HVAC EQUIPMENT

COMPONENT FUNCTIONS & MAINTENANCE

HVAC EQUIPMENT: COMPONENT FUNCTIONS & MAINTENANCE

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ABSORPTION UNIT GENERATOR:
COMPONENT FUNCTIONS

PURPOSE: Unit uses lithium bromide solution heated by steam or direct-fired gas burner. Generates chilled water in cooling and dehumidification.

1 **ABSORBER CONTROL CENTER**
Provides tubing connection point for safety interlock, controls for condenser water.

2 **PURGE UNIT (MOTOR, PUMP, SOLENOID VALVE, SHUT-OFF VALVE)**
Removes non-condensables from system.

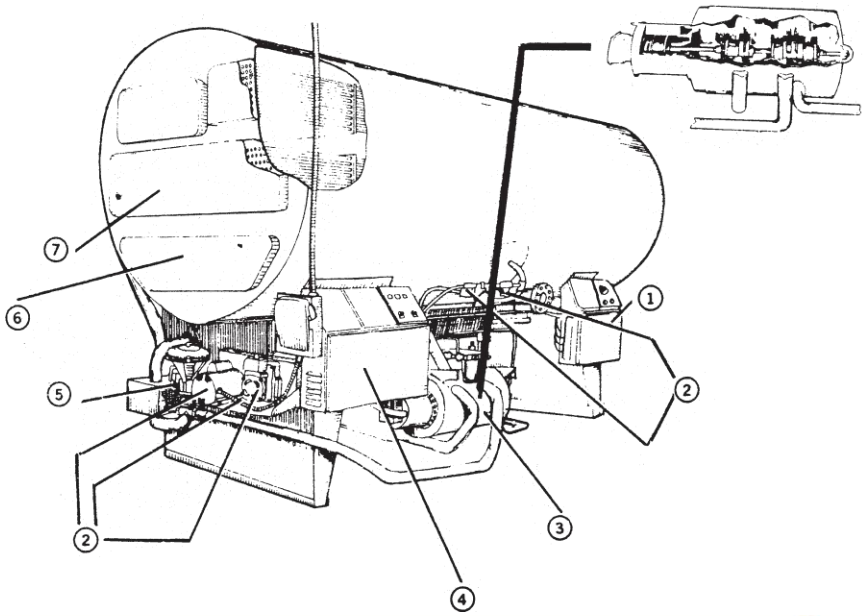
3 **PUMPS (REFRIGERANT, ABSORBER, CONCENTRATOR)**
Pumps refrigerant to evaporator spray header, solution into absorber, and solution to concentrator.

4 **ELECTRIC CONTROL PANEL**
Contains internal operating and safety controls.

5 **ECONOMIZER VALVE**
Controls solution flow to concentrator.

6 **ABSORBER HEAD**
Allows access to water-side of absorber.

7 **EVAPORATOR HEAD**
Allows access to water-side of evaporator.



ABSORPTION UNIT GENERATOR:
COMPONENT MAINTENANCE

1 ABSORBER CONTROL CENTER
Clean controls.
Calibrate and adjust safety devices.
Check air leads and/or electrical connections.
Sequence test all controls.

2 PURGE UNIT (MOTOR, PUMP, SOLENOID VALVE, SHUT-OFF VALVE)
Lubricate motor.
Change purge unit oil.
Check drive belt and adjust tension.
Sequence test and check for non-condensables.

3 PUMPS (REFRIGERANT, ABSORBER, CONCENTRATOR)
Inspect starter.
Replace worn contacts.
Measure operating voltage and current.
Record and compare to name plate data.
Test vibration.
Lubricate motor and pump bearings.
Inspect gaskets and seals for leakage and deterioration.
Clean and paint as required.
Clean pump motor cooling water strainer.
Test motor winding insulation resistance.

4 ELECTRIC CONTROL PANEL
Clean, calibrate and adjust.
Check capacity control.
Check safety controls.
Test indicator lights.
Inspect contacts.
Clean contacts as required.

5 ECONOMIZER VALVE
Check valve operation.
Replace motor diaphragm.

6 ABSORBER HEAD
Inspect and clean water-side as necessary.
Inspect connections for leaks.
Repair or tighten as required.

7 EVAPORATOR HEAD
Inspect and clean water-side as necessary.
Inspect connections for leaks.
Repair or tighten as required.

AIR-COOLED CONDENSER:
COMPONENT FUNCTIONS

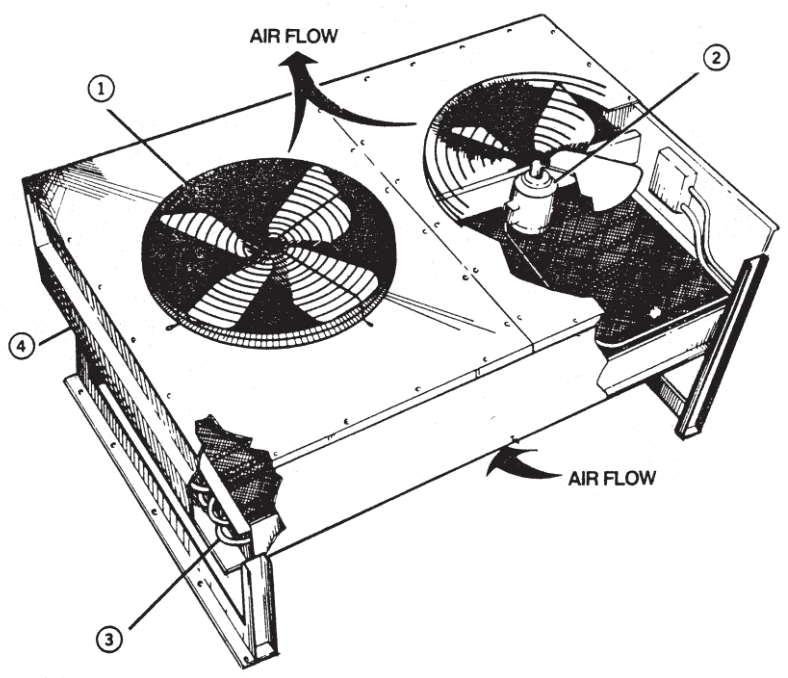
PURPOSE: Uses ambient air to condense freon gas from inside unit back to a liquid.

1 FAN
Circulates air through condenser coil.

2 MOTOR
Provides energy source for fan.

3 CONDENSER COIL
Converts refrigerant from high-temperature/high-pressure gas to low-temperature/high-pressure liquid. Provides efficient heat transfer.

4 FRAME
Provides support for all tubing and equipment.



AIR-COOLED CONDENSER:
COMPONENT MAINTENANCE

1 FAN

Check for alignment, balance and security to shaft.
Check for corrosion and wear.
Lubricate bearings and check for end play, excessive bearing temperature and unusual bearing wear.
Check condition of drive couplings and belts.
Check fan wheel and clean dirt accumulation.
Check and tighten mounting bolts.
Check for proper belt tension.
Check rain shields.
Verify unit operation.

2 MOTOR

Inspect starter coils and contacts.
Tighten all electrical connections.
Lubricate motor bearings.
Examine motor mount resiliency.
Measure and record operating voltage and current.
Record, compare to name plate data.
Test motor winding insulation resistance.

3 CONDENSER COIL

Clean finned surfaces with wire brush or high-pressure water.
Check for damage or leaks.
Straighten bent fins.
Check pipe clamps for security and vibration.

4 FRAME

Check for damage, rust and corrosion.
Treat for corrosion as required.

AIR-HANDLING UNIT:
COMPONENT FUNCTIONS

PURPOSE: Provides filtered, ventilated, heated or cooled air to area being served.

1 FAN
Moves heated or cooled and ventilated air to area being served.

2 MOTOR
Provides energy source for fan operation.

3 COOLING COIL
Provides cool air.

4 HEATING COIL
Provides heated air.

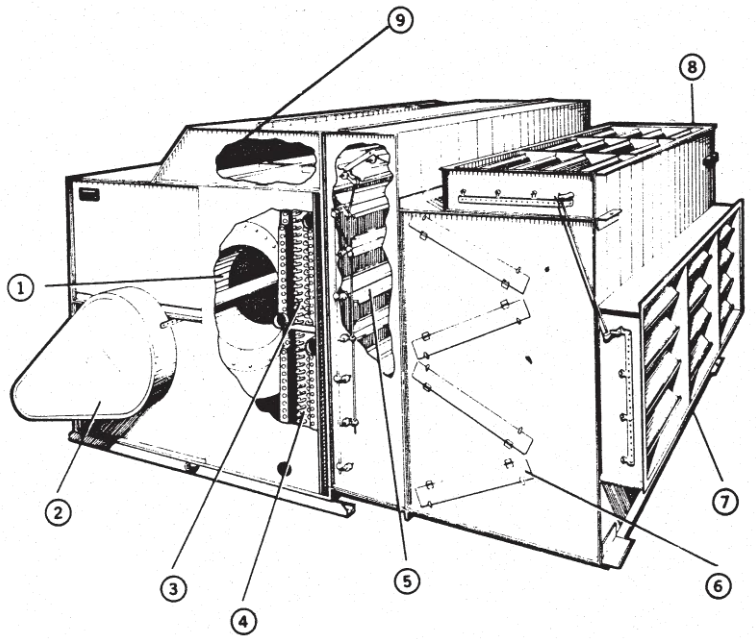
5 FACE & BYPASS DAMPERS
Regulate air flow through or around the heating and cooling coils.

6 FILTERS
Clean the air entering the unit.

7 RETURN AIR DAMPERS
Regulate the quantity of inside air entering the unit.

8 OUTSIDE AIR DAMPERS
Regulate the quantity of outside air entering the unit.

9 COIL BYPASS
Provides air flow bypass around heating/cooling coil.



AIR-HANDLING UNIT:
COMPONENT MAINTENANCE

1 FAN
Inspect and clean.
Check for proper rotation.
Test for vibration.
Check shaft end play.
Check bearings.

2 MOTOR
Inspect starter coils and contacts.
Tighten electrical connections.
Test for vibration.
Lubricate.
Examine motor mount resiliency.
Inspect and adjust drive couplings, pulleys and belts.
Inspect for corrosion and wear.
Check housing clearance.
Check alignment, balance and security to shaft.

3 COOLING COIL
Inspect and clean.
Straighten fins.
Check for damage or leaks.
Inspect and clean condensate pans and drains.

4 HEATING COIL
Inspect and clean.
Straighten fins.
Check for damage or leaks.

5 FACE & BYPASS DAMPERS
Lubricate bearings.
Check for proper close-off and operation.
Tighten any loose blade connectors.

6 FILTERS
Inspect; replace as indicated.

7 RETURN AIR DAMPERS
Lubricate bearings.
Check for proper close-off and operation.
Tighten any loose blade connectors.
Inspect bearings for excessive wear.

8 OUTSIDE AIR DAMPERS
Lubricate bearings.
Check for proper close-off and operation.
Tighten any loose sections.

9 COIL BYPASS
Check for proper operation of bypass.

BASE-MOUNTED CIRCULATING PUMP: COMPONENT FUNCTIONS

PURPOSE: Circulates liquids through piping system.

1 MOTOR
Provides energy for pump operation.

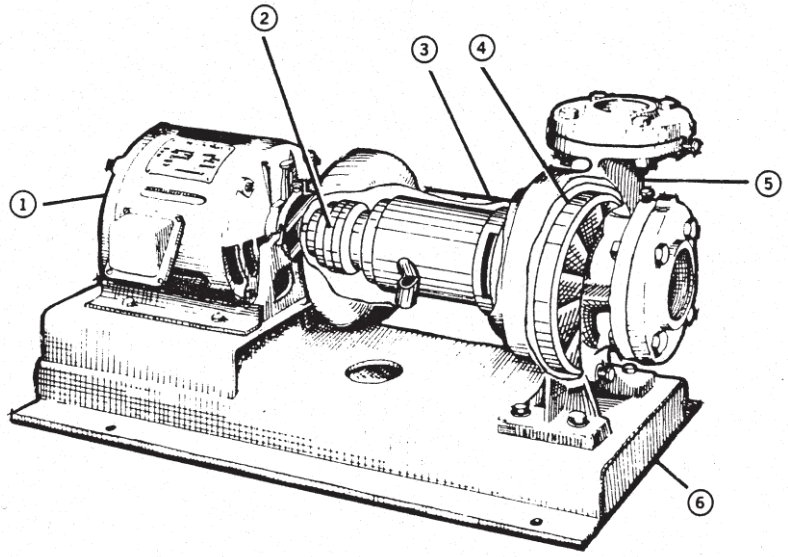
2 COUPLING
Provides linkage between motor and impeller.

3 BEARING ASSEMBLY
Supports the shaft and impeller.

4 IMPELLER
Moves liquid through piping system.

5 HOUSING
Provides physical link with piping system.

6 BASE
Provides support for complete pump assembly.



BASE-MOUNTED CIRCULATING PUMP:
COMPONENT MAINTENANCE

1 MOTOR
Inspect and clean starter coils.
Inspect and tighten contacts.
Test for vibration.
Lubricate motor bearings.
Test motor winding insulation resistance.
Measure and record operating voltage and current draw; compare to name plate data.

2 COUPLING
Check for proper alignment and condition.
Inspect for wear and shaft security.
Replace if worn.
Lubricate as indicated.

3 BEARING ASSEMBLY
Lubricate as required.
Check for leaks or wear.

4 IMPELLER
Replace as required.

5 HOUSING
Check packing and mechanical seals for leakage.
Inspect gaskets for leakage and deterioration.
Lubricate driven shaft bearings.

6 BASE
Secure mounts.
Replace if worn.
Check for corrosion.
Clean and paint as indicated.

CENTRIFUGAL LIQUID CHILLER:
COMPONENT FUNCTIONS

PURPOSE: Provides chilled water for cooling and dehumidification.

1 CONTROL CENTER
Provides wiring connection point, safety interlocks, controls and capacity control for compressor operation.

2 VANES
Regulate the amount of refrigerant vapor entering compressor.

3 COMPRESSOR
Converts low-temperature/low-pressure vapor to high-temperature/high-pressure vapor.

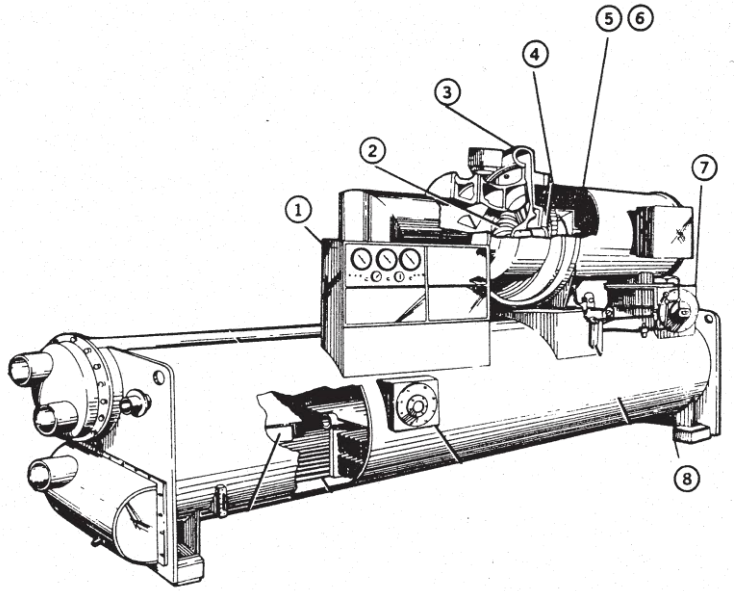
4 IMPELLER
Provides mechanical means to convert low-temperature/ low-pressure vapor to high-temperature/high-pressure vapor.

5 MOTOR
Provides energy for compressor operation.

6 TRANSMISSION
Provides mechanical link between motor and impeller.

7 LUBRICATION PUMP
Supplies oil to critical bearings in compressor.

8 VIBRATION ISOLATORS
Reduce noise transmission of unit to building.



CENTRIFUGAL LIQUID CHILLER:
COMPONENT FUNCTIONS

9 PURGE UNIT
Removes non-condensables and water vapor from refrigerant system.

10 FLOW CONTROL
Regulates refrigerant flow from the condenser to the cooler.

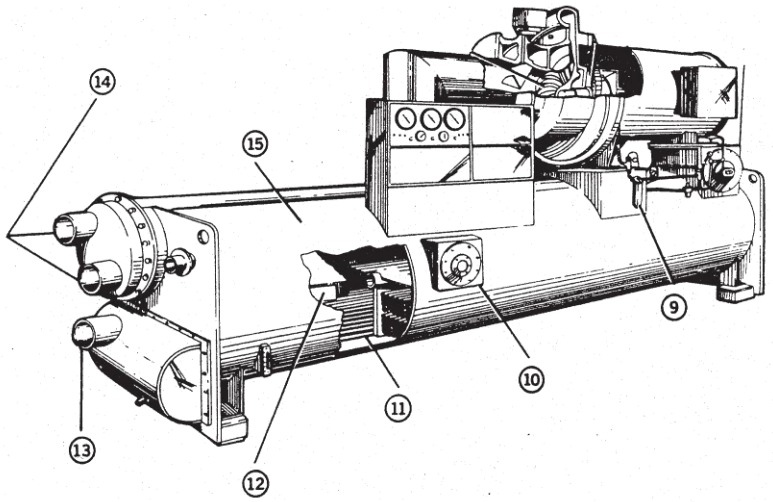
11 COOLER
Provides area for heat transfer from chilled water to refrigerant.

12 ELIMINATOR
Reduces velocity of the boiling refrigerant in cooler and eliminates liquid refrigerant from entering compressor.

13 CHILLED WATER CONNECTION
Provides connections for chilled water supply and return.

14 CONDENSER WATER CONNECTIONS
Provide connections for condenser water supply and return.

15 CONDENSER
Converts refrigerant from high-temperature/ high-pressure gas to low-temperature/high-pressure liquid.



CENTRIFUGAL LIQUID CHILLER:
COMPONENT MAINTENANCE

1 CONTROL CENTER
Calibrate and clean controls and safety devices.
Inspect, clean and tighten electrical contacts.
Check set point of controls and limits.
Sequence test all controls.
Test temperature and pressure indicators.

2 VANES
Checks for proper operation.
Lubricate vane linkages.
Check vane control for proper operation.
Repair as required.

3 COMPRESSOR
Check refrigerant charge.
Check for refrigerant and oil leaks.
Test for proper operation and efficiency.
Observe bearing and operating surface temperatures.
Check oil heater operation.
Check oil level and condition.
Perform acid test.
Measure acid test.
Measure vibration on main bearings.

4 IMPELLER
Measure vibration.

5 MOTOR
Measure operating current and voltage; record, compare to name plate data.
Inspect starter coils and contacts.
Lubricate motor bearings.
Check motor insulation resistance.
Check condition and alignment of drive section.
Measure vibration.
Examine motor mount resiliency.
Test motor winding insulation resistance.

6 TRANSMISSION
Check for proper lubrication.

7 LUBRICATION PUMP
Inspect and check for proper operation.
Check oil heater for proper operation.
Change oil and filter as indicated.
Test operation of oil pump.

8 VIBRATION ISOLATORS
Check for corrosion and fatigue.

CENTRIFUGAL LIQUID CHILLER:
COMPONENT MAINTENANCE

9 PURGE UNIT
Lubricate motor.
Clean purge drum.
Change purge unit oil.
Check drive belt and adjust tension.

10 FLOW CONTROL
Check float control operation as required.

11 COOLER
Inspect rupture disc for leaks.
Inspect and clean tubes as required.

12 ELIMINATOR
Check for proper refrigerant level in cooler.

13 CHILLED WATER CONNECTION

14 CONDENSER WATER CONNECTIONS
Inspect and check for leaks.
Repair or tighten as required.

15 CONDENSER
Inspect and clean tubes as indicated.
Inspect for corrosion.
Clean and paint as required.

COOLING TOWER:
COMPONENT FUNCTIONS

PURPOSE: Cools hot condenser water used by compressors or chillers.

1 MOTOR
Provides energy source for fan.

2 WATER INLET
Provides connection for condenser water supply.

3 BASIN
Provides distribution area for condenser water flow through tower.

4 BAFFLES
Provide evaporative cooling surface for condenser water.

5 SUMP
Provides storage area for tower water.

6 WATER OUTLET
Provides connection for condenser water return.

7 OVERFLOW
Provides safety outlet for excessive tower water.

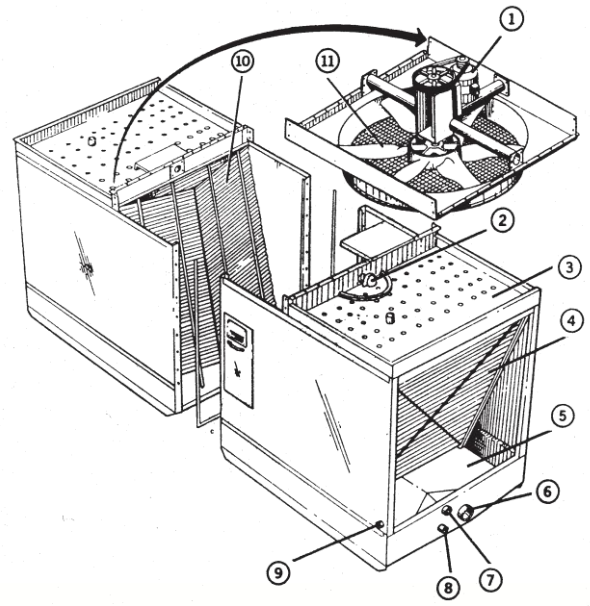
8 DRAIN
Allows tower to be emptied and cleaned.

9 FLOAT VALVE
Maintains proper water level in tower.

10 ELIMINATORS
Stop condenser water from being thrown from unit.

11 FAN
Circulates air through tower.

12 SUMP HEATERS (if applicable)
Prevent sump water from freezing.



COOLING TOWER:
COMPONENT MAINTENANCE

1 MOTOR
Inspect starter coils and contacts.
Tighten all electrical connections.
Measure operating current and voltage; record, compare to nameplate data.
Test vibration.
Lubricate bearings.
Examine motor mount resiliency.
Test motor insulation resistance.

2 WATER INLET
Inspect and check for leaks.

3 BASIN
Inspect for corrosion.
Clean as required.

4 BAFFLES
Inspect for corrosion and wear.
Clean or replace as required.

5 SUMP
Inspect and clean as required.

6 WATER OUTLET
Inspect and check for leaks.
Clean strainer.

7 OVERFLOW
Inspect for obstructions.
Clean as required.

8 DRAIN
Inspect for obstructions.

9 FLOAT VALVE
Inspect for corrosion and wear.
Check proper operation and close-off.

10 ELIMINATORS
Inspect and check for corrosion and wear.

11 FAN
Check blades and clean dirt accumulation.
Lubricate bearings and check for end play, excessive bearing temperature and wear.
Check condition of drive couplings, pulleys and belts. Adjust as required.
Check for corrosion and wear.
Check alignment, balance and security to shaft.
Check gearbox oil level; change as indicated.
Check drive shafts and lubricate.

12 SUMP HEATERS (if applicable)
Check operational control.
Check voltage and amp draw.
Calibrate control as needed.

EVAPORATOR COIL:
COMPONENT FUNCTIONS

PURPOSE: Provides means to cool and/or dehumidify air flowing through coil.

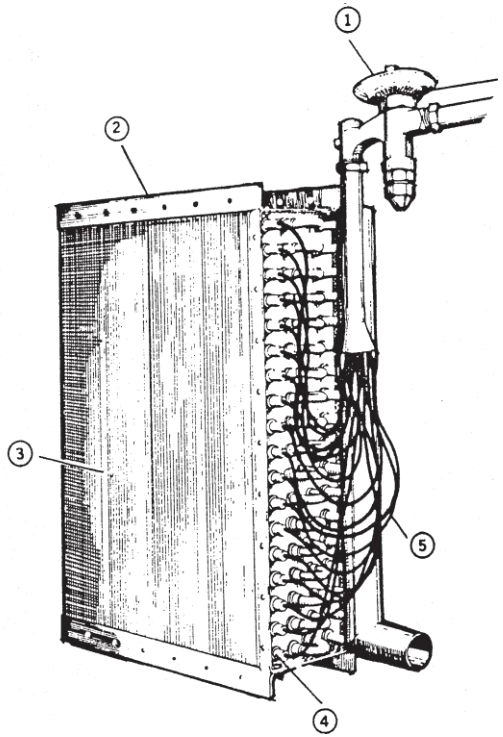
1 THERMAL EXPANSION VALVE
Regulates liquid refrigerant flow according to load conditions.

2 FRAME
Holds all tubing and fins. Provides support for mounting.

3 FINS
Provide efficient heat transfer.

4 COIL TUBES
Circulate refrigerant.

5 DISTRIBUTOR TUBES
Equalize refrigerant flow to coil.



EVAPORATOR COIL:
COMPONENT MAINTENANCE

1 THERMAL EXPANSION VALVE
Inspect thermal bulb for security.
Check thermal bulb insulation.
Check and adjust superheat.

2 FRAME
Check for damage, rust and corrosion.
Check for security in duct or system.
Clean drain pan.
Trace back condensate drain piping, checking for blockage.

3 FINS
Straighten fins with coil comb.
Clean all surfaces as indicated.

4 COIL TUBES
Check for leaks.

5 DISTRIBUTOR TUBES
Check for leaks.
Check for proper flow of refrigerant.

GAS-FIRED UNIT HEATER:
COMPONENT FUNCTIONS

PURPOSE: Heats air flow through unit for heating area served.

1 MOTOR
Provides energy source for fan operation.

2 FAN
Circulates air in the system. Moves air across heat exchanger.

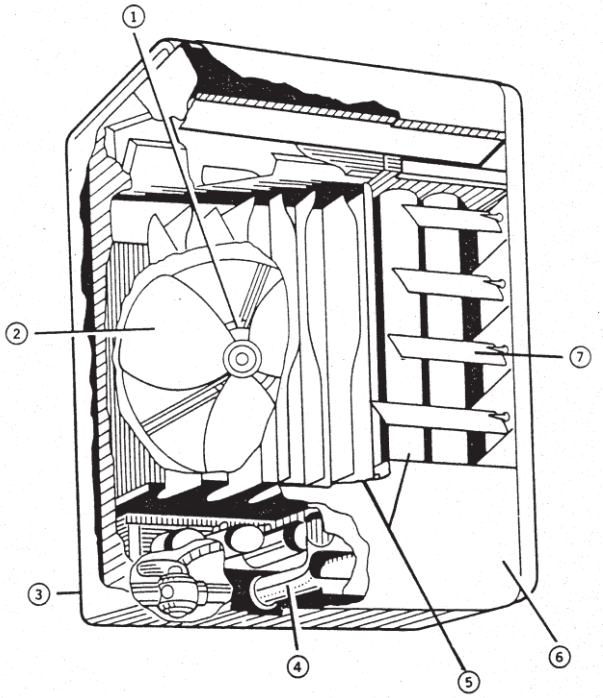
3 CONTROLS & SAFETY LIMITS
Controls temperature and provides for safety measures.

4 BURNER SECTION
Produces heat through combustion.

5 HEAT EXCHANGER
Transfers heat from fuel to air flow through unit.

6 HOUSING
Provides enclosure for system components.

7 FLOW VANES
Control air direction.



GAS-FIRED UNIT HEATER:
COMPONENT MAINTENANCE

1 MOTOR
Check current.
Lubricate motor bearings.

2 FAN
Inspect and clean.
Check for proper rotation, alignment and balance.
Test for vibration.

3 CONTROLS AND SAFETY LIMITS
Perform operation tests and assure proper settings of operating coils, high-temperature safety control, flame-failure safety limit.

4 BURNER SECTION
Check flame composition and shape.
Inspect and clean orifices, passages and nozzles.
Adjust fuel/air ratio.
Check gas pressure regulator setting.
Check pilot and pilot safety.
Check burners and fan control.

5 HEAT EXCHANGER
Check for soot buildup, corrosion, or cracks and holes in exchanger.

6 HOUSING
Check mounts for security.
Clean and remove external/internal dirt accumulation.

7 FLOW VANES
Adjust as needed.

HEAT EXCHANGER (STEAM TO HOT WATER):
COMPONENT FUNCTIONS

PURPOSE: Generates hot water from steam.

1 INLET AND OUTLET
Provides connections to the hot water system.

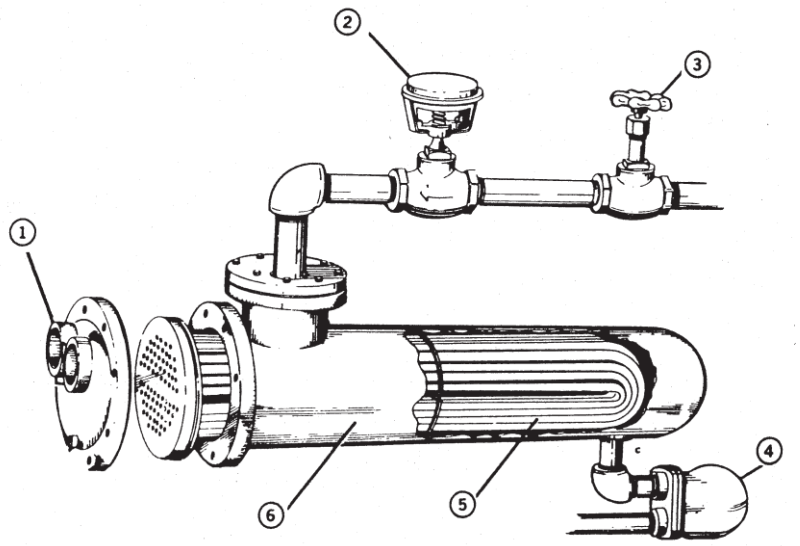
2 CONTROL VALVE
Controls steam going into exchanger according to hot-water system demands.

3 HAND VALVE
Provides manual shut-off for maintenance and safety.

4 TRAP
Keeps steam in exchanger.
Allows condensate to return to steam source.

5 TUBES
Separate steam and hot water.
Provide heat transfer surface from the steam to the hot water.

6 SHELL
Provides housing for tubes and steam.



HEAT EXCHANGER (STEAM TO HOT WATER):
COMPONENT MAINTENANCE

1 INLET AND OUTLET
Check for leaks.
Tighten as required.
Check and record operating temperatures.

2 CONTROL VALVE
Check for proper operation, close-off and bonnet leakage.
Calibrate as required.
Clean as indicated.
Repack and redisc as required.

3 HAND VALVE CHECK
for leakage. Repack as
required.
Check piping and insulation for leaks or damage.

4 TRAP
Check element, jet, float and needle valves.
Clean.
Repair or replace maintainable items.

5 TUBES
Clean.
Inspect for leaks or damage.

6 SHELL
Inspect for damage or leaks.
Repair insulation.
Clean and paint as indicated.

HEAT PUMP (INDOOR UNIT):
COMPONENT FUNCTIONS

PURPOSE: Provides hot/cool air to area being served.

1 FILTER
Cleans the air entering the unit.

2 INSIDE COIL
Provides heating/cooling source for area being served.

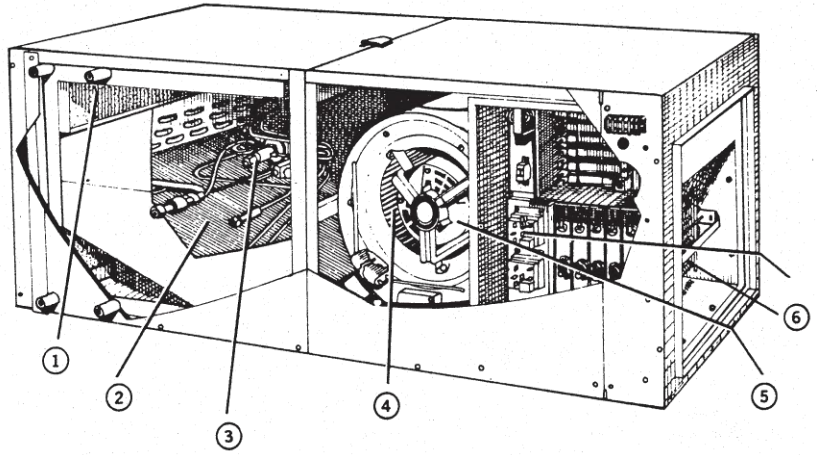
3 METERING DEVICE
Provides refrigerant flow control.

4 SUPPLY FAN
Circulates conditioned air to space being served.

5 SUPPLY FAN MOTOR
Provides energy source for supply fan operation.

6 ELECTRIC HEAT ELEMENTS
Provides additional heat when required.

7 CONTROL PANEL
Provides selection and control for unit operation.



HEAT PUMP (INDOOR UNIT):
COMPONENT MAINTENANCE

1 FILTER
Inspect and replace as indicated.

2 INSIDE COIL
Inspect and clean.
Straighten fins.
Check for damage or leaks.
Inspect and clean drain pan and drain line.

3 METERING DEVICE
Check for proper operation.
Adjust as required.

4 SUPPLY FAN
Inspect and clean.
Check for proper rotation and clearance.
Check security to motor shaft.

5 SUPPLY FAN MOTOR
Inspect and clean.
Lubricate.
Examine motor mount resiliency.

6 ELECTRIC HEAT ELEMENTS
Check amp draw.
Check condition of elements.

7 CONTROL PANEL
Test for proper operation.
Tighten all electrical connections.
Sequence test all controls.
Inspect and clean contacts.

HEAT PUMP (OUTDOOR UNIT):
COMPONENT FUNCTIONS

PURPOSE: Provides means to condense, from inside unit, freon gas back to liquid for cooling (and vice versa for heating).

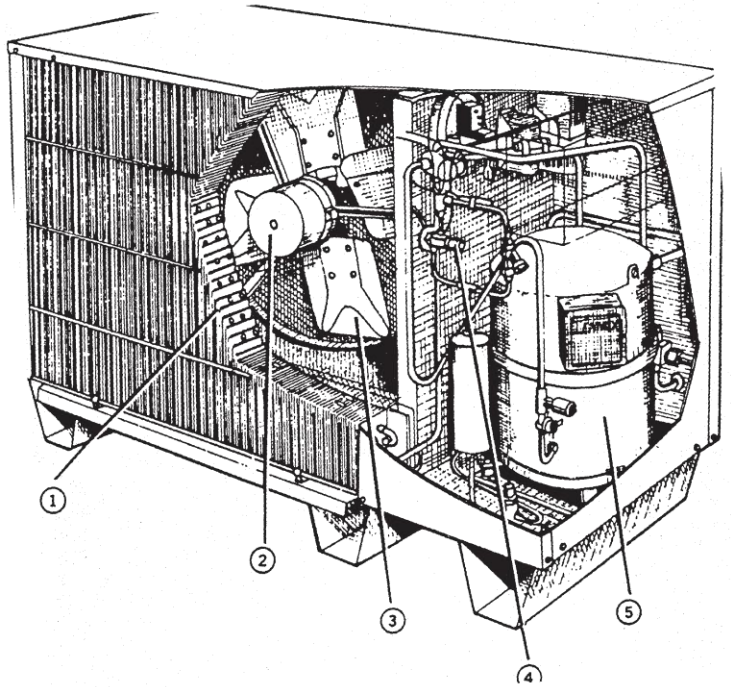
1 **OUTSIDE COIL**
Dissipates or absorbs heat to/from outside air.

2 **OUTSIDE FAN MOTOR**
Provides energy source for fan operation.

3 **OUTSIDE FAN**
Circulates air through outside coil

4 **METERING DEVICE**
Provides refrigerant flow control.

5 **COMPRESSOR**
Converts low-temperature/low-pressure gas to high-temperature/high-pressure gas.



HEAT PUMP (OUTDOOR UNIT):
COMPONENT MAINTENANCE

1 OUTSIDE COIL
Inspect and clean.
Straighten fins.
Check for damage or leaks.

2 OUTSIDE FAN MOTOR
Inspect and clean. Lubricate.
Examine motor mount resiliency.

3 OUTSIDE FAN
Inspect and clean.
Check for proper rotation and clearance.
Check for security to motor shaft.
Check alignment and balance.

4 METERING DEVICE
Check for proper operation.
Adjust as required.

5 COMPRESSOR
Check refrigerant charge.
Check for refrigerant and oil leaks.
Check crankcase heater operation.
Measure operating voltage and current; record, compare to nameplate data.
Check for proper operation of all operating and safety controls.

HEATING COIL (HOT WATER OR STEAM):
COMPONENT FUNCTIONS

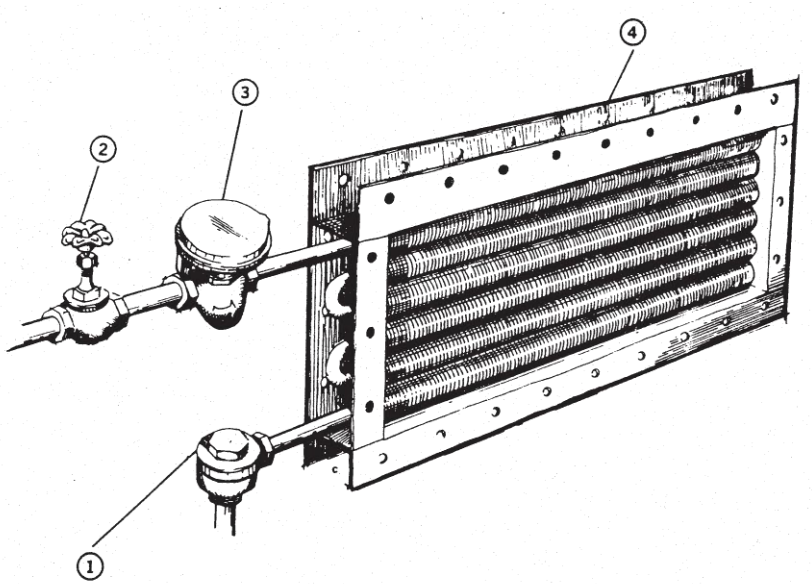
PURPOSE: Provides means to heat air flowing through coil.

1 TRAP (STEAM ONLY)
Keeps steam in coil.
Allows condensate to return to steam source.

2 HAND VALVE
Provides manual shut-off for maintenance and safety.

3 CONTROL VALVE
Controls steam input to coil according to needs of area being served.

4 COIL
Provides efficient heat transfer.



HEATING COIL (HOT WATER OR STEAM):
COMPONENT MAINTENANCE

1 TRAP (STEAM ONLY)
Clean.
Check element, seat, float and needle valve.
Repair or replace maintainable items.

2 HAND VALVE
Check for leakage.
Check piping and insulation for leaks or damage.

3 CONTROL VALVE
Check for proper operation, close-off and bonnet leakage.
Repack, redisc, lubricate and reseat.

4 COIL
Check condition of finned surfaces.
Clean air side.
Straighten fins.
Check for corrosion and leaks.
Inspect casing for rust and security.
Check for blockage.

IN-LINE CIRCULATING PUMP:
COMPONENT FUNCTIONS

PURPOSE: Circulates liquid through piping system.

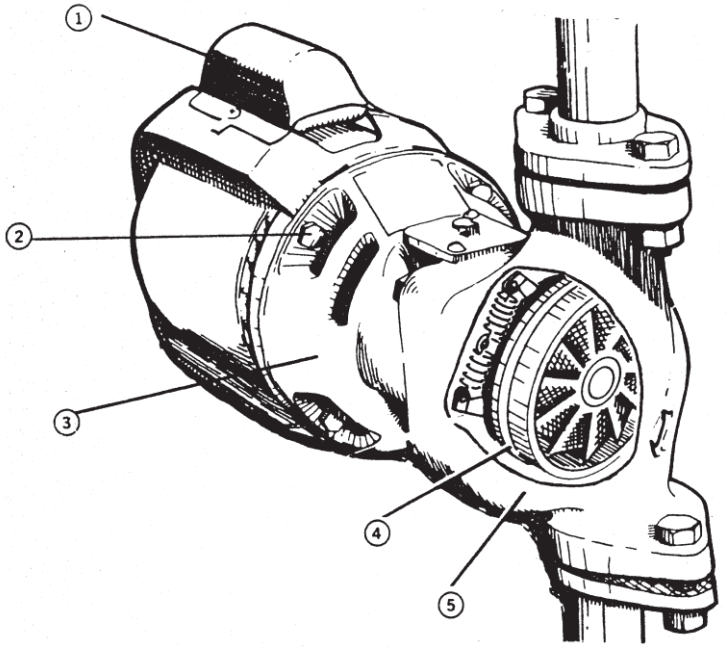
1 **MOTOR**
Provides energy for pump.

2 **COUPLING**
Provides physical link between motor and impeller.

3 **BEARING ASSEMBLY & SEAL**
Provides support for pump shaft and is the means of pre-venting water from leaking.

4 **IMPELLER**
Moves liquid through piping system.

5 **HOUSING**
Provides connection between piping and piping system.



IN-LINE CIRCULATING PUMP:
COMPONENT MAINTENANCE

1 MOTOR
Check motor mount resiliency.
Lubricate motor bearings.
Inspect and clean starter.
Tighten connections.

2 COUPLING
Check proper alignment and condition.
Inspect for wear and shaft security.
Replace if worn.

3 BEARING ASSEMBLY & SEAL
Lubricate as required.
Check for leaks or wear.

4 IMPELLER
Replace as required.

5 HOUSING
Check packing and mechanical seals for leakage.
Inspect gaskets for leakage and deterioration.
Lubricate drive shaft bearings.

RECIPROCATING COMPRESSOR:
COMPONENT FUNCTIONS

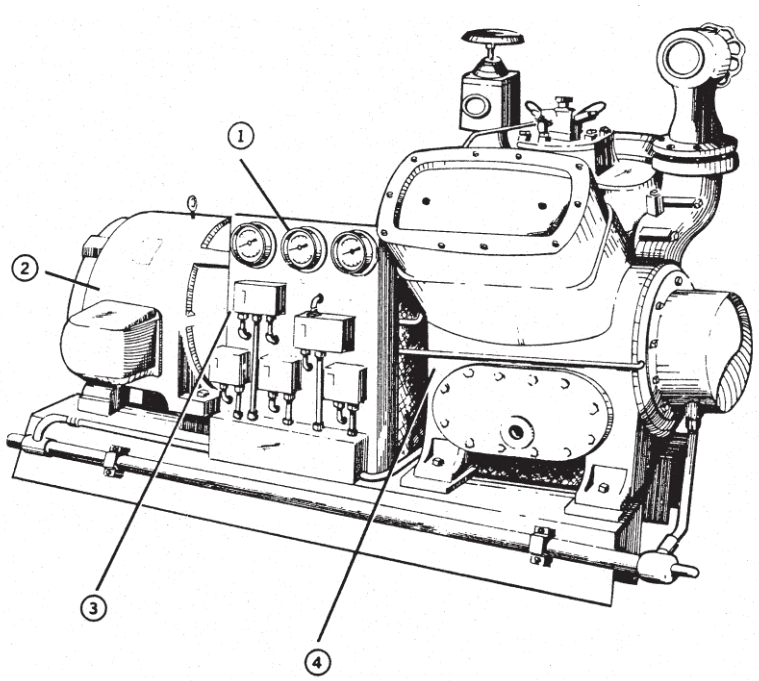
PURPOSE: Provides means to convert low temperature freon gas to high temperature freon gas.

1 GAUGES
Provide indication for compressor monitoring.

2 MOTOR
Provides energy for compressor.

3 CONTROL PANEL
Provides safety interlocks and controls for compressor operation.

4 COMPRESSOR
Converts low-temperature/high-pressure gas to high-temperature/high-pressure gas.



RECIPROCATING COMPRESSOR:
COMPONENT MAINTENANCE

1 GAUGES
Clean, calibrate and check for proper operation.
Check for leaks and tighten fittings.

2 MOTOR
Measure operating voltage and current; record, compare to nameplate data.
Inspect starter coils and contacts.
Lubricate motor bearings.
Test motor insulation resistance.
Measure vibration.
Check condition and alignment of drive section.
Inspect and clean starter.
Examine mounts.

3 CONTROL PANEL
Calibrate and clean operating and safety controls.
Check setpoint of controls and limits.
Sequence test all controls.
Tighten connections.
Inspect and clean contacts.

4 COMPRESSOR
Check crankcase heater operation.
Check refrigerant charge.
Check for refrigerant and oil leaks.
Test for efficiency.
Check oil level and condition.
Perform acid test.
Observe bearing and operating surface temperatures.
Measure vibration.
Sequence cylinder unloaders.
Inspect high-pressure safety valve.
Check refrigerant site glass.
Check and record suction and discharge pressure, superheat and oil differential pressure.

ROOFTOP HVAC:
COMPONENT FUNCTIONS

PURPOSE: Provides filtered, ventilated, heated/cooled, dehumidified air to areas served.

1 REFRIGERATION CONTROL PANEL
Provides safety interlocks and controls for compressor operation.

2 CONDENSER FAN
Circulates air through condenser coil.

3 ZONE CONTROL ACTUATORS (MULTI-ZONE UNITS ONLY)
Operate zone dampers on demand from area thermostat.

4 COOLING COIL
Circulates conditioned air to areas being served.

5 MAIN FAN
Circulates conditioned air to areas being served.

6 FILTER SECTION
Provides source for filtering air in unit.

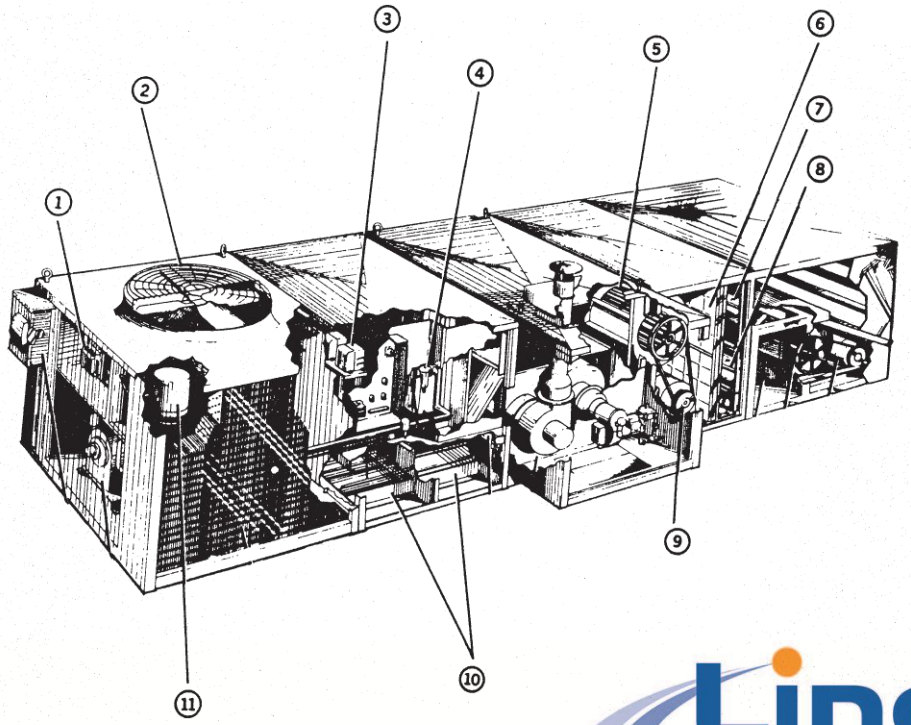
7 FRESH AIR DAMPER & ACTUATOR
Provides source of outside air for ventilation.

8 RETURN AIR DAMPER & ACTUATOR
Provides source of recirculated air from building.

9 MAIN FAN MOTOR
Circulates conditioned air to areas being served.

10 ZONE DAMPERS
Provides source for conditioning air to areas being served.

11 CONDENSER FAN MOTOR
Provides energy source for motor.



ROOFTOP HVAC:
COMPONENT FUNCTIONS

12 ELECTRICAL DISCONNECT
Provides primary electrical power safety shut-off.

13 REFRIGERATION COMPRESSOR
Converts low-temperature/low-pressure gas to high-temperature/high-pressure gas.

14 CONDENSER COIL
Converts refrigerant from high-temperature/ high-pressure gas to low-temperature/high-pressure liquid.

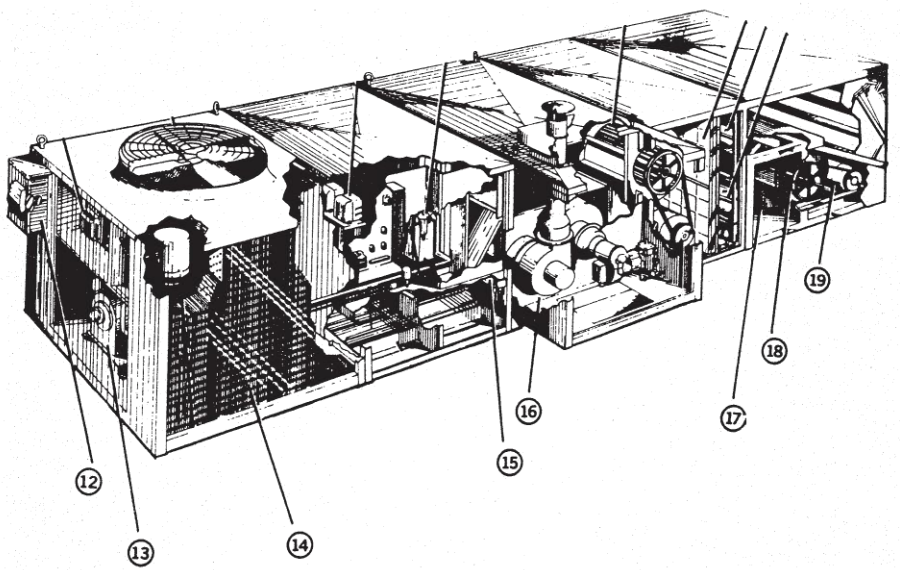
15 HEATING SECTION
Provides heat source for areas being served.

16 BURNER SECTION
Provides combustion controls, fuel regulating equipment and safety controls for heating section.

17 EXHAUST AIR DAMPER & ACTUATOR
Provides outlet for exhausted air from building.

18 RETURN AIR FAN
Circulates return air from building.

19 RETURN AIR FAN MOTOR
Provides energy source for return air fan.



ROOFTOP HVAC:
COMPONENT MAINTENANCE

1 REFRIGERATION CONTROL PANEL
Calibrate and clean controllers and safety controls.
Check setpoint of controls and limits.

2 CONDENSER FAN
Check fan wheel and clean dirt accumulation.
Lubricate bearings and check for end play, excessive bearing temperature and wear.
Check condition of drive couplings and belts; adjust as required.
Check for corrosion and wear.
Check for alignment, balance and security to shaft.

3 ZONE CONTROL ACTUATORS
Inspect, clean and calibrate.
Repair as necessary.

4 COOLING COIL
Check and clean condensate pan and drain.
Inspect and clean as indicated.
Check condition of finned surfaces and straighten if bent.
Check for corrosion and leaks.
Check thermostatic expansion valve.

5 MAIN FAN
Lubricate bearings and check for end play, excessive bearing temperature and wear.
Check fan wheel and clean dirt accumulation.
Check condition of drive couplings and belts.
Check for alignment, balance and security to shaft.

6 FILTER SECTION
Replace media as indicated.

7 FRESH AIR DAMPER & ACTUATOR
Check for unrestricted and proper operation.
Lubricate bearings as required.
Check for unrestricted and proper operation.
Lubricate bearings as required.

9 MAIN FAN MOTOR
Inspect starter coils and contacts.
Tighten all electrical connections.
Measure operating current and voltage; record, compare with nameplate data.
Test for vibration.
Lubricate motor bearings.
Test motor insulation resistance.
Examine motor mount resiliency.

ROOFTOP HVAC:
COMPONENT MAINTENANCE

10 ZONE DAMPERS
Check for proper operation.
Check linkage and adjust if required.
Lubricate bearings as indicated.

11 CONDENSER FAN MOTOR
Inspect starter coils and contacts.
Tighten all electrical connections.
Measure operating current and voltage; record, compare to nameplate data.
Test for vibration.
Lubricate bearings.
Examine motor mount resiliency.
Test motor insulation resistance.

12 ELECTRICAL DISCONNECT
Inspect contacts.
Check for proper operation.

13 REFRIGERATION COMPRESSOR
Check crankcase heater operation. Check refrigerant charge.
Check for refrigerant and oil leaks.
Check oil level and condition.
Perform acid test.
Observe bearing and operating surface temperatures.
Measure vibration.
Measure operating voltage and current; record, compare to nameplate data.

14 CONDENSER COIL
Clean finned surfaces.
Check for damage or leaks.
Straighten bent fins.

15 HEATING SECTION
Inspect and clean as required.
Check for leaks in exchanger.

16 BURNER SECTION
Perform combustion and draft tests.
Inspect and clean nozzles.
Inspect, clean and lubricate blower.
Check operating and safety controls.

17 EXHAUST AIR DAMPER & ACTUATOR
Check for unrestricted and proper operation.
Lubricate bearings as required.

18 RETURN AIR FAN
Lubricate bearings and check for end play, excessive bearing temperature and wear.
Check fan wheel and clean off dirt accumulation.
Check condition of drive couplings and belts.
Check for alignment, balance and security to shaft.

ROOFTOP HVAC:
COMPONENT MAINTENANCE

19 RETURN AIR FAN MOTOR

Inspect starter coils and contacts.
Tighten all electrical connections.
Measure operating current and voltage; record, compare to nameplate data.
Test for vibration.
Lubricate motor bearings.
Check motor insulation resistance.
Examine motor mount resiliency.

SECTIONAL BOILER (GAS-FIRED):
COMPONENT FUNCTIONS

PURPOSE: Provides steam or hot water for heating.

1 **SMOKE PIPE (FLUE)**
Carries combustion by-products away from burner.

2 **RELIEF VALVE**
Provides overpressure safety if other controls fail.

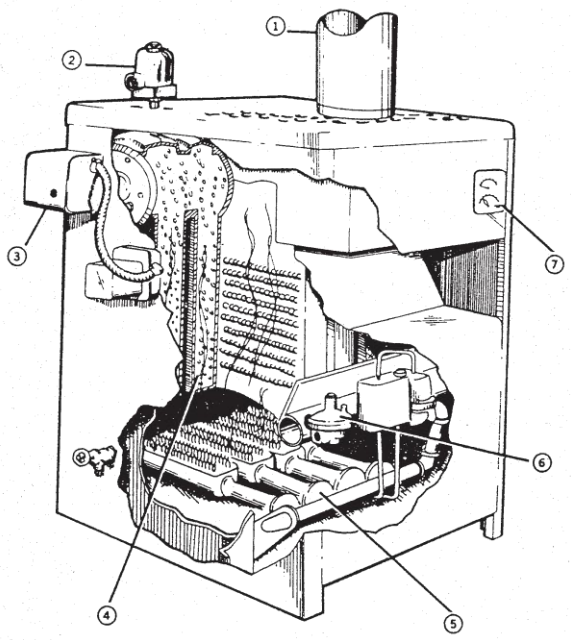
3 **CONTROLS AND SAFETY LIMITS**
Controls gas train to maintain desired medium temperature and safety.

4 **BOILER SECTION**
Holds heating medium (water or steam) during heat transfer.

5 **BURNER SECTION**
Transfers heat from fuel to heating medium (water or steam) in boiler section.

6 **GAS TRAIN**
Regulates flow of fuel to burner.

7 **GAUGE**
Indicates medium temperature and pressure.



SECTIONAL BOILER (GAS-FIRED):
COMPONENT MAINTENANCE

1 SMOKE PIPE (FLUE)
Perform flue gas analysis.
Inspect for soot, corrosion and leaks.

2 RELIEF VALVE
Perform try-lever test for proper closing.

3 CONTROLS & SAFETY LIMITS
Blow down low-water cutoff.
Perform operation tests and assure proper settings of:
operating control, high-temperature safety limit,
flame-failure safety and high/ low gas pressure cutoff.
Tighten connections.
Inspect and clean contacts.
Check and adjust feedwater system.
Check and adjust low-water cutoff device.
Check and clean pilot and pilot safety.

4 BOILER SECTION
Inspect for leakage and security.
Clean fire passages and heating surfaces.
Check condition of water, both visually and by
chemical test.

5 BURNER SECTION
Check flame composition and shape.
Perform combustion and draft test.
Inspect and clean orifices, passages and nozzles.
Adjust fuel/air ratio.
Check and clean pilot and igniters.

6 GAS TRAIN
Check for proper operation of main and safety valves.
Check for leaks and overall security.
Assure gas valve shut-off.
Check gas pressure regulator setting.

7 GAUGE
Check for accuracy and proper operation.

SELF-CONTAINED AIR CONDITIONING UNIT:
COMPONENT FUNCTIONS

PURPOSE: Provides filtered, heated/cooled air to area served.

1 FILTER
Cleans the air entering the unit.

2 COOLING COIL
Provides cooling source for area served.

3 HEATING COIL
Provides heat source for area served.

4 SUPPLY FAN MOTOR
Provides energy source for fan operation.

5 SUPPLY FAN
Circulates conditioned air to area served.

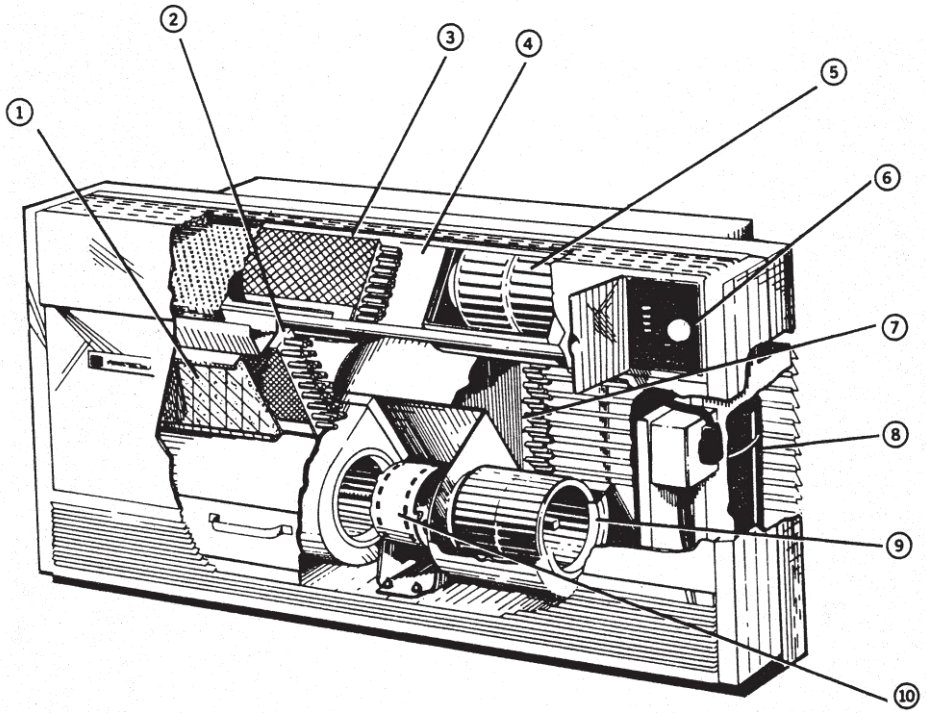
6 CONTROL PANEL
Provides controls for unit operation.

7 CONDENSER COIL
Converts refrigerant from high-temperature/high-pressure gas to low-temperature/high-pressure liquid.

8 COMPRESSOR
Converts low-temperature/low-pressure gas to high temperature/high-pressure gas.

9 CONDENSER FAN
Circulates air through condenser coil.

10 CONDENSER FAN MOTOR
Provides energy source for fan operation.



SELF-CONTAINED AIR CONDITIONING UNIT:
COMPONENT MAINTENANCE

1 FILTER
Replace as indicated.

2 COOLING COIL
Inspect and clean.
Straighten fins.
Check for damage or leaks.
Clean condensate pan and drain.

3 HEATING COIL
Inspect and clean.
Straighten fins.
Check for damage or leaks.

4 SUPPLY FAN MOTOR
Inspect and clean.
Lubricate.
Examine motor mount resiliency.

5 SUPPLY FAN
Inspect and clean.
Check for proper rotation and clearance.
Check security to motor shaft.

6 CONTROL PANEL
Test controls for proper operation.

7 CONDENSER COIL
Inspect and clean.
Straighten fins.
Check for damage or leaks.

8 COMPRESSOR
Check refrigerant charge.
Check for refrigerant and oil leaks.
Check crankcase heater operation.

9 CONDENSER FAN
Inspect and clean.
Check for proper rotation and clearance.

10 CONDENSER FAN MOTOR
Inspect and clean.
Lubricate.
Examine motor mount resiliency.

SQUIRREL CAGE FAN:
COMPONENT FUNCTIONS

PURPOSE: Provides means of moving air to area served.

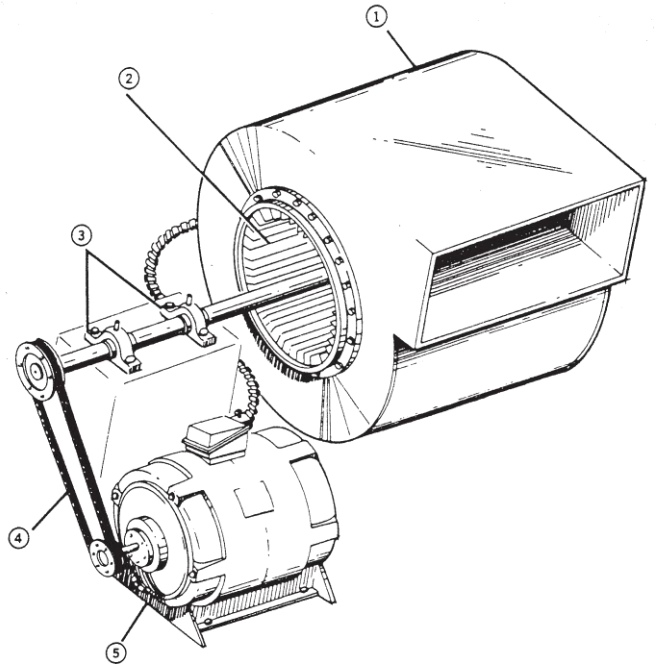
1 HOUSING
Provides air direction.

2 FAN IMPELLER
Circulates air in the system.

3 BEARINGS
Support fan impeller.

4 BELTS & PULLEYS
Provides linkage from motor to fan impeller.

5 MOTOR
Provides energy for fan operation.



SQUIRREL CAGE FAN:
COMPONENT MAINTENANCE

1 HOUSING
Check mounts for security and resiliency.
Clean internal dirt accumulation.

2 FAN IMPELLER
Inspect and clean.
Check for proper fan rotation.
Test for vibration.

3 BEARINGS
Inspect for wear or overheating.
Lubricate.
Replace if worn.

4 BELTS & PULLEYS
Check pulley for proper alignment.
Check pulley for internal wear and security to shaft.
Check belts for wear and deterioration.
Check belt tension.

5. MOTOR
Inspect starter coils and contacts.
Measure operating voltage and current; record, compare to nameplate data.
Test for vibration.
Check motor insulation resistance.
Lubricate motor bearings.

STEAM HUMIDIFIER:
COMPONENT FUNCTIONS

PURPOSE: Provides moisture to area served.

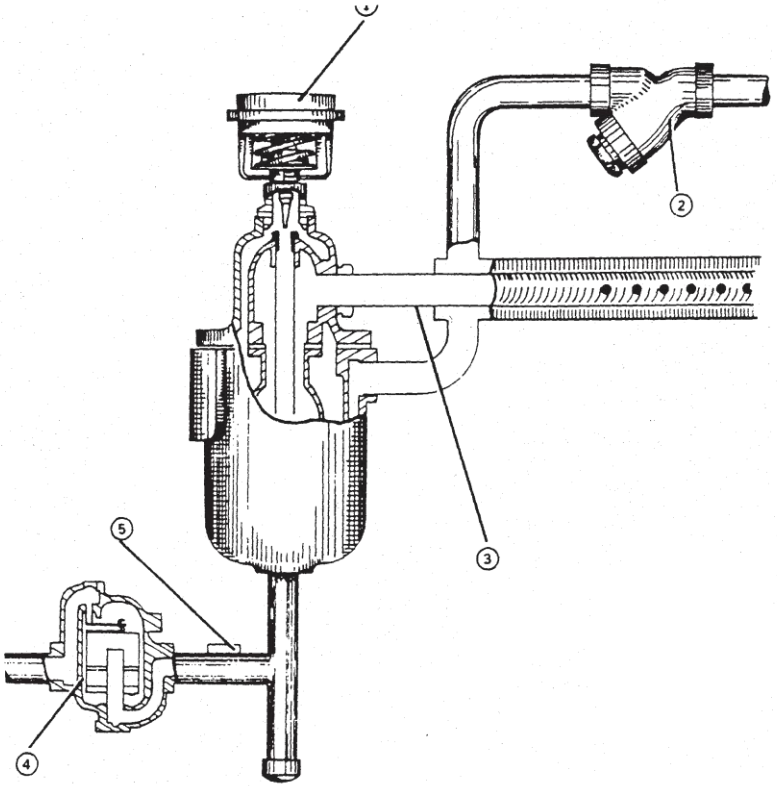
1 **OPERATIONAL & CONTROL SYSTEM (PNEUMATIC OR ELECTRIC)**
Controls steam to system according to space humidity demands.

2 **STRAINER**
Removes particles from supply steam.

3 **STEAM JACKET & DISTRIBUTION MANIFOLD**
Heats manifold to prevent condensation and distributes steam to space.

4 **TRAP**
Keeps steam in system.
Allows condensate to return to steam source.

5 **TEMPERATURE SWITCH**
Prevents unit from starting cold.



STEAM HUMIDIFIER:
COMPONENT FUNCTIONS

1. **OPERATIONAL & CONTROL SYSTEM (PNEUMATIC OR ELECTRIC)**
   Clean and calibrate.
   Check operator diaphragm if pneumatic.
   Check metering valve for close-off. Repack, redisc or reseat as necessary.
2. **STRAINER**
   Pull strainer and clean.
   Check for leaks.
   Treat for corrosion.
3. **STEAM JACKET & DISTRIBUTION MANIFOLD**
   Check for proper steam flow around manifold.
   Check for security to duct.
   Check and clean manifold slats.
4. **TRAP**
   Clean as required.
   Check element, jet, float and needle valves.
   Repair or replace maintainable items.
5. **TEMPERATURE SWITCH**
   Check operation.
   Calibrate.

UNIT VENTILATOR (HEATING & VENTILATING):
COMPONENT FUNCTIONS

PURPOSE: Provides heated, ventilated air to area served.

1 **FRESH & RETURN AIR DAMPERS**
Regulate the amount of outside and return air entering the unit.

2 **MOTOR**
Provides energy source for fan operation.

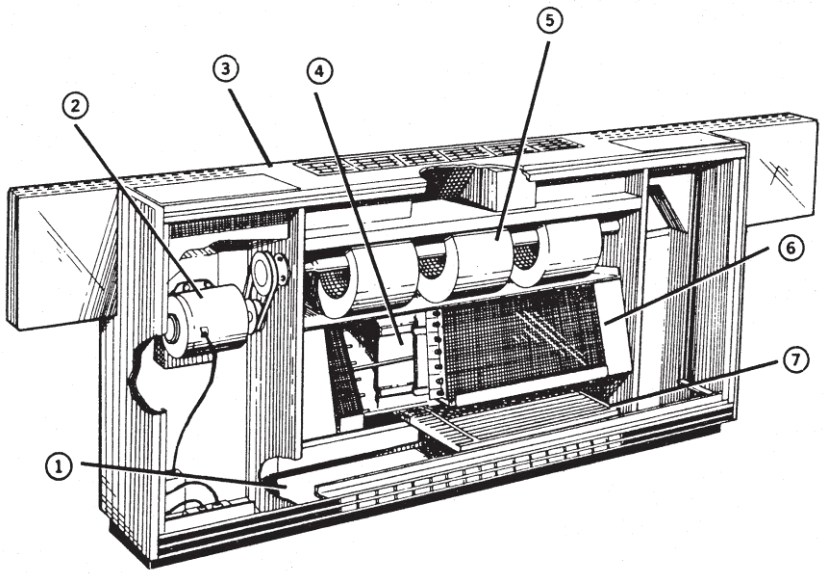
3 **CONTROL SECTION**
Contains unit operating controls.

4 **FACE & BYPASS DAMPERS**
Regulate air flow through or around heating coil or a combination of both.

5 **SUPPLY FAN**
Circulates air to space being served.

6 **HEATING COIL**
Provides heat source for space being served.

7 **FILTER**
Cleans the air entering the unit.



UNIT VENTILATOR (HEATING & VENTILATING):
COMPONENT MAINTENANCE

1 FRESH & RETURN AIR DAMPERS
Lubricate bearings.
Check for proper operation and closure.

2 MOTOR
Inspect and clean as required.
Lubricate bearings.
Examine motor mount resiliency.

3 CONTROL SECTION
Check operation of controls.
Calibrate as indicated.

4 FACE & BYPASS DAMPERS
Lubricate bearings.
Check for proper operation and closure.

5 SUPPLY FAN
Inspect and clean.
Check for proper rotation and clearance.
Check security to motor shaft.
Inspect belt and pulley.

6 HEATING COIL
Inspect and clean.
Straighten fins.
Check for damage or leaks.

7 FILTER
Replace as indicated.

WATER-COOLED CONDENSER:
COMPONENT FUNCTIONS

PURPOSE: Provides means to condense hot freon gas back to liquid.

1 REFRIGERANT GAS INLET
Provides refrigerant gas connection.

2 SHELL
Provides housing for tubes and refrigerant gas.

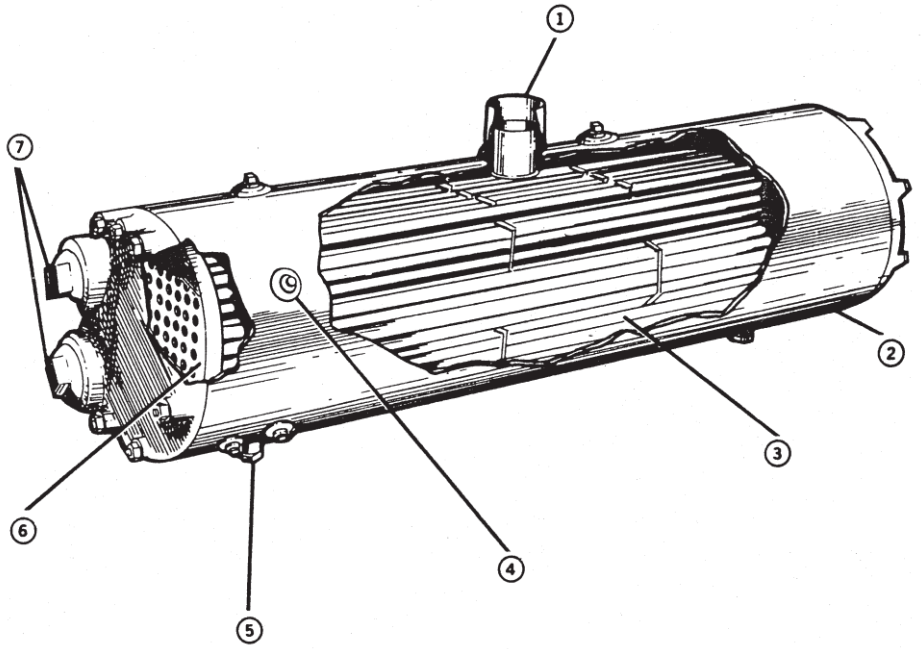
3 TUBES
Separate condenser water and refrigerant gas and provide heat transfer surface from refrigerant gas to condenser water.

4 LIQUID LEVEL OPENING
Provides liquid refrigerant connection.

5 LIQUID REFRIGERANT OUTLET
Provides liquid refrigerant connection.

6 TUBE SHEET
Provides support for tubes and separation between refrigerant gas and condenser water.

7 WATER INLET & OUTLET
Provides connections for condenser water supply and return.



WATER-COOLED CONDENSER:
COMPONENT MAINTENANCE

1 REFRIGERANT GAS INLET
Inspect and check for leaks.

2 SHELL
Inspect for leaks.
Clean as required.
Treat for corrosion as indicated.

3 TUBES
Inspect and clean as required.

4 LIQUID LEVEL OPENING
Inspect and check for leaks.

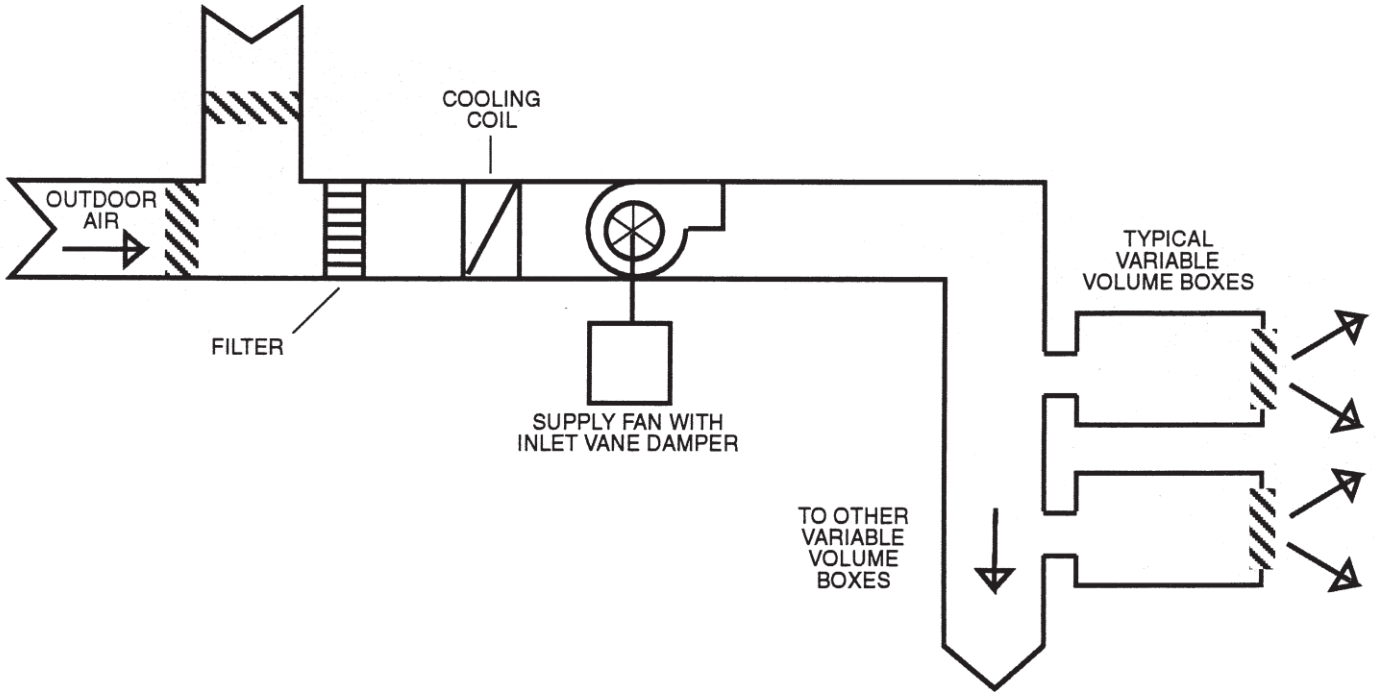
5 LIQUID REFRIGERANT OUTLET
Inspect and check for leaks.

6 TUBE SHEET
Inspect and clean as required.

7 WATER INLET & OUTLET
Inspect and check for leaks.
Replace gaskets.
Clean as required.
Treat for corrosion as indicated.
Record inlet and outlet water temperatures.

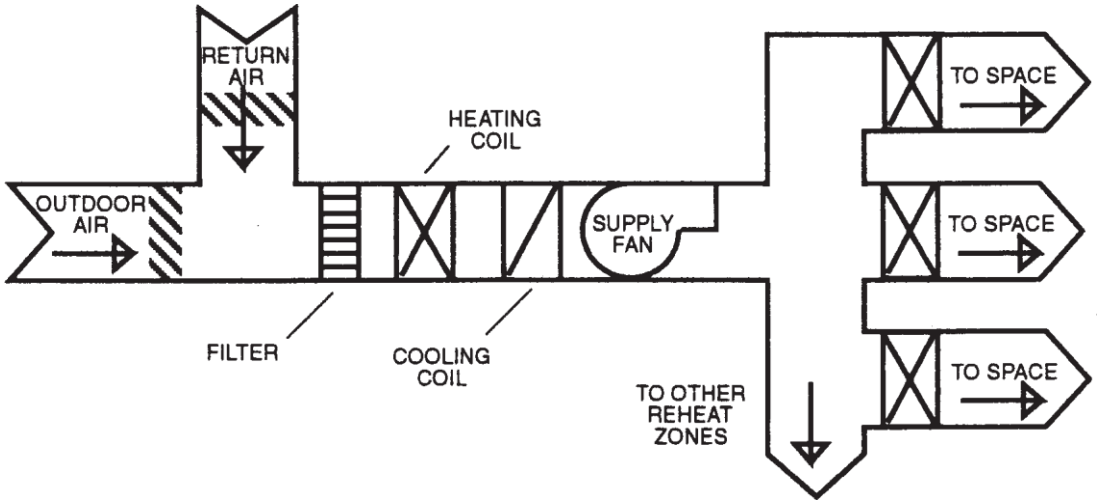
HVAC SYSTEMS:

VARIABLE AIR VOLUME SYSTEMS



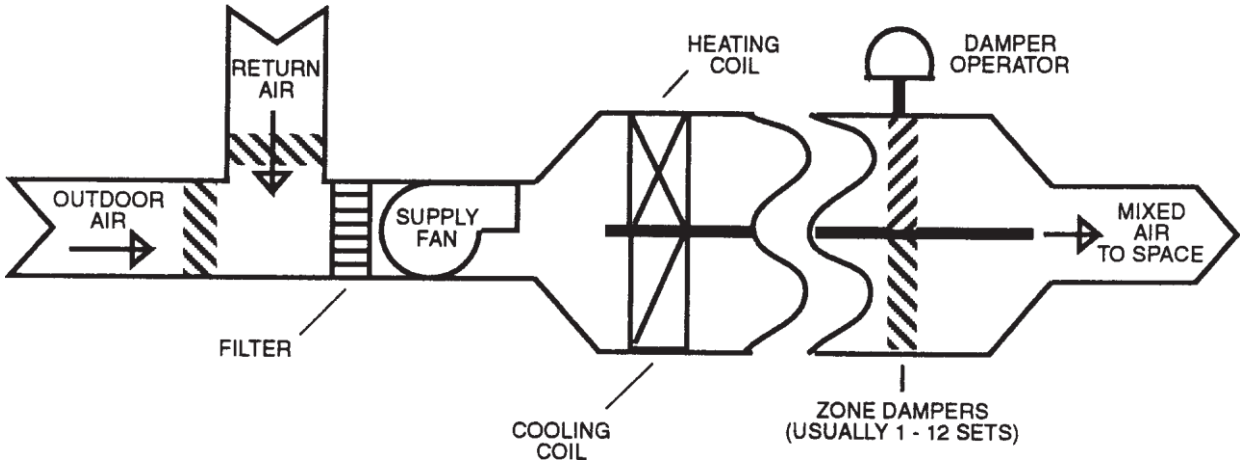
A variable air volume system delivers a varying amount of air as required by the conditioned spaces. The volume control may be by fan inlet (vortex) damper, discharge damper or fan speed control. Terminal sections may be single duct variable volume units with or without reheat, controlled by space thermostats.

HVAC SYSTEMS:
TERMINAL REHEAT SYSTEMS



Reheat systems are modifications of single zone systems. Fixed cold temperature air is supplied by the central conditioning system and reheated in the terminal units when the space cooling load is less than maximum. The reheat is controlled by thermostats located in each condition space.

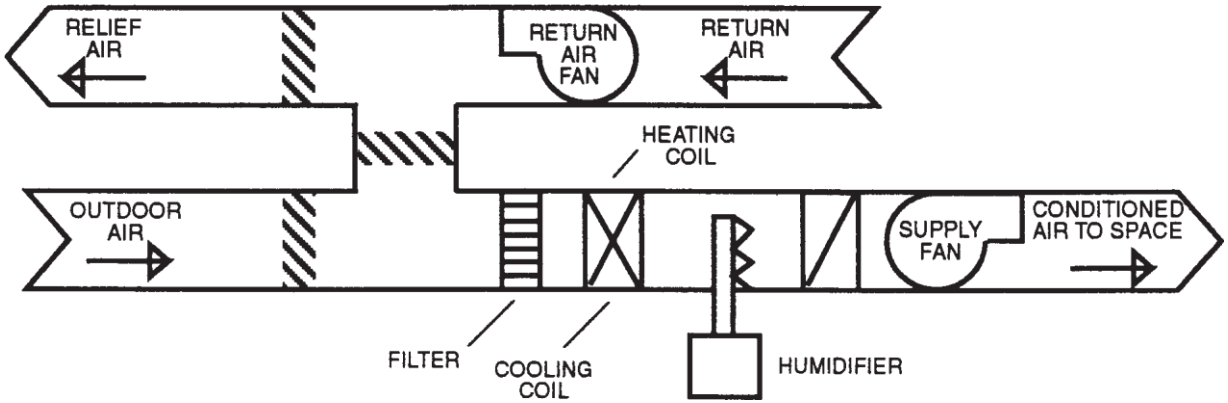
HVAC SYSTEMS:
MULTIZONE SYSTEMS



Multizone systems condition all air at the central system and mix heating and cooled air at the unit to satisfy various zone loads as sensed by zone thermostats. These systems may be packaged roof top units or field fabricated systems.

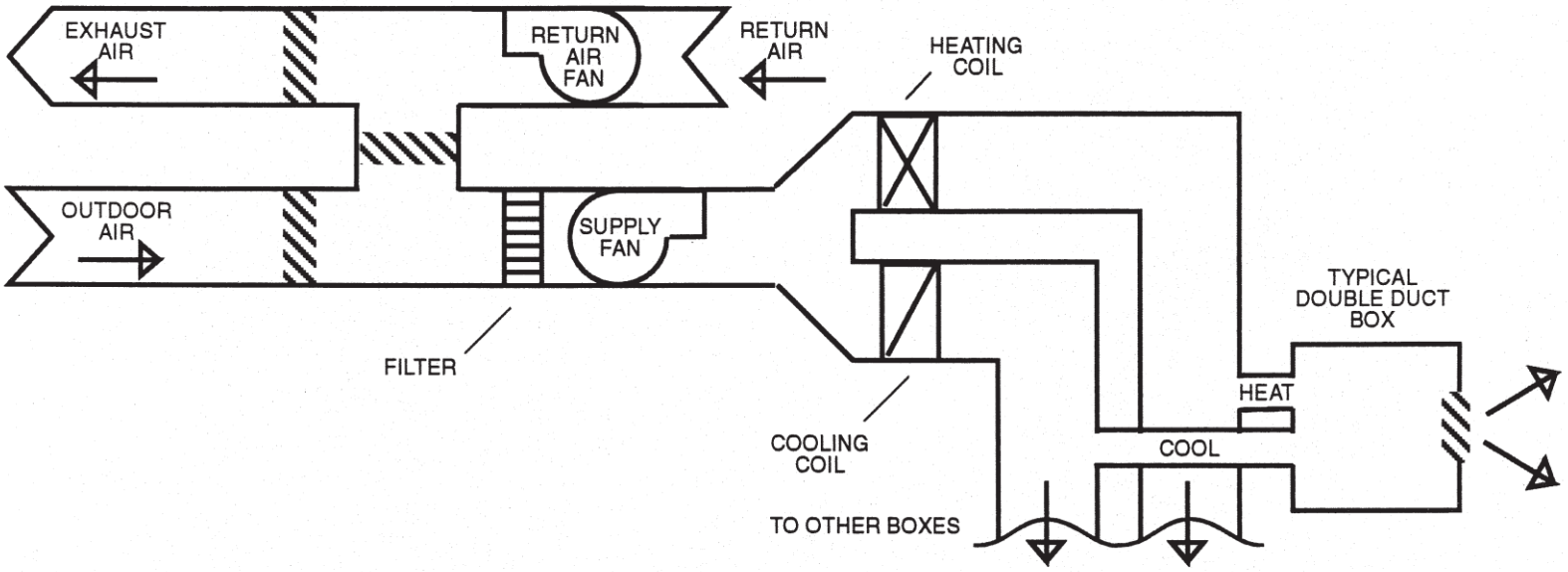
HVAC SYSTEMS:

SINGLE ZONE SYSTEMS



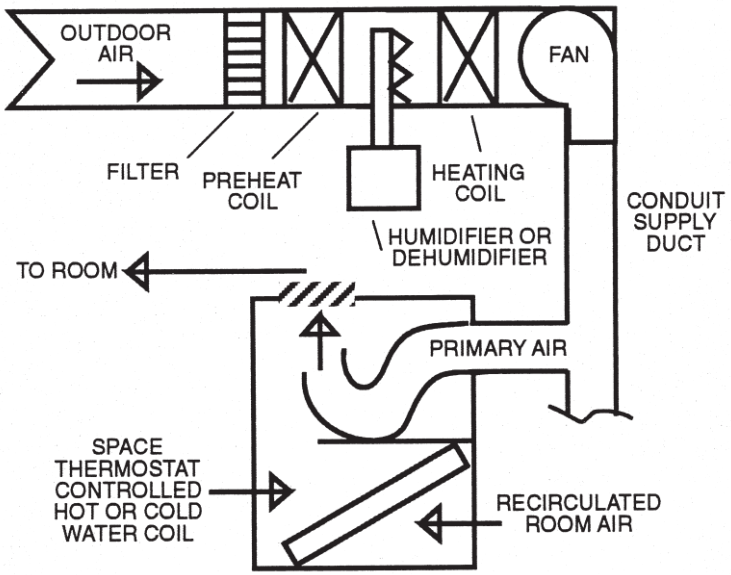
Single zone systems consist of a mixing, conditioning and fan section. The conditioning section may have heating, cooling, humidifying or a combination of capabilities. Single zone systems can be factory assembled root top units or built up from individual components and may or may not have distributing duct work.

HVAC SYSTEMS:
DUAL DUCT SYSTEMS



Dual duct systems condition all air at the central system. Then, heated and cooled air is ducted to the conditioned spaces and mixed as required in terminal mixing boxes.

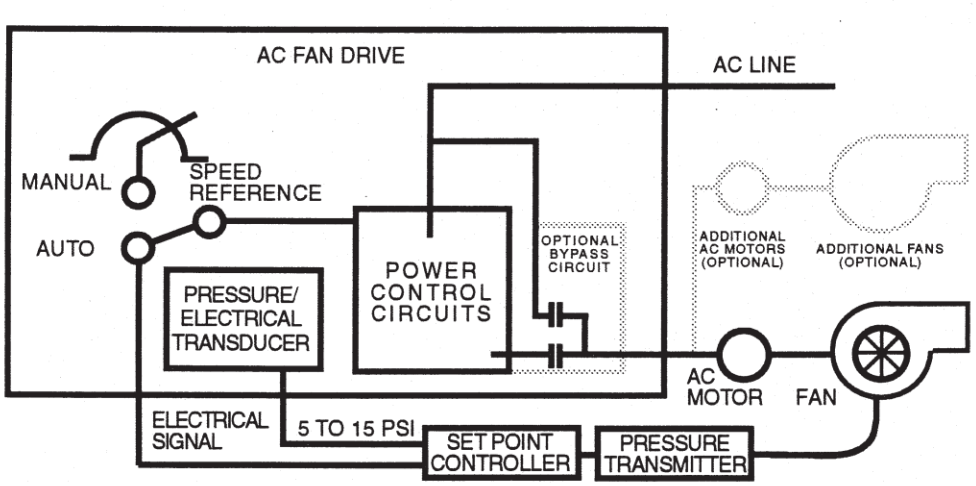
HVAC SYSTEMS:
INDUCTION SYSTEMS



Induction systems generally have units at the outside perimeter of conditioned spaces. Conditioned primary air is supplied to the units where it passes through nozzles or jets and, by induction, draws room air through the induction unit coil. Room temperature control is accomplished by modulating water flow through the unit coil.

HVAC SYSTEMS:

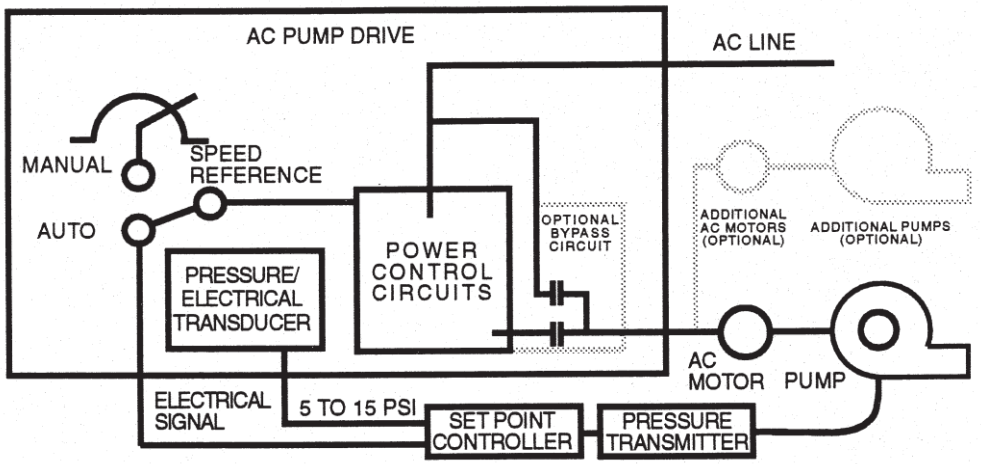
VARIABLE DRIVE FOR VAV SYSTEMS



The AC drive is used to adjust the speed of, and therefore the flow from, the fan or fans in a VAV System. The fan drive receives a control signal from the VAV control system and adjusts the fan speed to deliver exactly the desired amount of air.

HVAC SYSTEMS:

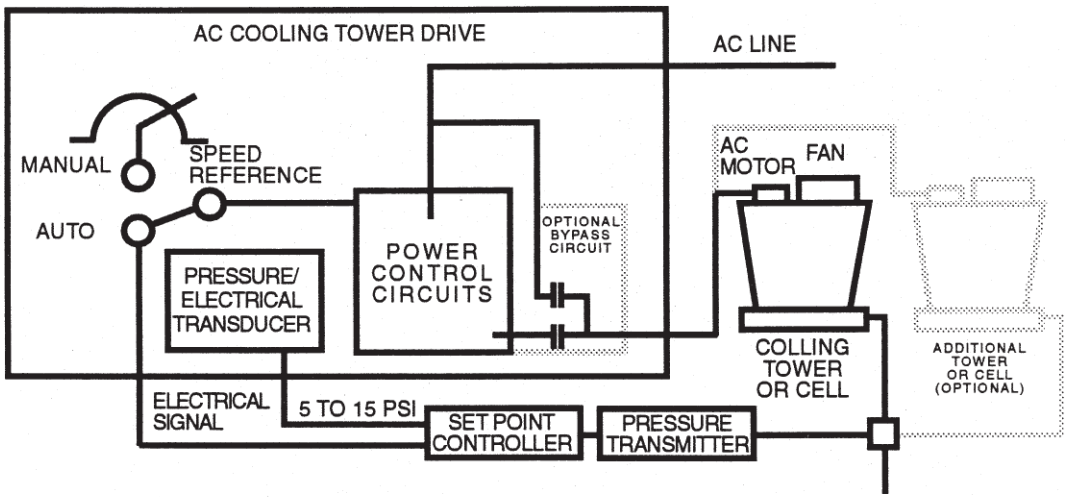
VARIABLE DRIVE FOR PUMPING SYSTEMS



The AC drive is used to adjust the speed, and therefore the flow, of the pump or pumps in the system. The pump drive usually receives a signal from a differential pressure transmitter and adjusts the pump speed to deliver water at exactly the desired flow or pressure.

HVAC SYSTEMS:

VARIABLE DRIVE FOR COOLING TOWER SYSTEMS



The AC drive is used to adjust the speed and therefore the flow, of the fan or fans on a cooling tower. The cooling tower drive receives a control signal from the cooling tower control system and adjusts the fan speed to deliver water at exactly the de- sired temperature.