DIAGNOSTICS AND TROUBLESHOOTING

Below are two lists; a list of standard operating codes and a list of fault codes. The fault code list provides diagnostic and troubleshooting information to help determine the problem and fix it. Standard operating codes are not fault codes and the presence of a standard operating code indicates a no-fault condition.

NOTE: Verify display orientation is correct before interpreting fault codes. Otherwise, the fault codes may be upside-down. If a fault code or operating code is not on these lists, the display may be upside-down.

TABLE 19
96% VARIABLE SPEED NORMAL OPERATION CODES

NORMAL OPERATION CODES

Key

CODE DISPLAYED AT DUAL SEVEN-SEGMENT DISPLAY OF CONTROL	NAME DESCRIPTION

NORMAL OPERATION CODE

0	**STANDBY MODE** **DESCRIPTION:** This code is displayed anytime there is no fault present and no thermostat call present. The furnace is idle.
H or h	**GAS HEAT MODE** **DESCRIPTION:** This code is displayed anytime there is a call for gas heat. The lower-case "h" is displayed when the thermostat is requesting low gas heat and the upper-case "H" is displayed when the thermostat is requesting high-stage gas heat.
C or c	**COOLING MODE** **DESCRIPTION:** This code is displayed anytime there is a call for cooling. The lower-case "c" is displayed when the thermostat is requesting low-stage cooling and the upper-case "C" is displayed when the thermostat is requesting high-stage cooling.
HP or hP	**HEAT-PUMP HEATING MODE** **DESCRIPTION:** This code is displayed anytime there is a call for heat-pump heat. The lower-case "hP" is displayed when the thermostat is requesting low-stage heat-pump heat and the upper-case "HP" is displayed when the thermostat is requesting high stage heat-pump heat.
F	**CONTINUOUS FAN MODE** **DESCRIPTION:** This code is displayed anytime there is a call for continuous fan from the thermostat.
dF	**DEFROST MODE** **DESCRIPTION:** This code indicates that the heat-pump is in defrost mode (dual-fuel systems only) and furnace is operating for defrost operation which is fixed at low-stage gas heating operation.
Cd or cd	**COOLING IN DE-HUMIDIFICATION MODE** **DESCRIPTION:** This code indicates that there is a both cooling and de-humidification demand present at the same time. When de-humidification is active, the cooling airflow will be reduced in order to allow water to accumulate on the condenser thereby removing humidity from the conditioned environment. The lower-case "cd" is displayed when the thermostat is requesting low-cooling with de-humidification and the upper-case "Cd" is displayed when the thermostat is requesting high-stage cooling with de-humidification.

TABLE 20
96% VARIABLE SPEED FAULT CODES WITH DESCRIPTIONS AND SOLUTIONS

FAULT CODES

Key

FAULT CODE DISPLAYED AT DUAL SEVEN-SEGMENT DISPLAY OF CONTROL	DISPLAYED TEXT
	STATUS
	DESCRIPTION
	EXPECTED OPERATION
	CAUSE
	SOLUTION

FAULT CODES

d1	**NO MODEL DATA**
	STATUS: This is a critical fault. The furnace will not operate in any mode.
	DESCRIPTION: This code is displayed anytime there is no model data at the furnace. The model data is electronically stored data that is used to define (among other things) blower operation. Without the model data, the furnace cannot function. Note that model data may be available even if there is no card attached to the furnace control. A missing memory card will display fault code "d4" if model data is available on the network.
	EXPECTED OPERATION: No operation (including thermostat) will be permitted without the model data. The model data defines the IBM (Indoor Blower Motor) speed-torque curve. Without this information, the IBM can not operate. Refer to the section of this manual titled "INTEGRATED FURNACE CONTROL" under the subsection titled "MEMORY CARD" for details on the hierarchy of use of multiple copies of model data and distribution (among other details) of model data.
	CAUSE: Typically, the memory card will be missing from the furnace. In most cases, the cause of this fault will be the loss or disconnection of the original memory card from the furnace control (or I.F.C.). When the furnace control (or I.F.C.) is replaced, the memory card must be saved and installed in the replacement control.
	SOLUTION: Replace the missing memory card into the connector labeled P6 on the furnace control (I.F.C.). If the original card can not be found, a replacement card can be ordered from ProStock. Be sure to order the correct memory card for the furnace. Note: Furnace power must be cycled off and then on again after replacing the card or the model data will not be read.
d4	**NO VALID MODEL DATA ON MEMORY CARD**
	STATUS: This is a non-critical fault. The furnace should operate in any mode.
	DESCRIPTION: The memory card inserted into the slot at position P6 of the furnace control is corrupt and can not be used OR there is no memory card installed at all. However, a valid copy of model data for the furnace still resides in the furnace microprocessor.
	EXPECTED OPERATION: model data from the memory card can not be used because it is invalid or not present at all. Operation should proceed as normal with this fault (d4) only being displayed during the standby mode.
	CAUSE: This fault is displayed when there is no information on the memory card (blank), the card is not present or the memory card has corrupted and can not be properly read.
	SOLUTION: Remove the memory card and replace with the ***original*** memory card from the furnace or the ***correct*** replacement memory card. **Never replace the memory card of a furnace with a memory card from another furnace or component (e.g. condenser or air handler). Doing so could result in improper operation of the blower which may cause damage to the heat exchanger. If the original memory card for the furnace control is available and working, it must be used.** A correct replacement memory card can be ordered from ProStock. Be sure to have the furnace model and serial number available when ordering.
d6	**HORSEPOWER CONFLICT ON MEMORY CARD**
	STATUS: This is a non-critical fault. The furnace should operate in any mode.
	DESCRIPTION: The horsepower reported by the motor does not match the horsepower stored in memory in the model data of the memory card. However, the model data stored on the microprocessor of the furnace control does match the attached motor.
	EXPECTED OPERATION: model data from the memory card can not be used because it is invalid. Operation should proceed as normal with this fault (d6) only being displayed during the standby mode.
	CAUSE: There are two possible causes for this fault: (1) The blower motor has recently been replaced and the wrong horsepower motor was used. (2) The memory card or furnace control has recently been replaced and the wrong card or replacement control was used.
	SOLUTION: Determine the correct motor and/or model data card for the furnace and replace the incorrect or damaged part with a new, correct part. **Never replace the memory card of a furnace with a memory card from another furnace or component (e.g. condenser or air handler). Doing so could result in improper operation of the blower which may cause damage to the heat exchanger. If the original memory card for the furnace control is available and working, it must be used.** A correct replacement memory card can be ordered from ProStock. Be sure to have the furnace model and serial number available when ordering.

TABLE 20 (continued)
96% VARIABLE SPEED FAULT CODES WITH DESCRIPTIONS AND SOLUTIONS

10	**ONE-HOUR LOCKOUT** **STATUS:** This is a critical fault. The furnace will not operate in gas heat modes but all other modes (e.g. cooling) should function. **DESCRIPTION:** This fault is displayed under the following conditions: **1.** When a failed ignition has occurred four times in a row, the control enters one-hour lockout and fault codes "**10**" and "**11**" will be displayed alternately at the seven-segment display. See fault code **11** for a description on expected operation, causes and solutions for this fault code. **2.** after declaring a Water Sensed condition (heating operation is shut down due to this fault) several times consecutively. When the control enters lockout the fault codes "**59**" (Water Sensed) and "**10**" (soft lockout) will be displayed alternately at the seven-segment display. See fault code **59** for a description on expected operation, causes and solutions for this fault code. **3.** While the control has entered a one-hour lockout after declaring a dead blower after the main limit control has been open for more than 150 seconds, the fault codes "**61**" (Non-operational blower) and "**10**" (soft lockout) will be displayed alternately at the seven-segment display. Note: the dead blower fault and associated one-hour lockout will occur up to four times in one heat call. Upon declaring this fault for the fourth time in one heat call, the control will enter hard lockout requiring manual reset of power to the furnace. See fault code **61** for a description on expected operation, causes and solutions for this fault code. **4.** When IFC is in soft lockout and fault "93" is active, the fault code "**93**" is to be displayed alternately with the fault code "**10**" at the furnace seven-segment display. See fault code **93** for a description on expected operation, causes and solutions for this fault code. **5.** When flame is lost five times in a row, the control enters one-hour lockout and fault codes "***10***" and "***13***" will be displayed alternately at the IFC seven-segment display. See fault code **13** for a description on expected operation, causes and solutions for this fault code. **6.** While the control is in one-hour lockout due to an unexpected flame, the fault codes "**14**" (unexpected flame) and "**10**" (soft lockout) will be displayed alternately at the furnace seven-segment display. See fault code **14** for a description on expected operation, causes and solutions for this fault code.
11	**FAILED IGNITION** **STATUS:** Up to three failed ignitions will not constitute a critical condition. Critical condition (with no heating operation) is only noted when the furnace has failed to ignite four or more times consecutively. After four failed ignition attempts, the IFC enters one-hour lockout and the dual faults "*11*" and "10" are alternately displayed at the IFC's seven-segment display. **DESCRIPTION:** This fault is displayed at the furnace control after the first failed ignition attempt. It continues to be displayed until successful ignition or the furnace control has failed to ignite four consecutive times. After four attempts, the status of the fault is elevated to "10" and the furnace control (or I.F.C.) reacts as described under description for the fault code "10". Note: This fault will not be displayed to the homeowner on communicating systems unless it occurs at least three times within a single heat call. It will not be displayed to the homeowner after the first or even second failure. However, it will be displayed in the active fault screen of thermostat immediately after the first failure (and all subsequent failures) during a single heat call. Further, this fault (11) will only be logged into the fault buffer one time. It will not log more than once in the buffer. **EXPECTED OPERATION:** After the first failed ignition attempt, the fault ("*11*") is displayed and the inducer will complete a 20 second post-purge followed by a second ignition attempt. This cycle will be repeated until gas heat is established or until the fourth failed ignition attempt. After the fourth failed attempt, the furnace control (IFC) will proceed to one-hour lockout. **CAUSE:** There can be several causes for a failed ignition attempt(s). The most common are: (1) The flame sense rod is unable to sense flame. It may need cleaning or may not be properly connected. (2) The gas valve may be turned off. (3) The igniter is not working properly. It may not be properly connected or the spark location may not be correct. (4) The furnace control may not be working properly and may need to be replaced. (5) The flame may not be properly spreading from the first burner to the last. **SOLUTION:** The solution will depend on the cause. Solutions to noted causes (1) through (5) above are: (1) Clean or replace the flame sense rod or check all connections and wire between the rod and the furnace control (or I.F.C.). Make sure furnace ground is properly connected. (2) Turn the valve on. (3) Replace or reposition the igniter or check all connections and wire between the igniter and the furnace control (or I.F.C.). (4) Replace the furnace control. (5) Check the manifold pressure during ignition. For natural gas it should be approx. 3.5" wc and for LP gas it should be approx. 10" wc. If manifold pressure is good, watch the burner during ignition. If the first burner lights, but the second, third and so on do not light, the burner may need to be replaced.

TABLE 20 (continued)
96% VARIABLE SPEED FAULT CODES WITH DESCRIPTIONS AND SOLUTIONS

12	**LOW FLAME SENSE** **STATUS:** The status of this fault is non-critical and furnace operation will continue as normal in heating (and all other) mode(s). If flame sense is low, the furnace control (or I.F.C.) may soon no longer be able to properly sense the flame and status of the problem may be elevated to the level of fault code "*13*" or fault "*11*" (if flame can not be sensed at all). **DESCRIPTION:** The flame sense current from the flame sense rod at the furnace control (or I.F.C.) is weak or marginal at best. **EXPECTED OPERATION:** All operation (including gas heat) will proceed as normal with only the fault code ("*12*") displayed at the furnace control (I.F.C.) and "*LO FLAME SENSE*" displayed in the fault area of a communicating thermostat. **CAUSE:** (1) The most common cause for low flame sense during heat operation is that the flame sense rod may need cleaning or may not be properly connected or wiring between the rod and the furnace control may be shorted or opened. (2) Another cause for low flame may be an improperly mounted or poorly grounded flame sensor. **SOLUTION:** (1) Clean or replace the flame sense rod or check all connections and wire between the rod and the furnace control (or I.F.C.). (2) Reinstall or replace flame sensor and check wiring and connections. Also make sure the furnace is properly grounded.
13	**FLAME LOST AFTER ESTABLISHED** **STATUS:** Flame loss is not a critical fault. Subsequent ignition attempts will follow and normal operation should resume. However, a lost flame can often be followed by failed ignition attempts then a one-hour lockout. Once the status has reached one-hour lockout, the fault condition is critical (although attempts at ignition will be made again after the 1 hour lockout). **DESCRIPTION:** After a successful ignition trial, the flame (which *was* properly sensed) is no longer sensed. This can happen any time after successful ignition while a valid heat call is present. **EXPECTED OPERATION:** When flame is lost, the fault code ("***13***") is immediately displayed at the IFC SSD's. The IBM (Indoor Blower Motor) is energized (if it was not already) at the correct speed (based on the demand from the thermostat) and completes a 90 second blower off delay. The IDM (Induced Draft Motor) remains energized at the most recent speed (based on the demand from the thermostat or as required for ignition cycle) for a 20 second post-purge. After both the post-purge and blower off delay are complete, the fault code ("***13***") is removed and a new attempt at ignition is made. Often, the new ignition attempt will fail and operation will proceed as though a failed ignition has occurred from that point (see fault code "***11***"). Note: This fault will not be displayed to the homeowner on communicating systems unless it occurs at least three times within a single heat call. It will not be displayed to the homeowner after the first or even second failure. However, it will be displayed in the active fault screen of thermostat immediately after the first failure (and all subsequent failures) during a single heat call. Further, this fault (**13**) will only be logged into the fault buffer one time. It will not log more than once in the buffer. **CAUSE:** (1) The most common cause for low flame sense during heat operation is that the flame sense rod may need cleaning or may not be properly connected or wiring between the rod and the furnace control may be shorted or opened. (2) Another cause for low flame may be an improperly mounted or poorly grounded flame sensor. (3) Flame pattern may be unstable. **SOLUTION:** (1) Clean or replace the flame sense rod or check all connections and wire between the rod and the furnace control (or I.F.C.). (2) Reinstall or replace flame sensor and check wiring and connections. Also make sure the furnace is properly grounded. (3) Check that all burner assembly components are properly installed. Check for good seals between the burner and blower compartments. Insure that the combustion door gasket is in place and the door is properly installed and sealed.
14	**FLAME PRESENT WITH GAS VALVE OFF** **STATUS:** This is an extremely critical fault and should rarely (if ever) be seen in the field. The furnace will not operate with this fault present. **DESCRIPTION:** This fault indicates flame is present when it should not be. Flame is seen to be present when the gas valve is supposed to be off. **EXPECTED OPERATION:** When unexpected flame is sensed, the IBM (Indoor Blower Motor) is energized at maximum heat speed and IDM (Induced Draft Motor) is energized at high speed. Both will remain energized until the fault is cleared. Response to any thermostat call is not permitted until the fault is cleared. Note that the gas valve circuit should not have been energized when the unexpected flame was sensed. When the condition causing the fault is cleared, the IDM will complete a 20 second post-purge and the IBM will complete a 90 second blower off-delay. The control will then enter a one-hour lockout and display the fault codes "***10***" (one-hour lockout) and "***14***" (unexpected flame) alternately for the duration of the one-hour lockout. Operation is returned to normal after the lockout period. **CAUSE:** (1) Field mis-wiring of 24VAC to the gas valve main solenoid. (2) Faulty gas valve stuck in the "OPEN" position. (3) Faulty furnace control (signal improperly sensed when it should not be sensed at all). **SOLUTION:** (1) Wire properly. (2) Replace gas valve. (3) Replace furnace control.

TABLE 20 (continued)
96% VARIABLE SPEED FAULT CODES WITH DESCRIPTIONS AND SOLUTIONS

22	**MAIN LIMIT OPEN** **STATUS:** This is a critical fault. The furnace will not operate in gas heat modes but all other modes (e.g. cooling) should function. **DESCRIPTION:** The main limit has opened or is sensed to be opened. This normally means that the temperture inside the heat exchanger area has gone above a certain predetermined critical value and heating operation is not permitted until the limit cools to within normal parameters. **EXPECTED OPERATION:** If the furnace was in heating operation when this fault occurred, blower operation will immediately stop and the furnace will shut down normally with post-purge at the correct speed. After the post purge (or immediately if no heat call was present), no other operation (including thermostat calls) will occur until this fault is cleared. This fault may be displayed in heating or cooling modes and may also be displayed in heatiing mode after the main limit control has been opened four times consecutively for more than 150 seconds (2m: 30sec) each time or after the main limit control has opened at 40% heat rate and the main limit does not close within 150 seconds. If this happens, the IFC determines that the motor and/or blower may not be functional and enters a hard lockout condition requiring repair of the blower/motor or determining cause for main limit to open and manual reset of power to the furnace. **CAUSE:** (1) No airflow (2) Insufficient airflow (3) Faulty limit control (4) Loose or faulty wiring. (5) Dead (non-functional) blower. (6) Input too high **SOLUTION:** (1) Check for proper blower operation. Is the blower turning during heat (or any other) mode? If not, a blower motor fault should also be present. Check the wiring to the motor then check the motor. It may need replacing. (2) Check ductwork and filters. Determine the static pressure and make sure it is not above the published values for the furnace. Check the rate and outlet air temperature for high and low heat using a jumper wire between R and W/W1 respectively. Compare them to the nameplate maximum values and adjust if necessary. If a SA sensor is used cycle power to the furnace. (3) Replace the limit control. (4) Check wiring and connections. Replace and/or repair as necessary. (5) See Fault Code 61 for description, causes, operation and solutions. (6) Insure properly sized burner orifices are installed. Check the manifold pressure at high fire and compare to the nameplate values. Adjust as needed.
23	**HALC OPEN** **STATUS:** This is a critical fault. The furnace will not operate in gas heat modes but all other modes (e.g. cooling) should function. **DESCRIPTION:** This fault is displayed when the IFC does not sense continuity between pins 3 and 5 of connector P1 on the furnace control. Note: The fault code exists in the list of fault codes but the furnace as currently configured does not include an HALC control. There is a jumper wire in place of the control and, when the furnace control displays this fault, it generally means that the jumper wire is not making connection between the two pins on the control. **EXPECTED OPERATION:** When the circuit has been opened, the IBM (Indoor Blower Motor) is energized at maximum heating speed. The gas valve circuit is de-energized (if it was energized) and the IDM (Induced Draft Motor) is energized at high speed for 20 seconds after the fault is sensed. Response to thermostat cooling calls will take place as normal with IBM energizing at the higher of the two blower speeds (high heat or cool) when a call for cooling is also present. When the fault is cleared, the IBM will remain energized for the 90 second blower off-delay period. **CAUSE:** No continuity between pins 3 and 5 of connector P1 on the furnace control. **SOLUTION:** (1) Repair the jumper between pins 3 and 5 of connector P1 on the furnace control.
26	**LINE AND NEUTRAL REVERSED OR POOR GROUND** **STATUS:** This is a critical fault. The furnace will not operate in gas heat or any other modes. **DESCRIPTION:** This fault code is an indication that line voltage and neutral are reversed to the furnace control or may also be an indication of a grounding issue. No operation is not allowed to proceed until the problem is corrected. **EXPECTED OPERATION:** No heating or cooling operation will take place. **CAUSE:** (1) Line and neutral to the furnace have been interchanged at the furnace. (2) Line voltage and neutral have been interchanged at the disconnect or at the breaker box. (3) Furnace control cannot properly sense ground. **SOLUTION:** (1) Check voltage with meter and reverse line and neutral if necessary. (2) Check voltage with meter and reverse line and neutral if necessary. (3) Check ground wire inside furnace cabinet is attached to sheet metal, verify ground to furnace cabinet and at breaker box.

TABLE 20 (continued)
96% VARIABLE SPEED FAULT CODES WITH DESCRIPTIONS AND SOLUTIONS

30	**OPEN FUSE** **STATUS:** This is a critical fault. The furnace will not operate in any mode. **DESCRIPTION:** The fuse has been opened. This usually occurs when there is a 24VAC short to common or ground on the low-voltage side of the transformer. **EXPECTED OPERATION:** The fault code is displayed and no other operation can take place. **CAUSE:** An electrical short from low voltage (24VAC) to ground or common has occurred. **SOLUTION:** Repair the short circuit condition and replace fuse.
33	**OVER-TEMPERATURE SWITCH (ROLL-OUT) OPEN** **STATUS:** This is a critical fault. The furnace will not operate in gas heat modes but all other modes (e.g. cooling) should function. **DESCRIPTION:** The Manually Reset Limit Control (M.R.L.C.) is also known by the name "Rollout Limit". There can be several on any given furnace. When one or more of these limits open, they must be manually pushed back to the closed position (hence the name; *Manually* Reset) to force the acknowledgement of a critical fault. This fault will occur when flames have rolled out of the normal area in the heat exchanger and into the burner compartment. This fault should rarely (if ever) be seen in the field and indicates a very serious problem that must be repaired before furnace operation can continue. **EXPECTED OPERATION:** When the MRLC (Manually Reset Limit Control) circuit has been opened, the IBM (Indoor Blower Motor) is energized at maximum heating speed. The gas valve circuit is de-energized (if it was energized) and the IDM (Induced Draft Motor) is energized at high speed. Response to thermostat cooling calls will take place as normal with IBM energizing at the higher of the two blower speeds (high heat or cool) when a call for cooling is also present. When the fault is cleared, the IDM will remain energized for a 20 second post-purge and the IBM will remain energized for the user-selected blower off-delay period. **CAUSE:** (1) Insufficient venting through either the inlet or exhaust. (2) Loose or faulty wiring. (3) Unstable flame pattern. **SOLUTION:** (1) Check that the pressure switch(es) have not been welded closed or bypassed. Check that the inducer is operating at the proper rpm. Insure that the venting does not exceed the maximum specified lengths. Check for obstructions in combustion venting. Check that all gaskets between the inducer and center panel / heat exchanger are properly installed and sealed. (2) Check wiring and connections. Replace and/or repair as necessary. (3) Check that all burner assembly components are properly installed. Check that all seals between the burner and blower compartments are tight. Insure that the door seals are in place and that the burner door is properly installed and does not leak. Check to make sure that the heat exchanger has not been damaged; i.e.: crushed tubes, breached collector box and etc.
44	**LOW PRESSURE SWITCH CLOSED, INDUCER OFF** **STATUS:** This is a critical fault. The furnace will not operate in gas heat modes but all other modes (e.g. cooling) should function if present simultaneously with a heating call (e.g. defrost call in dual-fuel mode). **DESCRIPTION:** The low pressure control (or switch) should not be closed when the inducer is not running. If it is, this is a sign of a serious condition. The switch may be welded closed or purposely bypassed in the field. Before any heat cycle can begin, the pressure switch is tested to make sure that it is opened. The switch is ignored except in gas heating modes. **EXPECTED OPERATION:** There will be no other operation than displaying of the fault code and diagnostic messages to the homeowner and technician. The fault code is only present during a heat call *before* pre-purge begins. **CAUSE:** (1) Faulty switch. (2) Pressure switch physically bypassed in the field. (3) Loose or faulty wiring. (4) Abnormally high negative pressure present on vent system without inducer running. **SOLUTION:** (1) Replace low pressure control (switch). (2) Remove bypass and restore correct operation. Determine reason for bypass (e.g. vent length too long) and correct issue. Notify homeowner and proper authorities of illegal tampering if necessary. (3) Check wiring and connections. Replace and/or repair as necessary. (4) Check for proper venting and terminations as defined in the furnace installation instructions.

TABLE 20 (continued)
96% VARIABLE SPEED FAULT CODES WITH DESCRIPTIONS AND SOLUTIONS

45	**LOW PRESSURE SWITCH OPEN, INDUCER ON HIGH SPEED**
	STATUS: This is a critical fault. The furnace will not operate in gas heat modes but all other modes (e.g. cooling) should function if present simultaneously with a heating call (e.g. defrost call in dual-fuel mode).
	DESCRIPTION: This fault indicates that the low pressure switch is open ***when the inducer is energized at high speed***. The switch must close after the inducer is energized and before the ignition sequence can begin. The switch is ignored except in heating modes.
	EXPECTED OPERATION: (1) DISPLAYED *BEFORE* HEAT IS ESTABLISHED: The IBM (Indoor Blower Motor) will not be energized. The fault code will not be displayed until the IDM (Induced Draft Motor) has been energized for a minimum of ten seconds. The IDM will remain energized at the high speed (high speed is default pre-purge speed) for a period of five minutes after the beginning of the pre-purge attempt. After five minutes, the IDM is de-energized and second attempt at pre-purge is made (as long as the heat call is still present). This cycle is repeated indefinitely until either the pressure switch closes or the heat call is lost. (2) DISPLAYED *AFTER* HEAT IS ESTABLISHED - If this fault is displayed *after* heat is established, the gas valve will be de-energized, the IBM will be energized (if not already energized) at the correct heat speed (determined by the firing rate required by the thermostat) and the IDM will remain energized at high speed. The IBM will complete a 90 second blower off-delay and the IDM will complete a 20 second post-purge (at high speed). After these delays, a new attempt at ignition will be made provided the call for heat is still present.
	CAUSE: (1) Blockage or improper termination in either the inlet or exhaust vents. (2) The flue vent length and/or number of elbows exceeds the maximum number specified. (3) Faulty or disconnected inducer. (4) Faulty control board (inducer relay). (5) Loose or faulty wiring. (6) Disconnected, blocked, split or cut pressure switch hoses. (7) Wind gusts (sporadic). (8) Faulty pressure switch.
	SOLUTION: (1) Check the vent system for blockage and proper termination and repair as necessary. (2) Check the specification sheets and/or installation instructions. Remove excess venting. (3) Repair or replace inducer and/or inducer wiring and/or electrical connections. (4) Replace control board. (5) Check wiring and connections. Replace and/or repair as necessary. (6) Replace hoses as necessary. (7) Insure proper termination and determine if high altitude kit may be necessary (8) Replace the pressure switch.
46	**LOW PRESSURE SWITCH OPEN, INDUCER ON LOW SPEED**
	STATUS: This is a critical fault. The furnace will not operate in gas heat modes but all other modes (e.g. cooling) should function if present simultaneously with a heating call (e.g. defrost call in dual-fuel mode).
	DESCRIPTION: This fault indicates that the low pressure switch is open ***when the inducer is energized at low speed***. Since the furnace only ignites at high fire, this condition should never be seen except after the blower on delay period of the ignition cycle and only after the furnace attempt to switch to low stage heating. The switch is ignored except in heating modes.
	EXPECTED OPERATION: This fault is displayed only after heat is established and switched to low fire with the IBM (Indoor Blower Motor) energized at low speed. When this fault is displayed the gas valve will be de-energized, the IBM will remain energized at the low heat speed and the IDM (Induced Draft Motor) will remain energized at the low speed. The IBM will complete the user-selected blower off-delay (at low speed) and the IDM will complete a 20 second post-purge (at low speed). After these delays, a new attempt at ignition will be made provided the call for heat is still present.
	CAUSE: (1) Blockage or improper termination in either the inlet or exhaust vents. (2) The flue vent length and/or number of elbows exceeds the maximum number specified. (3) Faulty or disconnected inducer. (4) Faulty control board (inducer relay). (5) High altitude kit not installed in areas of high elevation. (6) Loose or faulty wiring. (7) Disconnected, blocked, split or cut pressure switch hoses. (8) Wind gusts (sporadic). (9) Faulty pressure switch.
	SOLUTION: (1) Check the vent system for blockage and proper termination and repair as necessary. (2) Check the specification sheets and/or installation instructions. Remove excess venting. (3) Repair or replace inducer and/or inducer wiring and/or electrical connections. (4) Replace control board. (5) Check elevation of the installation and consult the specifications for the furnace to determine if a high altitude kit is needed. Install proper kit as necessary. (6) Check wiring and connections. Replace and/or repair as necessary. (7) Replace hoses as necessary. (8) Insure proper termination and determine if high altitude kit may be necessary (9) Replace the pressure switch.

TABLE 20 (continued)
96% VARIABLE SPEED FAULT CODES WITH DESCRIPTIONS AND SOLUTIONS

	HIGH PRESSURE SWITCH CLOSED, INDUCER OFF
55	**STATUS:** This is a critical fault. The furnace will not operate in gas heat modes but all other modes (e.g. cooling) should function if present simultaneously with a heating call (e.g. defrost call in dual-fuel mode). **DESCRIPTION:** The high pressure control (or switch) should not be closed when the inducer is not running. If it is, this is a sign of a serious condition. The switch may be welded closed or purposely bypassed in the field. Before any heat cycle can begin, the pressure switch is tested to make sure that it is opened. The switch is ignored except in gas heating modes. **EXPECTED OPERATION:** There will be no other operation than displaying of the fault code and diagnostic messages to the homeowner and technician. The fault code is only present during a heat call before pre-purge begins. **CAUSE:** (1) Faulty switch. (2) Pressure switch physically bypassed in the field. (3) Loose or faulty wiring. (4) Abnormally high negative pressure present on vent system without inducer running. **SOLUTION:** (1) Replace high pressure control (switch). (2) Remove bypass and restore correct operation. Determine reason for bypass (e.g. vent length too long) and correct issue. Notify homeowner and proper authorities of illegal tampering if necessary. (3) Check wiring and connections. Replace and/or repair as necessary. (4) Check for proper venting and terminations as defined in the furnace installation instructions.
	HIGH PRESSURE SWITCH OPEN, INDUCER ON HIGH SPEED
57	**STATUS:** This is a critical fault. The furnace will not operate in gas heat modes but all other modes (e.g. cooling) should function if present simultaneously with a heating call (e.g. defrost call in dual-fuel mode). If this fault is experienced during high heat operation and the low pressure switch remains engaged, the furnace will switch to low fire heat and continue to run (if possible) to try to satisfy the thermostat. **DESCRIPTION:** This fault indicates that the high pressure switch is open when the inducer is energized at high speed. This fault can be displayed any time during the heat call except during low heat call and only *after* the pre-purge and blower on delays are complete. **EXPECTED OPERATION:** (1) DISPLAYED BEFORE HEAT IS ESTABLISHED: The IBM (Indoor Blower Motor) will not be energized. The fault code will not be displayed until the IDM (Induced Draft Motor) has been energized for a minimum of ten seconds. The IDM will remain energized at the high speed (high speed is default pre-purge speed) for a period of five minutes after the beginning of the pre-purge attempt. After five minutes, the IDM is de-energized and second attempt at pre-purge is made (as long as the heat call is still present). This cycle is repeated indefinitely until either the pressure switch closes or the heat call is lost. (2) DISPLAYED AFTER HEAT IS ESTABLISHED - If this fault is displayed after heat is established, the IDM will remain energized at high speed and the firing rate will drop to low stage provided the low pressure switch remains closed. The IBM will energize at, or switch to, the low-fire rate (also provided the low pressure switch remains closed). Low heat is provided until the heat call ends or the high pressure switch closes. If the high pressure switch closes, the heat rate and blower speed will be adjusted to the correct (higher) rate required by the thermostat and the IDM will remain energized at high speed. If the low pressure switch also will not remain closed, operation will be as described under fault code # 46 ("LPC OPEN") above. **CAUSE:** (1) Blockage or improper termination in either the inlet or exhaust vents. (2) The flue vent length and/or number of elbows exceeds the maximum number specified. (3) Faulty or disconnected inducer. (4) Faulty control board (inducer relay). (5) High altitude kit not installed in areas of high elevation. (6) Loose or faulty wiring. (7) Disconnected, blocked, split or cut pressure switch hoses. (8) Wind gusts (sporadic). (9) Faulty pressure switch. **SOLUTION:** (1) Check the vent system for blockage and proper termination and repair as necessary. (2) Check the specification sheets and/or installation instructions. Remove excess venting. (3) Repair or replace inducer and/or inducer wiring and/or electrical connections. (4) Replace control board. (5) Check elevation of the installation and consult the specifications for the furnace to determine if a high altitude kit is needed. Install proper kit as necessary. (6) Check wiring and connections. Replace and/or repair as necessary. (7) Replace hoses as necessary. (8) Insure proper termination and determine if high altitude kit may be necessary (see item 4) (9) Replace the pressure switch.
	WATER CIRCUIT OPEN
58	**STATUS:** This is a critical fault experienced by the furnace. The furnace will not operate in gas heat modes but all other modes (e.g. cooling) should function if a call is present. **DESCRIPTION:** The IFC cannot detect electrical continuity between pins 1 and 2 of connector P4 of the furnace control. The IFC looks for continuity between these pins to determine if the water sensors (2) are present in the circuit. When both sensors are present and properly connected and wiring is not damaged, there should be electrical continuity between these pins. **EXPECTED OPERATION:** No gas heating operation can proceed and the fault is displayed. All other modes (e.g. cooling) of operation should operate as normal. **CAUSE:** (1) Wiring has been damaged between the control or sensor. (2) Connection of P4 at the IFC or at the water sensors is not properly made. (3) Water sensor has been removed. **SOLUTION:** (1) Repair or replace wiring. (2) Repair connections or replace wiring or sensors or controls as necessary. (3) Replace missing water sensor.

TABLE 20 (continued)
96% VARIABLE SPEED FAULT CODES WITH DESCRIPTIONS AND SOLUTIONS

59	**WATER SENSED** **STATUS:** This is a critical fault experienced by the furnace. The furnace will not operate in gas heat modes but all other modes (e.g. cooling) should function if a call is present. **DESCRIPTION:** The IFC has detected current flowing from pin(s) 1 and/or 2 of connector P4 of the furnace control. The IFC looks for current flow from these pins to determine if water is present in the collector box. When water is present, the sensor will pass a small amount of electrical current to the sheet metal of the furnace. This current flow will notify the IFC that water is present. Note: The condition must be present continuously for at least ten seconds before the IFC will declare the fault. **EXPECTED OPERATION:** No gas heating operation can proceed and the fault is displayed. All other modes (e.g. cooling) of operation should operate as normal. **CAUSE:** (1) A blocked condensate drain or the drain trap has become blocked and cannot allow condensate water to flow properly. (2) Wiring to the sensors has been damaged and exposed wiring is touching the furnace sheet metal. (3) Water sensor has been removed from the collector box with wires still attached and the metal probe is touching the sheet metal portion of the furnace. **SOLUTION:** (1) Remove/Repair drain blockage. (2) Replace/Repair wiring between IFC and both sensors. (3) Return sensor(s) to proper location in the collector box.
60	**BLOWER FAULT - BLOWER CAN STILL RUN** **STATUS:** This is a non-critical fault experienced by the furnace. All operations (including thermostat calls) should continue as normal with no perceivable difference in operation. **DESCRIPTION:** A blower fault which is non-critical allows the blower to continue to run but at less-than-optimal conditions. **EXPECTED OPERATION:** All (including thermostat) operation should continue as normal. Blower operation may be slightly compromised but will continue. **CAUSE:** (1) The blower has hit the maximum speed or torque limit specified by the manufacturer *or* is running at the temperature limit because the static pressure is too high. **SOLUTION:** (1) The static pressure is too high because the ductwork is improperly designed or is restricted for some other reason or the filter needs cleaning or replacing. Remove the obstruction or repair the duct so that static pressure does not exceed published values in the specification sheets or installation instructions.
61	**BLOWER FAULT - MOTOR CANNOT RUN** **STATUS:** This is a critical fault. The furnace will not operate in any mode. **DESCRIPTION:** The blower has failed critically or there is a critical motor fault - such as thermal limit trip that prevents the blower motor from running. **EXPECTED OPERATION:** If the furnace was in heating operation when this fault occurred, blower operation will immediately stop and the furnace will shut down normally with post-purge at the correct speed. After the post purge (or immediately if no heat call was present), no other operation (including thermostat calls) will occur until this fault is cleared. This fault may be displayed in heating or cooling modes and may also be displayed in heating mode after the main limit control has been opened four times consecutively for more than 150 seconds (2m:30sec) each time. If this happens, the IFC determines that the motor and/or blower is not functional and enters a hard lockout condition requiring repair of the blower/motor and manual reset of power to the furnace. **CAUSE:** (1) The motor has tripped on thermal limit because of a restriction or bearing failure. (2) The motor Power Factor Correction (P.F.C.) choke is faulty and needs replacing. (3) The furnace model data is faulty or corrupted. (4) Wiring to the motor and/or P.F.C. has become compromised. (5) The blower wheel has become damaged or is not properly attached to the motor shaft. (6) The motor has failed catastrophically. **SOLUTION:** (1) Remove obstruction or replace motor. (2) Replace the Power Factor Correction choke. (3) Replace the furnace memory card with the correct replacement part from ProStock. (4) Inspect and replace or repair wiring and/or connectors to the motor and/or P.F.C. as necessary. (5) Replace the blower wheel and/or attach the blower wheel to the motor shaft properly. (6) Replace the motor.

TABLE 20 (continued)
96% VARIABLE SPEED FAULT CODES WITH DESCRIPTIONS AND SOLUTIONS

66	**BLOWER CUTBACK**
	STATUS: This is a non-critical fault experienced by the furnace. All operations (including thermostat calls) should continue as normal with no perceivable difference in operation.
	DESCRIPTION: The blower motor is operating at the highest rpm or torque that specifications allow but the application requires more torque or speed in order to get the desired airflow under the current static pressure conditions. The motor will continue to operate because internal software will prevent operation above the permitted range. However, a fault is sent to the furnace control (or I.F.C.) from the motor. **Note:** This fault will not be displayed after the first three minutes of blower operation after power reset. Further, this fault will not be logged in the fault buffer or fault history after the first hour of operation and will only be logged into the fault buffer a maximum of one time. This code (66) indication is intended as a tool to notify the installer of inadequate airflow due to excessive static pressure in the duct of the system. The code is not intended to be a fault code. It is merely an operating indicator.
	EXPECTED OPERATION: All (including thermostat) operation should continue as normal. Blower operation may be slightly compromised but will continue.
	CAUSE: (1) The blower has hit the maximum speed or torque limit specified by the manufacturer because the static pressure is too high.
	SOLUTION: (1) The static pressure is too high because the ductwork is improperly designed or is restricted for some other reason or the filter needs cleaning or replacing. Remove the obstruction or repair the duct so that static pressure does not exceed published values in the specification sheets or installation instructions for the furnace.
68	**NO BLOWER COMMUNICATIONS**
	STATUS: This is a critical fault. The furnace will not operate in any mode.
	DESCRIPTION: The furnace control (I.F.C.) can not communicate with the blower motor.
	EXPECTED OPERATION: If the furnace was in heating operation when this fault occurred, the gas valve will immediately close (flame will be lost), IBM (Indoor Blower Motor) operation will immediately stop and the furnace will shut down normally (except without IBM operation) with IDM (Induced Draft Motor) post-purge at the correct speed. After the post purge (or immediately if no heat call was present), no other operation (including thermostat calls) will occur until this fault is cleared.
	CAUSE: (1) The wires between the blower motor have been disconnected or there is a poor connection. (2) There is no line voltage to the motor. (3) The furnace model data is faulty or corrupted. (4) The motor has failed catastrophically.
	SOLUTION: (1) Check wiring, connectors and terminals - repair or replace as necessary. (2) Check line voltage wiring, connectors and terminals to the Power Factor Correction choke and ECM motor. Repair and replace as necessary. (3) Replace the furnace memory card with the correct replacement part from ProStock. (4) Replace the motor.
93	**INTERNAL CONTROL FAULT DETECTED**
	STATUS: This is a critical fault. The furnace will not operate in any mode of operation.
	DESCRIPTION: This is a severe fault that should rarely (if ever) be discovered in the field. It is an indicator of an internal microprocessor fault on the furnace control (or I.F.C.) or voltage applied to the main gas valve solenoid when there should be none.
	EXPECTED OPERATION: If possible, if the furnace was in heating operation when this fault occurred, the gas valve will immediately close (flame will be lost), IBM (Indoor Blower Motor) operation will immediately stop and the furnace will shut down normally (except without IBM operation) with IDM (Induced Draft Motor) post-purge at the correct speed. After the post purge (or immediately if no heat call was present), no other operation (including thermostat calls) will occur until this fault is cleared. However, this fault may also indicate an internal microprocessor failure. This may mean that the heat call will not end as expected and that all outputs will be de-energized and gas valve closed immediately when the fault is sensed.
	CAUSE: (1) 24VAC or similar voltage applied to the main gas valve solenoid circuit unexpectedly. (2) Furnace control software test failure - failed furnace control (or I.F.C.).
	SOLUTION: (1) Check for miswiring in the furnace. (2) Replace the furnace control (or I.F.C.).
99	**REMOTE FAULTS RESET PERFORMED**
	This is a notification that fault codes in the fault buffer have been reset.

LOCKOUT AND REPLACING THE FURNACE CONTROL

All lockout conditions can be cleared immediately provided that the original fault causing the lockout is cleared and power to the unit is cycled off and then back on again or (soft lockout only) if a heat call is cycled off for greater than 2 seconds but less than 20 seconds.

The furnace control will not initiate a heat cycle during any lockout condition. A call for compressor or continuous fan will generally be responded to but control will display the lockout error fault code instead of the “C” (for compressor) or “F” (for Continuous fan).

FIVE-MINUTE LOCKOUT

A five minute “soft” lockout will be initiated if the low pressure switch fails to close after 60 seconds of continuous inducer operation at the beginning of a normal heat cycle (pressure switch proving period). The seven-segment display will display the appropriate fault. Lockout will automatically be reset after five minutes.

ONE-HOUR LOCKOUT

A one hour “soft” lock out will be initiated when:

- Flame has not been detected after four ignition trials.
- Flame has been lost for five times in one heat call.
- Undesired flame has been detected. The one-hour period will commence after flame is no longer detected.
- Dead Blower has been detected (main limit circuit open for more than 150 seconds)
- When voltage has unexpectedly been detected on the gas valve circuit and voltage goes away when inducer is shut off.
- If a *Water Sensed* condition is detected once during heat call (heat cycle terminated in response to fault) and then clears and then is detected again within 5 minutes of the next heat attempt (same heat call).

The seven-segment display will alternately display “*10*” and the code number for the fault causing the lockout. Lockout will automatically be reset after one hour.

HARD LOCKOUT

Three conditions shall cause a hard lockout:

1. The control senses an unspecified internal fault. Fault code “***93***” is set and displayed. This lockout condition cannot be reset by cycling the heat call.

2. Voltage is detected unexpectedly on the gas valve contacts (welded relay) and will not clear by cycling the inducer . Fault code “***93***” is set and displayed. This lockout condition cannot be reset by cycling the heat call.

3. The furnace control will declare that the blower motor is inoperable (dead) if the main limit control has been open for more than 150 seconds. Gas heating is terminated. However, the control continues to try to operate heating for up to four attempts in case the blower motor starts working again. If a dead blower has been declared four times in one heat call, the furnace control enters a hard-lockout. Fault code “***61***” is set and displayed. This lockout condition **CAN** be reset by cycling the heat call.

REPLACING THE FURNACE CONTROL

In the event that the furnace control must be replaced, the memory card must be removed from the original furnace control and retained with the furnace. A plastic tether with a note wrapped around the tether is used to remind the technician not to remove the card from the furnace. Use this card to insert into the memory card connector labeled P6 of the replacement control board. Failure to save and connect the memory card properly to the replacement control may result in no operation or undesired operation of the furnace.

When replacing the furnace control, be sure to match the dipswitch settings of the original control on the replacement.

DO NOT CUT THE PLASTIC WIRE TIE USED AS A TETHER TO THE ATTACHED MEMORY CARD. DOING SO WILL DEFEAT THE PURPOSE OF RETAINING THE MEMORY CARD – WHICH COULD LEAD TO A LOSS OF CRITICAL DATA NECESSARY TO OPERATE THE FURNACE. THE CARD MUST STAY WITH THE FURNACE – EVEN WHEN THE FURNACE CONTROL (IFC) MUST BE REPLACED. NEVER USE A CONTROL BOARD TAKEN FROM ANOTHER FURNACE AS A REPLACEMENT CONTROL FOR THIS FURNACE. FURNACE CONTROLS TAKEN FROM OTHER FURNACES MAY CONTAMINATE THE SYSTEM WITH THE WRONG MODEL DATA WHICH CAN ONLY BE FIXED BY REPLACING THE MEMORY CARD WITH THE ORIGINAL MEMORY CARD FROM THE ORIGINAL FURNACE OR A REPLACEMENT MEMORY CARD DESIGNED FOR THE ORIGINAL FURNACE.

DIAGNOSING BLOWER MOTOR ISSUES

If the main circulating blower motor will not operate when it should, there are some different methods for diagnosing the problem.

DIAGNOSTICS AND TROUBLESHOOTING

DIAGNOSING BLOWER MOTOR ISSUES

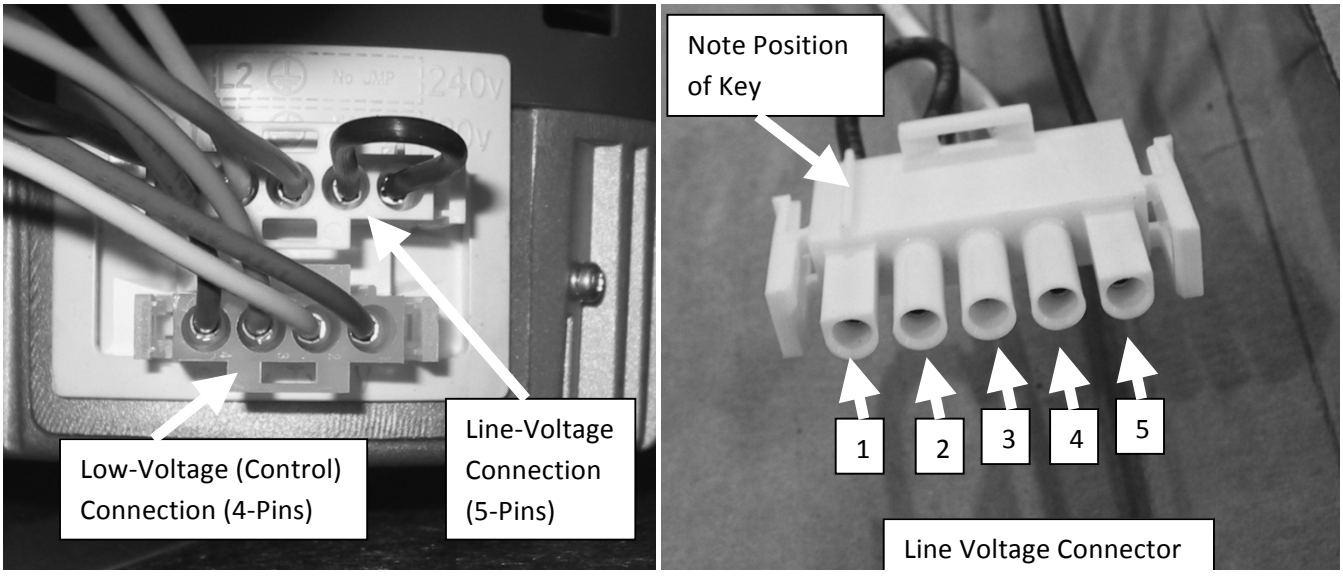
1. **MOTOR POWER AND COMMUNICATIONS ISSUES (FAULT CODE "68")**

   Is the motor communicating properly with the furnace control? If not, the fault code "68" will be displayed any time there is a call for cooling, heating or continuous fan. To determine the cause of this issue, follow these steps:

   A. Remove the line voltage connector from the motor. This is the 5-pin connector. With the door switch closed, verify that there is 115-120VAC between pins 4 and 5 of the connector (see photos in Figure 62B). If no line voltage is detected, check the wiring and correct the issue. Line voltage should be present at these pins any time the furnace is powered. Make sure that the pins of the connector are fully seated in the housing to ensure good contact with the connection at the motor. When voltage is confirmed at these pins, replace the connector on the motor.

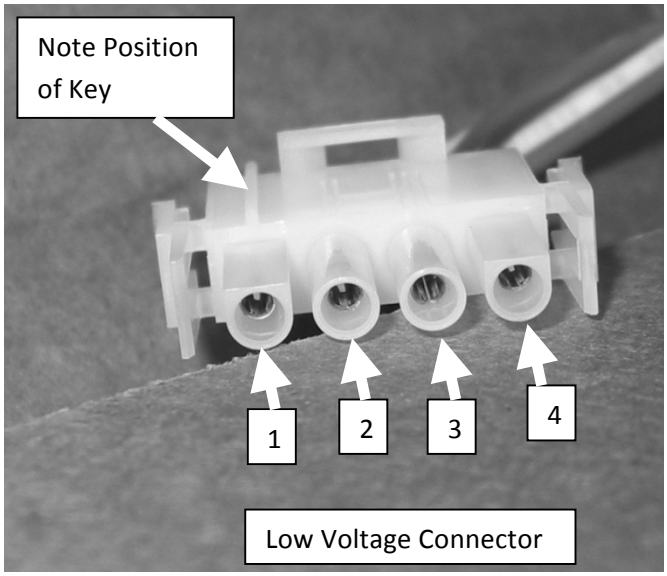
   B. Remove the motor control connector from the furnace control at P5 and apply 24VAC to pins 3 & 4 (see photo). With the door switch closed (motor powered) and 24VAC on pins 3 & 4, the motor should start operating at 75% of capacity. If the motor is operating at a good speed, it is likely not the motor that is the problem. If the motor is not operating, verify that the control wiring between the motor and furnace control (to P5) is good and that all the pins on both ends are fully seated. If the wiring connections looks good, and the motor still will not operate, the motor likely needs to be replaced.

FIGURE 62
LINE VOLTAGE AND LOW VOLTAGE CONNECTIONS TO THE COMMUNICATING MOTOR



DIAGNOSING BLOWER MOTOR ISSUES

FIGURE 63
LOW VOLTAGE CONNECTION PIN DETAIL



2. OVERSPEED OPERATION (CODE "66")

Note: This code will only be displayed during the first three minutes of blower operation and then only if the call for fan is great enough to force the motor into speed limit.

A. Is the duct work of the system restrictive or confined? Or, maybe many (or all) of the supply registers are closed in the duct system. If so, the motor may indicate that it is operating in power limit under certain conditions by displaying code "66". Remove the restrictions or reconfigure the duct work to avoid this code.

B. Is the motor set-screw not tightened to the motor shaft? This may cause erratic motor operation and cause the furnace to display a "66" fault code. Further, airflow will be low or air may not be moving at all.

3. INTERNAL ERROR – MOTOR UNABLE TO OPERATE (FAULT CODE "61")

If the blower motor is able to communicate with the furnace control but is experiencing an internal issue – such as overheating, the fault code "61" will be displayed. Internal overloading may reset once the condition causing the problem has been removed. However, it is likely that the motor will need to be replaced.

A. Is the motor wheel blocked by an obstruction? If so, the motor may be in locked-rotor state and the furnace control will report fault code "61". Remove the obstruction and try to operate the motor again. If the motor continues to fail, it may be permanently damaged and may need to be replaced.

B. Is the motor overheating? If so, it may report an overheat condition to the furnace control and the control will report fault code "61". Determine the cause of overheating and repair. Try to operate the motor again. If the motor continues to fail, it may be permanently damaged and may need to be replaced.

4. INTERNAL ERROR – MOTOR ABLE TO OPERATE (FAULT CODE "60")

This is a low-level fault that is not likely to be displayed often. Operation will continue as normal but fault code will be displayed. Long-term permanent damage to the motor is not expected.

DIAGNOSTICS AND TROUBLESHOOTING

FIGURE 64
2-STAGE FURNACE TROUBLESHOOTING CHART

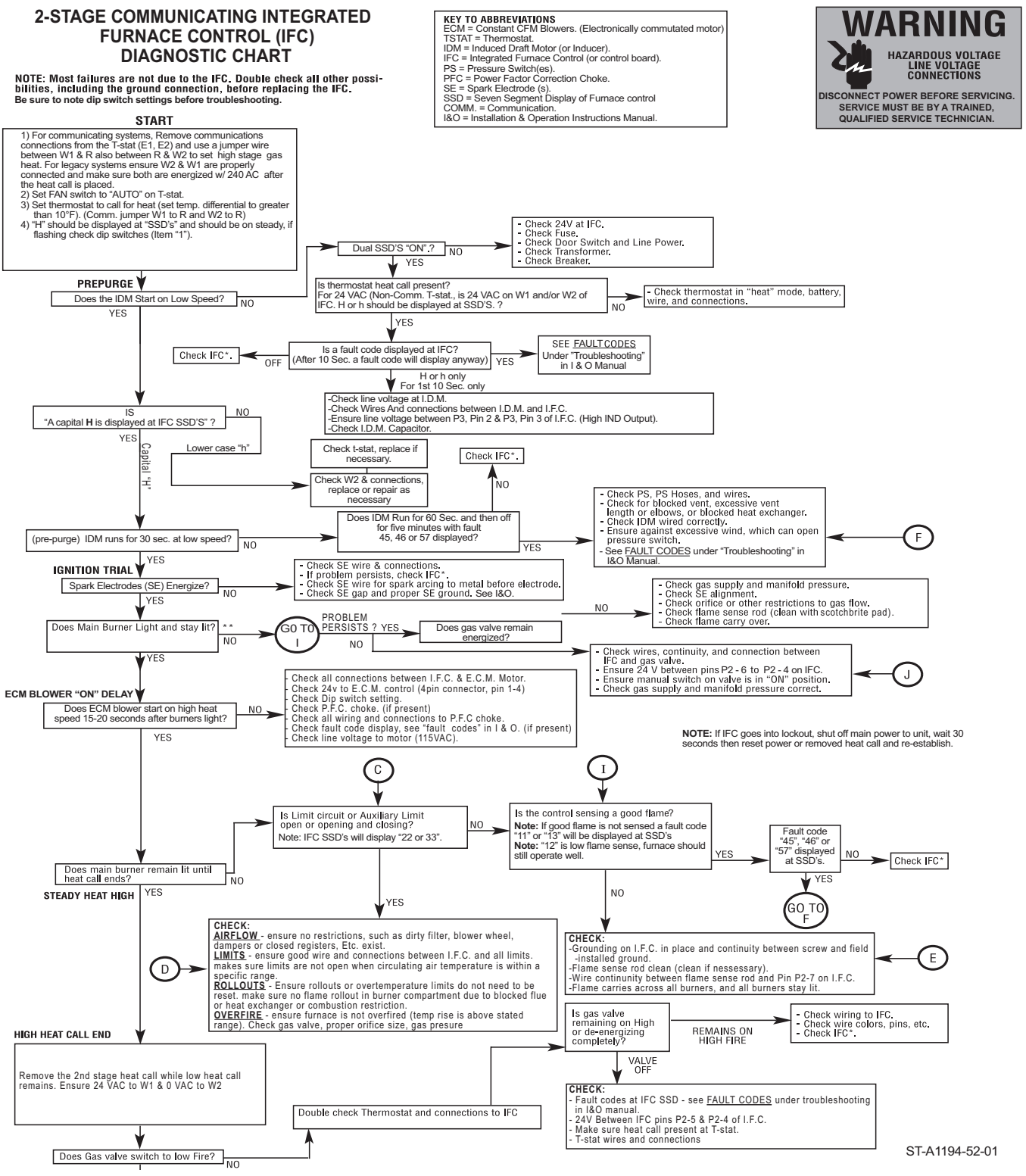
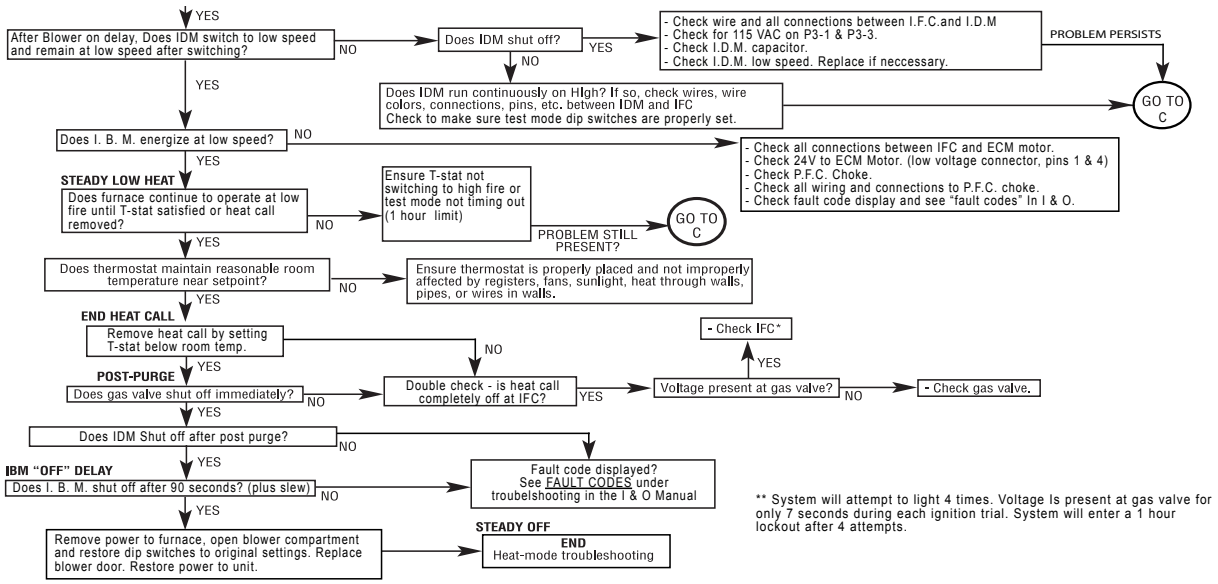


FIGURE 64 (continued)
2-STAGE FURNACE TROUBLESHOOTING CHART



REPEAT THIS SEQUENCE UNTIL TROUBLE- FREE OPERATION

ST-A1194-52-01

TROUBLESHOOTING SECTION

IGNITER LOCATION

The igniter location is critical to furnace operation.

If the igniter is ever replaced always pay attention to the electrodes of the igniter to verify they are properly gapped. The gap should be .110” (2.79mm) between the electrodes.

Once the gap is properly verified and installed the location of the gap must be in the proper location in relation to the burner for best performance. See Figure 65 for igniter location.

FIGURE 65
ENSURE THE ELECTRODE GAP IS LOCATED IN THE HATCHED AREA RELATIVE TO THE BURNER FACE.

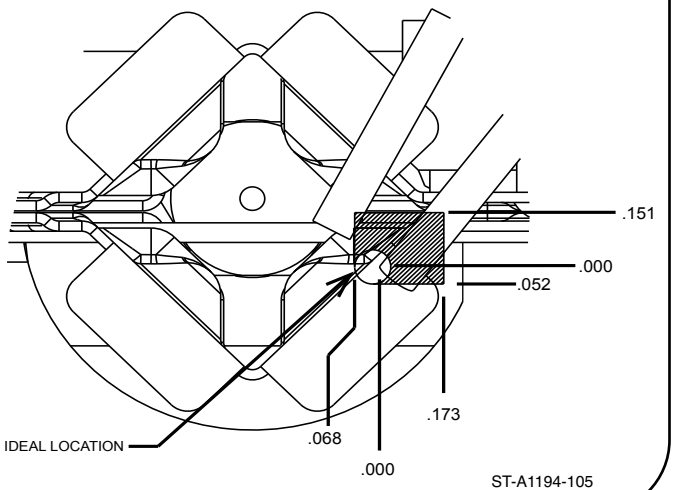


FIGURE 66
IGNITER ELECTRODE TO THE BURNER FACE

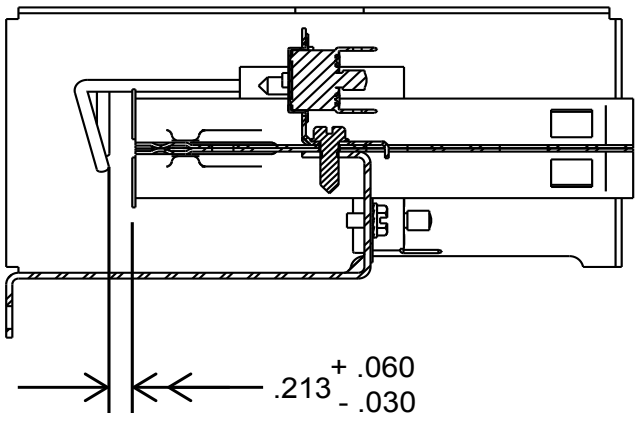
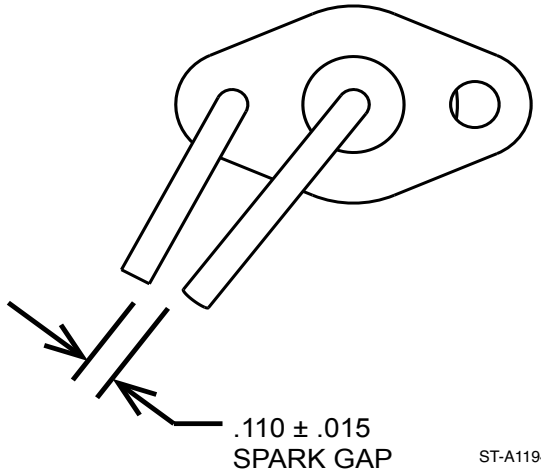


FIGURE 67
SPARK GAP BETWEEN IGNITER ELECTRODES



WIRING DIAGRAM

Figure 68 is a complete wiring diagram for the furnace. A wiring diagram is also available on the unit.

FIGURE 68
2-STAGE ECM FURNACE WIRING DIAGRAM