



Republic of the Philippines

Department of Education

DepEd Complex, Meralco Avenue, Pasig City

STRENGTHENED SENIOR HIGH SCHOOL CURRICULUM

COMMERCIAL AIR-CONDITIONING INSTALLATION AND SERVICING

Grade 12

Course Description:

This course is designed to equip learners with essential skills for servicing refrigeration and air conditioning units. It focuses on installing, maintaining, troubleshooting, and commissioning commercial refrigeration and air conditioning units. Upon completion, learners will be eligible to take assessments to earn National Certificate level III in Commercial Air-Conditioning Installation and Servicing, higher education, and careers in the HVAC industry sector.

Elective: Technical Professional

Prerequisite: Domestic Refrigeration and Air-Conditioning Servicing

Time Allotment: 320 hours for one semester, 16 hours per week

Schedule: First/Second Semester

QUARTER 1

CONTENT STANDARD	The learner understands the concepts and principles of the Commercial Air-Conditioning unit	
PERFORMANCE STANDARD	The learner performs the installation of the Commercial Air-Conditioning unit with safety precautions.	
LEARNING COMPETENCIES	CONTENT	
1. Perform pre-installation procedure for the commercial air-conditioning units	Pre-installation procedure for commercial air-conditioning units <ul style="list-style-type: none"> • Survey site <ul style="list-style-type: none"> ○ Room size and layout ○ Heat load ○ Air flow and ventilation ○ Drainage ○ Insulation ○ Power supply ○ Structural and architectural ○ Maintenance access ○ Codes and permits • Electrical requirements <ul style="list-style-type: none"> ○ Plans and layout ○ Devices (NEMA) ○ Conductors 	

	<ul style="list-style-type: none"> ○ Specifications *Following PEC ● Preparation of tools, equipment, and materials <ul style="list-style-type: none"> ○ Fastener ○ Hand tool and power tool ○ Welding equipment ○ Marking spirit level /water level tool ○ Sealant and insulation ○ Types of PVC drainpipes ○ Types of PVC fittings/accessories ● Bill of materials
<p>2. Perform installation of commercial air-conditioning units</p>	<p>Installation of commercial air-conditioning units</p> <ul style="list-style-type: none"> ● Identification of air-conditioning units <ul style="list-style-type: none"> ○ Types ○ Specs ● Cavity works <ul style="list-style-type: none"> ○ Layout ○ Execution ● Installation of mounting support <ul style="list-style-type: none"> ○ Frames ○ Bracket ● Positioning and aligning methods ● Electrical installation ● Application of insulation material <ul style="list-style-type: none"> ○ Types ○ Specs ● Installation of condensate drain <ul style="list-style-type: none"> ○ Positioning ○ Specs ● Performance test of air conditioning unit <ul style="list-style-type: none"> ○ power source requirements ○ insulation resistance ○ pressure and temperature ○ amperage

	<ul style="list-style-type: none"> ○ air velocity ○ sound and vibration ○ leak test ○ calibration and adjustment ● Service costing and documentation <p><i>*Following Occupational Health and Safety(OHS)</i></p>
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QUARTER 2

CONTENT STANDARD	The learner understands the concepts and principles of the Commercial Air-Conditioning unit
PERFORMANCE STANDARD	The learner performs maintenance, troubleshooting, and commissioning Commercial Air-Conditioning units with safety precautions.
LEARNING COMPETENCIES	CONTENT
1. Perform service and maintenance of the commercial air-conditioning units	Service and maintenance of the commercial air-conditioning units Cleaning procedure of the air filter <ul style="list-style-type: none"> ● Types ● Specs ● Restricted airflow effects Cleaning methods of the mechanical system <ul style="list-style-type: none"> ● Tools and equipment ● Assembling and disassembling ● Cleaning chemical agents <ul style="list-style-type: none"> ○ Types ○ Specs ○ Application ● Kink and dent effects Maintenance methods of the fan motor <ul style="list-style-type: none"> ● Types ● Operation ● Voltage requirements ● Fan blade/blower

	<ul style="list-style-type: none"> ○ Types ○ Specs • Mounting support • Lubrication <p>Maintenance of service power</p> <ul style="list-style-type: none"> • Electrical controls/devices • Circuit connections • Power source • Insulation resistance <p>Service costing and documentation</p> <p><i>*Following Occupational Health and Safety(OHS)</i></p>
<p>2. Discuss pre-troubleshooting of commercial air-conditioning units</p>	<p>Pre-troubleshooting of commercial air conditioning units</p> <ul style="list-style-type: none"> • Principles and concepts • Occupational Health and Safety (OHS) • System specification <p>Tools and Equipment</p>
<p>3. Perform troubleshooting of commercial air-conditioning units</p>	<p>Troubleshooting of commercial air-condition units</p> <ul style="list-style-type: none"> • Schematic wiring diagrams, signs, charts, and symbols • Parameters <ul style="list-style-type: none"> ○ Electrical ○ Mechanical • Electrical and mechanical components • Troubleshooting and diagnosis <ul style="list-style-type: none"> ○ Testing mechanical system ○ Testing electrical system • Faults and problems • Error Codes • Control systems <ul style="list-style-type: none"> ○ Types ○ Specs • Remedy procedure • Recovery/Recycling of refrigerants <ul style="list-style-type: none"> ○ Types

	<ul style="list-style-type: none"> ○ Specs • System reprocesses • Testing of repaired units • Code of Practice for RAC
4. Perform commissioning of commercial air conditioning units	<p>Commissioning of commercial air conditioning units</p> <ul style="list-style-type: none"> • Commissioning checklist • Testing of parameters <ul style="list-style-type: none"> ○ Pressure ○ Current ○ Temperature ○ Air velocity • Manufacturer's manual • Start-up and commissioning • Service costing and documentation

GLOSSARY

British Thermal Unit (BTU) is a unit of energy used to measure heat. It represents the amount of heat required to raise the temperature of one pound of water by one degree Fahrenheit. BTUs are commonly used in the heating, cooling, and energy industries.

Compressor is a pump of a refrigerating mechanism that draws a low pressure on the cooling side of the refrigerant cycle and squeezes or compresses the gas into the high-pressure or condensing side of the cycle.

Condenser is the part of the refrigeration mechanism that receives hot, high-pressure refrigerant gas from the compressor and cools gaseous refrigerant until it returns to its liquid state.

Evaporator is a part of a refrigerating mechanism in which the refrigerant vaporizes and absorbs heat

Heating Ventilating and Air Conditioning (HVAC)

Latent Heat is heating energy absorbed in the process of changing the form of a substance (melting, vaporization, fusion) without change in temperature

Metering device is a component that regulates the flow of refrigerant by throttling the gas in an appropriate amount from high-pressure liquid into low-pressure liquid refrigerant gas

Methods of Heat Transfer refer to radiation, conduction, convection, or a combination of these three methods. It is the movement of heat from one body or substance to another

Refrigerants are a substance used in refrigerating mechanisms. It absorbs heat in an evaporator by changing of state from a liquid to a gas, and releases its heat in a condenser as the substance returns from the gaseous state back to a liquid state

Refrigeration Cycle is the process used in cooling systems to transfer heat from a lower-temperature space to a higher-temperature space. It involves four main stages: compression, condensation, expansion, and evaporation, where a refrigerant absorbs and releases heat to cool the desired area.

The Seasonal Energy Efficiency Ratio (SEER) measures the cooling efficiency of air conditioners and heat pumps. It is calculated by dividing the total cooling output (in BTUs) by the total energy consumed (in watt-hours) over a typical cooling season. A higher SEER indicates better energy efficiency.

Sensible Heat is heat that causes a change in the temperature of a substance

Subcooling is the cooling of liquid refrigerant below its condensing temperature

Superheat is the temperature of vapor above its boiling temperature as a liquid at the pressure. This is the difference between the temperature at the evaporator outlet and the lower temperature of the refrigerant evaporating in the evaporator

Thermostat is a device that senses ambient temperature conditions and, in turn, acts to control a circuit

Ton of refrigeration is a refrigerating effect equal to the melting of 1 ton of ice in 24 hours. This may be expressed as follows: 288,000 Btu/24 hr., 12,000 Btu/hr., 200 Btu/min.

TOOLS	MATERIALS	EQUIPMENT
Flaring tool	Copper tube 1/2", 5/8", 1/4 ", 3/8", 5/16", 1/2, 1/8, 3/16, "OD, 50 ft. per roll	Vacuum pump motor, two stage, 1/2 HP , 220 volts
Swaging tool	Aluminum tube, 3/8 "OD, 100 ft. per roll	Recovery/ Recycling unit, portable type, 220 volts
Tube cutter	Capillary tube 1/16, OD, 100 ft. per roll	Oxy- Acetylene welding machine w/ complete outfit
Tube bender (lever type), 5/8	Silver rod	Recovery Cylinder 20 kg
Tube bender (lever type), 1/2	Aluminum rod	Refrigerator , single door 5 cu. Ft. 220 volts
Tube bender (lever type), 5/16	Silver flux	Refrigerator , two door no frost, 6 cu. Ft. 220 volts
Tube bender (lever type), 3/8	Filter drier, 1/4 "OD flared connection	Freezer chest type, 10 cu Ft. 220 volts
Tube bender (lever type), 1/4	Filter drier, 1/4 "OD solder connection	Freezer, upright 6 cu. Ft. 220 volts
Tube bender (spring type)	Flare cap, 1/4 " OD	Water dispenser 220 volts
Service cylinder, 2.5 kg. Capacity	Flare union, 1/4 " OD	Digital Clamp meter
Service cylinder, 10 kg. Capacity	Flare plug, 1/4 "OD	Analog clamp meter
Electrical pliers	Refrigerant 134a	Window type aircon 1 hp 220 volts, non-inverter type
Pliers, long nose	Refrigerant 22	Window type aircon 1 hp 220 volts, inverter type
Pliers, diagonal	R-410A	Air compressor, complete w/ accessories 220 volts, 60 Hz
Capillary tube cutter	R-32	Compressor motor 100 watts, 220 volts, 60 Hz
Screw driver, flat	R-600a	Electric drill portable, 3/8, 220 volts, 60 Hz
Screw driver Philips	Nitrogen gas	Pedestal grinding machine, 220 volts, 60 Hz
Flat files, fine	Oxygen	Portable grinding machine, 220 volts, 60 HZ
Allen wrench, metric	Acetylene gas	Air blower (portable), 220 volts, 60 Hz

Allen wrench, English	Dual capacitor 25, 30, 35 mfd 370 vac	Arc welding machine, AC max. 50 amps. 220 V, 60 Hz
Adjustable wrench 8"	Fan capacitor ,3, 4, 5, 6, 7, mfd 220 vac	Gauge manifold and hoses w/ ball valves, R-410A / R-32
Adjustable wrench 10"	Starting capacitor 60, 80, 100-105 mfd 220 volts	Gauge manifold and hoses w/ ball valves, R-22 / R-134a
Open wrench, metric	Potential relay 1, 1.5 2 hp 220 volts	Digital Volt ohm milli-ammeter
Open wrench, English	Overload protector 1/6 ,1/8, 1/10 , 1/5, 1.5 2hp 220 volts	Electronic leak detector (Fluorine based)
Box wrench	Current relay 1/5, 1/6, 1/8 , 1/10, hp 220 volts	Electronic leak detector (Hydrocarbon based)
Socket wrench	Soldering lead	Digital Thermometer
Ratchet wrench (service valve)	Potential relay 1, 1.5 2 hp 220 volts	Nitrogen regulator
Vise grip, 8"	Polyethylene tape	Vacuum meter
Ballpen hammer, 8 oz	Rubber insulation foam: 1/2", 5/8", 1/4 " , 3/8", 5/16", 1/2, 1/8, 3/16, "OD, 8 ft. per roll	Refrigerant identifier
Rubber mallet	Circuit breaker: 15 Amp, 20Amp, 25 amp, 30 Amp	Weighing scale, digital
Hack saw, standard size	Thhn Wire: 14, 12, 10 AWG (Stranded)	
Steel rule, metric & English, 12"	Circuit Breaker enclosure (NEMA)	
Push rule, 15 meters	PVC: 1/2 & 3/4	
L – square, 12"	Flexible Hose: 1/2	
Pinch off tool	Dyna bolt: #6	
Soldering iron, 100w , 220 volts	Mounting bracket (condenser unit)	
Aviation snip, straight	Electrical Tape	
	Silicon sealant	

REFERENCE

- Althouse, R., Turnquist, C., & Bracciano, A. (2000). *Modern refrigeration and air conditioning*. 11th ed. Delmar Cengage Learning.
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- Ebonite, RS.(2016)*Domestic Refrigeration and Air Conditioning Servicing*. Volume I.1st ed. Rex Bookstore.
- Ebonite, RS.(2017)*Domestic Refrigeration and Air Conditioning Servicing*. Volume II. 2nd ed. Rex Bookstore.
- Department of Environment and Natural Resources (DENR), Environmental Management Bureau (EMB), & Pollution Control Division (POD). (2013). *Code of practice for refrigeration and air conditioning (Philippine setting, revised edition)*. DENR-EMB-POD.
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