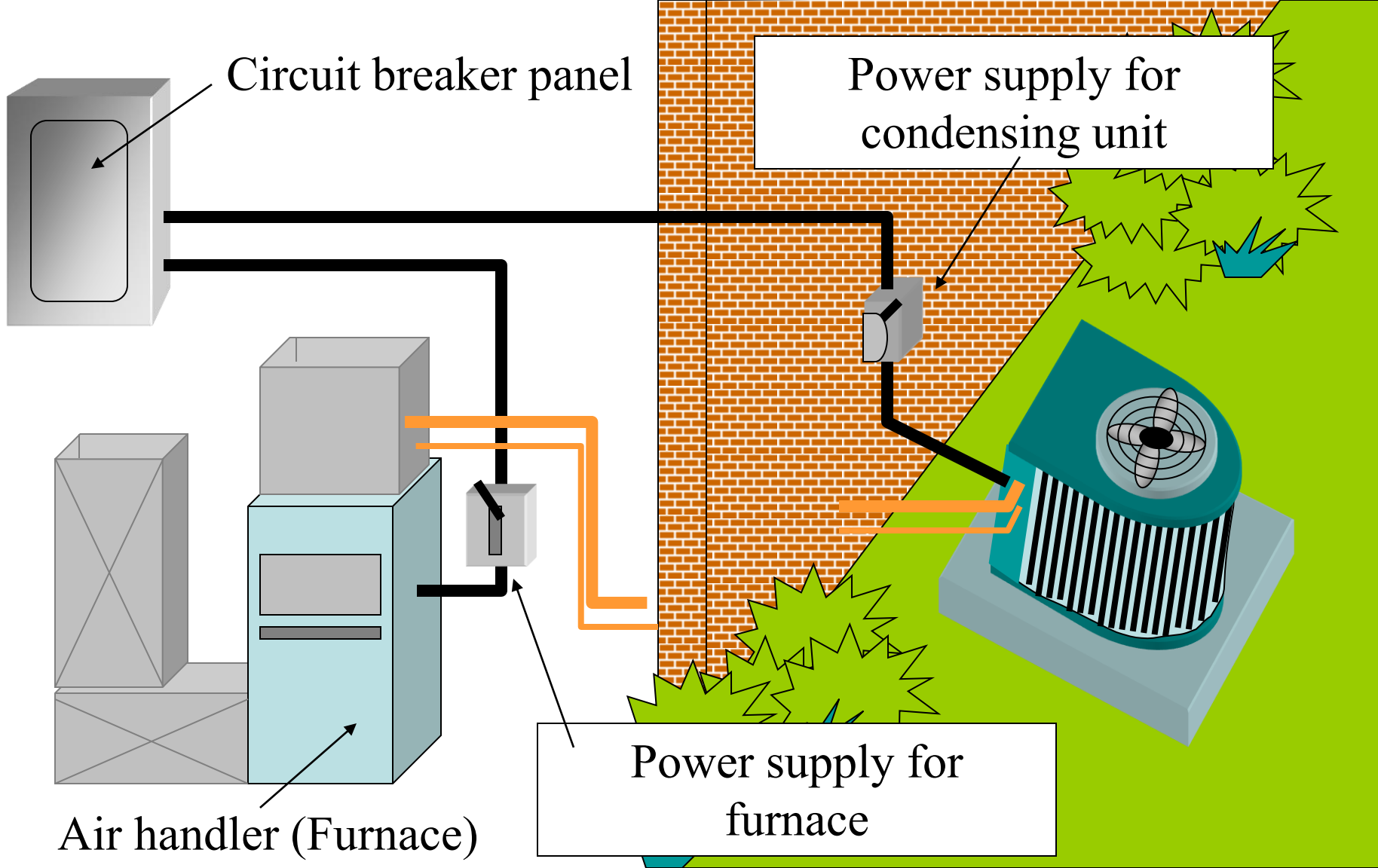


UNIT OBJECTIVES

- Describe the concept of year-round air conditioning
- List three typical year-round air conditioning system types
- List the five ways to condition the air
- Determine airflow for a cooling system
- Explain why heating systems requires less airflow than cooling systems
- Explain how airflow is controlled for the heating and cooling systems
- Describe two control voltage power supplies used on add-on systems
- Explain the concepts of add-on and package air conditioning

COMFORT ALL YEAR

- System that conditions the living space with heating and cooling throughout the year
- Most common ways of providing year round air conditioning
 - Air conditioning with electric resistance heat
 - Electric air conditioning with gas heat
 - Electric air conditioning with oil heat
 - A heat pump system



FIVE PROCESSES FOR CONDITIONING AIR

- Air is conditioned when it is heated, cooled, humidified, dehumidified and/or cleaned
- Most air-conditioning and heating systems and forced-air systems
- Air is distributed through ductwork to the conditioned space
- The fan is the component that provides the force to move the air through the duct system
- The heat for the system could be an electric, gas, or oil furnace

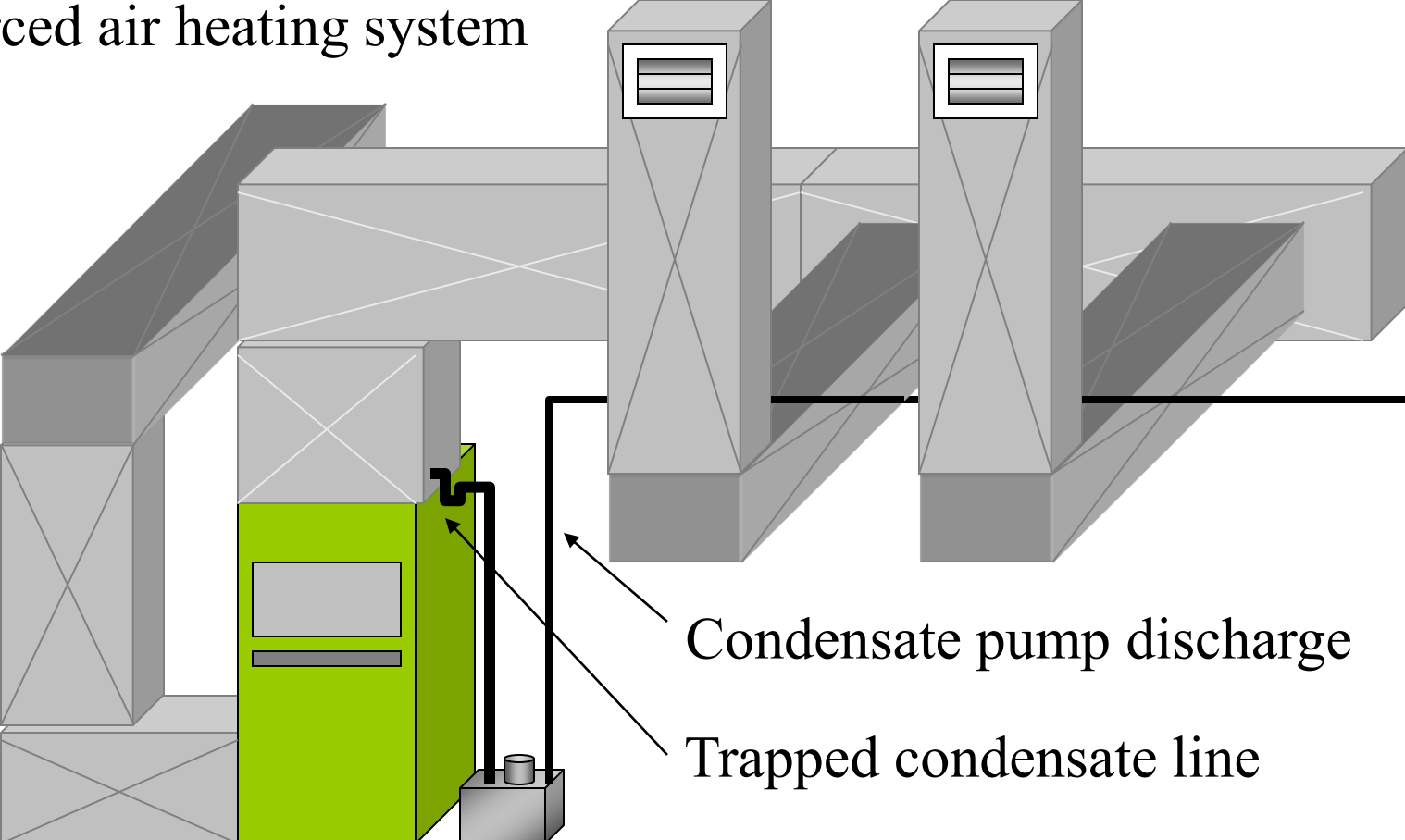
ADD-ON AIR CONDITIONING

- Air-conditioning systems must have the correct air circulation
- Typically require an airflow of 400 cfm per ton of cooling
- Most forced-air heating systems do not require 400 cfm
- The ductwork must be sized for the proper airflow of the air-conditioning unit

INSULATION FOR EXISTING DUCTWORK

- Ductwork should be insulated if it is located outside the conditioned space
- Insulation helps prevent heat exchange between the air in the duct and the ambient air
- Systems installed for heating only may have a undersized duct systems and blowers if air conditioning is added
- A load calculation should be done on the structure

Duct systems must be insulated when air conditioning is added to a forced air heating system



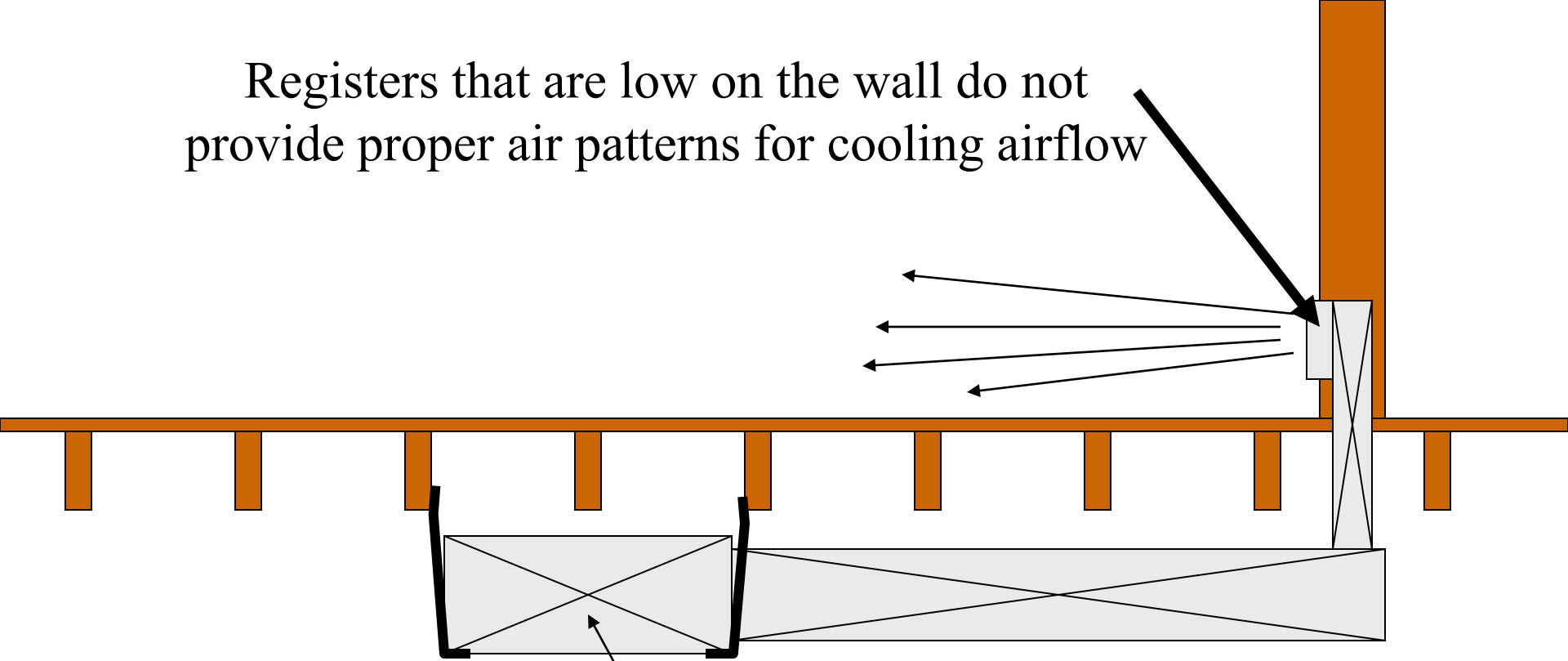
Condensate pump discharge

Trapped condensate line

EVALUATION OF AN EXISTING DUCT SYSTEM

- Blower size and the motor horsepower may be guides as to the amount of air the fan section is capable of moving
- Duct system may be evaluated with an evaluation chart
- Registers may not provide the correct air pattern for cooling
- The air-conditioning installation may require an airflow that is too great for an existing furnace

Registers that are low on the wall do not provide proper air patterns for cooling airflow

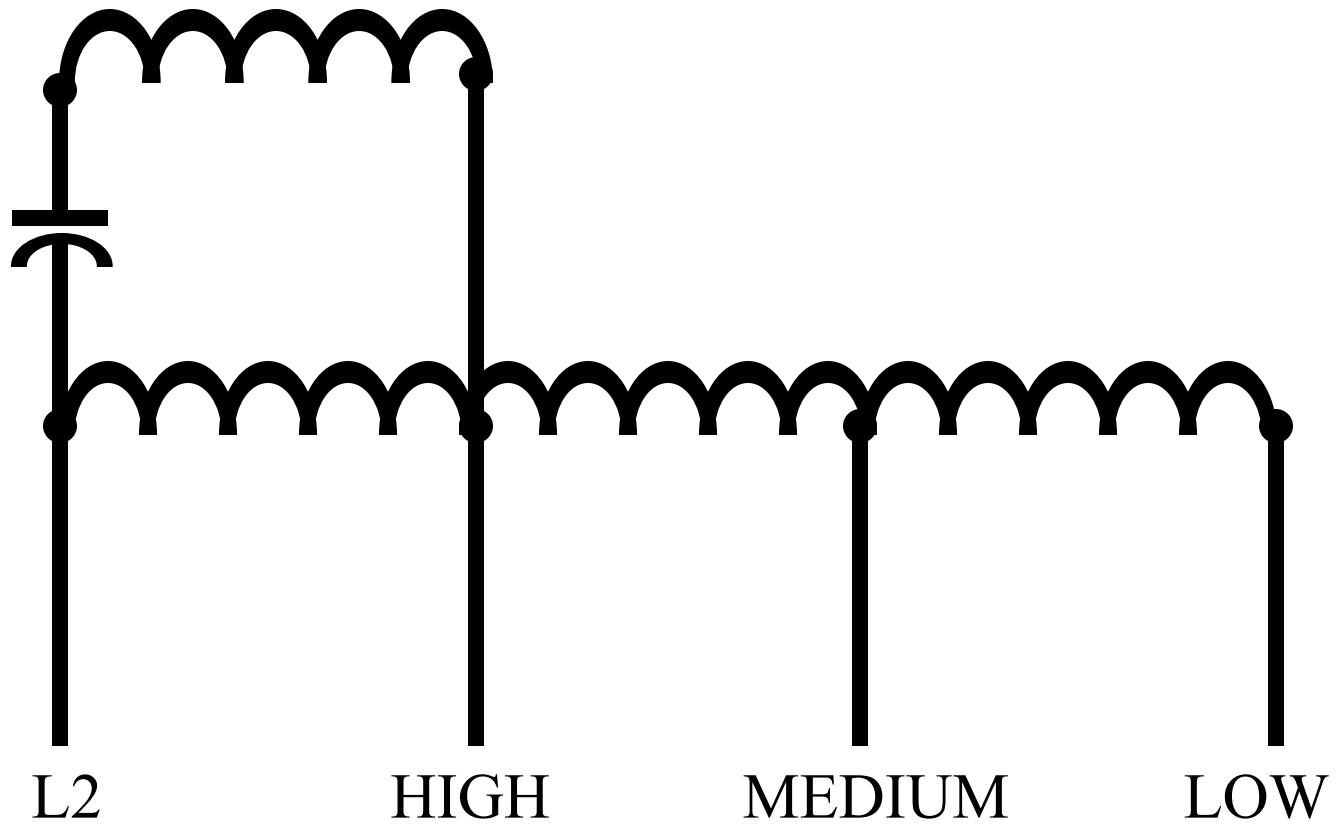


Supply duct from existing heating system

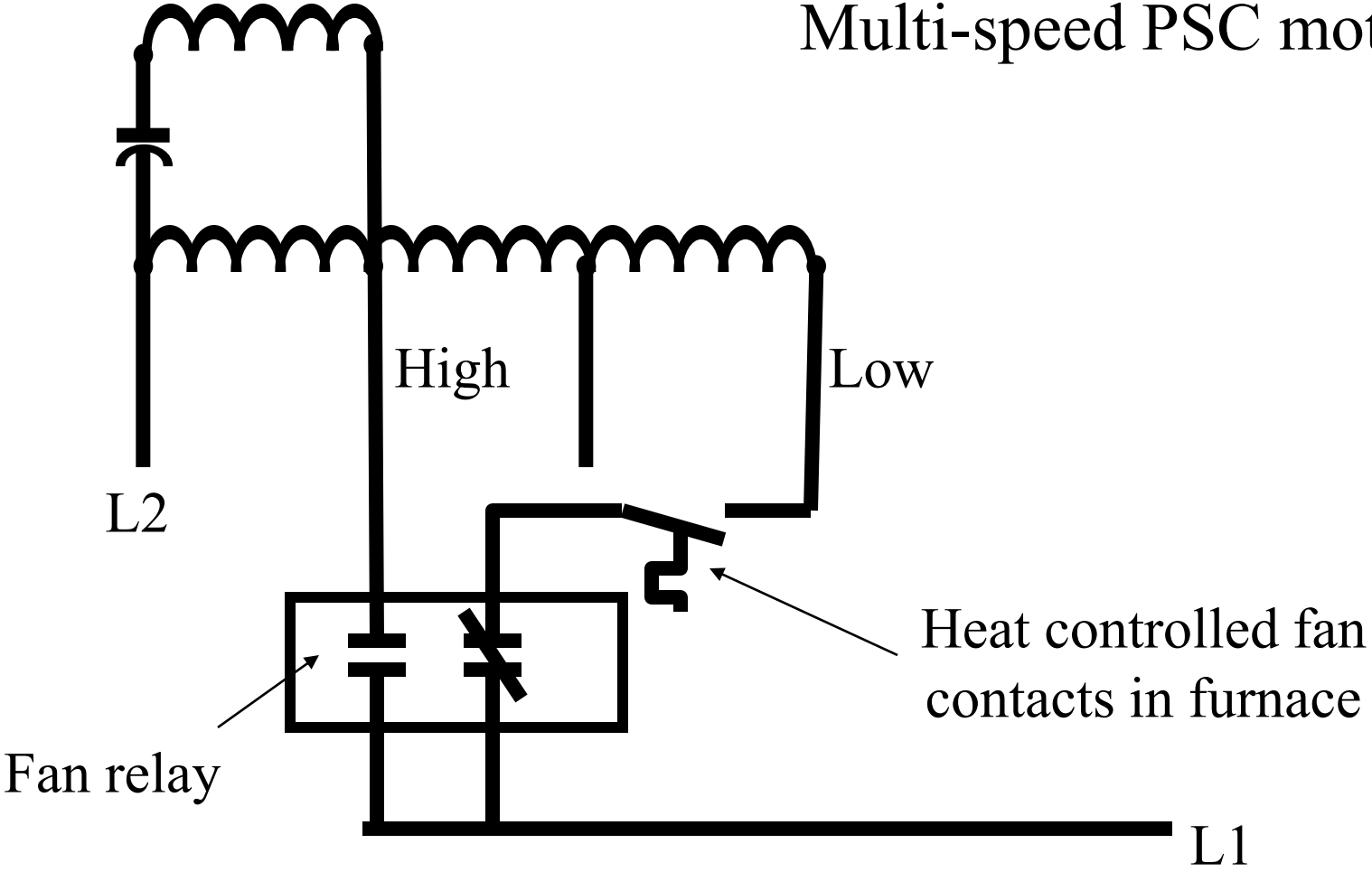
COOLING vs HEATING AIR QUANTITY

- A 400 cfm airflow used in the winter time may create drafts
- Too much air will cause products of combustion to be too cool and condensation may occur
- Changing the air volume can be achieved with dampers or a multi-speed fan
- Damper positions must be changed manually each season
- Motor pulleys can be used to change the airflow for each season
- Multi-speed motors have a winding for each motor speed

Multi-speed PSC motor



Multi-speed PSC motor



L2

High

Low

Fan relay

Heat controlled fan contacts in furnace

L1

CONTROL WIRING FOR COOLING AND HEATING

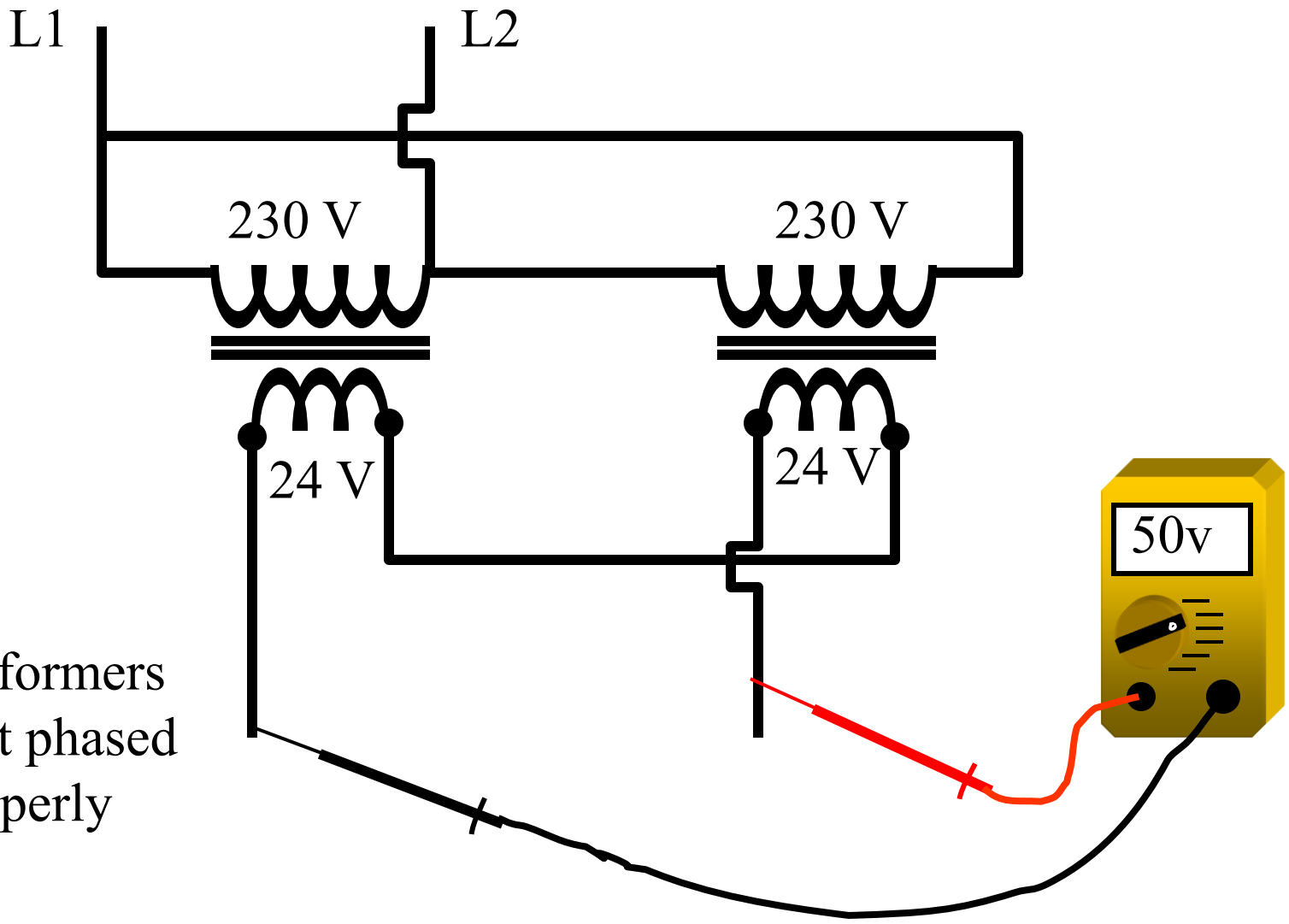
- Another consideration for year-round air conditioning is the control wiring
- Control system must be capable of operating heating and air-conditioning equipment at the proper times
- The thermostat is the control that accomplishes this

TWO LOW-VOLTAGE POWER SUPPLIES

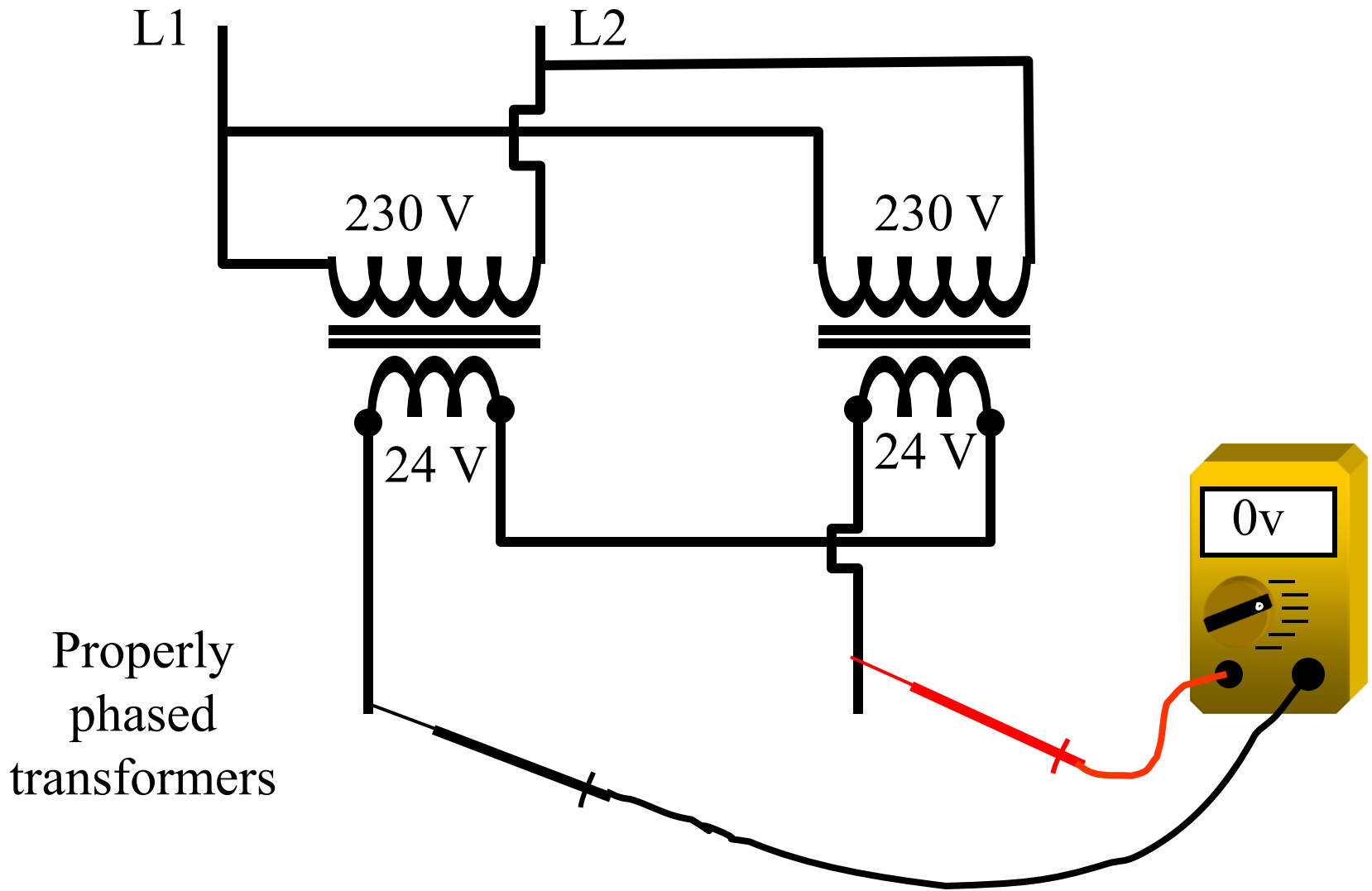
- There may be two power supplies if the heating system was installed first and the air conditioning added later
- Air-conditioning systems usually require a 40-VA transformer to supply enough current to energize the compressor contactor and fan relay
- Most furnaces can operate on a 25-VA transformer
- When two power supplies are used, a special arrangement must be made in the thermostat and subbase

PHASING TWO LOW-VOLTAGE TRANSFORMERS

- Transformers wired in parallel
- Transformers must be kept in phase
- To determine whether or not the transformer are in phase use a voltmeter and apply it to the two hot connections
- High voltage indicates the transformers are out of phase
- The meter will read 0 V from the hot lead if the transformers are in phase
- Out-of-phase transformer can be corrected with the primary or secondary wiring



Transformers
are not phased
properly



ADDING A FAN RELAY

- Most fossil-fuel furnaces will start the fan with a thermal-type fan switch in the heating mode
- A separate fan relay must be installed when the air conditioning is installed
- The fan relay may be called a transformer relay package or fan center
- The fan relay is part of the low- and high- voltage circuits

NEW ALL-WEATHER SYSTEMS

- Ductwork is designed around the cooling system
- All-weather split systems have the ductwork sized to handle the air for the cooling mode
- Package or self-contained all-weather systems are not normally made for oil with air conditioning
- Most are gas and electric or electric and electric

WIRING THE ALL-WEATHER SYSTEM

- Similar to that of air-conditioning systems except that extra power may have to be supplied for the electric heat
- Control wiring is the same as gas furnace and electric air conditioning except that the wiring is all done between the thermostat and the package unit

SERVICING THE ALL-WEATHER SYSTEM

- Package systems have the advantage of being located outside
- All the control wiring is at the unit and major components are accessible
- Dirty filters can affect both the heating and cooling function of the equipment
- Any gas hazard is virtually eliminated because gas is dissipated outside

SUMMARY - 1

- Year round comfort can be accomplished with a heat pump system or electric air conditioning with a furnace (gas, oil or electric)
- Air is conditioned when it is heated, cooled, humidified, dehumidified and/or cleaned
- Air is distributed through ductwork to the space
- Ductwork must be sized for the proper airflow of the air-conditioning unit (about 400 cfm per ton)

SUMMARY - 2

- Ductwork should be insulated if it is located outside the conditioned space
- Required airflow for heating and cooling modes of operation are different (cooling requires more airflow)
- Control system must be capable of operating heating and air-conditioning equipment at the proper times
- There may be two power supplies if the heating system was installed first and the air conditioning added later
- Transformers must be properly phased

SUMMARY - 3

- A separate fan relay must be installed when the air conditioning is installed
- All-weather split systems have the ductwork sized to handle the air for the cooling mode
- Wiring for a package all-weather systems is similar to that of air-conditioning systems except that extra power may have to be supplied for the electric heat
- Package all weather systems are typically located outside and all major system components are easily accessible