Course 106

HVAC Systems
Introduction and Overview

Module 3:
Tools

INSTRUCTOR GUIDE

RAIL CAR TRAINING CONSORTIUM

Table of Contents

Overview to Course 106

Course 106: *Introduction and Overview of HVAC Systems* is to provide participants with an orientation to rail car HVAC, basic principles and key components. This course is organized into three modules:

1. Overview of Rail Car HVAC and General Safety Procedures
2. Background Knowledge
3. Tools

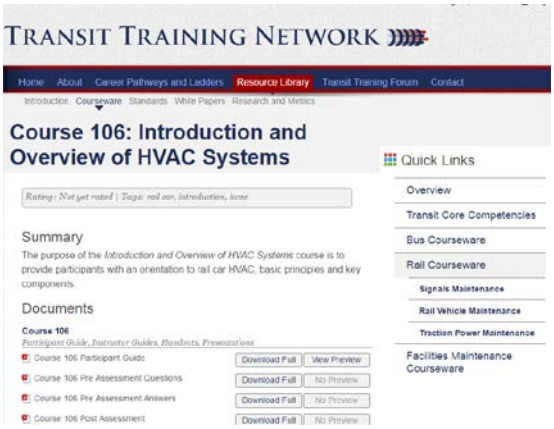
Materials for Instruction

Check that you have the following materials for instruction:

✔	
	Instructor Guide – each instructor gets one copy
	PowerPoint Presentation
	Participant Guide or Coursebook for each participant – each class participant gets their own copy
	Module Quizzes
	Pre-course Assessment
	Post-course Assessment

All materials can be downloaded from www.transittraining.net. Click this link.

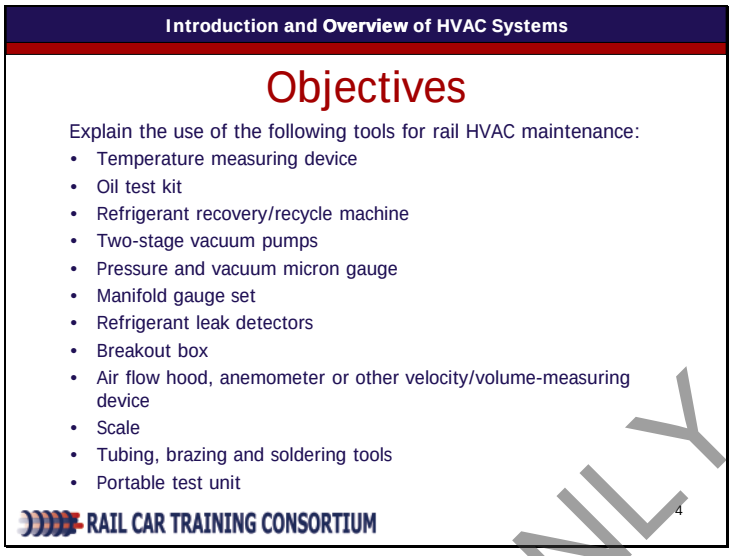
- Click on the **Resource Library** tab.
- In lower right under **Useful & Helpful Links** click on **Courseware.**
- Under **Quick Links** click on **Rail Courseware**.
- Click on **Rail Vehicle Maintenance**.
- Scroll down to **Course 106: Introduction and Overview of HVAC Systems**
- Follow relevant links to download files.



Course 106 Assessments

- Before starting to teach this course, each participant should complete a **Pre-course Assessment**.
- After teaching all three modules for Course 106, each participant should complete the **Post-course Assessment**.

Slide 4



INSTRUCTIONAL ACTIVITY: Direction

TIME: 1 minute

SAY: The goal of this module is to ensure you have a basic understanding of the tools used for HVAC maintenance. Upon completion of this course, you should be able to explain the purpose and operations of tools as they apply to HVAC maintenance. At the end of this session, you should be able to do all of the following… ***Read Objectives***

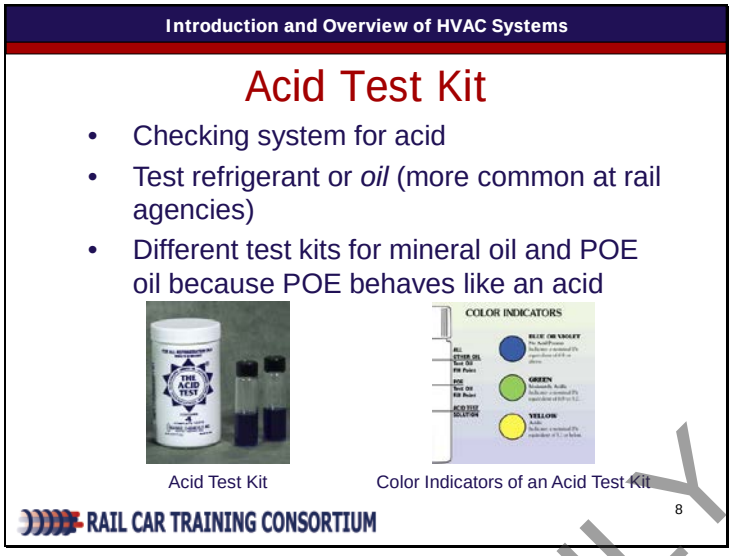
DO: Review slide. Click through animations to reveal each section of module.

PARTICIPANT GUIDE (COURSEBOOK) PAGE REFERENCE: _____

Other Tools/Media/Materials: N/A

Instructor Notes

Slide 8



INSTRUCTIONAL EVENT: Present the content

TIME: 2 minutes

SAY: The acids sometimes found in refrigerants can be formed by chemical reactions with components and/or materials of construction, lubricating oils, and/or impurities. The instability of the refrigerant, and thus the formation of acids, is accelerated by elevated temperatures which could be the result of improper operation, such as a failed condenser fan or clogged airflow path. Checking the system for acid should be a routine maintenance practice, because acid can be easily treated before the compressor fails. You can check the refrigerant oil for acid, or you can check the refrigerant for the acid. Rail HVAC OEMs generally recommend checking refrigerant oil.
If you decide to use an oil acid test kit (Figure 3.3 and Figure 3.4), be aware that using the wrong type of test kit with an ester-based (POE) oil can result in a false acid reading, because the oil behaves like an acid to the test kit (that is, the ester oil displays amphoteric properties). That's why many oil acid test kits have one kit (or one scale) for mineral oils and a different test kit (or scale) for POE oils.

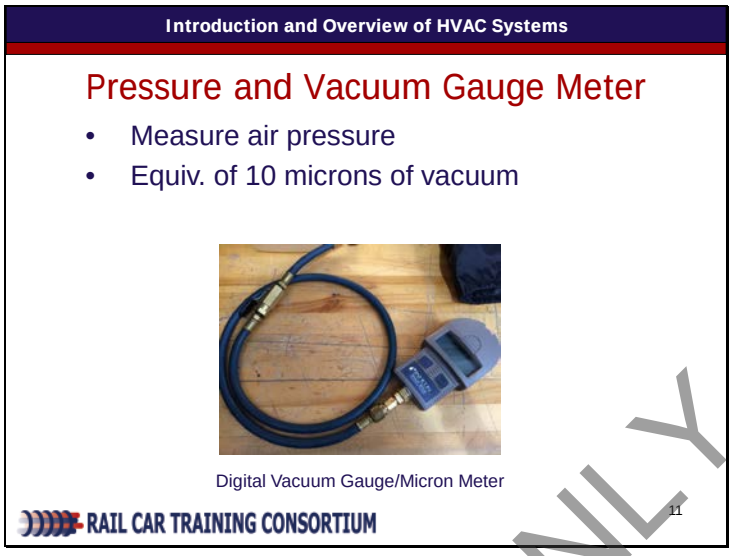
DO: Review slide. Refer participants to coursebook.

PARTICIPANT GUIDE (COURSEBOOK) PAGE REFERENCE: _____

Other Tools/Media/Materials: Coursebook. Acid Test Kit.

Instructor Notes

Slide 11



INSTRUCTIONAL EVENT: Present the content

TIME: 2 minutes

SAY: Pressure and Vacuum Gauge/Micron Meter Instruments used to measure pressure are called pressure gauges or vacuum gauges (Figure 3.8). A vacuum gauge is used to determine the level of atmosphere (degassing and dehydration) in the system. It has an interchangeable sensor that measures to the equivalent of 10 microns of vacuum. A micron is a unit of measurement starting from a perfect vacuum (no pressure) that is expressed in linear increments: one inch = 25,400 microns and one micron = 1/25,400 of an inch.

DO: Review slide. Refer participants to coursebook

PARTICIPANT GUIDE (COURSEBOOK) PAGE REFERENCE: _____

Other Tools/Media/Materials: Coursebook. Pressure and vacuum gauge meter.

Instructor Notes

Slide 19

INSTRUCTIONAL EVENT: Present the content

TIME: 2 minutes

SAY: Electronic leak detectors contain an element sensitive to a particular refrigerant class. The device may be battery- or AC-powered and often has a pump to suck in the gas and air mixture. A ticking signal that increases in frequency and intensity as the probe “homes in” on the leak alerts the operator. Many also have varying sensitivity ranges that can be adjusted, Figure 3.12.

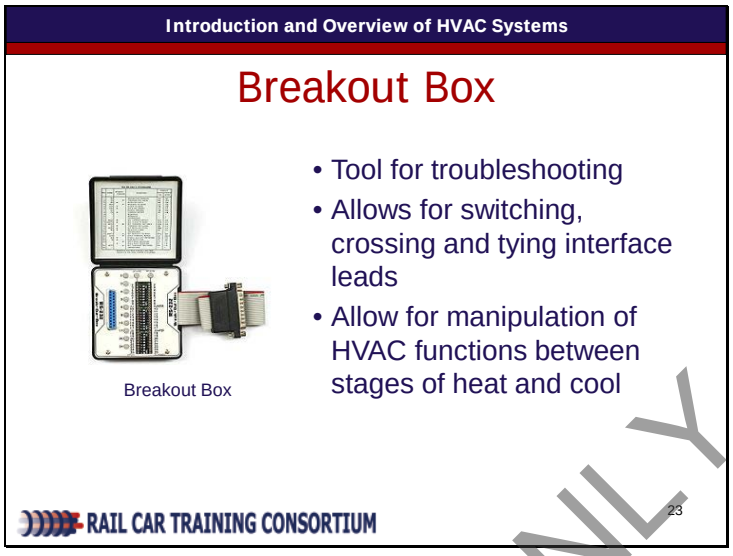
DO: Review slide. Refer participants to coursebook

PARTICIPANT GUIDE (COURSEBOOK) PAGE REFERENCE: _____

Other Tools/Media/Materials: Coursebook. Electronic/Ultrasound leak detectors, soap solution, etc.

Instructor Notes

Slide 23



INSTRUCTIONAL EVENT: Present the content

TIME: 2 minutes

SAY: The breakout box (Figure 3.17) lets the technician establish electrical connection to individual lines on a connector without interrupting the connection between the equipment and the diagnostic tool. This allows for simultaneous execution of testing and monitoring the test. It enables users to switch, cross and tie interface leads, and to manipulate HVAC functions between different stages of heat and cool for troubleshooting purposes.

DO: Review slide. Refer participants to coursebook

PARTICIPANT GUIDE (COURSEBOOK) PAGE REFERENCE: _____

Other Tools/Media/Materials: Coursebook. Breakout box.

Instructor Notes

Slide 26

INSTRUCTIONAL EVENT: Present the content

TIME: 1 minute

SAY: Pictured are tools used to cut, bend and flare tubing. Detailed instructions on measuring, cutting, bending and flaring tubing are provided in Module 3 of Course 206.

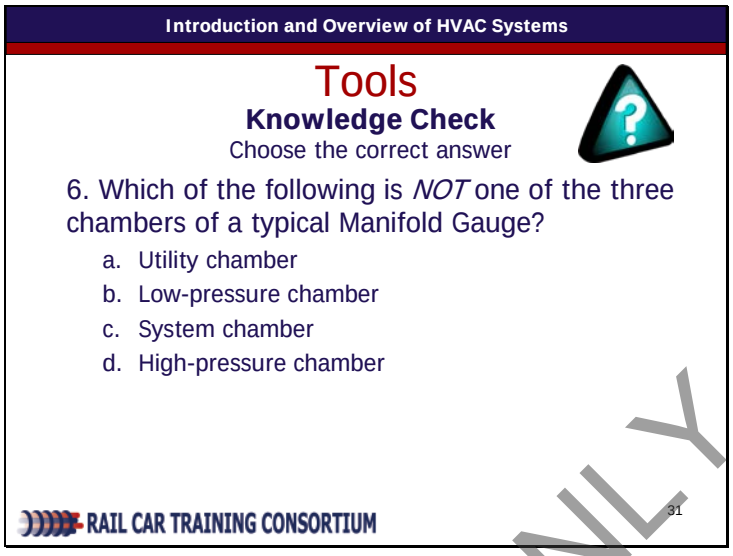
DO: Review slide. Refer participants to coursebook

PARTICIPANT GUIDE (COURSEBOOK) PAGE REFERENCE: _____

Other Tools/Media/Materials: Coursebook. Tubing/piping tools.

Instructor Notes

Slide 31



INSTRUCTIONAL EVENT: Provide learning guidance. Class Discussion and Small group activity

TIME: 1 minute

SAY: Here's the Knowledge Check. What do you think the answer is?

DO: This should be easily answered by all participants. When they decide on the answer, advance the slide to reveal the correct answer. **Answer:** c. System chamber

PARTICIPANT GUIDE (COURSEBOOK) PAGE REFERENCE: _____

Other Tools/Media/Materials: N/A

Instructor Notes