

# Installation Instructions

378  
Series B

ALL WEATHER HEATING & COOLING UNIT

bryant

39378D9 Rev. 1  
5/10/65

## GENERAL

The Model 378 is approved by the American Gas Association for:

1. Use with natural, mixed, and propane gases.
2. Outdoor installation
  - a. On a roof
  - b. At ground level
3. Indoor installation (when equipped with Bryant draft hood assembly, Part No. 36154C8 and special front door in place of door furnished.)
  - a. Attic
  - b. Basement, utility room, etc.
4. Use with 36W, 54W, 90W, and 108W water coils.
5. Use with 48R, 60R, 90R, and 120R direct expansion coils.

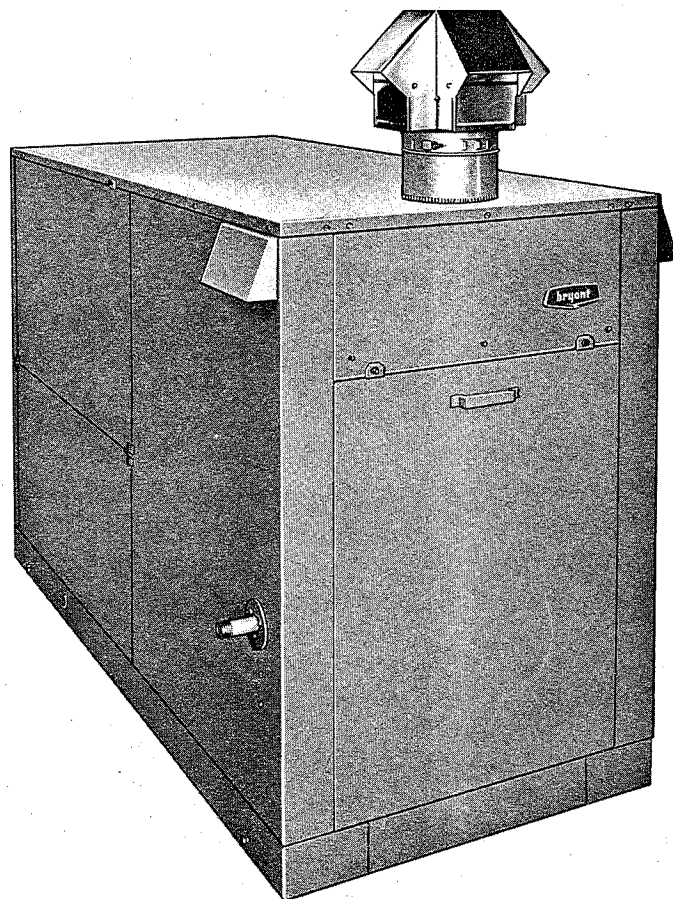
## INSPECTION

Be sure available gas supply is the same as shown on American Gas Association rating plate.

Check electric supply - voltage, phase, and frequency - to be sure that it is the same as required on the rating plate. Check to be sure that adequate power is available to handle the increased electrical load when the unit is used for cooling.

Installation of the all-weather heating and cooling unit consists of the following:

1. Locating the Unit
2. Gas Piping
3. Venting
4. Electric Connections
5. Start-up and Adjustment
6. Connection with Electric Air Conditioner (when used)
7. Connection with Gas Air Conditioner (when used)



## LOCATING THE UNIT

When installing in conjunction with a cooling system refer to the applicable section of this instruction for additional information.

Before locating the unit, refer to local codes.

## OUTDOOR INSTALLATION

### Mounting

The unit design permits use of four corner posts, rails, or any other method of support sufficiently strong to accommodate the weight; however, consult local codes - particularly for roof installation.

Units must be level.

### Clearances

1. Provide a minimum 1 inch clearance on bottom for water drainage (rain, sleet, and snow).

378 ALL WEATHER INDOOR/OUTDOOR UNIT

|                           | 48R - 378 | 60R - 378   | 36W - 378   | 54W - 378   | 90R - 378   | 120R - 378  | 90W - 378   | 108W - 378  |
|---------------------------|-----------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|
| Heating input             | Btuh      | 150-100,000 | 150-100,000 | 150-100,000 | 300-200,000 | 300-200,000 | 300-200,000 | 300-200,000 |
| Bonnet capacity           | Btuh      | 112-75,000  | 112-75,000  | 112-75,000  | 225-150,000 | 225-150,000 | 225-150,000 | 225-150,000 |
| DX Coil rating            | Btuh      | 48,000      | 60,000      | --          | 90,000      | 110,000     | --          | --          |
| Water Coil rating         | Btuh      | --          | --          | 36,000      | 54,000      | --          | 90,000      | 108,000     |
| Air flow                  | CFM       | 1600        | 2000        | 1200        | 1800        | 4000        | 3000        | 3600        |
| External static           | In. water | 0.20        | 0.20        | 0.15        | 0.20        | 0.30        | 0.25        | 0.30        |
| Blower motor              | H.P.      | 1/2         | 3/4         | 1/2         | 3/4         | 1           | 1           | 1-1/2       |
|                           | Volts     | 230         | 230         | 230         | 230         | 230         | 230         | 230         |
|                           | Phase     | 1           | 1           | 1           | 1           | 1           | 1           | 1           |
|                           | Cycle     | 60          | 60          | 60          | 60          | 60          | 60          | 60          |
|                           | FLA       | 4           | 5           | 4           | 5           | 7           | 7           | 9           |
| Suction line              | In. o.d.  | 1-1/8       | 7/8         | --          | 1-1/8       | 1-3/8       | --          | --          |
| Liquid line               | In. o.d.  | 1/2         | 3/8         | --          | 5/8         | 5/8         | --          | --          |
| Inlet water line          | NPT       | --          | --          | 1-1/4       | 1-1/4       | --          | 1-1/4       | 1-1/4       |
| Outlet water line         | NPT       | --          | --          | 1-1/4       | 1-1/4       | --          | 1-1/4       | 1-1/4       |
| Condensate drain          | In. o.d.  | 7/8         | 7/8         | 7/8         | 7/8         | 7/8         | 7/8         | 7/8         |
| Refrigerant               | R         | 500         | 500         | --          | 22          | 500         | --          | --          |
| Filters (disposable)      | In.       | (2) 25x20x1 | (2) 25x20x1 | (2) 25x20x1 | (4) 25x20x1 | (4) 25x20x1 | (4) 25x20x1 | (4) 25x20x1 |
| Approx. shipping wt. Lbs. |           | 580         | 600         | 595         | 605         | 975         | 710         | 995         |

## Outdoor Installation - Clearances (cont'd)

2. Provide adequate clearance for outlet and return duct connections.

3. Clearance from combustibles:

From casing, all sides and top 6"

\* From base . . . . . 0"

\* This permits use of combustible material as support.

**Caution:** When using rails, etc. as support, do not enclose unit so as to interfere with drainage.

4. Service clearance:

Front - 24"

Side - Provide adequate side clearance for filter removal. Clearance on left side for blower service; side clearance for coil service.

Provide adequate clearance when air conditioner is located adjacent to unit.

## INDOOR INSTALLATION

### Mounting

Unit may be set flush with floor or mounted on supports. There is no need to provide clearance under the base. Shim as required to make unit level.

### Clearances

1. From combustible materials:

a. 0" clearance on bottom.

b. 6" clearance from casing surface; line contact allowed.

c. 6" vent and draft hood.

2. Service access: Same as for outdoor installation.

## COMBUSTION AND VENTILATION AIR

When the furnace is installed in a confined space, but in a building otherwise having adequate infiltration from the outside, air for combustion and ventilation may be taken from the building. Two openings should be provided, each having a free area of one square inch for each 1000 Btu per hour - one located above the draft diverter relief opening and the other near the floor.

When the furnace is installed in a building of unusually tight construction, air for combustion and ventilation should be obtained from outdoors or from spaces freely communicating with the outdoors. Two openings should be provided, each having a free area of one square inch for each 2000 Btu per hour - one located above the draft diverter relief opening and the other near the floor.

For further information on this subject, refer to ASA Z21.30-1959, or later editions of this standard, "Installation of Gas Appliances and Gas Piping."

## GAS PIPING

The gas supply line should be a separate line direct from the meter to the furnace.

Check local utility for recommendations concerning existing lines. Choose a supply pipe size large enough to keep the pressure loss as low as practical.

Never use pipe smaller than the gas connection to the furnace. Observe local codes for all gas pipe installation.

The following are pertinent recommendations:

1. Avoid low spots in long runs of pipe. It is best to grade all pipe 1/4 inch in 15 feet to prevent traps. All horizontal runs should grade to risers. Risers should be used to connect to the furnace and to the meter.

2. Install a drip leg in the riser leading to the furnace. This drip leg will serve as a trap for dirt and condensate.

The drip leg can be installed by connecting a tee to the riser leading to the furnace so that the straight-through section of the tee is vertical. Then, connect a capped nipple to the tee. The capped nipple should extend below the level of the gas controls a minimum of 6 inches.

3. A manual shut-off valve should be installed in the gas line within sight of and convenient to the furnace. This shut-off valve is furnished.

4. Support all piping with appropriate hangers, etc. Properly support gas piping at furnace to prevent damage to weather tight seal.

5. After all connections are made, check for leakage using soap and water solution, or in accordance with local utility regulations. Never use a match or other open flame.

## VENTING

### INDOOR INSTALLATION

Consult local codes. Unless the local codes direct otherwise, the unit may be vented to a permanent chimney, or to a listed Type B or Type C gas vent.

The Model 378 furnace is approved for indoor installation only when used with draft hood, Bryant Part No. 36154C8.

To install indoor draft hood:

- a. Remove upper front access panel to gain entrance to flue collector.
- b. Insert draft hood inside furnace casing collar and push it down over the flue collector collar to form snug connection.
- c. Fasten draft hood to flue collector collar with sheet metal screws.

The following recommendations are made:

1. Select flue connection material that is satisfactory for the installation and that meets the requirements of the local codes.
2. The flue connection pipe must be the same size as the outlet collar on the furnace. No reduction in this size is permissible in the pipe run.
3. Run pipe as directly as possible with a minimum number of turns.
4. Maintain a minimum of 1/4 inch per linear foot upward slope on all horizontal runs.
5. Rigidly support the flue pipe with hangers and straps to insure that there will be no movement after installation.
6. Extend the flue connection pipe through the chimney wall, flush with the inner face of the chimney liner. Never connect into a chimney serving an open fireplace unless the fireplace opening is sealed off.
7. The chimney or gas vent should extend high enough above the roof or neighboring obstruction so that wind from any direction will not create a positive pressure in the vicinity of the outlet of the chimney or gas vent. The installer is referred to Part V of American Standard "Installation of Gas Appliances and Gas Piping", ASA Z21.30, 1959 for detailed information on chimney and gas vent use. In general, the chimney or gas vent should extend 3 feet higher than the point of emergence through the roof, and at least 2 feet higher than any object within a radius of 15 feet.

8. If more than one appliance is vented into the same chimney, the cross-sectional area of the chimney must be as large as the largest flue pipe being connected, plus 50 per cent of the cross-sectional areas of the additional flue pipes being connected.

9. If more than one appliance is manifolded into the same flue connecting pipe, the cross-sectional area of this manifold pipe must be as large as the sum of the cross-sectional areas of the pipes connecting into it.

10. Flue pipe must be at least 6 inches from any combustible materials.

Do not use dampers or other adjustable restrictions in flue.

Any part of the vent which is outdoors must be adequately insulated to assure proper chimney action and prevent condensation.

### OUTDOOR INSTALLATION

The Model 378 all-weather unit is shipped with outdoor vent as standard equipment and must be installed in accordance with the following instructions and without alterations.

#### Installing Outdoor Vent

1. Remove upper front access panel to gain entrance to flue collector.
2. Insert cap and pipe assembly through furnace casing.

**Important:** Be sure the outer wall of the double walled pipe extends over the furnace casing connector collar to assure weather tight connection and that the inner wall connects to the flue collector collar.

3. Fasten the flue pipe assembly to the flue collector collar with sheet metal screws. **Note:** Additional venting is not required on outdoor units.

### ELECTRIC CONNECTIONS

1. All electrical connections are to be made in accordance with National Electrical Codes and local codes governing such wiring.

Field connections are to be made in accordance with wiring label attached to unit. See Figures 1 and 2.

2. Weather tight connections must be made at electrical entrance to the unit on all outdoor installations.

3. Thermostat connections for heating only are to be made at terminals 4 and W. See Figure 3 for low voltage connections when cooling equipment is used.

4. A separate, fused, electrical line should be run for this installation.

## START-UP AND ADJUSTMENT

### 1. Before Starting the Unit:

- a. Check to see that electric and piping connections have been made.
- b. Make sure gas piping is purged and free of air; do not purge into the combustion chamber of the furnace. All gas piping connections should be leak tested. Do not use an open flame. Use a soap and water solution.

### 2. Start-Up:

Follow lighting instructions attached to the unit. Sequence of control operation is as follows:

- a. When pilot gas cock is opened, gas flows to the pilot and to the pilot pressure switch.
- b. Pilot pressure switch then closes to complete the 24 volt circuit. The pilot then lights automatically.
- c. Subsequent switch action completes circuit through Y and W to energize the electric gas valve.

When the thermostat calls for heat, circuit is closed between W and 4. This allows current to flow through combustion air fan relay which energizes the combustion air blower and builds up pressure in the combustion air switch. When combustion air pressure switch is closed, low voltage is completed.

The conditioning air blower is not actuated by a fan switch, but by a delay fan relay.

If the lower limit opens, the automatic gas valve is de-energized.

If the upper limit opens, the automatic gas valve is de-energized, and the combustion air pressure switch is by-passed so that the conditioning air blower will continue to run.

The automatic pilot turns the main gas off, should pilot flame be put out. This can be checked by turning the main burners and pilot on, then shutting the pilot gas off. The main burners should shut off.

The limit controls the temperature reached in the

unit. The limit will shut off the main gas if the temperature goes too high. The limit may be checked by removing the fan belt and firing the unit. The burners should shut in a few minutes.

### 3. Adjust Gas Input:

**Air Shutter Adjustment** - To adjust the air shutter, pull the shutter closed until there is a slight yellow tip at the top of each flame. Then open the shutter until the yellow tip disappears.

Gas input should agree with that shown on the rating plate of the unit. The burners are equipped with orifices sized to give the correct input with a manifold pressure of 3 inches w.c.  $\pm$  0.3 for natural and mixed gases, and 11 inches w.c. for propane gas.

The furnaces are approved for minimum firing rates (shown on rating plate) as follows:

Size 150 - May be fired at 100,000 BTUH input.

Size 300 - May be fired at 200,000 BTUH input.

**Note:** The size 150 furnace (natural gas only) is also approved for modulated input down to 50,000 BTUH when equipped with an approved modulating valve. The size 300 furnace (natural gas only) is approved for modulated input down to 100,000 BTUH.

See next page for

## Gas Input Measurement

Determine gas input as follows:

- a. Determine the number of seconds required for the gas meter test dial to complete one revolution.
- b. Divide 3600 by the number of seconds in Item (a) above.
- c. Multiply result of Item (b) by the number of cubic feet shown for one revolution of the test dial. This gives you cubic feet per hour of gas flow.
- d. Multiply result of Item (c) by the heating value of the gas in BTU (consult local utility for value). This gives you the total measured input in BTUH. Compare this value with that on your rating plate.

Example: Suppose that the size of the test dial is 1/2 (.5) cu. ft.; it takes 20 seconds for the dial to complete one revolution; heating value of gas is 1050 BTU/cu. ft. Proceed as follows:

- a. 20 seconds to complete one revolution.
- b. 3600 divided by 20 equals 180.
- c. 180 x 0.5 equals 90 cu. ft. per hour of gas flow.
- d. 90 x 1050 equals 94,500 BTUH input.

Only minor changes should have to be made at the pressure regulator. If the manifold pressure must be changed more than  $\pm 0.3$  w.c. to obtain rated input, the orifices should be changed accordingly.

#### 4. Air Flow and Temperature Rise

The furnace is approved for operation under the temperature rise conditions shown in Table I.

TABLE I

| Model No.                        | Input Btu per hr. | Temperature Rise Air through Furnace |
|----------------------------------|-------------------|--------------------------------------|
| 36W, 54W, 48R, 60R, & 150 - 378  | 150,000           | 45° F to 75° F                       |
|                                  | 100,000           | 20° F to 75° F                       |
| 90W, 108W, 90R 120R, & 300 - 378 | 300,000           | 45° F to 75° F                       |
|                                  | 200,000           | 20° F to 75° F                       |

The pulley setting has been made at the factory to give an air flow compatible with the intended use of the equipment; i. e., the setting varies with the type of cooling coil to be used. Table II gives the pulley setting as the furnace leaves the factory, and shows also how the pulley can be adjusted to give the desired air flow if the duct resistance is higher than normal.

The static pressure against which the furnace is operating is the difference in pressures in the return air duct and the discharge duct near the furnace. If this differential pressure, determined when the filters are clean and the pulley is opened the number of turns shown for normal static, is more than shown for normal static in Table II, the blower speed should be increased by changing the pulley setting to that shown in the column for higher than normal static pressures.

The temperature rise is the difference between the temperature of the air in the return duct and in the discharge duct near the furnace. This temperature rise, measured after equilibrium has been attained, should be within the range shown in Table I. The pulley setting shown in Table II should give an air rise within the approved range.

TABLE II

| Model No.  | Normal Static (ARI) |                                      | Higher Static * |                           |
|------------|---------------------|--------------------------------------|-----------------|---------------------------|
|            | Static in. w.c.     | Factory Setting of Pulley Turns Open | Static in. w.c. | Pulley Setting Turns Open |
| 36W - 378  | 0.15                | 3½                                   | 0.50            | 1½                        |
| 54W - 378  | 0.20                | 4                                    | 0.50            | 2                         |
| 48R - 378  | 0.20                | 1½                                   | 0.40            | 0                         |
| 60R - 378  | 0.20                | 3½                                   | 0.50            | 1½                        |
| 150 - 378  | 0.20                | 2½                                   | 0.50            | ½                         |
| 90W - 378  | 0.25                | 1½                                   | 0.45            | 0                         |
| 108W - 378 | 0.30                | 2½                                   | 0.50            | 1                         |
| 90R - 378  | 0.25                | ½                                    | 0.35            | 0                         |
| 120R - 378 | 0.30                | 1                                    | 0.40            | 0                         |
| 300 - 378  | 0.25                | ½                                    | 0.35            | 0                         |

\* The furnaces are approved for operation up to 0.50 in. w.c.

## CONNECTING CONDENSING UNIT TO R TYPE MODEL 378

The evaporator coil is supplied as an integral part of the "R" Type 378 unit.

The condensing unit may be installed remotely or adjacent to the "R" Type 378 unit.

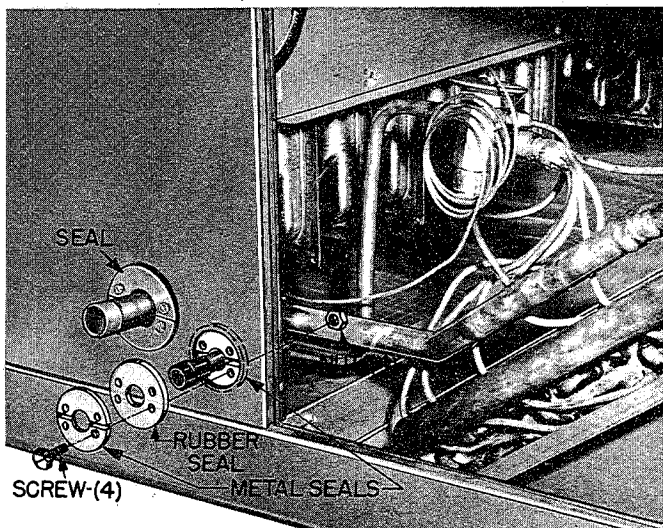
Consult Condensing Unit Installation Instructions for minimum clearances and connection of refrigerant tubing.

All openings in refrigerant lines from evaporator coil and condensing unit are plugged or capped to keep moisture out of the system. These plugs or caps should not be removed until each connection is made. Each connection should be made in the shortest time possible to avoid contamination from surrounding air.

**Note:** The 90R and 120R 378 units have a factory installed expansion valve. Items 1 through 5 will, therefore, not apply for these sizes in the following instructions. The expansion valves for the 48R and 60R 378 units are supplied as a loose part with the condensing unit.

To install the expansion valve, proceed as follows:

1. Remove panels from right-hand side of the 378 unit.
2. Remove plug from flare nut connector on distributor and insert expansion valve.
3. Remove plug from external equalizer line flare fitting and connect equalizer to expansion valve.
4. Shipped as loose parts on 48 & 60 sizes are 2 large metal seals, a neoprene gasket, and nuts and bolts to seal the liquid line opening. Install air seals as shown.



5. Uncoil capillary line of expansion valve and attach sensing bulb to top of horizontal suction line inside of unit casing. Wrap bulb with prestite tape (shipped with unit as a loose part).

6. Connect coil to condensing unit per instructions packaged with the condensing unit.

7. Follow procedures outlined in Condensing Unit Installation Instruction for leak testing and evacuation.

8. Replace panels on unit and connect condensate (located on opposite side of unit) to a suitable drain site.

9. All electrical connections should be made in accordance with National Electric Code and any local codes that might apply. Make electrical connections as shown in wiring diagram in condensing unit instruction and the low voltage diagram in this instruction.

## CONNECTING GAS AIR CONDITIONER TO W TYPE 378

### All Weather Indoor-Outdoor Unit

#### Water Coil Connections

For installation of chilled water lines from the gas air conditioner to the water coil in the Model 378, refer to installation instructions furnished with the gas air conditioner.

For piping and wiring recommendations on multiple gas air conditioner installations as required for the Models 90W 378 and 108W, contact your Bryant distributor.

#### Winter Shut-Down Protection

It will be necessary to add anti-freeze to the chilled water system for winter protection whether the Model 378 is installed indoors or outdoors. The addition of the anti-freeze will furnish freeze protection for the coil and piping. It will also provide for expansion of water in the coil if the coil is located in the heated air stream.

Winter shut-down protection can be provided as follows:

1. With the pump circulating water with additive (borax), add one gallon of methanol (uninhibited methyl alcohol) for each 20 gallons of water or fraction thereof, and circulate for ten minutes.
2. It is not necessary to drain the system.
3. Tag the unit to show methanol has been added.
4. Determine the correct amount of methanol required as follows:
  - a. Estimate the system water capacity in gallons from table below. Multiply the length of pipe in feet by the gallons in one foot; then add the gallons of water in chiller, or chillers, and coil.
  - b. Water Capacity Table:
 

|                                    | Water Capacity Gallons |
|------------------------------------|------------------------|
| 36-450 Chiller . . . . .           | 5                      |
| 54-450 Chiller . . . . .           | 8                      |
| 36W-378 or 54W-378 Coil . . . .    | 1.5                    |
| 90W-378 or 108W-378 Coil . . . .   | 3.0                    |
| 1 ft. of 3/4 inch pipe . . . . .   | .03                    |
| 1 ft. of 1 inch pipe . . . . .     | .05                    |
| 1 ft. of 1-1/4 inch pipe . . . . . | .08                    |
| 1 ft. of 1-1/2 inch pipe . . . . . | .12                    |
  - c. With the pump operating, adjust the water operating level in the chiller.

**Summer Operation**

In general, it is recommended that the methanol be flushed from the chilled water system for summer operation. The presence of methanol in the chilled water will reduce the capacity with a corresponding increase in operating cost. However, the reduction in capacity resulting from the 5% solution of methanol is small (less than 1%) and the methanol may be left in the system.

If the system is drained, flushed, and refilled with water, be sure to add one box of chilled water additive (borax) for each 20 gallons of water or fraction thereof in the system.

**Note:** The above explanation covers only the normal winter shut-down protection. If, for any reason, the gas air conditioner must operate when the outdoor temperatures are below freezing, it will be necessary to prepare the chilled water system for the minimum temperature. Consult your Bryant distributor for special procedures to follow.

**LUBRICATION**

**Blower Motor** – if equipped with oil cups, oil motor bearings with SAE 10-20 non-detergent oil each heating and cooling season. Use approximately six drops for each bearing. Some motors are equipped with bearings of a permanently lubricated type and, therefore, need no further oiling.

**Blower Bearings** – are of the permanently lubricated type and, therefore, need no further oiling.

**Combustion Air Blower Motor** – (located in control compartment). Oil motor bearings with SAE 10-20 non-detergent oil each heating season. Use approximately three drops for each bearing.

**Air Filter**

Periodically inspect air filters. Replace when dirty with filters of the same size (see marking on filters), making sure that arrows on edge of filter point in direction of air flow (toward blower).

Excessively dirty filters reduce furnace efficiency.

**Cleaning the Unit**

1. Be sure main line disconnect switch is in the "off" position. Tag with suitable warning label.
2. Turn manual gas and pilot valve to "off" position.
3. Remove upper and lower front access panels.
4. Disconnect pilot and escapement tubing.
5. Remove burners.
6. Remove screws holding horizontal dividing panel and flue collector in place.
7. Tip dividing panel and flue collector up and back to give access to flue outlets.
8. Remove flue baffles.
9. Clean flue passages with suitable brush.
10. Re-assemble furnace by reversing the above procedure, making sure all seals are properly replaced.

See following pages for Wiring Diagrams.



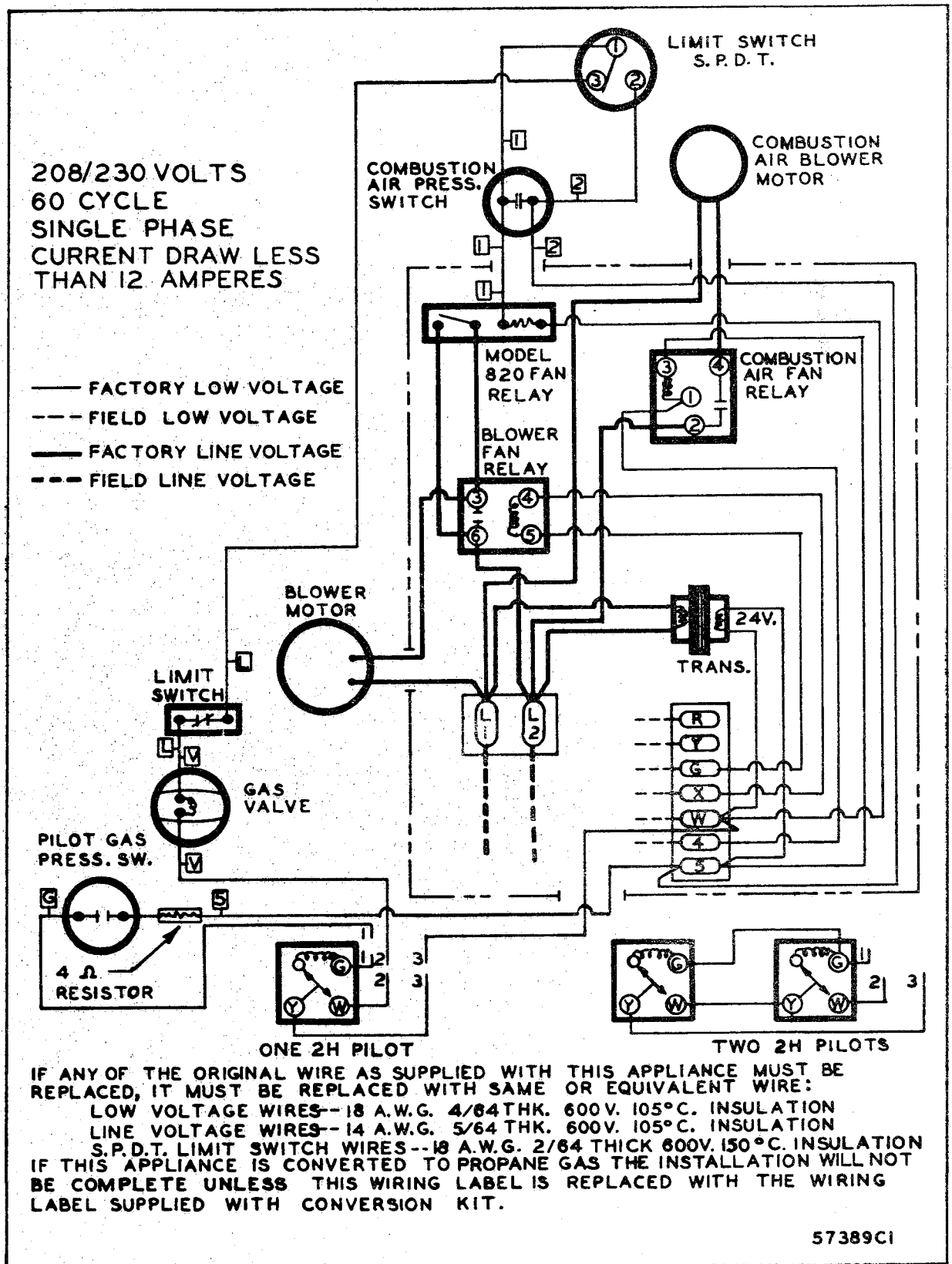


Figure 1 - Wiring for City Gases

EH 378

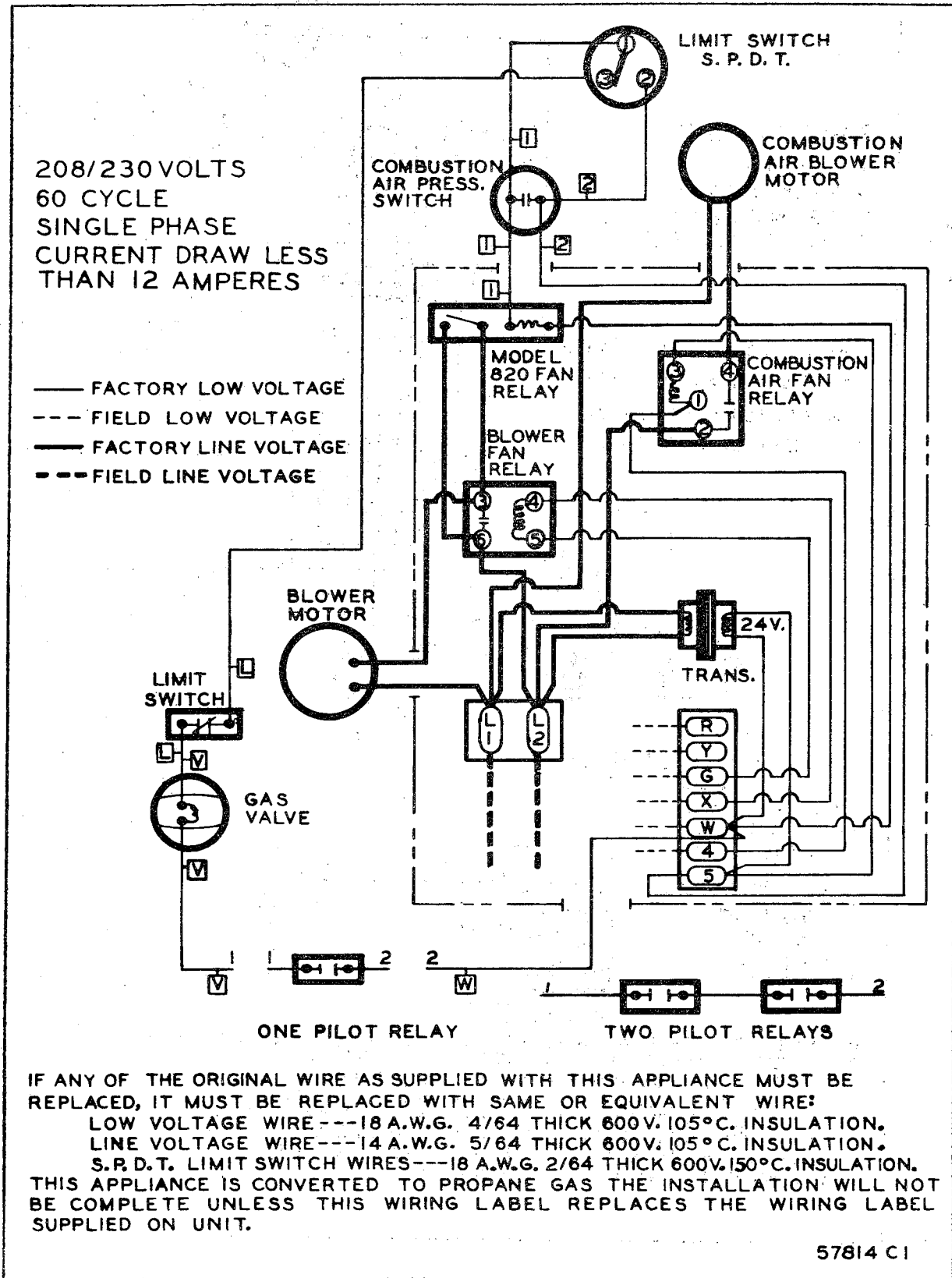
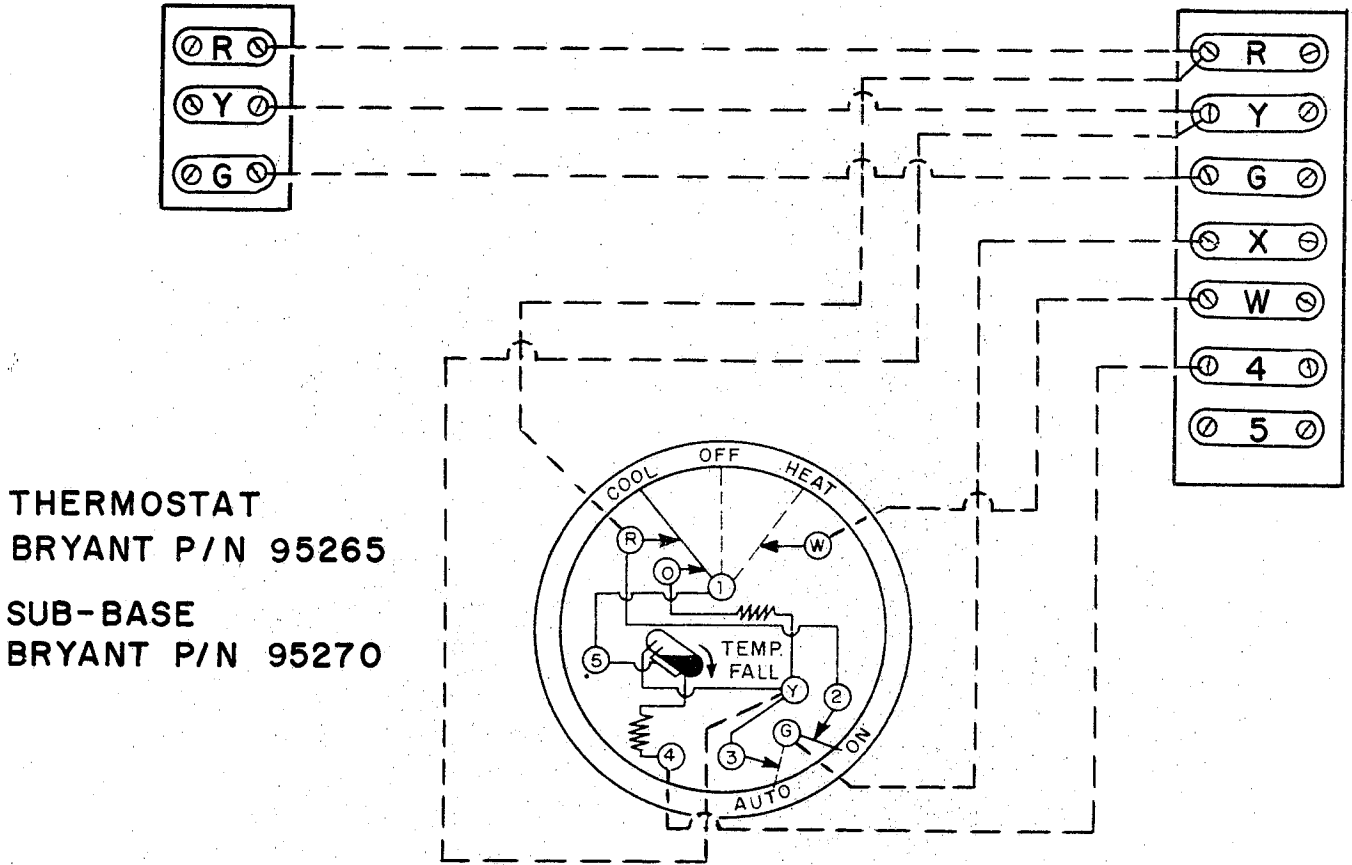


Figure 2 - Wiring for Propane Gas

LOW VOLTAGE  
TERMINAL STRIP  
ON CONDENSING UNIT

LOW VOLTAGE  
TERMINAL STRIP  
ON 378 UNIT



THERMOSTAT  
BRYANT P/N 95265  
SUB-BASE  
BRYANT P/N 95270

Figure 3 - Low Voltage Wiring

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