

Refrigeration & Air Conditioning Technology

SIXTH EDITION

SECTION 2

SAFETY, TOOLS AND EQUIPMENT, SHOP PRACTICES

UNIT 10

SYSTEM CHARGING

UNIT OBJECTIVES

After studying this unit, the reader should be able to

- Describe how refrigerant is charged into systems in the vapor and liquid states.
- Describe system charging using two different weighing methods.
- State the advantage of using electronic scales for weighing refrigerant into a system.

UNIT OBJECTIVES

After studying this unit, the reader should be able to

- Describe two types of charging devices.
- Charge refrigerant blends incorporating a temperature glide and fractionation potential.
- Charge fixed orifice, capillary tube, and piston (short tube) air-conditioning systems using charging charts and curves.

UNIT OBJECTIVES

After studying this unit, the reader should be able to

- Use the subcooling method of charging to charge airconditioning and heat pump systems that incorporate a thermostatic expansion valve (txv) as the metering device.
- Use modern temperature/pressure charts that incorporate dew point and bubble point values for calculating subcooling and superheat amounts.

CHARGING A REFRIGERATION SYSTEM

- Correct charge must be added for a refrigeration system to operate as designed
- Added by weighing, measuring, or using operating pressures
- Carefully monitor evaporator superheat, condenser subcooling, operating pressures and compressor amperage

VAPOR REFRIGERANT CHARGING

- Vapor can be added to the high- and low-pressure sides of the system while it is not operating
- Vapor can be added to the low-pressure side of the system while it is operating
- The refrigerant cylinder may need to be warmed in order to build up the pressure to properly charge the system
 - Warm water can be used to heat the cylinder
 - Never use a torch heat the refrigerant cylinder

LIQUID REFRIGERANT CHARGING

- When the system has been evacuated, liquid refrigerant can be added through the liquid line or receiver
- Liquid charging is faster than vapor charging
- The low-pressure control may need to be bypassed during the charging process
- Liquid refrigerant can be charged into the low side of the system if the refrigerant has first been vaporized
- When charging systems with blended refrigerants, the refrigerant must leave the cylinder as a liquid

WEIGHING REFRIGERANT

- Weighing the correct charge into the system can be accomplished with an electronic scale
- Bathroom scales should not be used to weigh refrigerant
- Electronic scales are often used
 - Expensive but very accurate
 - Automatically displays amount of refrigerant removed from cylinder
 - Some units dispense a predetermined amount of refrigerant and then shut off

USING CHARGING CHARTS (FIXED RESTRICTOR-TYPE METERING DEVICES)

- Curves and/or charts supplied by manufacturers
- Used to help technicians properly charge systems
- Since charts and curve vary for manufacturer to manufacturer, always follow directions carefully
- Uses superheat values
- Charge carefully! It is always easier to add refrigerant than remove it

CHARGING NEAR-AZEOTROPIC (ZEOTROPIC) REFRIGERANT BLENDS

- Blended refrigerants
 - Made up of two or more other refrigerants
 - Have different properties than component refrigerants
- Azeotropic blends
 - Have only one saturation temperature for each pressure
 - Behave like commonly known refrigerants (R-12, R-22)
- Near-azeotropic (zeotropic) blends
 - Temperature glide when they evaporate or condense

CHARGING ZEOTROPIC BLENDS

- Dew point value
 - Where saturated vapor begins to condense
 - Used for superheat calculations
- Bubble point values
 - Where saturated liquid begins to boil
 - Used for subcooling calculations

CHARGING ZEOTROPIC BLENDS

- Fractionation
 - Part of the blend will evaporate or condense before the rest of the blend
 - Will not occur when the refrigerant is in the liquid state
- The component of the blend with the lowest boiling point will leak faster than the other components
- Refrigerant must leave the cylinder as a liquid

UNIT SUMMARY - 1

- Evaporator superheat, condenser sub-cooling and compressor amperages should be monitored when charging an air conditioning or refrigeration system
- Refrigerant can be added to a system in either the vapor or liquid state
- Liquid charging is faster than vapor charging
- Refrigerant charges can be weighed into the system
- Charging charts can be used to determine the proper system charge

UNIT SUMMARY - 2

- Azeotropic blends behave as single refrigerants
- Near-azeotropic blends have a temperature glide
- Temperature glide indicates that there is more than one saturation temperature at a given pressure
- Blended refrigerants must leave the tank as a liquid
- The dew point is where vapors begin to condense
- Bubble point is where liquids begin to vaporize