrical resistant graded for heating comes with controller



SPECIFICATIONS:

- Semi-hermetic compressor (1HP), (1.5HP), (2HP)
- Flow Meter
- Evaporator
- Shell-in-tube condenser
- Tube-in-tube condenser
- Crankcase pressure
- Evaporator pressure regulator
- AXV automatic expansion device

INDUSTRIAL REFRIGERATION TRAINER

Model: C3281

INTRODUCTION: Industrial refrigeration can be defined as the order from the factory to provide cooling for the large-scale processes. In this book, the definition is limited to processes other than air conditioning or food and beverages. These falls within a more General definition of industrial refrigeration, but are covered elsewhere.

FEATURES

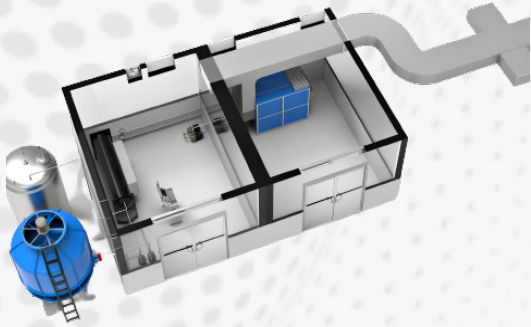
Model C3281 demonstrates a complete industrial refrigeration demonstration unit. It enables students to learn the principles of industrial refrigeration systems. The trainer is a self-contained and freestanding with unit. The compressor is interchangeable between open type and semi-hermetic type. The unit consists of crankcase heater with automatic control system. There are two air evaporators with defrost mechanisms. They are integrated with solenoid valves, timers and associated equipment. There are also two standard types of water-cooled condensers; tube-in-tube and shell-in-tube.

Size and Weight

- Dimension : approx. 2,500 x 650 x 1,890 mm (LWH)
- Weight : 100 kg

C) THERMODYNAMIC (HVAC SYSTEM)

30 TON WATER COOLED CHILLER SYSTEM WITH IR4.0 Model: C3301



INTRODUCTION: Model C3301 Water Cooled Chiller System offers the cooling capacity as well as functionality demonstration for training purposes. The chiller has cooling capacity of 30 tonne refrigeration (TR) and integrates with cooling tower and AHU. The whole refrigeration system is connected to Supervisory Control and Data Acquisition (SCADA) system. SCADA system is installed in a computer from the workstation. End user can manipulate the data from the SCADA system and record the readings to export to Excel.

FEATURES

Model C3301 Water Cooled Chiller System is also equipped with **Augmented Reality (AR)** for free of charge. AR allows end user to see the whole equipment in their smart phone. Internal parts of chiller and AHU can be seen with using AR technology.

SPECIFICATIONS:

- Fully instrumented Chiller System (capacity: 30 tonne)
- Fully Instrumented AHU System
- Air Ducting Distribution System
- Cooling Tower and water piping system
- Water Storage Tank
- Cooling Tower and water piping system
- Water Storage Tank
- Local Control Panel:
 - i) Control System (Siemens PLC)
 - ii) SCADA System
 - iii) IOT Gateway for IR4.0.

AIR-CONDITIONING MONITORING SYSTEM WITH IR4.0 Model: C3311

INTRODUCTION: Model C3311 Air-Conditioning Monitoring System offers the complete demonstration of a simple air conditioning unit connected with IoT. All variables such as temperatures and pressures can be detected from our sensors. The signals can be showcased on how the IoT works. Students can access the data from any smart devices such as phones or tablets with the access of internet.

FEATURES

- Automated monitoring of system status
- Control and regulation functions for customers and specialists
- A range of access options (app, browser, tablet)
- Structured and user-dependent data processing
- Provision of device-specific performance indicators for end customers
- Alarm notification in the event of errors or required maintenance
- Maintenance and service functions for engineers

SPECIFICATIONS:

- Two (2) compatible Air Conditioner unit 2.5 HP with the system and interface and with IR receiver. Capacity BTU/h = Approx. 23,000 - 25,000
- Heat exchanger inner unit
- valve
- suction line receiver

- Compressor
- Reversing valve
- **Size and Weight :**
 - Overall space : approx. 2,076 x 1,500 x 1,800 mm (LWH)
 - Total weight : approx. 70 kg
- **Power Supply** : 240 VAC / 1-phase, 13A/50Hz



SPECIFICATIONS:

- Industrial standard AHU unit
- Local Control Panel
- Augmented Reality (AR) software package
- **Size and Weight :**
 - Dimension** : approx. 1,800 x 990 x 1,600 mm (LWH)
 - Weight** : 70 kg
- **Power Supply:** 415VAC / 32A / 3-phase, 50Hz

CENTER STATION AHU TRAINER

Model: C3321

INTRODUCTION: A complete AHU does not complete without cooling coil. Cooling coil is used to cool and dehumidify the air. Both direct expansion cooling and chilled water cooling coils are available for use depending on the system design. These coils are arranged in rows with different fin spacing. Aluminium fins and copper tubes are used in the design of the coils. The corrosion resistance hydrophilic fins are used due to its lower cost and lower resistance to the air velocity.

FEATURES

- Model C3321 is custom designed to study the AHU working principle, AHU operation, performance of AHU and AHU maintenance
- Model C3321 demonstrates a complete air handling unit. Students can study different parts of an air handling unit such as housing, fan, cooling coil, filter, humidifier and mixing box. Each of these components have their own functionality. Students can observe the working components.

C) THERMODYNAMIC (HVAC SYSTEM)



FLOOR STANDING AIR-CONDITIONING TRAINER

Model: C3331

INTRODUCTION: There are many types of air conditioners in the market. One of the common air conditioners is packaged air conditioner. The window and split air conditioners are usually used for the small air conditioning capacities up to 5 tons. The central air conditioning systems are used for where the cooling loads extend beyond 20 tons. The packaged air conditioners are used for the cooling capacities in between these two extremes.

FEATURES

Model C3331 Floor Standing Air-Conditioning Trainer demonstrates a complete air-cooled packaged air conditioner. Students can study the functionalities of the air-cooled packaged air conditioner. Students can also observe the connectivity between air-cooled packaged air conditioner and GI ducting. There are also four main types of GI ducting such as linear, square, round and double deflection diffuser.

SPECIFICATIONS: Floor Standing Air Conditioner

- i. Total cooling capacity : 29,000
- ii. Total input power : 2900 Watt
- iii. Running current : 13.0 – 13.5 A
- iv. EER : Approx. 9 - 10 Btu/hr/W

■ Size and Weight :

- Dimension (Indoor) : approx. 1850 x 600 x 270 (HWD)
- Dimension (Outdoor) : approx. 753 x 866 x 328 (HWD)
- Weight (Indoor) : approx. 51 kg
- Weight (Outdoor) : approx. 105 kg

WATER COOLED PACKAGED AIR-CONDITIONING FLOOR STANDING Model: C3341

INTRODUCTION: There are two main types of packaged air conditioners, mainly air-cooled and water-cooled. The main difference is the condenser is either using air to cool or water to cool in the system. In the packaged units with the water-cooled condenser, the compressor is located at the bottom along with the condenser.

FEATURES

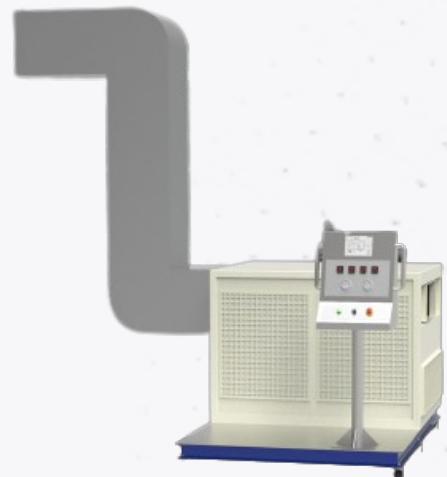
Model C3341 WATER COOLED PACKAGED AIR-CONDITIONING FLOOR STANDING demonstrates a complete water-cooled packaged air conditioner. Students can study the functionalities of the water-cooled packaged air conditioner. Students can also observe the connectivity between water-cooled packaged air conditioner and GI ducting. There are also four main types of GI ducting such as linear, square, round and double deflection diffuser.

SPECIFICATIONS: Floor Standing Air Conditioner

- i. Total cooling capacity : 29,000
- ii. Total input power : 2900 Watt
- iii. Running current : 13.0 – 13.5 A
- iv. EER : Approx. 9 - 10 Btu/hr/W
- v. Compressor type : Scroll
- vi. Refrigerant type : R22/R407
- vii. Approx. operating weight : 970 – 975 Lbs

■ Cooling tower:

- Strainer
- Water pump
- Gate valve in/out
- Thermometer gauge in/out
- Water pressure gauge in/out
- Check valve in/out
- Fan motor
- Fan blade



AIR COOLED PACKAGED AIR-CONDITIONING FLOOR STANDING Model: C3351

INTRODUCTION: There are two main types of packaged air conditioners, mainly air-cooled and water-cooled. The main difference is the condenser is either using air to cool or water to cool in the system. In the packaged units with the air-cooled condenser, the condenser of the refrigeration system is cooled by atmospheric air

FEATURES

Model C3351 AIR COOLED PACKAGED AIR-CONDITIONING FLOOR STANDING demonstrates a complete air-cooled packaged air conditioner. Students can study the functionalities of the air-cooled packaged air conditioner. Students can also observe the connectivity between air-cooled packaged air conditioner and GI ducting. There are also four main types of GI ducting such as linear, square, round and double deflection diffuser.



SPECIFICATIONS: Air-Cooled Packaged Air Conditioner

- i. Total cooling capacity : 55,000
- ii. Total input power : 5490 Watt
- iii. Running current : 9.0 – 9.5 A
- iv. EER : 10 -10.1 Btu/hr/W

C) THERMODYNAMIC (HVAC SYSTEM)

HVAC AND MINI CHILLER SYSTEM

Model: C3361

INTRODUCTION: Chillers are an evitable equipment of a Heating, Ventilation and Cooling (HVAC) system. It removes heat from the air of surroundings using refrigerant. In general, chillers can be classified into two types; air-cooled chiller and water-cooled chiller. Both chillers have the same functionality, which are for cooling the designated area. The chillers usually work with air handling unit (AHU) to deliver the coldness to the designated area. For air-cooled chiller, air is used to cool the hot refrigerant in the condenser and the cooled refrigerant removes heat from water in evaporator to produce chilled water. Chilled water is then pumped to AHU to provide cooling effect to the designated area.

In conventional water-cooled chiller, air is replaced with water to cool the hot refrigerant in the condenser. Therefore, water-cooled chiller is usually associated with an additional cooling tower. Cooling tower will be located at outdoor and it can produce cooled water for the usage in the condenser in water-cooled chiller. In the meanwhile, AHU accepts the chilled water from water-cooled chiller and chilled water will cool the air in the AHU. Once air is cooled, AHU will distribute it throughout the building.

SPECIFICATIONS:

- [A] AHU (Air Handling Unit)
- [B] FCU (Fan Coil Unit)
- [C] Cooling Tower
- [D] Mini Chiller
- [E] Water tank
- [F] Air ducting
- [G] PLC control system
- [H] SCADA workstation for HMI monitoring in real time

- | AHU Technical data | | AHU Technical data | |
|--------------------|----------|--------------------|-----|
| Nominal Ratings | | Blower | |
| Cooling (BTU/h) | : 24,000 | Diameter (in.) | :10 |
| Electric Heat (kW) | : 5 | Width (in.) | : 6 |

WINDOW TYPE AIR-CONDITIONING TRAINER

Model: C3371

INTRODUCTION:

Window air conditioner is sometimes referred to as room air conditioner as well. It is the simplest form of an air conditioning system and is mounted on windows or walls. It is a single unit that is assembled in a casing where all the components are located.

This refrigeration unit has a double shaft fan motor with fans mounted on both sides of the motor. One at the evaporator side and the other at the condenser side.

SPECIFICATIONS: Air conditioner

- Cooling Capacity (Btu/h): 12000
- EER (Btu/h/w) : 10.24
- Indoor Side Air Flow (cubic meter/h) : 430/340
- Indoor Side Air Flow (cfm) : 253/200
- Indoor Side Sound Level (dB(A)) : 50/46
- Outdoor Side Sound Level (dB(A)) : 59/54

Power meter

- Display Type : LCD
- Number of Digits : 4
- Measurement Range: 50mA – 90A

Voltmeter

- Current Type: DC
- Cutout Size : 37.5 (Dia.) mm
- Maximum Display Value: 30V
- Depth : 23mm
- Meter Type : Moving Coil

Compressor

- Type : Refrigeration Compressor

Sensors

- Condenser Coil Temperature sensor
- Hot gas temperature sensor
- Liquid temperature sensor
- Evaporator Coil Temperature sensor
- Suction temperature sensor



SPECIFICATIONS:

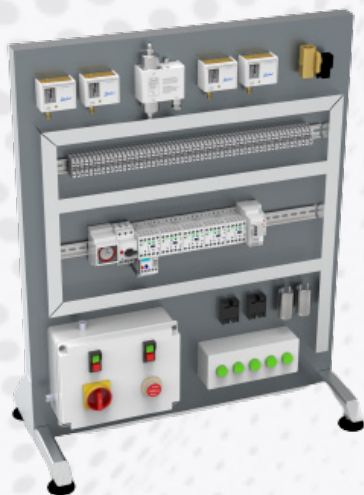
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|--------------------|---------------------|------------------------------|
| ■ [A] Refrigerator | ■ [D] Ammeter | ■ [H] Hot Pressure Gauge |
| ■ [B] Power Meter | ■ [E] Power Control | ■ [I] Suction Pressure Gauge |
| ■ [C] Voltmeter | ■ [F] Compressor | |
| | ■ [G] Sensors | |

DOUBLE DOOR REFRIGERATION FREEZER

TRAINER Model: C3381

INTRODUCTION: A refrigerator (colloquially fridge) consists of a thermally insulated compartment and a heat pump (mechanical, electronic or chemical) that transfers heat from its inside to its external environment so that its inside is cooled to a temperature below the room temperature. Refrigeration is an essential food storage technique in developed countries. The lower temperature lowers the reproduction rate of bacteria, so the refrigerator reduces the rate of spoilage. A refrigerator maintains a temperature a few degrees above the freezing point of water. Optimum temperature range for perishable food storage is 3 to 5 °C. A similar device that maintains a temperature below the freezing point of water is called a freezer. The refrigerator replaced the icebox, which had been a common household appliance for almost a century and a half.

C) THERMODYNAMIC (HVAC SYSTEM)



Accessories:

- Solenoid Valve
- Lamps

ELECTRICAL INSTALLATION IN REFRIGERATION SYSTEM Model: C3391

INTRODUCTION:

A refrigeration system contains of many electrical components such as pressure switch, thermostats, timer, circuit breakers, contactors, relays and capacitors. This refrigeration wiring skills trainer is designed to show the wiring of the refrigeration system so the trainees are able to learn about the fundamentals of the refrigeration system such as planning and designing of the wiring.

SPECIFICATIONS:

- High Pressure Switch
- Low Pressure Switch
- Differential Pressure Switch
- Thermostat
- Timer
- Bimetallic Circuit Breaker
- 3NO/1NC Contactors
- Size and Weight :

Dimension : approx. 820 x 420 x 1,010 mm (LWH)

Weight : 50 kg

- Circuit Breaker with Start-up Current Limiter
- Adjustable Pressure Relay
- Thermistor Circuit Breaker
- 4NO Contactors
- Electromagnetic Start-up Relay
- PTC Start-Up Relay
- Time Relay
- Start-up Capacitor

VORTEX COOLING DEVICE

Model: C3401

INTRODUCTION: A vortex tube creates cold air and hot air by forcing compressed air through a generation chamber, which spins the air at a high rate of speed (1,000,000 rpm) into a vortex. The high speed air heats up as it spins along the inner walls of the tube toward the control valve. A percentage of the hot, high speed air is permitted to exit at the valve.

FEATURES

1. Functional model for cold air generation using a vortex cooling device (vortex tube) with the aid of compressed air
2. Experimental unit with clear design of all components at the front
3. Simple design, no moving components, wear-free
4. Measuring of the compressed air inlet pressure by manometer
5. Flow rate measurement of compressed air and exhaust hot air by rotameters
6. Digital displays for inlet temperature and outlet temperature of cold and hot air

SPECIFICATIONS: Vortex cooling device

- Inlet Pressure : 5,5bar
- Air Consumption : Max. 420L/min
- Refrigeration Capacity : Max. 267W (230kcal/h)
- Minimum Temperature : -40°C
- Maximum Temperature : 110°C

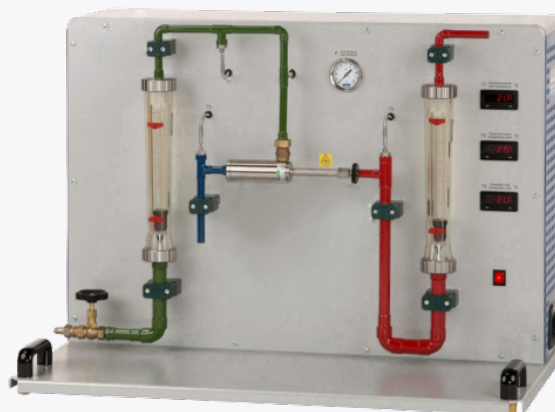
SPECIFICATIONS:

Air Compressor

- Compressor : min. 6bar, 25m3/h

Measuring ranges

- Temperature : 3x -50...150°C
- Pressure : 0...10bar
- Flow Rate : 2x 2...25m3/h



SPECIFICATIONS:

- Refrigeration Chamber
- Freezing Chamber
- Fault indication
- Display and controls with process schematic
- Valve
- Manometer
- Pressure Switch
- Heat Exchanger
- Compressor
- Condenser (includes fan) values
- Receiver
- Evaporation pressure controller

REFRIGERATION SYSTEM WITH REFRIGERATION AND FREEZING CHAMBER Model: C3411

INTRODUCTION: The objective of the Refrigeration System with Refrigeration and Freezing Chamber designed by GAD is to introduce the student into the complex world of refrigeration systems, as well as to study and determine the characteristic operation parameters of the unit in function of the environmental demands (heat, temperature, refrigeration, etc.). It is a unit designed to study a refrigeration system with two different chambers at different temperatures.

FEATURES

- [1] investigation of a refrigeration system with refrigeration and freezing chambers
- [2] refrigeration circuit with compressor, condenser and 2 evaporators with thermostatic expansion valve and evaporation pressure controller
- [3] insulated freezing chamber with fan and electric defrost heater
- [4] insulated refrigeration chamber with evaporation pressure controller
- [5] heat exchanger for refrigerant supercooling
- [6] refrigerant mass flow rate calculated in the software from recorded measured values
- [7] simulation of 18 faults

C) THERMODYNAMIC (HVAC SYSTEM)



REFRIGERATION COMPRESSOR TRAINING

EQUIPMENT Model: C3431

INTRODUCTION: The setup of **Model C3431 Refrigeration Compressor Training System** represents a typical refrigeration circuit consisting of a hermetic compressor, condenser, evaporator and expansion element. Evaporator and condenser are designed as finned tube heat exchangers. The pipes of both heat exchangers are partially transparent to visualise the process of the phase transition during evaporation and condensing.

EXPERIMENTAL CAPABILITIES:

- Investigation of a refrigeration system with different expansion elements
- Refrigeration circuit consisting of a hermetic compressor, condenser, evaporator and expansion element
- Transparent finned tube heat exchangers as condenser and evaporator to observe the phase transitions of the refrigerant
- Expansion valve and capillary tubes of different lengths as expansion elements
- Receiver for underfilling/overfilling the system with refrigerant
- sensors record pressure, temperature, and flow rate
- Compressor equipped with two pressure switches

SPECIFICATIONS:

- | | | |
|-----------------------|---------------------------|---|
| ■ Local Control Panel | ■ Thermal Expansion Valve | ■ Size and Weight : |
| ■ Compressor | ■ Oil Filter | Dimension : 1400 x 732 x 1,690 mm (LWH) |
| ■ Condenser | ■ Refrigerant Flow Meter | Weight : 110 kg |
| ■ Evaporator | ■ Temperature Sensor | ■ Power Supply: 240 VAC / 1-phase, 13A/50Hz |

REFRIGERATION SELF-ASSEMBLY TRAINING

EQUIPMENT Model: C3441

INTRODUCTION: **Model C3441 Refrigerator Self Assembly Training**

Equipment is an air conditioning system that consists out of two separate units; the air-cooled condensing unit and the air handling unit. The air handling unit is installed in the air conditioned room itself, whereas the condensing unit is installed either in the engine room or other mechanical space. The condensing unit can be mounted outside as well. The two units are connected by insulated refrigerant lines.

EXPERIMENTAL CAPABILITIES:

- The cutting, bending, and expanding of pipe
- Install the pipeline into right location
- Refrigerator pressure maintaining and leak hunting
- Estimate the winding of compressor
- System circuit laying and connection
- Refrigerator system vacuuming
- Refrigerator system refrigerating fluid filling

SPECIFICATIONS:

- | | | |
|-----------------------|----------------------------|---|
| ■ Compressor | ■ Isolator Switch | ■ Size and Weight : |
| ■ High Pressure Gauge | ■ Vacuum Pump | Dimension : 900 x 600 x 559mm (LWH) |
| ■ Low Pressure Gauge | ■ Condenser | Weight : 45kg |
| ■ Hand Valve | ■ Evaporator Coil with Fan | ■ Power Supply: 240 VAC / 1-phase, 13A/50Hz |
| ■ Copper Bender | | |
| ■ Copper Tubing | | |
| ■ Clamp Meter | | |



SPECIFICATIONS:

- | | | |
|---------------------|---------------------------|---|
| ■ Structure | ■ External Multimeter | ■ Power Supply: 240 VAC / 1-phase, 13A/50Hz |
| ■ Compressor | ■ Fault Simulation System | |
| ■ Refrigerant, R-22 | ■ Safety Features | |
| | ■ Circuit Diagram | |

COMPRESSOR FAULT SIMULATOR TRAINER

Model: C3461

INTRODUCTION: The objective of the Model C3461 Compressor Fault Simulator designed by GAD is to introduce the student into the complex world of refrigeration systems, as well as to study and determine the characteristic operation parameters of the unit in function of the environmental demands (heat, temperature, refrigeration, etc.).

FEATURES

- [1] Familiarisation with the electrical connections on a refrigerant compressor
- [2] Familiarisation with electrical circuit diagrams
- [3] Function and operating behaviour of electrical components
- [4] Finding and identifying 15 different faults measurements on component, some at mains voltage
- [5] Can be upgraded and connected with **Data Acquisition System, SCADA**
- [6] Compatible to integrate with **IR4.0 features such as IoT and AR**