

Typical Sequence of Operation

General System Sequence of Operation (refer to unit wiring diagrams)

1. When electric power is applied to the unit, the 24 volt transformer is energized.
Time delay begins (set at five minutes from the factory, field adjustable from 6 seconds to 8 minutes). Upon completion of the delay period the coil of the slave relay is energized, closing its N.O. contacts. This makes a circuit through the normally closed high pressure cutout, compressor motor protection module if applicable, and through the oil failure cutout to the low pressure control. The N.O. contacts of the slave relay close making a line voltage circuit to the N.O. contacts of the cooling pilot relay. At the same time, the crankcase heaters are energized.
2. On a call for system operation the field installed system switch is closed, and a control circuit is made.
3. The coil energizes the blower pilot relay which closes its N.O. contacts, energizing the coil of the evaporator blower motor contactor which in turn closes its line voltage contacts and energizes the evaporator blower motor also making a line voltage power supply to the gas furnace.
4. As the evaporator blower motor contactor closes, it causes a 24 volt control circuit to terminal "R" of the compressor lock-out thermostat "CLT" and gas furnace.
5. If the outdoor ambient temperature is above the set point of 65°F, the coil of the cooling pilot relay causes its N.O. contacts to close, making a line voltage circuit across the coil of the liquid line solenoid valve.
6. As the refrigerant pressure increases and closes the low pressure control, a line voltage circuit is made to the time delay. Upon completion of the delay period the coil(s) of the compressor contactor(s) are energized, causing the contactor to close and energize the compressor.
A line voltage circuit is also made to the unloading pressure control. If it is closed, a circuit is made to the coils of the unloader solenoid and the hot gas bypass solenoid valve.
7. When the compressor contactor closes, it also closes the compressor contactor auxiliary making a circuit to the coil of the condenser fan contactor and through low ambient fan controls to the coils of condenser fan contactors.
8. If the outdoor ambient temperature is below the set point of 65°F the N.O. contacts of the compressor contactor auxiliary energizes the coil of the interlock relay causing its N.O. contacts to close in the gas furnace control circuit. NOTE: The compressor contactor auxiliary "CC2A" can only be closed if the compressor contactor is open, therefore the interlock relay prevents the simultaneous operation of the compressor and gas furnace.
9. On a call for heat, a control circuit is made to energize the coil of the heat relay. The main blower proving switch will close when air flow is present.
10. The furnace section is made from the control terminal across the N.O. contacts of the combustion pressure switch, energizing pilot ignition time delay relay heater. After delay of approximately 30-50 seconds the time delay relay's switch closes energizing the furnace venter motor. As the venter operates, it causes the combustion pressure switch to open. The ignition control energizes a high voltage electric spark, and the pilot valve solenoid in the combination gas valve.
11. The flame sensor proves the presents of the pilot flame generating a DC current of 0.2 microamp (or greater) to the ignition control. The ignition control's internal switch action then de-energizes the spark transformer and makes a circuit to the high fire solenoid of the combination gas valve.
12. When there is a call for gas furnace operation the discharge air temperature causes a change in the resistance of a discharge air sensor thermistor. The Maxitrol solid state control center measures the sensor's change in resistance and sends a varying DC current to the Modulator-Regulator valve to adjust the gas input as required.

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Typical Sequence of Operation Continued

Mechanical Cooling. The compressor starts when the outside air temperature is above the adjustable set point. In the cooling mode the leaving air temperature will be maintained by hot gas bypass and/or unloading the compressor. This is accomplished through suction-pressure sensing, thus tracking the outside air temperature variations.

Gas Heat. In the heating mode the leaving air temperature will be maintained by a modulating gas regulator in response to the leaving air temperature set point.

When the leaving air temperature drops below the leaving air sensor set point, the venter motor is energized after 15 seconds (approximate) time delay. Venter flow causes switching from N.O. to N.C. contacts, energizing the pilot gas valve and spark gap to produce a pilot flame on each operating cycle. The sensing probe proves the presence of the pilot flame and energizes the safety switch portion of the control. The switch action de-energizes the spark gap and energizes the main valve. The main gas ignites and the unit fires a full rate. If the flame is extinguished during the main burner operation, the safety switch closes the main valve and recycles the spark gap.

Electronic Proven Pilot Spark Ignition Control. When there is a call for heat, the electric spark and pilot valve are automatically energized to produce a pilot flame on each operating cycle. The flame sensor proves the presence of the pilot flame; internal switch action de-energizes the spark transformer and energizes the main burner electric valve. The main gas ignites and the heating cycle is in normal operation. When the call for heat is satisfied the main burner valve and the pilot valve are de-energized.

Series 21/31 Maxitrol Regulator. This unit may be equipped with electronic modulation that will provide firing rate of 100% down to 50%, depending on the heat requirements as established by the thermistor sensor. The thermistor is a resistor that changes its resistance depending upon the surrounding temperature. This change in resistance is monitored by the solid state control center which, in addition to opening and closing the main valve, will furnish varying DC current to the modulating valve to adjust the gas input as required. The modulating valve is basically a regulator with electrical means of raising and lowering the discharge pressure. When no DC current is fed to this device, it becomes a gas pressure regulator, supplying 3.5" w.c. pressure to the main operating valve and the burners.

Condenser Fan Motor and Control. A variable speed fan motor and control is standard with all reheat options because units operating in low ambient temperature require a control system maintain stable head pressure. Head pressure control is accomplished with one or two variable speed condenser fan drives. A pressure sensing control modulates the condenser fan speed as required to maintain head pressure between 190 psig and 250 psig.

Models 051, 061, 071, 101 and 141 – are equipped with one variable speed motor and control.

Models 181, 201 and 271 – are equipped with one single phase variable speed motor and one three phase motor (dual fan units).

The model 361 is equipped with one variable speed motor and three – three phase motors (four fan unit).

The pressure sensing system consists of a variable speed motor driven fan and a constant speed motor driven fan. Both are controlled from refrigerant pressure rather than ambient temperature, reflecting actual operating conditions in the machine which will vary as the growing cycle and the number of operating compressors change.

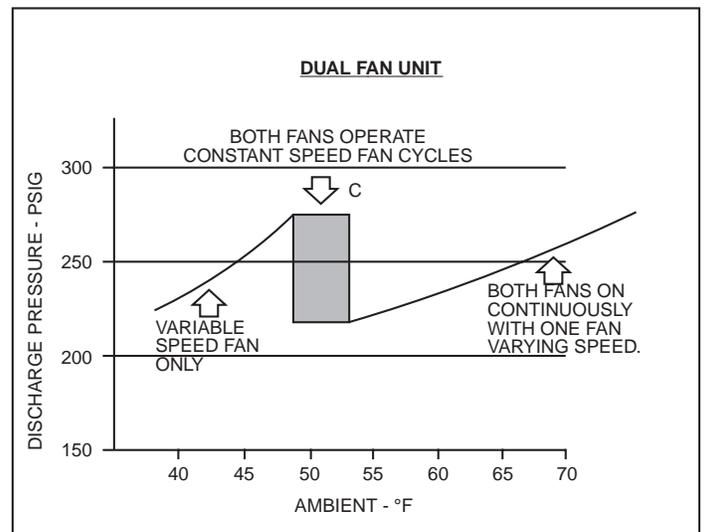
At low ambient, the variable speed fan operates, increasing in

speed until maximum RPM is achieved at or around 45°F ambient. An adjustable pressure switch operates the constant speed three-phase fan set to energize the motor at 275 psig and de-energize at 220 psig. In the ambient temperature span of approximately 50°F to 53°F, the variable speed fan will ramp between maximum and minimum speed while the constant speed fan cycles. The start-stop cycle varies from 45 seconds to 2-1/2 minutes during this period.

At 53°F, both fans are operating, the variable speed at minimum RPM and the constant speed at full RPM. As the ambient continues to rise, the variable speed motor increases to full speed and remains there.

If the application calls for a closer setting between maximum and minimum pressure settings on the constant speed fan, for example 275 psig on, 240 psig off, the effect will be to lengthen the temperature span during which the cycling takes place, for example 50°F to 57°F.

Optional Hot Gas Reheat. Factory installed hot gas reheat circuit includes inlet regulator valve, check valves, hot gas solenoid operated control valve, variable speed condenser head pressure control, on stage sensor, and one row heat reclaim coil. The coil is equal to the evaporator face area and installed in the reheat position. The sensor is factory mounted. Hot gas reheat may not be operated below 60°F ambient temperature.



Optional Reheat Plus™. To lower relative humidity (RH) in the supply air stream, a one row subcooling coil, generally equal to the evaporator face area may be specified. The refrigerant liquid passes through the tube side, adding up to 40°F of subcooling. For every two degrees of subcooling, the compressor capacity is increased on percent. This is also reflected as an increase in efficiency. The resulting heat is passed into the air stream as reheat, usually 8°F to 10°F at 200 cfm/ton, thus the lower discharge air relative humidity.

Optional Motorized Outside Air Damper. The on/off two-position damper motor and damper are factory mounted in unit and interlocked with blower motor.

Optional Clogged Filter Indicator. Dirty or clogged filters are red flagged by an indicator when the preset pressure differential across the filters is reached. The indicator is factory installed and manual-reset. It includes contacts for remote annunciation.

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