TRN 140 Transportation Climate Control

COURSE DESCRIPTION:

Prerequisites: None
Corequisites: TRN 140A

This course covers the theory of refrigeration and heating, electrical/electronic/pneumatic controls, and diagnosis and repair of climate control systems. Topics include diagnosis and repair of climate control components and systems, recovery/recycling of refrigerants, and safety and environmental regulations. Upon completion, students should be able to diagnose and repair vehicle climate control systems. Course Hours Per Week: Class, 1. Lab, 2. Semester Hours Credit, 2.

STUDENT LEARNING OUTCOMES:

Upon successful completion of this course, the student will be able to:
(State-wide outcomes)

a. In a lab setting, demonstrate work place safety per OSHA and EPA guidelines that apply to relevant climate control systems found on transportation vehicles and equipment.
b. Given a transportation vehicle or related equipment with a fault to the climate control system, diagnose and repair the climate control system using the recommended lab equipment as outlined by the related service information.
c. Using the recommended equipment as outlined by the EPA, identify and perform the proper recovery and recycling procedures for any refrigerant in a transportation vehicle or related equipment.
d. Describe the operation of the heating, ventilation and air condition systems.
e. Describe the use of climate control testing equipment to aid diagnosis of the systems.
f. Describe the use of appropriate service information and capacity charts.
g. Describe the EPA regulations that govern the proper use of refrigerants in a transportation vehicle or related equipment.

(Local outcomes)

h. Explain basic air conditioning, heating and cooling theory and system operation.
i. Identify refrigeration components.
j. Identify refrigeration and cooling system safety precautions.
k. Inspect refrigeration and cooling system components.
l. Perform system performance tests of heating, cooling and air conditioning systems.
m. Perform leak testing of air conditioning systems.
n. Identify vehicle refrigerant type.
o. Recover and recycle refrigerants.
p. Discharge and service air conditioning system components.
q. Evacuate and charge air conditioning systems.
r. Determine R-12 system retrofit feasibility.

s. Perform component repair/replacement procedures.

OUTLINE OF INSTRUCTION:

I. Class orientation
- A. Class routine and lab policy
- B. Required materials
- C. Automotive lab safety
- D. Lab equipment use/operation

II. Air Conditioning System
- A. Basic Principles of Refrigeration
  - 1) Temperature/pressure relationship
  - 2) Latent heat of evaporation/fusion
- B. System Components, Purpose, Operation of Each, Inspection and Service
  - 1) Evaporator
    - (a) Water Drain
    - (b) Blower Motor
  - 2) Compressor
    - (a) Various Types
    - (b) Electromagnetic clutch
  - 3) Condenser
  - 4) Receiver-drier
    - (a) Installation
    - (b) Fusible safety plug
    - (c) Desiccant
    - (d) Sight Glass
  - 5) Expansion Valve/orifice tube
    - (a) Sensing bulb- internally or externally equalized
    - (b) Inlet screen
  - 6) Accumulator
- C. Refrigerant Flow
- D. Types of Systems (Temperature Controls) and Test Procedures
  - 1) Cycling
  - 2) STV and STV/BPO
  - 3) POA
  - 4) EPR
  - 5) VIR and EEVIR
  - 6) Fixed orifice tube
  - 7) Manual and vacuum controls
  - 8) ETR
  - 9) “H” valve
  - 10) Combination valve

11) Automatic systems
    (a) Sensors
    (b) Servos
    (c) Amplifiers
    (d) Aspirators
    (e) Programmers
    (f) Trouble codes

E. High and Low Side
F. "Touch" Test
G. Condition of Refrigerant at Various Circuit Points
H. Basic Controls for Compressor Operations
    1) Ambient temperature switch
    2) Thermostatic switch
    3) Cycling clutch switch
    4) Low pressure cut-out switch
    5) High pressure cut-out switch
    6) High pressure relief valve
    7) Thermal limiter and superheat switch
    8) Compressor control valve
    9) Pressure sensing switch

III. System Service
A. Manifold Gauge Set
    1) Hose hook up
        (a) Purging test hoses
        (b) Stabilizing system
        (c) Attachment with third gauge
    2) Hand valve positions
    3) Normal gauge readings
B. Service Valves
    1) Schrader connections
C. Safety in Handling of Refrigerant
    1) Storage
    2) Discharging
    3) Recycling
    4) Can tap installation
    5) Phosgene gas
    6) Environmental concerns
D. Evacuation Procedure
E. Isolation of Compressor
F. Check and Add Compressor Oil
G. Charging Procedures
H. Recovery and Recycling

1) Adding refrigerant as a liquid
2) Charging with vapor
3) Adding refrigerant to accumulator type systems
4) EPA regulations

I. Leak Testing
1) Halide
2) Electronic
3) Soap
4) Dytel

J. Compressor Reed Valve Replacement
K. Compressor Front Seal Replacement
L. Replace Low Pressure Protection Devices
M. Replace Clutch Components
N. Replace Hoses, Lines, Fittings, and Seals
O. Expansion Valve Screen Replacement
P. VIR Overhaul
Q. Receiver-Drier/Desiccant Replacement
R. Accumulator Replacement
S. Expansion Tube Replacement
T. STV and EPR Valve Replacement
U. Compressor Replacement/Flushing System

IV. Problem/Diagnosis
A. Engine Overheating
B. Noisy System Operation
1) Mounts
2) Bearings
(a) pulley
(b) clutch
3) Belts
4) Excessive high or low charge
5) Moisture in the refrigerant

C. Insufficient Cooling
D. Intermittent Cooling
E. No cooling at all
F. Windshield Fogging
G. Abnormal Low-Side Readings
H. Abnormal High-Side Readings
I. Frost on Evaporator
J. Sight Glass
1) Clear
2) Bubbles
3) Oily
4) Cloudy

K. Electrical Circuit Problems
    1) Blown fuse
    2) Defective wiring
    3) Bad connections
    4) Defective thermostat
    5) Magnetic clutch
L. Effects of moisture in System
M. POA Systems/Pressures
N. EPR Systems/Pressures
O. Air Distribution
    1) Vacuum motors
    2) Manual cables
    3) Blower motor
        (a) Relays
        (b) Fuses
        (c) Resistors
P. Driveability/Compressor Control Check Areas
    1) Constant run relay
    2) Time delay relay
    3) Wide open throttle switch
    4) Low vacuum switch
    5) Power steering pressure switch
    6) Power brake time relay
    7) High coolant temperatu5re switch
    8) Electronic control module delay timer
    9) Anti-dieseling relay

V. Heating Systems
A. Components
    1) Blend doors
    2) Blower motor
    3) Control valves
    4) Plenum chamber
    5) Vacuum reservoir and check valve
    6) Electrical controls
B. Flow Control Valve Operation
    1) “Bowden” cable operated
    2) Restricted heater
    3) Small hose usually inlet
C. Thermostat and By-pass
D. Radiator, Pressure Cap, and Expansion Tank Operation
E. Service
    1) Electrolysis damage
    2) “Bloc-Chek” test

3) Testing radiator pressure cap
4) Reverse flushing
5) Fluid fan inspection
6) Replace heater coolant valve
7) Replace heater core
8) Replace hoses
9) Replace drive belts
10) Replace pulleys
11) Replace fan shroud
12) Replace electric fan
13) Replace control panel

F. Problem/Diagnosis
1) No heat
2) Too much heat (no control)

G. Blower Motors
1) Ducting-AC/heating
2) Heater core position
3) Evaporator position
4) Inspect/test/replace resistors

REQUIRED TEXTBOOKS AND MATERIALS:

Textbook to be determined by instructor.