BRECKWELL

Hearth Products

Dealer Service Guide for Breckwell Pellet Stoves

Prepared for the exclusive use of authorized dealers
of Breckwell Hearth Products

Manufactured by
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Contents

Section Three

Troubleshooting and Diagnosis

Diagnosing and solving operational problems and other customer complaints can be challenging and aggravating. It can also be either rewarding or detrimental to your business, depending on how well prepared you are to handle the process. The strongest, most lasting impression that a customer forms of you does not come from the sales process, but from how you responded to their needs when a problem (real or imagined) arose.

There will never be any better resource than your own skill, experience, and imagination in dealing with customer service calls. But this dealer service guide is intended to give you additional resources you can use to home in on the cause of a problem as quickly and accurately as possible. Where Section One gave an overview of the role each component system plays in the operation of Breckwell pellet stoves, this section provides step by step procedures you can use to eliminate unlikely causes and test for effective solutions. This section represents the accumulated knowledge of Breckwell engineers, who not only designed the stoves, but have years of experience working with service people to identify and solve operational problems.

Breckwell strongly urges you to actively use this section to diagnose problems. Unless the source of the problem is obvious and unambiguous, you will find that these procedures actually simplify the task of finding the problem and devising a effective solution. There is nothing more aggravating to a customer (or service manager!) than to have a stove worked on and supposedly fixed, only to find that the problem persists. Callbacks are not only immediately expensive, but they can do lasting damage to the reputation of a service-oriented business. In most cases these diagnostic procedures will lead you to the real problem, so you can fix it the first time.

3.1 How to Use This Section

Section 3.2 reviews the tools and instruments that you will need to test and repair Breckwell stoves. Most of these are conventional tools that should already be part of a well-equipped service person's tool kit. Others are more specialized tools or instruments that we have found to be useful or essential. In some cases we make a recommendation for a specific brand and model, but you can substitute another so long as it has equivalent characteristics.

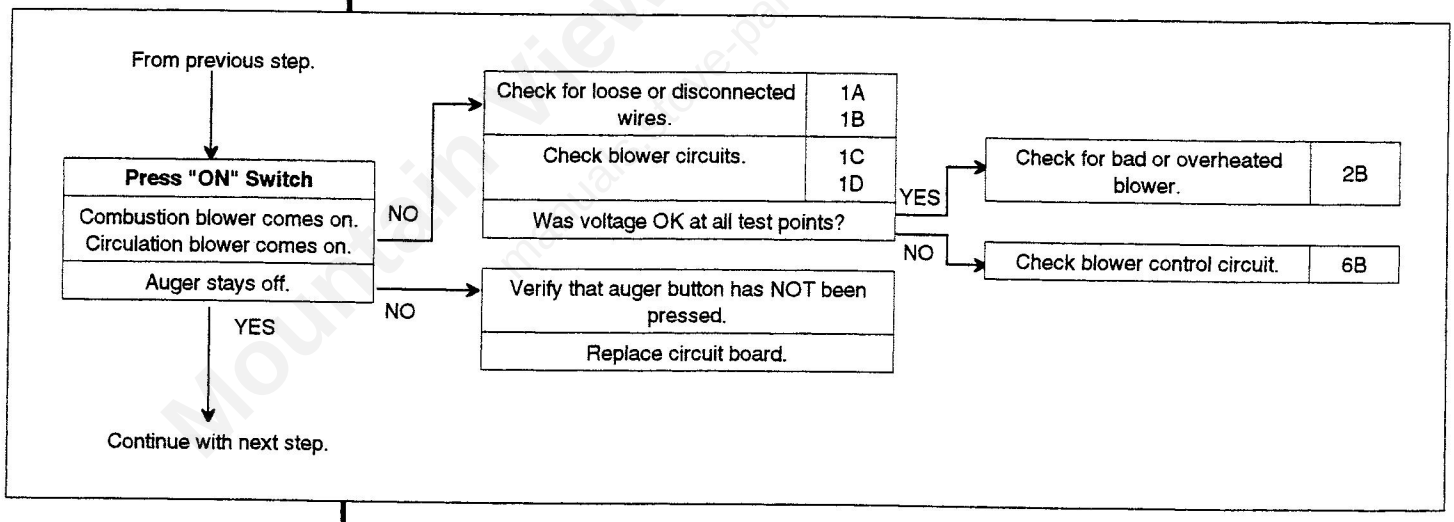
Section 3.3 consists of a flow chart showing the normal operating cycle of Breckwell pellet stoves. It is important that you study this chart and become intimately familiar with the sequence of events programmed into the stove control system, and how it responds to various events. Most functional problems can be understood by observing what does – and doesn't – happen at specific times during the operating sequence. You will want to refer to this chart from time to time as you trace component problems.

Sections 3.4 and 3.5 get to the heart of the diagnostic process. Most traditional troubleshooting charts show you some symptoms and suggest some possible causes, but leave you to figure out what the actual diagnosis is. This often leads to "shotgun" diagnostics: blindly replacing parts or making adjustments until the problem goes away. The procedures in this manual offer a different approach, by giving you a logical path to follow to narrow down and eventually identify the cause of the problem with confidence.

Section 3.4 includes several diagnostic flow charts. These are similar to the normal operating cycle chart in Section 3.3, in that they follow the startup and operating sequences for the stove. As you start up the stove and follow the path, you will make observations about what should or shouldn't happen. Based on these observations, the chart will branch off to further actions and observations.

The chart will direct you to jump to specific tests, which are contained in Section 3.5. Each of these tests contains a step by step procedure for checking out the condition or operation of a specific component or stove system. Depending on the results of the test, you may jump back to the diagnostic flow chart to try the next test, or branch off on a different line of investigation. You will continue following the chart until the specific cause of the problem is identified, at which point you will be advised about how to fix it.

Below is an example of a section from one of the diagnostic flow charts:



Actions which you should take, such as adjusting a switch on the stove, are shown in **bold**. The box on the left directs you to press the "ON" switch on the stove. You should then make observations about what happens. In this case, the combustion and circulation blowers should come on, but the auger should stay off. If all of these things are true, you can follow the "YES" path to the next step.

But if, for instance, one of the blowers did not come on, you should follow the "NO" path to the diagnostic box to the right. You are first directed to

check for loose or disconnected wires. Tests 1A and 1B, which are found in Section 3.5.1, contain detailed instructions on what to do. If the problem is not identified in Test 1A or 1B, you would continue to the next instruction, which is to check the blower circuits using Tests 1C and 1D.

Tests 1C and 1D contain instructions for checking the voltage at several test points. If you aren't able to detect the reason the blower isn't working in these tests, you would come back and use the results of the voltage tests to answer the next question. If the voltage checked out OK, you would answer YES and branch to the box that has you check for a bad blower in Test 2B. If the voltage was not adequate, you would follow the "NO" path and check the blower control circuit on the circuit board, using Test 6B.

Every pathway on the chart leads to a diagnosis. All you have to do is take the actions directed, make observations, and follow the logical path to narrow down the possible causes. You will often identify the problem along the way, and not have to follow the whole path, but you will always end up with a solution what should take care of the problem.

There are a few rules and recommendations for making the best use of this diagnostic system:

- **Start at the beginning.** The charts are designed to work from the point where the stove is plugged in through each step in the startup, steady operation, and shutdown cycle. In many cases a problem that the customer notices during steady operation can best be detected during the startup period, and some causes are eliminated by observations you make during startup. The charts work best if you start with a cold stove and follow the step by step process.

  However, sometimes it is not practical to start with a cold stove. You are free to use your best judgment about where to enter the diagnostic flow chart, and in many cases you can get to the correct diagnosis from several points on the chart. However, you should be reasonably sure that the stove is operating properly at each prior step in the chart, and be aware that the chart sequence may lead you more quickly or directly to the source of the problem. You should be prepared to go back to the beginning if you aren't able to identify the problem by starting in the middle.

- **Follow the steps exactly.** The steps in the chart are designed to be executed in a particular order. Frequently, the most common or easy to solve causes are tested first. In other cases, it is necessary to eliminate one possibility before the next one can be accurately investigated. You will arrive at the most positive diagnosis -- and often more quickly -- if you follow the pathways as given.

  You may be tempted to take a shortcut or skip a diagnostic test because your intuition or experience tells you it is unlikely to reveal the cause. You are free to apply your best judgment to the use of the

charts. However, you should keep in mind that you might reach a dead end, or worse, an incorrect diagnosis. You may end up having to go back and perform the tests you skipped anyhow.

- **Interact with the customer.** Although these charts are designed to be used by qualified service people, you can use them with the customer to identify the conditions under which the problem occurs. This can save time and, in some cases, eliminate the need for a service call. You can use the chart over the phone, asking the customer to run though the startup sequence as shown on the chart and report the results to you. Once you reach a point where something doesn't work as expected, you can decide whether a service call is needed or if the customer can take some action to solve the problem.

Once you have arrived at a diagnosis, you need to know what to do about it. In most cases, the test procedures will tell you what to adjust or replace. But in other cases a more detailed description of how to make a repair is needed. Such service procedures are found in Section 3.6.

3.2 Tools and Instruments

Following is an exhaustive list of the tools and instruments you might use when working on pellet stoves. some of them you won't use often, but there is no substitute for the right tool when you need it.

Common Tools

1/4" drive socket wrench set
3/8" drive socket wrench set
Socket wrench extensions
Basic open end and box wrench set
Needle nose pliers (straight and bent jaws)
6 inch and 8 inch channel-type pliers
6 inch and 8 inch vice grip pliers
16 oz. ball peen hammer
Basic screwdriver set; Phillips and common head
Basic allen wrench set
1/8 inch and 5/8 inch tee handle allen wrenches
Bit-type screwdriver with:
    #2 Phillips bit, 3 inches long
    1/4" magnetic hex driver bit
    3/8" magnetic hex driver bit
Small rat tail file
1 inch bastard (flat) file
1 1/4" putty knife
Retractable razor knife
Wire cutters and strippers
3/8" x 16 thread tap

3/8 inch reversible, variable speed power drill
Basic drill bit set, including 1/16" to 3/8" bits
Pop rivet gun with 1/8" and 5/16" rivets

Special Tools

Molex Pin Remover #11-03-0038-HT60630A
Molex Crimper Unit #HTR-60622
Loveless Ash system, chimney sweeping vac, or equivalent

Instruments

Manometer capable of reading 0 to 1 inches of water (inWC) or 0 to 248 Pascals (Pa), in 0.05 inWC increments (12.5 Pa). Some suggested examples are:

Magnehelic Gauges
Dwyer #2001
Dwyer #A-432
(Inexpensive and easy to use)

The Energy Conservatory
Digital Manometer
(Digital; more expensive but very accurate and versatile; use for house pressure testing too.)

Multimeter or volt meter (digital preferred)
Polarity and ground tester (for electrical outlets)
Stopwatch

Miscellaneous

Long flexible handle magnet
Dental mirror or swivel handle mirror
Flashlight
6 inch jumper wire with male spade connectors on both ends.
6 inch jumper wire with small male probe on both ends.
6 inch Y jumper wire with female spade connector on common end and male connectors on the other ends.
Power cord with inline switch and male and female spade connectors
Small bottle of "High Temperature Anti-Sieze"
1 inch diameter by 3 inch long bottle brush with flexible wire handle.
3 inch paint brush with stiff bristles
Spray cleaner and rags.
Touch up paints
Caulking gun and high temperature silicone.
Oil can and 20 WT motor oil.
Extra screws, gaskets, glass etc.

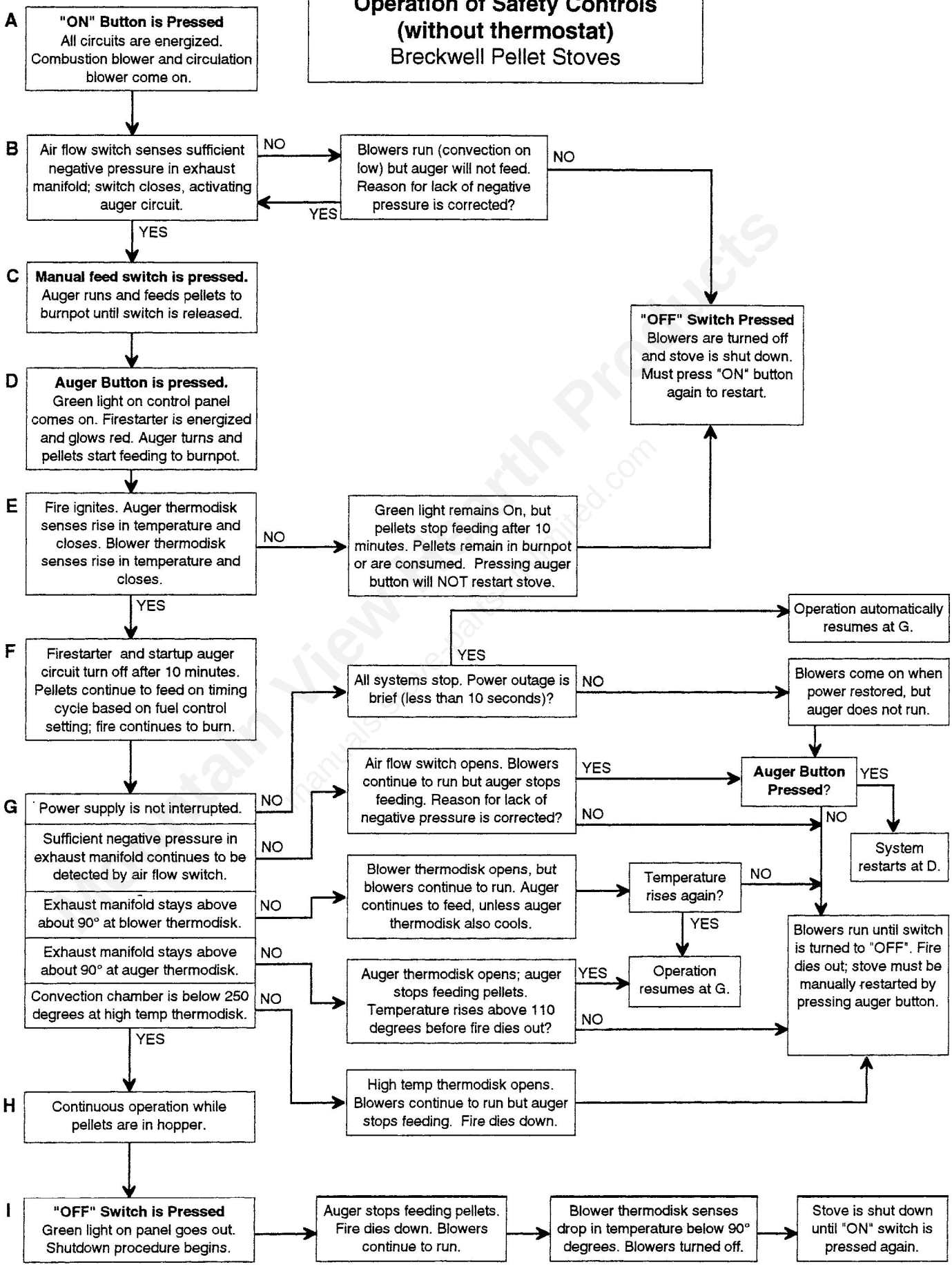
3.3 Normal Operating Sequence

The chart on the following page illustrates the normal sequence of events when a Breckwell pellet stove, equipped with a Hot Shot firestarter but without a thermostat, is started up, allowed to operate continuously, and shut down.

This chart gives an overview of the functioning of the operating and safety controls, and shows how the "logic" built in to the stove handles various events. You should become familiar with this chart and refer to it as you track down operation problems. There are a few points which should be highlighted:

- When a stove is equipped with an automatic firestarter, it is not necessary that the manual feed switch be pressed (Step C). As soon as the auger button is pressed, the auger will begin feeding pellets, and will continue for about 10 minutes. This provides an opportunity for the pellets to be ignited by the firestarter. In order for pellets to continue feeding enough heat must be generated to warm up and close the auger thermodisk. If this does not happen, pellets will stop feeding and any fire will die out. The stove must be restarted from Step A by turning the main switch Off and back to On, and again pressing the auger button.
- When the auger button is pressed, the green light should come on, indicating that the auger circuit is energized. If the high temp thermodisk or air flow switch is open, the circuit will be interrupted, and the green light will stay off. The status of the green light is a very important observation since, in effect, it tells you whether or not the stove is ready and able to operate.
- After a short power failure the stove will automatically resume operating without any action needed. The time that the power can be off varies from about 5 to 15 seconds. If the power failure is longer, the stove can be restarted by pressing the auger button; it is not necessary to turn the stove Off and back On.
- If the high temp thermodisk or air flow switch opens and stops the auger system, the green light will go out. The stove can be restarted by pressing the auger button, but only after the cause of the shutdown is corrected.
- The combustion and convection blowers will always run if the main switch is On, even if something else has shut down the auger system. The purpose of the blower thermodisk is just to turn the blowers off after the switch is turned Off and the stove cools. This can take about 45 minutes.

Section 3.3
Normal Operating Sequence and Operation of Safety Controls (without thermostat)
Breckwell Pellet Stoves



3.4 Diagnostic Flow Charts

The diagnostic flow charts which begin on the following page are the heart of a unique troubleshooting process designed to lead you confidently to a diagnosis and solution for the most common operational problems with Breckwell stoves. They are designed to be used in conjunction with the sets of diagnostic tests which are found in Section 3.5.

Complete instructions for using the flow charts and the test procedures are found in Section 3.1. Remember that these charts are meant to be executed in the order shown. Even if the problem is one that doesn't show up until the stove has been running for a while, you should start the diagnostic process at the beginning of the "Startup Sequence" flow chart. Operational problems can often be better identified and diagnosed by observing what the stove does when it is started. Also, many of the logical steps in the chart depend on having eliminated a possible cause in a previous step. You will have most success with these charts if you follow them in the order given and perform the test procedures exactly as described.

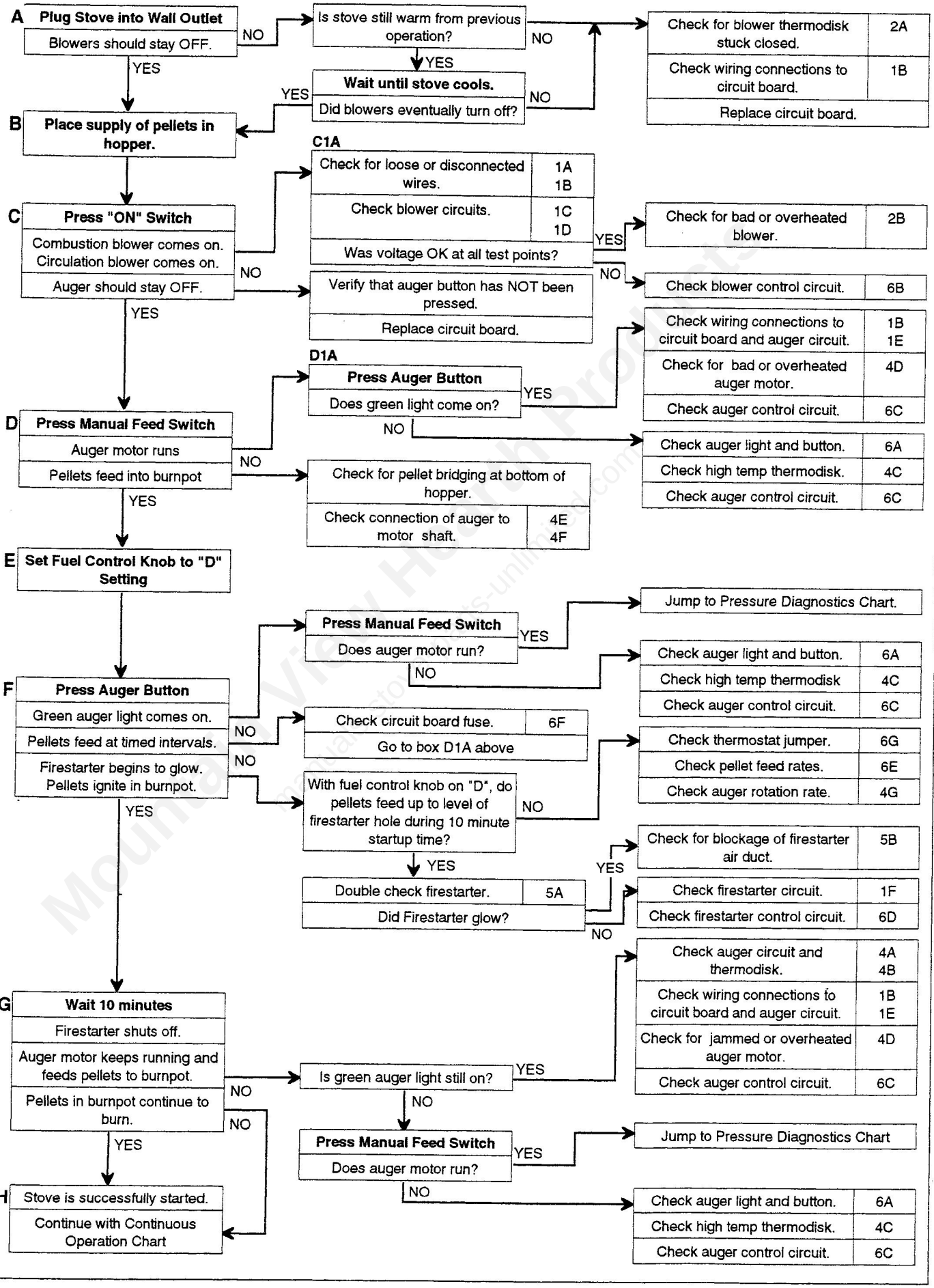
A note on safety: Many of these tests involve testing the electrical systems. Wherever possible, the test procedures will tell you to unplug the stove when setting up a test or connecting a jumper wire, for instance. As a matter of professional responsibility, you should always disconnect the power to minimize the electrical hazard whenever directed to do so.

However, many of the tests must be conducted with the power connected and the stove turned on. There is an inherent risk involved in testing electrical systems while they are energized. **You must always be aware when power is on, and constantly think about what parts are "hot".** Use your electrical test equipment carefully as directed by the test procedures, and avoid causing shorts or touching any part that is not involved in the test.

Don't even work on a stove that is not properly grounded. Before plugging the stove in and starting the process, check that the outlet is grounded and that the ground prong on the power cord has not been damaged. If you need to access the control compartment of the stove, the first thing you should do is make sure that the green ground wire is securely connected to the metal below the terminal strip. Most of the voltage checks in the test procedure have you measure the potential between the electrical component and the grounded stove body. This is both for your safety and a continual check on the grounding of the stove.

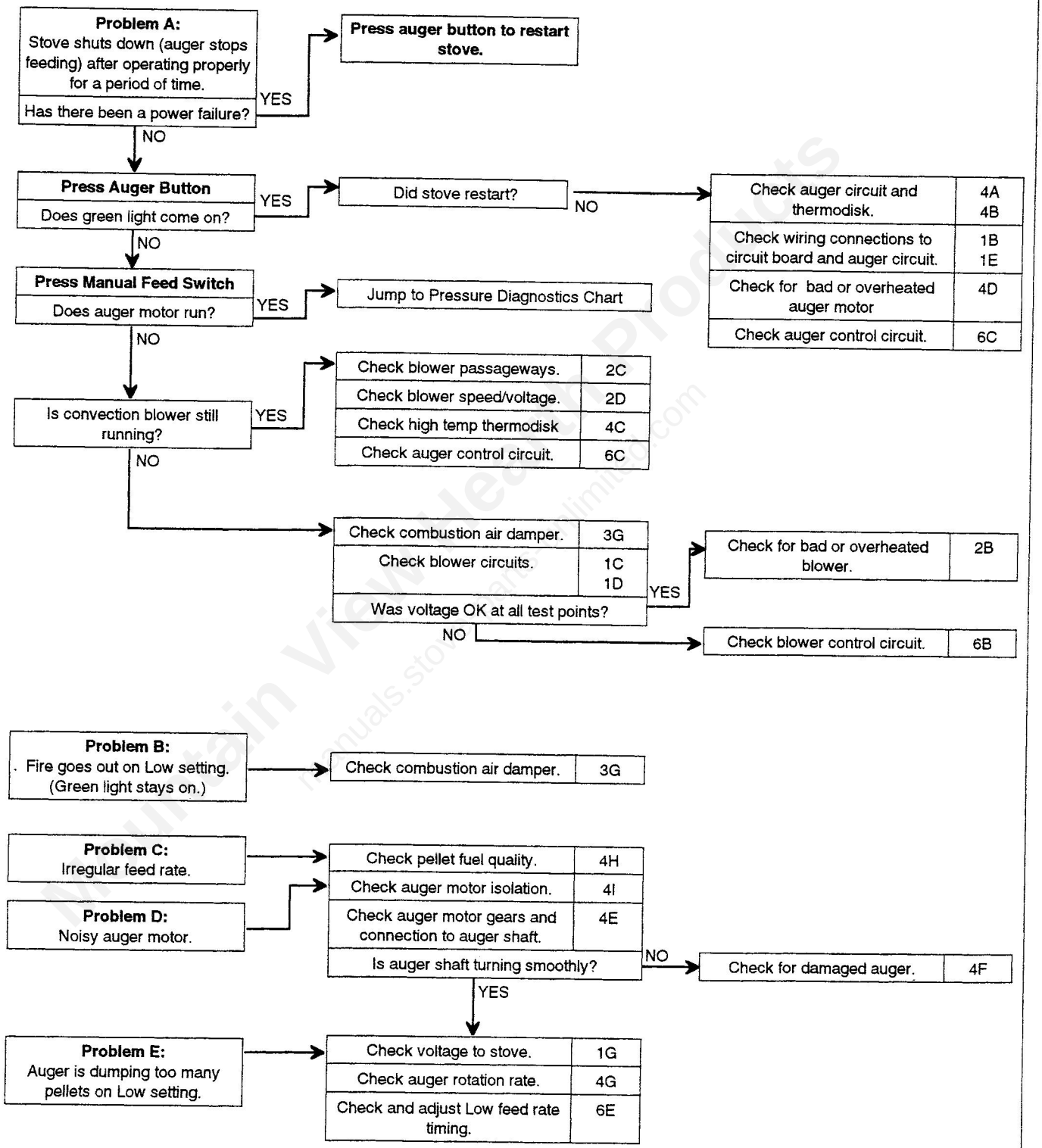
Don't permanently bypass thermodisks or the air flow switch. While some of the tests in this section have you temporarily bypass safety controls, *that is for diagnostic purposes only.* Never leave the customer's house with a safety switch bypassed, both for the customer's safety and your own liability protection.

3.4.1 Startup Sequence Diagnostic Flow Chart

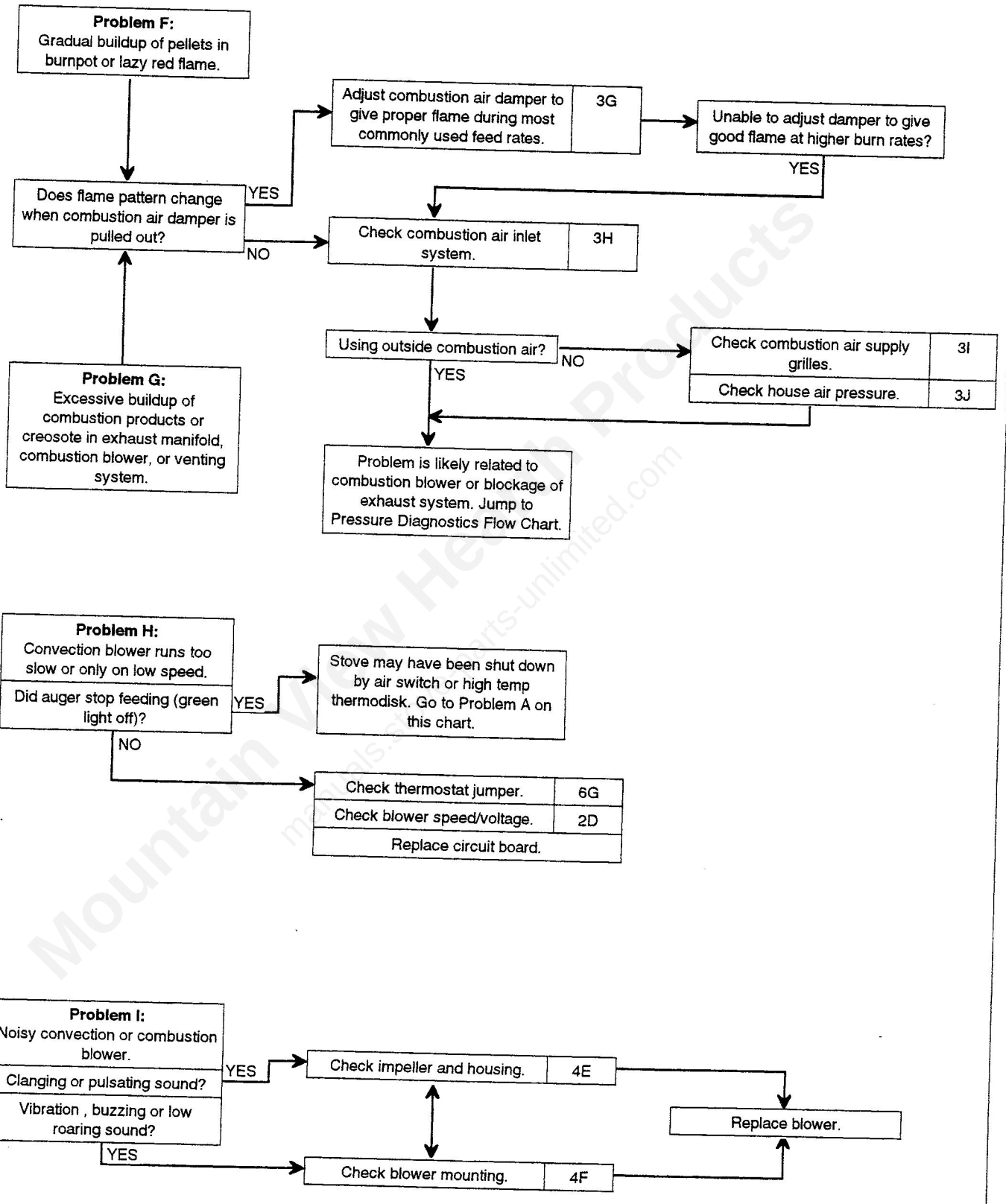


3.4.2 Continuous Operation Diagnostic Flow Chart

For problems that develop after the stove has been successfully started. If no problems, continue with the Shut Down Diagnostic Flow Chart.

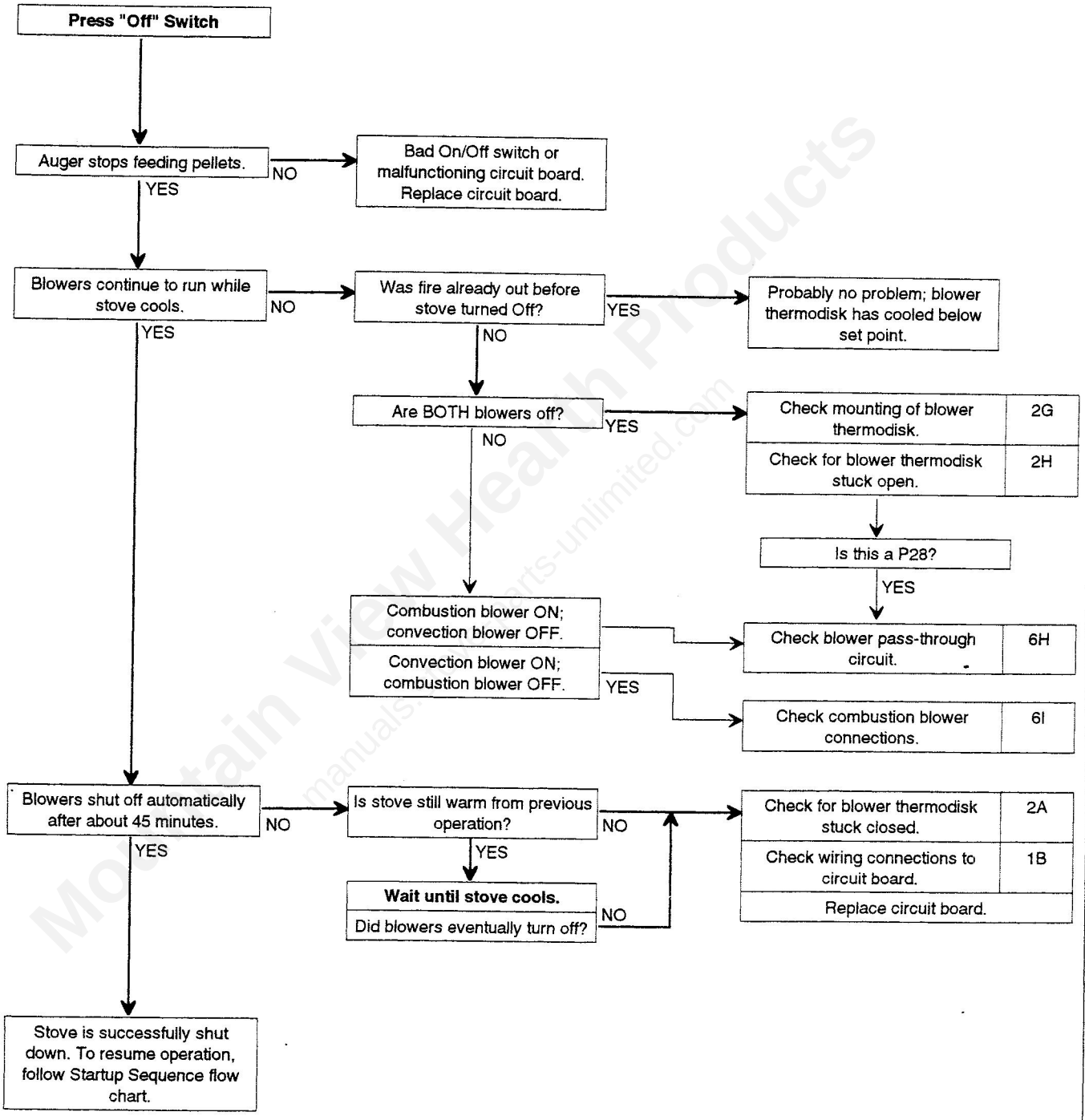


3.4.2 Continuous Operation Diagnostic Flow Chart
Continued

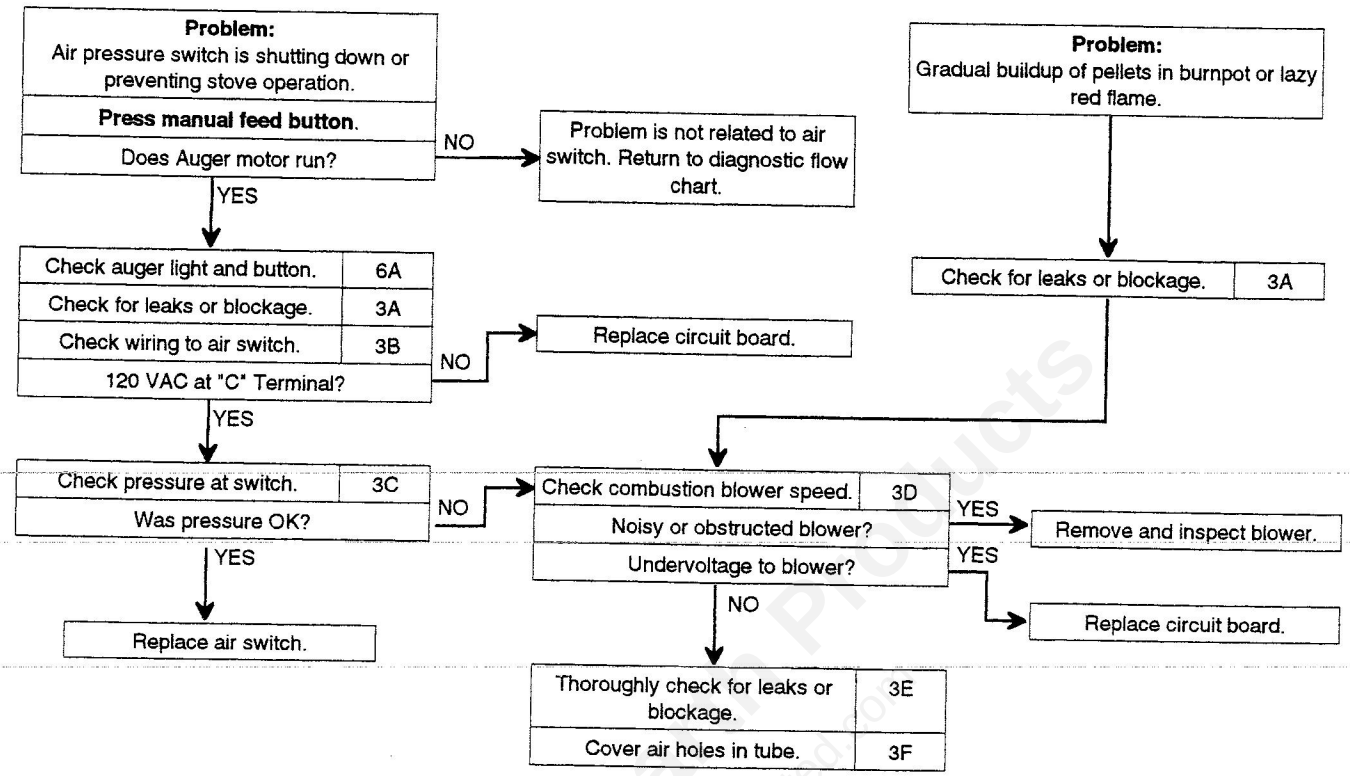


3.4.3 Shut Down Sequence Diagnostic Flow Chart

Assumes that Startup Sequence and Continuous Operation charts have been followed, and that operation is correct up to this point.



3.4.4 Pressure Diagnostic Flow Chart



3.5 Diagnostic Test Procedures

The following test procedures are to be used in conjunction with the diagnostic flow charts in section 3.4.

3.5.1 General Wiring Tests

Test 1A Check Wiring to Terminal Strip

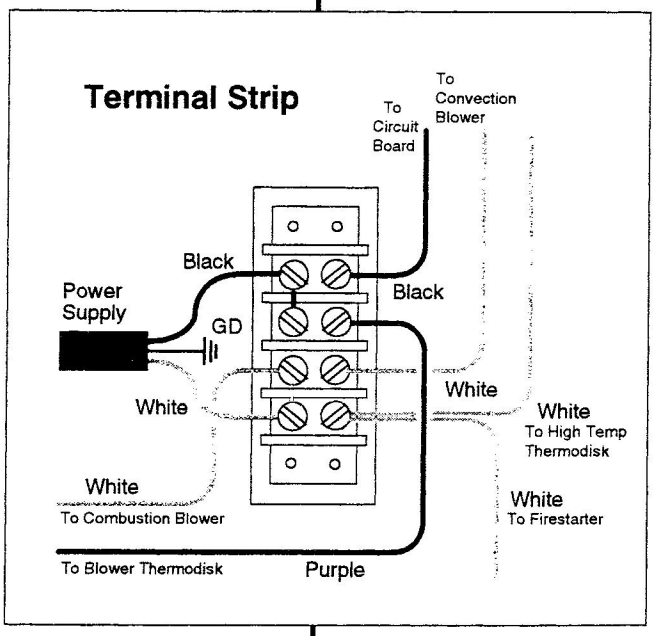
In order for power to be available to all components, and properly controlled by the circuit board, all wiring connections to the terminal strip must be secure.

Procedure

First, make sure that the stove power cord is securely plugged into a wall outlet. Then make sure that the wall outlet is energized. Is the wall outlet controlled by a wall switch? Has the fuse or circuit breaker for the wall switch blown or tripped? Use a plug-in outlet tester to verify that the outlet has power. If the outlet has power, continue with the following steps.

1. Unplug the power cord from the wall outlet.
2. Examine the power supply terminal strip, referring to diagram at right:[P28]
   - Note: Individual wires may be connected to a different terminal from those shown on the diagram. But the black and purple wires should still be connected to the "hot side" of the strip, and the white wires connected to the "neutral side", as shown.
   - Are black and white wires from the power cord securely connected to the terminals as shown in the diagram?
   - Are the two black, purple and two white wires securely connected to the terminal, leading to the correct components, as shown in the diagram?
   - Is the green ground wire securely attached to the screw on the side of the terminal block?
3. Correct any loose or disconnected wires. Plug the stove into the wall outlet and check to see if the component now operates properly. If not, continue with the next step.
4. Using a voltage meter or multimeter, check for power at the terminal strip. Set the meter to measure AC voltage (VAC) in a range of 100 to 200 volts. Place one probe on the ground connection screw. Touch the other probe to each of the four "hot side" terminals on the terminal

P28:
Because the P28 uses capacitor-start blowers, it has two blue wires connected to the neutral side of the terminal strip instead of two of the white wires. See the wiring diagram in the P28 Owner's Manual.



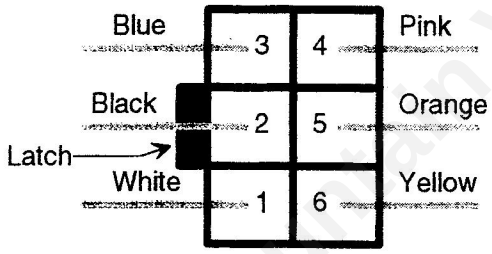
strip (the ones with the black and purple wires attached.) The meter should read at or near 120 volts in each case.

5. Leave one probe touching one of the "hot side" terminals. Now touch the other probe to each of the "neutral side" terminals. The meter should read at or near 120 volts at each of these terminals.
6. If you get 120 volts for each of the above measurements, power is available to the stove, and the source of the problem lies elsewhere. If you do not get 120 volts in each case, check power to the wall outlet. Also check to make sure that the wall outlet is grounded and that the ground prong on the power cord has not been pulled out or damaged. Check to see that the power cord has been cut or pinched such that a wire is broken. Repeat all of the above steps until you have power to all terminals on the terminal strip.

Test 1B Check Wiring of Molex Connector at Circuit Board

In order for power to be available to all components, and properly controlled by the circuit board, all wiring connections to the back of the Molex connector must be in the proper position and secure.

Wiring Pattern of Molex Connector
(Viewed from back)



Procedure

1. Unplug power cord from wall outlet.
2. Remove the control panel cover plate by removing the four brass mounting screws. **Carefully** pull out panel plate and attached circuit board. Detach at Molex connector. Set the circuit board aside.
3. Examine the back side of the male Molex connector, where the wires enter the connector. The wire colors and connections should conform to the diagram at right.
4. If the wire connections do not conform to the diagram, contact for the factory for instructions on repairing or replacing the wiring harness.

Test 1C Check Combustion Blower Circuit

The combustion blower circuit includes the Molex connector at the circuit board, the blower thermodisk, the blower, and the power supply terminal strip. You should have already checked for proper connection and voltage to the terminal strip and Molex connector before doing this test.

Procedure

1. The stove should be unplugged. Starting at the male end of the Molex connector where it attaches to the circuit board, trace the blue wire to where it attaches to the blower thermodisk.
   - Is the blue wire securely connected to the terminal on one side of the thermodisk?
   - Is the black wire leading to the combustion blower[P28] securely connected to the other terminal on the same side of the thermodisk?
   - Is the purple wire securely connected to the terminal on the opposite side of the thermodisk?
2. Identify the black and white wires leading from the combustion blower.[P28] Are these leads securely attached to the black and white wires with spade connectors?
3. Correct any loose or disconnected wires. Plug the stove into the wall, press the "On" switch, and see if the combustion blower now operates correctly. If not, continue with the next step.
4. With the stove still plugged in and turned "On", test for voltage to the blower circuit. Use a volt meter or multimeter set to measure AC voltage (VAC) in a range of 100 to 200 volts.
5. Place one probe on the terminal of the blower thermodisk where the purple wire is attached. Touch the other probe to an unpainted metal part of the stove. The volt meter should read at or near 120 Volts. If it does not, return to Test 1A and check the connections and power supply at the terminal strip.
6. Remove both probes from the stove, and place one probe on the other side of the thermodisk, where the blue and black wires are attached.[P28] Again touch the other probe to an unpainted metal part of the stove. The volt meter should read at or near 120 Volts. If you do get 120 Volts at these locations, the blower is bad or its internal thermal overload switch has shut it down. If you do not get 120 Volts, the circuit board may be bad.
5. Return to diagnostic flow chart.

P28:
Not applicable to this model.

P28:
Check all spade connections between blue brown and black wires leading to the blower and its capcitor.

P28:
This step is not applicable to the P28.

Test 1D Check Convection Blower Circuit

The convection blower circuit includes the Molex connector at the circuit board, the blower, and the power supply terminal strip. You should have already checked for proper connection and voltage to the terminal strip and Molex connector before doing this test.

Procedure

1. The stove should be unplugged. Starting at the male end of the Molex connector where it attaches to the circuit board, trace the pink wire to

P28:
Check all spade connections to the pink wire, and between the blue, black, and brown wires leading to the blower and its capacitor.

P23 and other with small circuit boards:
Set the feed rate to "High".

where it joins the lead to the convection blower with a spade connector. Make sure that the spade connectors are securely joined.[P28]

2. Trace the other lead from the convection blower to where it joins the white wire (leading to the terminal strip) with a spade connector. Make sure the spade connectors are firmly joined.
3. Correct any loose or disconnected wires. Plug the stove into the wall, press the "On" switch, and see if the convection blower now operates correctly. If not, continue with the next step.
4. With the stove still plugged in and turned "On", test for voltage to the blower circuit. Make sure that the feed control knob is set to "D".[P23] Use a volt meter or multimeter set to measure AC voltage (VAC) in a range of 100 to 200 volts.
5. Disconnect the pink wire from the convection blower lead at the spade connector. Touch one multimeter probe to the metal spade inside the connector at the end of the pink wire. Touch the other probe to an unpainted metal part of the stove.
6. The volt meter should read at or near 120 Volts. If you do get 120 Volts, the blower is bad or its internal thermal overload switch has shut it down. If you do not get 120 Volts, the circuit board may be bad.
7. Return to the diagnostic flow chart.

Test 1E Check Auger Circuit

The auger circuit includes the Molex connector at the circuit board, the auger thermodisk, the auger motor, the high temp thermodisk, and the power supply terminal strip. Wire connections at all these points must be correct and secure in order for the auger system to work properly. You should have already checked for proper connection and voltage to the terminal strip and Molex connector before doing this test.

Procedure

1. The stove should be unplugged. Starting at the male end of the Molex connector where it attaches to the circuit board, trace the orange wire to where it attaches to the auger thermodisk.
   - Is the orange wire securely connected to one side of the thermodisk? Is the other orange wire, leading to the auger motor, securely attached to the other terminal on the same side of the thermodisk?
   - Is the yellow wire securely connected to the terminal on other side of the auger thermodisk?
2. Follow the second orange wire from the thermodisk to the auger motor. Is the spade connector at the end of this wire securely connected to the spade connector on the lead coming off the auger motor?

3. Follow the other, gray, lead from the auger motor to the high temp thermodisk.
   - Is the gray lead from the motor securely connected to the spade connector at the end of the gray wire leading to the high temp thermodisk?
   - Is the gray wire securely connected to one side of the thermodisk? Is the other gray wire, leading to the air flow switch, securely attached to the other terminal on the same side of the thermodisk?
   - Is the white wire securely connected to the terminal on the other side of the high temp thermodisk?
4. Follow the gray wire from the high temp thermodisk to the air flow switch.
   - Is the gray wire securely attached to one terminal on the air flow switch?
   - Is the white wire securely attached to the other terminal on the air flow switch? Does this wire lead to position 1 on the Molex connector at the circuit board (see Test 1B)?
5. Correct any loose or disconnected wires. Plug the stove into the wall, press the "On" switch and the manual feed switch, and see if the auger motor now operates correctly. If not, continue with the next step.
6. With the stove still plugged in and turned "On", test for voltage to the auger circuit. Use a volt meter or multimeter set to measure AC voltage (VAC) in a range of 100 to 200 volts.
7. Place one probe on the terminal of the auger thermodisk where the orange wires are attached. Touch the other probe to an unpainted metal part of the stove. Press the manual feed switch. The volt meter should read at or near 120 Volts.
8. If you do not get 120 Volts, the circuit board may be bad. Return to the diagnostic flow chart. If you do get 120 Volts, continue with the next step.
9. Leave one probe touching the auger thermodisk terminal where the orange wires are attached. With the other probe, touch the terminal on the high temp thermodisk where the white wire is connected. Press the manual feed switch. The meter should read at or near 120 Volts. If it does not, go back to Test 1A and check the connections at the terminal strip.
10. Move the probe from the side of the high temp thermodisk with the white wire, to the terminal where the gray wires are attached. Press the manual feed switch. The meter should still read 120 Volts. If it does not, the high temp thermodisk is probably bad. Return to the diagnostic flow chart.

11. If you got 120 Volts on both sides of the high temp thermodisk, there is probably something wrong with the auger motor. Return to the diagnostic flow chart.

Test 1F Check Firestarter Circuit

The firestarter circuit includes the firestarter terminal on the circuit board, the "Hot Rod" firestarter itself, and the terminal strip. Wire connections at these points must be correct and secure in order for the firestarter to work properly. You should have verified that the firestarter does **not** glow, even though the green light is on, before doing these tests. You should also have already checked for proper connection and voltage to the terminal strip and Molex connector before doing these tests.

Procedure

1. Turn the stove off and unplug it from the wall.
2. Locate the red wire that attaches to a blade terminal near the bottom of the circuit board. Make sure that this wire is securely attached to the terminal.[Remote firestarters]
3. Follow the red wire back toward the firestarter. Make sure that the spade connector at the end of this wire is securely attached to the spade connector at the end of the lead from the firestarter.
4. Locate the other lead from the firestarter. Make sure that the spade connector at the end of this lead is securely attached to the spade connector at the end of the white wire that leads back to the terminal strip.
5. Follow the white wire back to the terminal strip. Make sure that this wire is securely attached to the screw terminal on the terminal strip.
6. Correct any loose or disconnected wires. Plug the stove into the wall, press the "On" switch, and see if the firestarter now operates correctly. If not, continue with the next step.
7. With the stove plugged in and turned "On", press the auger button. The green light should come on. If it doesn't, the problem is not with the firestarter circuit. Return to the diagnostic flow chart and determine the reason the green light is not on.
8. If the green light does come on, test for voltage to the firestarter circuit. Use a volt meter or multimeter set to measure AC voltage (VAC) in a range of 100 to 200 volts. Touch one probe to the metal blade terminal on the circuit board where the red wire is attached, taking care not to contact anything else on the circuit board.
9. Touch the other probe to an unpainted metal part of the stove. The volt meter should read at or near 120 volts. If you do **not** get 120 Volts, the

Remote firestarters: On stoves with remote firestarter circuit boards, the wiring descriptions in this test are not applicable. However, you can still check all wiring connections and the Molex connector attached to the firestarter circuit board. See the Owner's Manual for the stove.

circuit board may be bad. Return to the diagnostic flow chart. If you do get 120 Volts, continue with the next step.

10. Turn the stove Off and unplug it from the wall. Locate the two leads coming from the firestarter and disconnect **both** wires at the spade connectors. Set the multimeter to measure Ohms resistance (Ω). Insert the tip of the probes into the spade terminals, so that the probe contacts the metal inside the plastic insulation.
11. The multimeter should read between about 40 and 50 Ohms. If it reads infinite or very high resistance (numeral 1 on some meters), the firestarter is probably bad. Replace the firestarter and verify proper stove operation.
12. If the firestarter shows continuity and proper resistance, there is probably nothing wrong with it. Repeat the above steps until you locate the reason that power is not getting to the firestarter.

Test 1G Check Voltage to Stove

Certain stove functions, such as the blower speeds and the auger rotation rate, depend on the voltage delivered from the house to the stove. If the voltage is not within certain limits, the stove may not give satisfactory performance. This test focuses solely on the amount of voltage; you should already have determined that all internal wiring is sound and that power is getting to the proper components.

Procedure

1. Make sure the stove is plugged in. The stove does not need to be cool. Use a volt meter or multimeter to check the voltage at the terminal strip. Place one probe on the neutral side terminal where the white wire from the power cord is connected. Touch the other probe to the hot side terminal where the black wire from the power cord is connected.
2. The meter should read between 110 and 120 volts. If it reads significantly higher, a component such as the auger motor may run too fast, which could result too many pellets feeding, especially at the low setting. If it reads significantly lower, components such as the blowers or auger motor may run too slow. This could result in inadequate heat delivery or exhaust manifold pressure, or a pellet feed rate too low to keep the fire going.
3. If the reading is not within this range, the house electrical supply may not be adequate to operate the stove properly. The homeowner should call a qualified electrician to investigate the reason for the electrical supply problem.

3.5.2 Blower Tests

Test 2A Check for Blower Thermodisk Stuck Closed

The purpose of the blower thermodisk is to keep the convection and combustion blowers running any time the stove is warm. When the stove is warm the thermodisk should close, and the blowers will run, even if the On/Off switch is turned to Off. Once the stove cools the thermodisk should open, turning the blowers off. However, if the On/Off switch is set to ON, the blowers will always run, regardless of the status of the blower thermodisk.

Procedure

Note: Before doing this test make sure the On/Off switch on the control panel is turned OFF, and that the stove is cool.

1. Unplug the power cord from the wall outlet. **Stove should be cool.**
2. Locate blower thermodisk (T22). You should find it attached to the exhaust manifold near the combustion blower. A purple wire leading directly from the stove terminal strip should be attached to one side of the thermodisk. A blue wire and a black wire should be connected to the terminals on the other side of the disk.[P28]
3. Disconnect the purple wire from the thermodisk.
4. Plug the stove back in, but do not turn it On. Neither the combustion blower nor the convection blower should run. If they do, the blower thermodisk is not the problem. Return to the diagnostic flow chart.
5. If the blowers do not run, unplug the stove and perform the following test to check the thermodisk.
6. Use a multimeter set to measure Ohms resistance (Ω). Leave the purple wire detached.
7. Place one multimeter probe on the terminal on one side of the thermodisk, and place the other probe on the terminal on the other side of the thermodisk.
8. If the stove is cool, the multimeter should show infinite or very high resistance (numeral 1 on some meters).
9. If the multimeter shows zero or very low resistance (and the stove is cool), the thermodisk is bad. Replace the thermodisk and reconnect the purple wire.
10. Verify proper stove operation.

P28:
The P28 does not have the black wire attached with the blue wire.

Test 2B Check for Overheated or Jammed Blower

Both the combustion blower and the convection blower include internal thermal protection that will shut the blower down if it becomes too hot. Before concluding that a blower is broken, you need to be sure that it is not shutting down for this reason. If the blower is overheating, you need to determine the reason for this before replacing the blower.

Procedure

Before doing these tests you should have made sure that all wiring connections are secure and that power is available to the blower. See tests 1A, 1B, 1C, and 1D.

1. Identify which blower is not operating. If *both* bowers are not operating, it is highly unlikely that they both have gone bad. Return to the diagnostic flow chart and perform tests 1A, 1B, 1C, and 1D.
2. If the stove is still turned on, *listen* to the blower. If you hear it hum, but it is not turning at all, it is probably jammed.
3. Turn the stove Off, and unplug it. CAREFULLY feel the outside surface of the blower motor or motor housing. If it is hot (not warm, but HOT – too hot to touch) it is likely that the internal thermal protection has shut the blower down. If the motor is not hot the blower is probably simply burned out. Replace it and verify proper stove operation.
4. If the blower motor is hot, allow the stove and blower to cool. (This may take some time.) Then plug the stove in and turn it On again. If the blower now runs, it was overheated.
5. If the blower was jammed or overheated, you need to find out why. Neither the combustion blower nor the convection blower should have any reason to overheat as a result of normal operation of the stove, and foreign objects should not be able to get in the blowers. Examine the outside of the blower and, if necessary, remove it. Look inside the impeller blades and everywhere within the housing for foreign objects and remove any you find. Also look for obstruction of the blades of the smaller cooling fan next to the motor.
6. If the stove is not operated properly, the combustion fan can become clogged with creosote or other combustion products. This can cause the motor to work so hard that it overheats. Remove the blower, clean out the blower housing and all exhaust passageways. You must then identify the reason for the excessive deposits. See the diagnostic flow chart for this subject.
7. Reassemble the stove, turn it on, and verify proper operation.

Test 2C Check Blower Passageways

If the convection blower is running at the proper speed, and the convection air passageways are not blocked, the stove should not be able to overheat. In other words, the high temp thermodisk should not have shut the stove down. Before looking for a problem with the thermodisk, do these tests to make sure that blower is able to move enough air to keep the stove from overheating.

Procedure

1. Plug the stove in and turn it On. Verify that the convection blower is running. (If it isn't, return to the diagnostic flow chart and follow the path for "blower not running".)
2. Turn the feed control knob to "Low", which should make the blower run at its slowest speed. Tear off a strip of newspaper or other lightweight paper about and inch wide and 6 inches long. Hold this paper above the convection air outlets and move it slowly across all of the outlets. Even with the blower on slow speed, there should be enough air movement to push the paper outward.
3. Repeat this test for all other feed control settings. Listen for any unusual air noises, such as a rushing or whistling sound, that may indicate an obstruction of the air passageways.
4. If you find that air movement is not adequate, hear unusual noise, or for any reason suspect that the air passageways are not clear, turn the stove off and unplug it. Remove the convection blower and inspect the blower and air plenum behind the firebox. Look for foreign objects or loose parts. Shine a flashlight down each of the heat exchanger tubes (remove front grille if necessary) and verify that they are clear. If you find any obstruction, remove it, reassemble the stove and check for proper operation.
5. If you find no obstruction, reassemble the stove and return to the diagnostic flow chart to continue checking for potential blower problems.

Test 2D Check Blower Speed/Voltage

The speed of the convection blower is matched to the pellet feed rate. This provides the right amount of air flow to match the heat output of the stove, and also ensures that the blower will move enough air to prevent the stove from overheating. The circuit board controls the blower speed by varying the voltage. These tests will check for proper voltage to the convection blower.

Procedure

1. Turn the stove Off and unplug it. Make a "Y" jumper wire by crimping TWO 18 gauge wires into a female spade connector. At the other end of

one of the wires, crimp on a male spade connector. Place a spade connector of either gender on the end of the other wire.

2. Disconnect the spade connectors that join the pink wire from the Molex connector to the white wire lead to the convection blower.[P28] Use your Y jumper to reconnect these two wires. You will now be able to use the remaining loose end of the Y jumper to measure the voltage to the convection blower.

3. Use a volt meter or multimeter set to measure AC voltage. Insert one probe into the loose spade connector of the Y jumper. Touch the other probe to an unpainted metal part of the stove.

4. Plug the stove in and turn it On. Set the feed control knob to "Low". The meter should indicate about 60 Volts. Repeat for each of the other feed control settings, and with the high fan switch turned On. The voltage at each setting should be approximately as shown in the table below. If the voltages are OK, return to the diagnostic flow chart and continue with the next test.

Convection Fan Voltage

Low	B	C	D	E	Max	High Fan
60 V	75 V	90 V	115 V	115 V	115 V	115 V

For the P23 and other models with small circuit boards with only four feed rate settings, the following table gives the approximate blower voltages:

Convection Fan Voltage (P23 etc.)

Low	B	C	High	High Fan
65 V	80 V	105 V	115 V	115 V

5. If any of these voltages is significantly lower than shown, the convection fan may not run fast enough to cool the stove or deliver heat to the house. Before concluding that the circuit board is at fault, however, check the voltage supplied to the stove by the house. Touch one probe of your multimeter to the "hot" side of the terminal strip (where the black and purple wires attach), and touch the other probe to an unpainted metal part of the stove. This voltage should be at or near 120 volts. If it isn't, the circuit board is not at fault; the homeowner needs to have an electrician check the house electrical supply.

6. On the P28, pre-1996 versions of the P24, and some other older models, the circuit board includes a blower speed potentiometer. You may be able to use this to increase the blower voltage to match the specifications above. Locate the potentiometer on the side of the board (this is different from the auger timing potentiometer on the back of the board). Use a small screwdriver to turn the pot clockwise to increase the voltage until the reading at the low setting is 55 to 60 volts. Restart the

P28:
On this model, the pink wire joins another pink wire. Disconnect the spade connectors at this point and connect your jumper between the two pink wires.

stove to see if the convection fan can now cool the stove enough to keep the high temp thermodisk from opening.

7. If the house voltage is adequate, but the convection fan voltages don't meet the levels shown above, the circuit board is not supplying adequate voltage. Replace the circuit board, reassemble the stove, and verify proper operation.

Test 2E Check Impeller and Housing

A clanging or pulsating sound from a blower is usually a sign of a damaged, unbalanced, or loose impeller, or of a foreign object inside the blower housing.

Procedure

1. Turn off the stove and unplug it. Identify the blower that is making the noise and dismount it from the stove.
2. Spin the impeller with your hand. Does the impeller appear to spin on its axis, or is it wobbling? Do you hear a rubbing or "contact" sound at some point in the rotation? Examine the inside of the fan housing. Look for foreign objects, and shake out the blower. In the case of the combustion blower, look for build up of creosote or loose chunks touching the impeller.
3. If the impeller was wobbling, find the set screw on the hub of the impeller. Loosen it with an allen wrench (if necessary) and recenter the hub so that it spins concentrically. Retighten the set screw.
4. Plug the stove in. Turn the feed control knob to Low. Holding the blower securely, turn the stove On. **Make sure fingers are clear of the impeller.** Is the objectionable sound still present? Carefully turn the feed control knob to higher settings to make sure the sound is gone at all speeds. If the sound is still present, turn the stove off and unplug it, and continue with the next step.
5. Remove the inlet cover ring (in the case of the convection blower) and find the set screw on the hub of the impeller. Loosen the set screw with an allen wrench and remove the impeller. Examine the impeller for damage: missing or bent blades, out-of-round shape, etc. Look carefully inside the fan housing for foreign objects or creosote, and clean out the housing as necessary. Repeat step 4.
6. If you are unable to identify and eliminate the source of the noise, or if the impeller is damaged beyond repair, replace the blower.
7. If the noise goes away when the blower is dismounted from the stove, but comes back when the blower is reattached, continue your investigation with Test 2F.

Test 2F Check Blower Mounting

The way that the blower is mounted on the stove can transfer vibrations to the stove, which can be quite noticeable. Careful mounting and gasketing, along with oiling of the blower motor, can eliminate objectionable noises.

Procedure

1. Turn the stove on and put your hand on the blower housing. If the blower itself has a substantial vibration or wobble, it is more likely that the impeller is loose or damaged. Go to Test 4E. If the vibration is small or undetectable continue with the next step.
2. If this involves the convection blower, oil the motor with 1 or two drops of SAE 20 motor oil, at the location indicated in the stove owner's manual.
3. The solution to a blower vibration noise problem can be as simple as loosening and retightening the mounting screws. Ideally, the screws should be tightened to equal torque. In practice, you can usually adjust the tightness of each screw until a combination is found the eliminates the vibration. Do this while the blower is running. Avoid overtightening the screws; the gasket should not squeeze out from between the flanges.
4. If retightening the screws did not solve the problem, remove the blower and inspect the blower gasket. It should be intact, without cracks or gaps, and it should be flexible or compressible, not hard or crumbly. If the gasket is not in good condition, replace it.
5. If there was nothing wrong with the gasket, add another gasket for additional isolation of the blower from the stove.
6. Remount the blower on the stove. Again adjust the mounting screws to eliminate vibration. If the sound it not eliminated, got to Test 2E to make sure that an internal problem is not the source of the noise.

Test 2G Check Mounting of Blower Thermodisk

The purpose of the blower thermodisk is to keep the convection and combustion blowers running any time the stove is warm. When the stove is warm the thermodisk should close, and the blowers should run, even if the On/Off switch is turned to Off. In order to work, the thermodisk must be mounted so that it will be warmed up by the hot exhaust manifold.

Procedure

1. Verify that the blower thermodisk is mounted so that its face is close to, or in contact with, the metal of the exhaust manifold or combustion blower housing. If it is not close to the metal, it may not warm up when the stove warms up. Make sure the mounting screws are tight.

2. If you have any suspicion that the thermodisk is not being sufficiently warmed by the stove, do the following test.
3. Unplug the stove, and dismount the thermodisk by unscrewing the mounting screws. Make sure that neither of the exposed electrical terminals on the thermodisk are contacting anything, including the stove or your hand, and plug the stove back in. Hold the thermodisk by the wires so that the face of the thermodisk is down. Hold a butane lighter (or better yet, a heat source such as a hair dryer) below the thermodisk. The lighter flame does not need to come anywhere near the thermodisk; just let the heat rise up to the disk. The thermodisk only needs to be warmed to about 110 °F in order to close. Before too long, the thermodisk should click and the blowers should come on.
4. If the blowers do come on when tested in the way, unplug the stove and mount the thermodisk so it makes better contact with the hot stove. Make sure that there is no foreign material under the disk, and file off any metal pimples or welding material. If necessary, bend the thermodisk mounting flanges so that the disk contact the stove when the screws are tightened.
5. If the blowers did not come on during this test, the thermodisk is probably stuck in the open position. Return to the diagnostic flow chart and continue with the next test to investigate this further.

Test 2H Check for Blower Thermodisk Stuck Open

The purpose of the blower thermodisk is to keep the convection and combustion blowers running any time the stove is warm. When the stove is warm the thermodisk should close, and the blowers should run, even if the On/Off switch is turned to Off. This test checks to see if the thermodisk is stuck in the open position when it should be closed.

Procedure

Note: This test is intended to be run while the stove is still at least warm from previous operation. If the stove is not warm, start it up and run through a complete startup sequence (should take about 10 minutes) before following the steps below.

1. With a fire burning in the burnpot, switch the stove to Off. If the stove is operating properly, the auger should stop feeding pellets and the fire should begin to die down, but both the combustion blower and the convection blower should continue to run. If both blowers turn off, continue with the steps below. If one or the other blower remains on, the problem is probably not with the blower thermodisk; return to the diagnostic flow chart.
2. Use a volt meter or multimeter set to measure AC voltage. Touch one probe to the terminal on the blower thermodisk where the purple wire

is attached. Touch the other probe to an unpainted metal part of the stove. The meter should read at or near 120 volts.

3. If it does not, check the connection of the purple wire to the terminal on the thermodisk, and also check the connection of the purple wire to the terminal strip. For safety, unplug the stove while you do this. Once you have checked the connections, plug the stove back in. If the stove is still warm, the blowers may come on. If they do, the poor connection of purple wire was the problem. If the blowers still don't come on, continue with the following steps, but only after you have established voltage on the purple wire side of the thermodisk.
4. Touch one probe of the meter to the terminal on the blower thermodisk where the black and blue wires attach,[P28] and touch the other probe to an unpainted metal part of the stove. If the stove is still warm, the meter should read at or near 120 volts.
5. If you have voltage on the purple wire side, but not on the blue/black wire side, and the stove is still warm, then the blower thermodisk is probably stuck open. To verify this, bypass the thermodisk. First, unplug the stove. Pull the purple wire part way off the thermodisk terminal, but still attached. Use a jumper wire with insulated alligator clips on both ends. Clip one end to the exposed thermodisk terminal below the purple wire. Clip the other end to the "chair" connector (which connects the black and blue wires) on the other side of the thermodisk. When you plug the stove in, both blowers should come on. If they do, the thermodisk is bad; replace it, reassemble the stove, and verify proper operation.
6. If you had voltage on both sides of the thermodisk, or if the blowers did not come on even after you bypassed the thermodisk, the problem does not lie with the thermodisk. Assuming that you have followed the Startup Sequence flow chart and that the blowers DO operate when the stove is switched On, the only possible explanation is that the "chair" connector which holds the blue and black wires is not making electrical contact with the thermodisk terminal. Unplug the stove, examine the chair connector, wiggle it or tighten it until contact is established.

P28:
The P28 has only a blue wire attached to this side of the thermodisk. The test is still valid.

3.5.3 Air Pressure and Flow Tests

Test 3A Check for Leaks or Blockage

In order to allow the stove to operate and feed pellets to the fire, the air pressure switch must detect a certain negative pressure in the combustion system. There can be many causes for inadequate negative pressure, which can be difficult to diagnose. But before getting too deep into the problem, it is worthwhile to make a check of some of the more common, easily detected sources of pressure problems.

P23 and others with small circuit boards: Set the feed rate to "High".

Procedure

1. Turn the stove Off, and then turn it back On. (This test works best if you can take the time to allow the stove to cool.) Make sure the feed control is set to "D".[P23] Does the convection blower come on at full speed? Press the auger button. Does the green light come on? Push the combustion air damper all the way in. Does the green light come on now? If any of these things are true, then the air switch is **close** to detecting enough pressure, but for some reason the pressure is not maintained during all phases of operation.
2. With the stove turned Off, open the stove door. Inspect the door gasketing for any obvious breaks or deterioration. Check the air wash plate to make sure it is not loose. Check the other glass retaining brackets to make sure they are holding the glass tight against the glass gasket. Check the glass gasket for breaks or deterioration. Check to make sure that the cleanout shutters on the firebox sides are properly mounted and closed. Now close the door, making sure it is tightly latched. Turn the stove On and press the auger button. Does the green light come on now?
3. With the stove still turned On, go outside and check the end of the venting system. Is a good volume of air flowing out the end of the pipe? If there isn't a good volume of air, or you aren't sure, go back inside, turn the stove Off, and carefully detach the vent pipe from where it attaches to the stove. Turn the stove back On and press the auger button. Does the green light come on now? If there was not a good volume of air, and the green light comes on with the venting system detached, there is too much resistance in the vent. That means that it is an overly long or complex venting system, it is too small, or it is obstructed by flue deposits or other foreign objects. Inspect and clean the vent if necessary. Consult the installation manual for the stove for proper sizing and limitations on length and number of elbows in the system.

Test 3B Check Wiring to Air Switch

The air flow switch safety circuit includes the white wire from the circuit board to the air switch, the air switch itself, and the gray wire from the air switch to the high temp thermodisk. If the connection of any of these wires is not secure, the safety circuit will not let the auger run.

Procedure

1. Turn the stove Off and unplug it. Locate the air flow switch (shiny, disk-shaped control with red rubber tube attached). There should be a white wire attached to a terminal marked "C", and a gray wire attached to a terminal marked "NO". Check to make sure that these wires are properly located and securely connected.

2. The gray wire should lead to the high temp thermodisk. Make sure that it is securely attached to the terminal on the high temp thermodisk.
3. The white should lead back to the male end of the Molex connector attached to the circuit board. This wire should be securely inserted into position 1 of the Molex connector (see Test 1B for diagram).
4. If you find any loose or improperly connected wires, correct the problem, restart the stove, and verify proper operation. Otherwise, continue with the next step.
5. Plug the stove in and turn it On. (Press the auger button to confirm that the green light is still not coming on.) Use a voltmeter or multimeter to test the air switch circuit. Set the meter to measure in the range of 100 to 200 AC voltage (VAC). Touch one probe to an unpainted metal part of the stove. Touch the other probe to the air switch terminal with the white wire attached, marked "C". The meter should indicate at or near 120 volts. If it reads at or near zero, go back to Test 6A to makes sure the auger light is not malfunctioning. If you are sure the light is OK, then there is probably a problem with the circuit board. Return to the diagnostic flow chart.
6. If the meter did read 120 volts at the white wire terminal, switch the probe to the other terminal on the air switch, with the gray wire attached. If this terminal **also** reads 120 volts then the problem is not with the air switch; it probably with the high temp thermodisk. Restart the stove and follow the Startup Diagnostic Flow Chart from the beginning.
7. If you made it this far, the air switch is definitely open. This could either be for a good reason, or because of a bad air switch. Return to the diagnostic flow chart to find out.

Test 3C Check Pressure at Air Switch

In order for the stove to function safety and properly, there must sufficient negative pressure in the firebox to pull in combustion air and prevent the stove from spilling smoke. The venting system must also be properly designed and clear so that the combustion products can be safely exhausted. The air switch constantly monitors these conditions and will shut the stove down if they are not right. The air switch is required by the stove's safety listing and must be functioning properly. These tests will determine if there is a problem with the switch, or if there is a pressure problem with the stove that needs to be corrected.

Procedure

1. Turn the stove Off and unplug it. Locate the air flow switch and the red rubber tube connected to it. Disconnect the red tube where it attaches to the barb on the side of the air switch.

2. Inspect the red tube. Look for cracks or holes, especially where it attaches to the air switch or the manifold pressure tap. The tube may have two small holes, one or both of which may be covered – this is normal. Do not cover or uncover either hole at this time.
2. Insert a coat hanger or similar thin wire into the red tube. You will need to maneuver the wire around a bit to get it into the metal manifold pressure tap tube; if you can't get it in, remove the red tube from the tap. Ream out the tap to make sure it is clear.
3. Reconnect the tube to the pressure tap and to the air switch. Plug the stove in, turn it On, and press the auger button. If the green light now comes on, a clogged pressure tap may have been the source of the problem. You should clean the manifold and exhaust system. If the green light still did not come on, turn the stove Off, unplug it, and continue with the next step.
4. Disconnect the red tube from the air switch. You will need a manometer (negative pressure gauge), to read the pressure in the tube. (For example, Dwyer Instruments Magnehelic or other gauge capable of reading from zero to 1.0 inches of water (inWC; or 0 to 248 Pascals) in increments of 0.05 inWC. Use a 1/4 inch metal tube or 1/4 inch plastic barb to connect the manometer hose to the red tube. Make sure your connection is leak-tight.
5. Bypass the air switch. Disconnect both the white and gray wires, and use a jumper wire with either alligator clips or male spade connectors on both ends to connect the two wires.

P23 and others with small circuit boards: Set the feed rate to "High".

6. Plug the stove in and turn it On, and adjust the feed control to "D".[P23] The combustion blower should come on, and the convection blower should come on at full speed. (If they don't, unplug the stove and check your connections on the air switch bypass.)
7. Read the manometer. It should indicate about 0.3 inWC (75 Pa) or more. If the stove is still hot from previous operation, the reading could be somewhat less than this.
8. Press the auger button. The green light should come on. **If it doesn't, you shouldn't be doing these tests. Return the stove to its normal configuration and follow all steps in the Startup Diagnostic Flowchart.**
7. Let the stove go through its normal startup sequence. Once the pellets ignite and start to warm up the stove, you should see the pressure reading on the manometer start to drop. After the stove has completely warmed up, the manometer should still read at least 0.1 inWC (25 Pa).
9. If the pressure becomes less than 0.1 inWC, the air switch is doing its job: there is a problem with pressure in the stove that needs to be fixed. A pressure of between 0.1 inWC and 0.15 inWC indicates that conditions

are marginal: the switch may be cutting out under windy conditions, during a high fire etc. In either case, return to the diagnostic flow chart to determine the reason for the inadequate negative pressure. (Leave your pressure measuring apparatus connected to the air hose; you may need it for further tests.)

10. If the pressure stays above 0.15 inWC (37 Pa), the air switch is probably defective. Replace the air switch, restart the stove, and verify proper operation.

Test 3D Check Combustion Blower Speed

If you are doing this test you should have already determined that the pressure switch is not sensing enough pressure, or that not enough air is flowing through the system. One of the reasons for this could be that the combustion blower is not running fast enough.

Procedure

1. The stove should already be burning, with the air switch bypassed, if you are doing this test (if not, see Test 3C for instructions on bypassing the air switch). Make sure the feed rate is set to "D".[P23] Observe and listen to the combustion blower. Is it obviously running slowly? Can you hear clanking, rubbing, or rattling noises? If so, the blower may be obstructed or have loose parts. Return to the diagnostic flow chart.

P23 and others with small circuit boards: Set the feed rate to "High".

2. The next step is to check the voltage available to the combustion blower. First, check the voltage to the stove. Use a voltmeter or multimeter set to measure 100 to 200 volts AC. Touch one probe to one of the screw terminals with a black or purple wire on the stove terminal strip. Touch the other probe to an unpainted metal part of the stove. The meter should read at or near 120 volts. If it doesn't, the house voltage is inadequate. The homeowner needs to have an electrician look at their electrical supply; there may be nothing wrong with the stove.

3. Next, test the voltage to the combustion blower. Touch one probe to an unpainted metal part of the stove. Touch the other probe to the terminals on the blower thermodisk where the black and blue wires are attached.[P28] (Don't detach the wires.) The meter should read between 110 and 120 volts. If it doesn't, it is not getting enough voltage, which will make it run too slow. The cause of this is probably a problem with the circuit board which is resulting in a loss of voltage.

P28: On this model, detach the spade connector which connects the black wire leading to the blower with a blue wire leading to the capacitor. Use a Y jumper, as described in Test 2D, to reconnect these wires. Measure the voltage at the loose end of the Y jumper.

4. Return to the diagnostic flowchart.

Test 3E Thoroughly Check for Leaks or Blockage

If the air switch is not detecting enough negative pressure, yet the combustion blower is running properly, there must be some leak or blockage that is preventing the system from developing enough pressure. You should have

already checked for obvious leaks in Test 3A – if not, do so now. These tests will be a more in-depth search for leaks or obstruction.

Procedure

1. You should still have your manometer connected to the red air tube as described in Test 3C. If not, reconnect it now.
2. Turn the stove ON, but don't press the auger button. Watch your manometer until it reaches a steady reading, and note what the pressure is.
3. Open the stove door, and watch the manometer. The pressure shown should drop significantly; by at least 25 to 30 percent of the original reading. If it doesn't, there *may* be a significant leak on the combustion chamber side of the blower.
4. Close the door, and again observe the pressure reading on the manometer. Now go outside and remove the vent cap. Use duct tape to block off about 75 percent of the end of the vent pipe. (Use one piece of tape to block off one half, then another piece running the other direction to block off half of the "half-moon".) Go back inside and observe the reading on the manometer. The pressure should drop significantly. If it only drops a little bit, or not at all, it is possible that there is an obstruction in the venting system.
5. Unfortunately, the above tests are not an absolute indication of which half of the system has the problem. You may end up having to thoroughly examine all parts of the system. But they at least give you a place to start.
6. Carefully examine the door and gaskets, the glass and the glass gasket, and the air wash plate and the other glass retaining brackets. Look closely for any breaks or tears in the gaskets. Check to make sure they seat firmly against the glass and against the stove body. Check to make sure all retaining screws are tight. Sandwich a dollar bill between the door and stove. You should have difficulty pulling it out when you close the door. Repeat this test around the entire perimeter of the door. Replace any gaskets that do not seal well.
7. Inspect the interior of the firebox. Look for any leaks that could allow air to enter the firebox, such as broken welds or heat exchanger tubes. Also check the glass and gasketing on any side windows.
8. Open the cleanout shutters inside the firebox and examine the passageways. Remove any buildup of ash or soot. Clean the exhaust manifold, and run a pipe cleaner through the manifold pressure tap from the inside.
9. Check the exhaust manifold for leaks such as cracks or broken welds. Check the gasket where the combustion blower is mounted to the

manifold. Detach the venting system and remove the combustion blower. Inspect the gasket for gaps or deterioration. Make sure than debris or combustion products are not interfering with the blower.

10. Inspect and clean the venting system. Make sure that any obstructions and accumulations of combustion products are completely removed. Make sure that the size, length and number of elbows conforms with the limitations set forth in the owner's manual. Make sure that the vent cap is not crushed or clogged such that it interferes with the exit of exhaust gases.

11. After you have thoroughly checked the entire system for leaks or exhaust system restrictions, reassemble the stove and turn it On. Check the manometer reading again. Has there been any improvement over the previous pressure reading? If so, you may have solved the problem. Reconnect the red pressure tube to the air switch, remove the jumper wire, and run the stove through a full ignition and fire cycle, so see if it now operates properly in all phases of operation.

12. If the pressure did not improve, or the stove still does not operate properly, return to the diagnostic flow chart.

Test 3F Cover Hole in Air Tube

There are two holes in the red air tube leading to the air switch. These are intentional leaks to provide proper operation of the air switch under most installation and climatic conditions. One or both of these holes will be left open by the factory. If you have determined by previous testing that there is no correctable leak or obstruction that is causing excessively low pressure at the air switch, then these holes can be used to boost the pressure.

Procedure

1. Turn the stove Off and unplug it. Remove your manometer tube and jumper wire if they are still present.

2. Locate the small holes on each side of in the red air tube. One of these holes may already be covered with tape. If so, you will want to cover the second hole.

3. Use a good quality duct tape to cover one of the holes. Overlap the tape well beyond the hole so that air can't leak past the edges. Make sure you cover only one of the holes. (If one of the holes was already covered, you can wrap it again with your duct tape.)

4. If both holes were already covered, remove the existing tape and rewrap the holes with a new piece of duct tape. Make sure the tape covers both holes and smooth it onto the hose so that air can't leak past the edges.

5. Reconnect the air tube to the air switch, reassemble the stove, and turn it On. Press the auger button and verify that the stove functions properly during all phases of operation.
6. If the stove still does not operate properly, cover the remaining hole (if there is one.) If you have completely followed the diagnostic flow charts, and done all of the tests, and the air switch still won't let the stove operate, contact the factory for assistance.

Test 3G Adjust Combustion Air Damper

The combustion air damper limits the amount of air available to the fire. It can be used to adjust the air to fuel ratio to match the burn rate. Adjustment of the damper can also be used to minimize problem such as pellets burning out on Low feed rate or excessive soot buildup. Follow these general guidelines to adjust the damper.

- You will usually want to adjust the damper all the way in (closed) and then open it up a particular amount. It is always better to work from a reference point than to blindly "chase" the proper setting.
- In general, the damper should be adjusted for the fuel feed rate most commonly used. A good starting point is to open the damper 1/4 inch, then 1/8 inch for each setting above "Low". In other words, if the customer most frequently burns the stove at the "D" setting, open the damper about 5/8 inch.
- If the customer is having trouble holding fire at the Low setting, close the damper slightly. Easy does it: the damper should be closed no more than 1/16 inch at a time until the fire will hold on Low.
- If the customer is getting a lazy red flame, or is having trouble with excessive soot on the glass or in the venting system, open the damper slightly. Again, adjust the damper gently, about 1/16 inch at a time, until the flame improves.
- With marginal quality fuel or venting conditions, it may be difficult to find an adjustment that works well for both Low fire and normal operation. Instruct the customer on how to carefully adjust the damper to get best results for the feed rate they select. This may only need to be a small adjustment – 1/16 to 1/8 inch between low and moderate burn rates. Make sure the customer understands that overadjustment can cause more problems than underadjustment.
- One or two small pieces of tape can be unobtrusively wrapped around the damper rod as reference points for the best settings for different burn rates.
- If even large adjustments don't seem to make much difference, or if you can't get a brilliant, fast-moving flame even with the damper all the way open, check for obstructions in the combustion air system. Remove the burnpot and use a flashlight to look for obstructions in

the pipe. Remove the outside air duct and check for obstructions in the duct and the inlet pipe. (See Test 3H for more details on checking the combustion air system.)

Test 3H Check Combustion Air System

In order for the stove to receive enough combustion air, the combustion air damper must be operating properly, and combustion air tube must be clear of obstructions.

Procedure

Note: Older models of Breckwell pellet stoves used a coupling to join the damper control rod to the damper blade. If used improperly, it could become unscrewed at the coupling, leaving the damper blade sitting loose in the combustion air tube. If this is an older stove, check to be sure that this has not happened, in addition to the inspections described below.

1. Open the stove door and examine the burnpot. Is it properly mounted on the combustion air tube? It should fit cleanly over the tube and be pushed all the way back so that it is about 1/8 inch from the back wall of the firebox. If it is not fully mounted, air will not be pulled forcefully through the ports in the burnpot, which could lead to poor combustion. Remount the burnpot and see if the stove now operates properly.
2. If the burnpot was properly mounted, remove it and examine it closely for blockage. Over time, ash or clinkers can fall through the ports and partially obstruct air flow within the burnpot. It is also possible that some foreign object has somehow been pulled in through the combustion air tube and is stopping up the burnpot. Take the burnpot outside and shake it out, or use an air compressor to blow it clear. Pay special attention to the narrow area at the bottom. If you found significant obstruction or foreign objects, reattach the burnpot and start the stove to see if the problem is solved. Otherwise, continue with the next step.
3. Leave the burnpot off, and remove the combustion air supply duct from the inlet end of the combustion air tube. Use a flashlight, and mirror if necessary, to look down the tube, from either end.
4. Pull the combustion air damper all the way out. You should see the blade almost completely clear the inside of the tube. If it does not, look for some reason that the damper does not have full travel. Is some part of the rod or blade getting caught on an internal stove part?
5. With the damper still pulled out, examine the rest of the combustion air tube. Make sure that it is clear of obstructions that could reduce the air flow.

6. Reattach the burnpot, making sure it is in the proper position, but leave the combustion air duct detached. Leave the damper pulled all the way out. Start the stove and establish a fire at a high pellet feed rate.
7. Does the stove now operate properly, with a bright, flickering flame rather than a red, lazy flame? Are you able to close the damper to achieve a proper air flow at all feed rates (see Test 3G)? If so, it is likely that the combustion air duct is blocked or partially obstructed. Inspect it thoroughly to find the cause. If the combustion air duct extends outside, check the inlet to make sure that outdoor debris or children's toys, etc., aren't blocking the duct. Clear any obstructions and reassemble the duct, restart the stove and adjust it for optimum performance.
8. If the stove still does not operate properly, even with the combustion air duct detached, the cause of the problem probably does not lie on the air inlet side of the system. Return to the diagnostic flow chart and continue with the next test.

Test 3I Check Combustion Air Supply Grilles

If the stove does not get its combustion air supply directly from the outdoors, it must be able to pull air through grilles in the side of the stove or fireplace cover panels to the air inlet tube. If this airflow is inhibited, a poor quality, smoky fire can result, even with the damper all the way open.

Procedure

1. If this is a freestanding stove, blockage of the air supply is unlikely. Still, check for any obstructions (such as a forgotten piece of paper) of the grilles or other openings that supply air to the stove.
2. If the stove is an insert, air must be able to get into the fireplace cavity through grilles in the cover panels or under the stove. Since the convection fan is also trying to use the air within the fireplace cavity, blocked grilles can quickly lead to a pressure problem. Check these openings carefully for obstructions. Try operating the stove with the insert pulled out about 1/2 inch, so that there is gap between the cover panels and the fireplace face. If the fire now burns properly, you know that not enough air is getting in through the normal openings.
3. If you are unable to find any obstruction of the grilles, the stove can be left pulled out just enough to provide for proper operation. A better solution is to run a combustion air supply duct up the chimney or through the back wall of the fireplace.

Test 3J Check House Air Pressures

If the stove is taking its combustion air from indoors, it may be competing with other forces or devices in the house. This is particularly likely if a large exhaust fan is in use. While the procedures below can't identify all of the

many possible reasons for adverse house pressures, they do lead to the most common causes.

Procedure

1. Interview the homeowner about when the improper stove operation occurs. Does it happen all the time, without regard to weather conditions or family activities? Does it occur only on cold or windy days? Mainly at night, or while dinner is being cooked? When a door is opened, or closed?

2. Ask about fans or other systems that exhaust air from the house. In particular, look for downdraft kitchen ranges or commercial size hoods, and whole house or attic fans (especially if they are automatically activated). If the stove is in an area that was added on to the house, ask how the furnace ducting system was extended to the new room. In many such cases the duct system was modified in a way that creates a severe pressure imbalance in the house, especially if some rooms are frequently closed off from the rest of the house.

3. Using the information you have gained, start the stove under the conditions most likely to have the problem. Get the fire established and verify that combustion is poor: with a lazy red flame. (If combustion is not poor, then your efforts should focus on finding the conditions under which it *does* get poor.)

4. Experiment with various house conditions that might alleviate the problem (or make it occur.) Observe the flame to see how it is affected by what you are doing. Following are some suggestions that have been found to be helpful in tracking down house pressure problems:

   - Turn on any downdraft ranges or large range hoods. Do the same for any whole house fan that could possibly operate while the stove is burning. This includes exhaust-only ventilation systems that may be built in to many newer houses.
   - Open a window on the *lowest story that connects with the stove room.* In other words, if the stove is in the basement, open a basement window or door. If the stove is on the first floor and the basement door is usually closed, open a window on the first floor. If the basement door is normally open, open a window in the basement.
   - To see if you can make a combustion problem *worse*, open a window on the top floor of the house, and close any openings low in the house.
   - If the day is windy, experiment with opening windows on various sides and levels of the house. Generally, an opening on the leeward side of the house will tend to exhaust air from the house, especially if it is at a high level.

- Turn on the furnace so that the distribution fan runs (if the furnace has a "fan only" switch, use that). With the fan running, experiment with closing and opening various doors within the house. In particular, check what happens when the stove room is isolated from the rest of the house. Check to see if any return air or supply air registers have been closed or covered with rugs or furniture. If the stove is in a basement, check to see if there is an open return grille on the furnace or return duct, and see what happens when it is closed.

As time allows, also experiment with different combinations of the above, such as the running the furnace with different windows open.

5. If you identify conditions under which the problem occurs, or conditions which stop the problem, you and the homeowner may have several choices:
   - If the combustion problem can be avoided without major inconvenience, such as by always keeping a particular door open, the homeowner may choose to do just that, without making any other modifications.
   - If it is found that a problem with a major house system, such as the furnace ducting system, is the cause of poor combustion, the homeowner may choose to have a specialist in house pressures try to further diagnose and solve the problem.
   - In many cases the simplest answer may be to install an outside air supply for the pellet stove. In some cases this can be as simple as making a passive opening to the outdoors close to the stove, although this has obvious disadvantages. The best approach is usually to provide a combustion air duct directly from the outdoors to the air inlet tube of the stove. Follow the instructions in the installation manual for the stove model to install the outside air duct.
6. If your investigations did not reveal any circumstances that improved combustion (or made it worse), then you can provisionally eliminate adverse house pressures as the cause of the problem. Return to the diagnostic flow chart and continue with your investigation. However, keep in mind that house pressure problems can be deviously hard to find, and that there may in fact be conditions that you were unable to reproduce that are the cause of the problem. Ask the homeowner to pay attention to what might be going on in the house when the problem occurs, and be prepared to come back to the house investigation if you are unable to solve the problem elsewhere.

3.5.4 Auger Tests

Test 4A Check for Power to Auger Thermodisk

In order for the auger thermodisk to complete the electrical connection between the circuit board and the auger motor, electricity must reach the

thermodisk through the yellow wire. If voltage is not present or is not adequate, the auger motor will not run or will not run at the proper speed.

Procedure

1. Plug the stove in and turn it On. Press the auger button and verify that the green auger light comes on. (If the stove is already running, you can leave it On, but make sure the large green light on the control panel is on.) Adjust the feed rate to the "D" setting or higher.[P23]
2. Locate the small green auger timing light, which should be visible through a small hole in the control panel.[P23] Watch this light for at least 15 seconds. It should blink on for a few seconds during this time. If it doesn't, the circuit board may be bad. Return to the diagnostic flow chart and move to the next test.
3. If the small green light does blink on, continue with the next step.
4. Using a volt meter or multimeter, check for power at the auger thermodisk. Set the meter to measure AC voltage (VAC) in a range of 100 to 200 volts.
5. Place one probe on the terminal of the thermodisk where the yellow wire is attached. Place the other probe on an unpainted metal part of the stove. Wait at least 15 seconds while observing the volt meter. Sometime during this period, the voltmeter should indicate at or near 120 Volts for a few seconds.
4. If the voltmeter does **not** show 120 Volts during this period, the circuit board may be bad. Return to the diagnostic flow chart and move to the next test.
5. If the voltmeter does show 120 volts, power is available to the auger circuit. Go on to Test 4B to check the auger thermodisk.

P23 and others with small circuit boards: Set the feed rate to "High".

P23 and others with small circuit boards: The auger timing light is visible through the hole near the upper left corner of the control panel.

Test 4B Check Auger Thermodisk

The auger thermodisk (T-22) completes the electrical connection between the circuit board and the auger motor. This is a *normally open* thermodisk. When the stove is being started automatically with the firestarter (or when the manual feed switch is pressed), the circuit board sends electricity to the auger by way of the orange wire, which bypasses the auger thermodisk. But after the firestarter sequence goes off, electricity to the auger must come from the yellow wire, and pass through the auger thermodisk. If the stove is cold, or the fire was not successfully started, the auger thermodisk will remain open, which prevents the auger motor from feeding pellets endlessly to a cold burnpot. Once a fire is established, the auger thermodisk should close and allow the auger motor to feed on a timed cycle determined by the fuel control setting.

Procedure

If the auger feeds pellets to after fire goes out:

Note: If the fire goes out without the having been turned to "Off", the auger will continue to feed pellets until the auger thermodisk cools below its set point. However, the auger should stop feeding before pellets fill the burnpot. If pellets do not stop feeding even after the stove has cooled, do the test below.

1. Unplug the stove from the wall outlet. Stove should be cool.
2. Locate the auger thermodisk (T22). It should be mounted on the exhaust manifold or blower housing, and have a yellow wire attached to one side, and two orange wires attached to the other side.
3. Disconnect the yellow wire from the thermodisk.
4. Set your multimeter to measure Ohms resistance (Ω).
5. Place one probe on the thermodisk terminals where the yellow wire attaches, and the other probe on the thermodisk terminal where the orange wire is attached.
6. The multimeter should show infinite or very high resistance (numeral 1 on some meters). If this is the case, the auger thermodisk is not the cause of the problem. Return to diagnostic flow chart.
7. If the multimeter shows zero or very low resistance, the thermodisk is bad. REPLACE the thermodisk and reconnect the yellow wire.
8. Verify proper stove operation.

If the auger does NOT come on and feed pellets after the stove is warm:

P23 and others with small circuit boards: Set the feed rate to "High".

1. Stove should have been burning for at least 15 minutes after having been started on the "D" feed rate setting.[P23] If necessary, use the manual feed switch to maintain a supply of burning pellets in the burnpot during this period. If the auger does not start feeding pellets on its own after this period of time, do the following test.
2. Bypass the auger thermodisk by using an INSULATED alligator clip jumper wire. CAREFULLY clip one end of the jumper wire to the thermodisk terminal where the orange wires attach, and clip the other end of the jumper wire to the other terminal of the thermodisk, where the yellow wire attaches.
3. Wait at least 15 seconds. The auger motor should now come on for a few seconds during this time. If necessary, use the manual feed switch to supply a load of pellets to the burnpot and make sure the fire is still burning.

4. If the auger motor DID come on, the auger thermodisk may be bad. To verify this, turn the stove Off. If the combustion and convection blowers keep running, then the stove is warm enough that the auger thermodisk should have closed. Shut down and unplug the stove, replace the thermodisk, and relight to verify proper operation.
5. If the blowers turn off, then the stove is not hot enough to close the thermodisks. Restart the stove and repeat the steps above until the stove is warm enough to close the blower thermodisk. Make sure the feed control is set to "D".
6. If the auger motor DID NOT come on when bypassed, the thermodisk is not the cause of the problem. Repeat test 4A to verify that electricity is reaching the thermodisk. Return to the diagnostic flow chart.

Test 4C Check High Temp Thermodisk

The purpose of the high temp thermodisk is stop the feeding of new fuel to the fire if the stove becomes overheated for any reason. This thermodisk is closed during normal operation. If the high temp thermodisk opens, the auger motor circuit will be interrupted and the auger will not run, even on manual feed. The combustion blower will continue running at full speed, and the convection blower will run at low speed. The green light will go off.

Procedure

Note: Before concluding that the high temp thermodisk is bad, you **must** be sure that the stove is not truly overheated. Do these tests only after the stove has cooled.

1. With the stove plugged in and turned "On", press the auger button. If the green light on the control board comes on, the thermodisk is NOT the problem. Return to the diagnostic flow chart.
2. With the stove turned Off and unplugged, check the connection of the white wire to the high temp thermodisk and to the stove's power terminal strip. Wiggle the spade terminal connection to the thermodisk, and make sure it is fully inserted. Make sure that the other end of the white wire is securely screwed down to the terminal strip.
3. Plug the stove in, turn it On, and press the auger button. If the green light comes on, the bad connection was the problem. Connect the white wire securely and verify proper stove operation.
4. If the green light still did not come on, turn the stove Off and unplug it again. Now check the thermodisk for continuity with a multimeter set to measure Ohms resistance (Ω). Disconnect the white wire from the thermodisk. Touch one probe to the terminal on one side of the thermodisk, and touch the other probe to the terminal on the other side. The multimeter should read zero or very low resistance. If this is the

case, the thermodisk is NOT the problem. Return to the diagnostic flow chart.

5. If the multimeter shows infinite or very high resistance (numeral 1 on some meters), the thermodisk is bad. REPLACE the thermodisk, reconnect the wires, and verify proper stove operation.

Test 4D Check for Overheated or Jammed Auger Motor

The auger motor includes internal thermal protection that will shut the motor down if it becomes too hot. Before concluding that the motor is broken, you need to be sure that it is not shutting down for this reason. If the motor is overheating, you need to determine the reason for this before replacing it.

Procedure

Before doing these tests you should have made sure that all wiring connections are secure and that power is available to the auger motor. See tests 1B and 1E.

1. First make sure that the auger motor is really not running. (It is possible that the motor is turning but the shaft is slipping in the coupling.) Observe the copper-colored rotor within the motor, and press the manual feed switch. If the rotor turns but the auger shaft coupling (or the auger itself) does not turn, either the shaft is slipping in the coupling, or the gears in the auger motor are stripped. Jump to Test 4E.
2. While pressing the manual feed switch, *listen* to the auger motor. If you hear it hum, but it is not turning at all, the auger is probably jammed.
3. If you don't hear the motor humming, turn the stove Off, and unplug it. CAREFULLY feel the outside surface of the motor. If it is hot (not warm, but HOT – too hot to touch) it is possible that the internal thermal protection has shut the motor down. If the motor is not hot it is probably simply burned out.
4. If the motor is hot, allow the stove and motor to cool. (This may take some time.) Then plug the stove in and turn it On again, pressing the manual feed switch. If the auger motor now runs, it was overheated. It can continue to be used, but the reason that it overheated should be identified and corrected.
5. If the auger was not jammed or overheated, and does not run even after a period of cooling off, then it is probably irreparably damaged. Replace the auger motor and verify proper operation.
6. If the auger was jammed or overheated, you need to find out why. The auger should not jam, and the motor should not overheat during normal operation of the stove with wood pellets. Jump to Test 4F.

Test 4E Check for Stripped Auger Motor Gears

The auger motor has a closed gearbox attached to provide the proper torque to turn the auger. If the gears within this box become stripped, the motor must be replaced. Do not do the following test until you are sure that the *auger motor turns*, but the *coupling to the shaft does not turn* (see Test 4D).

Procedure

1. There should be about 1/4 inch of space between the auger motor gearbox and the bottom of the auger coupling. You should be able to see the auger motor shaft in this space.
2. Press the manual feed switch. If you can see the shaft turning, then it is simply slipping within the coupling. Using a 5/32 allen wrench, loosen the lower set screw on the coupling. Press the manual feed switch until you see the flat area on the shaft line up with the set screw. Tighten the set screw, wiggling the coupling back and forth as necessary to get the screw well-seated. Restart the stove to verify proper operation.
3. If the auger coupling turns, but the auger itself does not turn, the coupling is slipping on the auger shaft. Use a 5/32 allen wrench to loosen the upper set screw on the coupling. Wiggle the auger motor until the coupling slips off the auger shaft. Use vise grips or channel lock pliers to turn the auger shaft counterclockwise until the depression on the shaft lines up with the set screw on the coupling. Slip the coupling back onto the shaft, make sure the depression is under the set screw, and tighten the screw. Restart the stove and verify proper operation.
4. If the auger motor shaft is not turning, the gears in the gearbox are probably stripped. The auger motor will have to be replaced, but you should also determine the reason for the stress on the gears that caused them to strip. Go to Test 4F to check for a jammed or damaged auger.

Test 4F Check for Slipping, Jammed or Damaged Auger

If the auger motor runs, but the auger is not turning or has been damaged, pellets will not feed properly. Follow the procedure below only after being sure that the auger motor has power and is capable of operating.

Procedure

1. Turn the stove Off and unplug it. Disconnect the leads from the auger motor at the spade connectors where they join the orange and gray wires.
2. Using a 5/32 allen wrench, loosen the lower set screw on the coupling between the auger motor shaft and the auger shaft. Wiggle the auger motor until it disconnects from the coupling. Set the motor aside.

3. With vice grips or channel lock pliers, grip the end of the coupling (being careful not to damage the set screw) and wiggle it back and forth. This may be all that is necessary to dislodge a jam.

4. To manually turn the auger, grip it as above, and turn it carefully counterclockwise. Do not force the auger, but turn it back and forth to attempt to dislodge any jams. **Do not turn the auger clockwise more than 1/4 turn.** Turn the auger counterclockwise several revolutions to clear any jams.

P23:
To remove the auger on this model, remove the two biscuit mounting screws and the silicone. With a screwdriver, pry the auger (with the biscuit attached) from the housing.

5. If you still are unable to clear the jam and turn the auger, you will have to remove the auger shaft.[P23] First remove any pellets from the hopper. Remove the two biscuit mounting screws from opposite sides near the bottom of the auger tube. Pull the auger, with the coupling and biscuit (round plate at the bottom of the auger) attached, halfway down out of the tube. Loosen the set screw on the coupling, and remove it and the biscuit. You can then pull the auger all the way out of the tube.

6. Inspect the debris that falls out of the auger tube for any foreign objects that may have jammed the auger. Inspect the auger tube and any remaining material in the hopper for foreign objects.

P22, P23:
The pitch of the auger flights on these models is 2 inches (50.8 mm).

7. Inspect the auger. There should be a glob of welding material on the TOP of the top flight and on the BOTTOM of the bottom flight. The auger screw should make a smooth and continuous spiral, and the edges should be free of major nicks or deformation. The pitch of the screw from flight to flight should be 1 1/8 inches (28.6 mm).[P22, P23], Measure this from the tip of the top flight to the top of the next flight down. If the auger does not meet these qualifications, it has become damaged. Replace the auger.

8. To reinstall the auger, insert it (with the long end of the shaft up) all the way up into the auger tube. Make sure that the shaft seats in the hole in the upper bushing. Twirl the auger with your fingers a few times to make sure it can turn freely. Now slip the biscuit back on the bottom of the auger, and place the coupling on the end. Line the coupling set screw up with the depression on the shaft and tighten the set screw. Push the biscuit up into the tube, lining up the screw holes on the edge with the screw holes on the tube. Reinstall the biscuit retaining screws. Attach the auger motor shaft to the coupling, making sure the set screw lines up with the flat on the auger shaft. Reconnect the auger leads at the spade connectors.

Test 4G Check Auger Rotation Rate

In order to feed pellets at the correct rate, the auger must rotate at the correct rate. The following tests will determine if the rotation rate is correct and, if it isn't, the possible reasons.

Procedure

1. Plug in the stove and turn it On. Press the manual feed switch and watch the auger coupling. It should rotate at least four complete revolutions in about one minute.[P22, P23] If it does, the feed rate is probably correct; return to the diagnostic flow chart.
2. If the auger coupling does not rotate four times in a minute, attempt to find out why.
3. First, check the voltage to the stove. Use a voltmeter or multimeter set to measure 100 to 200 volts AC. Touch one probe to one of the screw terminals with a black or purple wire on the stove terminal strip. Touch the other probe to an unpainted metal part of the stove. The meter should read at or near 120 volts. If it doesn't, the house voltage is inadequate. The homeowner needs to have an electrician look at their electrical supply; there is probably nothing wrong with the stove.
4. Next, check the voltage to the auger circuit. Place one of the volt meter probes on the auger thermodisk terminal where the orange wires are attached. Touch the other probe to an unpainted metal part of the stove. Press the manual feed switch. The multimeter should read at or near 120 volts.
5. If the multimeter doesn't show about 120 volts, voltage may be lost in the circuit board. Bypass the circuit board as described in Test 6C, with a jumper between the black wire and orange wire (position 2 and position 5) at the Molex connector. Repeat steps 1 through 4 above. If the rotation speed and voltage are OK, replace the circuit board. If they are still not OK, check for poor wiring connections in the auger circuit (Test 1E).
6. If voltage in the auger circuit is OK, but the auger motor is still not turning at four revolutions per minute, the auger may be out of position or partially jammed, or the auger motor may be bad. Perform Tests 4D, 4E, and 4F. If the auger motor still does not turn at the proper rate even after you have examined the complete auger system, replace the auger motor. Restart the stove and verify proper operation.

P22, P23:
The rotation rate on these models should be one revolution per minute.

Test 4H Check Pellet Fuel Quality

Breckwell pellet stove can burn a wide variety of pellet fuels, However, the quality and characteristics of the fuel can affect performance. Examine the fuel for the following factors:

- **Pellets too long:** Excessively long pellets don't feed as well, and not enough fuel may be delivered on the Low setting. The fuel should not have many pellets which are over 3/4 inch long.
- **Excessive fines:** Fines can fill the bottom of the hopper, clog the auger or burnpot, and interfere with good pellet flow, especially at

low feed rates. A bag of pellets should contain no more than about a cupful of fines. Avoid pouring the fines into the hopper.

- **Excessive moisture:** Moisture makes igniting and maintaining a low fire difficult. Most pellets are bagged with proper moisture, but they can become wet after opening. If pellets feel moist they are definitely too wet.
- **Excessive ash:** Ash is the noncombustible material left over after the wood in the pellets burns. Too much ash, or ash with a low fusion temperature, can cause clinkering and clogging of the burnpot. If hard, crusty material is left in the burnpot, the fuel probably has too much ash.

Test 4I Check Auger Motor Isolation

The auger motor needs to be isolated from contact with other metal stove surfaces, both to minimize auger noise and to ensure proper rotation.

Procedure

1. The back part of the auger gearbox should rest against a post attached to the combustion air tube. This post should be covered with a rubber bumper. Grasp the back of the auger motor and turn it a few degrees to the left, away from the bumper (it should move freely while the auger motor is not on.) Examine the rubber bumper. It should fully cover the post, and be free of cracks or worn spots. If it is brittle, has significant cracks, or doesn't fit securely on the post, replace it. If it has a worn spot where it is contacted by the motor, rotate the bumper on the post.
2. Turn the motor back until it contacts the rubber bumper. The front part of the motor should not contact the combustion air tube. If it does, remove the rubber bumper, and carefully bend the post away from the motor – only a slight adjustment should be sufficient to keep the motor away from the tube. Replace the rubber bumper.
3. Turn the stove On and press the manual feed switch. Observe the auger motor, and make sure that it rests against the rubber-covered part of the post, and does not contact any other part of the stove. If the motor chatters or vibrates, there is probably a problem with the connection of the motor to the auger shaft. Return to the diagnostic flow chart.

3.5.5 Firestarter Tests

Test 5A Check for Glowing Firestarter

Before concluding that the firestarter is not working, we need to take a close look and makes sure that it is not glowing.

Procedure

First make sure that the stove is operating properly in other respects. You should not conduct this test until you have made sure that the green light **does** come on when the auger button is pressed, and that the auger feeds pellets when the manual feed button is pressed.

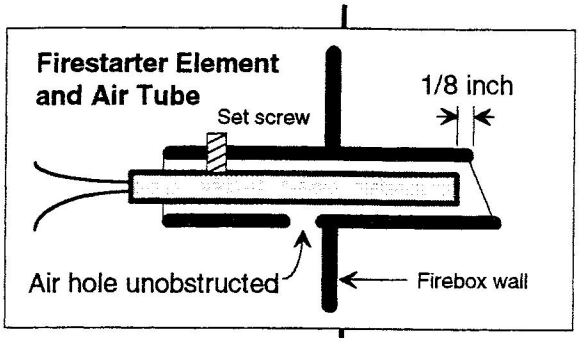
1. Shut down the stove by turning the On/Off switch to "Off", but leave it plugged into the wall.
2. Open the stove door and pull off the burnpot. Set it aside inside the stove so you have a clear view of the end of the firestarter inside the tube. Close the stove door and make sure you can see the firestarter.
3. Switch the stove to "On" and press the auger button. Watch the firestarter. It should begin to glow red within about 3 minutes and should continue glowing for about eight to ten minutes from the time you pressed the auger button. (Pellets will be fed into the firebox during this time. You might want to catch them with a bowl and return them to the hopper.)
4. If the firestarter does glow then there is some other reason the pellets do not ignite. Return to diagnostic flow chart.
5. If the firestarter does not glow then there is probably something wrong with the firestarter circuit wiring or the circuit board. Return to diagnostic flow chart.

Test 5B Check for Blocked Firestarter Air Tube

Pellets are ignited in the burnpot by hot air drawn across the firestarter and in through the hole in the side of the burnpot. In order for the firestarter to work, the firestarter tube must be unobstructed and the holes at both ends of the tube must be clear. The firestarter element must also be properly placed in the tube. Before doing these tests you should have verified that the firestarter does glow when the auger button is pressed, and the pellets are feeding properly into the burnpot.

Procedure

1. Turn the stove off and unplug it from the wall.
2. Open the stove door and verify that the 1/4 inch hole on the side of the burnpot, directly below the pellet feed tube, is not obstructed. Remove the burnpot, and examine the end of the firestarter air tube. It should also be clear and unobstructed.
3. You should be able to see the end of the firestarter element near the end of the firestarter tube. The end of the element should be about 1/8 inch back from the **top edge** of the air tube. Measure this distance to make sure it is correct.



4. Go to the back of the stove, inside the controls compartment, and locate the other end of the firestarter air tube, just below and to the left of the combustion air tube.
5. If the end of the firestarter element was not about 1/8 inch from the end of the air tube, use a 1/8 inch allen wrench to loosen the set screw on top of the air tube. Adjust the element to the proper location, and retighten the set screw.
6. Feel the underside of the firestarter air tube, near the stove wall, and find the air hole. Make sure that this hole is not obstructed by debris such as fiber insulation. Blow compressed air through the air tube to eliminate any remaining debris.
7. Put the stove back together and verify proper operation.

3.5.6 Circuit Board Tests

Test 6A Check for Malfunctioning Auger Light or Button

The auger light (large green light at top of control panel) indicates whether or not power is available to the auger circuit. This is normally very important information when diagnosing an operational problem. However, it is possible that the electrical connections to the light itself could malfunction, which would give you a false indication of a problem.

Procedure

There are several ways to verify that electricity is getting to the auger circuit whether or not the green light is on. The simplest is described below.

P23 and others with small circuit boards: The auger timing light is visible through the hole near the upper left corner of the control panel.

1. Turn the stove on and press the auger button. The large green light should come on. If it doesn't, watch for the small green auger timing light through the hole in the middle left of the control panel.[P23] If the auger circuit is getting power, this light should come for a few seconds before 15 seconds are up.
2. If the small light does come on, but the large green light doesn't come on, there is a problem with the circuit board. Replace the circuit board and verify proper stove operation.
3. If the small light does not come on, it is possible that the auger button was not fully pressed. Remove the black auger button by pulling it straight off. A small white post should be exposed. Press this post and listen for a click. The large green light should come on, and the small green light should blink on for a few seconds within 15 seconds.
4. If the large green light comes on now, the black button has worn away so that it pushes too far down on the white post. Insert a small wad of

paper into the hole in the black button, and push it back on the post. Make sure that the button is not too loose on the post. Push the black button and verify that the green light comes on.

5. If the green lights still do not come on, the auger circuit is not getting power. Return to the diagnostic flow chart and continue with the other tests.

Test 6B Check Blower Control Circuit

This test will verify that a problem with the blower control circuit on the circuit board is the reason that the blowers do not run.

Procedure

1. Unplug the stove.
2. Detach the Molex connector from the circuit board. Set the circuit board aside.
3. Use an 18 gauge copper jumper wire, with about 1/4 inch of bare wire exposed on each end. Twist the bare wire so it is tight.
4. Insert one end of the jumper wire into position 2 of the Molex connector (see diagram with Test 1B), which corresponds to the black wire. Insert the other end of the jumper into position 3, which corresponds to the blue wire. Set the Molex connector down so that it doesn't touch any metal.
5. Plug the stove in. The combustion blower should come on immediately. If it doesn't, the problem is not with the circuit board. Return to the diagnostic flow chart and perform tests 1A though 1D.
6. Unplug the stove. Leave the one end of the jumper in position 2 (black wire), but move the other end to position 4 (pink wire).
7. Plug the stove in. the convection blower should come on immediately. If it doesn't, the problem is not with the circuit board. Return to the diagnostic flow chart and perform tests 1A though 1D.
8. If both blowers came on when tested as above (but don't come on when the stove is connected and operated properly), then the circuit board is probably bad. Unplug the stove, replace the circuit board, and verify proper stove operation.

Test 6C Check Auger Control Circuit

This test will verify that a problem with the auger control circuit on the circuit board is the reason that the auger does not run.

Procedure

1. Unplug the stove.

2. Detach the Molex connector from the circuit board. Set the circuit board aside.
3. Use an 18 gauge copper jumper wire, with about 1/4 inch of bare wire exposed on each end. Twist the bare wire so it is tight.
4. Insert one end of the jumper wire into position 2 of the Molex connector (see diagram with Test 1B), which corresponds to the black wire.

5a. **If auger does NOT run when manual feed switch is pressed:** Insert the other end of the jumper into position 5 of the Molex connector, which corresponds to the orange wire. Set the Molex connector down so that it doesn't touch any metal.

5b. **If the auger runs when manual feed switch is pressed, but does NOT run automatically when stove is warmed up:** Insert the other end of the jumper into position 6 of the Molex connector, which corresponds to the yellow wire. Bypass the auger thermodisk by using an INSULATED alligator clip jumper wire. CAREFULLY clip one end of the jumper wire to the thermodisk terminal where the orange wires attach, and clip the other end of the jumper wire to the other terminal of the thermodisk, where the yellow wire attaches.

6. Plug the stove in. The auger should come on immediately. If it doesn't, the problem is NOT with the circuit board. Return to the diagnostic flow chart and perform the previous wiring tests.
7. If the auger came on when tested as above (but don't come one when the stove is connected and operated properly), then the circuit board is probably bad. Unplug the stove, replace the circuit board, and verify proper stove operation.

Test 6D Check Firestarter Control Circuit

This test will verify that a problem with the firestarter control circuit on the circuit board is the reason that the firestarter does not come on.

Remote firestarter boards: This test is only for units equipped with direct connected firestarters. **Do not attempt to follow this procedure with remote firestarter boards.** Contact the factory for assistance in diagnosing problems with the remote firestarter.

Procedure Remote firestarter boards

1. **Unplug the stove.**
2. Detach the Molex connector from the circuit board. Detach the red firestarter wire from the terminal on the circuit board. Set the circuit board aside.
3. Use an 18 gauge copper jumper wire, with about 1/4 inch of bare wire exposed on one end. Twist the bare wire so it is tight. Attach a male spade connector to the other end.

4. **Make sure the stove is unplugged!** Screw the bare end of the jumper wire to one of the hot-side terminals on the stove terminal strip. (This would be a terminal with one of the black or purple wires.)
5. Push the other end of the jumper wire into the spade terminal at the end of the red firestarter wire.
6. Plug the stove in (you don't need to turn the stove On.) Open the stove door and remove the burnpot so that the end of the firestarter is visible. The firestarter should begin to get hot within a few seconds, and should glow red hot within a minute or two. If it doesn't, the problem is not with the circuit board. Return to the diagnostic flow chart and recheck all wiring connections to the firestarter, and check for continuity in the firestarter (Test 1F).
7. If the firestarter came on when tested as above (but doesn't come on when the stove is connected and operated properly), then the circuit board is probably bad. Unplug the stove, replace the circuit board, and verify proper stove operation.

Test 6E Check Pellet Feed Rates

The circuit board turns on the auger motor for a certain period of time during a cycle of approximately 14 to 15 seconds. The amount of time that the auger is on depends on the feed rate setting on the control panel. If the timing is not correct, the auger may not supply the proper amount of pellets to the burn pot. These tests will check the feed rate timing at each of the control panel settings.

Procedure

Note: For these tests you will need a stopwatch accurate to at least one tenth of a second (0.1 sec). You will be observing the small green auger timing light which is visible through a small hole in the control panel.[P23] It is not necessary to remove the control panel or circuit board in order to do these tests.

P23 and others with small circuit boards: The auger timing light is visible through the hole near the upper left corner of the control panel.

1. Plug the stove in and turn it On. Press the auger button. The large green light should come on and stay on.
2. Turn the control knob to Low.
3. First, time the full duty cycle. Use your stopwatch to measure the time from when the small green light blinks On to when it blinks On again. This time should be between 14 and 16 seconds.[P23]

P23 and others with small circuit boards: The duty cycle should be about 20 seconds for these models.

4. Now, measure the auger On time. Use your stopwatch to measure the time that the small green light is On during each duty cycle. Time the light during several cycles and average the results.
5. Repeat steps 2 through 4 for each of the feed rate settings on the control panel.

Other models not shown in the charts: See Section Four for other models or consult the factory for information on older boards.

6. The auger On time should fall within the ranges indicated in the chart below for each of the feed rate settings.[Others] *Important: If a thermostat is connected, and the thermostat jumper is properly set (see Test 6G), the auger timings for the E and Max settings should be the same as for setting D.*

Auger On Time During Each Cycle (P24, P28, P2000 etc.) Total Duty Cycle: about 15 seconds					
Low	**B**	**C**	**D**	**E**	**Max**
0.7 - 1.3 sec.	1.1 - 1.7 sec.	1.8 - 2.4 sec.	2.6 - 3.2 sec.	3.8 - 4.4 sec.	4.2 - 4.8 sec.

Auger On Time During Each Cycle (P23) Total Duty Cycle: about 20 seconds			
Low	**B**	**C**	**High**
3.7 - 5.4 sec.	7.8 - 9.2 sec.	15.5 - 16.8 sec	Constant

7. If the pellet feed timing is within the above range for all settings, return to the diagnostic flow chart and continue with the next test.
8. The timing cycles for setting "B" and above are not adjustable in the field. If the timing is significantly different from the above standards, contact the factory for instructions.
9. If the timing of the "Low" setting is not within the above range, or the problem you are working on relates to the Low setting, you may be able to adjust the timing. Locate the low feed rate potentiometer on the back of the circuit board. It will be a small round object with a small screwdriver slot in the middle, located near the center or upper half of the circuit board.
10. If the Low timing was too short, or the stove is not holding fire on the Low setting, use a small screwdriver to turn the potentiometer 1/4 turn *clockwise.*
11. If the Low timing was too long, or the stove is dumping too many pellets on the Low setting. use a small screwdriver to turn the potentiometer 1/4 turn *counterclockwise.*
12. If the you find that the potentiometer has already been turned as far up or down as it will go, and the stove is still not operating correctly, contact the factory for instructions.

Test 6F Check Circuit Board Fuse

There is a small fuse located on the back of the circuit board which serves as overcurrent protection for the auger circuit. If there is a short in the auger circuit, or if a malfunction causes a constant auger feed, this fuse will blow. An external problem, such as a power surge, can also blow the fuse. Other stove functions will appear normal, but the auger will not feed (the

manual feed switch will still work). This test will determine if the fuse has interrupted the circuit and whether or not there is a problem with the auger circuit.

P23 and others with small circuit board: The small circuit board does not have an auger circuit fuse. Skip this test.

Procedure[P23]

1. **Turn the stove Off and unplug it.** Remove the control panel and circuit board, and unplug the Molex connector and red firestarter wire.
2. Locate the fuse, just above the Molex connector near the bottom of the circuit board. Examine the fuse closely (you may find it easier to remove it.) If the glass of the fuse is dark, or you can see that the filament inside the tube is broken, the fuse has blown. If the fuse has NOT blown, return to the diagnostic flow chart.
3. If the fuse has blown, replace it with a Bussman .75 or 1 AMP, slow blow, 250V, MDL 3/4 fuse (or equivalent).
4. Reconnect and install the circuit board. Plug the stove in, turn it On and start an operating cycle. If the auger feeds automatically according to the feed cycle, and doesn't shut down, the auger circuit is probably OK; replacing the fuse has solved the problem.
5. If the auger doesn't run, or shuts down again after a period of operation, there is probably a problem with the auger circuit. Repeat steps 1 and 2 above to see if the fuse has blown again.
6. If the fuse if blown, either the circuit board is bad, or there is a short circuit in the auger circuit.
7. **Unplug the stove. Disconnect the Molex connector and red firestarter wire from the circuit board.** Use a multimeter set to measure Ohms resistance (Ω) between the auger circuit and ground. Touch one probe to the terminal on the auger thermodisk where the orange wires connect. Touch the other probe to an unpainted metal part of the stove. The multimeter should show infinite or very high resistance (numeral 1 on some meters). Move the first probe from the terminal with the orange wires to the terminal with the yellow wire. The meter should still show high resistance.
8. If the meter shows zero or low resistance in either case, there is a short in the auger circuit. Examine all wires and connections in the auger circuit (see Test 1E), to find the short. Replace the fuse and test the stove until the short is found and eliminated.
9. If there is no short in the auger circuit, the circuit board itself is probably blown. Replace the circuit board and verify proper stove operation.

Test 6G Check Thermostat Jumpers

P23 and others with small circuit board: The small circuit board does not have a provision for attaching a thermostat. Skip this test.

If the stove circuit board in use has a provision for an optional thermostat, but no thermostat is connected, improper placement of the thermostat jumper (or shunt) can cause incorrect operation of the convection blower and auger.

Procedure[P23]

1. Unplug the stove and remove the circuit board. Looking at the back of the circuit board, find the terminal for attachment of the thermostat wires. Next to the terminal there will be a set of four small pins sticking up from the board. There should be a small square plastic part called a jumper (or shunt) slipped over two of these pins.
2. If the stove is equipped with a thermostat, the jumper should be slipped over the *lower pair* of pins. If the stove is not equipped with a thermostat, the jumper should be over the *upper pair* of pins.
3. If the jumper is not positioned correctly, the stove will not operate properly. Using needle nose pliers, pull the jumper up and off and slip it carefully over the pair of pins indicated in step 2.
4. Reassemble the stove and test it for proper operation.

Test 6H Check Blower Pass-Through Circuit

P28: On this model, the power for both blowers passes through the circuit board, even when the stove is turned Off. Therefore, this test is appropriate even when both blowers stop running.

When the stove is turned On, the power for both the combustion blower and the convection blower comes from the circuit board. When the stove is turned off but is still hot, power comes from the purple wire, through the blower thermodisk and the blue wire to the circuit board. In order for the convection blower to operate, the circuit board makes a connection between the blue wire and the pink wire, after stepping down the voltage so the blower runs at low speed.

Procedure

Note: This test is only meaningful if the blowers operate properly when the stove is turned On, but the convection blower does not continue running when the stove is turned Off while still warm. If BOTH blowers stop running when the stove is turned Off, this procedure will not find the problem.[P28] Return to the diagnostic flow chart.

P28: There is no chair connector, just a blue wire connected to this side of the thermodisk.

1. Unplug the stove. First, bypass the blower thermodisk. Pull the purple wire part way off the thermodisk terminal, but still attached. Use a jumper wire with insulated alligator clips on both ends. Clip one end to the exposed thermodisk terminal below the purple wire. Clip the other end to the "chair" connector (which connects the black and blue wires) on the other side of the thermodisk.[P28]
2. Next, bypass the circuit board. Disconnect the firestarter wire and the Molex connector. Set the circuit board aside. Use an 18 gauge copper

jumper wire with about 1/4 inch of bare wire exposed on each end. Twist the bare wire so it is tight. Insert one end of the wire into position 3 on the male Molex connector (see diagram with Test 1B), which corresponds to the blue wire. Insert the other end of the jumper wire into position 4, which corresponds to the pink wire. Once you are sure that the wire is securely inserted on both ends and not touching anything conductive, plug the stove in.

3. Both the combustion blower and the convection blower should come on. (If neither comes on, check your thermodisk bypass.) If the convection blower comes on, but it did not come on when the Molex connector was connected to the circuit board, there is probably a problem with the circuit board. Replace the circuit board, return the stove to a normal configuration, and verify proper operation.

4. If the combustion blower comes on, but the convection blower still does not come on, the circuit board is probably not the cause of the problem. Go to the Startup Sequence flow chart and make sure that there is nothing wrong with the operation of the blower during normal operation.

Test 6I Check Combustion Blower Connections

It is highly unlikely that the combustion blower would stop running when the stove is turned to Off, while the convection blower continues running. If the convection blower is running, the blower thermodisk must be closed, and even a defective circuit board cannot shut the combustion blower off during this stage. Therefore, the only possible explanation would be poor electrical connection between the blower thermodisk and the combustion blower, or between the blower and the terminal strip. However, such a problem would also show up during normal operation, when the stove is switched to On. Therefore, the best way to diagnose this problem is to return to the Startup Sequence diagnostic flowchart and follow its instructions exactly.

3.6 Selected Adjustment and Replacement Procedures

The adjustment or replacement of most components of Breckwell pellet stoves is simple and uncomplicated. Where necessary, certain procedures have been described in some detail under the appropriate test procedure in Section 3.6. This section includes several jobs which either aren't covered elsewhere, which need more detail, or involve special considerations.

3.6.1 Installing an Optional Thermostat

P23 etc.:
The P23 and some older models do not contain a provision for attaching a thermostat.

Breckwell itself does not provide a thermostat as either standard equipment or as an option. However, the circuit board includes a provision for connecting a thermostat obtained locally.[P23] This can be anything from a basic, inexpensive thermostat to a programmable set back type, but it must be a millivolt type thermostat.

Procedure

1. Locate and mount the thermostat per the instructions provided with the thermostat. Do not locate the thermostat in a place that would be exposed to the radiant energy or warm air flow from the pellet stove. It is usually best to locate it near the thermostat for the conventional heating system, unless the purpose of the stove is to heat an area separate from the rest of the house.
2. Run 18 gauge thermostat wire from the thermostat back to the stove, but do not connect to the thermostat yet. Leave extra wire extending beyond the thermostat to allow for final adjustment of the length.
3. **Unplug the stove.** Access the circuit board by removing the four screws that hold the control panel plate. Gently pull the circuit board and control panel from the stove. You should not have to detach the wiring harness.
4. Look at the back of the board. You should see the two thermostat wire terminals near the upper left corner. Next to the terminals will be four vertical jumper pins, with a plastic part called a shunt slipped over two of them. Using needle nose pliers, carefully pull the shunt up and off the pins, and place it on the **lower two** pins.
5. Connect the thermostat wire to the thermostat terminals on the circuit board. The polarity of the wires doesn't matter.
6. Reinstall the circuit board and control panel, and secure the thermostat wire so that it doesn't present a tripping hazard or contact any hot part of the stove.
7. Cut the end of the thermostat wire to length and connect to the thermostat according to the thermostat instructions.

Operation

The thermostat operates by cycling the stove between the low setting and a higher fire setting. When the thermostat calls for heat it will adjust the feed rate to whatever the feed rate control knob is currently set at. When the thermostat is satisfied, it will adjust the feed rate to the low setting; just enough to keep the fire burning.

The thermostat will not start the stove! It can only control the stove to maintain the desired heat level one the fire is started and established in the normal way.

To start the stove with a thermostat attached, first turn the thermostat up to a temperature higher than the current room temperature. Turn the stove On, and ignite the fuel in the usual way (manually or with the automatic firestarter). After the fire is established (allow about 15 minutes), adjust the feed rate control to the desired setting. Since the cycling of the stove will be controlled by the thermostat, this should be a setting that is sufficient to heat the house to the desired temperature, or higher. The higher the setting, the shorter the "On time" when the thermostat calls for heat.

The thermostat can then be adjusted to the desired temperature. Note that if the thermostat is not in the same room as the stove, the stove room will get warmer than the thermostat setting. The homeowner will learn by experimentation what thermostat setting to use for the desired comfort level in the stove room.

3.6.2 Installing an Optional Firestarter

Since mid-1997, all Breckwell pellet stoves except the P23 series have included the Hot Rod firestarter as standard equipment. The firestarter can be added to the P23, or previous versions of other models, without a great deal of trouble.

Breckwell provides two types of firestarter: one which connects directly to the main circuit board and is controlled by it, and one which uses a remote circuit board. Both systems use the same Hot Rod firestarter element. The P23 series stoves can *only* use the system with the remote firestarter board. Other stove models may be able to use either type, depending on the type of main circuit board in the stove and when the stove was produced. All stoves produced prior to 1996 use the remote circuit board; most stoves produced since 1996 (except the P23) have connections for either system.

On main circuit boards that can accept either type of firestarter, proper connection of the firestarter wire, and placement of the jumper (shunt) is important. Some boards will have two blade-type terminals for connection of the wire. Other boards will have a red-striped white wire coming off the board, as well as a blade terminal. Both boards will have a set of three pins near the right hand edge (looking at the back of the board). A jumper needs to be placed over either the upper two, or lower two of these pins. The

following table shows how these connections are made, depending on the type of main circuit board and firestarter.

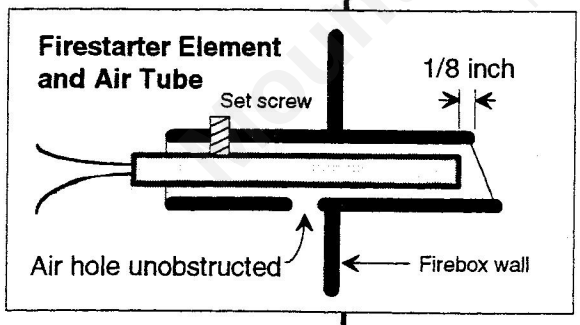
Connection of Firestarter to Main Circuit Board		
Circuit Board Type	**Remote Firestarter**	**Direct Firestarter**
P23 and other stoves with small circuit boards:	Connect to blade terminal. No jumper pins.	NA
1996: With red-striped wire and one blade terminal	Connect to red-striped wire. Jumper on lower two pins.	Connect to blade terminal on right side of board. Jumper on upper two pins.
1997: With two blade terminals	Connect to blade terminal on left side of board. Jumper on lower two pins.	Connect to blade terminal on right side of board. Jumper on upper two pins.

Refer back to this chart when following the procedures to install the firestarter.

Procedure

Installing the Hot Rod firestarter element (all stoves):

1. Unplug the stove and acess the rear controls compartment. On the P24I (insert), the installation will go much easier if you remove the convection blower and set it aside.
2. Locate the firestarter housing tube to the left of the combustion air pipe. Remove the 3/8 inch hinge pin from the end of the tube by loosening the set screw on top of the tube with a 1/8 inch allen wrench.
3. Insert the Hot Rod element into the rear of the firestarter tube until the end of the element with the wires is flush with the end of the tube. Go around to the front of the stove and remove the burnpot. The end of the firestarter element should be set back 1/8 inch from the top edge of the firestarter tube (see diagram). Adjust the element as necessary to get it into this position.

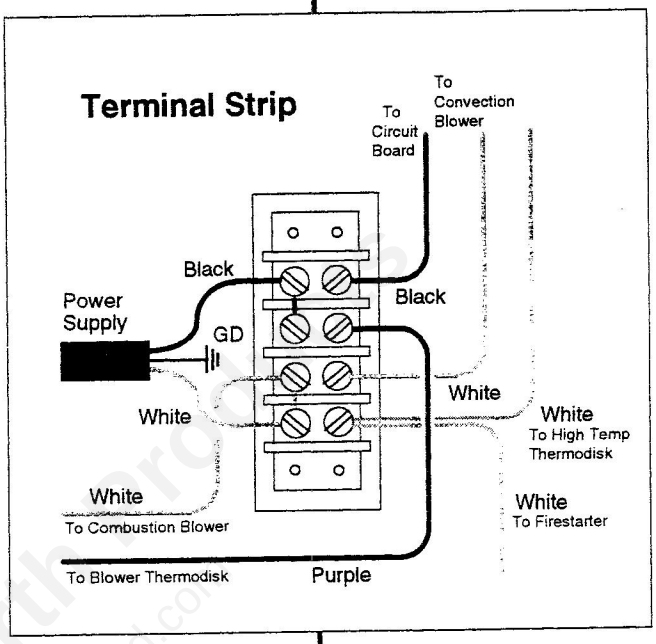


4. Return to the back of the stove and secure the element with the set screw. **Caution!** Do not overtighten the set screw, as it could crush the element. It is only necessary to snug the screw against the element.

If you are installing a firestarter directly to the main circuit board (without remote control board):

1. Use a 16 gauge or 18 gauge white insulated wire, about 6 inches to 1 foot long, to connect the firestarter element to the stove terminal strip. Crimp on a fork connector to one end and screw it down on one of the

terminals on the neutral side of the terminal strip (see diagram). The neutral side will have other white wires (and blue wires in the case of the P28) connected to it. You can gang the firestarter wire on the same terminal with another if necessary.



2. On the other side of your white wire, crimp on a 1/4 inch female spade connector. Attach this to the male spade connector at the end of either firestarter wire.
3. Connect the other firestarter wire to the red wire which is included in the wiring harness.
4. Connect the other end of the red wire to the blade terminal on the bottom right side of the main circuit board (looking at the back of the board).
5. Locate a set of three jumper pins near the right edge of the lower part of the board. There should be a plastic shunt slipped over two of the pins. Using needle nose pliers, pull the shunt of the pins and slip it over the *upper pair* of pins.
6. Reassemble the stove, plug it in, and run through a complete startup sequence to make sure that the firestarter and auger feed are operating properly.

If you are installing a firestarter with a remote circuit board (all P23 installations):

1. Carefully mount the remote firestarter control board on the guide bracket for the combustion air pipe. Make sure that the Molex connector is in the Up position and insert the four standoffs into the holes provided.
2. Connect the wiring harness to the firestarter control board by plugging in the male end of the Molex connector (on the harness) into the female end attached to the board. Connect the two red wires from the firestarter control board to the two wires from the Hot Rod element.
3. Connect the white striped wire from the firestarter control board to either the wire attached to the main control board (1996 board) or the blade terminal on the *left* side of the main board (1997 board) or the *only* blade terminal in the case of the P23 board.
4. If this is *not* a P23 or other stove with a small circuit board, locate the set of three jumper pins near the right edge of the lower part of the board. There should be a plastic shunt slipped over two of the pins.

Using needle nose pliers, pull the shunt of the pins and slip it over the *lower pair* of pins.

5. Reassemble the stove, plug it in, and run through a complete startup sequence to make sure that the firestarter and auger feed are operating properly.

3.6.3 Removing a Firestarter Element

If it becomes necessary to replace the firestarter element, you will need to remove the existing one. While this is almost as simple as it sounds, there are a couple of considerations that need to be kept in mind.

Procedure

1. Remove the burnpot from the firebox side of the firestarter air tube, and set is aside. Unplug the stove and access the rear controls compartment. On the P24I (insert), the installation will go much easier if you remove the convection blower and set it aside.
2. Remove the auger motor where the coupling attaches to the auger shaft by loosening the upper set screw on the coupling. Slide the auger motor down and off the shaft.
3. Disconnect the wire leads for the element at the spade connectors. Cut the wires off where they meet the end of the firestarter element.
4. Working from the **back** of the firestarter tube, use a hammer and a 1/4 inch dowel, metal rod, center punch, or equivalent to tap the firestarter element forward and out of the tube. Do not attempt to push the element backward out of the tube from the firebox. The front (hot end) of the element will have expanded from use and will be next to impossible to force out from the front.
5. Install a new firestarter element by following the procedure in Section 3.6.2.