

Automotive Heating And Air Conditioning

Eighth Edition

Automotive Heating and Air Conditioning

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Chapter 4 Refrigerants and Refrigerant Oils

ALWAYS LEARNING

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Learning Objectives (1 of 2)

- 4.1 Prepare for the ASE Heating and Air Conditioning (A7) certification test content area "B" (Refrigeration System Component Diagnosis and Repair).
- 4.2 Discuss the depletion of the ozone layer and the resulting issues of global warming.
- 4.3 Explain the impact of legislative laws on automotive A/C systems.

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Learning Objectives (2 of 2)

- 4.4 Discuss identifying refrigerants and proper storage container.
- 4.5 State the changes considered for future refrigerants.
- 4.6 Explain refrigerant safety precautions.
- 4.7 Discuss the different types and viscosities of refrigerant oils.

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Refrigerants and Environmental Issues (1 of 2)

- A chlorine atom from a chlorinated fluorocarbon (CFC) such as R-12 can travel into the stratosphere if it escapes or is released.
 - Under the effects of ice clouds and sunlight, it can combine with one of the oxygen atoms of an ozone molecule to form chlorine monoxide and an ordinary oxygen molecule, O₂.
 - This destroys that ozone molecule.

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Refrigerants and Environmental Issues (2 of 2)

- The chlorine can then break away and attack other ozone molecules.
- It is believed that 1 chlorine atom can destroy 10,000 to 100,000 ozone molecules.
- Global warming traps heat at the Earth's surface and lower atmosphere, and it is increasing the temperature of our living area.

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FIGURE 4-1 Large 30 pound containers of R-134a are light blue for easy identification.



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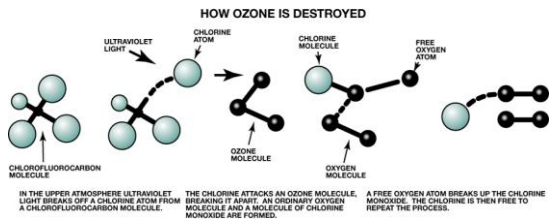
FIGURE 4-2 The stamped text at the top of this container reads "DOT-4BA400."



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FIGURE 4-4 Chlorofluorocarbon molecules break apart in the atmosphere.



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Legislation (1 of 3)

- Clean Air Act
 - Limit the production of ozone-depleting chemicals.
 - R-12 production in the United States ceased at the end of 1995.

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Legislation (2 of 3)

- Section 609
 - A portion of the Clean Air Act that places certain requirements on the mobile vehicle air conditioning (MVAC) service field.
 - Manufacture of HCFC-22 was stopped in 2010 in the United States and other developed countries.

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Legislation (3 of 3)

- Kyoto Protocol
 - Total Environmental Warming Impact (TEWI) index was developed, which rates the impact of various refrigerants along with the energy required to perform the cooling operation.

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HFO-1234yf

- What is HFO-1234yf?
- Ozone depletion and Global Warming potential
- Mandated
- Flammability
- R-1234yf concerns

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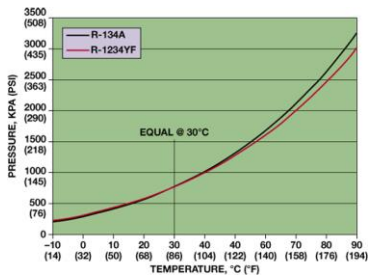
FIGURE 4-6 The chemical symbol for HFO-1234yf.



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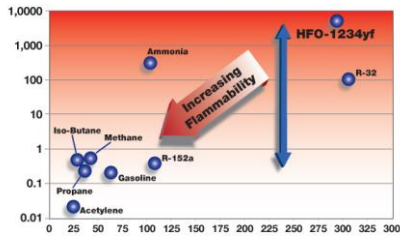
FIGURE 4-8 R-134a and R-1234yf have similar operating pressures.



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FIGURE 4-9 R-1234yf is just mildly flammable as shown at the top right of the chart.



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FIGURE 4-7 Due to the cost of R-1234yf, most shops will purchase 10 or 20 pound containers compared to the normal 30 pound container that most shops purchased for R-134a.



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Carbon Dioxide as a Refrigerant

- What is Carbon Dioxide?
- CO₂ as a refrigerant

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FIGURE 4-10 The label on a Toyota Fuel Cell Hybrid Vehicle (FCHV) showing that CO₂ (R744) is being used as the refrigerant.



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Alternative Refrigerants

- What is the SNAP program?
- Counterfeit and bootleg refrigerants

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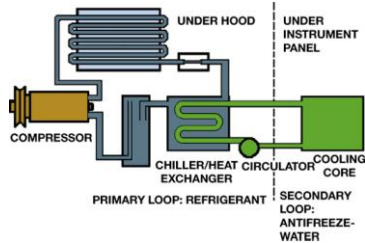
Secondary Loop Systems

- Systems that use potentially hazardous refrigerants will probably use a secondary loop.
 - A heat exchanger will provide a very cold fluid to connect with a liquid-to-air heat exchanger that will replace the evaporator.

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FIGURE 4-11 A secondary loop A/C system keeps the potentially dangerous or flammable refrigerant out of the passenger compartment by using a chiller/heat exchanger to cool an antifreeze and water mixture. This fluid then transfers heat from the cooling core in the air distribution section to the chiller.



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Refrigerant Safety Precautions (1 of 3)

- Wear safety goggles or a clear face shield and protective clothing (gloves) when working with refrigerants.
- Always be in a well-ventilated shop area when working with refrigerants and avoid small, enclosed areas.

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Refrigerant Safety Precautions (2 of 3)

- If liquid refrigerant is splashed onto the skin or into the eyes of a human or animal, it immediately boils and absorbs heat from the body part it is in direct contact with.
- If a CFC such as R-12 or R-22 comes into contact with a flame or heated metal, a poisonous gas similar to phosgene is formed.

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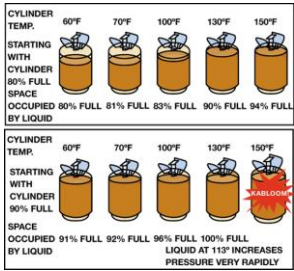
Refrigerant Safety Precautions (3 of 3)

- Several flammable refrigerants have been marketed, and even though they have been banned and are illegal, they still show up.
- When refrigerant containers are filled, room is left for expansion and the container is marked with its critical temperature, the maximum that it should be subjected to.

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FIGURE 4-12 When recovering refrigerant, the container should be filled to a maximum of about 80%.



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Refrigerant Oils (1 of 2)

- Refrigerants are commonly available in several sizes of containers including:
 - Small cans of 12 oz. to 14 oz. (400 g)
 - Larger drums or canisters of 15 lb. or 30 lb. (6.8 kg or 13.6 kg)
- Refrigerant containers are color coded:
 - R-12 containers are white; R-22 containers are green; R-134a containers are light blue

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Refrigerant Oils (2 of 2)

- Types of Refrigerant Oils
 - Mineral oil
 - PAG (polyalkylene glycol)
 - POE (polyol ester)
- Refrigerant oils are commonly available in several viscosities, including:
 - 46; 100; 150

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FIGURE 4-13 A container of refrigerant, which is a replacement for R-12 or R-134a and contains R-134a but also butane, a flammable gas.



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Summary (1 of 2)

- Refrigerants escaping into the atmosphere can have detrimental effects on the ozone layer and also increase climate change and global warming.
- The Clean Air Act places requirements for technicians to follow when servicing mobile A/C systems.

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Summary (2 of 2)

- Safety precautions should be followed when handling refrigerants.
- Refrigerant oils are available in different viscosities and the specified oil must be used when servicing an air-conditioning system.

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