HVAC Service Technicians Training Center

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Introduction to the Refrigeration Cycle: Part 2 (AC/R-2)

This course is a continuation of Part 1 I Intro. To Refrigeration Cycle, focusing on high temperature applications including: compressors, condensers, evaporators, metering devices, accessory components, compressor capacity controls, balanced system operation, and pressure-temperature charts.

DAY 1

SUBJECT:	Introduction to the Troubleshooting Chart and System Operating Components
GOAL:	Demonstrate how an entire air condition system is affected by a single problem and how it can be diagnosed by the troubleshooting chart. Show how the TXV and Cap react to over charge and under charge.
OBJECTIVES:	Understand the terminology on the troubleshooting char and terminology used in the HVAC/R trade. Use the chart to diagnose problems in a typical A/C system What happen to each component under these conditions Note differences between charging valves and the service valve
SUBJECT CONTENTS:	Troubleshooting chart instructions Terminology used on the chart Temp changes across an air cool condenser Temp changes across a DX fan coil Normal pressure ranges in an A/C system Sub cooling temp Superheat temp Terminology used on components TXV, captubes Safety when installing & removing service gauges Identify different types of refrigerant valves and the use Use of different thermometers Review of shop safety
METHODS/ TECHNIQUES:	Handout on troubleshooting chart Refrigeration & A/C Technology W.J.T.
RESOURCES:	Large troubleshooting chart Ref – trainer Overhead System room
EVALUATION:	Entrance Exam Give superheat reading for given problem Give subcool reading for given problem Get temperature difference across the air evaporator Get temperature difference across air cooler condenser

DAY 2

SUBJECT:	The Troubleshooting Chart And System Operating Components – Pressure Relief Devices
GOAL:	Demonstrate how system performance is affected by poor air flow and to use dye.
OBJECTIVES:	To use troubleshooting chart to diagnose different mechanical problems Understand that troubleshooting chart is a tool for learning to diagnose A/C system problems

To take correct temperature & pressure measurements
To identify different pressure relief devices and how they work
How pressure relief's are piped in a refrigeration system and why they are needed

SUBJECT CONTENTS: HVAC/R industry terms
Relief devices external
Fusible plug
Spring loaded
Safety reason for relief valves
Solving A/C problems using chart

METHODS/
TECHNIQUES: Refrigeration & A/C Technology W.J.T.
Troubleshooting charts
Overheads
System room

RESOURCES: Refrigeration & A/C technology W.J.T.
Troubleshooting handouts
Sporlan TXV
Alco TXV
Henry valve

EVALUATION: Homework
Quiz
Solving A/C problem using large troubleshooting chart in front of class
Shop – able to get superheat
able to get evap air diff. temp
able to get cond. air . diff. temp.

DAY 3

SUBJECT: Refrigeration Operating Temperatures And Defrost Systems

GOAL: To identify different refrigeration equipment and temperature ranges.
Demonstrate setting up of low pressure temperature control and the operation of different defrost controls

OBJECTIVES: Student will be able to:

Define refrigeration temperature ranges
a) AC high temperature
b) Medium temperature
c) Low temperature

Identify equipment
a) Low boy box
b) Reach in box
c) Walk in box
d) Ice machine
e) Heat pump

Discuss/note typical temperatures of evaporators coil temperature to discharge air temperature
a) Control of temperature
b) Adjusting of low pressure control
c) Fin spacing of different coils

Discuss/note different types of defrost: off cycle, radin, plane
a) Elect
b) Hot G
c) Start of defrost clock
d) Control of evaporator fan
e) Termination defrost
f) Clock

g) Temperature
h) Pressure

Understand the function of defrost

a) Ice melting
b) Returning oil to the compressor
c) Use on a heat pump

SUBJECT CONTENTS: Trade language
Temperature ranges
Setting of low pressure switcher
Setting of defrost controls

METHODS/ TECHNIQUES: Classroom handout
Refrigeration & A/C Technology W.J.T.
System room – set up of low pressure control

RESOURCES: Work book/handouts
Refrigeration & A/C Technology W.J.T.
PT. Char – Dupont, sporlan or alco

EVALUATION: Homework
Quiz
Shop performance – set up of pressure control

DAY 4

SUBJECT: EPR Control Devices, Refrigerant Migration Protection.
Troubleshooting Chart

GOAL: To understand the EPR valve and how it works with the TXV. To identify the 3 types of refrigerant migration protection strategy and draw an electrical wiring diagram for each.

OBJECTIVES: Student will be able to:

Distinguish between mechanical controls
Explain how an EPR valve functions
Describe electrical controls that apply to refrigerant migration protection
Discuss how poor air or water flow affected a system differently than a dirty condenser
Draw wiring diagram of 3 types of refrigeration migration protection

SUBJECT CONTENTS: Trade terms
EPR control diagrams & installation instruction
Review of TXV operation

METHODS/ TECHNIQUES: Refrigeration & A/C Technology W.J.T.
Work book handouts
Overheads
Large troubleshooting chart

RESOURCES: Refrigeration & A/C Technology W.J.T.
Sporlan
Alco
Henry
Asco
Dupont – product information

EVALUATION: Shop – show system with pump down
Demonstrate location of EPR valve installation
Demonstrate location of LL Solenoid installation & make wiring diagram
Quiz

DAY 5

SUBJECT: Recovery, Evacuation and Leak Checking

GOAL: Demonstrate the use of recovery equipment, vacuum pump & leak checking.

OBJECTIVES: Student will be able to:

- Understand the proper procedure to evacuate a refrigeration system
  a) Use of the micron gauge (scale)
  b) Best line size
  c) Heat lamps
- Connect a recovery machine
  a) Push pull
  b) Vapor recover
- Demonstrate how to leak check:
  a) Standing pressure test
  b) Electronic
  c) Halide leak
  d) Dye – visible & U.V.
  e) Sound ultra sonic

SUBJECT CONTENTS: Trade (terms) language
Safety – precaution when using gauge manifold
Robinair vacuum instructions
Robinair recovery instructions
Hazards of working with halide torch leak detector

METHODS/
TECHNIQUES:
Refrigeration & A/C Technology W.J.T.
Work book handouts
Overheads

RESOURCES: Refrigeration & A/C Technology W.J.T.
Manufacture Instruction & Direction
a) Vacuum pump
b) Recovery

EVALUATION: Homework
Quiz
Shop (PBF)

DAY 6

SUBJECT: Refrigerant Oils And Safety Controls

GOAL: Demonstrate how an oil pressure works and how it is connected to a compressor. Also how to take net oil pressure on compressors.

OBJECTIVES: Student will be able to:

- Understand the purpose for refrigerant oil & types
- Understand net oil pressure reading
- Demonstrate how an oil pressure safety switch is wired in a circuit
- Explain the function of an oil pressure switch

SUBJECT CONTENTS: Trade (terms) language
Safety use of tools & equipment
Installation and testing of an oil pressure safety
Operation of an oil pressure safety switch

METHODS/
TECHNIQUES: Refrigeration & A/C Technology W.J.T.
Work book handouts
Overheads

RESOURCES: Refrigeration & A/C Technology W.J.T.
Penn - Johnson

EVALUATION: PBF
Quiz - written
Homework

DAYS 7 & 8

SUBJECT: Auxiliary Components – Their Applications and Operation in the Refrigeration Circuit

GOAL: To identify by shape & location on refrigeration piping the different components & their functions.

OBJECTIVES: Student will be able to point out location for component installation & lines connected to component and it's purpose.

a) Liquid line drier & size it
b) Capillary strainer - drier
c) Suction accumulator and with heat exchanger
d) Mufflers – suction & discharge
e) Receivers
f) Desuperheatiing heat exchanger
g) Subcooling heat exchanger
h) Oil separator
i) Oil reservoirs
j) Sight glasses
k) Vibration
l) EPR – valve
m) CPR – valve
n) Relief valve, plug & disk
o) Head pressure control
    - Fun Cycle
    - Fan speed
    - Air volume
p) Flooding condenser controls, oroa valve
q) Solenoid valve
r) Pressure switcher
    - Low pressure safety
    - Low pressure control
    - High pressure switch
    - Low ambient control
    - Oil safety switch

SUBJECT CONTENTS: Trade names of components
Trade terms used (language)
Troubleshooting chart; when components are used
Danger when using torch or system with compressed refrigerants

METHODS/ TECHNIQUES: Refrigeration & A/C Technology W.J.T.
Work book handouts
Overheads

RESOURCES: Refrigeration & A/C Technology W.J.T.
Refrigeration Research Inc.
Alco
Sporlan
Ranco
Penn – Johnson
Large Troubleshooting Chart

EVALUATION: Homework
Quiz

DAY 9

SUBJECT: Cooling Towers; Water Supplies & Water Reg Valve

GOAL: Demonstrate simple maintenance service on tower, back flush a condenser and adjust a water valve

OBJECTIVES: Student will be able to:

Discuss/understand the operation of a cooling tower
Identify different types of towers
a) Forced Air
b) Natural Draft
Discuss the water supply & treatment for cooling tower
Identify safety conditions when working on indoor & outdoor towers
Discuss adjusting/flushing water valve

SUBJECT CONTENTS:
Trade language (terms)
Poor safety attitude
The effect of electrical shock
Danger of flooding space
Freeze up

METHODS/
TECHNIQUES: Work book handouts
Overheads
PBF in system room

RESOURCES: Marley tower
Metrey
Penn - Johnson

EVALUATION: Homework
Quiz
PBF

DAY 10

SUBJECT: Evaporative Condensers, Evaporative Fluid Cooler and Drycoolers

GOAL: To understand different type of head rejection devices operation temperature and use in winter operation

OBJECTIVES: Student will be able to:
Identify & define an evaporative condenser, an evaporative fluid and a drycooler
Discuss temperature drop across each
Discuss winter operation, types of sump heaters, fan cycle controls

SUBJECT CONTENTS: Trade (terms) language
Taking temperature
Check performances
Venting lines
Safety with electrical around water

METHODS/
TECHNIQUES: Work book handouts
Overheads
Large troubleshooting charts

RESOURCES: Marley
EDPAC
BAC
Mammoth Inc.
North American Heat Transfer
Heat Craft

EVALUATION: Homework
Quiz

DAYS 11 & 12

SUBJECT: Using Troubleshooting Chart to Find Component Problems

GOAL: To be able to diagnose problems where chart leaves off by reason & logic

OBJECTIVES: Student will be able to:
Solve refrigerant service calls

	Check components mechanical & electrical
	Diagnose multiple problems
SUBJECT CONTENTS:	Dealing with customers poor attitudes
	Service Industry term & language
	Care in taking pressure & temperature reading
	Safety on ladders & electric shock
	Rules for diagnosing
	Problem – to solve
METHODS/ TECHNIQUES:	Refrigeration & A/C Technology W.J.T.
	Large troubleshooting chart
	Work book
	Service calls
	System room – role playing
RESOURCES:	Refrigeration & A/C Technology W.J.T.
EVALUATION:	Quiz
	Homework
	PBF
	Solving Service Problems