📘 LESSON PACKET

Refrigerant Recovery, Gauges & Charging Tools

TMM Academics – Sealed System Training

📌 Lesson Overview

This lesson focuses on the tools and procedures used to access, recover, and measure refrigerant in sealed systems. Understanding how to properly use access valves, gauges, recovery machines, and scales is critical for accurate diagnostics and EPA-compliant service.

🔹 Section 1: Accessing the Sealed System

Most refrigerators do not come with service ports installed.

To connect gauges and recover refrigerant, technicians must install an access point using:

- Piercing valves
- Stem valves
- Locking pliers-style access tools

These tools allow technicians to safely tap into the system and measure pressures.

Key Point:
Without proper access, no accurate diagnosis can be made on a sealed system.

🔹 Section 2: Piercing Valves vs. Stem Valves

Piercing valves create a hole in the tubing to access the system.

However, once installed, they can be difficult to reseal and may cause leaks.

Stem valves are preferred for:

- Checking pressures

- Recovering refrigerant

They are not meant for permanent installation or charging.

Section 3: Temporary Access Tools

Locking pliers-style access tools can pierce tubing and provide temporary access.

These tools:

- Are reusable
- Do not permanently stay on the system
- Must be properly sealed to avoid leaks

A damaged seal or dull piercing tip will cause refrigerant loss.

Section 4: Refrigerant Gauges

Gauges are used to measure system pressure.

Types include:

- Analog gauges
- Digital gauges
- 3-port manifolds
- 4-port manifolds

A basic gauge set can perform the same function as expensive models, but durability and reliability matter.

Section 5: 3-Port vs. 4-Port Manifolds

A 3-port manifold requires disconnecting hoses when switching between vacuum and charging.

This introduces air into the system.

A 4-port manifold allows:

- Continuous connection
- No air contamination
- Easier transition from vacuum to charging

Key Point:
4-port manifolds reduce the risk of introducing air into the system.

🔹 Section 6: Recovery Machines

Recovery machines remove refrigerant from the system and store it in a recovery tank.

A typical setup includes:

- Recovery machine
- Recovery tank
- Filter dryer
- Sight glass
- Oil separator

These components protect the machine and ensure proper recovery.

🔹 Section 7: Recovery Methods

There are two main recovery methods:

Passive Recovery:

- Refrigerant flows naturally into a container
- Not sufficient for full recovery

Active Recovery:

- Uses a recovery machine
- Required to meet EPA standards

Technicians must reach approximately a **10-inch vacuum** before opening the system.

🔹 Section 8: Refrigerant Scales

Refrigerant must be measured precisely when charging a system.

Modern systems often use:

- Grams instead of ounces
- Very small charge amounts

For example, some systems may only require:

- 40–70 grams of refrigerant

This requires accurate scales capable of reading small measurements.

🔹 Section 9: Small vs. Large Charging Equipment

Technicians do not always need large tanks and scales.

Alternatives include:

- Small refrigerant cans
- Compact digital scales
- Dial-a-charge devices

These tools are easier to transport and more practical for in-home service.

🔹 Section 10: Vacuum and Evacuation

After recovery, the system must be evacuated to remove:

- Air
- Moisture
- Non-condensables

A proper vacuum should reach:

- Close to 500 microns for best results

Technicians monitor vacuum using a micron gauge for accuracy.

🔹 Section 11: Importance of a Micron Gauge

Standard gauges may show a full vacuum, but they are not precise.

A micron gauge provides:

- Accurate vacuum measurement
- Confirmation of system dryness
- Better system reliability

🔹 Section 12: EPA Requirements and Log Books

Technicians are required to:

- Track refrigerant recovered
- Record refrigerant added
- Maintain a log book

Failure to document refrigerant handling can result in significant fines.

🔹 Section 13: System Diagnosis Using Pressure

With the system off, pressures should equalize.

Example:
At room temperature (~70°F), R134a should read approximately 50–70 PSI.

If pressure is significantly lower, the system may have:

- A leak
- Low charge

🔹 Section 14: Restrictions vs. Leaks

A restriction can be identified by:

- Partial frost pattern

- Low suction pressure
- Pressure dropping into vacuum during operation

A leak can be identified by:

- Low pressure that stabilizes when refrigerant is added

Understanding this difference is critical for proper diagnosis.

🔹 Section 15: Nitrogen Use

Nitrogen is used to:

- Pressure test the system
- Check for leaks
- Prevent contamination

It should never exceed safe pressure limits (typically under 100 PSI).

🔹 Section 16: Takeaway

Proper recovery, evacuation, and charging are critical to sealed system success.

Using the correct tools and procedures ensures:

- Accurate diagnostics
- System reliability
- Compliance with EPA regulations

📝 Review Questions

Multiple Choice

1. What is the purpose of an access valve?
   A. Add refrigerant
   B. Measure electrical current

C. Connect gauges to the system
D. Increase pressure

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2. What is the main advantage of a 4-port manifold?
   A. Lower cost
   B. Faster recovery
   C. Prevents air from entering system
   D. Smaller size

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3. What vacuum level is required before opening a sealed system?
   A. 0 PSI
   B. 10-inch vacuum
   C. 30 PSI
   D. 100 PSI

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4. Why are micron gauges used?
   A. Measure voltage
   B. Measure refrigerant type
   C. Measure deep vacuum accurately
   D. Increase pressure

Short Answer

5. Why are small scales important when charging modern refrigerators?
6. What is one risk of using a piercing valve improperly?

Scenario-Based

7. A technician measures 30 PSI on a system at room temperature with the compressor off. What does this indicate and what should be suspected?

✅ Answer Key

1. C – Connect gauges to the system
2. C – Prevents air from entering system
3. B – 10-inch vacuum
4. C – Measure deep vacuum accurately
5. Because modern systems use very small refrigerant charges measured in grams
6. It can cause leaks or permanent damage to the tubing
7. The system is likely undercharged or has a leak