SECTION 9

DOMESTIC APPLIANCES

UNIT 47

ROOM AIR CONDITIONERS

UNIT OBJECTIVES

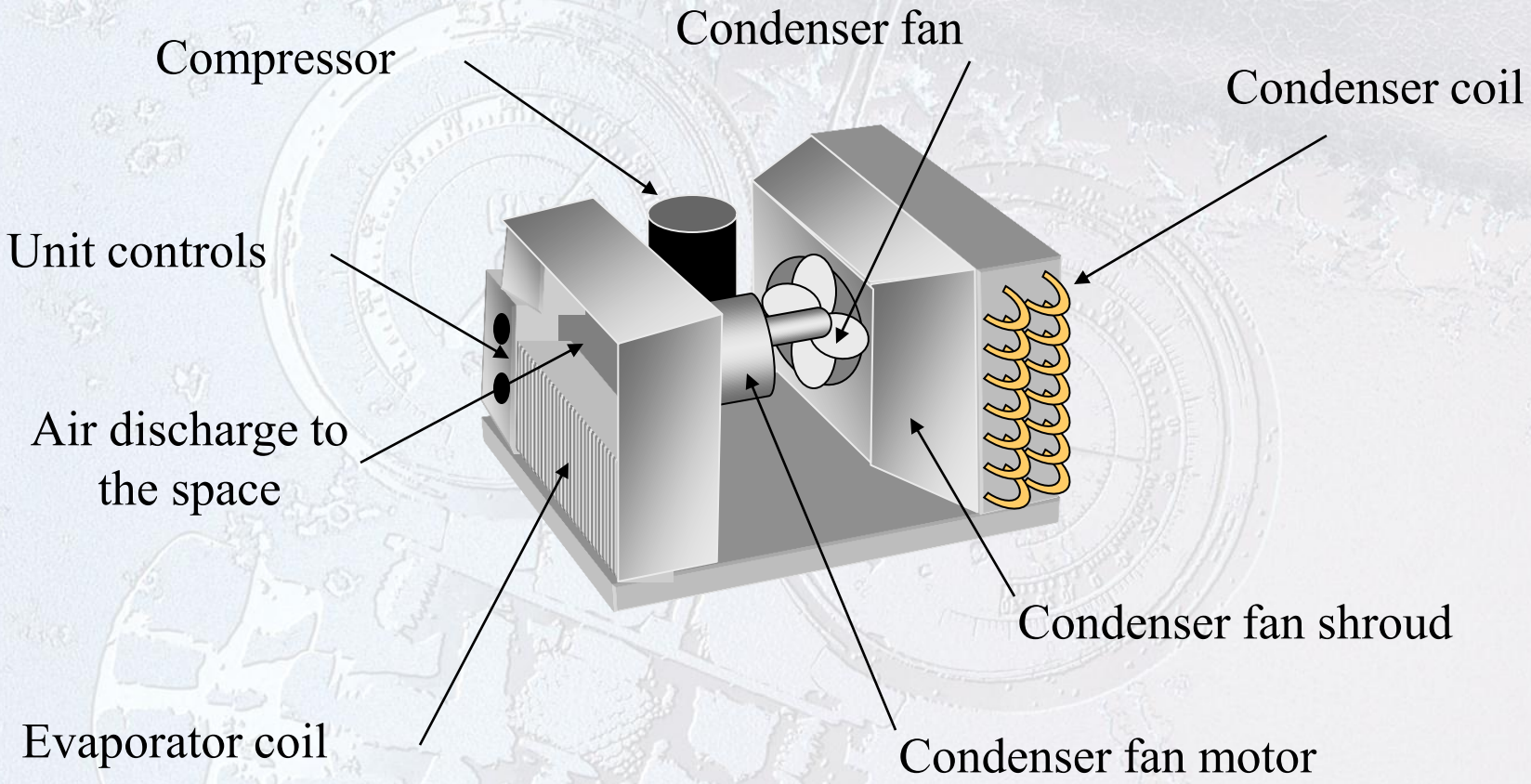
After studying this unit, the reader should be able to

- Explain various designs of window and through the wall units
- Explain the refrigeration cycle and its components in a window unit
- Explain the purpose of a capillary tube/suction line heat exchanger
- Describe reverse-cycle refrigeration in heat pump window units
- Describe the controls used in window and through the wall units
- Discuss service procedures for window air conditioners

AIR CONDITIONING AND HEATING WITH ROOM UNITS

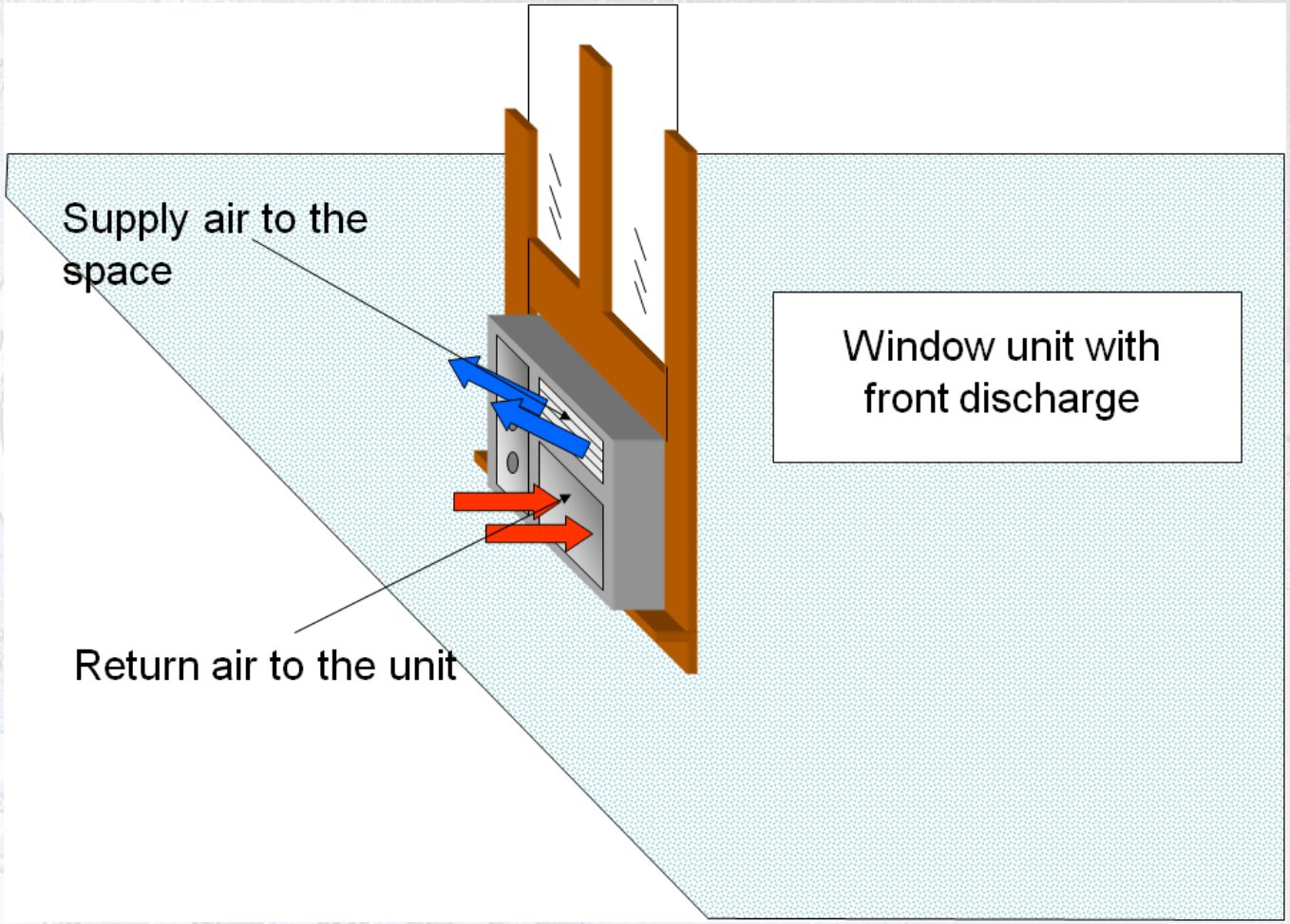
- Room units condition the air in one room
- Self-contained systems
- Cooling only or heating/cooling models
- Units that provide heating can use electric strip heaters or reverse-cycle refrigeration (heat pump)
- Some units can be used to condition the air in more than one room

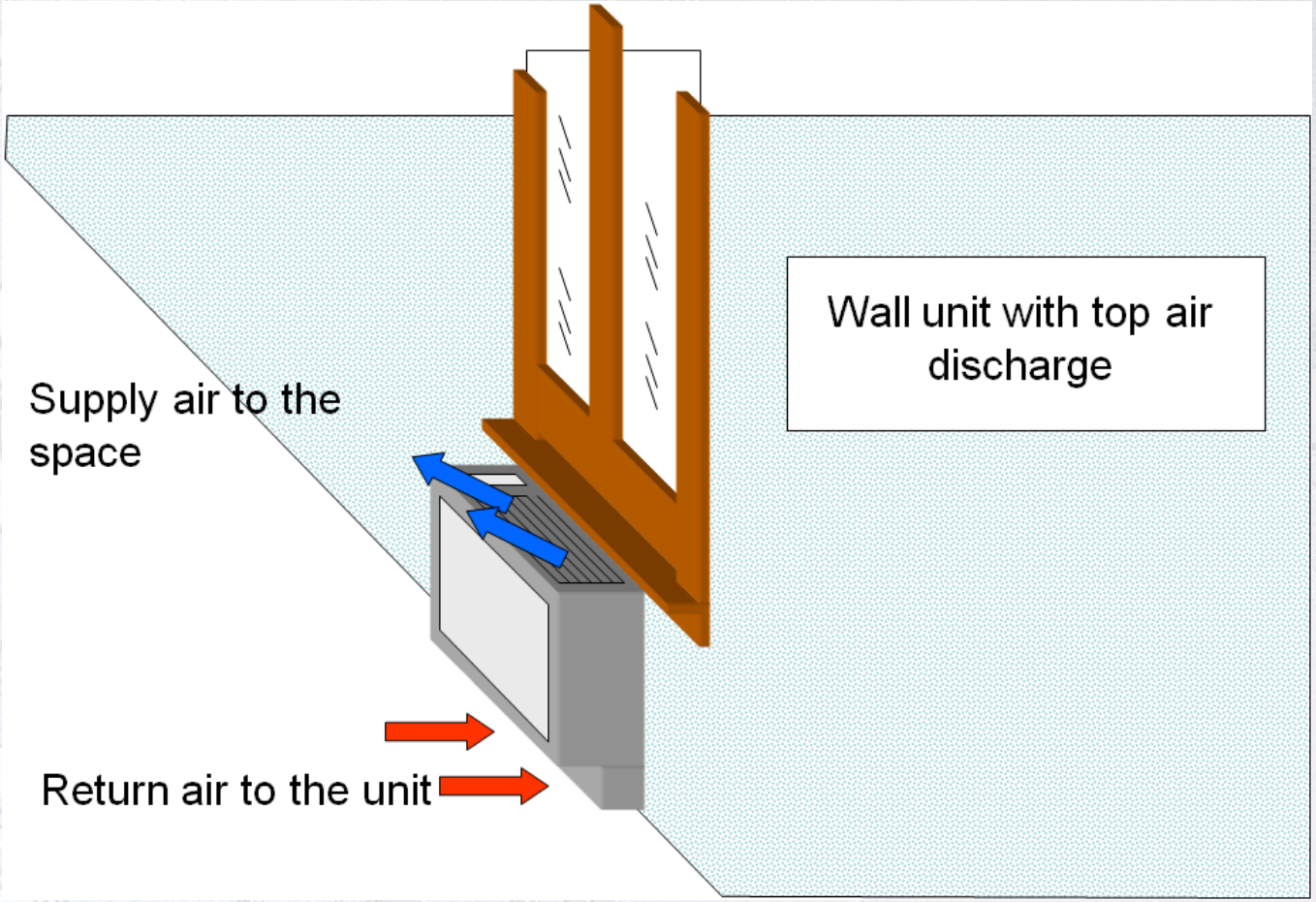
WINDOW AIR CONDITIONER (SIMPLIFIED)

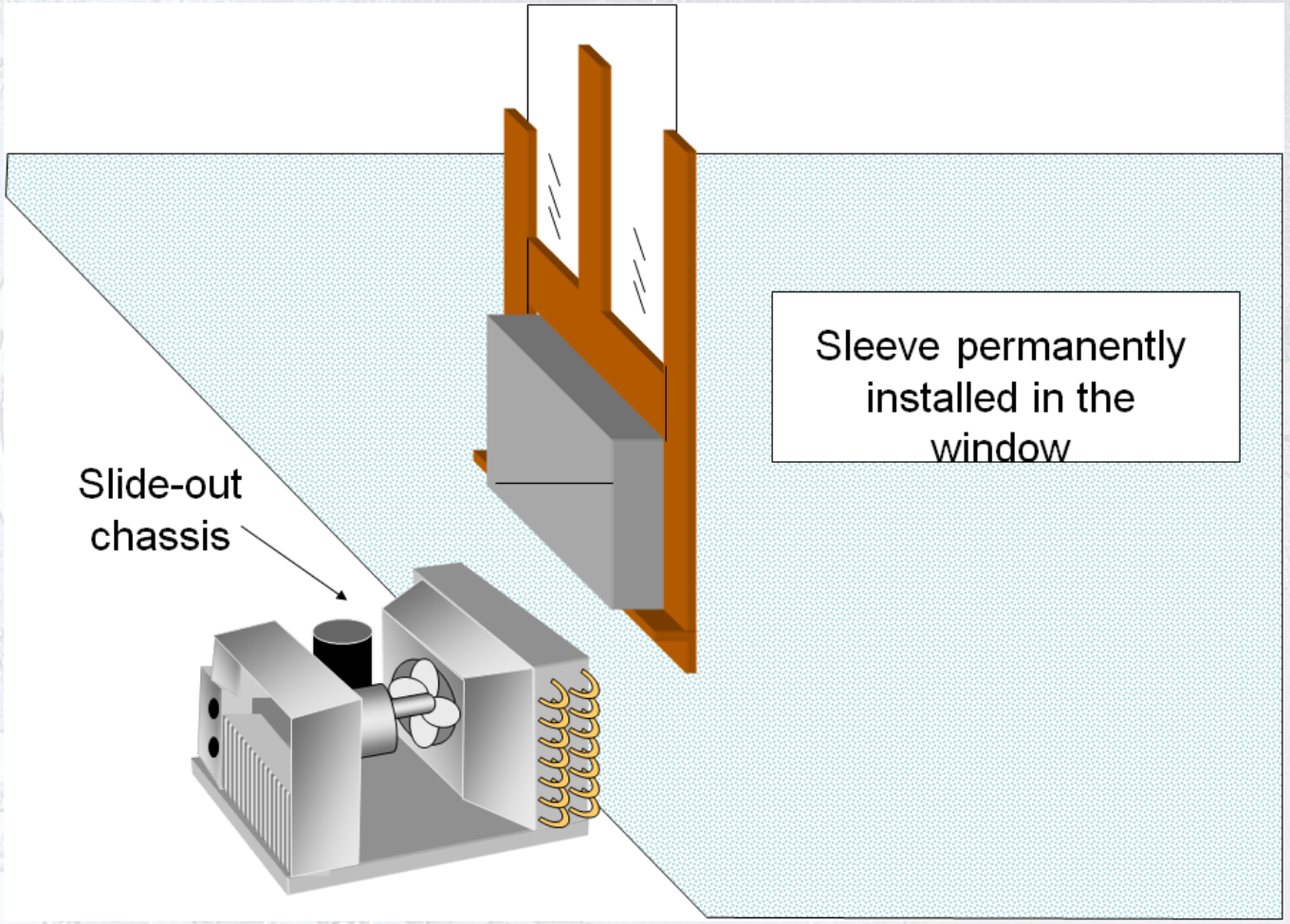


ROOM AIR CONDITIONING: COOLING

- Can be window or though-the-wall type units
- Most units have one fan motor that is used for both the evaporator and condenser (2 shafts)
- Unit capacity ranges from 4,000 to 24,000 btu/h
- Units can be front or top discharge
- Units can be fixed to the case or have a chassis that slides out of the case (sleeve)
- Slide-out chassis are easier to service



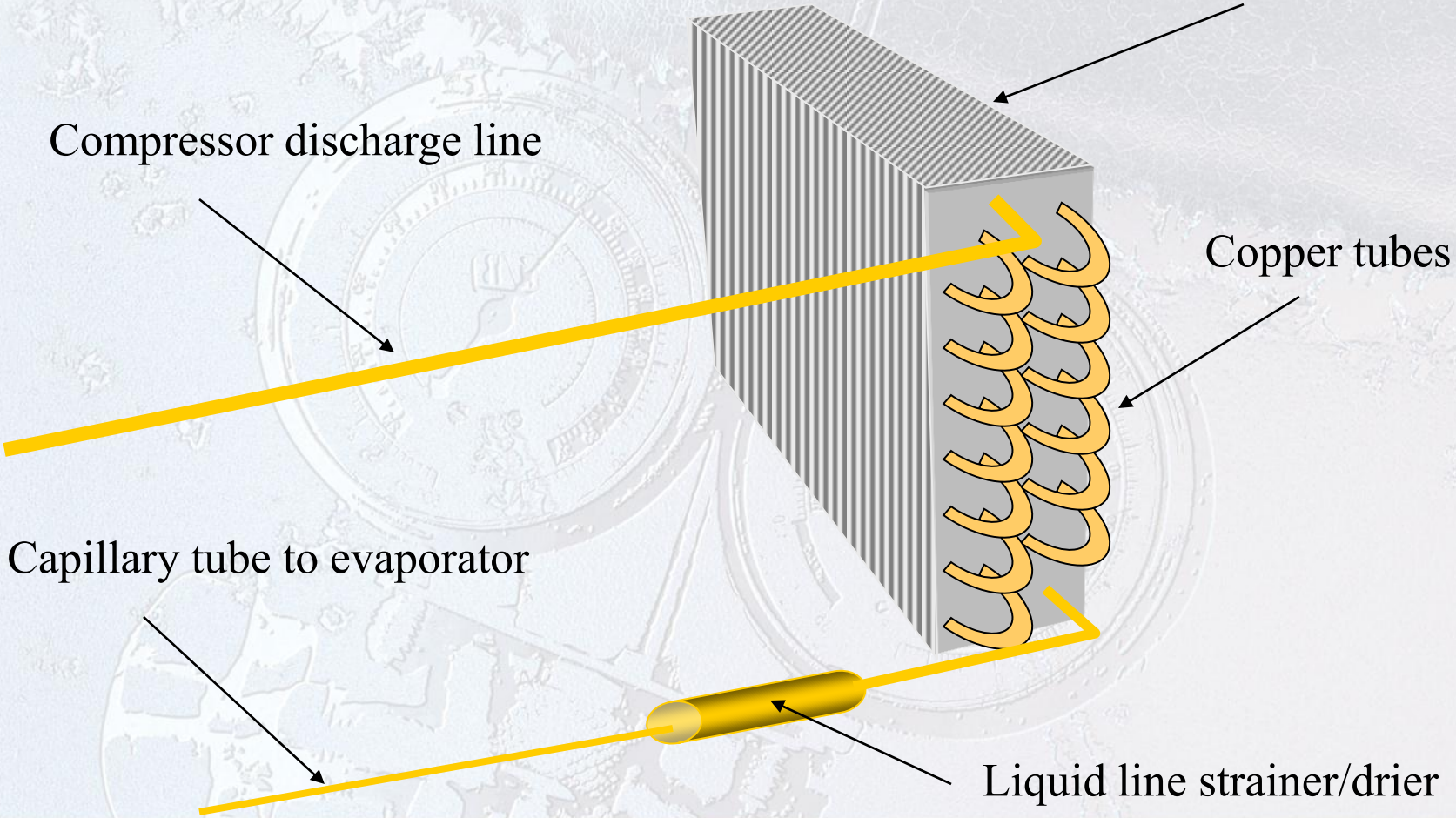




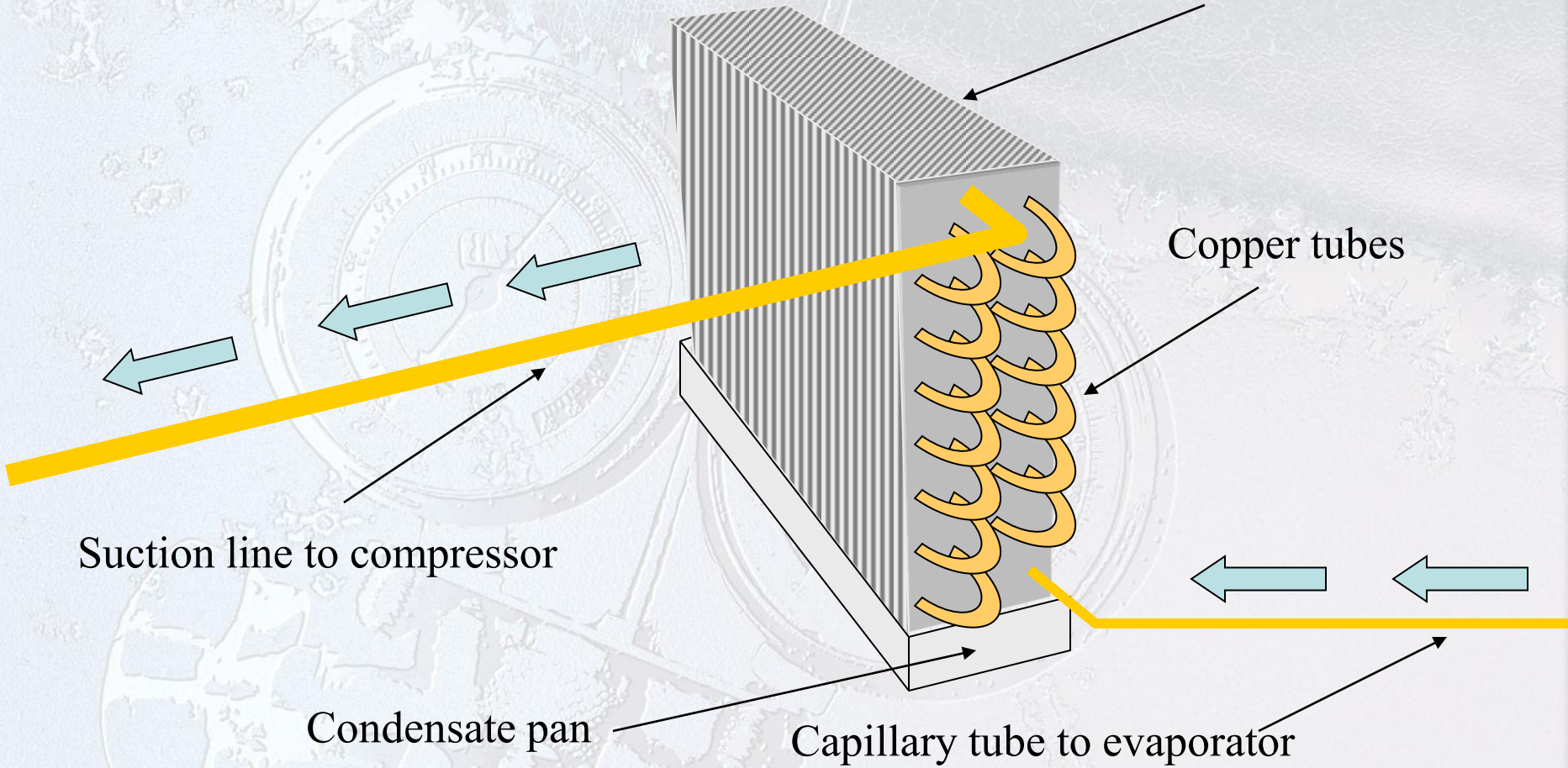
REFRIGERATION CYCLE: COOLING

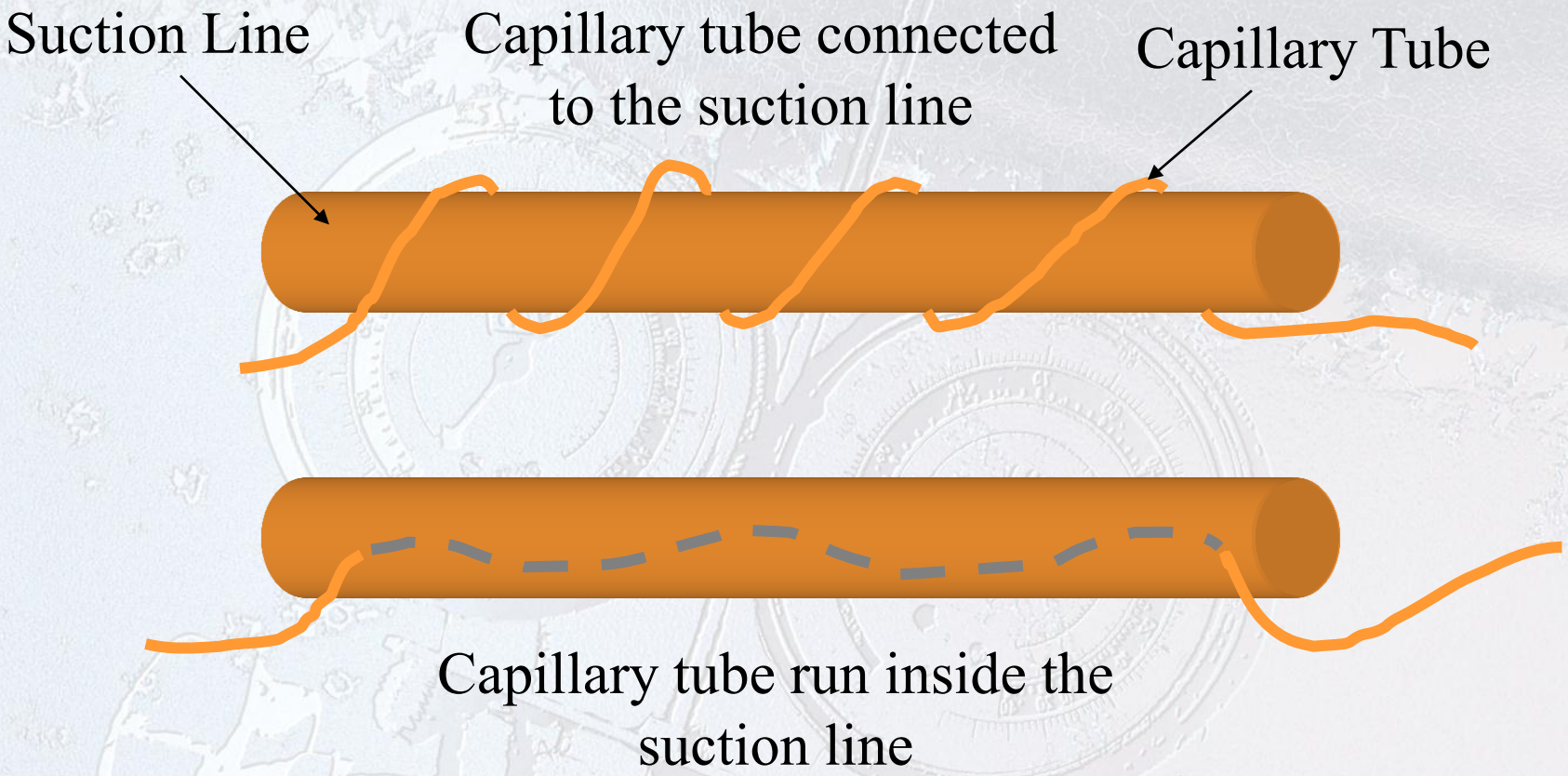
- Most commonly used refrigerant is R-22
- Room units are high temperature appliances
- Units consist of the same four basic components
  - Evaporator
  - Compressor
  - Condenser
  - Metering device

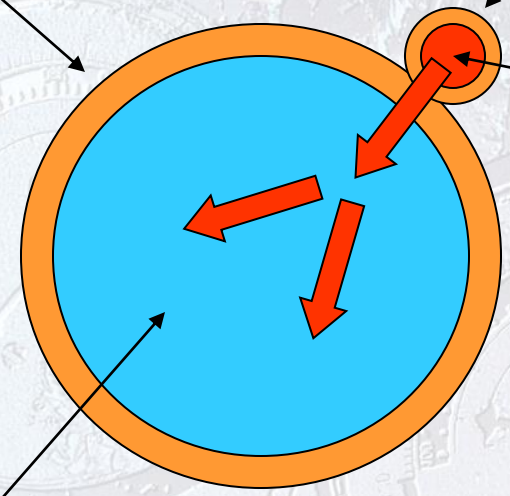
WINDOW UNIT CONDENSER COIL



WINDOW UNIT EVAPORTOR COIL







REFRIGERATION CYCLE: COOLING

- The evaporator absorbs heat from the space
  - The evaporator dehumidifies and cools
  - Made of copper tubes and aluminum fins
  - Fins are in close contact with the tubing
  - Operates below dew point temperature
  - Typical evaporator temperature is about 35 degrees
  - The evaporator coil should not freeze
  - Condensation forms on the coil

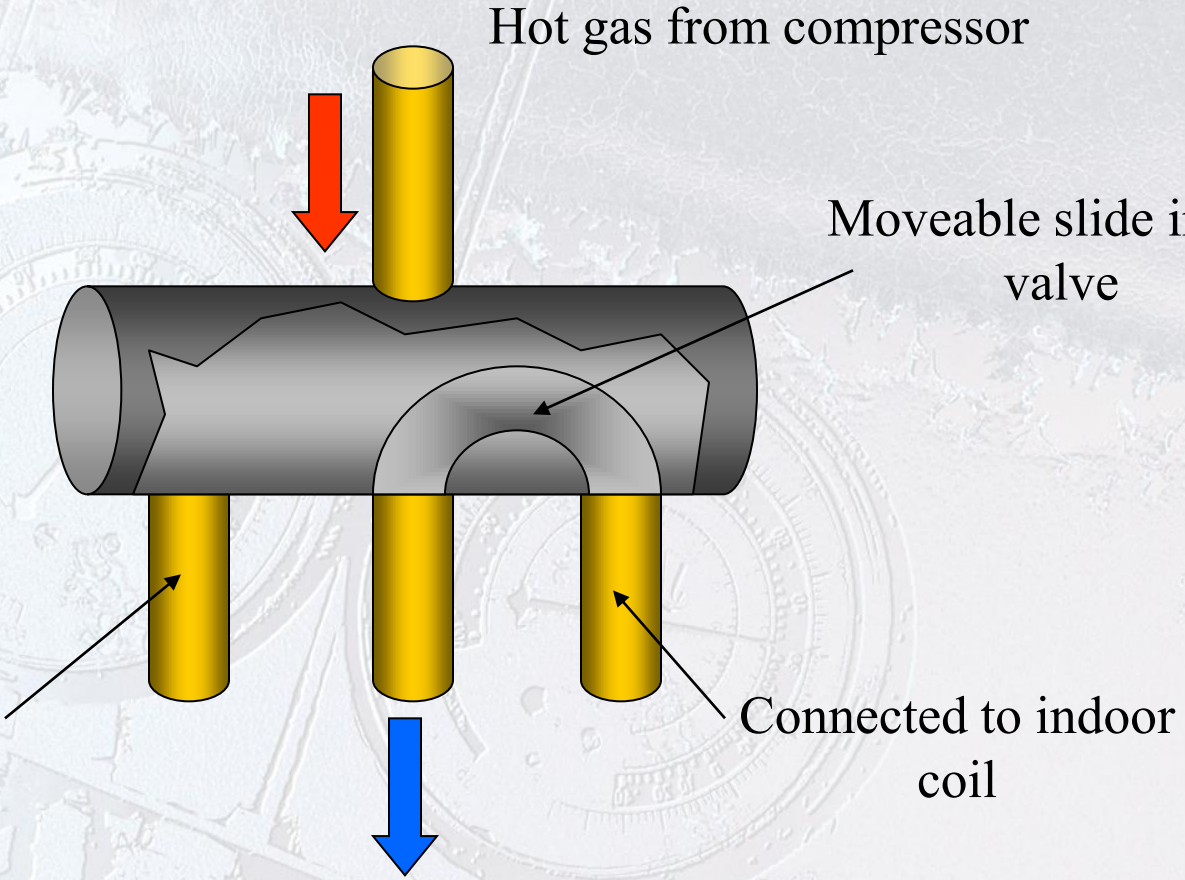
REFRIGERATION CYCLE: COOLING

- Compressor pumps refrigerant through the unit
  - Typically hermetically sealed rotary or reciprocating
- Condenser rejects heat from the system
  - Usually made of copper tubes with aluminum fins
  - Condenses the heat-laden vapor from the compressor
- Capillary tube metering device
  - Controls refrigerant flow to the evaporator

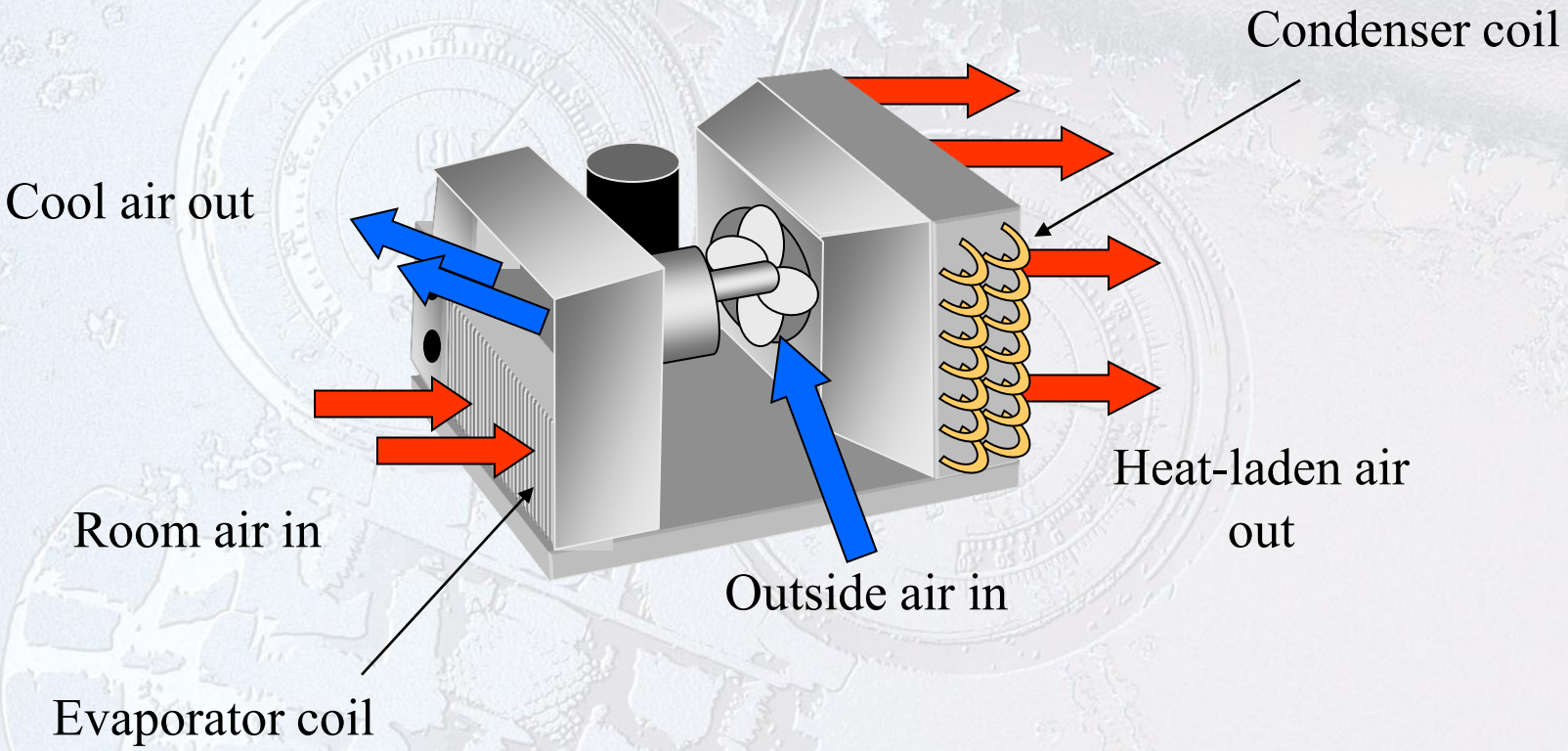
REFRIGERATION CYCLE: HEATING (HEAT PUMP)

- Reverse-cycle refrigeration (4-way reversing valve)
- Unit can provide heating or cooling
- In the heating mode, the indoor coil functions as the condenser; the outdoor unit as the evaporator
- In the cooling mode, the indoor coil functions as the evaporator; the outdoor unit as the condenser
- Supplementary electric heaters are often used

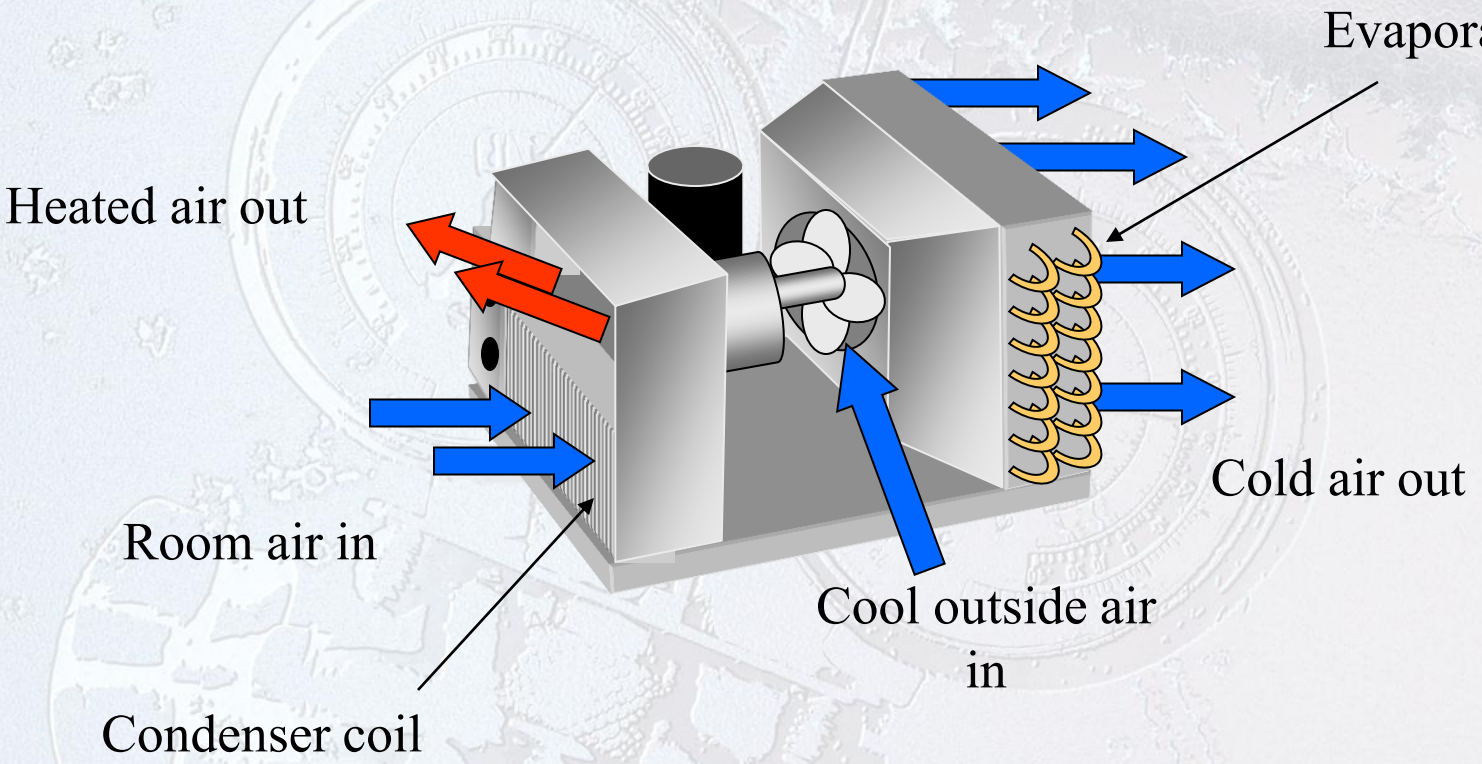
Direct-acting reversing valve is controlled directly by a solenoid coil



WINDOW HEAT PUMP AIR CONDITIONER (COOLING MODE - SIMPLIFIED)

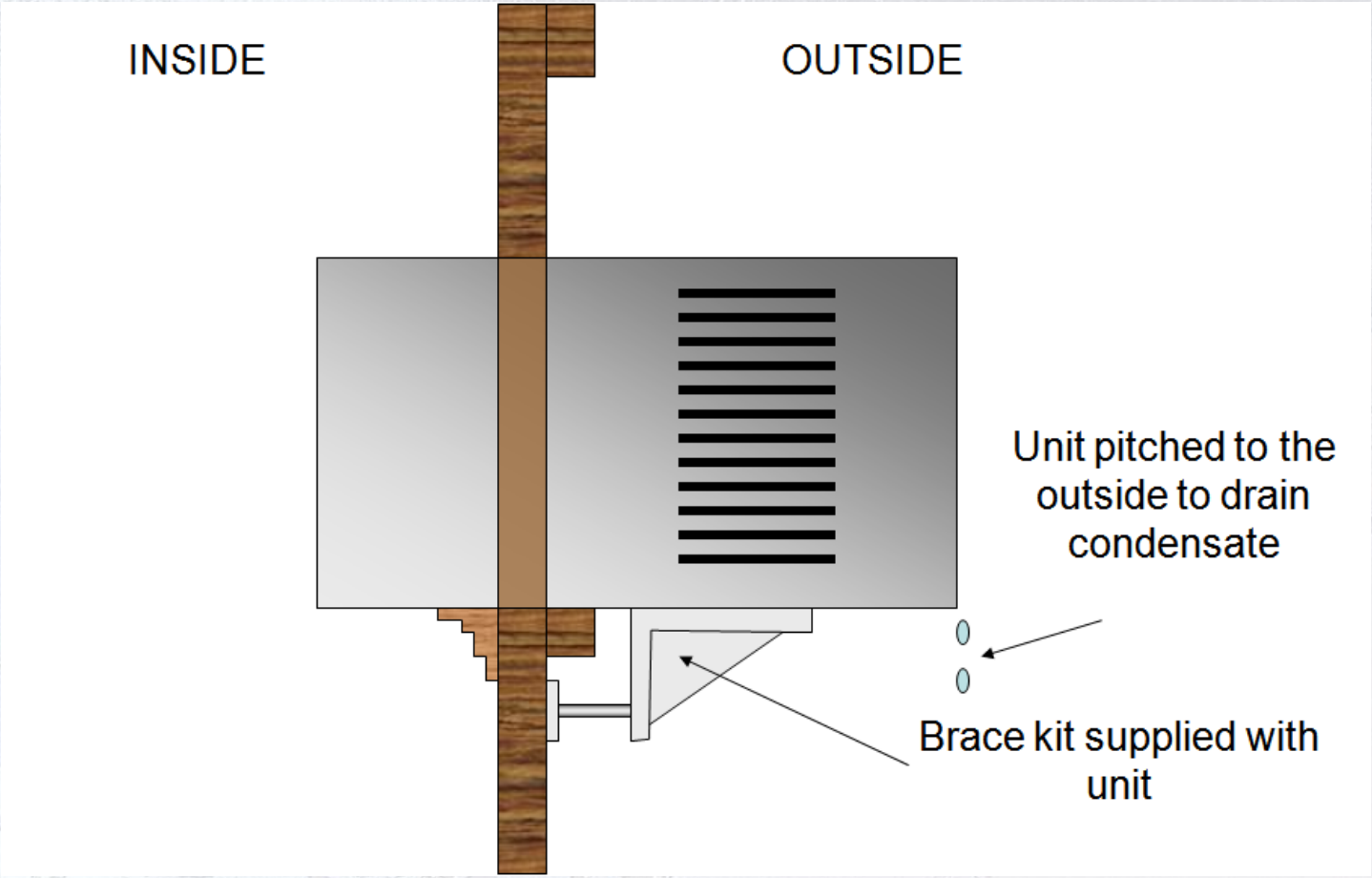


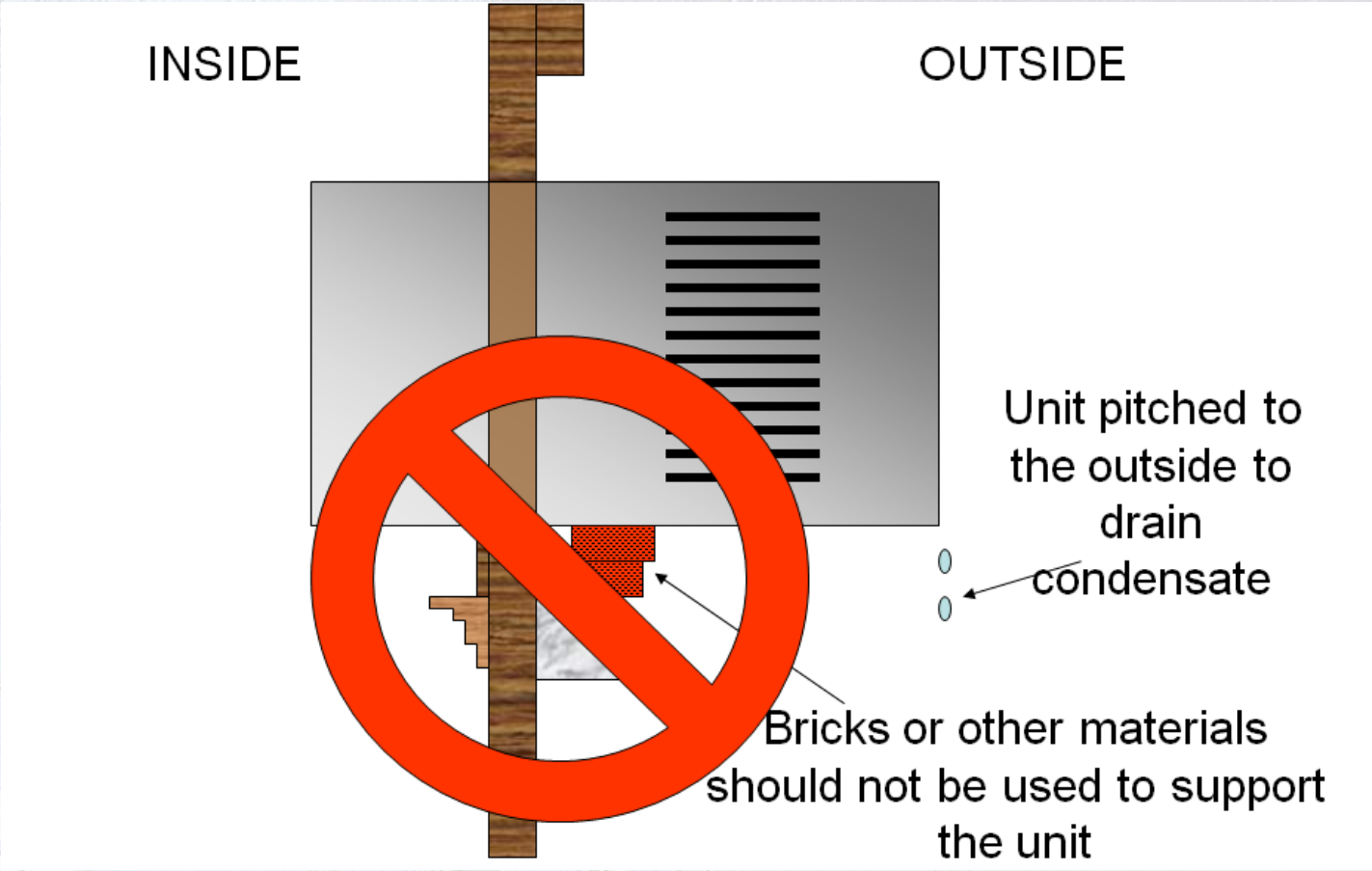
WINDOW HEAT PUMP AIR CONDITIONER (HEATING MODE - SIMPLIFIED)



INSTALLATION

- Installed in the window or through the wall
- Units should have a dedicated electric circuit
- Unit must be properly supported
- Units should be pitched toward the outside of the structure to help remove condensate
- Air must be able to circulate freely
- Through the wall units can be installed during building construction (sleeves are installed when walls are constructed and the units are slid in afterwards)

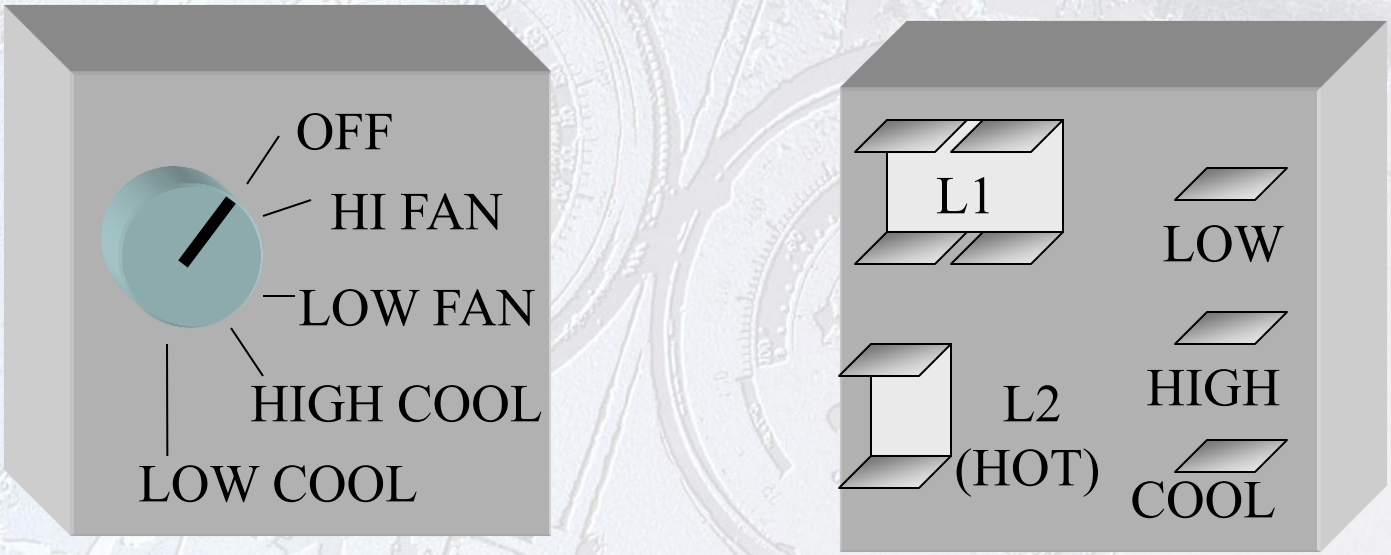




ROOM UNIT CONTROLS: COOLING

- All controls are located within the unit
- Thermostat sensor is located in the return air stream
- Switch controls fan speed and compressor circuit
- Power cord wired directly to the control switch
- High cool mode operates the compressor and the high speed of the fan motor
- Low cool mode operates the compressor and the low speed of the fan motor

TYPICAL AIR CONDITIONING SELECTOR SWITCH (SIMPLIFIED)



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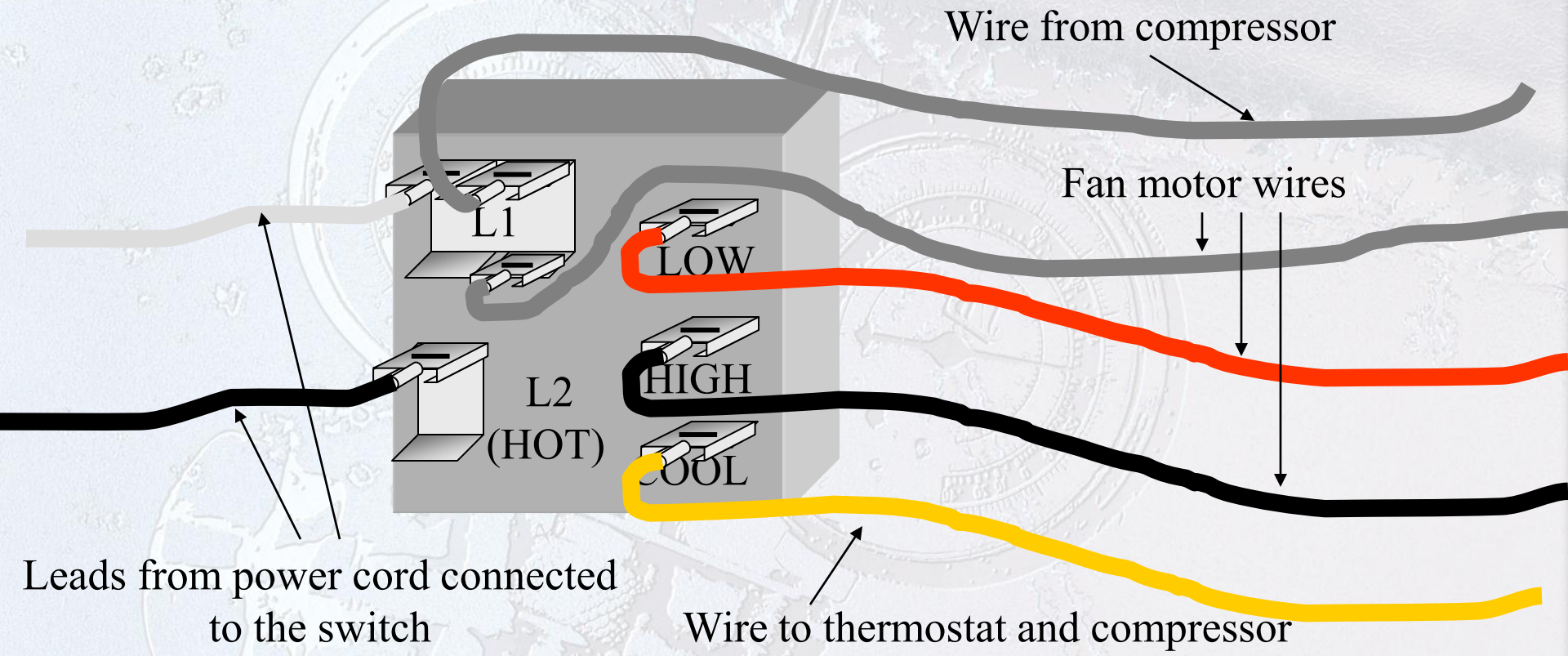
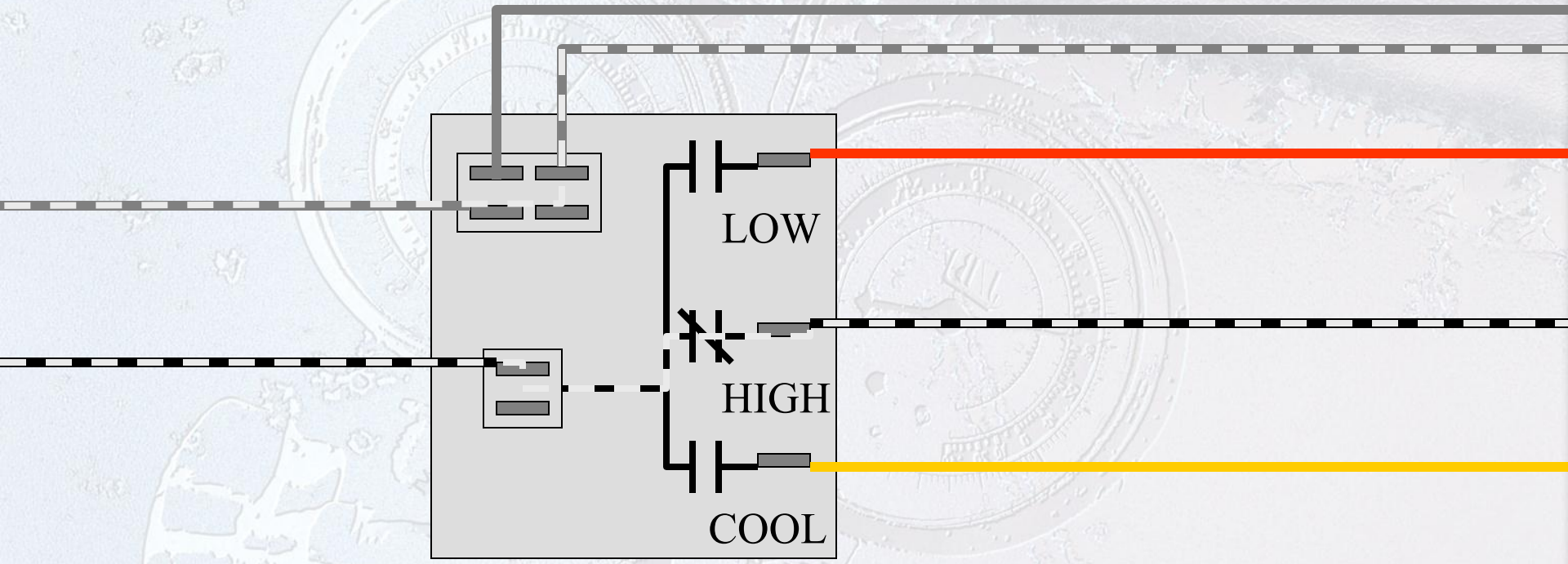
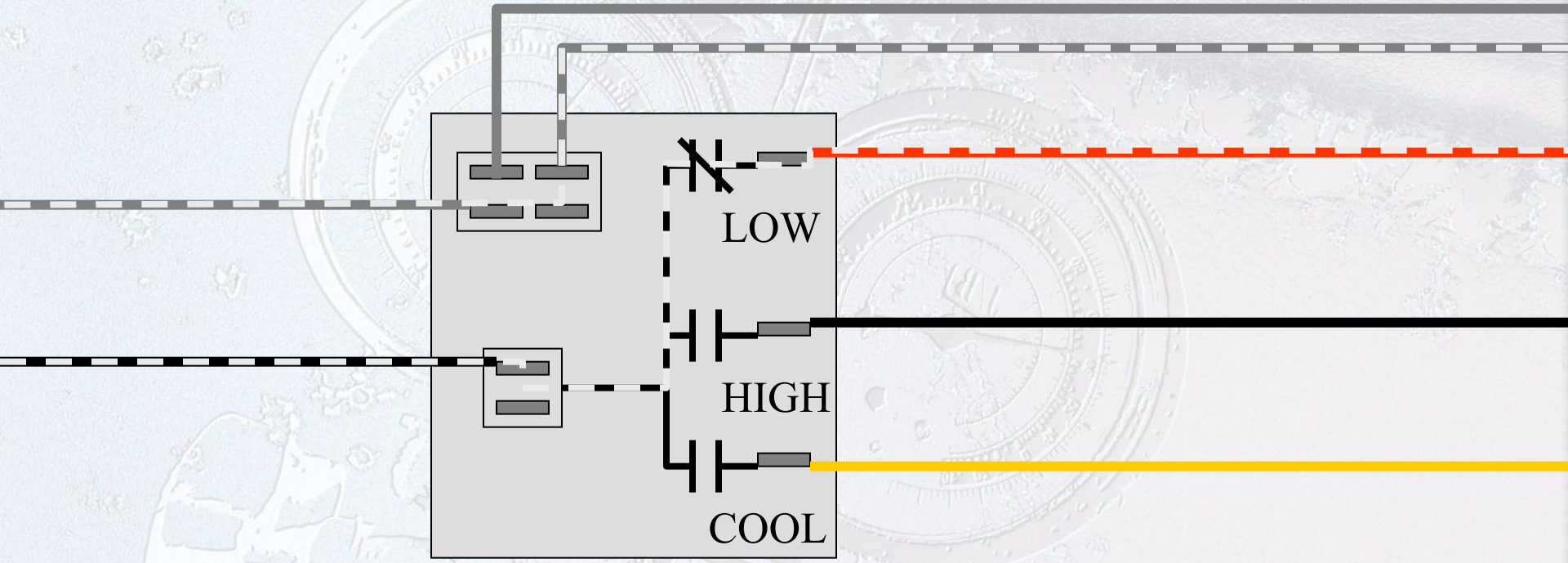


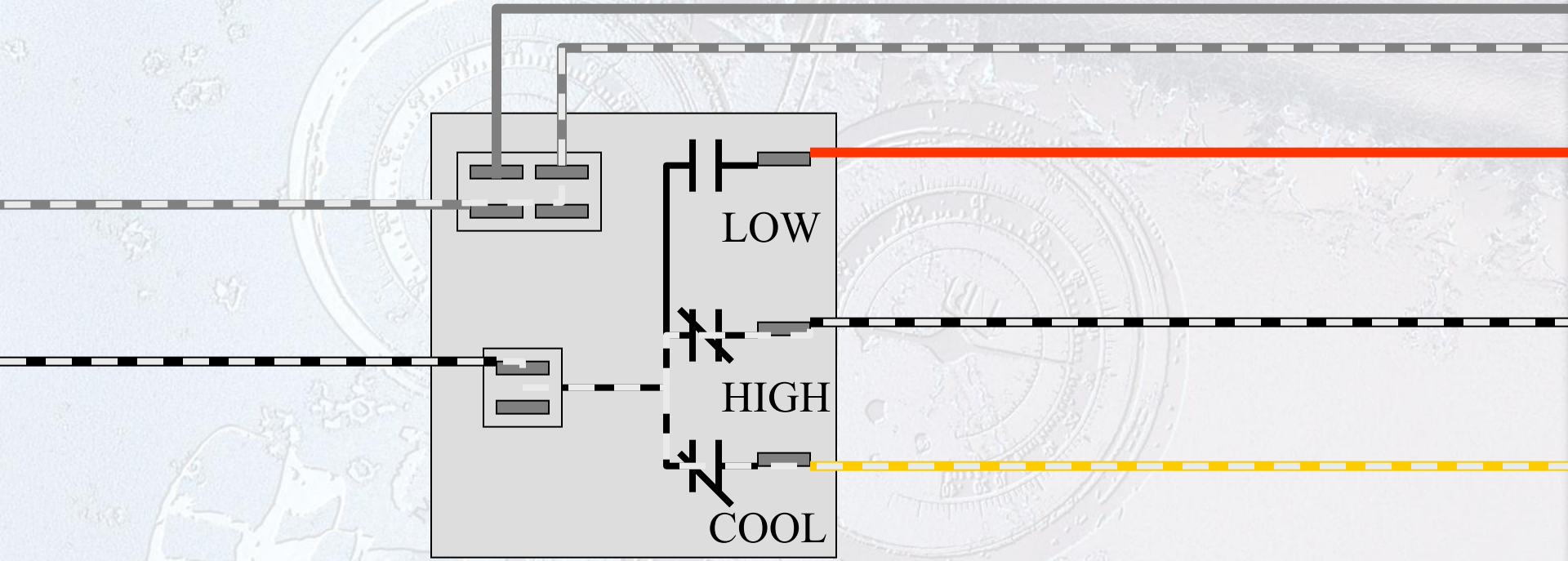
ROOM AIR CONDITIONER WITH SWITCH SET TO HIGH FAN



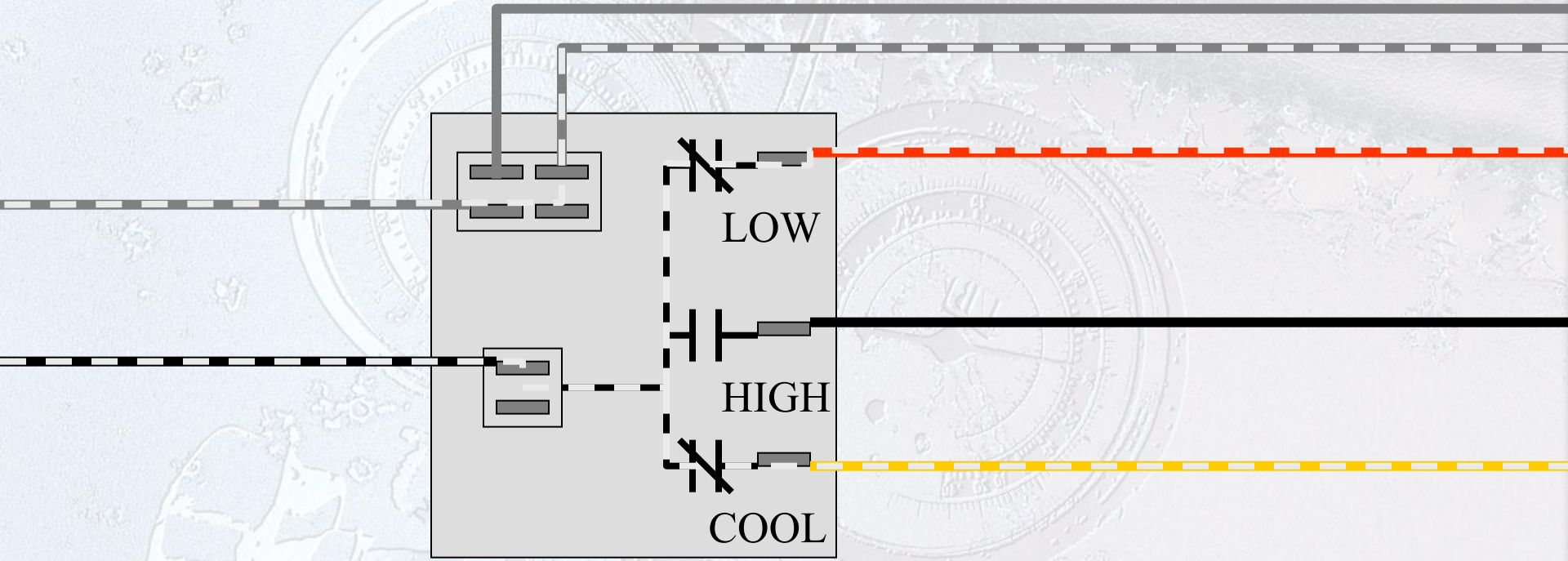
ROOM AIR CONDITIONER WITH SWITCH SET TO LOW FAN



ROOM AIR CONDITIONER WITH SWITCH SET TO HIGH COOL



ROOM AIR CONDITIONER WITH SWITCH SET TO LOW COOL



CONTROLS: COOLING AND HEATING UNITS

- The selector switch changes the unit over between the heating and cooling modes
- Thermostat sensor located in return air stream
- Selector switch controls compressor and fan speeds
- Thermostat controls both the heating and cooling modes of operation
- Some units have electronics and remote controls

MAINTAINING/SERVICING ROOM UNITS

- Filters and coils should be kept clean
- Motors may need to be lubricated
- Room units are critically charged
- Gages should be installed only when necessary
- Line tap valves may need to be installed (consult valve manufacturer for important information)
- Perform a bench test if a low charge is suspected
- Unit leaks should be located and repaired

MAINTAINING/SERVICING ROOM UNITS

- Nitrogen or a nitrogen/R-22 mixture can be used for leak detection purposes (trace of R-22)
- Nitrogen or nitrogen/R-22 mixture can be released from the unit after the leak detection process
- System must be properly evacuated after the leak has been located and repaired (triple evacuation)
- If the capillary tube must be replaced, it must be cut and sized properly

SERVICING ROOM UNITS

- Care should be taken when replacing motors to prevent damage to blowers, fans and coils
- All units must be electrically grounded
- Electrical service must be the correct voltage
- Thermostats can be checked by taking voltage readings across them
  - A reading of 0 volts indicates the thermostat is closed
  - A line voltage reading indicates the thermostat is open

SERVICING ROOM UNITS

- Some units have energy saver switches that cycle the fan motor on and off with the compressor
- Check power cords for damage, loose connections and overheated or swollen plugs
- Selector switches can be checked with the power on
  - Line voltage readings should be obtained from the common terminals and the individual circuits
  - If power enters the switch but does not leave it, the switch is defective and should be replaced

SUMMARY - 1

- Room units are self-contained appliances that condition the air in one room
- Cooling only or heating/cooling models
- Units that provide heating can use electric strip heaters or reverse-cycle refrigeration (heat pump)
- Can be window or though-the-wall type units
- Units can be fixed to the case or have a chassis that slides out of the case (sleeve)
- Room units are high temperature appliances

SUMMARY - 2

- Typical evaporator temperature is about 35 degrees
- Reverse-cycle refrigeration can provide heating or cooling
- In the heating mode, the indoor coil functions as the condenser; the outdoor unit as the evaporator
- Units should have a dedicated electric circuit
- Unit must be properly supported and should be pitched toward the outside of the structure to help remove condensate

SUMMARY - 3

- All controls are located within the unit
- Switch controls fan speed and compressor circuit
- High cool mode operates the compressor and the high speed of the fan motor
- The selector switch changes the unit over between the heating and cooling modes
- Thermostat sensor located in return air stream
- Room unit maintenance primarily involves filters and motor lubrication

SUMMARY - 4

- Gages should be installed only when necessary
- Unit leaks should be located and repaired
- System must be properly evacuated after the leak has been located and repaired (triple evacuation)
- Care should be taken when replacing motors to prevent damage to blowers, fans and coils
- Check power cords for damage, loose connections and overheated or swollen plugs