*9MAC
TROUBLESHOOTING GUIDE

INDEX

SAFETY CONSIDERATIONS

Installing and servicing heating equipment can be hazardous due to gas and electrical components. Only trained and qualified personnel should install, repair, or service heating equipment.

Untrained personnel can perform basic maintenance functions such as cleaning coils, or cleaning and replacing filters. All other operations should be performed by trained service personnel. When working on heating equipment, observe precautions in literature, on tags, and on labels attached to or shipped with the unit, and other safety precautions that may apply.

Follow all safety codes. In the United States, follow all safety codes including the National Fuel Gas Code (NFGC) NFPA 54-2006/ANSI Z223.1-2006. In Canada, refer to the National Standard of Canada Natural Gas and Propane Installation Codes (NSCNGPIC), CSA B149.1-05.

Wear safety glasses and work gloves. Have a fire extinguisher available during start-up, adjustment procedures, and service calls.

Recognize safety information. This is the safety-alert symbol ⚠. When you see this symbol on the furnace and in instructions or manuals, be alert to the potential for personal injury.

Understand the signal words DANGER, WARNING, and CAUTION, and NOTE. The words DANGER, WARNING, and CAUTION are used with the safety-alert symbol. DANGER identifies the most serious hazards which will result in severe personal injury or death. WARNING signifies hazards which could result in personal injury or death. CAUTION is used to identify unsafe practices which may result in minor personal injury, or product and property damage. NOTE is used to highlight suggestions which will result in enhanced installation, reliability, or operation.

INSTRUCTIONS

This guide uses your expertise and observations to lead you to the trouble spot as efficiently as possible. This is only intended as a guide and should not be used blindly. Your experience and expertise are of high value when troubleshooting this unit. Do not disregard all of your instincts.

The modulating furnace control was designed with diagnostic capabilities built in. A AMBER LED is used to flash a status code which will lead you to one of the sections as listed in the Index.

You should ALWAYS begin in the START HERE section (see Index for page number) which will guide you to the appropriate section where a minimal number of steps will be used to correct the problem. Once in a section, read the ACTION. An ACTION may have a number in the GO TO column. Do whatever the ACTION says, then proceed to the step indicated in the GO TO column.

If the ACTION is a question (a question will have a number in the YES or NO column), answer it YES or NO. If the answer is YES, go to the step indicated in the YES column. If the answer is NO, go to the step indicated in the NO column.

Let's try our guide out using the EXAMPLE section below, and see how it works. Suppose that the problem is a defective low pressure switch (for example the contacts will not open). This is an internal problem and cannot simply be seen. We go to the START HERE section to Step 1.

EXAMPLE
Start Here Section

STEP	ACTION	YES	NO	GO TO
1.	Step 1 tells us NOT TO REMOVE THE BLOWER DOOR. It then asks the question, "Is AMBER LED status light ON SOLID, alternately flashing bright-dim-bright-dim like a heartbeat, or flashing ON and OFF?". If the low pressure switch was defective, a pressure switch did not open status code would be flashing, so the answer is YES. We go to Step 2.	2	19	
2.	Step 2 asks the question, "Is the AMBER LED status light ON SOLID?". If the low pressure switch was defective, a pressure switch did not open status code would be flashing, so the answer is NO. We go to Step 4.	3	4	
4.	Step 4 asks the question, "Is the AMBER LED status light alternately flashing bright-dim-bright-dim like a heartbeat?". If the low pressure switch was defective, a pressure switch did not open status code would be flashing, so the answer is NO. We go to Step 5.	7	5	
5.	Step 5 tells us to determine the status code. The status code is a single or two digit number with the first number determined by the number of short flashes and the second number after the (+) sign is the number of long flashes. So we count the short flashes and long flashes if available and see that status code 2 is flashing and go to Step 6.			6
6.	Step 6 tells us to go to status code 2 section.			INDEX

GENERAL

The furnace must have a 115-vac power supply properly connected and grounded. Correct polarity must be maintained to enable gas heating operation.

The gas service pressure must not exceed 0.5 psig (14-in.wc), and no less than 0.16 psig (4.5-in.wc).

Thermostat wire connections to the furnace at R and W/W1 are the minimum required for gas heating operation. W2 must be connected for 2-stage heating thermostats. Y/Y2 and G are required to be connected to the furnace for single-stage cooling and heat pumps. Y1, Y/Y2, and G are required for two-stage cooling and heat pumps. G is required for continuous-fan. COM-24V is required for some clock thermostats. These connections must be made at the 24-vac terminal block on the furnace control. (See Appendix A)

This furnace can be installed with either a single-stage heat/cool or a two-stage heat/cool thermostat.

⚠ CAUTION: This furnace is equipped with a manual reset switch in the gas control area. The switch will open and shut off power to the gas valve, if a flame rollout or overheating condition occurs in the gas control area. DO NOT bypass the switch. Correct inadequate combustion-air supply, or component failure before resetting the switch.

Before operating the furnace, check each manual reset switch for continuity. If necessary, press and release the button to reset the switch.

SEQUENCE OF OPERATION

Using the schematic diagram in Appendix A, follow the sequence of operation through the different modes. Read and follow the wiring diagram very carefully!!

Note: If a power interruption occurs during a call for heat (W/W1 or W/W1-and-W2), the control will start a 90-second blower-only ON period two seconds after power is restored, if the thermostat is still calling for gas heating. The amber LED light will flash code 12 during the 90-second period, after which the LED will be ON continuous, as long as no faults are detected. After the 90-second period, the furnace will respond to the thermostat normally.

The blower door must be installed for power to be conducted through the blower door interlock switch ILK to the furnace control CPU, transformer TRAN, inducer motor IDM, blower motor BLWM, hot-surface igniter HSI, and gas valve GV.

COMMUNICATING CONTROL AND MODULATING HEATING

Best comfort will be attained when a Communicating Wall Control is used with this product. Wiring and set-up instructions are provided with the communicating control. See the furnace data sheet accessory section for help in selecting the appropriate communicating control for this furnace.

When a communicating control is used, the furnace will modulate through its full operation range, or can be limited via the minimum and maximum cfm configurations.

Operation of the furnace at the beginning and end of each heating cycle, will be the same as detailed below in the Single-Stage

Thermostat section, EXCEPT that the communicating control will send modulating rate command signals through the communication bus rather than energizing the 24-v thermostat terminals.

SINGLE-STAGE THERMOSTAT AND MODULATING HEATING (ADAPTIVE MODE)

Note: Minimum-heat only switch SW1-2 selects the minimum-heat only operation mode when ON. Intermediate-heat only switch SW4-2 selects intermediate-heat only operation mode when ON. If both switches are ON the furnace control will default to intermediate-heat. If either or both switches are ON the furnace control will operate at two-stages only as referenced in the Two Stage Thermostat section below. If both switches are OFF the furnace control will operate in the adaptive heating mode in response to a call for heat. When the W2 thermostat terminal is energized it will always cause maximum-heat operation as long as the R to W circuit is closed, regardless of the setting of the minimum-heat or intermediate-heat only switches.

This furnace can operate as a modulating furnace with a single-stage thermostat because the furnace control CPU includes a programmed adaptive sequence of controlled operation, which selects a modulated rate between minimum- and maximum-heat. This selection is based upon the stored history of the length of previous gas-heating periods of the single-stage thermostat.

The furnace will start up in either intermediate-, or maximum-heat. The furnace will transition and operate at minimum-heat or the calculated modulating rate after starting and operating for 45 seconds at intermediate-heat. The furnace control CPU defaults to minimum-heat on the first thermostat cycle and calculates the modulating rate that the furnace should run at for 19 minutes on subsequent heat cycles.

If the power is interrupted, the stored modulating rate is erased and the furnace control will select intermediate-heat for 45 seconds, minimum-heat for 19 minutes and then switch to maximum-heat, as long as the thermostat continues to call for heat. The furnace control CPU then uses this information to calculate the modulating rate the furnace will operate at on the next heating cycle. If the calculated modulating rate is between 40% - 99% then the furnace control CPU will operate for 45 seconds at intermediate-heat, and then operate at the calculated modulating rate for up to 19 minutes and then switch to maximum-heat as long as the thermostat continues to call for heat. If the calculated modulating rate is 100% then the furnace control will only operate at maximum-heat until the thermostat is satisfied.

The wall thermostat "calls for heat", closing the R to W circuit. The furnace control CPU performs a self-check, verifies the low, medium, and high pressure switch contacts LPS, MPS, and HPS are open, then de-energizes the PSR relay to close the NC contact.

1. **Inducer Prepurge Period -** The furnace control CPU turns on inducer motor IDM and slowly increases the inducer motor speed. After the low pressure switch LPS closes the furnace control CPU continues to increase the inducer motor speed until the medium pressure switch MPS closes. When the medium pressure switch MPS closes, inducer motor RPM is noted by the furnace control CPU, and a 25-second prepurge period begins. The RPM is used to evaluate vent system resistance. This evaluation is then used to determine the required RPM necessary to operate the inducer motor during prepurge, the first 45 seconds of intermediate-heat mode, or any modulating rate that the furnace will transition to after the blower on-delay is completed.

Note: The heat cycle can start in either intermediate- or maximum-heat. If a maximum-heat cycle is initiated, the furnace control CPU will continue to increase the inducer motor speed after the medium pressure switch MPS closes. When the medium pressure switch closes, inducer motor RPM is noted by the furnace control CPU, and a 25-second prepurge period begins. The RPM is used to evaluate vent system resistance. This evaluation is then used to determine the required RPM necessary to operate the inducer motor in maximum-heat pre-purge, and maximum-heat mode. The high pressure switch HPS should be closed before ignition but the furnace control ignores this input until after ignition occurs.

2. **Igniter Warm-Up** - At the end of the prepurge period, the Hot-Surface Igniter HSI is energized for a 17-second igniter warm-up period.

3. **Trial-For-Ignition Sequence** - When the igniter warm-up period is completed the main gas valve relay contact GVR closes to energize the gas valve solenoid GV (pin PL17-5). The gas valve solenoid GV permits gas flow to the burners where it is ignited. Five seconds after the GVR closes, a 2-second Flame-Proving period begins. The HSI igniter will remain energized until flame is sensed or until the 2-second flame proving period begins.

4. **Flame-Proving** - When the burner flame is proved at the flame-proving sensor electrode FSE, the furnace control CPU begins the blower-ON delay period and continues to hold the gas valve GV open. If the burner flame is not proved within two seconds, the furnace control CPU will close the gas valve GV, and the furnace control CPU will repeat the ignition sequence for up to three more Trials-For-Ignition before going to Ignition-Lockout. **Lockout will be reset** automatically after three hours, by momentarily interrupting 115 vac power to the furnace, or by interrupting 24 vac power at SEC1 or SEC2 to the furnace control CPU (not at W/W1, G, R, etc.).

   If flame is proved when flame should not be present, the furnace control CPU will lock out of Gas-Heating mode and operate the inducer motor IDM at full speed until flame is no longer proved.

5. **Inducer Speed Change** – If the cycle starts in intermediate-heat, the furnace control CPU reduces the inducer speed slightly after flame sense. If the cycle starts in maximum-heat, the furnace control CPU increases the inducer speed after flame sense.

6. **Blower-On delay** – If the burner flame is proven the blower-ON delay for intermediate-heat and maximum-heat are as follows:

   Intermediate-heat – 45 seconds after the gas valve GV is opened the blower motor BLWM is turned ON at the modulating heat airflow.

   Maximum-heat – 25 seconds after the gas valve GV is opened the BLWM is turned ON at maximum-heat airflow.

   Simultaneously, the humidifier terminal HUM and electronic air cleaner terminal EAC-1 are energized and remain energized throughout the heating cycle.

7. **Switching from Intermediate-Heat to a Low Range Input -** If the furnace control switches from intermediate-heat to a low

range input (low range input is an input rate less than or equal to 51% of full rate, 45% of full rate on the 5T-060 model), the furnace control will turn the blower ON or switch to the modulating heat airflow, energize the PSR relay to open the NC contact, and slowly decrease the inducer motor speed to the desired inducer RPM.

Switching from Intermediate-Heat to a Medium Range Input - If the furnace control CPU switches from intermediate-heat to a different medium range input (medium range input is an input rate between 52% and 71% of full rate, 46% and 71% of full rate on the 5T-060 model), the furnace control CPU will turn the blower ON or switch to the modulating heat airflow, and continue to maintain the inducer motor speed or change it further if required.

Switching from Intermediate-Heat to a High Range Input - If the furnace control CPU switches from Intermediate-heat to a high range input (high range input is an input rate greater than or equal to 72% of full rate), the furnace control CPU will turn the blower ON or switch to the modulating heat airflow, and increase the inducer motor speed to the desired inducer motor RPM.

Switching from Low Range Input to Maximum-Heat - If the furnace control CPU switches from a low range input to maximum-heat, the furnace control CPU de-energize the PSR relay to close the NC contact and slowly increase the inducer motor speed until the medium pressure switch MPS closes. When the medium pressure switch MPS closes the inducer motor RPM is noted by the furnace control CPU. The RPM is used to evaluate vent system resistance. This evaluation is then used to determine the required RPM necessary to operate the inducer motor at maximum-heat. The blower motor BLWM will transition to maximum-heat airflow five seconds after the furnace control CPU switches from a low range input to maximum-heat. As the inducer RPM increases the high pressure switch HPS should close.

Switching from Medium Range Input to Maximum-Heat - If the furnace control CPU switches from a medium range input to maximum-heat, the furnace control CPU will increase the inducer motor speed to the maximum-heat inducer motor RPM. The blower motor BLWM will transition to maximum-heat airflow five seconds after the furnace control CPU switches from a medium range input to maximum-heat. As the inducer RPM increases the high pressure switch HPS should close.

8. **Blower-Off Delay** - When the thermostat is satisfied, the R to W circuit is opened, de-energizing the gas valve GV, stopping gas flow to the burners, and de-energizing the humidifier terminal HUM. The inducer motor IDM will remain energized for a 15-second post-purge period. The blower motor BLWM and air cleaner terminal EAC-1 will remain energized at minimum-heat airflow or transition to minimum-heat airflow for 90, 120, 150, or 180 seconds (depending on selection at blower-OFF delay switches). The furnace control CPU is factory-set for a 120-second blower-OFF delay.

TWO-STAGE THERMOSTAT AND TWO-STAGE MINIMUM/MAXIMUM HEATING

Note: In this mode the minimum-heat only switch SW1-2 must be ON to select the minimum-heat only operation mode in response to closing the thermostat R to W1 circuit. Closing the thermostat R to W1-and-W2 circuits always causes maximum-heat operation, regardless of the setting of the minimum-heat only switch.

The furnace will start up in either intermediate-, or maximum-heat. The furnace will operate in minimum-heat after starting and operating for 45 seconds at intermediate-heat before transitioning to minimum-heat.

The wall thermostat "calls for heat", closing the R to W1 circuit for minimum-heat or closing the R to W1-and-W2 circuits for maximum-heat. The furnace control performs a self-check, and verifies the low, medium, and high pressure switch contacts LPS, MPS, and HPS are open, then de-energizes the PSR relay to close the NC contact.

The start up and shut down functions and delays described above apply to the 2-stage minimum/maximum heating mode as well, except for switching from maximum- to minimum-heat.

1. **Switching from Maximum- to Minimum-Heat** - If the thermostat R to W2 circuit opens, and the R to W1 circuit remains closed, the furnace control CPU will gradually decrease the inducer motor speed to the required intermediate-heat RPM. When the inducer motor IDM reduces pressure sufficiently, the high pressure switch HPS will open and the gas rate will be changed to intermediate-heat. The gas valve solenoid GV (pin PL17-5) will remain energized as long as the low pressure switch LPS remains closed. When the inducer motor speed gets within 15% of the required intermediate-heat RPM the furnace control CPU will start a 5 second blower airflow change delay. After the 5 second blower airflow change delay is completed the blower airflow will transition to minimum-heat airflow. At this point the furnace control CPU will energize the PSR relay to open the NC contact and slowly decrease the inducer motor speed to the required minimum-heat RPM. When the PSR relay is energized and the NC contact opens the furnace control CPU will reduce the gas rate to minimum-heat.

TWO-STAGE THERMOSTAT AND TWO-STAGE INTERMEDIATE/MAXIMUM HEATING

Note: In this mode the intermediate-heat only switch SW4-2 must be ON to select the intermediate-heat only operation mode in response to closing the thermostat R to W1 circuit. Closing the thermostat R to W1-and-W2 circuits always causes maximum-heat operation, regardless of the setting of the intermediate-heat only switch.

The wall thermostat "calls for heat", closing the R to W1 circuit for intermediate-heat or closing the R to W1-and-W2 circuits for maximum-heat. The furnace control performs a self-check, and verifies the low, medium, and high pressure switch contacts LPS, MPS, and HPS are open, then de-energizes the PSR relay to close the NC contact.

The start up and shut down functions and delays described above apply to the 2-stage intermediate/maximum heating mode as well, except for switching from maximum- to intermediate-heat.

1. **Switching from Maximum- to Intermediate-Heat** – If the thermostat R to W2 circuit opens, and the R to W1 circuit remains closed, the furnace control CPU will gradually decrease the inducer motor speed to the required intermediate-heat RPM. When the inducer motor IDM reduces pressure sufficiently, the high pressure switch HPS will open and the gas rate will be changed to intermediate-heat. When the inducer motor speed

gets within 15% of the required intermediate-heat RPM the furnace control CPU will start a 5 second blower airflow change delay. After the 5 second blower airflow change delay is completed the blower airflow will transition to intermediate-heat airflow.

COOLING MODE

The thermostat "calls for cooling".

1. Single-Speed Cooling

The thermostat closes the R to G-and-Y circuits. The R to Y circuit starts the outdoor unit, and the R to G-and-Y/Y2 circuits start the furnace blower motor BLWM on cooling airflow. Cooling airflow is based on the A/C selection shown in Table 1.

The electronic air cleaner terminal EAC-1 is energized with 115 vac when the blower motor BLWM is operating.

When the thermostat is satisfied, the R to G-and-Y circuits are opened. The outdoor unit will stop, and the furnace blower motor BLWM will continue operating at cooling airflow for an additional 90 seconds. Jumper Y/Y2 to DHUM to reduce the cooling off-delay to 5 seconds. (See Fig. 1.)

2. Two-Stage Thermostat and Two-Speed Cooling

The thermostat closes the R to G-and-Y1 circuits for low-cooling or closes the R to G-and-Y1-and-Y2 circuits for high-cooling. The R to Y1 circuit starts the outdoor unit on low-cooling speed, and the R to G-and-Y1 circuit starts the furnace blower motor BLWM at low-cooling airflow which is the true on-board CF selection as shown in Table 1. The R to Y1-and-Y2 circuits start the outdoor unit on high-cooling speed, and the R to G-and-Y/Y2 circuits start the furnace blower motor BLWM at high-cooling airflow. High-cooling airflow is based on the A/C selection shown in Table 1.

The electronic air cleaner terminal EAC-1 is energized with 115 vac whenever the blower motor BLWM is operating.

When the thermostat is satisfied, the R to G-and-Y1 or R to G-and-Y1-and-Y2 circuits are opened. The outdoor unit stops, and the furnace blower BLWM and electronic air cleaner terminal EAC-1 will remain energized for an additional 90 seconds. Jumper Y1 to DHUM to reduce the cooling off-delay to 5 seconds. (See Fig. 1.)

DEHUMIDIFICATION MODE

The dehumidification output, D or DHUM on a Thermostat should be connected to the furnace control thermostat terminal DHUM. When there is a dehumidify demand, the DHUM input is activated, which means 24 vac signal is removed from the DHUM input terminal. In other words, the DHUM input logic is reversed. The DHUM input is turned ON when no dehumidify demand exists. Once 24 vac is detected by the furnace control on the DHUM input, dehumidification capability is activated. If the DHUM input is low for more than 48 hours, the furnace control reverts back to non-dehumidification mode.

The cooling operation described above in the Cooling Mode section also applies to Dehumidification Mode. The exceptions are listed below:

Table 1

AIR CONDITIONING (A/C) OR CONTINUOUS-FAN (CF)
AIRFLOW SELECTION CHART

BASED ON 350 CFM/TON (SETUP SWITCH SW1-5 OFF, SW4-3 OFF)

MODEL SIZE	SETUP SWITCH SW2 OR SW3 POSITIONS							
	OFF 1 2 3	OFF 1 2 3	OFF 1 2 3	OFF 1 2 3	OFF 1 2 3	OFF 1 2 3	OFF 1 2 3	OFF 1 2 3
3.5T-60, -80	DEF.	525[2]	700	875	1050[1]	1225	1225	1225
5T-60	DEF.	525[2]	700	875	1050	1225	1400	1750[1]
5T-80	DEF.	700[2]	875	1050	1225	1400	1750[1]	1750
100	DEF.	700[2]	875	1050	1225	1400	1750[1]	2100
120	DEF.	700	875[2]	1050	1225	1400	1750[1]	2100

BASED ON 400 CFM/TON (SETUP SWITCH SW1-5 ON, SW4-3 OFF)

MODEL SIZE	SETUP SWITCH SW2 OR SW3 POSITIONS							
	OFF 1 2 3	OFF 1 2 3	OFF 1 2 3	OFF 1 2 3	OFF 1 2 3	OFF 1 2 3	OFF 1 2 3	OFF 1 2 3
3.5T-60, -80	DEF.	600[2]	800	1000	1200[1]	1400	1400	1400
5T-60	DEF.	600[2]	800	1000	1200	1400	1600	2000[1]
5T-80	DEF.	800[2]	1000	1200	1400	1600	2000[1]	2000
100	DEF.	800[2]	1000	1200	1400	1600	2000[1]	2100
120	DEF.	800	1000[2]	1200	1400	1600	2000[1]	2100

BASED ON 325 CFM/TON (SETUP SWITCH SW1-5 OFF, SW4-3 ON)

MODEL SIZE	SETUP SWITCH SW2 OR SW3 POSITIONS							
	OFF 1 2 3	OFF 1 2 3	OFF 1 2 3	OFF 1 2 3	OFF 1 2 3	OFF 1 2 3	OFF 1 2 3	OFF 1 2 3
3.5T-60, -80	DEF.	488[2]	651	814	976[1]	1139	1139	1139
5T-60	DEF.	488[2]	651	814	976	1139	1302	1627[1]
5T-80	DEF.	651[2]	814	976	1139	1302	1627[1]	1627
100	DEF.	651[2]	814	976	1139	1302	1627[1]	1953
120	DEF.	651	814[2]	976	1139	1302	1627[1]	1953

BASED ON 370 CFM/TON (SETUP SWITCH SW1-5 ON, SW4-3 ON)

MODEL SIZE	SETUP SWITCH SW2 OR SW3 POSITIONS							
	OFF 1 2 3	OFF 1 2 3	OFF 1 2 3	OFF 1 2 3	OFF 1 2 3	OFF 1 2 3	OFF 1 2 3	OFF 1 2 3
3.5T-60, -80	DEF.	558[2]	744	930	1116[1]	1302	1302	1302
5T-60	DEF.	558[2]	744	930	1116	1302	1488	1860[1]
5T-80	DEF.	744[2]	930	1116	1302	1488	1860[1]	1860
100	DEF.	744[2]	930	1116	1302	1488	1860[1]	2100
120	DEF.	744	930[2]	1116	1302	1488	1860[1]	2100

1. DEFAULT A/C AIRFLOW WHEN A/C SWITCHES ARE IN OFF POSITION
2. DEFAULT CONT. FAN AIRFLOW WHEN CF SWITCHES ARE IN OFF POSITION
3. SWITCH POSITIONS ARE ALSO SHOWN ON FURNACE WIRING DIAGRAM

1. **Low Cooling -** When the R to G-and-Y1 circuit is closed and there is a demand for dehumidification, the furnace blower motor BLWM will drop the blower airflow to 86% of low-cooling airflow which is the true on-board CF selection as shown in Table 1.

2. **High Cooling -** When the R to G-and Y/Y2 circuit is closed and there is a demand for dehumidification, the furnace blower motor BLWM will drop the blower airflow to 86% of high-cooling airflow. High-cooling airflow is based on the A/C selection shown in Table 1.

3. **Cooling Off-Delay -** When the "call for cooling" is satisfied and there is a demand for dehumidification, the cooling blower-off delay is decreased from 90 seconds to 5 seconds.

SUPER-DEHUMIDIFY MODE

Super-Dehumidify mode can only be entered if the furnace control is in the Dehumidification mode and there is a demand for dehumidification. The cooling operation described in the Cooling Mode section above also applies to Super Dehumidify Mode. The exceptions are listed below:

1. **Low Cooling** – When the R to Y1 circuit is closed, R to G circuit is open, and there is a demand for dehumidification, the furnace blower motor BLWM will drop the blower airflow to 65% of low-cooling airflow for a maximum of 10 minutes each cooling cycle or until the R to G circuit closes or the demand for dehumidification is satisfied. Low-cooling airflow is the true on-board CF selection as shown in Table 1.

2. **High Cooling** – When the R to Y/Y2 circuit is closed, R to G circuit is open, and there is a demand for dehumidification, the furnace blower motor BLWM will drop the blower airflow to 65% of high-cooling airflow for a maximum of 10 minutes each cooling cycle or until the R to G circuit closes or the demand for dehumidification is satisfied. High-cooling airflow is based on the A/C selection shown in Table 1.

3. **Cooling Off-Delay** – When the "call for cooling" is satisfied and there is a demand for dehumidification, the cooling blower-off delay is decreased from 90 seconds to 5 seconds.

CONTINUOUS BLOWER MODE

When the R to G circuit is closed by the thermostat, the blower motor BLWM will operate at continuous blower airflow. Continuous blower airflow selection is initially based on the CF selection shown in Table 1. Factory default is shown in Table 1. Terminal EAC-1 is energized as long as the blower motor BLWM is energized.

During a call for heat, the furnace control CPU will transition the blower motor BLWM to continuous blower airflow, minimum-heat airflow, or the midrange airflow, whichever is lowest. The blower motor BLWM will remain ON until the main burners ignite then shut OFF and remain OFF for the blower-ON delay (45 seconds in intermediate-heat, and 25 seconds in maximum-heat), allowing the furnace heat exchangers to heat up more quickly, then restarts at the end of the blower-ON delay period at modulating or maximum-heat airflow respectively.

The blower motor BLWM will revert to continuous-blower airflow after the heating cycle is completed. When the thermostat satisfies, the furnace control CPU will drop the blower motor BLWM to minimum-heat airflow during the selected blower-OFF delay period before transitioning to continuous-blower airflow.

When the thermostat "calls for low-cooling", the blower motor BLWM will switch to low-cooling airflow. When the thermostat is satisfied, the blower motor BLWM will operate an additional 90 seconds at low-cooling airflow before transitioning back to continuous-blower airflow.

When the thermostat "calls for high-cooling", the blower motor BLWM will switch to high cooling airflow. When the thermostat is satisfied, the blower motor BLWM will operate an additional 90 seconds at high-cooling airflow before transitioning back to continuous-blower airflow.

When the R to G circuit is opened, the blower motor BLWM will continue operating for an additional 5 seconds, if no other function requires blower motor BLWM operation.

HEAT PUMP DEFROST

When installed with a heat pump, the furnace control automatically changes the timing sequence to avoid long blower off times during demand defrost cycles. Whenever W/W1 is energized along with Y1 or Y/Y2, the furnace control CPU will transition to or bring on the blower motor BLWM at cooling airflow, minimum-heat airflow, or the midrange airflow, whichever is lowest. The blower motor BLWM will remain on until the main burners ignite then shut OFF and remain OFF for 25 seconds before coming back on at modulating heat airflow. When the W/W1 input signal disappears, the furnace control begins a normal inducer post-purge period while changing the blower airflow. If Y/Y2 input is still energized the furnace control CPU will transition the blower motor BLWM airflow to cooling airflow. If Y/Y2 input signal disappears and the Y1 input is still energized the furnace control CPU will transition the blower motor BLWM to low-cooling airflow. If both the Y1 and Y/Y2 signals disappear at the same time, the blower motor BLWM will remain on at minimum-heat airflow for the selected blower-OFF delay period. At the end of the blower-OFF delay, the blower motor BLWM will shut OFF unless G is still energized, in which case the blower motor BLWM will operate at continuous blower airflow.

COMPONENT TEST

The furnace features a component test system to help diagnose a system problem in the case of a component failure. To initiate the component test procedure, ensure that there are no thermostat inputs to the control and all time delays have expired. Turn on setup switch SW1-6. (See Appendix A)

Note: The component test feature will not operate if the control is receiving any thermostat signals or until all time delays have expired.

The component test sequence is as follows:

1. The furnace control CPU turns the inducer motor IDM ON at medium speed and keeps it ON through step 4.
2. The furnace control CPU will test communication with the modulating gas valve GV.
3. After waiting 15 seconds the furnace control CPU turns the hot surface igniter ON for 15 seconds, then OFF.
4. The furnace control CPU then turns the blower motor BLWM on at midrange airflow for 15 seconds, then OFF.
5. After shutting the blower motor OFF the furnace control CPU shuts the inducer motor IDM OFF.

Note: The EAC terminals are energized when the blower is operating.

After the component test is completed, 1 or more status codes (Heartbeat, 2 + 5, 3 + 5, 4 + 1, or 4 + 2) will flash. See Service Label on control door or Service/Status Code Instructions for explanation of status codes.

Note: To repeat component test, turn setup switch SW1-6 to OFF and then back ON.

SERVICE/STATUS CODE INSTRUCTIONS

If status code recall is needed disconnect the "R" thermostat lead, reset power, and put setup switch "SW1-1" in the ON position. To clear the status code history put setup switch "SW1-1" in the ON position and jumper thermostat terminals "R", "W/W1", and "Y/Y2" simultaneously until the Heartbeat flashes.

LED CODE	STATUS
CONTINUOUS OFF -	Check 115 VAC at L1 and L2, 24 VAC at SEC-1 and SEC-2, and 24V fuse.
HEARTBEAT -	(bright-dim-bright-dim) Control has 24 VAC power.
ON SOLID -	The control is locked out and will auto reset after 1 hour. Lockout could be due to any of the following: - Flame sense circuit failure. - Gas valve relay stuck open. - Software check error. Reset power to clear lockout. Replace control if status code repeats.

EACH OF THE FOLLOWING STATUS CODES IS A SINGLE OR TWO DIGIT NUMBER WITH THE FIRST NUMBER DETERMINED BY THE NUMBER OF SHORT FLASHES AND THE SECOND NUMBER AFTER THE (+) SIGN IS THE NUMBER OF LONG FLASHES.

2 **PRESSURE SWITCH DID NOT OPEN** – Check for:
- Obstructed pressure tubing.
- Pressure switch stuck closed.

3 **LOW PRESSURE SWITCH DID NOT CLOSE OR REOPENED** – Indicates the low pressure switch input failed to close on a call for heat, or opened during minimum-heat. If opens during blower on-delay period, blower will come on for the selected blower off-delay. If opens within 5 minutes after ignition the next heating cycle will be restricted to maximum-heat. Check for:
- Proper vent sizing.
- Air leak between vestibule and blower compartment.
- Restricted vent.
- Plugged condensate drain.
- Low inlet gas pressure (if LGPS used).
- Excessive wind. If problem persists turn setup switch "SW1-3" ON to boost inducer speed.
- Improper pressure switch wiring.
- Failed or "Out-of-Calibration" pressure switches.
- Water in vent piping, possible sagging pipe.
- Disconnected or obstructed pressure tubing.

4 **LIMIT CIRCUIT FAULT** – Indicates the limit, or flame rollout is open or the furnace is operating in maximum-heat only mode due to 2 successive limit trips while operating at any rate less than or equal to 71% of maximum rate. Blower will run at intermediate heat airflow for 4 minutes or until open switch remakes whichever is longer. If open longer than 3 minutes, code changes to lockout #7. If open less than 3 minutes status code #4 continues to flash until blower shuts off. Flame rollout switch requires manual reset. Check for:
- Loose blower wheel.
- Defective switch or connections.
- Improper minimum- or maximum-heat gas input adjustment.
- Dirty filter or restricted duct system.
- Improper limit switch or no limit gasket.

5 **ABNORMAL FLAME-PROVING SIGNAL** – Flame is proved while gas valve is de-energized. Inducer will run until fault is cleared. Check for:
- Leaky gas valve.
- Stuck-open gas valve.

6 **IGNITION PROVING FAILURE** – Control will try three more times before lockout #6 + 1 occurs. If flame signal is lost during blower on-delay period, blower will come on for the selected blower off-delay. Check for:
- Low inlet gas pressure.
- Control ground continuity.
- Gas valve defective or turned off.
- Defective Hot Surface Igniter.
- Manual valve shut off.
- Oxide buildup on flame sensor (clean with fine steel wool).
- Proper flame sense micro amps (.5 micro amps DC min., 4.0 – 6.0 nominal).
- Green/Yellow wire MUST be connected to furnace sheet metal.
- Inadequate flame carryover or rough ignition.
- Flame sensor must not be grounded.

7 **LIMIT CIRCUIT LOCKOUT** – Lockout occurs if the limit, or flame rollout switch is open longer than 3 minutes or 10 successive limit trips occurred during maximum-heat. Control will auto reset after 3 hours. Refer to status code #4.

8 **GAS HEATING LOCKOUT** – Control will NOT auto reset. Check for:
- Stuck closed gas valve relay on control.
- Miswire or short to gas valve BLUE wire.

9 **MEDIUM PRESSURE SWITCH, HIGH PRESSURE SWITCH, OR PSR RELAY DID NOT CLOSE OR REOPENED** – Indicates the medium or high pressure switch input failed to close on a call for intermediate- or maximum-heat, or opened during a heat cycle. PSR relay may be defective. Refer to status code #3.

10 **POLARITY** – Check for correct line voltage polarity. If units are twinned, check for proper low-voltage (24V) transformer phasing.

1 + 2 **BLOWER ON AFTER POWER UP** – (115 VAC or 24 VAC) – Normal operation. Blower runs for 90 seconds, if unit is powered up during a call for heat (R-W/W1 closed) or (R-W/W1 opens) during the blower on-delay period.

1 + 5 **BLOWER MOTOR LOCKOUT** – Indicates the blower failed to reach 250 RPM or the blower failed to communicate within 30 seconds after being turned ON in two successive heating cycles. Control will auto reset after 3 hours. Refer to status code #4 + 1.

2 + 5 **MODEL SELECTION OR SETUP ERROR** – If status code 2 + 5 only flashes 4 times on power-up the control is missing its model plug PL4 and is defaulting to the model selection stored in memory. If status codes 2 + 5 flashes continuously it could indicate the following:
- Model plug PL4 is missing and there is no valid model stored in permanent memory. This will happen if you forget to install the model plug PL4 on a service replacement control.
- Thermostat call with setup switch "SW1-1" ON.
- Thermostat call with setup switch "SW1-6" ON.
- Setup switch "SW1-1" and "SW1-6" both ON together.
- Two different furnace models twinned.
- Service replacement control is incorrect. Need modulating board with software version V17 or later.
- See rating plate for model plug number and resistance values if code flashes continuously.

3 + 5 **GAS VALVE FAULT** – Indicates the modulating gas valve failed to respond to a command from the furnace control or power to the gas valve electronics was interrupted. Check for:
- Intermittent RED, YELLOW, or ORANGE wire at gas valve or PL8 connections.

4 + 1 **BLOWER MOTOR FAULT** – Indicates the blower failed to reach 250 RPM or the blower failed to communicate within the prescribed time limits. Thirty seconds after being turned ON or ten seconds during steady-state operation.

4 + 2 **INDUCER MOTOR FAULT** – Indicates the inducer has not started within 20 seconds after a call for heat, the inducer motor RPM is outside its valid range of operation, or the inducer RPM signal was lost for 5 seconds during operation. Check for:
- Proper vent sizing.
- Restricted vent.
- Failed inducer motor.
- Improper motor wiring.
- Blockage in the tubing to the pressure switch assembly or blockage in the pressure tap at the collector box.

4 + 3 **LOW OR MEDIUM PRESSURE SWITCH OPEN WHILE MEDIUM OR HIGH PRESSURE SWITCH IS CLOSED** – Check for:
- Low inlet gas pressure (if LGPS used).
- Plugged condensate drain.
- Improper pressure switch wiring.
- Water in vent piping, possible sagging pipe.
- Low or Medium pressure switch stuck open.
- Disconnected or obstructed pressure tubing.

6 + 1 **IGNITION LOCKOUT** – Control will auto reset after 3 hours. Refer to status code #6.

COMPONENT TEST

To initiate the component test sequence, shut "OFF" the room thermostat or disconnect the "R" thermostat lead. Reset power and then put setup switch "SW1-6" in the ON position to start the component test sequence. Once initiated the furnace control will turn the inducer ON at medium speed. The inducer motor will run for the entire test. The hot surface igniter and blower motor will be turned ON for 15 seconds each. When the blower is turned OFF the inducer will be turned OFF. When the component test is completed one or more of the following codes will flash.

LED CODE	DESCRIPTION
HEARTBEAT	Indicates the inducer motor, gas valve, & blower motor tested OK. Visual check of the hot surface igniter required.
2 + 5	**SETUP ERROR** – Same as code 2 + 5 above.
3 + 5	**GAS VALVE FAULT** – Same as code 3 + 5 above.
4 + 1	**BLOWER MOTOR FAULT** – Indicates blower motor failed test. Check blower, wiring, and furnace control.
4 + 2	**INDUCER MOTOR FAULT** – Indicates inducer motor failed test. Check inducer, wiring, and furnace control.

To repeat component test turn setup switch "SW1-6" OFF and then back ON. After component test is completed put setup switch "SW1-6" in the OFF position and reconnect the "R" thermostat lead.

START HERE - If a problem exists, the service technician should always begin troubleshooting here.

Special Note: All voltmeters are not the same - your voltage readings will vary. This applies to the entire content of this troubleshooting manual. They are not absolute values. Correct 115-VAC VOLTAGE, CURRENT, and power MEASUREMENTS CANNOT BE TAKEN ON MODULATING FURNACES UNLESS USING A TRUE rms METER.

STEP	ACTION	YES	NO	GO TO
1.	DO NOT REMOVE THE BLOWER DOOR! Record status of AMBER LED. See Service/Status Code Instructions. Is AMBER LED status light ON SOLID, alternately flashing bright-dim-bright-dim like a heartbeat, or flashing ON and OFF?	2	19	
2.	Is AMBER LED status light ON SOLID?	3	4	
3.	Go to page number indicated in the Index for the section covering AMBER LED ON SOLID.			INDEX
4.	Is the AMBER LED status light alternately flashing bright-dim-bright-dim like a heartbeat?	7	5	
5.	Determine status code. The status code is a single or two digit number with the first number determined by the number of short flashes and the second number after the (+) sign is the number of long flashes.			6
6.	Go to page number indicated in the Index for the section covering the status code.			INDEX
7.	Remove blower door and depress door switch. Use a piece of tape to hold it closed. To retrieve previous codes, disconnect the communication connector PL7 (if used) or the R thermostat lead (if used) from the furnace control board and wait for the blower to turn off if it is running. Put setup switch SW1-1 in the ON position and record the status codes listed in the status code history. The status codes will flash in the order of occurrence. Read status codes until the heartbeat flashes. After the heartbeat flashes several times the status codes will repeat.			8
8.	Was there a previous status code other than the heartbeat? **Note:** Status codes are erased after 72 hours or can be manually erased by putting setup switch SW1-1 in the ON position and jumpering R, W/W1, and Y/Y2 simultaneously until the heartbeat flashes.	9	10	
9.	Go to page number indicated in the Index for the section covering the first previous status code.			INDEX
10.	Does the problem appear to be low cooling airflow?	11	12	
11.	Go to page number indicated in Index for the section covering IMPROPER COOLING AIRFLOW.			INDEX
12.	Set thermostat to call for heat and set the thermostat fan control to AUTO position if equipped.			13
13.	Does the furnace respond to the call for heat?	14	28	
14.	Observe operation of furnace for 20 minutes or until AMBER LED status light starts blinking.			15
15.	Does the AMBER LED status light blink ON/OFF slowly with short flashes or a combination of short and long flashes?	5	16	
16.	Is the temperature rise below the range specified on the rating plate when the unit is operating in minimum, and/or maximum heat? **Note:** If the temperature rise is above the range specified on the rating plate refer to the Start-Up and Adjustment section in the Installation, Start-Up, and Operating Instructions.	17	18	
17.	Go to page number indicated in Index for the section covering MINIMUM AND/OR MAXIMUM HEAT TEMPERATURE RISE TOO LOW (COLD BLOW).			INDEX
18.	Go to page number indicated in Index for CLEANUP AND START-UP INSTRUCTIONS.			INDEX
19.	Make sure power is being supplied to the furnace.			20
20.	Check fuses, breakers, or manual disconnects to be sure they are correctly set. If not, reset them and go back to step 1.			21
21.	Remove blower door and depress door switch. Use a piece of tape to hold switch closed.			22
22.	Is 115-vac across L1 and L2?	24	23	
23.	Turn power off. Check continuity of power leads and door switch. If necessary repair power leads and/or replace door switch.			18
24.	Is 24-vac across SEC-1 and SEC-2?	32	26	
25.	Replace the modulating furnace control.			18

STEP	ACTION	YES	NO	GO TO
26.	Is 115-vac across the transformer leads?	27	25	
27.	Replace the transformer.			18
28.	Is 24-vac across W/W1 and on the modulating furnace control? You will not be able to check for voltage across W/W1 and COM-24V if the furnace is connected to a Communicating Wall Control at communication connector PL7. Go to step 29.	30	29	
29.	You have a defective thermostat, or a break in wiring between thermostat and furnace. Fix problem.			18
30.	Disconnect all thermostat leads from the thermostat terminal block and jumper R to W/W1. Does the furnace respond to the call for heat?	31	25	
31.	You have an incompatible thermostat. Do any of the following: - Wire the thermostat C terminal to COM-24V. - Isolate the W/W1 input with a relay. - Install ballast resistor across W/W1 and COM-24V. - Replace the thermostat with a compatible model.			18
32.	Turn power off. Remove secondary voltage fuse from the modulating furnace control and check the continuity of the fuse.			33
33.	Is the secondary voltage fuse open?	34	25	
34.	Go to page number indicated in Index for the section covering SECONDARY VOLTAGE FUSE IS OPEN.			INDEX

AMBER LED ON SOLID – Check to make sure the correct model plug PL4 is installed. The rating plate shows the correct model plug for this furnace. If the correct model plug is installed then the control is locked out and will auto reset after 1 hour. Lockout could be due to any of the following:

- **Flame sense circuit failure.**
- **Gas valve relay stuck open.**
- **Software check error.**

Reset power to clear lockout. Replace control if status code repeats.

IMPROPER COOLING AIR FLOW - Generally, this indicates the Y/Y2 thermostat lead is not properly connected. If a Communicating Wall Control is connected to communication connector PL7 then the wrong size outdoor unit could be configured in the Communicating Wall Control.

STEP	ACTION	YES	NO	GO TO
1.	Remove blower door and depress door switch. Use a piece of tape to hold switch closed.			27
2.	Set thermostat to call for cooling. If thermostat does not have G connection jumper across thermostat terminals R and G.			3
3.	Make sure thermostat fan control is in the AUTO position if equipped.			4
4.	Do you have 24-vac across Y/Y2 and COM-24V on the modulating furnace control?	8	5	
5.	You have a defective thermostat, or a break in the wiring between the thermostat and the furnace, or the Y/Y2 thermostat terminal is not wired to the thermostat.			6
6.	Fix the problem.			7
7.	Go to page number indicated in Index for CLEANUP AND START-UP INSTRUCTIONS.			INDEX
8.	Are the air conditioning airflow select switches A/C set to the proper airflow as required by the condensing unit? Typical airflow is based on 350 CFM/TON (See Table 2.)	10	9	
9.	Set the air conditioning airflow select switches A/C to the proper airflow as required by the condensing unit. (See Table 2.)			7
10.	Disconnect the G thermostat lead or jumper if used.			11
11.	Does the blower motor turn off in 5 seconds when the G thermostat lead is disconnected? **Note:** When using a humidity sensing thermostat the blower may change airflow when the G thermostat lead is disconnected and a call to dehumidify is active.	12	13	
12.	Replace the modulating furnace control.			7
13.	Reconnect the G thermostat lead or jumper and observe operation of furnace in cooling mode for 10 minutes.			14
14.	Does the furnace operate properly in cooling mode?	15	16	
15.	- Check outdoor unit for correct suction pressure and verify charge. - Check filter(s) and ductwork for restrictions. - Check furnace coil.			INDEX
16.	Does the AMBER LED abruptly shut off as the blower comes up to speed?	17	24	
17.	Do you have less than 17-vac between R and COM-24V on the modulating furnace control?	18	24	
18.	Do you have less than 90-vac between L1 and L2 on the modulating furnace control?	19	20	
19.	Make sure the wire gage between main fuse box and furnace complies with wire size specification in Installation, Start-Up, and Operating Instructions.			6
20.	Disconnect the R thermostat lead.			21
21.	Do you have less than 17-vac between R and COM-24V on the modulating furnace control?	22	23	
22.	Replace transformer.			7
23.	Check the thermostat wire gage between furnace and thermostat, and furnace and outdoor unit. It is recommended that AWG No. 18 color-coded copper thermostat wire be used for lengths up to 100 ft. For wire lengths over 100 ft, use AWG No. 16 wire.			6
24.	Is Status Code 4 + 1 flashing?	25	26	
25.	Go to the page number indicated in the Index for Status Code 4 + 1.			INDEX
26.	- Check outdoor unit for correct suction pressure and verify charge. - Check furnace coil.			7
27.	Is a Communicating Wall Control connected to communication connector PL7?	28	2	
28.	The wrong size outdoor unit may have been selected in the Communicating Wall Control. You will need to set the proper size of the outdoor unit in the Communicating Wall Control. If set properly then the Communicating Wall Control may be reducing the airflow for dehumidification.			7

Table 2 – Cooling Tonnage vs. Airflow (CFM)

AIR CONDITIONING TONS (12,000 BTU/HR)	AIRFLOW (CFM)	3.5T-060 & 3.5T-080 MODEL	5T-060 MODEL	5T-080 MODEL	100 & 120 MODEL
1-1/2	525	X	X		
2	700	X	X	X	X
2-1/2	875	X	X	X	X
3	1050	X	X	X	X
3-1/2	1225	X	X	X	X
4	1400		X	X	X
5	1750		X	X	X
6	2100				X

AIR CONDITIONING (A/C) OR CONTINUOUS-FAN (CF)
AIRFLOW SELECTION CHART

BASED ON 350 CFM/TON (SETUP SWITCH SW1-5 OFF, SW4-3 OFF)

MODEL SIZE	SETUP SWITCH SW2 OR SW3 POSITIONS							
								
3.5T-60, -80	DEF.	525[2]	700	875	1050[1]	1225	1225	1225
5T-60	DEF.	525[2]	700	875	1050	1225	1400	1750[1]
5T-80	DEF.	700[2]	875	1050	1225	1400	1750[1]	1750
100	DEF.	700[2]	875	1050	1225	1400	1750[1]	2100
120	DEF.	700	875[2]	1050	1225	1400	1750[1]	2100

BASED ON 400 CFM/TON (SETUP SWITCH SW1-5 ON, SW4-3 OFF)

MODEL SIZE	SETUP SWITCH SW2 OR SW3 POSITIONS							
								
3.5T-60, -80	DEF.	600[2]	800	1000	1200[1]	1400	1400	1400
5T-60	DEF.	600[2]	800	1000	1200	1400	1600	2000[1]
5T-80	DEF.	800[2]	1000	1200	1400	1600	2000[1]	2000
100	DEF.	800[2]	1000	1200	1400	1600	2000[1]	2100
120	DEF.	800	1000[2]	1200	1400	1600	2000[1]	2100

BASED ON 325 CFM/TON (SETUP SWITCH SW1-5 OFF, SW4-3 ON)

MODEL SIZE	SETUP SWITCH SW2 OR SW3 POSITIONS							
								
3.5T-60, -80	DEF.	488[2]	651	814	976[1]	1139	1139	1139
5T-60	DEF.	488[2]	651	814	976	1139	1302	1627[1]
5T-80	DEF.	651[2]	814	976	1139	1302	1627[1]	1627
100	DEF.	651[2]	814	976	1139	1302	1627[1]	1953
120	DEF.	651	814[2]	976	1139	1302	1627[1]	1953

BASED ON 370 CFM/TON (SETUP SWITCH SW1-5 ON, SW4-3 ON)

MODEL SIZE	SETUP SWITCH SW2 OR SW3 POSITIONS							
								
3.5T-60, -80	DEF.	558[2]	744	930	1116[1]	1302	1302	1302
5T-60	DEF.	558[2]	744	930	1116	1302	1488	1860[1]
5T-80	DEF.	744[2]	930	1116	1302	1488	1860[1]	1860
100	DEF.	744[2]	930	1116	1302	1488	1860[1]	2100
120	DEF.	744	930[2]	1116	1302	1488	1860[1]	2100

1. DEFAULT A/C AIRFLOW WHEN A/C SWITCHES ARE IN OFF POSITION
2. DEFAULT CONT. FAN AIRFLOW WHEN CF SWITCHES ARE IN OFF POSITION
3. SWITCH POSITIONS ARE ALSO SHOWN ON FURNACE WIRING DIAGRAM

MINIMUM AND/OR MAXIMUM HEAT TEMPERATURE RISE TOO LOW - Generally, this indicates the furnace is extremely underfired.

STEP	ACTION	YES	NO	GO TO
1.	Remove the blower door. Disconnect the communication connector PL7 (if used) or the R thermostat lead (if used) from the furnace control board. If setup switch SW4-2 is ON then turn it OFF.			2
2.	Depress the door switch. Use piece of tape to hold it closed.			3
3.	Put setup switch SW1-2 into the ON position.			4
4.	Jumper R, W/W1, and W2 thermostat terminals.			5
5.	Once the blower motor turns ON and the furnace is running in maximum heat, clock the maximum heat gas rate. On propane installations check the manifold pressure.			6
6.	Is the maximum heat rate within 2% of that specified on the rating plate?	9	7	
7.	Ensure the gas inlet pressure and burner orifices are correct. Reference the Installation, Start-Up, and Operating Instructions. Then adjust maximum heat on the gas valve to the proper manifold pressure. If maximum heat cannot be adjusted to the proper manifold pressure, replace the gas valve GV. **Note:** The modulating furnace manifold pressure is set at two points. The first point is maximum heat. The second point is minimum heat. Both adjustments are independent and are done with the same rotary adjustment switch on the modulating gas valve. When adjusting do not apply excessive force as you may damage the rotary adjustment switch. To adjust, slowly turn the rotary adjustment switch counterclockwise to decrease manifold pressure or clockwise to increase manifold pressure. Turn the rotary adjustment switch one click per second until you obtain the desired manifold pressure. If you turn the rotary adjustment switch too quickly the manifold pressure will not change.			11
8.	Fix problem.			11
9.	Check maximum heat temperature rise and external static pressure with blower door in place. Temperature rise should be mid range or higher than midpoint of range stated on furnace rating plate. External static pressure in maximum heat should be less then .7 in.w.c. If return temperature is below 60 deg. F condensation may form on heat exchangers. If left uncorrected failure will result.			10
10.	Remove the jumper from the R and W2 thermostat terminals. When the furnace is running in minimum heat, clock the minimum heat gas rate. On propane installations check the manifold pressure.			12
11.	Go to the page number indicated in Index for the CLEANUP AND STARTUP INSTRUCTIONS.			INDEX
12.	Is the minimum heat rate within 2% of that specified on the rating plate?	14	13	
13.	Ensure the gas inlet pressure and burner orifices are correct. Reference the Installation, Start-Up, and Operating Instructions. Then adjust minimum heat on the gas valve to the proper manifold pressure. If minimum heat cannot be adjusted to the proper manifold pressure, replace the gas valve GV. **Note:** The modulating furnace manifold pressure is set at two points. The first point is maximum heat. The second point is minimum heat. Both adjustments are independent and are done with the same rotary adjustment switch on the modulating gas valve. When adjusting do not apply excessive force as you may damage the rotary adjustment switch. To adjust, slowly turn the rotary adjustment switch counterclockwise to decrease manifold pressure or clockwise to increase manifold pressure. Turn the rotary adjustment switch one click per second until you obtain the desired manifold pressure. If you turn the rotary adjustment switch too quickly the manifold pressure will not change.			11
14.	Is outdoor condensing unit operating during heating cycle?	8	15	
15.	Check minimum heat temperature rise and external static pressure with blower door in place. Temperature rise should be mid range or higher than midpoint of range stated on furnace rating plate. External static pressure in minimum heat should be less then .25 in.w.c. If return temperature is below 60 deg. F condensation may form on heat exchangers. If left uncorrected failure will result.			16
16.	Check return air ducts in unheated spaces for leaks.			11

SECONDARY VOLTAGE FUSE IS OPEN

STEP	ACTION	YES	NO	GO TO
1.	Turn power off and remove the blower door.			2
2.	Is secondary voltage fuse blown? Check continuity to make sure.	5	3	
3.	Replace modulating furnace control.			4
4.	Replace secondary voltage fuse if necessary then go to page number indicated in Index for CLEANUP AND START-UP INSTRUCTIONS.			INDEX
5.	Disconnect the communication connector PL7 (if used), or all thermostat leads (if used) from the modulating furnace control (including all wires connected to the HUM terminal) and replace secondary voltage fuse.			6
6.	Turn power on and depress door switch. Use a piece of tape to hold switch closed.			7
7.	Does the AMBER LED alternately flash bright-dim-bright-dim like a heartbeat?	12	8	
8.	Turn power off and disconnect PL1 from modulating furnace control.			9
9.	Do you have continuity between either RED wire connected to the limit circuit and chassis ground?	10	41	
10.	You have a short circuit in the limit switch circuit. This includes limit switch LS, and both flame roll-out switches FRS.			11
11.	Fix problem.			4
12.	Disconnect the pressure tube from the collector box and jumper R and W/W1 thermostat terminals.			13
13.	Does the AMBER LED turn off when W/W1 is energized?	14	20	
14.	Turn power off and disconnect PL1 from modulating furnace control.			15
15.	Do you have continuity between the YELLOW wire connected to the low pressure switch LPS and chassis ground?	16	39	
16.	You have a short circuit in the YELLOW wire to the low pressure switch LPS.			11
17.	Does the AMBER LED turn off when the HUM terminal is energized? **Note:** On the modulating furnace control the HUM terminal is energized when the blower turns ON.	3	18	
18.	Disconnect jumper wire across R and W/W1 thermostat terminals and wait until blower stops.			19
19.	Jumper R, W/W1, and W2 thermostat terminals.			44
20.	Disconnect jumper wire across R and W/W1 thermostat terminals and wait until inducer stops.			21
21.	Reconnect the pressure tube from the pressure switch assembly back to the collector box.			22
22.	Jumper R and W/W1 thermostat terminals.			23
23.	Does the AMBER LED turn off before the hot surface igniter HSI is energized?	24	33	
24.	Turn power off and disconnect PL1 from modulating furnace control.			25
25.	Do you have continuity between the ORANGE wire connected to the low pressure switch LPS and chassis ground?	26	27	
26.	The ORANGE wire from low pressure switch LPS is shorting to ground. Replace or repair it.			11
27.	Do you have continuity between the VIOLET wire connected to the medium pressure switch MPS and chassis ground?	28	29	
28.	The VIOLET wire from medium pressure switch MPS is shorting to ground. Replace or repair it.			11
29.	Disconnect jumper wire across R and W/W1 thermostat terminals, reconnect PL1 to the modulating furnace control, disconnect PL17 from modulating gas valve, and replace secondary voltage fuse.			30
30.	Turn power on and depress door switch. Use a piece of tape to hold switch closed.			31
31.	Jumper R and W/W1 thermostat terminals.			32
32.	Does status code 3 + 5 flash?	60	3	
33.	Does the AMBER LED turn off when the gas valve GV is energized?	34	17	
34.	Disconnect jumper wire across R and W/W1 thermostat terminals and replace secondary voltage fuse.			35
35.	Put gas valve manual ON/OFF switch in the OFF position and jumper R and W/W1 thermostat terminals.			36

STEP	ACTION	YES	NO	GO TO
36.	Does status code 6 flash? If not, the AMBER LED should turn off when BLUE wire is energized.	60	37	
37.	Turn power off and disconnect PL1 from modulating furnace control.			38
38.	Do you have continuity between the BLUE wire and chassis ground?	59	3	
39.	Do you have continuity between the GRAY wire connected to both the medium and high pressure switches and chassis ground?	40	3	
40.	You have a short circuit in the GRAY wire to the medium and high pressure switches.			11
41.	Disconnect PL8 from modulating furnace control.			42
42.	Do you have continuity between RED wire on PL8 and chassis ground? **Note:** The terminals can be permanently damaged if the continuity probe is jammed into the terminal end of the connector. Use caution when checking continuity.	61	3	
43.	The RED wire to the modulating gas valve is shorting to ground. Replace or repair it.			11
44.	Does the AMBER LED turn off when the high pressure switch HPS is energized?	45	48	
45.	Turn power off and disconnect PL8 from modulating furnace control.			46
46.	Do you have continuity between the BROWN wire on PL8 and chassis ground? **Note:** The terminals can be permanently damaged if the continuity probe is jammed into the terminal end of the connector. Use caution when checking continuity.	47	3	
47.	The BROWN wire to the high pressure switch HPS is shorting to ground. Replace or repair it.			11
48.	Disconnect jumper wire across R, W/W1, and W2 thermostat terminals and wait until blower stops.			49
49.	Jumper R, G, and Y/Y2 thermostat terminals.			50
50.	Does the AMBER LED turn off when G and Y/Y2 are energized?	3	51	
51.	Reconnect communication connector PL7 (if used) or all thermostat leads (if used) to the modulating furnace control. Do not reconnect the humidifier lead to HUM terminal. Operate the furnace in heating and cooling mode from thermostat.			52
52.	Does the AMBER LED turn off during the heating cycle?	53	54	
53.	You have a defective thermostat or a short circuit in the wiring between thermostat and furnace. If the furnace is twinned, also check the twinning kit relay TKR.			11
54.	Does the AMBER LED turn off during the cooling cycle?	55	56	
55.	You have a defective thermostat or a short circuit in the wiring between thermostat and outdoor unit, or a short circuit in the outdoor unit contactor or reversing valve(heat pump only).			11
56.	Does the problem usually occur in cooling mode?	57	58	
57.	Check outdoor unit contactor. Failure to pull in can cause excessive current draw on low-voltage circuit. This can be an intermittent problem.			11
58.	Reconnect humidifier and check for excessive current draw when the blower turns ON. If current draw is excessive check wiring to humidifier solenoid, diode bridge(if used), and humidifier solenoid.			11
59.	The BLUE wire to gas valve GV is shorting to ground. Replace or repair it.			11
60.	Replace gas valve GV.			4
61.	Disconnect PL17 from modulating gas valve.			62
62.	Do you have continuity between RED wire on PL8 and chassis ground? **Note:** The terminals can be permanently damaged if the continuity probe is jammed into the terminal end of the connector. Use caution when checking continuity.	43	60	

Status Code 2

PRESSURE SWITCH DID NOT OPEN - This status code indicates the low, medium, or high pressure switch LPS, MPS, or HPS is made when a call for heat is initiated. The modulating furnace control will flash status code 2 until the switch opens, then cycle begins.

STEP	ACTION	YES	NO	GO TO
1.	Turn power off, remove blower door, and disconnect communication connector PL7 (if used) or the R thermostat lead (if used) from the furnace control board.			2
2.	Turn power on and depress door switch. Use a piece of tape to hold switch closed.			3
3.	Jumper R, W/W1, and W2 thermostat terminals.			4
4.	Does status code 2 flash?	8	5	
5.	Does a different status code flash?	6	7	
6.	Go to page number indicated in the Index for the section covering the status code.			INDEX
7.	Go to page number indicated in Index for CLEANUP AND START-UP INSTRUCTIONS.			INDEX
8.	Is the inducer motor ON?	18	9	
9.	Is 24-vac across ORANGE wire on the low pressure switch LPS and COM-24V on modulating furnace control?	15	10	
10.	Is 24-vac across connector terminal PL1-4 and COM-24V on modulating furnace control?	11	12	
11.	The main harness is miswired.			7
12.	Is 24-vac across VIOLET wire on the medium pressure switch MPS and COM-24V on modulating furnace control?	15	13	
13.	Is 24-vac across connector terminal PL1-3 and COM-24V on modulating furnace control?	11	16	
14.	Replace modulating furnace control.			7
15.	Replace the pressure switch assembly.			7
16.	Is 24-vac across BROWN wire on the high pressure switch HPS and COM-24V on modulating furnace control?	15	17	
17.	Is 24-vac across connector terminal PL8-4 and COM-24V on modulating furnace control?	11	14	
18.	Check the inducer PWM line. To do this disconnect 3-pin connector PL16 from the inducer motor or the inducer motor adapter harness (when used), and connect a DC voltmeter across terminals PL16-1 BROWN (+) and PL16-2 YELLOW (-). **Note:** The terminals can be permanently damaged if the voltmeter probe is jammed into the terminal end of the connector. Use caution when checking. Run COMPONENT TEST by turning setup switch SW1-6 ON. Does voltage across PL16-1 and PL16-2 change between states as shown below? - State 1 – OFF (1.0 – 4.0 vdc) - State 2 – MED (6.0 – 10.0 vdc)	19	14	
19.	Replace the inducer motor control (if you have 2 piece design) or the inducer motor assembly.			7

Status Code 3

LOW PRESSURE SWITCH DID NOT CLOSE OR REOPENED - This status code can occur as a result of the low pressure switch LPS not making or the low gas pressure switch LGPS opening. Regardless of which switch is open, the modulating furnace control will operate under the scenarios shown below. Keep in mind that whenever the modulating furnace control shuts unit down, gas remains off or shuts off immediately and inducer continues running for 15 seconds. If the low pressure switch LPS opens within 5 minutes after ignition the next heating cycle will be restricted to maximum-heat.

- MINIMUM, INTERMEDIATE, OR MAXIMUM HEAT

1. PREPURGE - If the low pressure switch LPS does not make within 45 seconds after a call for heat is initiated and the medium pressure switch MPS or high pressure switch HPS does not make the modulating furnace control will flash status code 3, shut the unit down, wait 2 minutes, stop flashing status code 3, and restart the heating cycle.

2. AFTER IGNITION - If the low pressure switch LPS opens after the burners ignite the modulating furnace control starts flashing status code 3, shuts unit down, turns on the blower, or continues to operate the blower, at minimum heat airflow for the selected blower off-delay period, stops flashing status code 3, and restarts the heating cycle.

STEP	ACTION	YES	NO	GO TO
1.	Turn power off, remove both doors, and disconnect communication connector PL7 (if used) or the R thermostat lead (if used) from the furnace control board.			2
2.	Turn power on and depress door switch. Use a piece of tape to hold switch closed.			3
3.	Jumper R and W/W1 thermostat terminals.			4
4.	Observe operation of the inducer motor for 1 minute before proceeding to the next step.			5
5.	Does status code 3 flash?	9	6	
6.	Does a different status code flash?	7	35	
7.	Go to page number indicated in the Index for the section covering the status code.			INDEX
8.	Go to page number indicated in Index for CLEANUP AND START-UP INSTRUCTIONS.			INDEX
9.	Is 24-vac across YELLOW wire on the low pressure switch LPS and COM-24V on modulating furnace control?	14	10	
10.	Is 24-vac across connector terminal PL1-2 and COM-24V on modulating furnace control?	11	13	
11.	PL15 is not connected or you have an open wire or bad terminal on the YELLOW wire from the modulating furnace control to the low pressure switch LPS.			12
12.	Repair or replace the main wire harness.			8
13.	Replace the modulating furnace control.			8
14.	At start of cycle as inducer is ramping up, does low pressure switch LPS make then break?	15	17	
15.	The problem is either a sag in vent pipe or a clogged drain trap or line. Also check for improperly plumbed drain tubing within furnace.			16
16.	Fix problem.			8
17.	Does status code 3 flash once then flash status code 4 + 3?	18	46	
18.	On propane installations the propane tank may be low otherwise you may have a loose connection between the low pressure switch LPS and the modulating furnace control. This includes the ORANGE wire interconnecting the low pressure switch LPS to the modulating furnace control.			16
19.	You have excessive restriction in the vent pipe. Also, check for proper vent sizing for installation.			16
20.	Were there any leaks or blockages found in steps 46-49?	16	21	
21.	Turn power off and disconnect jumper wire across R and W/W1 thermostat terminals.			22
22.	Connect 1 side of slope manometer with a tee to collector box pressure tap. Refer to pressure check diagram in Appendix C.			23
23.	Turn power on and jumper R and W/W1 thermostat terminals.			24
24.	Do you have at least 0.87 in. wc pressure drop across heat exchangers when fault occurs?	25	26	
25.	Replace the pressure switch assembly.			8
26.	Is inducer motor rotating in direction indicated on the inducer housing?	28	27	
27.	Replace inducer control (if you have 2 piece design) or inducer motor assembly.			8
28.	Turn power off.			29
29.	Is inducer wheel okay?	31	30	
30.	Replace inducer motor assembly.			8
31.	Is the inducer wheel properly mounted to the inducer motor shaft?	32	16	
32.	Does the inducer wheel turn freely?	19	16	
33.	The problem is caused by reversed vent and combustion-air pipes or some other moist air entering combustion-air pipe.			16

STEP	ACTION	YES	NO	GO TO
34.	You have excessive restriction in combustion-air or vent pipe. Also check for proper vent sizing for installation.			16
35.	Continue to observe furnace operation for 20 minutes or until status code starts flashing.			36
36.	Does status code 3 flash?	38	37	
37.	Does a different status code flash?	7	50	
38.	Turn power off and disconnect jumper wire across R and W/W1 thermostat terminals.			39
39.	Connect 1 side of slope manometer with a tee to collector box pressure tap. Refer to pressure check diagram in Appendix C.			40
40.	Turn power on and jumper R and W/W1 thermostat terminals.			41
41.	Monitor slope manometer. Does the pressure reading appear to be stable when fault occurs?	43	42	
42.	Check for a sag in vent pipe or partially clogged drain trap or line. Also check for improperly plumbed drain tubing within furnace.			8
43.	Does the pressure reading slowly drop off before flashing status code 3?	45	44	
44.	Problem could be caused by excessive wind conditions. If so the furnace will run the next cycle in maximum heat. Check wiring for an intermittent connection in low pressure switch LPS circuit. If problem still persists and wind conditions are not excessive turn setup switch SW1-3 ON to boost inducer speed. On the Communicating Wall Control select MIN/INT RISE ADJ.			8
45.	Check for partially clogged drain trap or line. If furnace is installed in the horizontal position make sure the furnace is pitched forward ¼ inch minimum to ½ inch maximum. If furnace is installed in the upflow or downflow position make sure the furnace is level or pitched forward within ½ inch.			8
46.	Check the collector box pressure tap for blockages. Use the back end of a small drill bit to clear debris out of the collector box pressure tap opening. It may be necessary to remove the collector box and clear away the debris if it keeps clogging.			47
47.	Check the tubing between the collector box and the pressure switch assembly for leaks or blockages.			48
48.	Check the tube between the pressure switches for leaks or blockages.			49
49.	Check the unused trap openings and make sure they are plugged.			20
50.	Turn power off and disconnect jumper wire across R and W/W1 thermostat terminals.			51
51.	Install the control door.			52
52.	Turn power on and jumper R and W/W1 thermostat terminals. Wait 1 minute.			53
53.	Does status code 3 flash?	55	54	
54.	Does a different status code flash?	7	8	
55.	Is there any frost build-up on the combustion-air inlet?	33	34	

Status Code 4

LIMIT CIRCUIT FAULT - This status code indicates the limit, flame rollout switch is open, or the furnace is operating in maximum-heat only mode due to 2 successive limit trips while operating at any rate ≤ 71% of maximum rate. Blower will run for 4 minutes at intermediate heat airflow or until the open switch remakes whichever is longer. If open longer than 3 minutes, code changes to lockout #7. If open less than 3 minutes status code #4 continues to flash until blower shuts off. Flame rollout switch requires manual reset.

STEP	ACTION	YES	NO	GO TO
1.	Turn power off, remove blower door, and disconnect communication connector PL7 (if used) or the R thermostat lead (if used) from the furnace control board. Note current setting of setup switch SW4-2 and then set it to the ON position.			2
2.	Turn power on and depress door switch. Use a piece of tape to hold switch closed.			3
3.	Does status code 4 flash?	11	4	
4.	Does a different status code flash?	5	6	
5.	Return setup switch SW4-2 to its original setting and go to page number indicated in the Index for the section covering the status code.			INDEX
6.	Jumper R and W/W1 thermostat terminals.			7
7.	Observe the furnace operation for 15 minutes or until status code starts flashing.			8
8.	Does status code 4 flash?	39	9	
9.	Does a different status code flash?	5	27	
10.	Return setup switch SW4-2 to its original setting and go to page number indicated in Index for CLEANUP AND START-UP INSTRUCTIONS.			INDEX
11.	Is 24-vac across connector terminal PL1-6 and COM-24V on modulating furnace control?	13	12	
12.	Replace the modulating furnace control.			10
13.	Is 24-vac across connector terminal PL1-8 and COM-24V on modulating furnace control?	12	14	
14.	Turn power off.			15
15.	Do you have continuity across limit switch LS?	19	16	
16.	Wait for unit to cool then recheck for continuity across limit switch LS.			17
17.	Do you have continuity across limit switch LS?	19	18	
18.	Replace limit switch.			10
19.	Do you have continuity across both flame rollout switch(es) FRS?	35	20	
20.	Can open flame rollout switch FRS be reset?	22	21	
21.	Replace flame rollout switch FRS.			10
22.	Reset flame rollout switch FRS, turn power on, and observe furnace operation for (2) 15 minute cycles.			23
23.	Does flame rollout switch FRS trip again?	25	24	
24.	Does a different status code flash?	5	10	
25.	You have inadequate combustion-air supply. This may be caused by: - Reversed vent and combustion-air pipes. - Poor burner, manifold, or orifice alignment. - Blocked heat exchanger. - Leak in secondary heat exchanger. - Leak somewhere between primary and secondary heat exchangers. - Leak between vestibule and blower compartment. - Flue gas leak in vestibule.			26
26.	Fix problem.			10
27.	While the unit is operating in intermediate heat jumper R and W2.			28
28.	Observe furnace operation for another 10 minutes or until status code 4 starts flashing.			29
29.	Does status code 4 flash?	50	30	
30.	Does a different status code flash?	5	31	
31.	Is the furnace in the downflow or horizontal position?	32	68	
32.	Disconnect the R thermostat lead, wait for blower to stop, and continue to observe furnace for 5 minutes.			33
33.	Does fault occur after blower stops?	34	10	
34.	Increase the blower off-delay time to 180 seconds by putting both setup switches SW1-7 and SW1-8 into the ON position.			26
35.	Turn power on.			36
36.	Does status code 4 flash?	38	37	
37.	Does a different status code flash?	5	6	
38.	You have an open RED wire or bad terminal in limit circuit. Repair wire or replace harness.			10
39.	Does furnace have the proper limit switch, and is the limit gasket installed? If so, are the heat exchangers properly aligned?	40	26	

STEP	ACTION	YES	NO	GO TO
40.	Remove tape from door switch, turn power off at main disconnect, and remove jumper across R and W/W1.			41
41.	Is the blower wheel firmly mounted on motor shaft?	42	26	
42.	Does the model plug PL4 match the part number specified on the Rating Plate?	44	43	
43.	Replace model plug.			10
44.	Clean or replace filter if necessary, then recycle furnace after limit resets.			45
45.	Turn power on and depress door switch. Use a piece of tape to hold switch closed.			46
46.	Jumper R and W/W1 thermostat terminals.			47
47.	Observe furnace operation for 15 minutes or until status code 4 starts flashing.			48
48.	Does status code 4 still occur during intermediate heat?	50	49	
49.	Does a different status code flash?	5	10	
50.	Is furnace considerably overfired (10% or more)? Clock input rate. Do not use manifold pressure method unless using propane.	51	52	
51.	Ensure gas inlet pressure and burner orifices (natural or propane) are correct. Then adjust gas valve to proper rate per Installation, Start-Up, and Operating Instructions. If it cannot be adjusted to proper rate, replace gas valve. **Note:** The modulating furnace manifold pressure is set at two points. The first point is maximum heat. The second point is minimum heat. Both adjustments are independent and are done with the same rotary adjustment switch on the modulating gas valve. When adjusting do not apply excessive force as you may damage the rotary adjustment switch. To adjust, slowly turn the rotary adjustment switch counterclockwise to decrease manifold pressure or clockwise to increase manifold pressure. Turn the rotary adjustment switch one click per second until you obtain the desired manifold pressure. If you turn the rotary adjustment switch too quickly the manifold pressure will not change.			10
52.	Is temperature rise within rise range?	54	53	
53.	Does the installation have a bypass humidifier or zoning system bypass?	58	61	
54.	Turn power off and install a temperature probe in front of limit switch button.			55
55.	Turn power on and cycle unit. Does limit switch open at a temperature at least 10 deg. F below temperature setpoint for limit switch? (EXAMPLE: The setpoint is 170 deg F, but the switch opens at a temperature below 160 deg F.)	18	56	
56.	The problem may be related to poor air distribution or excessive pressure drop across filter. Check filter and return-air grilles for blockage. Add turning vanes, more supply openings, or more return-air openings. Use Appendix D to evaluate external static pressure.			26
57.	With blower door in place record temperature rise across return air duct before and after the bypass.			58
58.	Is temperature rise of return air from bypass greater than 15 deg. F?	59	60	
59.	The bypass is oversized. Adjust damper or replace with properly sized bypass.			10
60.	Does installation have modulating zone dampers?	61	65	
61.	Disable modulating zone damper system with all dampers in open position except bypass damper. If installation is equipped with a bypass damper, it should be in the closed position.			62
62.	Turn power off and disconnect jumper from the R thermostat terminal. Turn power back on and reconnect jumper to R thermostat terminal. Observe for 15 minutes with the blower door in place.			63
63.	Does status code 4 flash?	65	64	
64.	The problem is caused by the modulating zone damper system. Check the zoning system manufacturer's Installation and Troubleshooting guide for corrective action.			10
65.	Turn power off and install a temperature probe in front of limit switch button.			66
66.	Turn power on and cycle unit. Does limit switch open at a temperature at least 10 deg. F below temperature setpoint for limit switch? (EXAMPLE: The setpoint is 170 deg F, but the switch opens at a temperature below 160 deg F.)	18	67	
67.	Adjust the blower airflow using dip switch SW1-3 and SW1-4 to get the temperature rise within the rise range. On systems with Communicating Wall Control set at the Communicating Wall Control.			26
68.	Remove tape from door switch, turn power off at main disconnect, and remove jumpers across R, W/W1, and W2.			69
69.	Put setup switch SW4-2 in the OFF position.			70
70.	Jumper R and W/W1 thermostat terminals.			71
71.	Observe furnace operation for 15 minutes or until status code 4 starts flashing.			72
72.	Does status code 4 flash occur during minimum heat?	74	73	
73.	Does a different status code flash?	5	10	
74.	Is furnace considerably overfired (10% or more)? Clock input rate. Do not use manifold pressure method unless using propane.	51	65	

Status Code 5

ABNORMAL FLAME-PROVING SIGNAL - This status code indicates the flame signal was sensed while gas valve GV was de-energized. The inducer will run until the fault is cleared.

STEP	ACTION	YES	NO	GO TO
1.	Turn off gas to the furnace by shutting off the external manual shut-off valve.			2
2.	Does status code 5 stop flashing?	3	4	
3.	Replace the gas valve.			8
4.	Disconnect wire from the flame-proving sensor electrode FSE.			8
5.	Does status code 5 stop flashing?	6	7	
6.	Clean flame sensor with fine steel wool. Remove burner gang and inspect. Remove any spider webs or unusual carbon deposits near where the flame sensor is located.			8
7.	Replace the modulating furnace control.			8
8.	Go to page number indicated in Index for CLEANUP AND START-UP INSTRUCTIONS.			INDEX

Status Code 6

IGNITION-PROVING FAULT - This status code indicates flame was not sensed during trial for ignition period. The control will repeat ignition sequence 3 more times before going to status code 6 + 1 - IGNITION LOCKOUT. This status code can also indicate flame signal was lost during steady-state operation.

STEP	ACTION	YES	NO	GO TO
1.	Shut the power off, remove the blower door, and disconnect communication connector PL7 (if used) or the R thermostat lead (if used) from the furnace control board.			2
2.	Turn the power on and depress the door switch. Use a piece of tape to hold it closed.			3
3.	Jumper the R and W/W1 thermostat terminals.			4
4.	Observe the operation of the furnace through a heating cycle.			5
5.	Does status code 6 flash?	9	6	
6.	Does a different status code flash?	7	8	
7.	Go to page number indicated in the Index for the section covering the status code.			INDEX
8.	Go to page number indicated in Index for CLEANUP AND START-UP INSTRUCTIONS.			INDEX
9.	Turn off the power and disconnect the jumper across the R and W/W1 thermostat terminals.			10
10.	Turn the power on.			11
11.	Check the hot surface igniter. To do this run a COMPONENT TEST by putting setup switch SW1-6 in the ON position. Does the igniter glow orange/white hot by the end of the 15 second warm-up period?	16	12	
12.	Hook an AC voltmeter across PL2-3 and L2 on the modulating furnace control. Repeat the COMPONENT TEST by turning setup switch SW1-6 OFF and then back ON. Is 115-vac across PL2-3 and L2 during the 15 second warm-up period?	14	13	
13.	Replace the modulating furnace control.			8
14.	Check continuity in harness and igniter. Replace failed component.			15
15.	Fix problem.			8
16.	Put setup switch SW1-6 in the OFF position, jumper the R and W/W1 thermostat terminals, and monitor voltage across BLUE and GREEN/YELLOW wires to gas valve GV.			17
17.	Just before status code 6 begins flashing was 24-vac across BLUE and GREEN/YELLOW wire to gas valve GV?	21	18	
18.	Turn off the power.			19
19.	Do you have continuity across the following connections? - PL1-10 and PL17-5, BLUE wire from the modulating furnace control to gas valve GV.	13	20	
20.	The BLUE wire from the modulating furnace control to the gas valve GV is not making a good connection. Repair the wire or replace the harness.			8
21.	Does the gas valve open and allow gas to flow?	24	22	
22.	Are all the manual gas cocks and the gas valve switch in the ON position?	23	15	
23.	Replace gas valve.			8
24.	Do the main burners ignite?	26	40	
25.	Check for the following: - Inadequate flame carryover or rough ignition. - Low inlet gas pressure. - Flue gas leak into vestibule. - Proper firing rate.			15

STEP	ACTION	YES	NO	GO TO
26.	Do the main burners stay on longer than a few seconds?	36	40	
27.	Turn off the power and disconnect the jumpers across the R, W/W1, and W2 thermostat terminals.			28
28.	Connect a DC microampmeter in series with the flame sensor wire.			29
29.	Turn power on and jumper R, W/W1, and W2 thermostat terminals.			30
30.	Is the DC current below .5 microamps?	32	31	
31.	Check connections and retry. If current is near typical value (4.0 to 6.0 microamps) and main burners will not stay on longer than a few seconds, check the following: - Flue gas leak into vestibule. - Inadequate flame carryover on rough ignition. - Low inlet gas pressure. - Low manifold pressure. Reference installation instructions for proper manifold pressure. - Slow opening gas valve. Gas should flow at full pressure within 4 seconds after the gas valve is energized. If the above items are OK replace the modulating furnace control.			15
32.	Clean flame sensor with fine steel wool and make sure it is properly positioned then recheck current. Current is typically 4.0 to 6.0 microamps.			33
33.	Is current near typical value?	35	34	
34.	Replace electrode.			8
35.	Will main burners ignite and stay on?	8	13	
36.	Do you have burner pulsation's?	37	49	
37.	Check the following: - Ensure there are no flue gas leaks in the vestibule. - Ensure vent and combustion-air pipes are not reversed. - Burner orifice size and alignment. - Inadequate flame carryover. - Add restriction to combustion-air pipe or lengthen a few feet if possible.			15
38.	While the unit is operating in minimum heat jumper R and W2.			39
39.	Do you have burner pulsation's in maximum heat?	37	8	
40.	Turn off the power and disconnect the jumper across the R and W/W1 thermostat terminals.			41
41.	Turn power on and jumper R, W/W1, and W2 thermostat terminals.			42
42.	Do the main burners ignite?	43	25	
43.	Do the main burners stay on longer than a few seconds?	44	27	
44.	Do you have burner pulsation's?	37	45	
45.	Disconnect jumper from R and W2.			46
46.	Do the main burners remain ON?	47	48	
47.	Furnace will operate at minimum or intermediate heat but will not ignite on intermediate heat. Check the following: - Inadequate flame carryover. - Low manifold pressure. Reference installation instructions for proper manifold pressure settings. - Slow opening gas valve. Gas should flow at full pressure within 4 seconds after the gas valve is energized. - Flame sensor location. - Hot surface igniter location.			15
48.	Furnace will not operate at minimum or intermediate heat and will not ignite on intermediate heat. Check the following: - Flame sensor location. - Very low manifold pressure. Reference installation instructions for proper manifold pressure settings. Turn rotary adjustment switch 1 step. Repeat until furnace will operate in intermediate heat. Then set maximum and minimum heat to the proper manifold pressure. Re-orifice if necessary.			15
49.	Do the main burners remain lit after switching to minimum-heat?	50	51	
50.	Do you have burner pulsation's in minimum heat?	37	38	
51.	Furnace will not operate at minimum heat but will ignite and operate at intermediate heat. Check the following: - Flame sensor location. - Minimum heat manifold pressure. Reference installation instructions for proper manifold pressure settings. First set the maximum heat manifold pressure then adjust the intermediate heat manifold pressure instead of the minimum heat manifold pressure. Re-orifice if necessary.			15

Status Code 7

LIMIT CIRCUIT LOCKOUT – Lockout occurs if the limit or flame rollout switch is open longer than 3 minutes or 10 successive limit trips occurred during maximum-heat. The modulating furnace control will auto-reset in 3 hours. Flame roll-out switch(es) FRS require manual-reset.

STEP	ACTION	YES	NO	GO TO
1.	Remove the blower door. Disconnect communication connector PL7 (if used) or the R thermostat lead (if used) from the furnace control board.			2
2.	Depress the door switch. Use piece of tape to hold it closed.			3
3.	Does status code 4 flash?	11	4	
4.	Does a different status code flash?	5	6	
5.	Go to page number indicated in the Index for the section covering the status code.			INDEX
6.	Jumper R and W/W1 thermostat terminals.			7
7.	Observe the furnace operation for 25 minutes or until status code starts flashing.			8
8.	Does status code 4 flash?	26	9	
9.	Does a different status code flash?	5	10	
10.	Go to page number indicated in Index for CLEANUP AND START-UP INSTRUCTIONS.			INDEX
11.	Is 24-vac across connector terminal PL1-6 and COM-24V on modulating furnace control?	13	12	
12.	Replace the modulating furnace control.			10
13.	Is 24-vac across connector terminal PL1-8 and COM-24V on modulating furnace control?	12	14	
14.	Turn power off.			15
15.	Do you have continuity across limit switch LS?	17	16	
16.	Replace limit switch LS.			10
17.	Do you have continuity across each flame rollout switch FRS?	25	18	
18.	Can flame rollout switch FRS be reset?	20	19	
19.	Replace flame rollout switch FRS.			10
20.	Reset flame rollout switch FRS, install both doors, turn power on, and observe furnace operation for two 15 minute cycles.			21
21.	Does the flame rollout switch FRS trip again?	23	22	
22.	Does a different status code flash?	5	10	
23.	You have inadequate combustion-air supply. This may be caused by: - Reversed vent and combustion-air pipes. - Poor burner, manifold, or orifice alignment. - Blocked heat exchanger. - Leak in secondary heat exchanger. - Leak somewhere between primary and secondary heat exchangers. - Leak between vestibule and blower compartment. - Flue gas leak in vestibule.			24
24.	Fix problem			10
25.	You have an open RED wire or bad terminal in limit circuit. Repair wire or replace harness.			10
26.	Does furnace have the proper limit switch? If so, is the limit gasket also installed?	27	24	
27.	Remove tape from door switch, turn power off at main disconnect, and remove jumper across R and W/W1.			28
28.	Is blower wheel firmly mounted on motor shaft?	29	24	
29.	Does the model plug PL4 match the part number specified on the Rating Plate?	31	30	
30.	Replace model plug.			10
31.	Lockout may have been caused by excessive return-air restriction. Check all dampers, filters, and return-air grilles for blockage. Add more return-air openings if necessary. Use Appendix D to evaluate external static pressure. Reference status code 4 for additional troubleshooting steps.			10

Status Code 8

GAS HEATING LOCKOUT - This status code indicates the gas valve relay GVR on the modulating furnace control is stuck closed or there is a miswire/short to gas valve BLUE wire. The modulating furnace control will NOT auto-reset.

STEP	ACTION	YES	NO	GO TO
1.	Remove blower door. Disconnect communication connector PL7 (if used) or the R thermostat lead (if used) from the furnace control board. Depress door switch.			2
2.	Does status code 8 flash?	3	6	
3.	There is a miswire or short to the gas valve BLUE wire.			4
4.	Fix problem			5
5.	Go to page number indicated in Index for CLEANUP AND START-UP INSTRUCTIONS.			INDEX
6.	Does a different status code flash?	7	8	
7.	Go to page number indicated in the Index for the section covering the status code.			INDEX
8.	Use a piece of tape to hold door switch closed.			9
9.	Jumper R and W/W1 thermostat terminals.			10
10.	Does status code 8 start flashing when the low pressure switch LPS makes?	11	12	
11.	Replace the modulating furnace control.			5
12.	Does a different status code flash?	7	13	
13.	Disconnect the jumper wire across R and W/W1 thermostat terminals and wait until the blower stops.			14
14.	Cycle the furnace several times to check for intermittent operation.			15
15.	Does status code 8 ever flash?	11	16	
16.	Go to page number indicated in Index for CLEANUP AND START-UP INSTRUCTIONS. If the problem persists on an intermittent basis, replace the modulating furnace control. If problem still persists on an intermittent basis after replacing the modulating furnace control, contact your distributor.			INDEX

Status Code 9

MEDIUM PRESSURE SWITCH, HIGH PRESSURE SWITCH, OR PSR RELAY DID NOT CLOSE OR REOPENED - This status code can occur under the scenarios shown below. Keep in mind that whenever the modulating furnace control shuts unit down, gas remains off or shuts off immediately, inducer continues running for 15 seconds, and if the blower is running, it remains running at minimum heat airflow or reduces to minimum heat airflow for the selected off-delay.

- LOW RANGE INPUT OPERATION (40% - 51% OF MAXIMUM HEAT, 40% - 45% OF MAXIMUM HEAT ON 5T-060)

1. STEADY-STATE - If the medium pressure switch input turns ON the modulating furnace control begins flashing status code 9 and continues to operate at the current low range input. After the call for heat is satisfied and the blower off-delay is completed the control will stop displaying status code 9.

- MEDIUM RANGE INPUT OPERATION (52% - 71% OF MAXIMUM HEAT, 46% - 71% OF MAXIMUM HEAT ON 5T-060)

1. PREPURGE - If the medium pressure switch MPS does not make within 45 seconds after the low pressure switch LPS made the modulating furnace control begins flashing status code 9, shuts unit down, waits 2 minutes, stops flashing status code 9, and restarts heating cycle.

   If medium pressure switch MPS opens before ignition, the modulating furnace control ramps inducer RPM up until the medium pressure switch MPS remakes. When the medium pressure switch MPS remakes the modulating furnace control continues the heating cycle. If medium pressure switch MPS does not remake within 45 sec after opening, the modulating furnace control starts flashing status code 9, shuts unit down, waits 2 minutes, stops flashing status code 9, and restarts heating cycle.

2. LOW TO MEDIUM RANGE INPUT TRANSITION - If the medium pressure switch MPS fails to make within 45 seconds after a medium range input was requested the modulating furnace control shuts unit down and begins flashing status code 9. After the blower off-delay is completed the modulating furnace control will stop displaying status code 9 and if there is a call for heat, begin a new heating cycle.

3. STEADY-STATE - If the medium pressure switch MPS opens the modulating furnace control ramps inducer RPM up until the medium pressure switch MPS remakes. When the medium pressure switch MPS remakes the modulating furnace control continues the heating cycle. If medium pressure switch MPS does not remake within 45 sec after opening, the modulating furnace control starts flashing status code 9 and shuts the unit down. After the blower off-delay is completed the modulating furnace control will stop displaying status code 9 and if there is a call for heat, begin a new heating cycle.

4. MEDIUM TO LOW RANGE INPUT TRANSITION – When transitioning to a low range input the medium pressure switch MPS should open when the PSR relay is energized to open the NC contact. However if the PSR relay contact remains closed and the medium pressure switch MPS is made the modulating furnace control begins flashing status code 9and continues to operate at the desired low range input. After the call for heat is satisfied and the blower off-delay is completed the modulating furnace control will stop displaying status code 9.

- HIGH RANGE INPUT OPERATION (72% - 100% OF MAXIMUM HEAT)

1. PREPURGE - If the medium pressure switch MPS does not make within 45 seconds after the low pressure switch LPS made the modulating furnace control begins flashing status code 9, shuts unit down, waits 2 minutes, stops flashing status code 9, and restarts heating cycle.

   If medium pressure switch MPS opens before ignition, the modulating furnace control ramps inducer RPM up until the medium pressure switch MPS remakes. When the medium pressure switch MPS remakes the modulating furnace control continues heating cycle. If medium pressure switch MPS does not remake within 45 sec after opening, the modulating furnace control starts flashing status code 9, shuts unit down, waits 2 minutes, stops flashing status code 9, and restarts heating cycle.

   The high pressure switch HPS is ignored until ignition occurs.

2. MEDIUM TO HIGH RANGE INPUT TRANSITION - If the medium pressure switch MPS opens while transitioning to a high range input, the modulating furnace control ramps inducer RPM up until the medium pressure switch MPS remakes. When the medium pressure switch MPS remakes the modulating furnace control continues heating cycle. If medium pressure switch MPS does not remake within 45 sec after opening, the modulating furnace control starts flashing status code 9 and shuts unit down. After the blower off-delay is completed the modulating furnace control will stop displaying status code 9 and if there is a call for heat, begin a new heating cycle.

   If the high pressure switch HPS opens or failed to make within 30 sec after starting the transition, the modulating furnace control ramps inducer RPM up until the high pressure switch HPS makes. If the high pressure switch HPS fails to make after an additional 45 sec, the modulating furnace control starts flashing status code 9and shuts unit down. After the blower off-delay is completed the modulating furnace control will stop displaying status code 9 and if there is a call for heat, begin a new heating cycle.

3. STEADY-STATE - If the high pressure switch HPS opens the modulating furnace control ramps inducer RPM up until the high pressure switch HPS remakes. When the high pressure switch HPS remakes the modulating furnace control continues the heating cycle. If high pressure switch HPS does not remake within 45 sec after opening, the modulating furnace control starts flashing status code 9 and shuts unit down. After the blower off-delay is completed the modulating furnace control will stop displaying status code 9 and if there is a call for heat, begin a new heating cycle.

4. HIGH TO MEDIUM RANGE INPUT TRANSITION - If the medium pressure switch MPS opens while transitioning to a medium range input, the modulating furnace control ramps inducer RPM up until the medium pressure switch MPS remakes. When the medium pressure switch MPS remakes the modulating furnace control continues heating cycle. If medium pressure switch MPS does not remake within 45 sec after opening, the modulating furnace control starts flashing status code 9 and shuts unit down. After the blower off-delay is completed the modulating furnace control will stop displaying status code 9 and if there is a call for heat, begin a new heating cycle.

5. OTHER TRANSITIONS - If the modulating furnace control is transitioning from low to high range input the modulating furnace control will first transition from low to medium range input and then transition from medium to high range input. If the modulating furnace control is transitioning from high to low range input the modulating furnace control will first transition from high to medium range input and then transition from medium to low range input.

STEP	ACTION	YES	NO	GO TO
1.	Turn power off, remove both doors, and disconnect communication connector PL7 (if used) or the R thermostat lead (if used) from the furnace control board.			2
2.	Turn power on and depress door switch. Use a piece of tape to hold switch closed.			3
3.	Put setup switch SW4-2 into the ON position, and jumper R and W/W1 thermostat terminals.			4
4.	Wait 90 seconds before proceeding to the next step.			5
5.	Is status code 9 flashing?	9	6	
6.	Is a different status code flashing?	7	34	
7.	Go to page number indicated in the Index for the section covering the status code.			INDEX
8.	Go to page number indicated in Index for CLEANUP AND START-UP INSTRUCTIONS.			INDEX
9.	Is 24-vac across GRAY wire on the medium pressure switch MPS and COM-24V on modulating furnace control?	15	10	
10.	Is 24-vac across connector terminal PL1-12 and COM-24V on modulating furnace control?	11	13	
11.	You have an open wire or bad terminal on the GRAY wire from the modulating furnace control to the medium pressure switch MPS.			12
12.	Repair or replace wire harness.			8
13.	Replace the modulating furnace control.			8
14.	You have excessive restriction in the vent pipe. Also, check for proper vent sizing for installation.			32

STEP	ACTION	YES	NO	GO TO
15.	Did the medium pressure switch MPS make, then break several times at start of cycle before faulting out?	16	17	
16.	The problem is either a sag in vent pipe or a clogged drain trap or line. Also check for improperly plumbed drain tubing within furnace.			32
17.	Is 24-vac across VIOLET wire on the medium pressure switch MPS and COM-24V on modulating furnace control? **Note:** You may need to wait a few minutes for the modulating furnace control to ramp the inducer motor back up to speed.	18	20	
18.	Is 24-vac across connector terminal PL1-3 and COM-24V on modulating furnace control?	13	19	
19.	You have an open wire or bad terminal on the VIOLET wire from the medium pressure switch MPS to the modulating furnace control.			12
20.	Turn power off and disconnect jumper wire across R and W/W1 thermostat terminals.			21
21.	Connect 1 side of slope manometer with a tee to collector box pressure tap. Refer to pressure check diagram in Appendix C.			22
22.	Turn power on and jumper R and W/W1 thermostat terminals.			23
23.	Do you have at least 1.08 in. wc pressure drop across heat exchangers when status code 9 flashes?	24	25	
24.	Replace the pressure switch assembly.			8
25.	Is inducer motor rotating in direction indicated on inducer housing?	27	26	
26.	Replace inducer control (if you have 2 piece design) or inducer motor assembly.			8
27.	Turn power off.			28
28.	Is inducer wheel okay?	30	29	
29.	Replace inducer motor assembly.			8
30.	Is the inducer wheel properly mounted to the inducer motor shaft?	33	32	
31.	Were there any leaks or blockages found in steps 60-63?	32	14	
32.	Fix problem.			8
33.	Does the inducer wheel turn freely?	60	32	
34.	Continue to observe furnace operation for 20 minutes or until status code starts flashing.			35
35.	Does status code 9 flash?	37	36	
36.	Does a different status code flash?	7	43	
37.	Turn power off and disconnect jumper wire across R and W/W1 thermostat terminals.			38
38.	Connect 1 side of slope manometer with a tee to collector box pressure tap. Refer to pressure check diagram in Appendix C.			39
39.	Turn power on and jumper R and W/W1 thermostat terminals.			40
40.	Monitor slope manometer. Does the pressure reading appear to be stable when fault occurs?	41	42	
41.	Did the pressure gradually drop over time until the fault occurred? If the pressure remained constant and then the fault all of sudden occurred go to step 50.	51	50	
42.	Check for a sag in vent pipe or partially clogged drain trap or line. Also check for improperly plumbed drain tubing within furnace.			8
43.	Turn power off and disconnect jumper wire across R and W/W1 thermostat terminals.			44
44.	Install the control door.			45
45.	Turn power on and jumper R and W/W1 thermostat terminals. Wait 1 minute.			46
46.	Does status code 9 flash?	48	47	
47.	Does a different status code flash?	7	53	
48.	Is there any frost build-up on the combustion-air inlet?	49	52	
49.	The problem is caused by reversed vent and combustion-air pipes or some other moist air entering combustion-air pipe.			32
50.	Replace pressure switch assembly. If problem persists, check wiring for an intermittent connection in medium pressure switch MPS circuit.			8
51.	Check for partially clogged drain trap or line. Also check for improperly plumbed drainage tubing within furnace. If furnace is installed in the horizontal position make sure the furnace is pitched forward ¼ inch minimum to ½ inch maximum. If furnace is installed in the upflow or downflow position make sure the furnace is level or pitched forward within ½ inch.			8
52.	You have excessive restriction in combustion-air or vent pipe. Also check for proper vent sizing for installation.			32
53.	Put setup switch SW1-2 into the ON position.			54
54.	Put setup switch SW4-2 into the OFF position.			55
55.	Is status code 9 flashing?	57	56	
56.	Does a different status code flash?	7	8	
57.	Turn power off and disconnect PL1 from modulating furnace control.			58

STEP	ACTION	YES	NO	GO TO
58.	Do you have continuity between the GRAY wire on the medium pressure switch MPS and the YELLOW wire on the low pressure switch?	59	13	
59.	The GRAY wire is shorting to the YELLOW or ORANGE wire that goes to the low pressure switch LPS.			12
60.	Check the collector box pressure tap for blockages. Use the back end of a small drill bit to clear debris out of the collector box pressure tap opening. It may be necessary to remove the collector box and clear away the debris if it keeps clogging.			61
61.	Check the tubing between the collector box and the pressure switch assembly for leaks or blockages.			62
62.	Check the tube between the pressure switches for leaks or blockages.			63
63.	Check the unused trap openings and make sure they are plugged.			31

Status Code 10

POLARITY - Indicates line voltage polarity is reversed, furnace is not grounded, or the transformers are out of phase in twinned units.

STEP	ACTION	YES	NO	GO TO
1.	Is this furnace twinned with another furnace?	7	2	
2.	Remove blower door and depress door switch. Use a piece of tape to hold switch closed.			3
3.	Is 115-vac across L2 and chassis ground?	4	20	
4.	Line voltage polarity is reversed. Fix problem.			5
5.	Go to page number indicated in Index for CLEANUP AND START-UP INSTRUCTIONS.			INDEX
6.	Replace the modulating furnace control.			5
7.	Remove blower door and depress door switch in each unit. Use tape to hold switches closed.			8
8.	Is the AMBER LED status light blinking rapidly in only one of the twinned units?	9	16	
9.	Are the fuses, breakers, or manual disconnects to the problem unit correctly set?	11	10	
10.	Fix problem.			5
11.	Are the Auxiliary Limit switches properly set?	12	10	
12.	Do you have 115-vac across L1 and L2 in the problem unit?	13	15	
13.	Do you have 24-vac across SEC-1 and SEC-2 in the problem unit?	6	14	
14.	Replace the transformer.			5
15.	Turn power off to both units. Check continuity of power leads and door switch in the problem unit. If necessary repair power leads and/or replace door switch in the problem unit.			5
16.	Check the furnace circuit breaker location in the service panel. On single-phase (residential) systems, each furnace circuit breaker should be located directly across from each other in service panel, or each furnace circuit breaker should be located on the same side of service panel, but must skip 1 space to be connected to the same leg of the 1-phase power supply. On 3-phase (commercial) systems, each furnace circuit breaker should be located directly across from each other in service panel, or each furnace circuit breaker should be located on the same side of service panel, but must skip 2 spaces to be connected to the same leg of the 3-phase power supply.			17
17.	Check the 115-vac power lead connections at the modulating furnace control of each furnace. The BLACK lead goes to L1 and the WHITE lead goes to L2.			18
18.	Check the 115-vac transformer lead connections at the modulating furnace control of each furnace. The BLACK lead goes to L1 and the WHITE lead goes to L2.			19
19.	If the circuit breaker location and the 115-vac wiring is correct reverse the transformer secondary lead connections SEC-1 and SEC-2 in the MAIN furnace.			5
20.	Is the furnace properly grounded back to the service panel?	6	10	

Status Code 1 + 2

BLOWER ON AFTER POWER UP - Blower will run for 90 seconds when furnace power is interrupted and later restored during a call for heat (R-W/W1 closed) or if the call for heat is interrupted (R-W/W1 opens) during the blower on-delay period. If this status code repeats every couple of minutes it is probably caused by a direct short in the pressure switch circuits, gas valve GV, wiring to gas valve GV, or humidifier coil.

STEP	ACTION	YES	NO	GO TO
1.	Remove the blower door and disconnect communication connector PL7 (if used) or the R thermostat lead (if used) from the furnace control board.			2
2.	Depress the door switch. Use piece of tape to hold it closed.			3
3.	Jumper R and W/W1 thermostat terminals.			4
4.	Does the furnace keep repeating the following cycle? Induced draft motor IDM runs, induced draft motor IDM stops, blower motor BLWM runs for 90 seconds while AMBER LED status light flashes status code 1 + 2.	5	20	
5.	Do you have less than 17-vac across R and COM-24V on the modulating furnace control?	6	14	
6.	Do you have less than 90-vac across L1 and L2 on the modulating furnace control?	7	10	
7.	Make sure wire gage between main fuse box and furnace complies with wire size specification in Installation, Start-Up, and Operating Instructions.			8
8.	Fix problem.			9
9.	Go to the page number indicated in Index for the CLEANUP AND STARTUP INSTRUCTIONS.			INDEX
10.	Disconnect the R thermostat lead.			11
11.	Do you have less than 19-vac across R and COM-24V on the modulating furnace control?	12	13	
12.	Replace transformer.			9
13.	The thermostat and/or thermostat wires are loading down the transformer. Replace the thermostat or repair thermostat wires.			9
14.	Does the hot surface igniter HSI come on during the cycle?	15	24	
15.	Disconnect the humidifier lead from HUM terminal on modulating furnace control.			16
16.	Does the furnace still alternately cycle induced draft motor IDM and blower motor BLWM as described in Step 4.	18	17	
17.	The humidifier may not be wired into the system properly or there is a direct short in wiring to humidifier solenoid coil, diode bridge(if used), or humidifier solenoid coil.			8
18.	The gas valve GV is miswired, there is a short in the gas valve GV, or there is a short in the wiring to the gas valve GV. Refer to Appendix E to check gas valve GV.			8
19.	There is a direct short in the ORANGE wire from the low pressure switch LPS.			8
20.	While the unit is operating in minimum heat jumper R and W2 thermostat terminals.			21
21.	Does the furnace abruptly shut down with no inducer post purge and then run blower motor BLWM for 90 seconds while AMBER LED status light flashes status code 1 + 2.	22	23	
22.	There is a direct short in the BROWN wire from the high pressure switch HPS.			8
23.	The call for heat was probably satisfied during the blower on-delay period, or power to the furnace was probably interrupted during a call for heat. This is normal operation. Go to the page number indicated in Index for the CLEANUP AND STARTUP INSTRUCTIONS.			INDEX
24.	Disconnect VIOLET wire from the medium pressure switch MPS.			25
25.	Does the furnace still alternately cycle induced draft motor IDM and blower motor BLWM as described in Step 4.	19	26	
26.	There is a direct short in the VIOLET wire from the medium pressure switch MPS.			8

Status Code 1 + 5

BLOWER MOTOR LOCKOUT - This status code indicates the blower failed to reach 250 RPM or the blower failed to communicate to the modulating furnace control within 30 seconds after being turned ON in two successive heating cycles. Control will auto reset after 3 hours. Refer to status code 4 + 1.

Status Code 2 + 5

MODEL SELECTION OR SETUP ERROR – If status code 2 + 5 only flashes 4 times on power-up the modulating furnace control is missing its model plug (PL4) and is defaulting to the model selection stored in memory.

If status code 2 + 5 flashes continuously it could indicate any of the following:

1. **Model plug (PL4) is missing and there is no valid model stored in permanent memory. This will happen if you forget to install the model plug (PL4) on a service replacement board.**
2. **Thermostat call with SW1-1 ON.**
3. **Thermostat call with SW1-6 ON.**
4. **SW1-1 and SW1-6 both ON together.**
5. **Two different furnace models twinned.**
6. **Service replacement control is incorrect. Need modulating furnace control with software version V17 or later.**

STEP	ACTION	YES	NO	GO TO
1.	Turn power off, remove the blower door, and disconnect communication connector PL7 (if used) or the R thermostat lead (if used) from the furnace control board.			2
2.	Turn power on and depress door switch. Use a piece of tape to hold switch closed.			3
3.	Does status code 2 + 5 flash only 4 times on power-up?	4	6	
4.	The model plug is missing or invalid but the control will default to the model stored in memory. The furnace will operate properly as if the model plug was installed. If you have the APM program you can confirm the setting in memory.			5
5.	Go to page number indicated in Index for CLEANUP AND START-UP INSTRUCTIONS.			INDEX
6.	Is setup switch SW1-1 in the ON position?	7	8	
7.	Put setup switch SW1-1 in the OFF position.			5
8.	Is setup switch SW1-6 in the ON position?	9	10	
9.	Put setup switch SW1-6 in the OFF position.			5
10.	Is this a new service replacement control?	19	13	
11.	You need to remove the model plug PL4 from the old control and install it on the new replacement control. Once you install the model plug the power to the furnace needs to be reset because the model plug is only read on power-up.			12
12.	If the model plug is not available from the old control, reference the resistance values on the rating plate along with the model plug part number. If absolutely necessary you can install two resistors into the PL4 connection on the control board. R1 goes across the middle 2 pins and R2 goes across the outer 2 pins. Resistors can be purchased at a nearby Radio Shack. The resistors need to be within 10% of the stated value. Check with an ohm meter before installing.			5
13.	Is this furnace twinned with another furnace?	14	17	
14.	Is the MAIN furnace flashing the status code?	15	17	
15.	Do the furnaces have the same model number on the rating plate?	18	16	
16.	Replace one of the furnaces because you cannot twin different size furnaces.			5
17.	Replace the modulating furnace control.			5
18.	One of the model plugs is bad. Ohm out each resistor and replace the one that does not match the resistance values on the rating plate.			5
19.	Is the model plug PL4 from the old control installed?	20	11	
20.	Make sure the service replacement control is correct. You need a modulating board with software version V17 or later. The version of software is printed in the WHITE box near the L2 terminals on the right side of the furnace control. Reference Figure 1 in Appendix A for the location of the software version.			5

Status Code 3 + 5

GAS VALVE FAULT - This status code indicates that the modulating gas valve failed to respond to a command from the modulating furnace control or power to the gas valve electronics was interrupted.

On every cycle after the medium pressure switch MPS makes the modulating furnace control sends a PWM (pulse width modulation) command to the gas valve GV for a duration of 1 second. Following this the gas valve GV responds back with the PWM command it received for a duration of 1 second. If the PWM response does not match the command sent the modulating furnace control will resend the PWM command up to 5 more times. After the gas valve sends the PWM response it operates the stepper motor. The stepper motor can be operated for up to 17 seconds if the propane jumper is installed in the gas valve GV. This worst case time is also dependent on the initial position of the stepper motor, if power was just reset, and if the initial call for heat after power-up is maximum heat. Generally speaking the stepper motor will only operate for a few seconds or less. After the stepper motor is done moving the gas valve GV will send a PWM-DONE command to the modulating furnace control. If the gas valve GV fails to respond back with the PWM command it received or the PWM-DONE command the modulating furnace control will flash status code 3 + 5, shut the unit down, wait 2 minutes, stop flashing status code 3 + 5, and restart the heating cycle.

The same general operation stated above also applies when the blower motor is turned on or whenever the modulating gas rate is changed. The only exception is the stepper motor will operate for a few seconds.

Due to these short 1 second command/response bursts it is difficult to troubleshoot the gas valve GV. As a result the COMPONENT TEST mode is designed to send the command for intermediate gas rate to the gas valve 15 seconds after the COMPONENT TEST is started. The only exception is the PWM command will only be sent 3 times and you may not get status code 3 + 5 to flash at the end of the COMPONENT TEST.

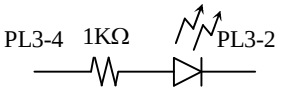
STEP	ACTION	YES	NO	GO TO
1.	Shut the power off, remove both doors and disconnect communication connector PL7 (if used) or the R thermostat lead (if used) from the furnace control board.			2
2.	Turn the power on and depress the door switch. Use a piece of tape to hold it closed.			3
3.	Jumper the R and W/W1 thermostat terminals.			4
4.	Observe the operation of the furnace for the next 5 minutes or until fault occurs.			5
5.	Does status code 3 + 5 flash?	9	6	
6.	Does a different status code flash?	7	8	
7.	Go to page number indicated in the Index for the section covering the status code.			INDEX
8.	Go to page number Indicated in Index for CLEANUP AND START-UP INSTRUCTIONS.			INDEX
9.	Does status code 3 + 5 flash at the start of the cycle before the hot surface igniter would normally be energized?	10	35	
10.	Is 24-vac across RED and GREEN/YELLOW wire at gas valve?	15	11	
11.	Is 24-vac across PL8-1 and COM-24V on modulating furnace control?	12	13	
12.	You have an open wire or bad terminal on the RED or GREEN/YELLOW wire from the modulating furnace control to the gas valve GV.			14
13.	Replace the modulating furnace control.			8
14.	Repair or replace the main wire harness.			8
15.	Disconnect jumper wire across R and W/W1 thermostat terminals and wait for the blower to turn off.			16
16.	Connect a DC voltmeter across terminals PL17-2 YELLOW (+) and PL17-4 GREEN/YELLOW (-). Is there 4-vdc across the YELLOW and GREEN/YELLOW wires?	18	17	
17.	Replace gas valve.			8
18.	Check the gas valve PWM input. To do this connect a DC voltmeter across terminals PL17-2 YELLOW (+) and PL17-4 GREEN/YELLOW (-) then run COMPONENT TEST by turning setup switch SW1-6 ON. In 15 seconds the voltage will drop briefly from 4.0-vdc. The voltage drop will be several volts or more and will last for about 1 second. If everything is working properly this will happen once otherwise the voltage will drop briefly 2 more times while the hot surface igniter is energized.			19
19.	Does the voltage drop briefly 3 times as described in step 18?	27	20	
20.	Does the voltage drop briefly at all?	21	23	
21.	If the voltage dropped briefly once then the communication between the modulating furnace control and the gas valve are working properly.			22
22.	Put setup switch SW1-6 in the OFF position. There may be an intermittent connection between the modulating furnace control and the main wire harness at connector PL8 or between the main wire harness and the gas valve at connector PL17.			14
23.	Turn power off and put setup switch SW1-6 in the OFF position.			24
24.	Disconnect PL8 from the modulating furnace control and PL17 from the gas valve.			25

STEP	ACTION	YES	NO	GO TO
25.	Do you have continuity between PL8-2 and PL17-2? **Note:** The terminals in PL8 can be permanently damaged if the voltmeter probe is jammed into the terminal end of the connector. Use caution when checking.	13	26	
26.	You have an open wire or a bad terminal on the YELLOW wire between connector PL8 and PL17. Repair or replace the wire harness.			8
27.	Put setup switch SW1-6 in the OFF position.			28
28.	Connect a DC voltmeter across terminals PL17-3 ORANGE (+) and PL17-4 GREEN/YELLOW (-). Is there 5-vdc across the ORANGE and GREEN/YELLOW wires?	29	17	
29.	Check the gas valve PWM output. To do this connect a DC voltmeter across terminals PL17-3 ORANGE (+) and PL17-4 GREEN/YELLOW (-) then run COMPONENT TEST by turning setup switch SW1-6 ON. In approximately 17 seconds the voltage will drop briefly from 5.0-vdc. The voltage drop will be several volts or more and will last for 1 to 2 seconds. If everything is working properly this will happen once. If power was reset before running the COMPONENT TEST there will be 2 shorter duration voltage drops spaced further apart. The time between these voltage drops depends on whether the valve has been converted to propane.			30
30.	Does the voltage drop as described in step 29?	31	17	
31.	Put setup switch SW1-6 in the OFF position.			32
32.	Connect a DC voltmeter across terminals PL8-3 ORANGE (+) and COM-24V (-)then run COMPONENT TEST by turning setup switch SW1-6 ON.			33
33.	Does the voltage drop as described in step 29?	13	34	
34.	You have an open wire or a bad terminal on the ORANGE wire between connector PL8 and PL17. Repair or replace wire harness.			8
35.	Does status code 3 + 5 flash when the blower turns on?	37	36	
36.	24-vac power to the stepper motor electronics is intermittent. Disconnect connector PL8 and PL17 and check the terminals at both ends of the RED wire. Repair or replace the wire harness.			8
37.	Disconnect jumper wire across R and W/W1 thermostat terminals and wait for the blower to turn off.			38
38.	Disconnect all accessories (humidifiers and/or EAC's).			39
39.	Jumper the R and W/W1 thermostat terminals.			40
40.	Does status code 3 + 5 flash when the blower turns on?	43	41	
41.	One of the accessories disconnected is creating electrical interference with the gas valve. Either isolate the accessory with a relay or replace the accessory.			42
42.	Fix the problem.			8
43.	Either the blower motor is creating electrical interference with the gas valve or the gas valve is overly sensitive. Replace the gas valve. If the problem persists replace entire blower motor including the blower control module.			42

Status Code 4 + 1

BLOWER MOTOR FAULT - This status code indicates the blower failed to reach 250 RPM or the blower failed to communicate to the modulating furnace control within 30 seconds after being turned ON or within 10 seconds during steady-state operation.

STEP	ACTION	YES	NO	GO TO
1.	Shut the power off, remove the blower door and disconnect communication connector PL7 (if used) or the R thermostat lead (if used) from the furnace control board.			2
2.	Turn the power on and depress the door switch. Use a piece of tape to hold it closed.			3
3.	Jumper the R and W/W1 thermostat terminals.			4
4.	Observe the operation of the furnace for the next 5 minutes or until fault occurs.			5
5.	Does status code 4 + 1 flash?	9	6	
6.	Does a different status code flash?	7	8	
7.	Go to page number indicated in the Index for the section covering the status code.			INDEX
8.	Go to page number Indicated in Index for CLEANUP AND START-UP INSTRUCTIONS.			INDEX
9.	Did the blower motor turn ON and come up to speed before status code flashes?	35	10	
10.	Remove tape from door switch and turn power off at main disconnect.			11
11.	Does the blower wheel rub against blower housing?	12	13	
12.	Fix the problem.			8
13.	Does the blower wheel turn freely?	14	15	
14.	Is blower wheel firmly mounted on motor shaft?	16	12	
15.	Replace the entire blower motor or blower control module attached to the blower motor. If you replace the blower control module go to step 41. Always inspect failed motor for water damage. If present, find source of water and fix it. Check A-coil and/or humidifier.			12
16.	Disconnect jumper wire across R and W/W1 thermostat terminals.			17
17.	Are all pins and wire leads intact on connectors between the modulating furnace control and the blower motor.	18	12	
18.	Turn the power on and depress the door switch. Use a piece of tape to hold it closed.			19
19.	Do you have 115-vac across the BLACK blower motor wire connected to L1 and the WHITE blower motor wire connected to L2?	21	20	
20.	Replace the modulating furnace control.			8
21.	Do you have 115-vac across the BLACK and WHITE power leads at the blower motor?	23	22	
22.	You have an open wire or bad terminal on either the BLACK or WHITE wire between the modulating furnace control and the blower motor. If you have a power choke disconnect it and check for continuity.			12
23.	Check the blower 12-vdc supply. To do this connect a DC voltmeter across terminals PL3-1 RED (+) and PL3-2 GREEN (-). Is there 12-vdc across the RED and GREEN blower wires?	24	20	
24.	Connect a DC voltmeter across the RED (+) and GREEN (-) wires at connector PL13. Is there 12-vdc across the RED and GREEN blower wires?	26	25	
25.	You have an open wire or bad terminal on either the RED or GREEN wire between connectors PL3 and PL13. Repair it or replace harness.			8
26.	Check the blower motor serial input signal. To do this disconnect PL3 from the furnace control and connect a DC voltmeter across terminals PL3-3 (+) and PL3-2 (-) on the modulating furnace control. Is there 5-vdc across PL3-3 and PL3-2? **Note:** The voltage should be very stable and should not fluctuate more than .02-vdc. If the voltage fluctuates get a different volt meter before going on to the following steps. **Note:** Since the modulating furnace control and the blower motor are continuously communicating you do not actually need to run the blower motor to troubleshoot the PL3 connection.	27	20	
27.	Reconnect PL3 to the modulating furnace control and connect a DC voltmeter across terminals PL3-3 YELLOW (+) and PL3-2 GREEN (-). Does the voltage appear to fluctuate more than it did in step 26? **Note:** Typical voltmeters will show a fluctuation of .2-vdc to 1-vdc. The amount of fluctuation is not important and you could see even more fluctuation depending on the voltmeter you use.	28	20	

STEP	ACTION	YES	NO	GO TO
28.	Check the blower motor serial output signal. To do this disconnect PL3 from the furnace control and connect a DC voltmeter across terminals PL3-4 (+) and PL3-2 (-) on the modulating furnace control. The voltage should be near 0-vdc but it will fluctuate briefly several times a second. If you have an analog voltmeter the needle will briefly go high several times a second. If you have a digital voltmeter with a bar graph it will show a large change in magnitude on the bar graph several times a second. If you have a plain digital voltmeter it will show a brief fluctuation in voltage and the magnitude may vary depending on the volt meter used. **Note:** Some voltmeters will not sense this fluctuation at all. Test your voltmeter on a known good furnace prior to servicing this product. **Note:** You can also make a simple blinky light with a 1 KΩ resistor and an LED (RED works best). These parts can be purchased at a nearby Radio Shack. The schematic is shown below:  When using the blinky light the LED will flash briefly several times a second when the blower motor serial output signal is working properly. LED's are directional and the lead closest to the flat side goes to PL3-2.			29
29.	Does the voltage fluctuate as described in step 28?	30	20	
30.	Reconnect PL3 to the modulating furnace control and connect a DC voltmeter across terminals PL3-4 BLUE (+) and PL3-2 GREEN (-). Does the voltage fluctuate as described in step 28?	31	33	
31.	Disconnect PL13 from the blower motor and connect a DC voltmeter across terminals PL13-3 BLUE (+) and PL13-4 GREEN (-). Does the voltage fluctuate as described in step 28?	15	32	
32.	You have an open wire or bad terminal on the BLUE wire between connectors PL3 and PL13. Repair it or replace harness.			8
33.	Disconnect PL13 from the blower motor and connect a DC voltmeter across terminals PL13-3 BLUE (+) and PL13-4 GREEN (-). Does the voltage fluctuate as described in step 28?	15	34	
34.	You have short to ground on the BLUE wire between connectors PL3 and PL13. Repair it or replace harness.			8
35.	The blower motor and furnace control are communicating but the RPM must be below 250.			36
36.	Disconnect jumper wire across R and W/W1 thermostat terminals.			37
37.	Remove tape from door switch and turn power off at main disconnect.			38
38.	Does the blower wheel rub against blower housing?	12	39	
39.	Does the blower wheel turn freely?	40	15	
40.	Is blower wheel firmly mounted on motor shaft?	15	12	

⚠ **WARNING: Wait at least 5 minutes after disconnecting line voltage from equipment before opening blower motor to prevent electric shock which can cause personal injury or death.**

STEP	ACTION	YES	NO	GO TO
41.	Remove tape from door switch and turn power off at main disconnect.			42
42.	Disconnect both multi-pin connectors from blower control module attached to the blower motor. Be sure to depress release latches on connectors or they may get damaged.			43
43.	Remove blower assembly from furnace.			44
44.	Remove two phillips head or two ¼-in. hex head bolts from blower control module attached to blower motor.			45
45.	Carefully lift blower control module off blower motor. Depress latch on internal connector to disconnect blower control module from motor portion of blower motor. DO NOT PULL ON WIRES. GRIP PLUG ONLY.			46

STEP	ACTION	YES	NO	GO TO
46.	When blower control module is completely detached from blower motor, verify with standard ohmmeter that the resistance from each motor lead in motor plug to unpainted motor end plate is greater than 100k ohms. Then verify motor windings are not shorted or open by measuring resistance between each combination of pins in motor plug (there are three different combinations, pin 1-2, pin 2-3, and pin 1-3). Resistance should be approximately equal across each combination of pins.			47
47.	Did the motor pass the resistance check?	48	50	
48.	Does blower wheel turn freely with blower control module removed?	49	50	
49.	Replace blower control module. Inspect failed blower control module for water damage. If present, find source of water and fix. Check A-coil and/or humidifier.			8
50.	Replace entire blower motor including blower control module. Inspect blower control module for water damage. If present, find source of water and fix. Check A-coil and/or humidifier.			8

Status Code 4 + 2

INDUCER MOTOR FAULT - This status code indicates the inducer has not started within 20 seconds after a call for heat, the inducer RPM is outside its valid range of operation, or the inducer RPM signal was lost for 5 seconds during operation.

STEP	ACTION	YES	NO	GO TO
1.	Shut the power off, remove both doors and disconnect communication connector PL7 (if used) or the R thermostat lead (if used) from the furnace control board.			2
2.	Turn the power on and depress the door switch. Use a piece of tape to hold it closed.			3
3.	Jumper the R and W/W1 thermostat terminals.			4
4.	Observe the operation of the furnace for the next 8 minutes or until fault occurs.			5
5.	Does status code 4 + 2 flash?	9	6	
6.	Does a different status code flash?	7	57	
7.	Go to page number indicated in the Index for the section covering the status code.			INDEX
8.	Go to page number Indicated in Index for CLEANUP AND START-UP INSTRUCTIONS.			INDEX
9.	Does the inducer motor turn on?	27	10	
10.	Hook an AC voltmeter across PL2-4 and L2 on the modulating furnace control. Is 115-vac across PL2-4 and L2?	12	11	
11.	Replace the modulating furnace control.			8
12.	Do you have 115-vac across PL11-2 and PL11-1? **Note:** If the furnace has an inducer motor adapter harness check for 115-vac across pin 6 and pin 12 at the inducer motor connector. The terminals can be permanently damaged if the voltmeter probe is jammed into the terminal end of the connector. Use caution when checking.	14	13	
13.	You have an open wire or bad terminal on either the BLACK or WHITE wire between the modulating furnace control and the inducer motor. Repair or replace main wire harness.			8
14.	Are all pins and wire leads intact on connectors between modulating furnace control and the inducer motor?	16	15	
15.	Fix problem.			8
16.	Turn power off and disconnect jumper wire across R and W/W1 thermostat terminals.			17
17.	Turn power back on.			18
18.	Check the inducer PWM line. To do this disconnect 3-pin connector PL16 from the inducer motor or the inducer motor adapter harness (when used), and connect a DC voltmeter across terminals PL16-1 BROWN (+) and PL16-2 YELLOW (-). **Note:** The terminals can be permanently damaged if the voltmeter probe is jammed into the terminal end of the connector. Use caution when checking. Run COMPONENT TEST by turning setup switch SW1-6 ON. Does voltage across PL16-1 and PL16-2 change between states as shown below? - State 1 – OFF (2.0 – 5.0 vdc) - State 2 – MED (9.0 – 13.0 vdc)	23	19	
19.	Turn power off.			20
20.	Do you have continuity between PL16-1 and PL1-11?	21	22	
21.	Do you have continuity between PL16-2 and PL1-9?	11	22	
22.	You have an open wire or bad terminal on either the BROWN or YELLOW wire between the modulating furnace control and the inducer motor. Repair or replace the wire harness.			8

STEP	ACTION	YES	NO	GO TO
23.	Reconnect PL16 to the inducer motor and put setup switch SW1-6 in the OFF position.			24
24.	Does inducer wheel turn freely?	26	25	
25.	Replace the inducer motor control (if you have a 2 piece design) or the inducer motor assembly.			8
26.	Does the inducer wheel rub against inducer housing?	15	25	
27.	Does status code 4 + 2 flash within 20 seconds after a call for heat?	28	39	
28.	Turn power off and disconnect jumper from the R and W/W1 thermostat terminals.			29
29.	Disconnect collector box tube to pressure switch assembly.			30
30.	Turn power on and jumper the R and W/W1 thermostat terminals.			31
31.	Does status code 4 + 2 flash within 20 seconds after a call for heat?	32	33	
32.	Reconnect collector box tube to pressure switch assembly.			34
33.	Reconnect collector box tube to pressure switch assembly.			40
34.	Disconnect jumper across R and W/W1 thermostat terminals.			35
35.	Check the RPM feedback line. To do this connect a DC voltmeter across terminals PL16-1 BROWN (+) and PL16-3 ORANGE (-), then put setup switch SW1-6 for COMPONENT TEST in the ON position. Does the voltage across PL16-1 and PL16-3 change between states as shown below? - State 1 – OFF (15.0 – 17.0 vdc) - State 2 – MED (12.0 – 14.0 vdc)	36	25	
36.	Turn power off.			37
37.	Do you have continuity between PL16-3 and PL1-7?	11	38	
38.	You have an open wire or bad terminal on the ORANGE wire between PL16 and PL1.			15
39.	Does fault occur a few seconds after the medium pressure switch MPS makes? **Note:** Check for 24-vac between the N.O. (Normally Open) contact on medium pressure switch MPS and Com on the modulating furnace control to know when the medium pressure switch MPS makes. **Note:** You may need to wait a few minutes for the modulating furnace control to ramp the inducer motor back up to speed.	40	55	
40.	Is the inducer motor rotating in direction shown on inducer housing?	41	25	
41.	Turn power off and disconnect jumper from the R and W/W1 thermostat terminals.			49
42.	Connect 1 side of slope manometer with a tee to collector box pressure tap. Refer to pressure check diagram in Appendix C.			43
43.	Turn power on and jumper the R and W/W1 thermostat terminals.			44
44.	Do you have more than 1.08 in. wc pressure drop across heat exchangers when medium pressure switch MPS makes? **Note:** Check for 24-vac between the N.O. (Normally Open) contact on medium pressure switch MPS and Com on the modulating furnace control to know when the medium pressure switch MPS makes.	45	46	
45.	Replace the pressure switch assembly.			8
46.	Turn power off.			47
47.	Is inducer wheel okay?	54	48	
48.	Replace the inducer motor assembly.			8
49.	Check the collector box pressure tap for blockages. Use the back end of a small drill bit to clear debris out of the collector box pressure tap opening. It may be necessary to remove the collector box and clear away the debris if it keeps clogging.			50
50.	Check the tubing between the collector box and the pressure switch assembly for leaks or blockages.			51
51.	Check the tube between the pressure switches for leaks or blockages.			52
52.	Check the unused trap openings and make sure they are plugged.			53
53.	Were there any leaks or blockages found in steps 49-52?	15	42	
54.	You have excessive restriction in the vent pipe. Also check for proper vent sizing for installation.			15
55.	Make sure all pins and wire leads are intact on connectors between modulating furnace control and the inducer motor.			56
56.	Replace the inducer motor control (if you have a 2 piece design) or the inducer motor assembly. If problem still persists after replacing the inducer motor, contact your distributor.			8
57.	Turn power off and disconnect jumper from the R and W/W1 thermostat terminals.			58
58.	Install the control door.			59
59.	Turn power on and jumper the R and W/W1 thermostat terminals.			60
60.	Does status code 4 + 2 flash?	62	61	

STEP	ACTION	YES	NO	GO TO
61.	Does a different status code flash?	7	65	
62.	Is there any frost build-up on combustion-air inlet?	63	64	
63.	The problem is caused by reversed vent and combustion-air pipes or some other moist air entering combustion-air pipe.			15
64.	You have excessive restriction in combustion-air or vent pipe. Also check for proper vent sizing for installation.			15
65.	While the unit is operating in minimum heat jumper R and W2.			66
66.	Observe the operation of the furnace for the next 8 minutes or until fault occurs.			67
67.	Does status code 4 + 2 flash?	25	68	
68.	Does a different status code flash?	7	8	

Status Code 4 + 3

LOW OR MEDIUM PRESSURE SWITCH OPEN WHILE MEDIUM OR HIGH PRESSURE SWITCH IS CLOSED - This status code can occur as a result of the low pressure switch LPS not making during a call for heat. Keep in mind that whenever status code 4 + 3 occurs the modulating furnace control shuts unit down, turns the inducer off, and gas remains off.

- INTERMEDIATE, OR MAXIMUM HEAT

1. PREPURGE - If the medium pressure switch MPS makes and the low pressure switch LPS is still open the modulating furnace control starts flashing status code 4 + 3, shuts unit down, and waits 2 minutes before restarting the heating cycle. Same goes if the high pressure switch HPS makes and the medium pressure switch MPS is still open.

STEP	ACTION	YES	NO	GO TO
1.	Turn power off, remove the blower door and disconnect communication connector PL7 (if used) or the R thermostat lead (if used) from the furnace control board.			2
2.	Turn the power on and depress the door switch. Use a piece of tape to hold switch closed.			3
3.	Jumper the R and W/W1 thermostat terminals.			4
4.	Observe the operation of the furnace until ignition.			5
5.	Does status code 4 + 3 flash?	9	6	
6.	Does a different status code flash?	7	8	
7.	Go to page number indicated in the Index for the section covering the status code.			INDEX
8.	Go to page number Indicated in Index for CLEANUP AND START-UP INSTRUCTIONS.			INDEX
9.	Are the pressure switches wired correctly?	11	10	
10.	Fix problem.			8
11.	Is 24-vac across YELLOW wire on the low pressure switch LPS and COM-24V on modulating furnace control?	14	12	
12.	Is 24-vac across connector terminal PL1-2 and COM-24V on modulating furnace control?	13	18	
13.	You have an open wire or bad terminal on the YELLOW wire from the modulating furnace control to the low pressure switch LPS. Repair it or replace the harness.			8
14.	Is 24-vac across ORANGE wire on the low pressure switch LPS and COM-24V on modulating furnace control? **Note:** You may need to wait a few minutes for the modulating furnace control to ramp the inducer motor back up to speed.	15	19	
15.	Is 24-vac across connector terminal PL1-4 and COM-24V on modulating furnace control?	20	16	
16.	Turn power off and disconnect jumper wire across R and W/W1 thermostat terminals.			17
17.	You have an open circuit between the low pressure switch LPS and the modulating furnace control. This includes all the ORANGE wires interconnecting the low pressure switch LPS to the modulating furnace control. It also includes the low gas pressure switch LGPS (if used). Check the continuity across the low gas pressure switch LGPS (if used). If there is no continuity check the propane line pressure. If the propane line pressure is correct replace the low gas pressure switch LGPS. Check the continuity of each ORANGE wire interconnecting the low pressure switch LPS and the modulating furnace control. Repair open wire or replace harness.			8
18.	Replace the modulating furnace control.			8
19.	Replace the pressure switch assembly.			8

STEP	ACTION	YES	NO	GO TO
20.	Is 24-vac across GRAY wire on the medium pressure switch MPS and COM-24V on modulating furnace control?	22	21	
21.	You have an open wire or bad terminal on the GRAY wire from the high pressure switch HPS to the medium pressure switch MPS. Repair it or replace the harness.			8
22.	Is 24-vac across VIOLET wire on the medium pressure switch MPS and COM-24V on modulating furnace control? **Note:** You may need to wait a few minutes for the modulating furnace control to ramp the inducer motor back up to speed.	23	19	
23.	Is 24-vac across connector terminal PL1-3 and COM-24V on modulating furnace control?	18	24	
24.	Turn power off and disconnect jumper wire across R and W/W1 thermostat terminals.			25
25.	You have an open wire or bad terminal on the VIOLET wire from the medium pressure switch MPS to the modulating furnace control.			10

Status Code 6 + 1

IGNITION LOCKOUT - This status code indicates the furnace failed to ignite gas and/or prove flame in 4 attempts. The modulating furnace control will auto-reset in 3 hours. If the inducer motor is not running during lockout refer to status code 6.

If the inducer motor is running at full speed during lockout this indicates that flame sense was lost 3 times within 60 minutes of cumulative gas valve operating time after the gas valve was already ON for 70 seconds. It is usually caused by flame rollout that causes loss of flame sense before the flame rollout switch can trip.

CLEANUP AND START-UP INSTRUCTIONS

1. Start furnace using procedure outlined on Lighting Instructions attached to furnace. Observe operation of furnace through at least 1 complete heating cycle controlled from the room thermostat. Observe cycle for 20 minutes or until a status code is flashed. If status code flashes, refer to the Index.
2. Recycle as necessary and check thermostat heat anticipator setting, gas input rates, and temperature rises. These procedures are outlined in Installation, Start-Up, and Operating Instructions.
3. Check operation of safety devices: limit switch and flame rollout switch.
4. Put all setup switches in their proper positions.
5. Remove tape from the door switch.
6. Replace thermostat leads (if necessary).
7. Set thermostat in AUTO position, calling for heat.
8. Set thermostat to desired temperature.
9. Replace both furnace doors. Clean up.

APPENDIX A
BOARD LAYOUT AND WIRING SCHEMATICS

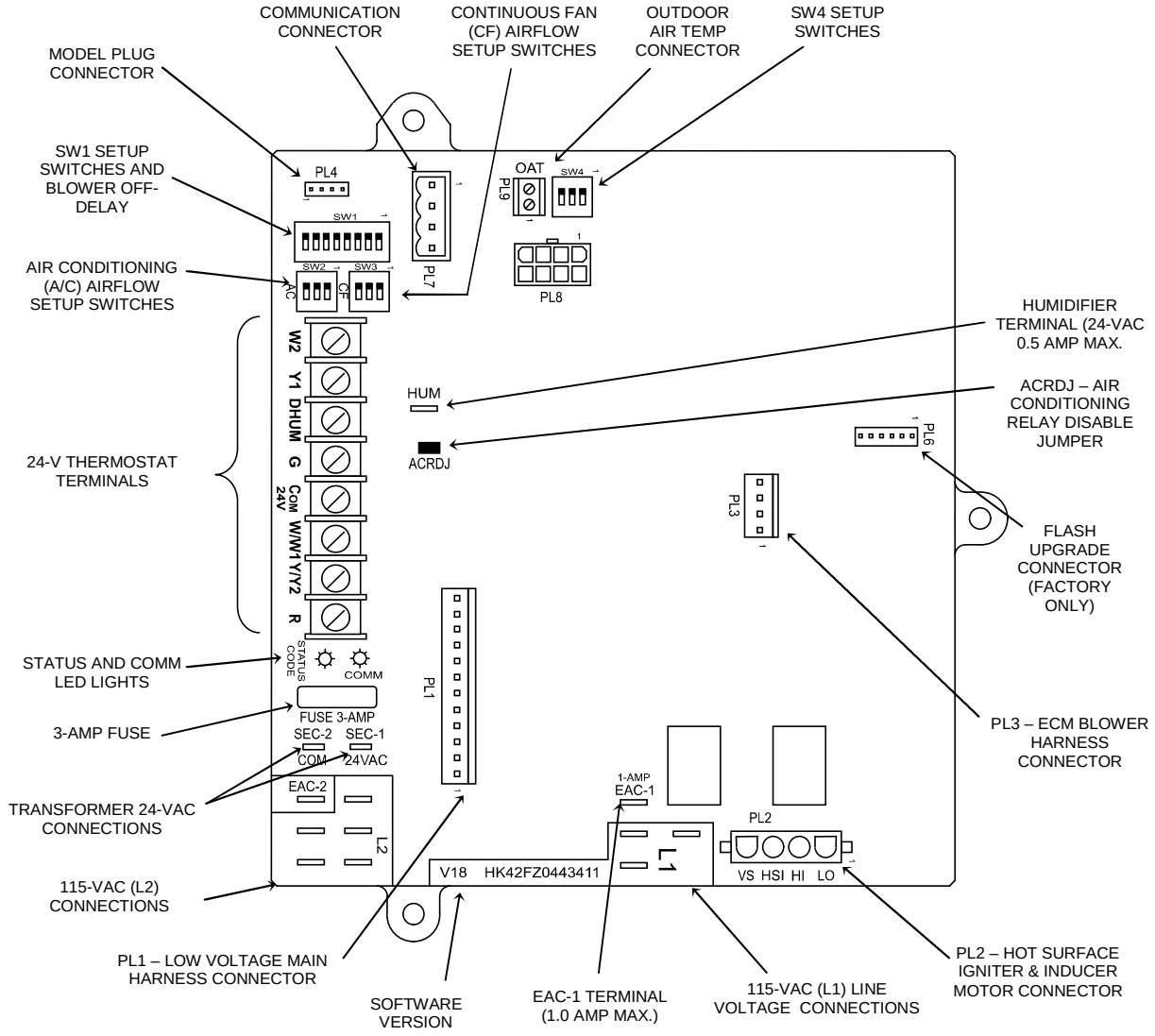
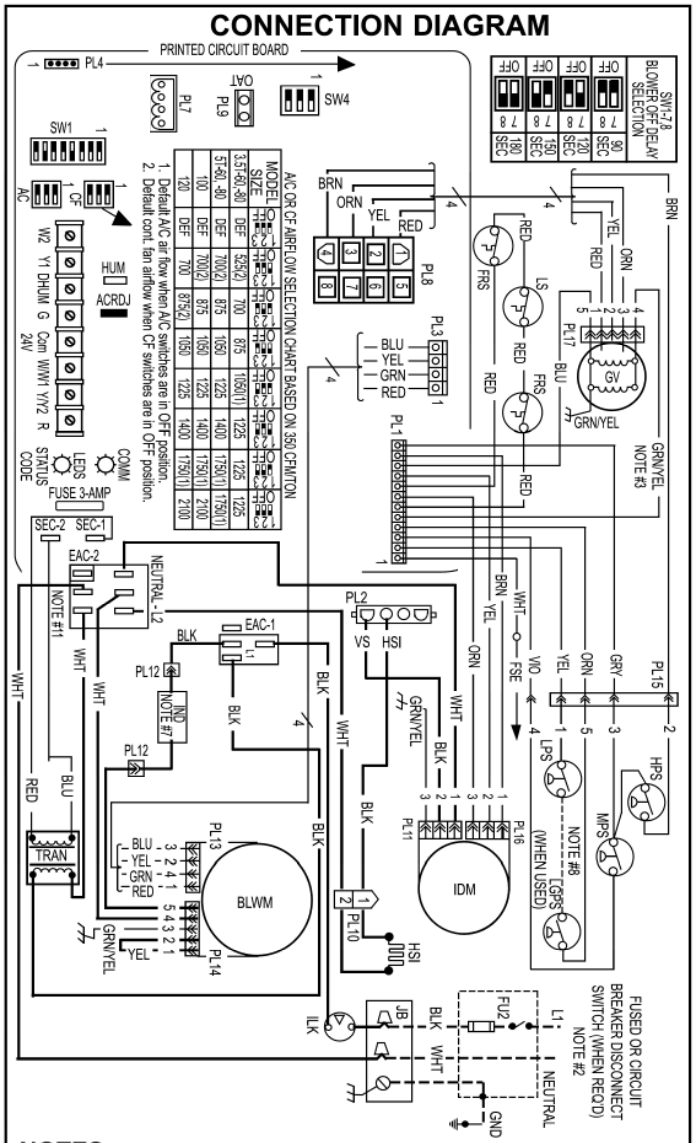
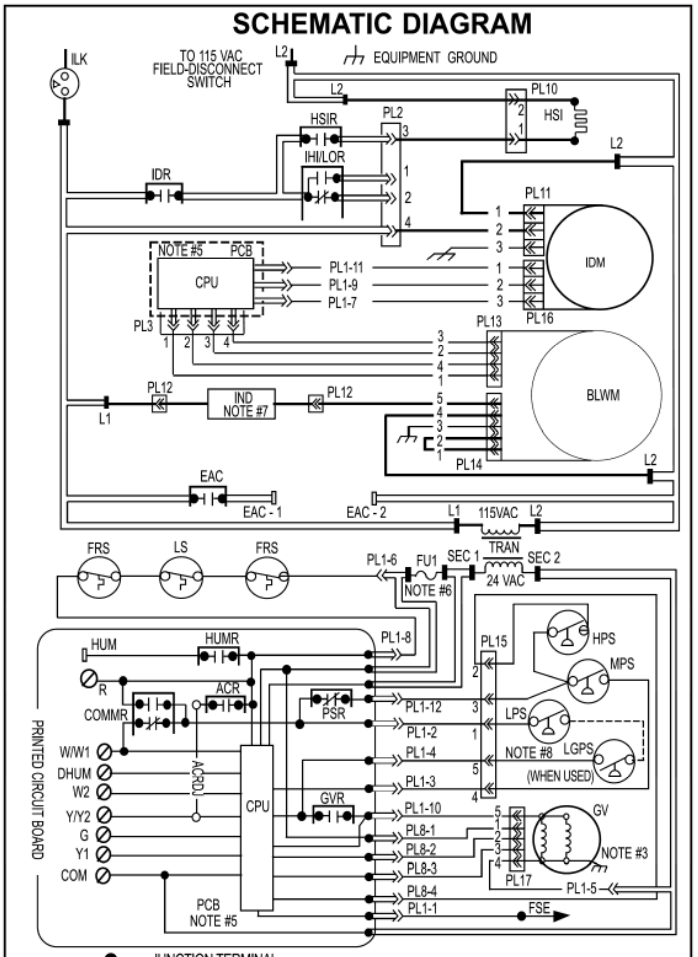


Fig. 1 – Modulating Furnace Control



NOTES:

1. If any of the original equipment wire is replaced use wire rated for 105ºC.
2. Use only copper wire between the disconnect switch and the furnace junction box (JB).
3. This wire must be connected to furnace sheet metal for control to prove flame.
4. Symbols are electrical representation only.
5. Solid lines inside PCB are printed circuit board conductors and are not included in legend.
6. Replace only with a 3 amp fuse.
7. Inductor is used with 3/4 hp and 1 hp ECM Blower motors.
8. Factory connected when (LGPS) not used.
9. Blower off-delay, gas heating selections are (90, 120, 150, 180) seconds, cooling or heat pump 90 seconds or 5 seconds when dehumidify call is active.
10. Ignition lockout will occur after four consecutive usuccessful trials for ignition. Control will auto-reset after three hours.
11. Any of the 5 wires shown within the NEUTRAL L2 box can be connected to any terminal within the box.
12. Blower motor (BLWM) and Inducer motor (IDM) are locked-rotor overload protected by redundant electronic control circuits.



LEGEND

	JUNCTION TERMINAL		FACTORY POWER WIRING (115VAC)
	CONTROL TERMINAL		FACTORY CONTROL WIRING (24VAC)
	PCB CONTROL TERMINAL		FIELD CONTROL WIRING (24VAC)
	FIELD EARTH GROUND		CONDUCTOR ON CONTROL
	EQUIPMENT GROUND		FIELD WIRING SCREW TERMINAL
			PLUG RECEPTACLE

A/C	Air Conditioning (Adjustable Airflow - CFM)	LPS	Low Pressure Switch, SPST (N.O.)
ACR	Air Conditioning Relay, SPST (N.O.)	LS	Limit Switch, Auto-Reset, SPST (N.C.)
ACRDJ	Air Conditioning Relay Defeat Jumper	MPS	Medium Pressure Switch, SPST (N.C.)
BLWM	Blower Motor (ECM)	PCB	Printed Circuit Board
CF	Continuous Fan (Adjustable Airflow - CFM)	PL1	12-Circuit Connector
COMMR	Communication Relay, SPDT	PL2	4-Circuit HSI & IDM Connector
CPU	Microprocessor/Circuitry	PL3	4-Circuit ECM BLWM Connector
DHUM	DHUM Connection (24VAC)	PL4	4-Circuit Model Plug Connector
EAC-1	Electronic Air Cleaner Connection (115VAC 1.0 Amp Max.)	PL7	4-Circuit Communication Connector
EAC-2	Electronic Air Cleaner Connection (Common)	PL8	8-Circuit Modulation Connector
FRS	Flame-Rollout Switch, Man. Reset, SPST (N.C.)	PL9	2-Circuit OAT Connector
FSE	Flame e-Proving Sensor Electrode	PL10	2-Circuit HSI Connector
FU1	Fuse, 3 Amp, Automotive Blade Type Factory Installed	PL11	3-Circuit Inducer Power Connector
FU2	Fuse or Disconnect	PL12	1-Circuit Inductor Splice Connector
GV	Gas Valve	PL13	4-Circuit ECM Blower Ctrl. Connector
GVR	Gas Valve Relay, DPST (N.O.)	PL14	5-Circuit ECM Blower Power Connector
HPS	High Pressure Switch, SPST (N.O.)	PL15	6-Circuit Pressure Sw. Assy. Connector
PSR	Pressure Switch Relay, SPST (N.C.)	PL16	3-Circuit Inducer Control Connector
HSI	Hot Surface Igniter (115VAC)	PL17	5-Circuit Modulating Gas Valve Connector
HSIR	Hot Surface Igniter Relay, SPST (N.O.)	SW1-1	Manual Switch, Status Code Recall
HUM	24VAC Humidifier Connection (0.5 Amp Max.)	SW1-2	Manual Switch, Minimum Heat Only
HUMR	Humidifier Relay, SPST (N.O.)	SW1-3	Manual Switch, Min/Int Heat Rise Adj.
IDM	Induced Draft Motor, ECM	SW1-4	Manual Switch, Comfort/Effy. Adj.
IDR	Inducer Motor Relay, SPST (N.O.)	SW1-5	Manual Switch, Cooling CFM/Ton
IHI/LOR	Inducer Motor Speed Change Relay, SPDT	SW1-6	Manual Switch, Component Test
ILK	Blower Door Interlock Switch, SPST (N.O.)	SW1-7,8	Manual Switches, Blower Off-Delay
IND	Inductor (Note #7)	SW4-1	Manual Switch, Twinning Main (OFF) / Sec.
LED	Light Emitting Diode for Status Codes	SW4-2	Manual Switch, Intermediate-Heat SPST
LGPS	Low Gas Pressure Switch, SPST (N.O.)	SW4-3	Manual Switch, Future Use
		TRAN	Transformer, 115VAC / 24VAC

Fig. 2 – Wiring Schematic

APPENDIX B
ECM BLOWER MOTOR DESCRIPTION & OPERATION

The Regal-Beloit Electronically Commutated Motor (ECM) shown in figure 3 is the newest generation of variable speed blower motors. This motor has all of the capabilities of the previous ECM blower motor but has internal memory storage which provides operational information to the manufacturer when the motor is returned. In addition this new design has improved reliability due to the consolidation of two circuit boards into one. This single circuit board is completely potted and is less susceptible to water contamination then the previous design.

As in the previous design this motor does not have to be pre-programmed at the factory. Instead the modulating furnace control programs the ECM blower motor upon application of power to the ECM blower motor via the serial communication link between the modulating furnace control and the ECM blower motor. This eliminates the need for a multitude of different ECM blower motors where each one is programmed for one specific furnace model. The ECM blower motor is energized with 115-vac whenever power is available at the modulating furnace control, but operates only when the modulating furnace control communicates the proper serial commands to the ECM blower motor at PL13.

The ECM blower motor is first fed 115-vac power through the 5-pin connector PL14. The 115-vac power is then rectified to DC by a diode module. After rectification, the DC signal is electronically commutated and fed in sequential order to 3 stator windings. The frequency of commutation pulses determines motor speed.

Setting up the desired airflow CFM for an ECM blower motor is done by setting the A/C or CF selections on the modulating furnace control shown in figure 1. The ECM blower motor then delivers requested airflow CFM as defined by serial commands received from the modulating furnace control.

The ECM blower motor is configured via the modulating furnace control to react to changes in system static pressures to maintain nearly constant airflow CFM. The ECM blower motor delivers requested airflow CFM up to about 1.0 in.w.c. of static pressure for most airflow settings. The modulating furnace control is pre-programmed and contains all the information relative to each furnace model for all modes of operation. Blower characteristics for each model (airflow CFM, torque, and speed versus static pressure) are known from laboratory testing. If any 3 characteristics are known, the fourth can be defined. The airflow CFM is known because of the A/C and CF selections, model plug, and the thermostat input signals on the modulating furnace control. The modulating furnace control then communicates the airflow CFM to the ECM blower motor. Torque is known by the ECM blower motor because it is directly related to armature current which is measured by the ECM blower motor control. Speed is measured from the generated back EMF by the ECM motor control. This information (airflow CFM, torque and speed) are entered into an expression which calculates torque from speed and airflow CFM numbers. If the calculation does not match stored blower characteristics, torque is adjusted every 0.8 seconds until agreement is reached. The ECM blower motor does not directly measure static pressure, but does react to changes in static pressure to maintain constant airflow CFM.

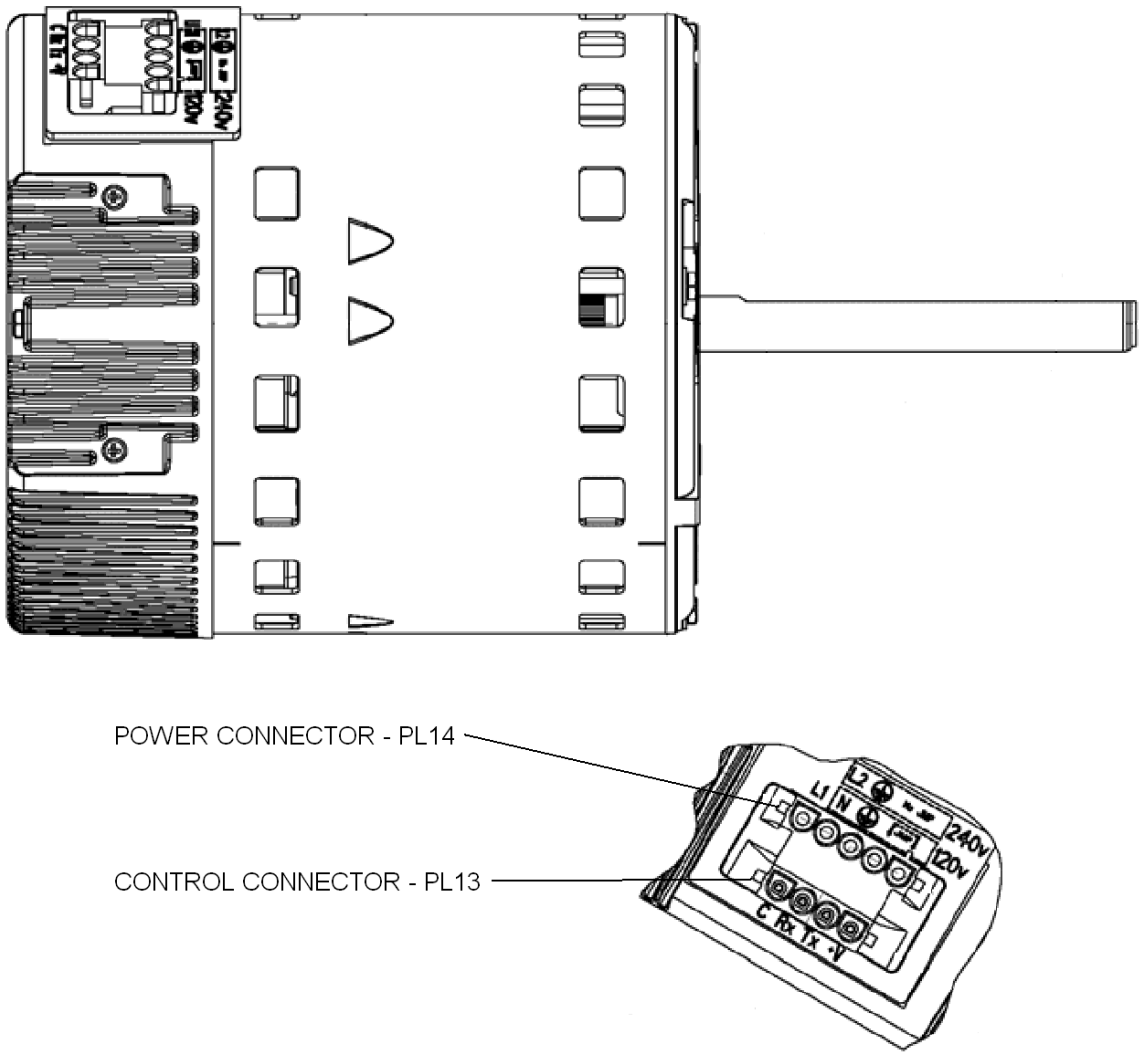


Figure 3 – ECM Blower Motor

APPENDIX C
PRESSURE CHECK DIAGRAM

PRESSURE SWITCH MAKE/BREAK POINTS

UNIT SIZE (BTUH)	HIGH PRESSURE SWITCH		MEDIUM PRESSURE SWITCH		LOW PRESSURE SWITCH	
	Make Point	**Break Point**	**Make Point**	**Break Point**	**Make Point**	**Break Point**
60,000 (17.5" casing)	1.21 in.wc max	1.05 in. wc +/- 0.06	0.85 in. wc max	0.70 in. wc +/- 0.05	0.62 in. wc max	0.47 in. wc +/- 0.05
60,000 (21" casing)	1.46 in.wc max	1.29 in. wc +/- 0.07	1.00 in. wc max	0.85 in. wc +/- 0.05	0.64 in. wc max	0.49 in. wc +/- 0.05
80,000	1.58 in.wc max	1.40 in. wc +/- 0.08	1.00 in. wc max	0.85 in. wc +/- 0.05	0.75 in. wc max	0.60 in. wc +/- 0.05
100,000	1.58 in.wc max	1.40 in. wc +/- 0.08	1.08 in. wc max	0.93 in. wc +/- 0.05	0.87 in. wc max	0.72 in. wc +/- 0.05
120,000	1.58 in.wc max	1.40 in. wc +/- 0.08	1.05 in. wc max	0.90 in. wc +/- 0.05	0.80 in. wc max	0.65 in. wc +/- 0.05

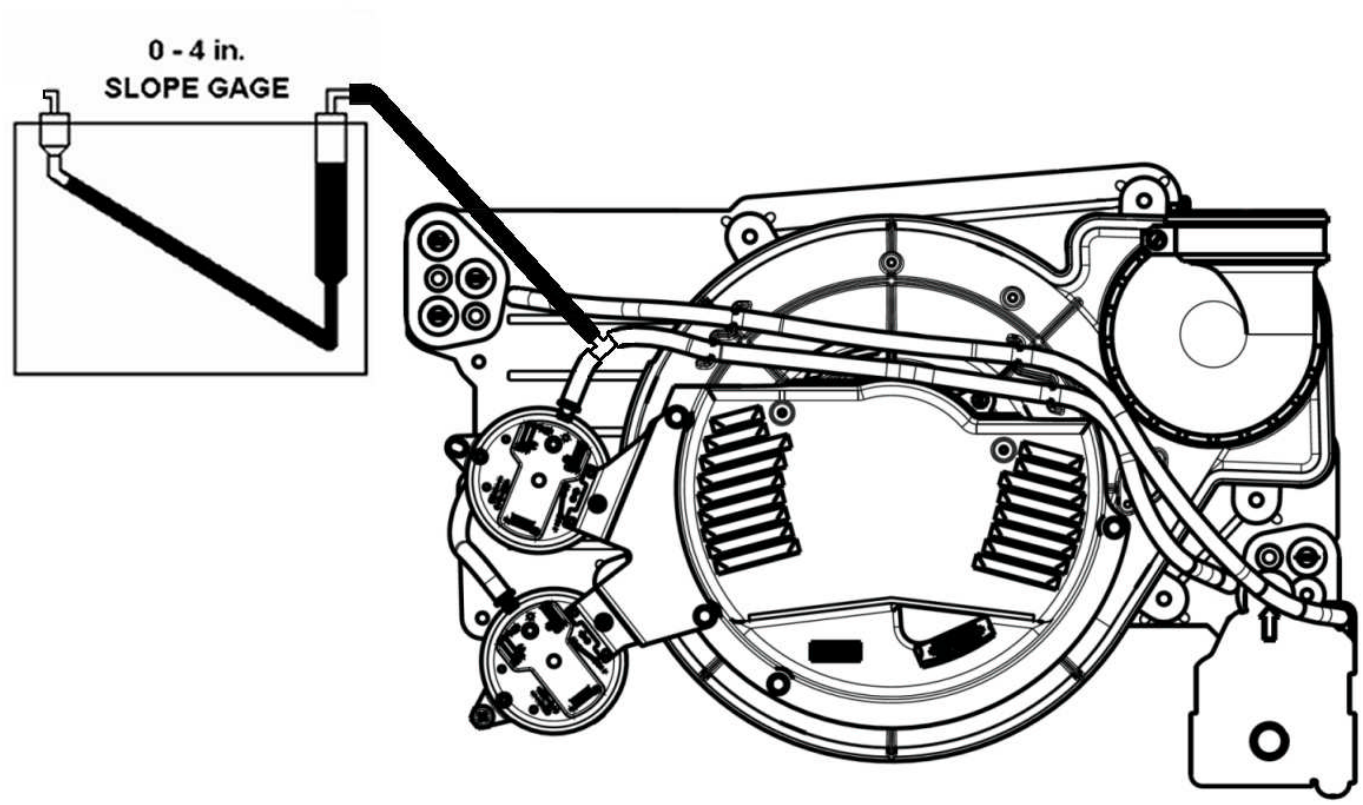


Figure 4 - Pressure Check Diagram
(Appearance May Vary)

APPENDIX D
STATIC PRESSURE READING LOCATION DIAGRAMS

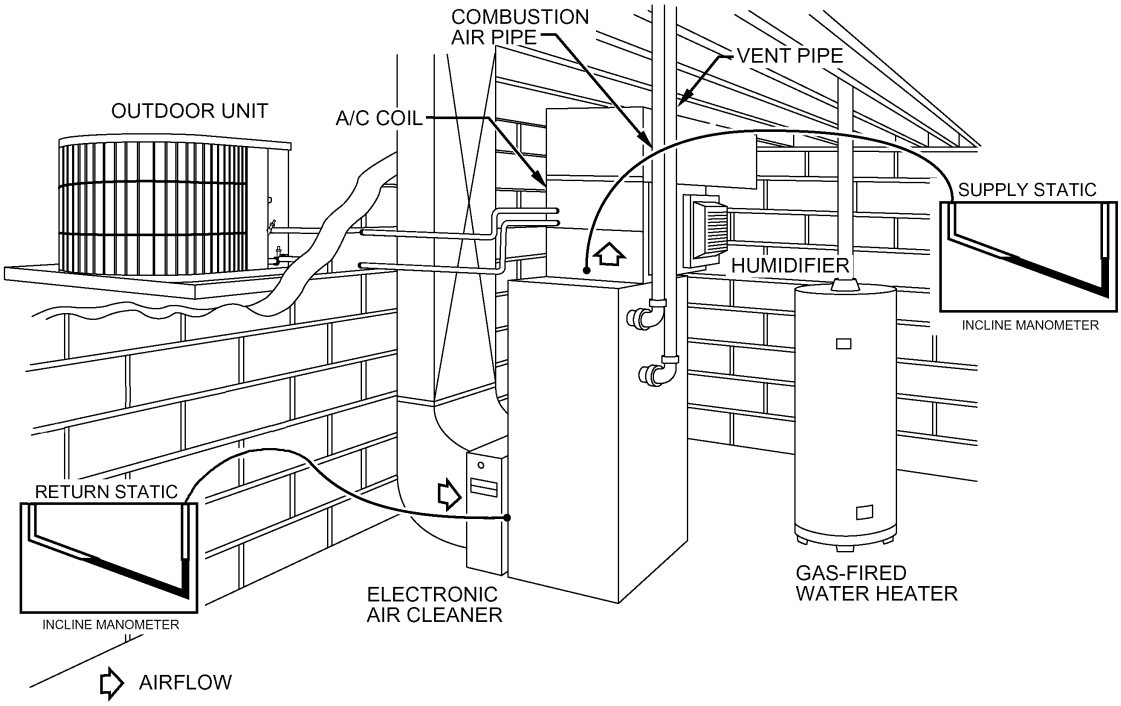


Figure 5 – Upflow Total Static Pressure Reading Locations

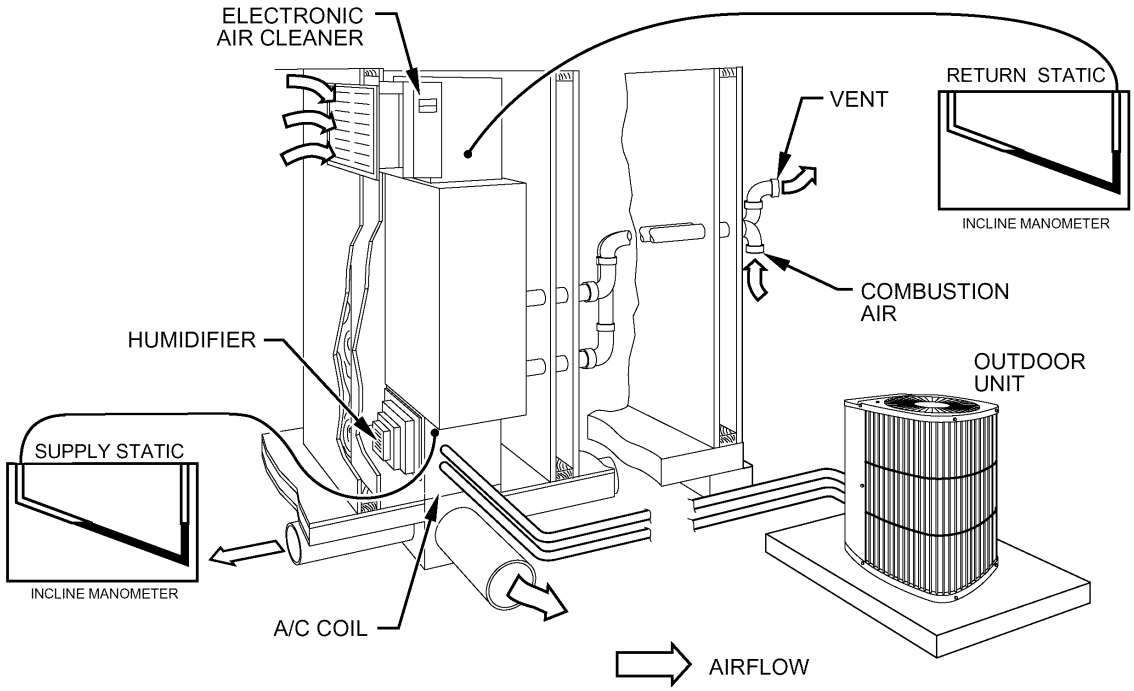


Figure 6 – Downflow Total Static Pressure Reading Locations

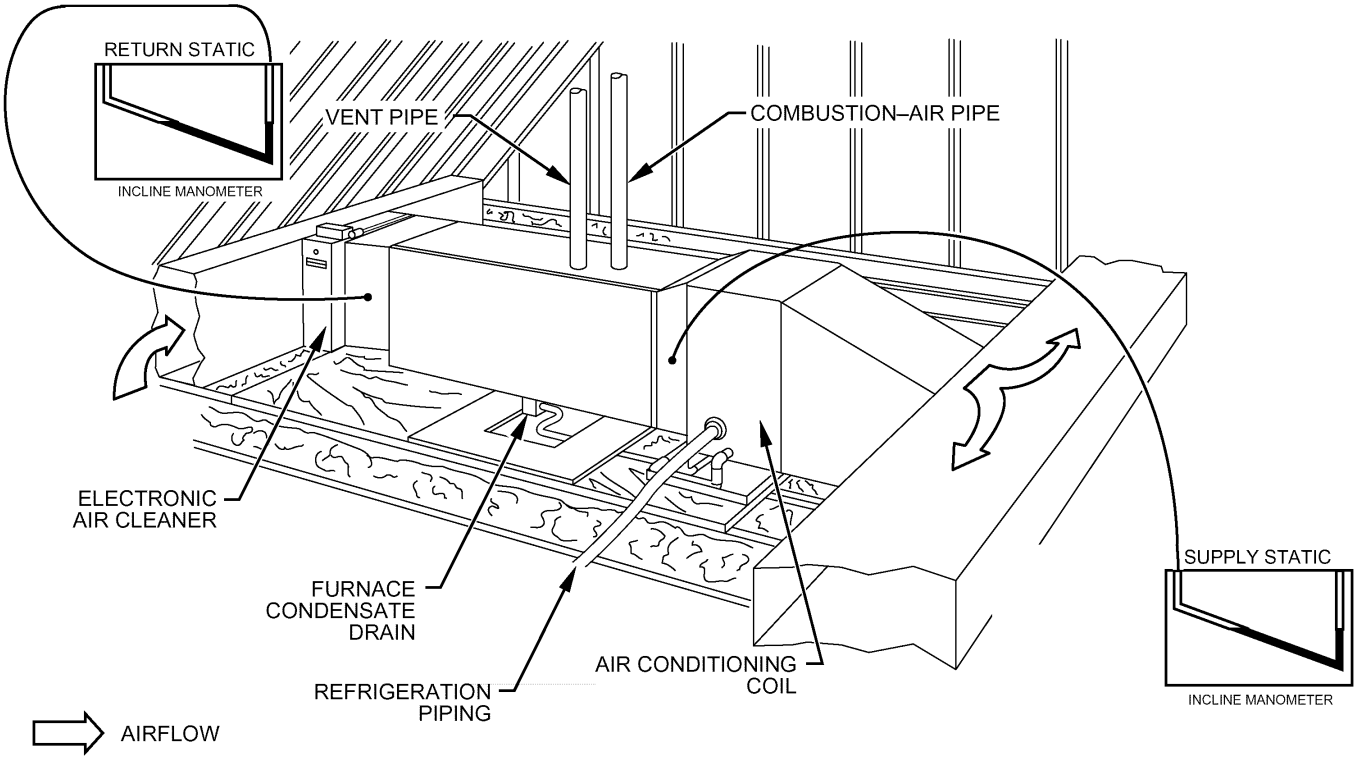


Figure 7 – Horizontal Right Total Static Pressure Reading Locations

Tools Needed:

1. Pitot Tube
2. Incline Manometer/Magnahelic

Example 1:

Return ESP after Filter	0.20 in.w.c.
Supply ESP before Coil	0.40 in.w.c.

Total ESP	0.60 in.w.c.

Example 2:

Return ESP before Filter	0.10 in.w.c.
Filter Static Pressure Drop @ 2000 cfm 0.10 in.w.c.	
Supply ESP after Coil	0.20 in.w.c.
Coil Static Pressure Drop Wet	0.20 in.w.c.

Total ESP	0.60 in.w.c.

Both Examples 1 and 2 are correct. Example 1 ESP readings were taken as laid out in static pressure reading location diagrams (Figures 5 - 7). Example 2 readings are taken as described. The coil and filter static pressure drops were taken from the manufacturer's product data sheets with the assumption that 2000 cfm is being delivered.

APPENDIX E
QUICK REFERENCE INFORMATION

PRESSURE SWITCH MAKE/BREAK POINTS

UNIT SIZE (BTUH)	HIGH PRESSURE SWITCH		MEDIUM PRESSURE SWITCH		LOW PRESSURE SWITCH	
	Make Point	**Break Point**	**Make Point**	**Break Point**	**Make Point**	**Break Point**
60,000 (17.5" casing)	1.21 in.wc max	1.05 in. wc +/- 0.06	0.85 in. wc max	0.70 in. wc +/- 0.05	0.62 in. wc max	0.47 in. wc +/- 0.05
60,000 (21" casing)	1.46 in.wc max	1.29 in. wc +/- 0.07	1.00 in. wc max	0.85 in. wc +/- 0.05	0.64 in. wc max	0.49 in. wc +/- 0.05
80,000	1.58 in.wc max	1.40 in. wc +/- 0.08	1.00 in. wc max	0.85 in. wc +/- 0.05	0.75 in. wc max	0.60 in. wc +/- 0.05
100,000	1.58 in.wc max	1.40 in. wc +/- 0.08	1.08 in. wc max	0.93 in. wc +/- 0.05	0.87 in. wc max	0.72 in. wc +/- 0.05
120,000	1.58 in.wc max	1.40 in. wc +/- 0.08	1.05 in. wc max	0.90 in. wc +/- 0.05	0.80 in. wc max	0.65 in. wc +/- 0.05

Flame Sensor Microamperage:

Microamp Range: 0.5 to 6.0 microamps
Typical Reading: 4 to 6 microamps

Hot Surface Igniter Reading:

The Silicon Nitride igniter in this furnace is not voltage sensitive and will work within the voltage range of 102 to 132 VAC. Hence, there is no voltage regulation circuits on the furnace control board. A new Silicon Nitride igniter has a normal resistance range of 40 to 70 ohms at room temperature and is relatively stable over the life of the igniter. The igniter resistance will increase with temperatures above room temperature.

Ohm reading of HSI @ 70°F: 40 to 70 ohms (resistance will remain relatively stable over the life of the igniter).

Gas Valve Ohm Readings:

PL17-5 to PL17-4: Resistance cannot be measured with an ohm meter because there is a bridge rectifier in the gas valve circuit.

Power Choke (Inductor):

Run unit in cooling mode, measure motor amp draw before power choke. Then re-run unit in cooling mode, but this time measure amp draw without power choke in line. The amp draw should be higher without power choke. Some ammeters will register a lower amp draw (look for a change in amperage).

APPENDIX F
FURNACE STAGING ALGORITHM

On initial thermostat call for heat after power-up, furnace staging algorithm will provide 45 seconds of intermediate heat followed by 19 minutes of minimum heat provided setup switches SW1-2 and SW4-2 are off. If call for heat still exists after operating for 45 seconds in intermediate heat and 19 minutes in minimum heat, the furnace will switch to maximum heat until the thermostat is satisfied.

During subsequent calls for heat:

- Modulating rate is calculated based on previous heating cycle.
- Maximum heat run time is not calculated. Maximum heat is activated in 1 of 3 ways and runs until the thermostat is satisfied:
  1. After intermediate heat has run for 45 seconds and minimum heat has run for 19 minutes and the call for heat is still present.
  2. When the furnace staging algorithm (using previous cycle information) determines maximum heat is necessary for the entire thermostat cycle.
  3. After the calculated modulating rate has operated for 19 minutes and the call for heat is still present.
     - The following flow chart shows how the furnace staging algorithm calculates the modulating rate. To predict the modulating rate for the next heating cycle the modulating rate (MOD%), time of operation at the modulating rate (MODT), and the time of operation at maximum heat (MAXT) for the previous cycle must be known. The furnace staging algorithm uses these values to determine the modulating rate for the next call for heat.
     - Four examples are shown below to illustrate what the furnace will do on a cold start, coming out of night setback, coming on and operating at an intermediate rate (rate between 52% - 71%), and returning to minimum heat operation.

EXAMPLE 1:
Furnace ran for 45 seconds in intermediate heat, 19 minutes in minimum heat (MOD% = 40%), and 5 minutes at maximum heat during previous call for heat.
MOD% = 40%
MODT = 19
MAXT = 5
Calculate Heat Load Requirement HLR: (40 x 19) + 65 + (100 x 5) = 1325
825 < 1325 < 1965 ⇒ Modulating rate for next cycle is 66%. ⇒ Next cycle furnace will run 45 seconds at intermediate heat followed by 19 minutes at 66% of full rate and then switch to maximum heat, if heat call is still present.

EXAMPLE 2:
Furnace ran for 45 seconds in intermediate heat, 19 minutes in minimum heat (MOD% = 40%), and 12 minutes at maximum heat during previous call for heat.
MOD% = 40%
MODT = 19
MAXT = 12
Calculate Heat Load Requirement HLR: (40 x 19) + 65 + (100 x 12) = 2025
2025 > 1965 ⇒ Next cycle furnace will only run in maximum heat.

EXAMPLE 3:
Furnace ran for 45 seconds at intermediate heat, 12 minutes at 66% of full rate (MOD% = 66%) during previous call for heat. This can happen if the furnace staging algorithm calculated a modulating rate of 66% based on previous call for heat. See EXAMPLE 1:
MOD% = 66%
MODT = 12
MAXT = 0
Calculate Heat Load Requirement HLR: (66 x 12) + 65 + (100 x 0) = 857
825 < 857 < 1965 ⇒ Modulating rate for next cycle is 42%. ⇒ Next cycle, furnace will run 45 seconds at intermediate heat, followed by 19 minutes at 42% of full rate and then switch to maximum heat, if heat call is still present.

EXAMPLE 4:
Furnace ran for 45 seconds at intermediate heat, 18 minutes at 42% of full rate (MOD% = 42%) during previous call for heat. This can happen if the furnace staging algorithm calculated a modulating rate of 42% based on a previous call for heat. See EXAMPLE 3:
MOD% = 42%
MODT = 18
MAXT = 0
Calculate Heat Load Requirement HLR: (42 x 18) + 65 + (100 x 0) = 821
821 < 825 ⇒ Next cycle furnace will only run for 45 seconds at intermediate heat, followed by 19 minutes at 40% of full rate and then switch to maximum heat, if heat call is still present.

Furnace Staging Algorithm