Strengthened Senior High School

DepED
DEPARTMENT OF EDUCATION

Lesson Exemplars for Domestic Refrigeration and Air-Conditioning Servicing

TECH-PRO ELECTIVE



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LESSON EXEMPLAR			
Learning Area	DOMESTIC REFRIGERATION AND AIR-CONDITIONING SERVICING	**Grade Level**	**11**
Term	SECOND	**Lesson Exemplar**	**1**

I. OBJECTIVES	
A. Content Standard	The learner understands the concepts and principles of maintaining domestic refrigeration and window-type air-conditioning units.
B. Performance Standard	The learner performs the maintenance of domestic refrigeration and window-type air-conditioning units with safety precautions.
C. Learning Competencies	Perform maintenance of window-type air-conditioning units (Cleaning procedure of the air filter - Types, Specs, Restricted airflow effects.
II. REFERENCES and MATERIALS	• **References:** TESDA TR - DRAC NC II Unit of Competency: Maintain Window-Type Air Conditioning Units; Manufacturer service manuals (Carrier, Kolin, LG, Panasonic); ASHRAE Handbook - HVAC Systems • **Materials:** Actual window-type AC unit (for demonstration), different types of air filters (washable foam, electrostatic, carbon, HEPA), dirty filter sample, clean filter sample, vacuum cleaner, soft brush, mild detergent, water hose, basin, microfiber cloth, magnifying glass, flashlight • **Tech Integration:** Time-lapse video showing airflow reduction from dirty filter, YouTube "How to Clean Window AC Filter - Step by Step", digital checklist app (Google Forms), QR code linking to manufacturer filter specs
III. CONTENT	**Title:** Maintenance of Window-Type AC - Air Filter Cleaning **Sub-topics:** 1. Types of air filters used in window-type AC (Foam, Mesh, Electrostatic, Carbon, HEPA) 2. Filter specifications (Size, MERV rating, washable vs. disposable)

	3. Effects of restricted airflow (Frozen evaporator, reduced cooling, high electric bill, compressor damage) 4. Step-by-step filter cleaning procedure 5. How often to clean filters (Frequency schedule) Safety precautions when cleaning filters	
IV. OBJECTIVES	At the end of the lesson, learners should be able to: 1. **Identify** at least three types of air filters used in window-type ACs. 2. **Explain** what happens to an AC when the air filter is clogged. 3. **Demonstrate** the proper procedure for removing, cleaning, and reinstalling a washable air filter. 4. **Differentiate** between washable and disposable filters. 5. **Determine** the correct cleaning frequency based on usage conditions. 6. **Follow** safety precautions (unplugging unit, handling wet components).	
V. PROCEDURES		**ANNOTATIONS**
A. Activating Prior Knowledge	**1. Activating Prior Knowledge** **Activating Prior Knowledge (5 mins)** • **Teacher Says:** "Good morning, class! Let me ask you a simple question. Who here has ever cleaned the air filter of their air conditioner at home? Raise your hand." *The teacher pauses.*	**Facilitation:** Count hands. Most students likely have NOT cleaned filters. **Rationale:** Reveals the gap between awareness and practice. Creates a "teachable moment."

	Teacher Says: "For those who raised hands—how often do you clean it? For those who didn't—what do you think happens if you NEVER clean the filter?" (Call 2-3 students.) **Teacher Says:** "Today, I will show you why a dirty air filter is the #1 cause of 'mahina ang lamig' complaints. And the best part? Cleaning it takes only 10 minutes, requires almost no tools, and can save your customer thousands of pesos on electric bills and repair costs. This is the easiest money you will make as a technician." **Teacher Says:** "I have two AC units here (or pictures). Watch this demonstration *Teacher shows:* A fan blowing through a clean filter (strong airflow). Then a fan blows through a dirty, clogged filter (weak airflow). **Teacher Says:** "What did you observe? (Airflow was blocked by the dirty filter). Now imagine your AC trying to pull air through that for months. The fan works harder; the evaporator gets too cold, ice forms, and the compressor struggles. That is what we prevent **Teacher Says:** "Now let me show you actual filters from real ACs Brand new clean foam filter Dirty filter (gray, clogged with dust, maybe mold) Disposable filter (paper/cardboard frame) Carbon filter (black, thin)	**Rationale:** Connects a simple task to customer satisfaction, energy savings, and technician income. Motivates learning. **Facilitation:** Use a clear plastic tube or vacuum demonstration. Or show time-lapse videos. **Rationale:** Visual, dramatic comparison. Students SEE the difference instantly.

B. Instituting New Knowledge	**Activating Prior Knowledge (5 mins)** **Teacher Says:** "Good morning, class! Let me ask you a simple question. Who here has ever cleaned the air filter of their air conditioner at home? Raise your hand "For those who raised hands—how often do you clean it? For those who didn't—what do you think happens if you NEVER clean the filter?" (Call 2-3 students.) **Establishing the Purpose (3 mins)** **Teacher Says:** "Today, I will show you why a dirty air filter is the #1 cause of 'mahina ang lamig' complaints. And the best part? Cleaning it takes only 10 minutes, requires almost no tools, and can save your customer thousands of pesos on electric bills and repair costs. This is the easiest money you will make as a technician. **Presenting Examples (10 mins)** **Teacher Says:** "I have two AC units here (or pictures). Watch this demonstration. *Teacher shows:* A fan blowing through a clean filter (strong airflow). Then a fan blows through a dirty, clogged filter (weak airflow). **Teacher Says:** "What did you observe? (Airflow was blocked by the dirty filter). Now imagine your AC trying to pull air through that for months. The fan works harder; the evaporator gets too cold, ice forms, and the compressor struggles. That is what we prevent.	**Facilitation:** Count hands. Most students likely have NOT cleaned filters. **Rationale:** Reveals the gap between awareness and practice. Creates "teachable moment **Rationale:** Connects a simple task to customer satisfaction, energy savings, and technician income. Motivates learning. **Facilitation:** Use a clear plastic tube or vacuum demonstration. Or show time-lapse video **Rationale:** Visual, dramatic comparison. Students SEE the difference instantly.

	Teacher Says: "Now let me show you actual filters from real ACs." *Teacher passes around:* Brand new clean foam filter Dirty filter (gray, clogged with dust, maybe mold) Carbon filter (black, thin) **Topic A: Types of Air Filters** 1. Foam/Mesh Filter (Most Common in Window-Type AC 2. Electrostatic Filter 3. Carbon Filter 4. HEPA Filter (High Efficiency Particulate Air) Topic B: Filter Specifications Effect #2: Frozen Evaporator Coils Effect #3: High Electric Bill Effect #4: Compressor Damage (Expensive Repair!) Topic D: Step-by-Step Filter Cleaning Procedure Step 1: Safety First 2.Remove the Front Grille 3. Remove the Filter 4. Inspect the Filter 5. Clean the Filter (For Washable Filters) 6. Clean the Filter Housing Area 7. Reinstall the Filter 8. Close the Grille and Test 9. Document and Educate the Customer	**Rationale: Engaging** title keeps attention.

C. Demonstrating Knowledge and Skills	**Activity: "Hands-On Filter Cleaning"** **Teacher Says:** "Now you will do it. Follow the steps I just taught you. I will observe and give feedback." *Teacher circulates, checks:* - Did they wear gloves? - Did they vacuum first? Did they use mild soap? Did they rinse thoroughly? Are they letting it dry properly? **Finding Practical Application (7 mins)** **Teacher Says:** "Scenario: You are called to a customer's house. Complaint: 'My AC is running but the room is not getting cold. It used to be cold. You check the filter. It is gray and clogged. You clean it. The customer asks, 'How much do I owe you?' What do you charge? And what do you tell the customer to prevent this problem from happening again?" *Answer:* Charge your service fee (e.g., ₱300-500). Tell the customer: "The filter was completely blocked. This prevented airflow. Your AC will cool properly now. To prevent this, clean the filter every 2 weeks. You can do it yourself—I can show you how." **Teacher Says:** "Complete this sentence: 'A dirty air filter is like _____ because _____. *Sample answers* "...a clogged nose because you cannot breathe properly." a mask with no holes because air cannot pass through a closed window because no fresh air enters	Facilitation: Divide class into 5 groups. Each group gets a dirty filter and a basin with soapy water. **Rationale:** Kinesthetic learning. Skills are built through DOING, not just listening. **Facilitation:** Discuss pricing. Typical service call + filter cleaning in the Philippines: ₱300-500. **Rationale:** Teaches customer education and preventive maintenance—good for repeat business. **Rationale:** Analogy construction deepens understanding.

	Evaluating Learning: QUIZ (10 mins) **Additional Activities (2 mins)** **Remediation:** Draw a before-and-after diagram showing airflow through a clean filter vs. a dirty filter. Label the direction of air.	
VI. ASSESSMENT	The learners' understanding will be evaluated through **written, performance-based, and oral assessments**. **EVALUATING LEARNING: QUIZ** **I. Multiple Choice (10 pts).** Encircle the letter with the best answer. 1. Which type of air filter is MOST common in standard window-type air conditioners? a) HEPA b) Carbon c) Foam/Mesh d) Fiberglass 2. What is the #1 effect of a severely clogged air filter on cooling performance? a) Louder noise b) Reduced cooling (mahina ang lamig) c) Water spraying d) Remote control stops working 3. How often should a filter be cleaned for a daily-used window-type AC? a) Everyday b) Every 2 weeks c) Every 6 months d) Once a year 4. Why should you NEVER install a wet filter back into the AC? a) It will short-circuit b) It promotes mold growth c) It will freeze immediately d) It will tear easily 5. What tool is best for removing loose dust from a filter BEFORE washing? a) Hammer b) Wire brush c) Vacuum cleaner with brush attachment d) Hair dryer 6. What does restrict airflow cause to happen on the evaporator coils? a) Overheating b) Freezing / ice buildup c) Rusting d) Compressor stops 7. Which filter type is designed to remove ODORS (smoke, cooking smells)? a) Foam b) Mesh c) Carbon d) HEPA 8. What should you do if you encounter a disposable filter that is dirty? a) Wash it with soap and water b) Replace it with a new one c) Shake it and reinstall d) Tell the customer it is fine 9. A filter that allows light to pass through is considered: a) Severely clogged b) Moderately clogged c) Clean or slightly dirty d) Broken 10. What is the FIRST step before removing any AC filter? a) Remove the front grille b) Unplug the AC c) Prepare soap and water d) Wear a face mask	

II. Matching (5 pts). Match the effect to the description.

Effect	Description
11. Frozen evaporator	A. AC runs longer, uses more electricity
12. Reduced cooling	B. Ice forms on coils, blocks airflow completely
13. High electric bill	C. The room never reaches the set temperature
14. Compressor damage	D. Oil breaks down, compressor seizes
15. Water leakage	E. Ice melts and drips inside the room

Performance Task (Hands-On Demonstration):
Each student will demonstrate the complete filter cleaning procedure on a training AC unit or simulator.

Practical Exam Checklist (20 points total):

Step	Task	Points	Pass/Fail
1	Unplugs unit before starting	2	
2	Wears gloves	1	
3	Removes front grille correctly	2	
4	Removes filter without tearing	1	
5	Vacuum removes loose dust first	2	
6	Uses mild soap (not harsh chemicals)	2	
7	Rinses until water runs clear	2	

	8	Allows filter to dry completely (or uses dry spare)	2
	9	Reinstalls filter in correct orientation	2
	10	Reattaches grille and tests unit	2
	11	Documents the service	2
	Passing Score: 16/20 (80%)		
VII. REFLECTION	**REFLECTION** • **Highlights:** • **Challenges:** • **Adjustments:**		
VIII. USE OF GENERATIVE AI	In preparing this Learning Exemplar (LE), the author used Generative AI to assist in structuring and drafting instructional content and assessment items. The author reviewed, edited, and finalized the writing of the content to ensure alignment with curriculum standards and contextual relevance. The author takes full responsibility for the final content of this LE.		

LESSON EXEMPLAR			
Learning Area	DOMESTIC REFRIGERATION AND AIR-CONDITIONING SERVICING	**Grade Level**	**11**
Term	SECOND	**Lesson Exemplar**	**2**

I. OBJECTIVES	
A. Content Standard	The learner understands the concepts and principles of maintaining domestic refrigeration and window-type air-conditioning units.
B. Performance Standard	The learner performs the maintenance of domestic refrigeration and window-type air-conditioning units with safety precautions.
C. Learning Competencies	Perform cleaning methods of the mechanical system (Tools and equipment, assembling and disassembling, cleaning chemical agents and dent effects.
II. REFERENCES and MATERIALS	**References:** TESDA TR - DRAC NC II; Manufacturer service manuals; Material Safety Data Sheets (MSDS) for coil cleaners; ASHRAE Handbook **Materials:** Window-type AC unit (for disassembly demonstration), screwdrivers (flat and Phillips), nut drivers, wrench set, pliers, soft brush, fin comb, coil cleaner spray (alkaline and non-acidic), water sprayer, protective cover for electrical parts, microfiber cloths, gloves, safety goggles, N95 mask **Tech Integration:** Video "Deep Cleaning a Window AC - Complete Disassembly", QR code linking to MSDS of coil cleaners, interactive parts labeling tool
III. CONTENT	Cleaning Methods of the Mechanical System **Sub-topics:** 1. Tools and equipment for mechanical system cleaning 2. Step-by-step disassembly of window-type AC (removing casing, accessing evaporator, condenser, blower wheel) 3. Cleaning chemical agents (Types: alkaline coil cleaner, self-rinse, no-rinse, foaming vs. non-foaming) 4. Application of cleaning agents (Dilution ratios, contact time, rinsing) 5. Effects of kinks and dents in condenser and evaporator coils (Reduced heat transfer, high pressures, compressor failure)

	6. Proper reassembly and testing	
IV. OBJECTIVES	At the end of the lesson, learners should be able to: 1. **Identify** the tools needed for deep cleaning a window-type AC. 2. **Disassemble** a window-type AC to access the mechanical components. 3. **Select** the appropriate cleaning chemical for evaporator vs. condenser coils. 4. **Explain** why kinks and dents in coils reduce AC performance. 5. **Demonstrate** proper application of coil cleaner without damaging fins or electrical parts. 6. **Reassemble** the unit correctly and test operation.	
V. PROCEDURES		**ANNOTATIONS**
A. Activating Prior Knowledge	**Activating Prior Knowledge** **Teacher Says:** "Last lesson, we learned how to clean the air filter. But is that enough? What if the AC still has poor cooling even after a clean filter? **Teacher Says:** "Exactly. Today, we went to DEEPER. We open the AC and clean the parts the customer never sees—the evaporator, condenser, and blower wheel **Establishing the Purpose (3 mins)** **Teacher Says:** "A customer calls you and says, 'I cleaned the filter myself, but my AC still isn't cold.' This is where you make real money. A deep mechanical cleaning (what we call 'general cleaning') costs ₱800-1,500. And it takes 1-2 hours. Today, you learned that skill." **Presenting Examples (10 mins)** **Teacher Says:** "Watch this 2-minute video of a severely clogged evaporator coil *Play videos.*	**Facilitation:** Call on students. Elicit: "The coils are dirty," "The fan is dirty," "The inside is clogged. **Rationale:** Builds on Lesson 1. Shows progression from basic to advanced maintenance **Rationale:** Establishes market value of the skill. Connects to income potential. **Facilitation:** Play video showing a coil packed with dust and lint. **Rationale:** Visual demonstration of "hidden dirt." Students cannot see this without disassembly.

	Teacher Says: "Now look at these two coils *Teacher shows:* Clean coil (shiny metal, fins straight, air passes through easily) -Dirty coil (gray/black, fins clogged, looks like felt) **-Teacher Asks:** "Which coil transfers heat better? Why?	
B. Instituting New Knowledge	**Discussing New Concept** **Teacher Script:** "Take notes. This is the 'General Cleaning' procedure that separates amateurs from professionals **Topic A: Tools and Equipment for Mechanical Cleaning** You need these tools. Check them off as I show them 1. **Hand Tools (for disassembly** 2. **Cleaning Tools** 3. **. Personal Protective Equipment (PPE) – REQUIRED** **Topic B: Disassembly Procedure (Accessing the Mechanical System)** **Steps** 1: Prepare the Unit 2: Remove the Control Panel 4. Remove the Top Cover 5. Remove the Front Casing (Wrapper) 6. Remove the Rear Grille (if needed to access condenser) 7. Cleaning Chemical Agents	**Rationale:** Professional identity building.

	Recommended Coil Cleaners For EVAPORATOR COILS (indoor, aluminum) **Topic D: Application of Cleaning Agents** Step-by-Step Cleaning - Evaporator Coils Teacher should create Step by Step in cleaning procedure in cleaning window type air conditioner evaporator.	
C. Demonstrating Knowledge and Skills	**Developing Mastery** **Activity: "Hands-On Partial Disassembly** **Teacher Says:** "In your groups, disassemble the unit until you can see the evaporator coils and blower wheel. DO NOT remove the casing entirely yet—just enough to see. I will come around to check *Teacher circulates, checks:* Did they unplug at first? Did they take photos? Did they label wires? Did they protect electrical parts? **Finding Practical Application** **Teacher Says:** "Scenario: You are cleaning a window-type AC. The evaporator coils are very dirty packed with lint. You apply coil cleaner	Facilitation: Divide class into groups of 4-5. Each group gets one training AC unit. **Rationale:** Team-based, low-risk practice before independent skill demonstration **Facilitation:** Guide to discussion. Condenser may look clean on the outside but can be dirty between the fins

	The customer asks, 'Will you also clean the condenser?' The condenser looks clean from outside. Do you still clean it? Why or why not? *Answer:* Yes, you should still clean the condenser if you have already disassembled the unit. The customer is paying for complete general cleaning. It takes an extra 5 minutes and ensures full system performance	**Rationale:** Professional ethics—do the complete job, not just what is visible
VI. ASSESSMENT	**Teacher Activity:** **Additional Activities (2 mins)** **Remediation:** Draw a simple diagram of a window-type AC. Label: Evaporator coil, Condenser coil, Blower wheel, Compressor, Control panel **Enrichment:** Research: What is the difference between "no-rinse" coil cleaner and "rinse-required" coil cleaner? When would you use each? Write 3 sentences **EVALUATING LEARNING: QUIZ** **I. Multiple Choice (10 pts).** Encircle the letter. 1. Which tool is used to straighten bent aluminum fins on a coil? a) Hammer b) Fin comb c) Wire brush d) Screwdriver 2. What type of chemical should NEVER be used to clean AC coils? a) Alkaline coil cleaner b) Muriatic acid c) Foaming coil cleaner d) Self-rinse cleaner 3. What is a kink in a copper tube? a) A bend that restricts flow b) A type of connector c) A cleaning tool d) A fan blade 4. Why should you cover electrical components before spraying water or chemicals? a) To keep them clean b) To prevent short circuits and damage c) To save water d) To make the unit heavier	

5. What is the correct order of disassembly? a) Casing → Filter → Grille → Control panel b) Filter → Grille → Control panel → Casing c) Grille → Filter → Control panel → Casing d) Control panel → Casing → Filter → Grille
6. Which component moves air across the evaporator coil? a) Compressor b) Blower wheel c) Condenser fan d) Capillary tube
7. A dented area on a coil causes: a) Improved cooling b) Reduced airflow and heat transfer c) Lower electricity use d) Faster compressor speed
8. What PPE is REQUIRED when using coil cleaner spray? a) Sunglasses only b) Goggles, gloves, and mask c) Just gloves d) Nothing, it is safe
9. How long should the coil cleaner be left on the coils (contact time) before rinsing? a) 30 seconds b) 5-10 minutes c) 1 hour d) Overnight
10. What should you do immediately if the coil cleaner gets into your eyes? a) Rub your eyes b) Rinse with water for 15 minutes and seek medical help c) Ignore it d) Apply more cleaner

II. True or False (5 pts). Write TRUE or FALSE.

11._____ Dish soap is an excellent cleaner for AC coils.
12._____ You should take photos during disassembly to help with reassembly.
13._____ A kinked copper tube can be simply bent back to fix it.
14._____ The condenser coil is located at the FRONT of a window-type AC (facing the room).
15._____ High-pressure washers are safe to use on AC coils.

III. Essay (5 pts). You are training a new helper. He wants to use muriatic acid to clean a dirty condenser coil because "it cleans faster." How do you explain why this is dangerous and wrong?

ANSWER KEY

1-b, 2-b, 3-a, 4-b, 5-c, 6-b, 7-b, 8-b, 9-b, 10-b
11-False, 12-True, 13-False, 14-False, 15-False

Essay Sample:

"Muriatic acid will destroy the aluminum fins. It causes rapid corrosion—the fins will turn into white powder and fall off. Without fins, the coil cannot transfer heat. The AC will never cool again. Use only alkaline coil cleaners made specifically for HVAC coils. Also, muriatic acid is dangerous to your skin, eyes, and lungs. Never use it on AC equipment.

A. Written Assessment (Knowledge Check)

Performance Task (Hands-On Demonstration):
Each student will perform a **complete mechanical cleaning** on a training AC unit following a checklist.

Practical Exam Checklist (30 points total):

Step	Task	Points	Pass/ Fail
1	Unplugs unit and removes filter/grille	2	
2	Disassembles to access evaporator correctly	3	
3	Covers electrical parts before cleaning	2	
4	Vacuums loose debris from coils	2	
5	Applies appropriate coil cleaner correctly	3	
6	Allows proper contact time	2	
7	Rinses with low-pressure water only	3	
8	Cleans blower wheel with brush	2	
9	Checks for kinks or dents (reports findings)	2	

	10	Dries components before reassembly	2
	11	Reassembles in correct order	3
	12	Tests unit operation after reassembly	2
	13	Follows all safety (PPE, unplugging)	2
	Passing Score: 24/30 (80%)		
VII. REFLECTION	**REFLECTION** • **Highlights:** • **Challenges:** • **Adjustments:** • **Learners for remediation**		
VIII. USE OF GENERATIVE AI	Proper maintenance of Air Conditioner fan motor involves cleaning, inspection, lubrication, and basic troubleshooting. These methods are important to ensure efficient operation, prevent damage, promote safety, and extend the lifespan of the appliance. Applying these practices in real-life situations helps reduce repair costs and improve appliance performance.		

LESSON EXEMPLAR			
Learning Area	DOMESTIC REFRIGERATION AND AIR-CONDITIONING SERVICING	**Grade Level**	**11**
Term	SECOND	**Lesson Exemplar**	**3**

I. OBJECTIVES	
A. Content Standard	The learner understands the concepts and principles of maintaining domestic refrigeration and window-type air-conditioning units.
B. Performance Standard	The learner performs the maintenance of domestic refrigeration and window-type air-conditioning units with safety precautions.
C. Learning Competencies	Discuss maintenance methods of the fan motor (Types, operation, voltage requirements, fan blade/blower types, lubrication, mounting support and alignment
II. REFERENCES and MATERIALS	**REFERENCES and MATERIALS** • **References:** TESDA TR - DRAC NC II; Motor maintenance manuals; Manufacturer service bulletins • **Materials:** Different fan motor types (shaded pole, PSC, capacitor start), multimeter, lubrication oil (electric motor oil - NOT WD-40), fan blades (propeller, blower wheel, axial), mounting brackets, spirit level, tachometer (for RPM check), screwdrivers, wrench set • **Tech Integration:** Video "How to Lubricate a Fan Motor - Correct Way", QR code linking to motor wiring diagrams, sound recording of bearing noise vs. normal motor sound
III. CONTENT	**Title:** Maintenance Methods of the Fan Motor **Sub-topics:** 1. Types of fan motors used in window-type AC (Shaded pole, PSC - Permanent Split Capacitor) 2. Motor operation principles (How they start and run) 3. Voltage requirements (220V vs. 110V, checking nameplate) 4. Fan blade/blower types (Propeller for condenser, Squirrel cage blower for evaporator) 5. Lubrication procedures (When, where, what oil to use) 6. Mounting support and alignment (Preventing vibration and noise) 7. Signs of motor failure (Humming but not spinning, noisy bearings, burnt smell)
IV. OBJECTIVES	At the end of the lesson, learners should be able to: 1. **Identify** the two main types of fan motors used in window-type ACs. 2. **Explain** why lubrication is important for motor longevity. 3. **Demonstrate** proper lubrication of a motor with oil ports.

	4. **Check** motor mounting alignment to prevent vibration. 5. **Measure** voltage supply to a fan motor. 6. **Replace** a fan blade without damaging the motor shaft.	
V. PROCEDURES		**ANNOTATIONS**
A. Activating Prior Knowledge	**Activating Prior Knowledge** **Teacher Says:** "In Lesson 2, we cleaned the blower wheel. What turns that blower wheel? What makes it spin? **Teacher Says:** "Yes. The fan motor. And what happens when a fan motor stops working?" (No airflow, evaporator freezes, no cooling **Establishing the Purpose** **Teacher Says:** "A fan motor that is noisy, slow, or not spinning is a common service call. A new motor costs ₱1,500-3,500. But sometimes, the motor just needs LUBRICATION or cleaning. Today, you learn how to tell the difference and how to make a motor last longer. That saves your customer money and builds your reputation. **Teacher Says:** "Listen to these two sounds *Sound 1:* Quiet hum, smooth airflow (good motor). *Sound 2:* Grinding, squealing, rattling (bad bearing or loose mount). **Teacher Says:** "Which sound means trouble? (Sound 2). Today, you learn to fix that before the motor fails completely. **Teacher also shows:** -Shaded pole motor (small, no capacitor, common for evaporator fan) -PSC motor (slightly larger, has a capacitor)	**Facilitation:** Call on students. "The motor," "The fan motor **Rationale:** Links back to previous lesson. Build continuity. **Rationale:** Shows value of preventive maintenance vs. replacement. Build diagnostic skills. **Facilitation:** Play audio clips or demonstrate with actual motors. **Rationale:** Trains for diagnosis.

	-Bad bearing (wobbly shaft) -Burnt motor (wires discolored, smell)	
B. Instituting New Knowledge	**Discussing New Concept** **Teacher Script:** "Title: 'Fan Motor Maintenance - Keeping the Air Moving. **Topic A: Types of Fan Motors** **1. Shaded Pole Motor** - Most common in window-type ACs for the evaporator fan (indoor blower) -Simple construction: No capacitor, no start switch -Low starting torque (cannot push heavy loads) - Speed is controlled by voltage (lower voltage = slower speed) -Usually, 2-4 speeds in window ACs *-Advantage:* Cheap, reliable - *Disadvantage:* Inefficient (runs hot), cannot be used for heavy fans - *Identification:* Look for copper shading rings around the stator poles - *Wiring:* Usually 3-5 wires (common, high speed, medium speed, low speed) **2. PSC Motor (Permanent Split Capacitor)** - Used in larger window ACs and split-type outdoor fans - Has a run capacitor (always in circuit) - Higher starting torque than shaded pole - More efficient, runs cooler - *Identification:* Has a capacitor connected to the motor (usually oval or round cylinder) - *Common failure:* Capacitor goes bad (motor hums but does not start)	**Rationale:** Clear, action-oriented title.

	Topic B: Motor Operation and Voltage Requirements **How a fan motor works (simplified):** -Electricity flows through the windings (coils of copper wire) - This creates a magnetic field - The magnetic field causes the rotor (the spinning part) to turn - The shaft spins the fan blade - Air moves **Voltage Requirements** - Check the motor nameplate (metal sticker on the motor body) - Common voltages in the Philippines: 220V (most common) or 110V (older units) - Using a 110V motor on 220V = burnout in seconds - Using a 220V motor on 110V = motor runs slow or not at all - *Action:* Always verify voltage with a multimeter before connecting	
C. Demonstrating Knowledge and Skills	**Developing Mastery** **Teacher Says:** "Each group will receive a motor. Your task: (1) Identify if it can be lubricated, (2) Locate the oil ports, (3) Demonstrate the lubrication procedure using oil (or simulate with water for practice). I will check *Teacher circulates, checks:* - Did they identify oil ports correctly? - Did they use the correct oil (or simulated)? - Did they avoid over-oiling?	**Rationale:** Hands-on skill practice in a low-risk environment.

	Teacher Says: "Scenario: A customer says, 'My AC makes a scraping noise when it runs. It started last week. It still cools fine. You open the unit. The blower wheel is loose on the motor shaft. What is the cause? How do you fix it? *Answer:* The setscrew that holds the blower wheel to the motor shaft has loosened. Fix: Loosen the screw, reposition the wheel (not rubbing), tighten the screw securely. **Making Generalization** **Teacher Says:** "Complete this sentence: 'A well-maintained fan motor is _____, but a neglected motor will _____. *Sample answer:* "...quiet and efficient; will make noise, draw high current, and eventually fail. **Evaluating Learning: QUIZ** **Remediation:** Draw a simple fan motor. Label: Shaft, Windings (draw as coils), Bearing area, Oil port (if applicable). **Enrichment:** Research: What is the difference between a sleeve bearing and a ball bearing motor? Which is more common in window-type ACs? Write 3 sentences. **EVALUATING LEARNING: QUIZ** **I. Multiple Choice (10 pts).** Encircle the letter. 1. Which type of fan motor is MOST common for the evaporator blower in window-type ACs? a) PSC motor b) Shaded pole motor c) Three-phase motor d) DC brushless motor	*Answer:* The setscrew that holds the blower wheel to the motor shaft has loosened. Fix: Loosen the screw, reposition the wheel (not rubbing), tighten the screw securely. **Rationale:** Realistic troubleshooting. Teaches that make noise often have simple mechanical fixes. **Rationale:** Contrasts preventive vs. reactive maintenance.

	2. What type of oil should be used to lubricate a fan motor bearing? a) WD-40 b) Cooking oil c) Electric motor oil d) Engine oil 10W-40 3. What happens if you use a 110V fan motor on a 220V supply? a) It runs faster and better b) It burns out quickly c) It runs slower d) Nothing, voltage doesn't matter 4. What is the correct number of oil drops to apply per oil port? a) 1 drop b) 3-5 drops c) Half a cup d) As much as possible 5. Which fan type is used for the condenser (outdoor section) of a window-type AC? a) Squirrel cage blower b) Propeller fan c) Axial vane fan d) Crossflow fan 6. What does a grinding noise from a fan motor usually indicate? a) Dirty filter b) Bad bearing c) Low refrigerant d) Normal operation 7. Which component helps a PSC motor start? a) Start relay b) Run capacitor c) Overload protector d) Thermostat 8. Why is WD-40 NOT recommended for motor lubrication? a) It is too expensive b) It is a solvent that removes existing oil c) It is too thick d) It conducts electricity 9. How often should a fan motor be lubricated for daily use of AC? a) Never b) Every 6-12 months c) Every 5 years d) Only when it stops working 10. What should you check first if a blower wheel is making a scraping noise? a) Replace the motor b) Check alignment and setscrew tightness c) Add more refrigerant d) Clean the filter 11. _____ A motor with a burnt smell should be lubricated to fix it. 12. _____ Rubber isolation grommets reduce motor vibration.	

	13._____ The evaporator fan motor turns the blower wheel. 14._____ You can use any oil for motor lubrication as long as it is liquid. 15._____ A PSC motor has a capacitor that stays in the circuit while running. **III. Essay (5 pts).** You are servicing an AC. The fan motor hums but does not spin. You manually spin the blower wheel with a stick, and the motor starts running. What is the likely problem? Explain your answer. **ANSWER KEY** 1-b, 2-c, 3-b, 4-b, 5-b, 6-b, 7-b, 8-b, 9-b, 10-b 11-False, 12-True, 13-True, 14-False, 15-True **Essay Sample:** *The problem is likely a bad start capacitor (if PSC motor) or a shaded pole motor that is failing. A shaded pole motor should start on its own. If it needs a manual spin, the bearings are likely dry or worn, or the motor windings have a weak starting coil. For a PSC motor, the capacitor may have lost capacitance, reducing starting torque. Test the capacitor with a multimeter and check for lubrication.* (Note: Shaded pole motors do not use capacitors, so teacher should clarify depending on motor type **Performance Task (Hands-On Demonstration):** Each student will demonstrate **fan motor inspection and lubrication** on a training motor.	

<table>
<tr>
<td>VI. ASSESSMENT</td>
<td>
Performance Task (Hands-On Demonstration):
Each student will demonstrate fan motor inspection and lubrication on a training motor.
Practical Exam Checklist (20 points total):
<table>
<tr><th>Step</th><th>Task</th><th>Points</th><th>Pass/Fail</th></tr>
<tr><td>1</td><td>Unplugs unit before accessing motor</td><td>2</td><td></td></tr>
<tr><td>2</td><td>Identifies motor type (shaded pole or PSC)</td><td>2</td><td></td></tr>
<tr><td>3</td><td>Locates oil ports (or identifies sealed motor)</td><td>2</td><td></td></tr>
<tr><td>4</td><td>Uses correct type of oil (electric motor oil)</td><td>2</td><td></td></tr>
<tr><td>5</td><td>Applies 3-5 drops per port (not over-oiling)</td><td>2</td><td></td></tr>
<tr><td>6</td><td>Manually rotates shaft to distribute oil</td><td>2</td><td></td></tr>
<tr><td>7</td><td>Checks mounting screws for tightness</td><td>2</td><td></td></tr>
<tr><td>8</td><td>Checks blower wheel alignment (if applicable)</td><td>2</td><td></td></tr>
<tr><td>9</td><td>Verifies voltage supply matches nameplate</td><td>2</td><td></td></tr>
<tr><td>10</td><td>Tests motor operation after maintenance</td><td>2</td><td></td></tr>
</table>
Passing Score: 16/20 (80%)
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</tr>
<tr>
<td>VII. REFLECTION</td>
<td>

Highlights:
Challenges:
Adjustments:
Learners for remediation:

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VIII. USE OF GENERATIVE AI	Proper maintenance of Air Conditioner fan motor involves cleaning, inspection, lubrication, and basic troubleshooting. These methods are important to ensure efficient operation, prevent damage, promote safety, and extend the lifespan of the appliance. Applying these practices in real-life situations helps reduce repair costs and improve appliance performance.

LESSON EXEMPLAR			
Learning Area	DOMESTIC REFRIGERATION AND AIR-CONDITIONING SERVICING	**Grade Level**	**11**
Term	SECOND	**Lesson Exemplar**	**4**

I. OBJECTIVES	
A. Content Standard	The learner understands the concepts and principles of maintaining domestic refrigeration and window-type air-conditioning units.
B. Performance Standard	The learner performs the maintenance of domestic refrigeration and window-type air-conditioning units with safety precautions.
C. Learning Competencies	Discuss maintenance of service power (Electrical controls/devices, circuit connections, power source, insulation resistance).
II. REFERENCES and MATERIALS	**REFERENCES and MATERIALS** • **References:** TESDA TR - DRAC NC II; Philippine Electrical Code (PEC) 2017 Articles 4.2, 5.1; Manufacturer wiring diagrams • **Materials:** Multimeter (digital), clamp meter, insulation resistance tester (megohmmeter/megger), sample electrical controls (selector switch, thermostat, relay, capacitor), wiring diagram of window-type AC, wire samples (various gauges), circuit breaker, outlet, safety gloves, safety goggles **Tech Integration:** PEC app (digital), video "How to Megger a Motor", QR code linking to wire sizing table, electrical symbol flashcard app
III. CONTENT	**Title:** Maintenance of Service Power **Sub-topics:** 1. Electrical controls and devices in window-type AC (Selector switch, thermostat, compressor relay, overload protector, capacitor) 2. Reading and interpreting circuit connections (Wiring diagrams) 3. Power source verification (Voltage, frequency, phase, dedicated line requirement) 4. Insulation resistance testing (Megger test - motor windings to ground) 5. Common electrical faults (Open circuit, short circuit, ground fault) 6. Safety procedures for electrical maintenance
IV. OBJECTIVES	At the end of the lesson, learners should be able to: 1. **Identify** the electrical control devices in a window-type AC. 2. **Read** a basic wiring diagram for a window-type AC.

	3. **Measure** voltage, amperage, and resistance using a multimeter. 4. **Perform** an insulation resistance test using a megger. 5. **Explain** the importance of a dedicated power line for AC units. 6. **Follow** lock-out/tag-out safety procedures when working on electrical systems.	
V. PROCEDURES		**ANNOTATIONS**
A. Activating Prior Knowledge	**Activating Prior Knowledge** **Teacher Says:** "In our previous lessons, we cleaned filters, coils, and motors. But what makes all of this work? What gives them power? **Teacher Says:** "Correct. Today, we focus on the ELECTRICAL system. Because a perfectly clean AC with a dead motor or no power is useless." **Establishing the Purpose (3 mins)** **Teacher Says:** "Electrical problems are the second most common service call after dirty filters. A customer says, 'My AC does not turn on at all.' If you cannot diagnose electrical issues, you lose that customer. Today, you learn to check power, test components, and find where the electricity stopped. **Presenting Examples (10 mins)** **Teacher Says:** "I will show you a window-type AC that is 'dead' (not turning on). Watch how I diagnose it. *Teacher demonstrates:* 1. Checks outlet with multimeter (0V) 2. Resets breaker (now 220V) 3. AC turns on	**Facilitation:** Call on students. "Electricity," "The outlet," "The power source **Rationale:** Transitions from mechanical maintenance to electrical maintenance. Shows interconnectedness. **Rationale:** Connects electrical skills to job competency and customer retention. **Facilitation:** Use a training unit with a simulated fault (e.g., unplugged, or tripped breaker, or bad thermostat). **Rationale:** Demonstrates the diagnostic process before teaching theory.

	Teacher Says: "Simple. But what if the outlet has power, but the AC still does not turn on? Then we go deeper.	
B. Instituting New Knowledge	**Discussing New Concept** **Teacher Script:** "Title: Electrical Maintenance - Following the Path of Power. **Topic A: Electrical Controls and Devices in Window-Type AC** **1. Selector Switch (Mode Switch)** - The knob you turn to select Off, Fan Only, Low Cool, Med Cool, High Cool - Connects power to different circuits: fan motor, compressor, or both - *Failure mode:* Contacts burn out → AC does not respond to some settings - *Test:* Continuity check between terminals with switch in different positions **2. Thermostat (Temperature Control)** - Senses room temperature and turns compressor ON/OFF - Contains a bimetal strip or thermistor - *Failure mode:* Stuck closed (compressor runs constantly), stuck open (compressor never runs) - *Test:* Continuity check when turned to coldest setting (should be closed) **3. Compressor Relay (Start Relay)** -Connects the start winding of the compressor during startup, then disconnects - Types: PTC (Positive Temperature Coefficient - most common in modern units) or current relay (older)	**Rationale:** Metaphor helps students visualize electrical flow as a path.

	- *Test:* Check resistance across terminals (PTC should show low resistance when cool, high when hot)" **4. Overload Protector** - Safety device that shuts off compressor if it overheats or draws too much current - Located on the compressor terminal cover -*Test:* Continuity check (should show continuity when cool **5. Capacitors** - Run capacitor (for compressor and sometimes fan motor) - *Failure mode:* Loss of capacitance, bulging, leaking oil, shorted - *Test:* Use a capacitor tester or multimeter with capacitance setting - *Safety:* DISCHARGE capacitors before touching (short terminals with insulated screwdriver) **Topic A: Reading Circuit Connections (Wiring Diagrams)** **Why learn wiring diagrams?** Because every AC has one glued inside the control panel. If you can read it, you can fix ANY unit—even one you have never seen before. **Topic C: Power Source Verification** **Before calling an AC 'broken,' check the power source** **Step 1: Check the outlet** **Step 2: Check the circuit breaker** **Step 3: Check for dedicated line** **Step 4: Check the plug and cord**	**Rationale:** Empowers students with transferable skills.

C. Demonstrating Knowledge and Skills	**Developing Mastery** **Teacher Says:** "Rotate through the stations. At each station, use your multimeter to diagnose the fault. Write your findings *Station 1:* No power outlet (simulated) — Student must check outlet voltage and trace to breaker. *Station 2:* Thermostat stuck open — Student must find out why the compressor does not run. *Station 3:* Bad capacitor — Student measures capacitance. *Station 4:* Motor with low insulation resistance — Student performs megger tests. **Finding Practical Application** **Teacher Says:** "Scenario: You arrive at a customer's house. The customer says, 'My AC stopped working. I tried to plug it into a different outlet, but it still won't turn on. You test the outlet—it has 220V. You open the AC and check it out. What are the NEXT THREE electrical components you test in order? *Answer:* 1. Selector switch (is it sending power?), 2. Thermostat (is it closed/calling for cooling?), 3. Compressor relay (is it sending power to compressor? **Making Generalization (5 mins)** **Teacher Says:** "Complete this sentence: 'Electrical troubleshooting is like following a _____ because _____. *Sample answer:* "...a treasure map because you start at the power source and follow the path until you find where the 'treasure' (electricity) stops	**Rationale:** Active learning simulates real service calls. Builds diagnostic speed. **Facilitation:** Guide: After verifying power, check the simplest components first. **Rationale:** Logical troubleshooting sequence. Avoid skipping steps.

	Remediation: Draw a simple series circuit with: Power source → Switch → Load (compressor) → Return to source. Label for each part. **EVALUATING LEARNING: QUIZ** **I. Multiple Choice (10 pts).** Encircle the letter. 1. What instrument is used to test insulation resistance (leakage to ground)? a) Multimeter b) Clamp meter c) Megger (insulation tester) d) Thermometer 2. What is the acceptable minimum insulation resistance for a compressor motor? a) 1 ohm b) 100 ohms c) 1,000 ohms d) 1,000,000 ohms (1 MΩ) 3. What voltage should a properly working outlet for a window-type AC in the Philippines measure? a) 110V b) 220V ±10% c) 12V d) 440V 4. If a compressor hums but does not start, which component is the most likely cause? a) Thermostat b) Start relay or capacitor c) Overload protector d) Selector switch 5. What safety steps MUST be done before touching capacitor terminals? a) Paint them b) Discharge them (short terminals) c) Spray with water d) Cover with tape 6. A breaker that trips immediately when the AC is plugged in indicates a) Dirty filter b) Short circuit c) Low refrigerant d) Normal operation 7. Which electrical component senses room temperature and turns the compressor on/off? a) Selector switch b) Thermostat c) Relay d) Overload 8. What does an open circuit mean? a) A complete path for electricity b) A break in the path, no current flows c) Too much current flows d) Voltage is too high 9. When using a megger, what voltage is typically used for a 220V compressor? a) 12V b) 50V c) 500V d) 5000V	**Rationale:** Metaphor reinforces a systematic approach.

10. A PTC relay has _____ resistance when cool and _____ resistance when hot. a) high; low b) low; high c) zero; infinite d) infinite; zero

II. Matching (5 pts). Match the symptom to the likely faulty component.

Symptom

11. AC does not respond to mode selector (only Off works)

12. Compressor runs constantly, never shuts off

13. Compressor tries to start but clicks off after 1-2 seconds

14. Compressor is hot but not running, then starts after 30 minutes

15. AC works but fan motor vibrates

III. Essay (5 pts). Explain the step-by-step process you would use to check why a window-type AC has no power (does not turn on at all). Include at least 4 checks.

ANSWER KEY

1-c, 2-d, 3-b, 4-b, 5-b, 6-b, 7-b, 8-b, 9-c, 10-b
11-B, 12-C, 13-D, 14-A, 15-E

Essay Sample:

*1. Check the outlet voltage with a multimeter (should be 220V). 2. Check the circuit breaker — reset if tripped. 3. Inspect the plug and cord for damage. 4. Open the AC and check the selector switch for continuity (should pass power to fan/compressor). 5. Check the thermostat continuity (turn to coldest, should be closed). 6. Check the compressor relay and overload protector.

VI. ASSESSMENT

Performance Task (Hands-On Demonstration):
Each student will perform an **electrical diagnostic check** on a training AC unit with a simulated fault.

Practical Exam Checklist (25 points total):

Step	Task	Points	Pass/ Fail
1	Unplugs unit before opening electrical panel	2	
2	Checks outlet voltage correctly	2	
3	Identifies all electrical components (selector, thermostat, relay, overload, capacitor)	3	
4	Reads wiring diagram to understand circuit	2	
5	Tests selector switch continuity	2	
6	Tests thermostat continuity	2	
7	Tests overload protector continuity	2	
8	Tests compressor relay (PTC resistance or current relay)	2	
9	Discharges and tests capacitor (capacitance)	3	
10	Performs megger test on fan motor or compressor (or simulation)	3	
11	Identifies the fault correctly	2	

Passing Score: 20/25 (80%)

VII. REFLECTION	• **Highlights:** • **Challenges:** • **Adjustments:** • **Learners for remediation:**
VIII. USE OF GENERATIVE AI	Proper maintenance of Air Conditioner fan motor involves cleaning, inspection, lubrication, and basic troubleshooting. These methods are important to ensure efficient operation, prevent damage, promote safety, and extend the lifespan of the appliance. Applying these practices in real-life situations helps reduce repair costs and improve appliance performance.