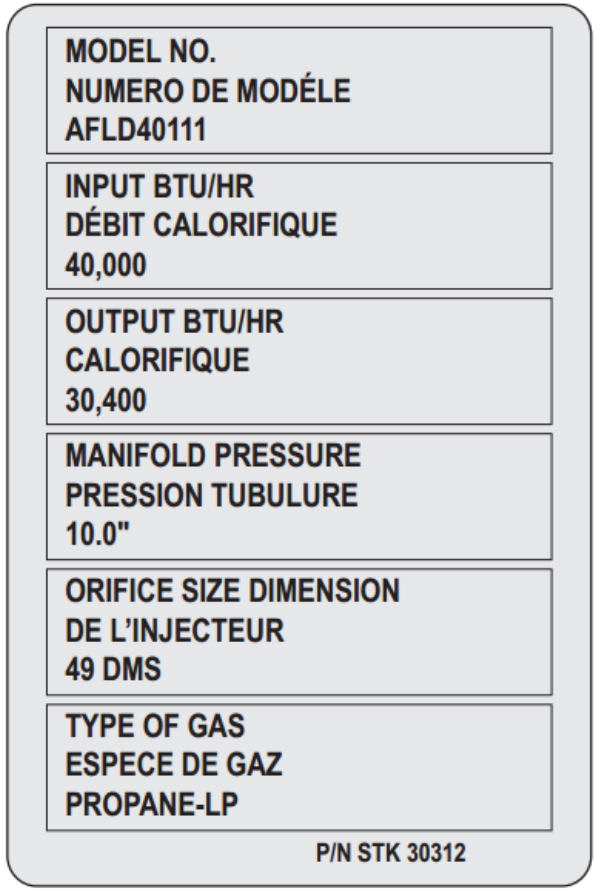
DOMETIC Furnaces

- AFL
- AFM
- AFS

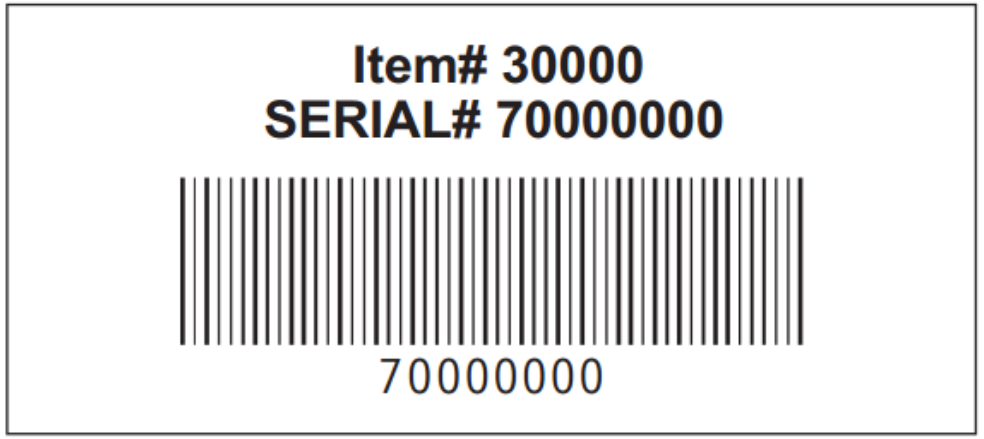
DOMETIC Furnaces

- DFL
- DFM
- DFS

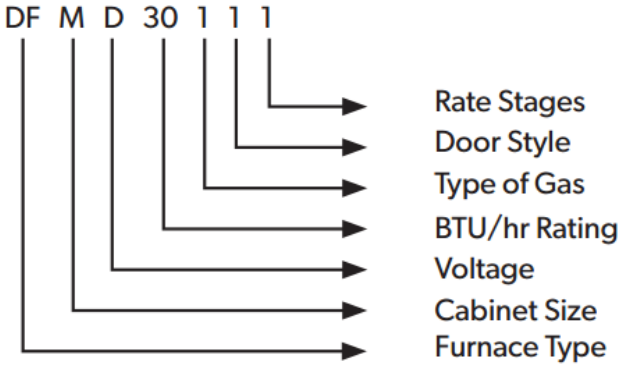
Model Identification



NOTE: The Model and Serial Numbers are NOT in the same location. For Identification, the Item Number and Serial Number will work just fine.



AF/DF Series

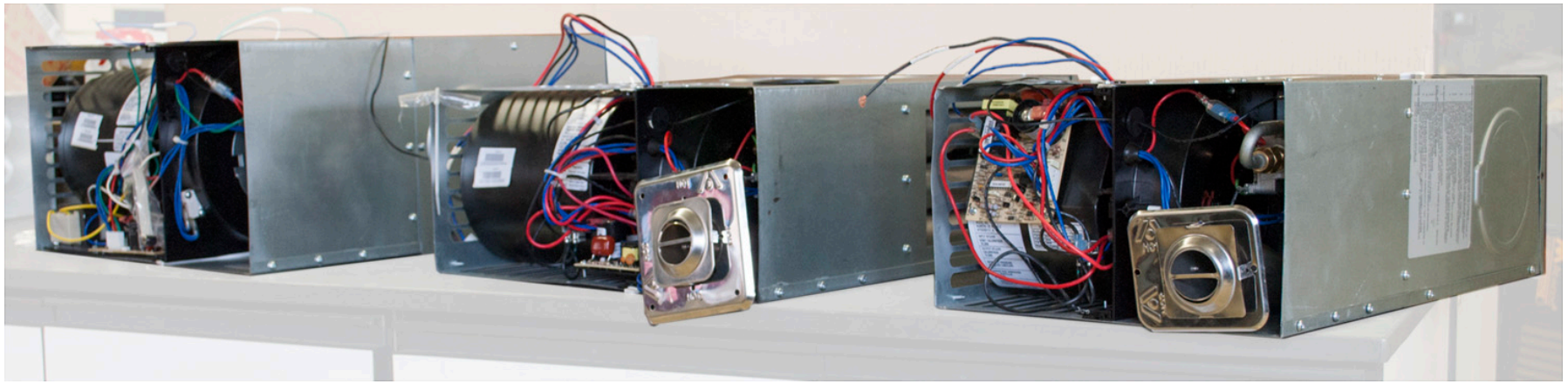


Model number example:
DFMD30111

How an RV Furnace Works

All RV furnaces are designed on the concept of sealed combustion with two blower wheels.

1. Room air wheel - This pulls air from the inside of the RV and blows it over the outside of the heat chamber to wipe the heat from the chamber to force into the duct system to distribute it throughout the RV.
2. Combustion air wheel - Pulls air from the outside of the RV, blows it into the burner chamber to mix the gas and air for combustion, and then blows the combustion air out the exhaust vent.
3. All the furnaces work the same just different shapes and sizes.



Furnace Sizing

The following methods should be used to determine the proper size furnace to use in the application.

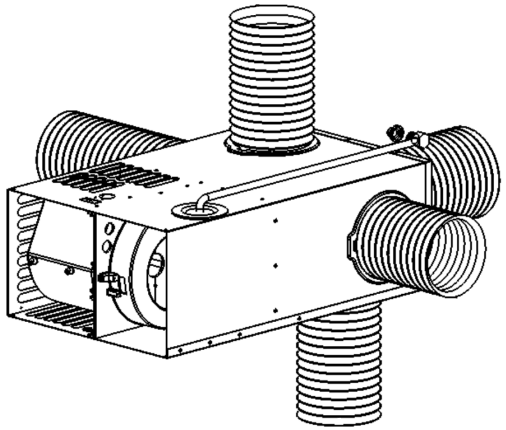
1. **If the unit is 8 ft. wide and has no slide-outs,** use the following formula. The inside length of the unit times 1000.
   Example: Unit length is 30 feet; 30 x 1000 = 30,000 BTU (Require size).
2. **If the unit has slide-outs,** take length times width of the slide-out, add to length times width of unit, times 125.
   Example: Unit 31 feet long x 8 feet wide and has a slide-out that is 14 feet long x 3 feet wide. (31 x 8) + (14 x 3) = 248 + 42 = 290 (125) = 36,250 BTU required.

If the unit is wider than 8 ft. or has any slide-outs, use the following formula. The inside length times width times 125. Example: Unit length is 35 feet. Width is 12 feet, (35 x 12) x 125 = 52,500 BTU.

Available Sizes

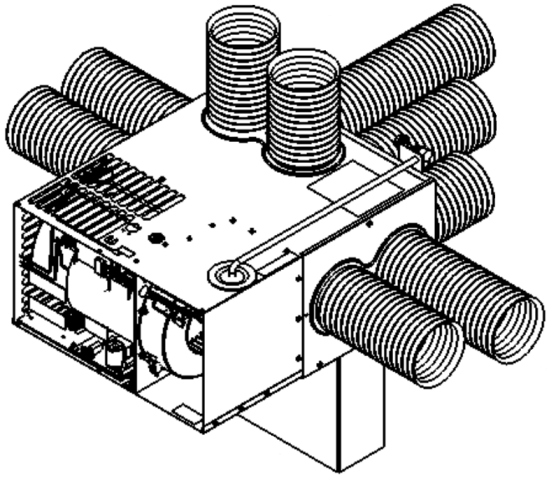
AFS & DFS

BTU 12K, 16K, 20K



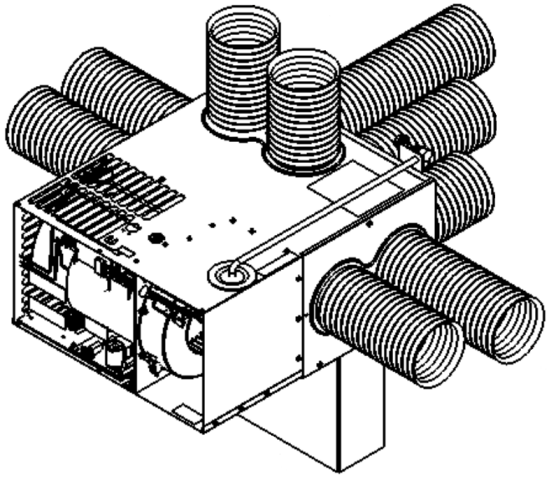
AFM & DFM

BTU 16K, 20K, 25K, 30K, 35K

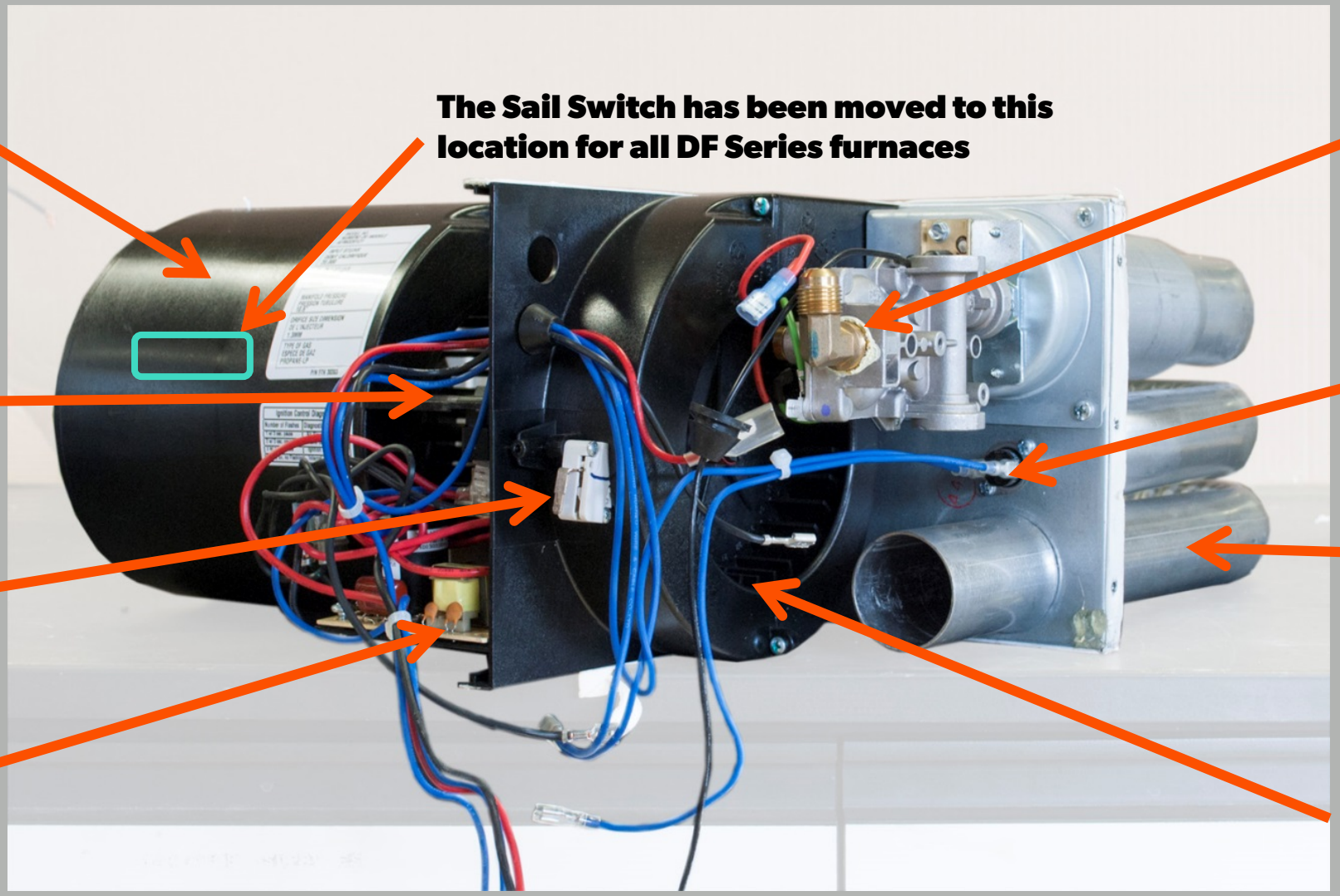


AFL & DFL

BTU 35K & 40K



Component Location



Furnaces

Installation

The 4 Always

Remember that you are working on a heating system and not just a furnace. A majority of furnace problems lie outside of the product itself. Therefore, when trouble-shooting a furnace problem, always check the following items before testing or replace components.

#1 – GAS PRESSURE

The gas pressure should be set at a minimum of 11" W.C. with a minimum of 50% and ideally 100% of the gas fired appliances operating. You should test this pressure with a U-tube Manometer only. If you choose to use a digital-type manometer, calibrate it often with a U-tube manometer.

#2 – VOLTAGE

Voltage to the furnace should be between 10.5 and 13.5VDC while under a load. High DC volts can cause the motor to spin to fast, overamp, and lead to ignition issues. Low DC volts can cause the motor to not spin fast enough to close the sail switch and can lead to ignition issues. Use a digital multi-meter when taking voltage readings. Do not use a test light. It does not provide enough useful information for proper diagnosis.

#3 - DUCTING

Always make sure that the furnace has at least the minimum number of ducts (not including closeable outlets) called out in the installation instructions. Check for proper duct connections at the furnace and heat registers, collapsed ducts and holes in the ducting. The duct runs must be as straight and tight as possible. The heat ducts must also be clean and clear of obstructions.

#4 – RETURN AIR

The return air passage should meet the minimum square inches as specified for the particular model of furnaces in the installation instructions. This air passage should also be clean and clear of obstructions. Do not put air filters in this passage way. Also make sure that combustibles are not stored in the furnace compartment.

Cold Weathers Effect on LP Tank Performance

A furnace is a consumer's friend when the outside temperature gets colder. Unfortunately though, cold is an enemy of LP gas. The BTU capacity of LP per volume decreases as the outside temperature gets colder. Therefore, based on how full the LP tanks are, the ambient temperature outside and how many BTU's the furnace is, there may not be enough gas to sustain ignition on the furnace.

Using the charts below, let's say that a 40,000 BTU furnace won't fire we also know that the 65 lb. LP bottle on the RV is 40% full and it is 0°F degrees outside. One's first thought might be that the burner or valve is bad. However, if we use the chart, the vaporization capacity of the tank in these conditions is only 38,500 BTU's. The furnace is not going to perform very well because there is insufficient BTU capacity in the tank. This make for a lean gas/air mixture which may not be able to be sense by the ignition control to maintain continuous operations.

20 lb. Bottle (*30 lb. bottle multiply x 1.40)

% Full	+20°	0°	-5°	-10°	-15°
60%	36,000	18,000	12,750	8,500	4,250
50%	32,400	16,200	12,150	8,100	4,050
40%	28,800	14,400	11,400	7,600	3,800
30%	25,200	12,600	10,450	7,300	3,150
20%	21,600	10,800	8,100	5,400	2,700
10%	16,200	8,100	6,075	4,050	2,025

65 lb. Under Mtd. LP Gas Tank BTU available at

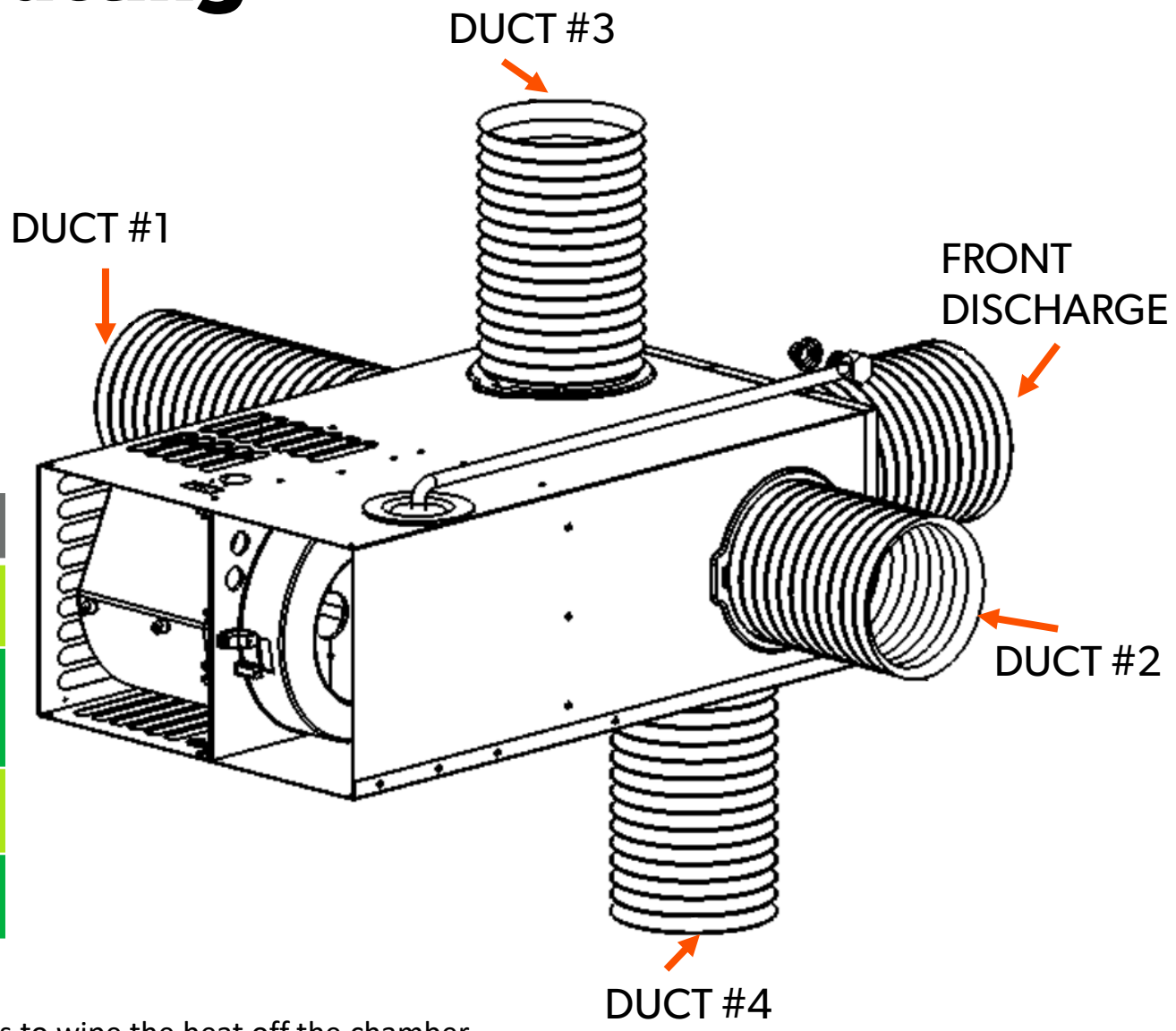
% Full	+20°	0°	-5°	-10°	-15°
60%	95.600	47.800	36,000	23,900	12,100
50%	86,000	43,000	32,250	21,500	11,750
40%	77,000	38,500	29.250	19,250	9,625
30%	68,000	34,000	25,500	17,000	8,500
20%	58,000	29,000	21,750	14,500	7,250
10%	43,200	21,600	16,200	10,800	5,400

DFS & AFS Required Ducting

Model	Required Discharge Area
DFSA (12)	Front Grill or 15 in²
DFS (12) (16) (20)	24 in²

35 square inches of return air required.

	DFSD12	DFSD16	DFSD20	DFSAD12
Side Ducts	2	2	2	X
Front w/ Side Ducting	1	1	1	X
Front Only 5" Duct	1	1	1	1
Front Only 4" Duct	2	2	2	X



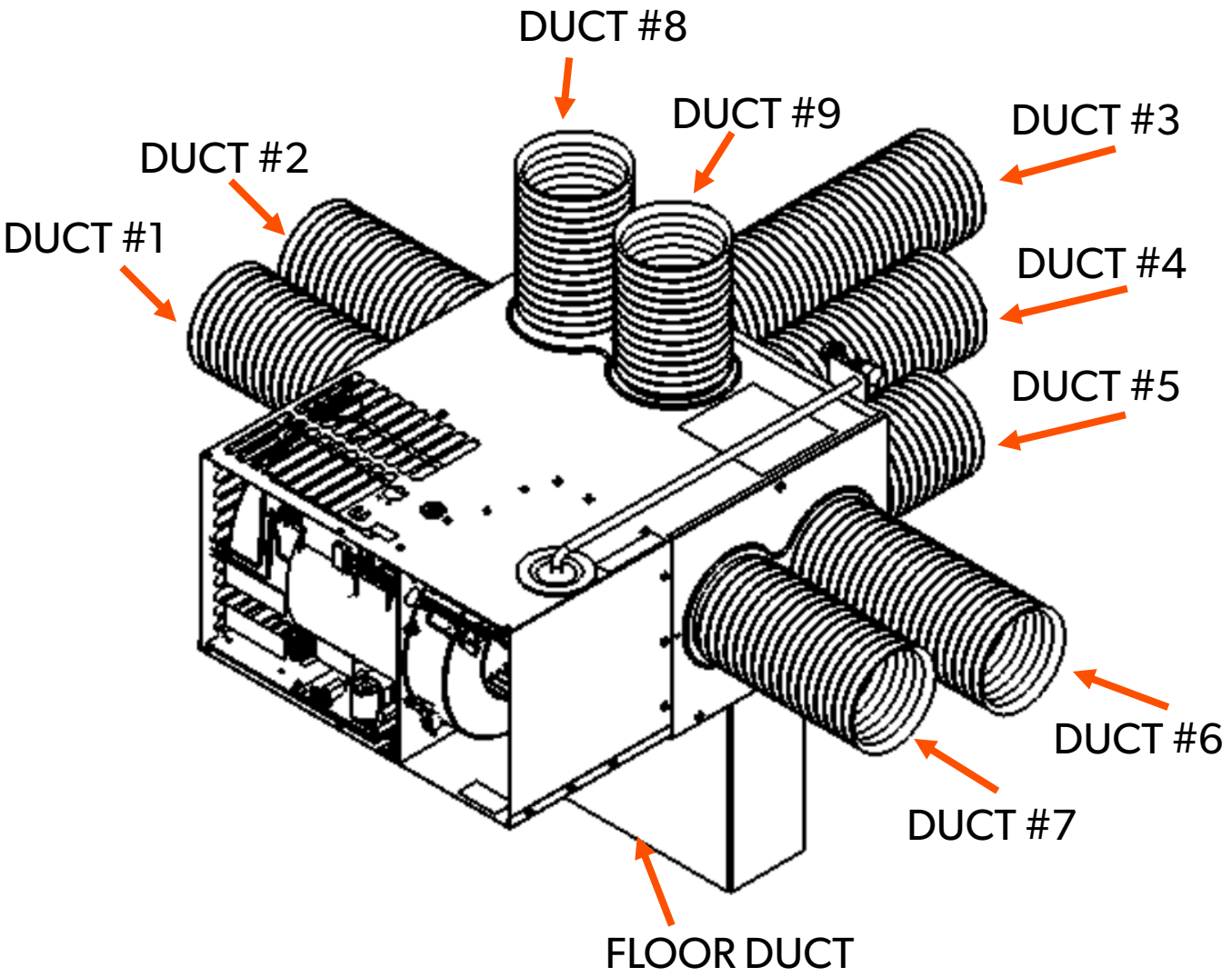
*Ducts must NOT be on same side. Must be on opposite sides to wipe the heat off the chamber.

DFM & AFM Required Ducting

Models	Required Discharge Area
DFM (16) (20)	24 in²
DFM (25) (30) (35)	36 in²
Horizontal Bottom	48 in²
Vertical Bottom	48 in²

65 square inches of return air required as a minimum, 80 square inches are suggested.

System	DFMD16	DFMD20	DFMD25 DFMD30 DFMD35
4" Ducts	2	2	3



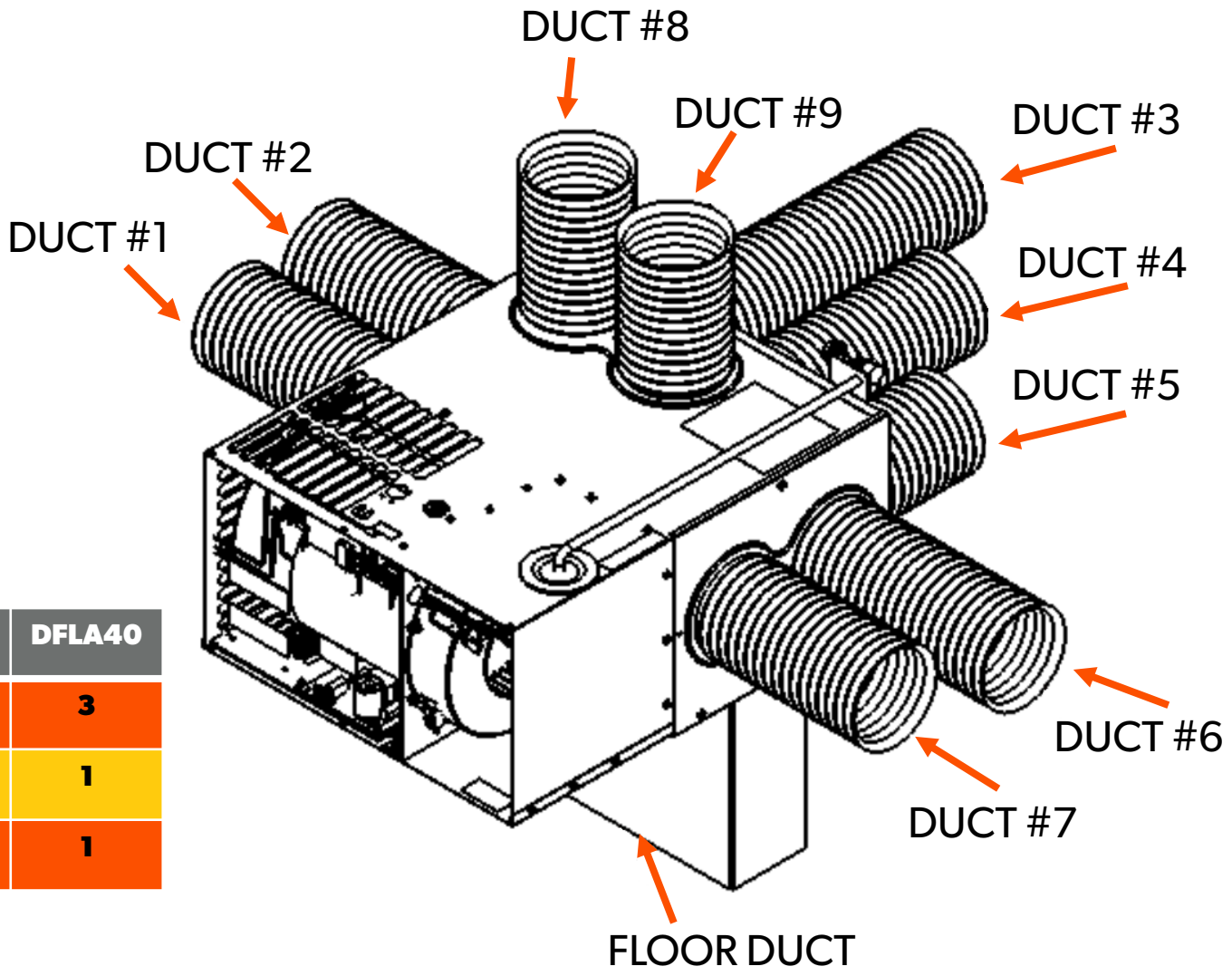
*Ducts must NOT be on same side. Must be on opposite sides to wipe the heat off the chamber.

DFL & AFL Required Ducting

Models	Required Discharge Area
DFL (35) (40)	36 in²
Horizontal Bottom	48 in²
Vertical Bottom	48 in²

65 square inches of return air required as a minimum, 80 square inches are suggested.

System	DFLD35	DFLD40	DFLA35	DFLA40
4" Duct	3	3	3	3
Bottom	1	1	1	1
Vertical Bottom	1	1	1	1

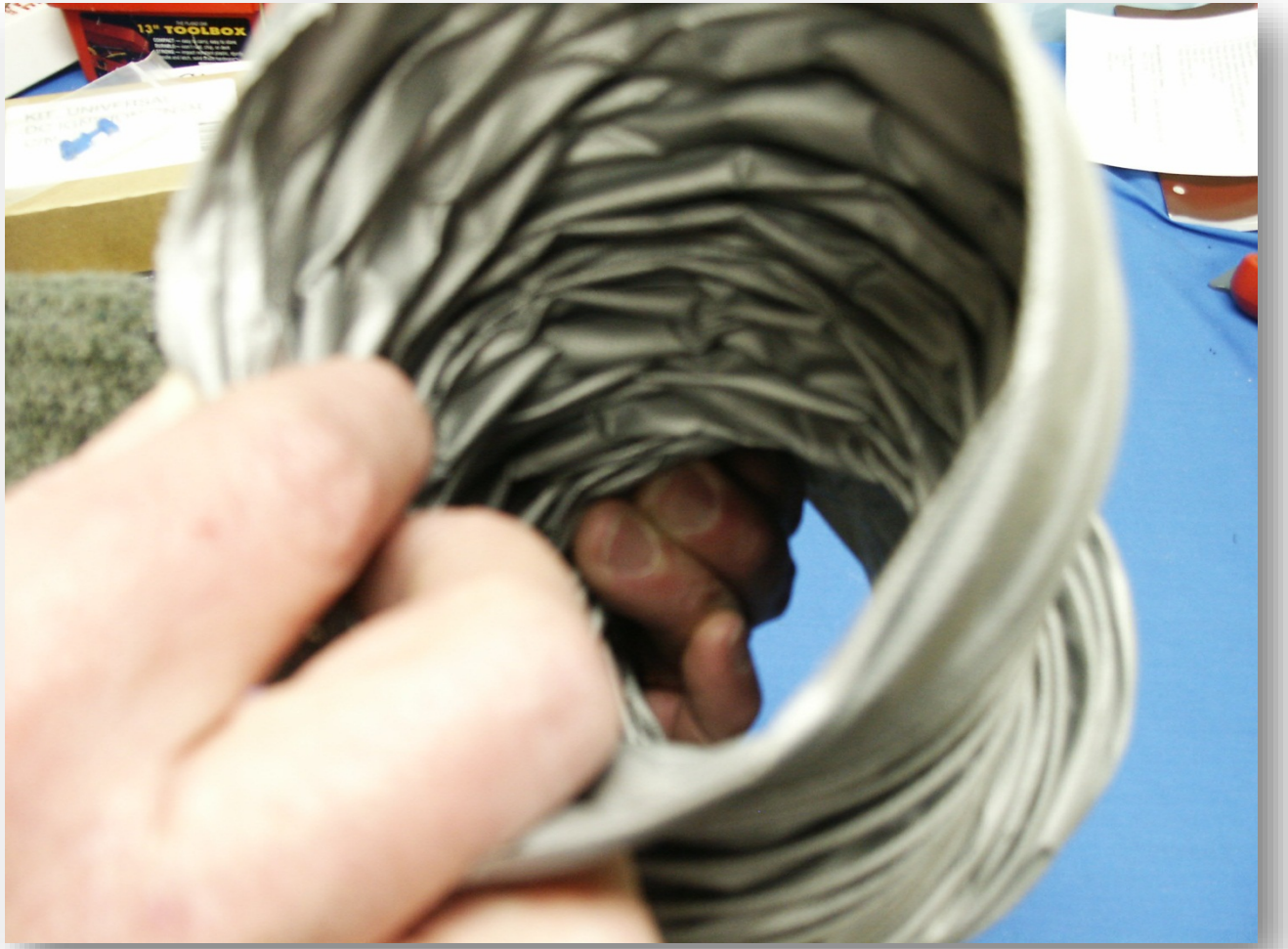


*Ducts must NOT be on same side. Must be on opposite sides to wipe the heat off the chamber.

1. **Types of ducts systems**
    1. Soft duct – routed throughout cabinets
    2. Hard duct – built within flooring
    3. Soft duct – below flooring
2. **Soft duct issues - above and below floor systems**
    1. Not meeting minimum requirements
    2. Too many bends/elbows not stretched tight
    3. Smashed or kinked
    4. Torn or not connected properly
    5. Too much length (ex. 10 ft of ducting needed but 40 ft winding throughout the RV - excess should be removed)
3. **Hard duct issues**
    1. Not large enough – not meeting minimum size required (48 sq. in.)
    2. Collapsed
    3. Furnace not lined up with opening in floor

(All can be checked by looking into duct system with mirror and flashlight)

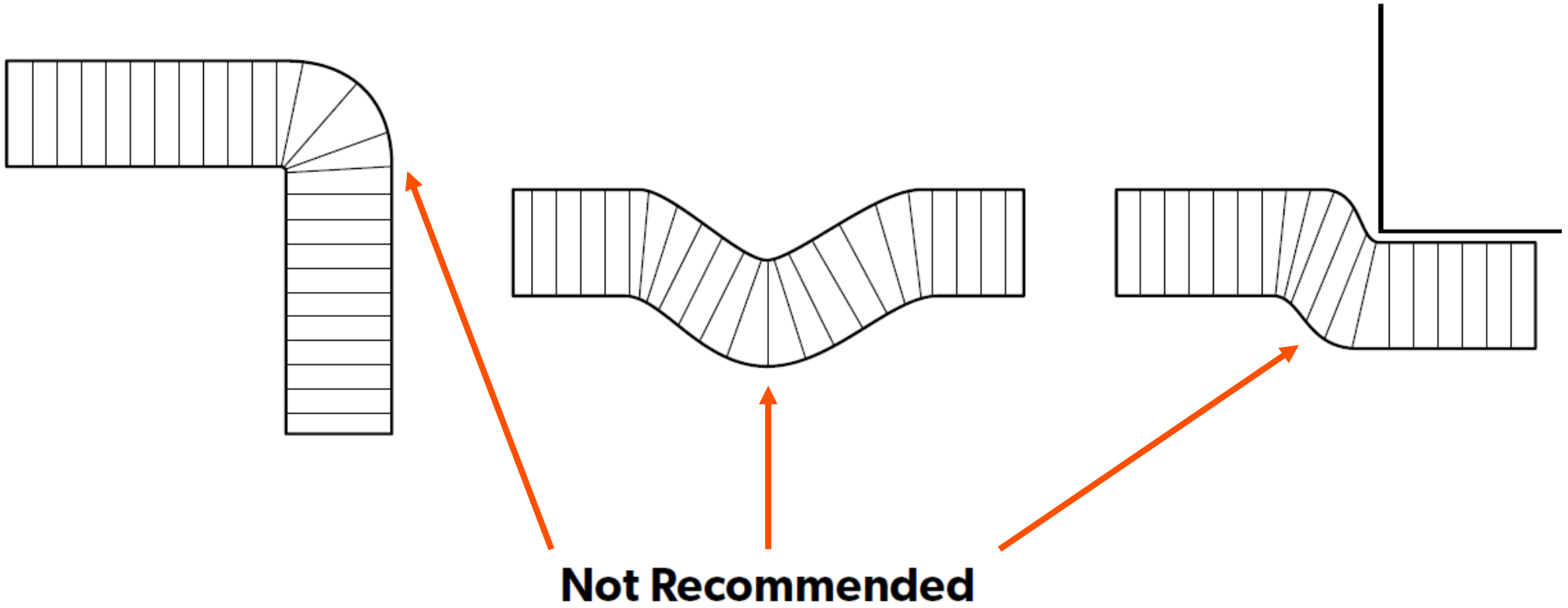
If there is excess ducting it will slow the air flow through the duct.



Ducting should be taught and as straight as possible

Ducting

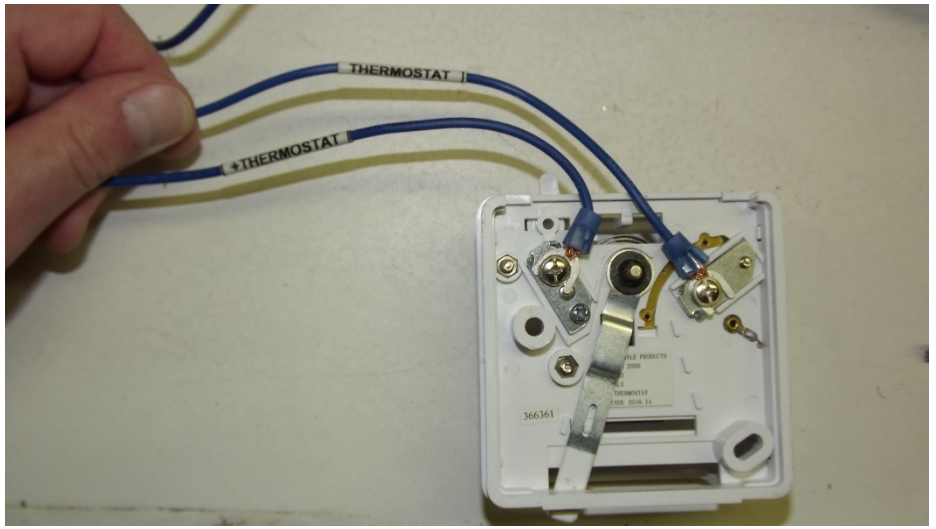
The Straighter the Ducts, the Better!

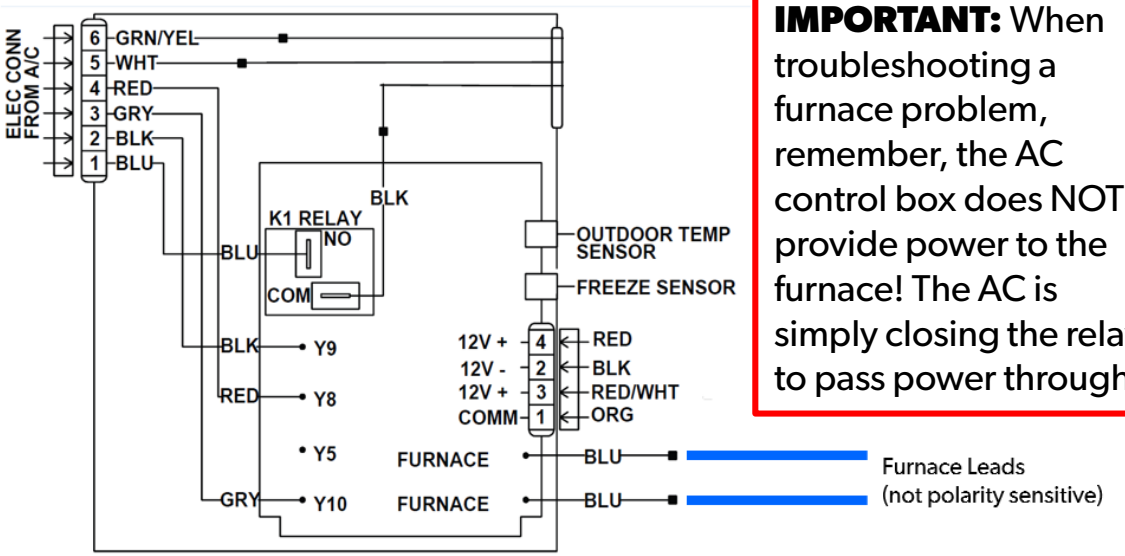


Not Recommended

General Rule of Thumb: Every 90 degree turn the ducting makes adds 10 feet to how hard the furnaces needs to work in order to heat the RV.

Thermostat / Control Box Wiring





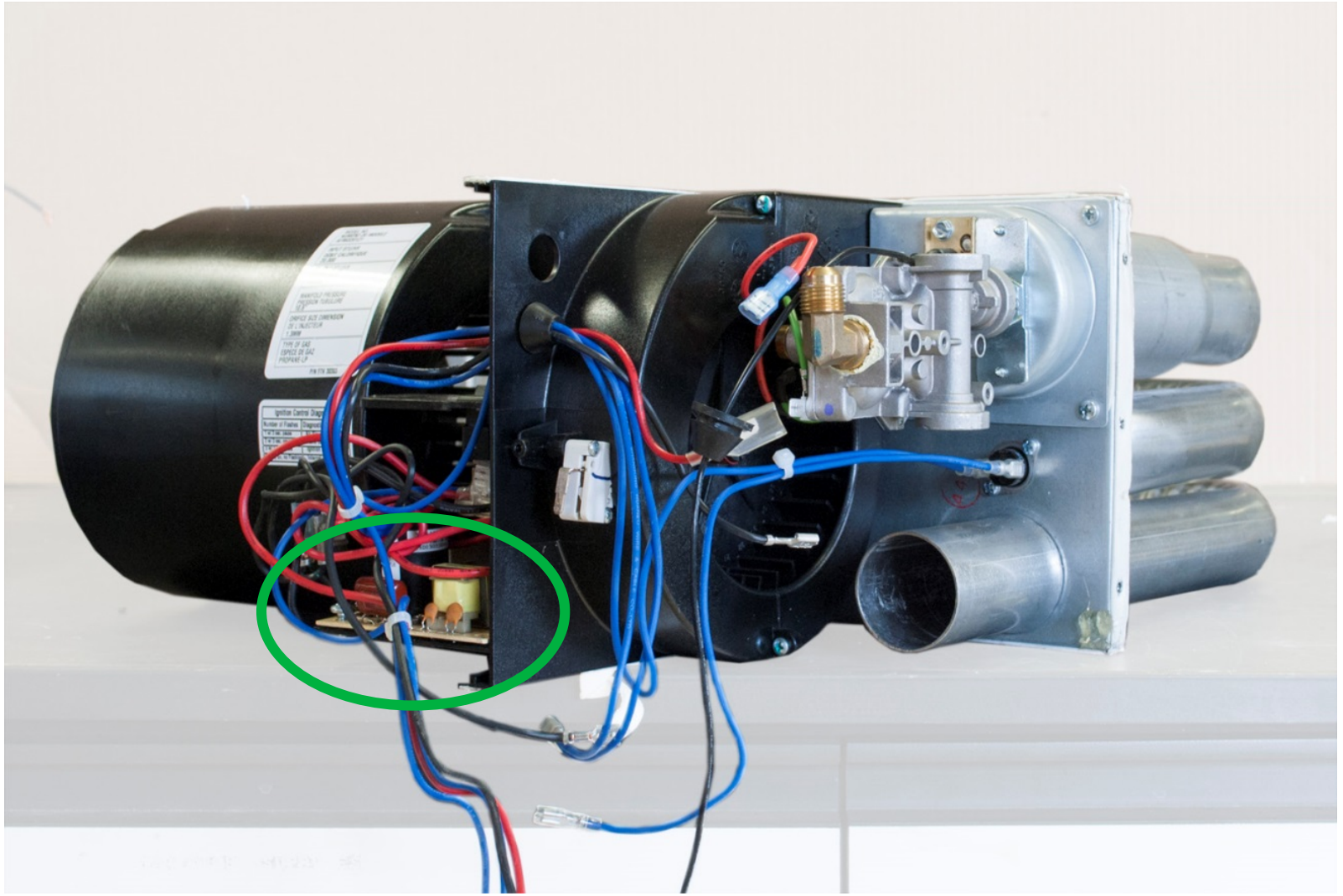
IMPORTANT: When troubleshooting a furnace problem, remember, the AC control box does NOT provide power to the furnace! The AC is simply closing the relay to pass power through.

To and from thermostat
One lead is positive (+) and the other is a return lead. As the thermostat calls for heat the thermostat closes and completes the circuit between the leads sending the signal to the board to activate the furnace.
NOTE: When using the Atwood/Dometic Bi-Metal thermostat, the anticipator needs to be set to “1”.

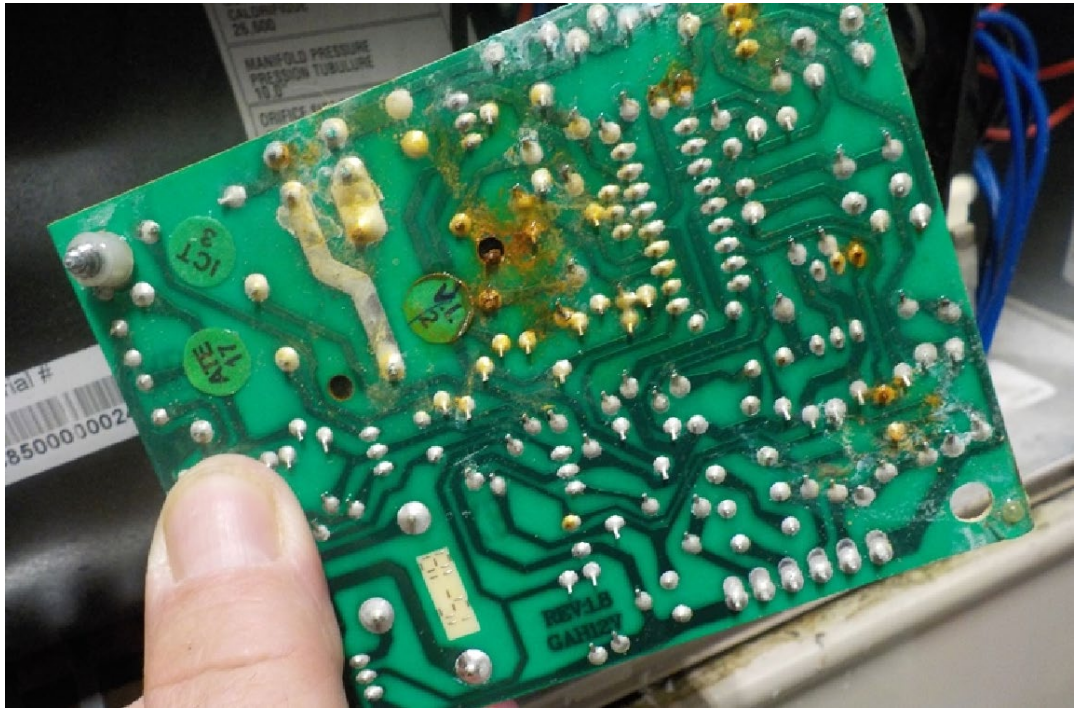
To and from AC control box
One lead is positive (+) and the other is a return lead. As the thermostat calls for heat the thermostat sends a communication signal to close the furnace relay on the AC control board. This completes the circuit between the furnace leads and sends the signal to the furnace board to activate the furnace.

Different Thermostats

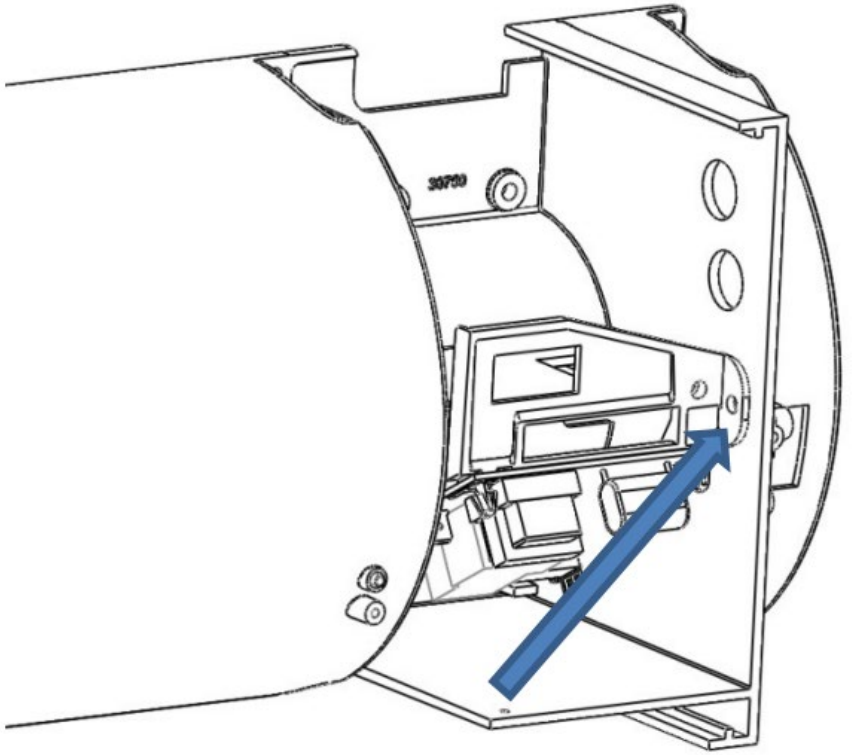
AFM Board Relocation



AFM Board Relocation



Water Damaged Board



New Board Location

The new mounting bracket installs the board at an angle and does not allow the board to rest of the bottom of the furnace housing which is where water would collect.

Control Board relocation took place in production around the serial number range starting with 630XXXXX. Approx. June of 2016.

AFM Board Relocation

Version 3 Door

Version 3 Door

Version 4 Door
(Introduced at the end of 2015)

The first generation of the AFM series furnaces had the potential to have water damage to the board due the location of the board mounting and the gasket of the Version 3 door. There is a board relocation kit that will change the mounting location of the control board, that, once installed, will prevent the board from having further water damage.

All of the current generation AFM units coming off the production line now have the board in the new location and the new Version 4 door. If you have a customer that needs a Board Relocation kit, contact our Warranty Authorization Department with all of the customer, furnace, and RV info and we will send the board relocation kit and the version 4 door if needed.

DF models require a metal door. Cannot go to metal door on AF models.

Furnaces

Sequence of Operations Systems Including the following

1. Fan System
2. Ignition System
3. Burner System

Sequence of Operation – DC Models (Standard Units)

The ON/OFF switch allows power to pass to the circuit breaker and the thermostat.

The thermostat controls the operating circuit to the furnace by reacting to room temperature. When room temperature is below the thermostat set point, the contact closes to allow current to flow to the **relay (relay can be either external or part of the ignition control board)**.

The circuit breaker limits amperage draw of motor.

The relay allows current to pass to the motor by closing a switch within the relay. Voltage from the thermostat activates the relay to turn the fan on. This takes 1 -25 seconds **(on units with the relay on the ignition control board there is only a 1 -2 second delay)**.

Current flows to the motor to operate the blower. One end of the motor shaft is for the circulating air wheel and the other side is for the combustion air wheel.

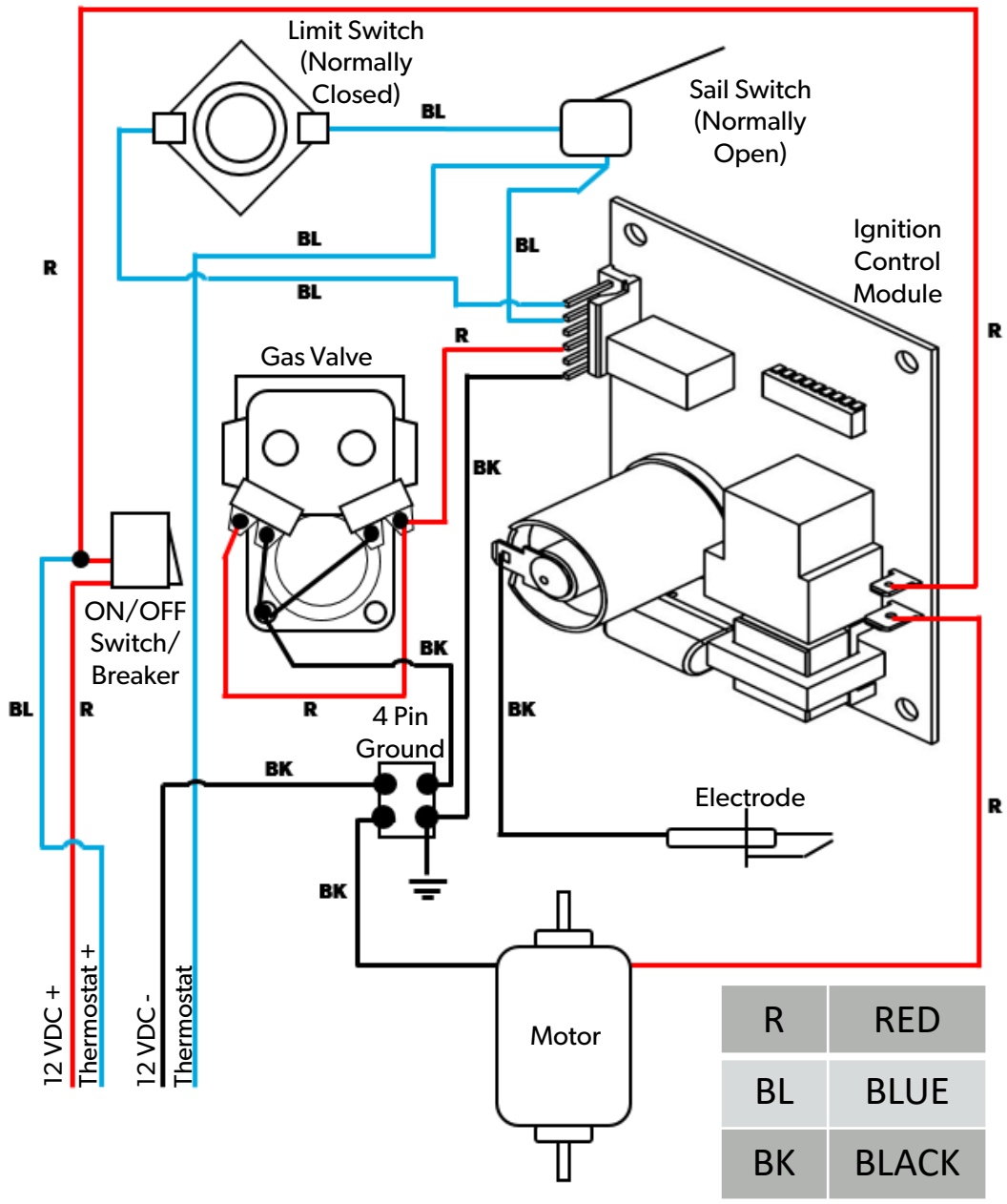
Circulating air blows against the sail switch and closes the contacts, completing the circuit. The sail switch is a safety device that insures air flow before ignition.

The limit switch is a safety device that protects the furnace from overheating. The contacts in the limit switch open at a given temperature setting, shutting off power to the electronic ignition system that controls the gas valve.

As power is applied to the circuit board, the system closes the following:

1. A timing circuit allows the blower to purge the chamber (15-17 seconds).
2. The board supplies current to the gas valve and causes it to open.
3. As the valve opens, the board sends a high voltage spark to the electrode at the burner. The board detects the presence of a flame. If the flame is not sensed after approximately six seconds, the board will lock out (after three tries for ignition, the control will lockout for one hour unless power is removed or thermostat is cycled).shutting off power will restart the cycle.
4. If the system does not ignite and the thermostat remains closed, the blower will remain on until the thermostat is reset manually on units with an external relay **(units with the relay on the ignition control will shut the blower off even if the thermostat contacts remain closed)**. If the thermostat is has not be satisfied within one hour the system will try the ignition cycle again.

When the thermostat senses the desired room air temperature contact open, removing power from the ignition system and shutting off the gas valve. The blower runs until the relay opens (90 seconds) the circuit shutting off current to the motor.



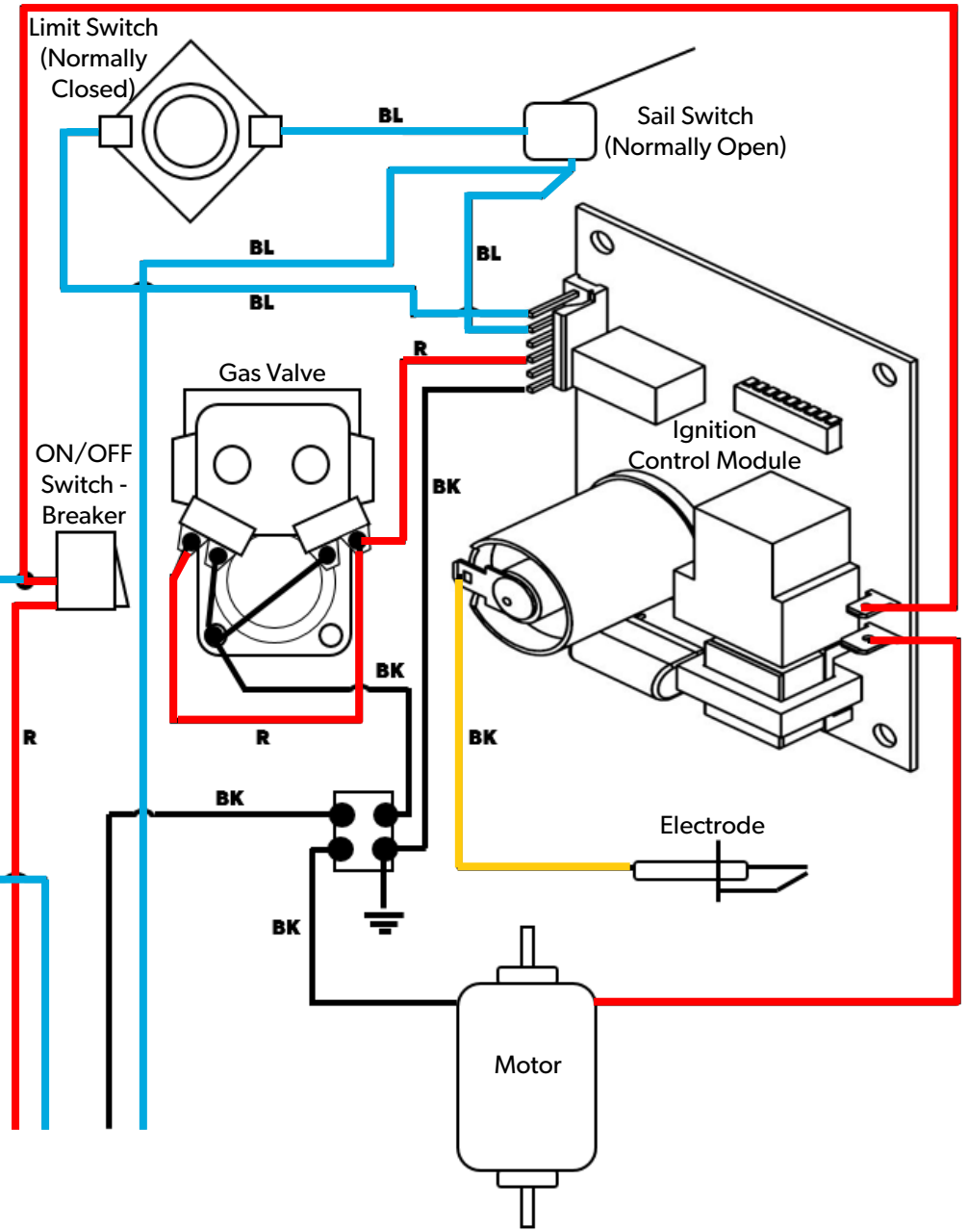
With the motor running, the Sail Switch Closes and sends power through the Limit Switch to the Circuit Board.

Switch turned on, power sent to the Circuit Board

The Circuit Board then opens the Gas Valve.

At the same time, sending power to the Thermostat

Power into the ON/OFF Switch



When the thermostat calls for heat, power is sent to one side of the sail switch and to the board.

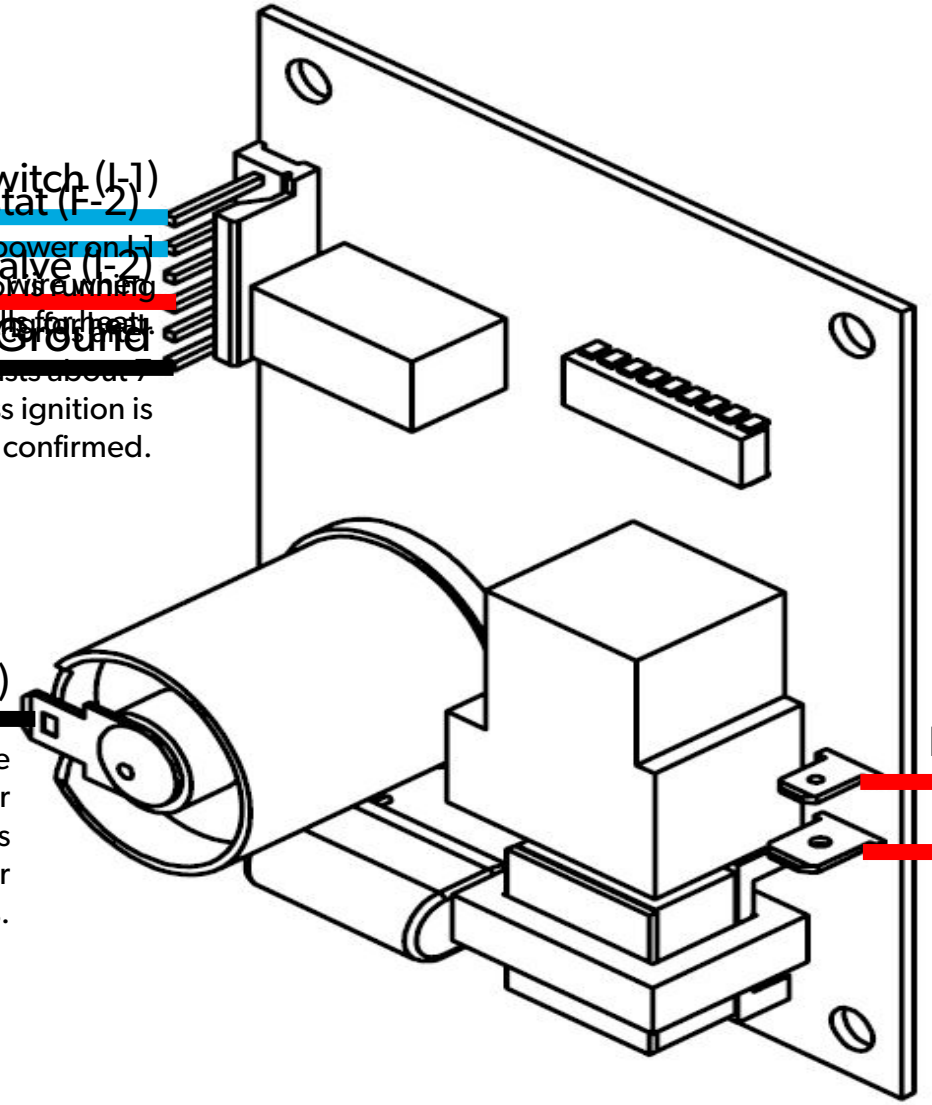
This causes the fan motor relay to close on the control board.

When the relay closes, power is sent to the motor. And initiates spark at the Electrode.

R	RED
BL	BLUE
BK	BLACK

Sequence of Operation at Circuit Board

When you should have power at each connection



Power from Sail / Limit switch (I-1)

Power from T-stat (F-2)

Should only have power on I-1 when the fan motor is running and the t-stat calls for heat.

Power to gas valve (I-2)

Power here 15 seconds after power at F-1, that lasts about 7 seconds, unless ignition is confirmed.

Ground

High tension to electrode (I-3)

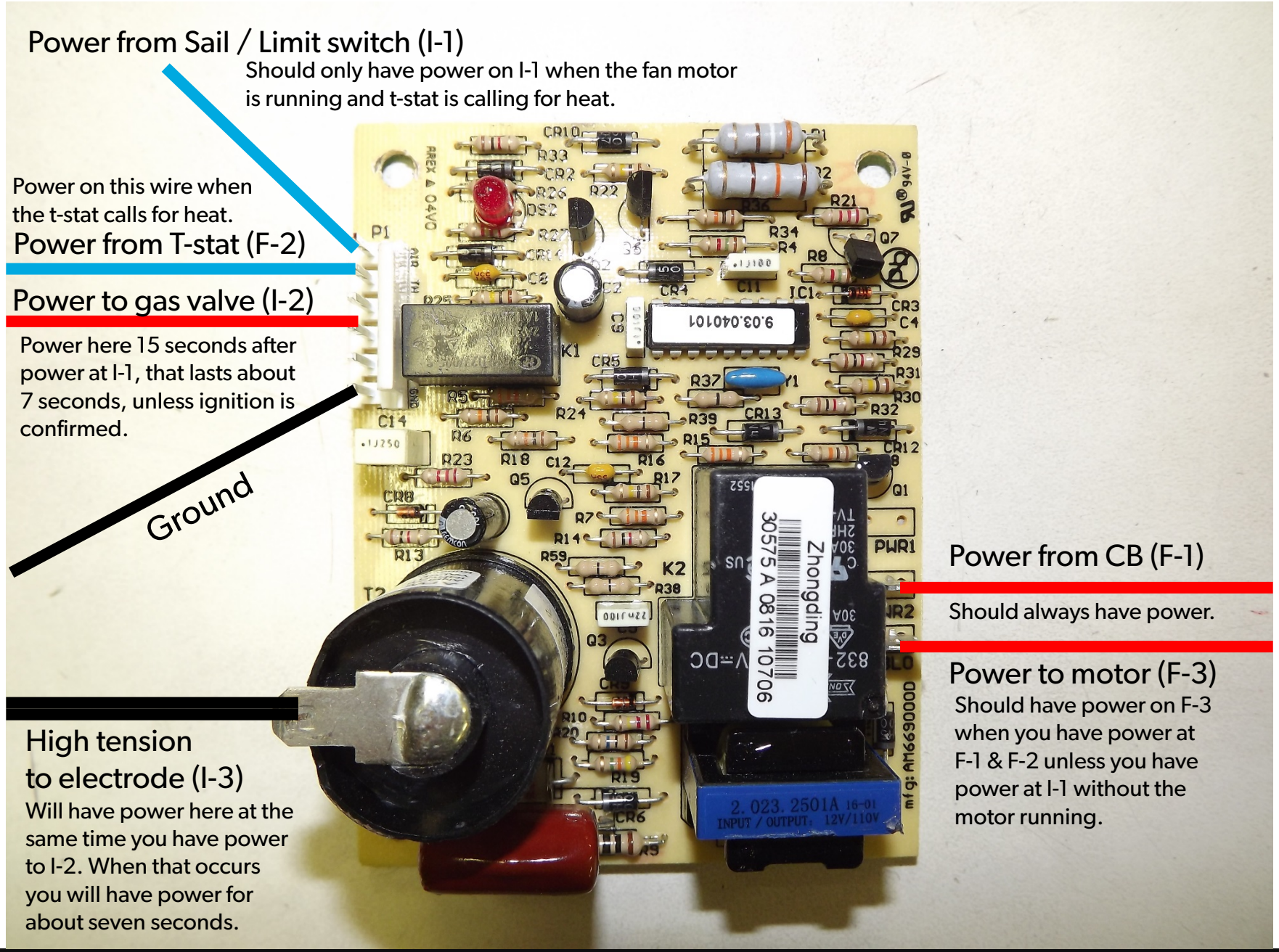
Will have power here at the same time you have power to I-2. When that occurs you will have power for about seven seconds.

Power from Circuit Breaker (F-1)

Should always have power

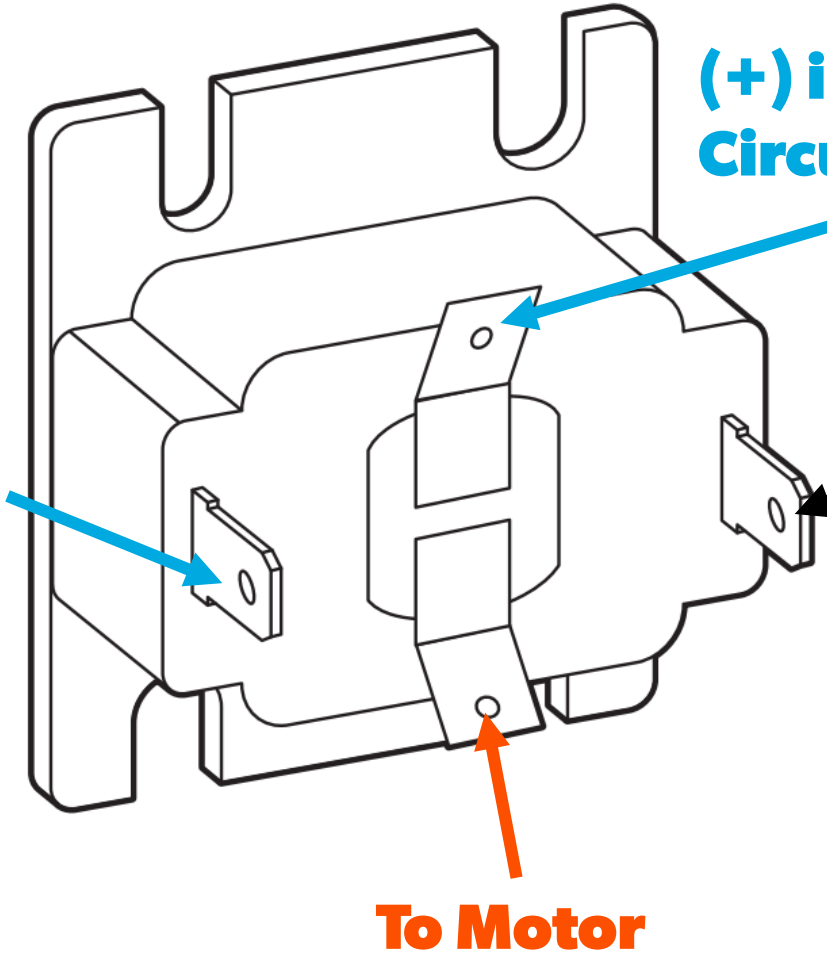
Power to motor (F-3)

Should have power on F-3 when you have power at F-1 & F-2 unless you have power at I-1 without the motor running.


Power from Sail / Limit switch (I-1)
Should only have power on I-1 when the fan motor is running and t-stat is calling for heat.
Power on this wire when the t-stat calls for heat.
Power from T-stat (F-2)
Power to gas valve (I-2)
Power here 15 seconds after power at I-1, that lasts about 7 seconds, unless ignition is confirmed.
Ground
High tension to electrode (I-3)
Will have power here at the same time you have power to I-2. When that occurs you will have power for about seven seconds.
Power from CB (F-1)
Should always have power.
Power to motor (F-3)
Should have power on F-3 when you have power at F-1 & F-2 unless you have power at I-1 without the motor running.

Separate Relay (Older Models)

Not used since July 2001 production models

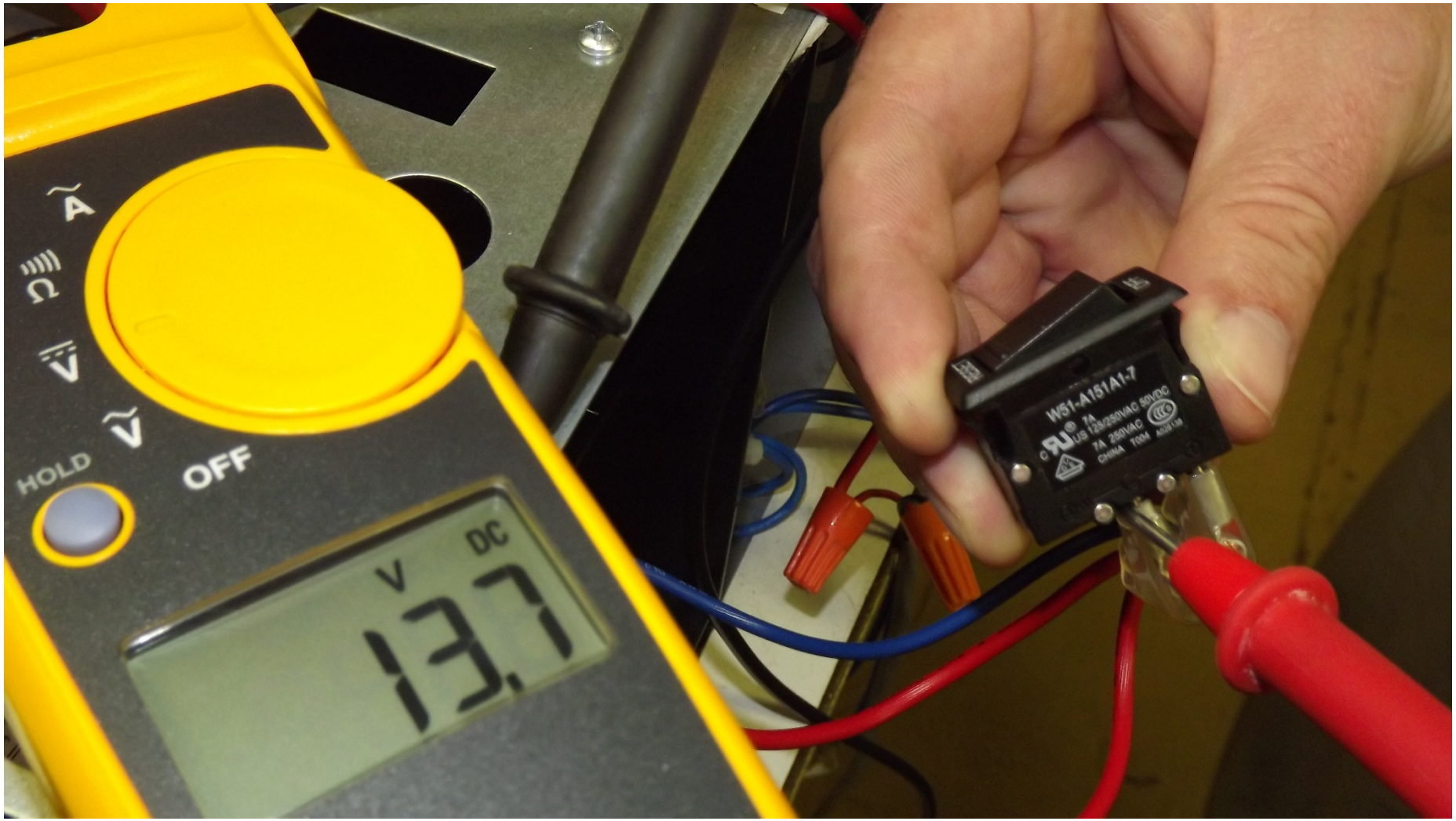


- If the relay becomes defective, you can replace the control board with a new style and bypass the relay.
- If the older control board becomes defective, you can install a new board and still utilize the relay.
- You can also replace a defective relay with a Dinosaur Branded Relay.
  Dinosaur PN: 48000

Furnaces

Fan System

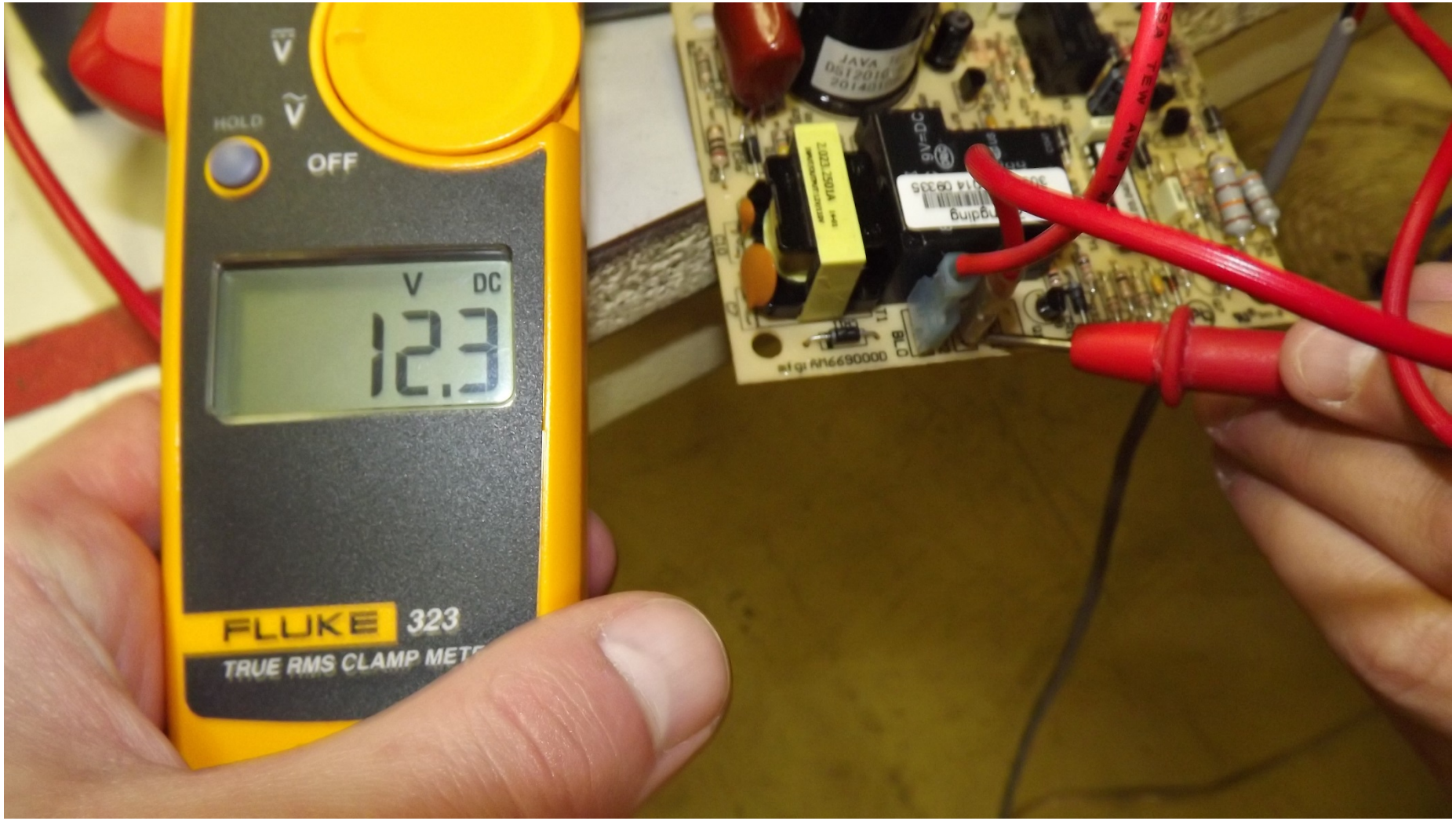
Checking power into the ON/OFF Switch/Breaker



Checking power out of the ON/OFF Switch/Breaker

From here it is sent to the Circuit Board.

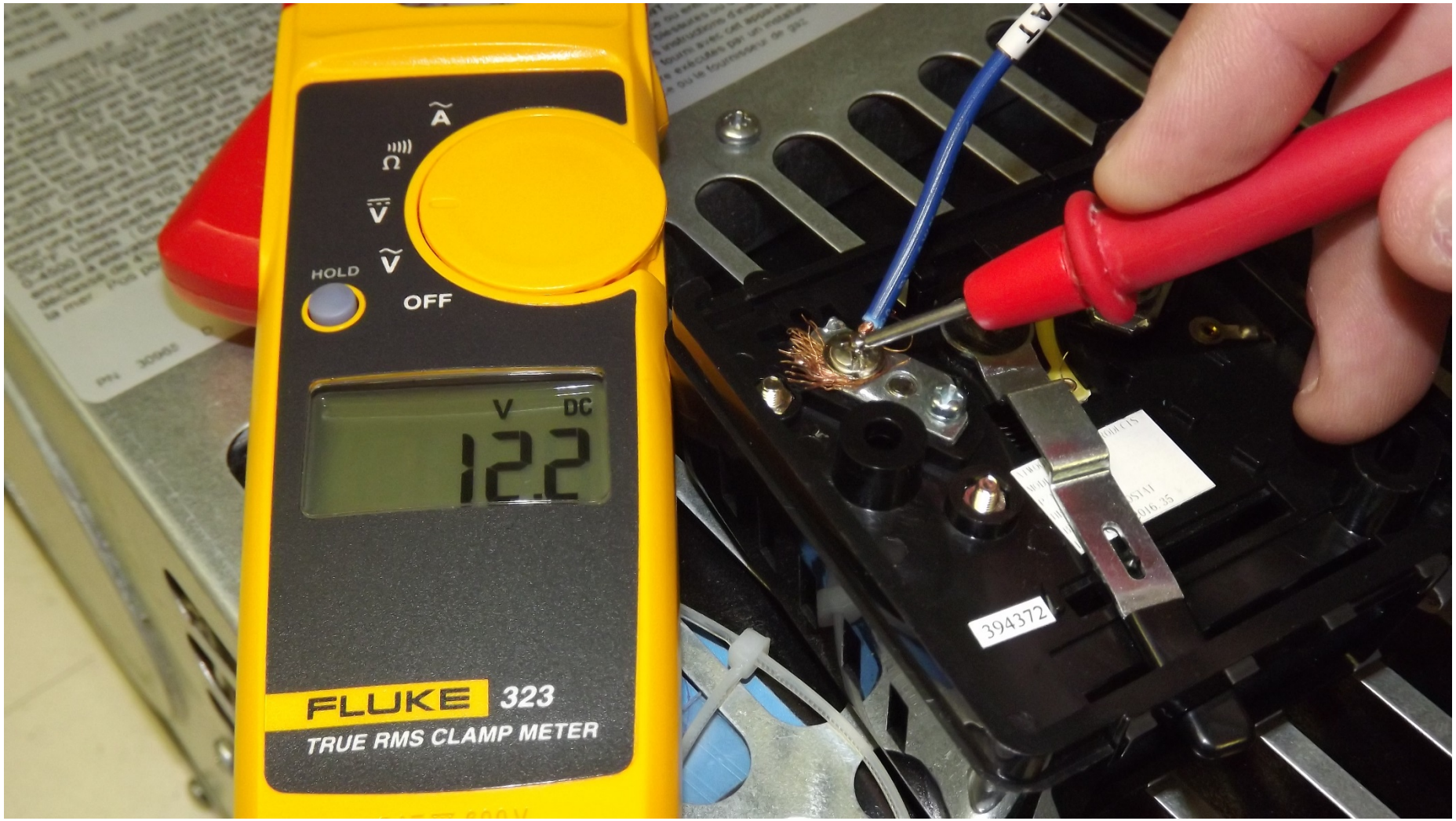
Checking power from ON/OFF Switch to Board



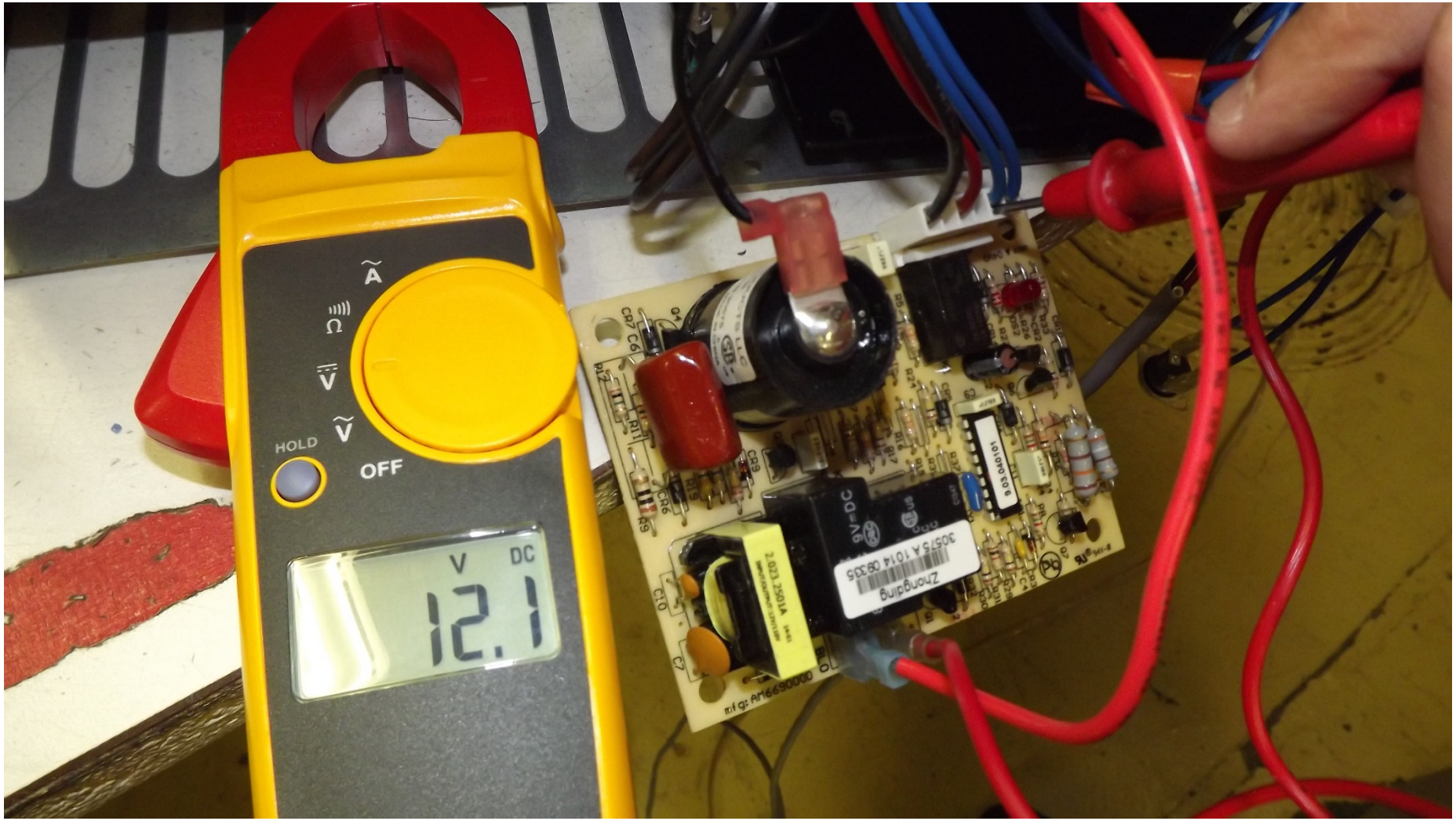
This is the red wire we marked F-1 on the wiring diagram we drew

At the same time, we are sending power to the Thermostat

Power through the thermostat when calling for heat

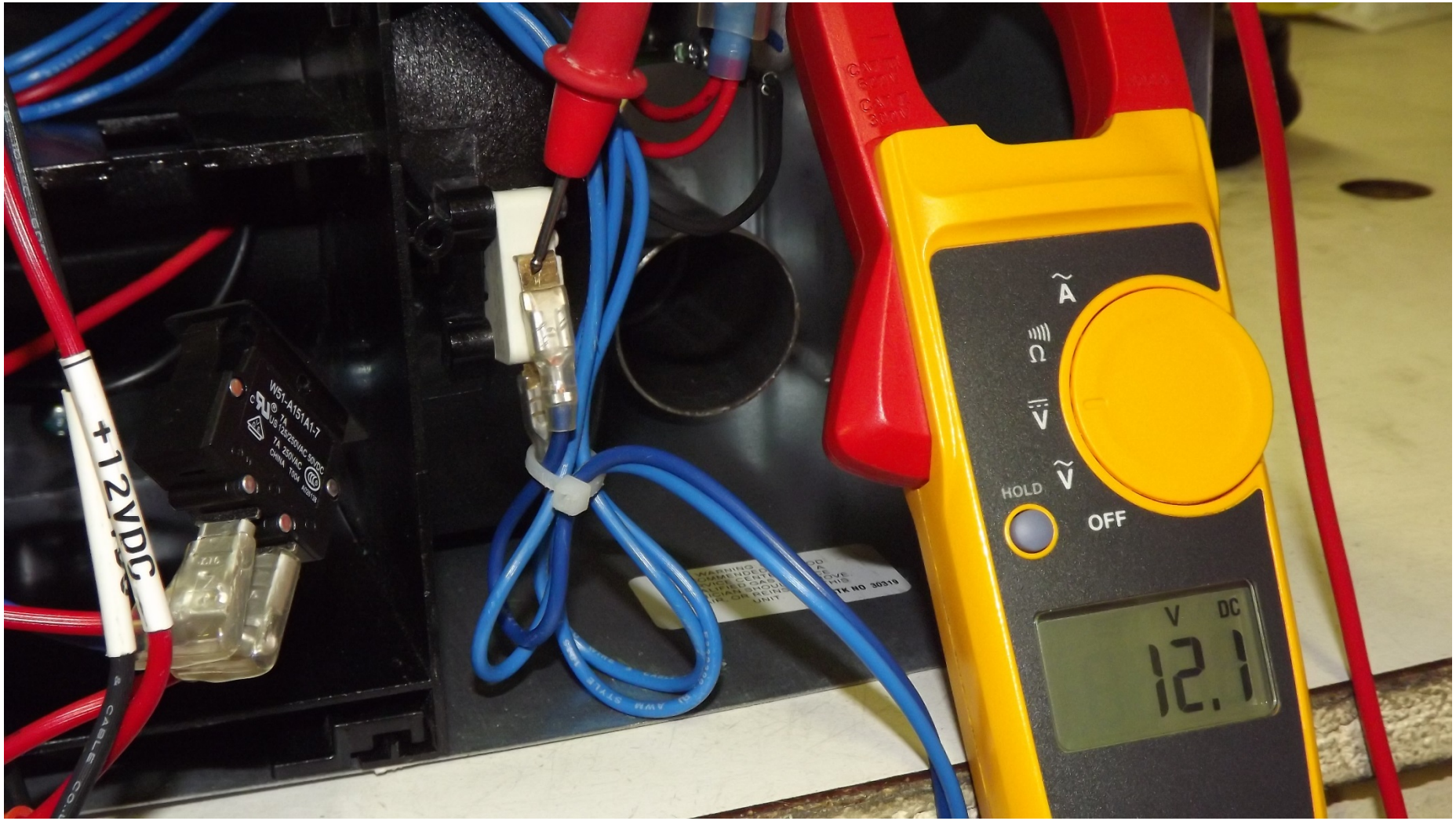


Power coming to the Board from the Thermostat



This is the blue wire we marked F-2 on the wiring diagram we drew.

… at the same time, power is sent to the Sail Switch

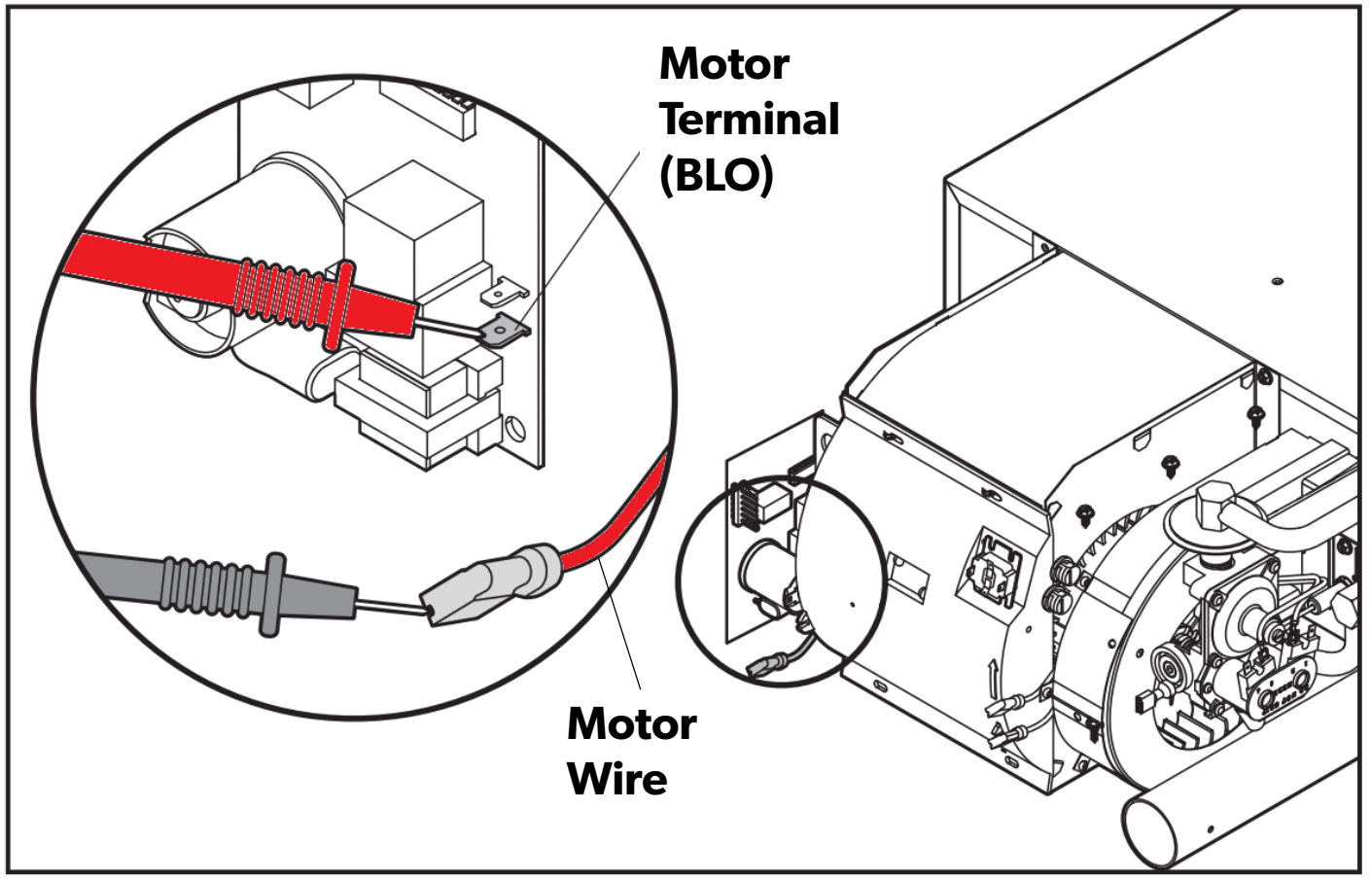


Relay closes on the board

Power is sent to the motor and it begins to run.

This is the red wire marked F-3 on the wiring diagram we drew.

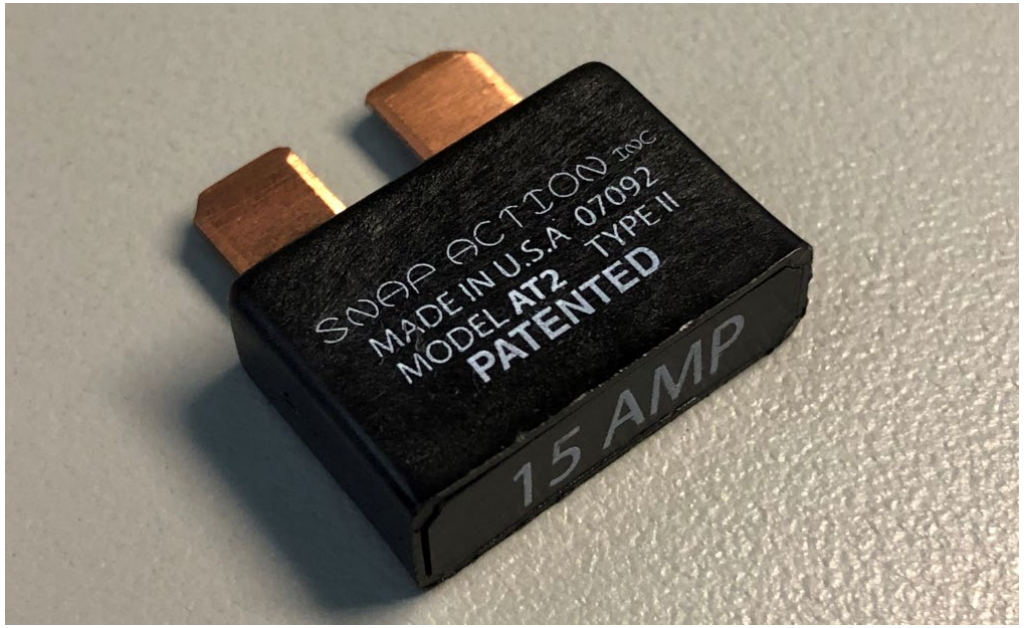
Fan Motor Amp-Draw Test (DC Amps)



To measure the in-line DC amperage of the motor, perform the following:

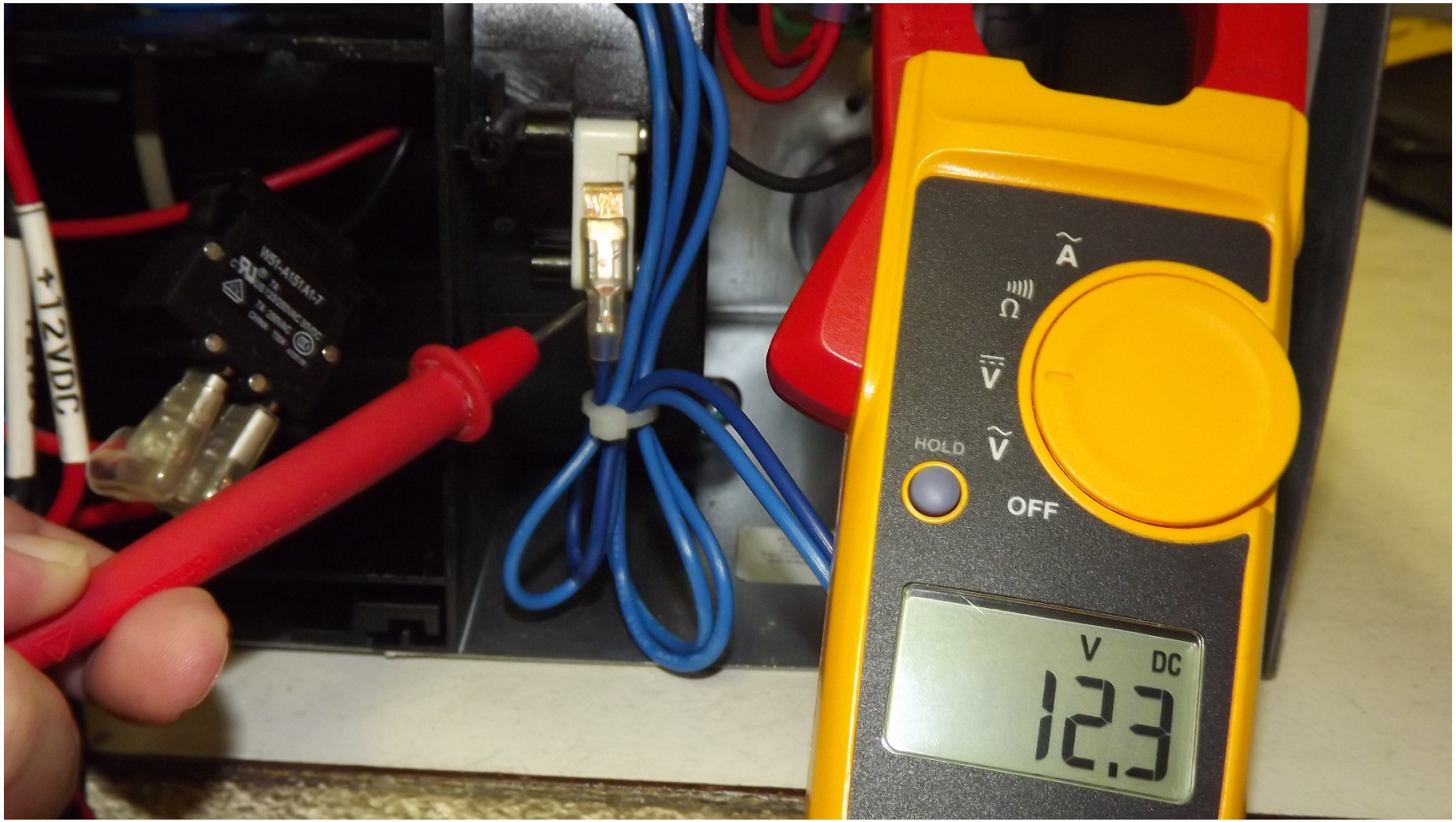
- Disconnect the motor wire off of the motor terminal on the circuit board.
- Connect the motor wire to one meter lead then touch the other lead to the motor terminal on the board to start the motor (the motor must be running to get amps).

Fan Motor Amp-Draw Test (DC Amps)



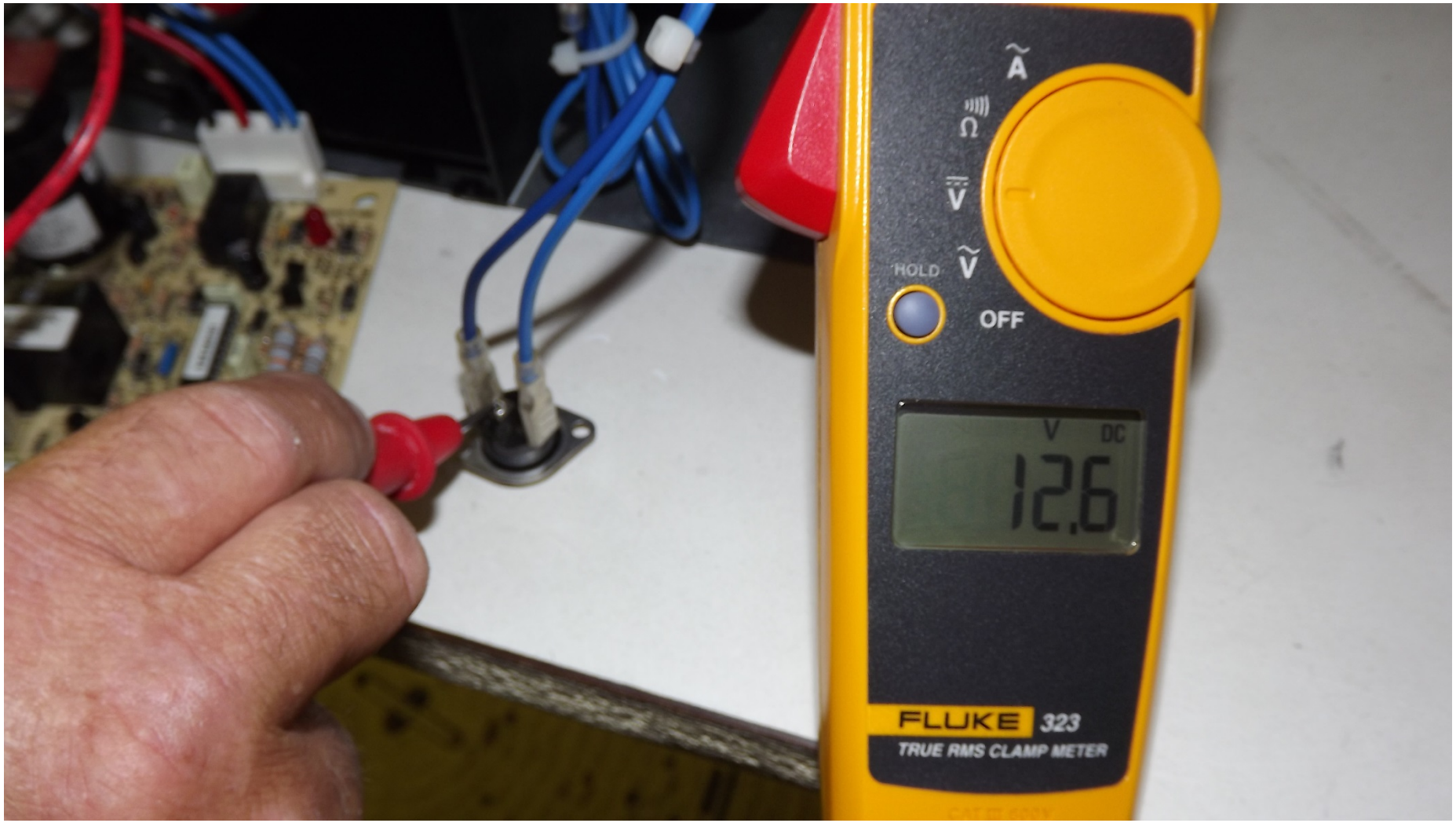
Note: AFM / DFM 30K & 35K BTU models come with a slow blow fuse that MUST be used. The fans on these units get to speed faster than other models and if the slow blow fuse is not used there is a high potential to trip a standard fuse in the fuse panel upon start up.

Sail Switch closes once airflow is established (75%)

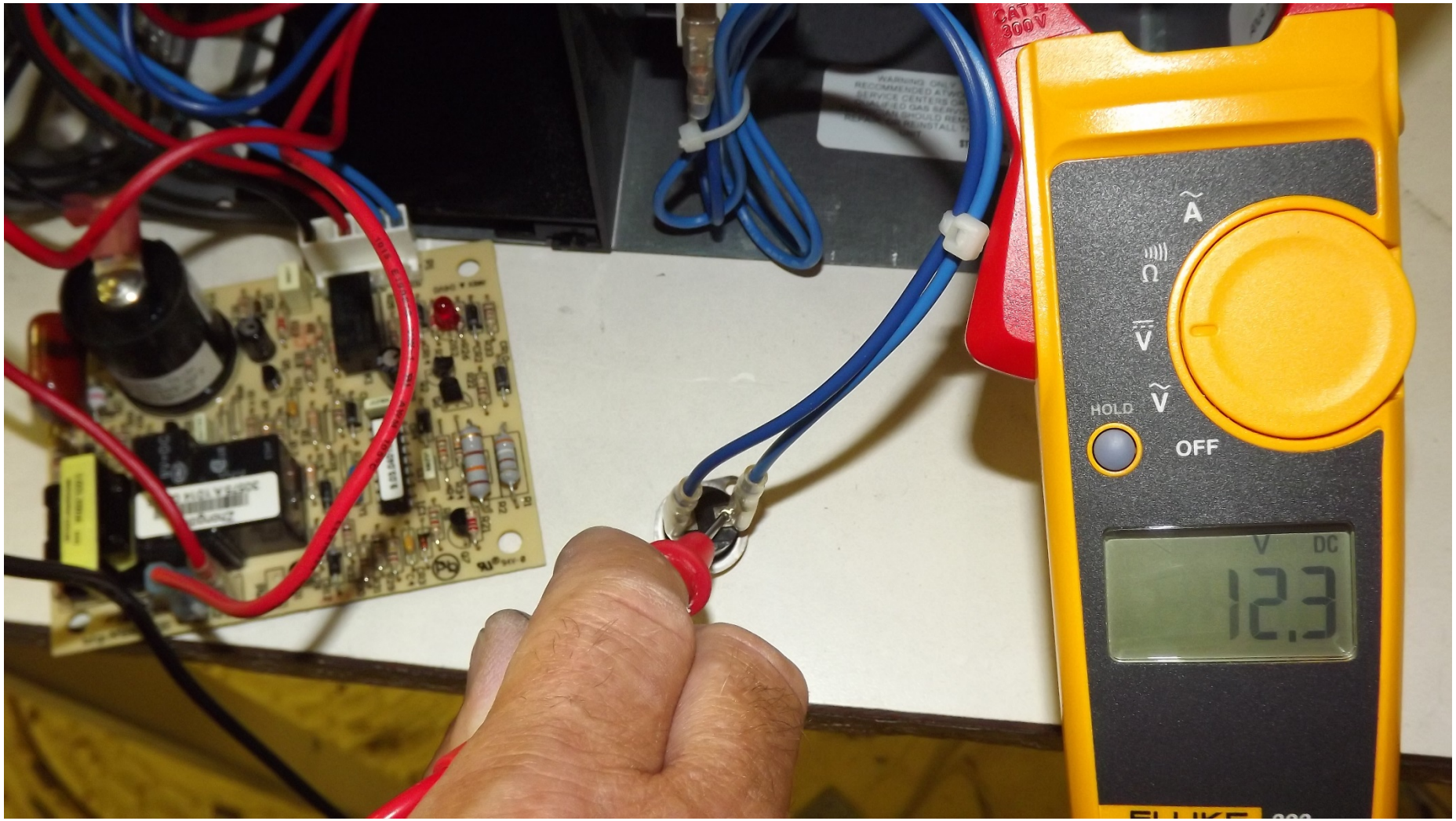


This proves to the system the fan motor is working before gas operation.

From the Sail Switch power then goes to the Limit Switch



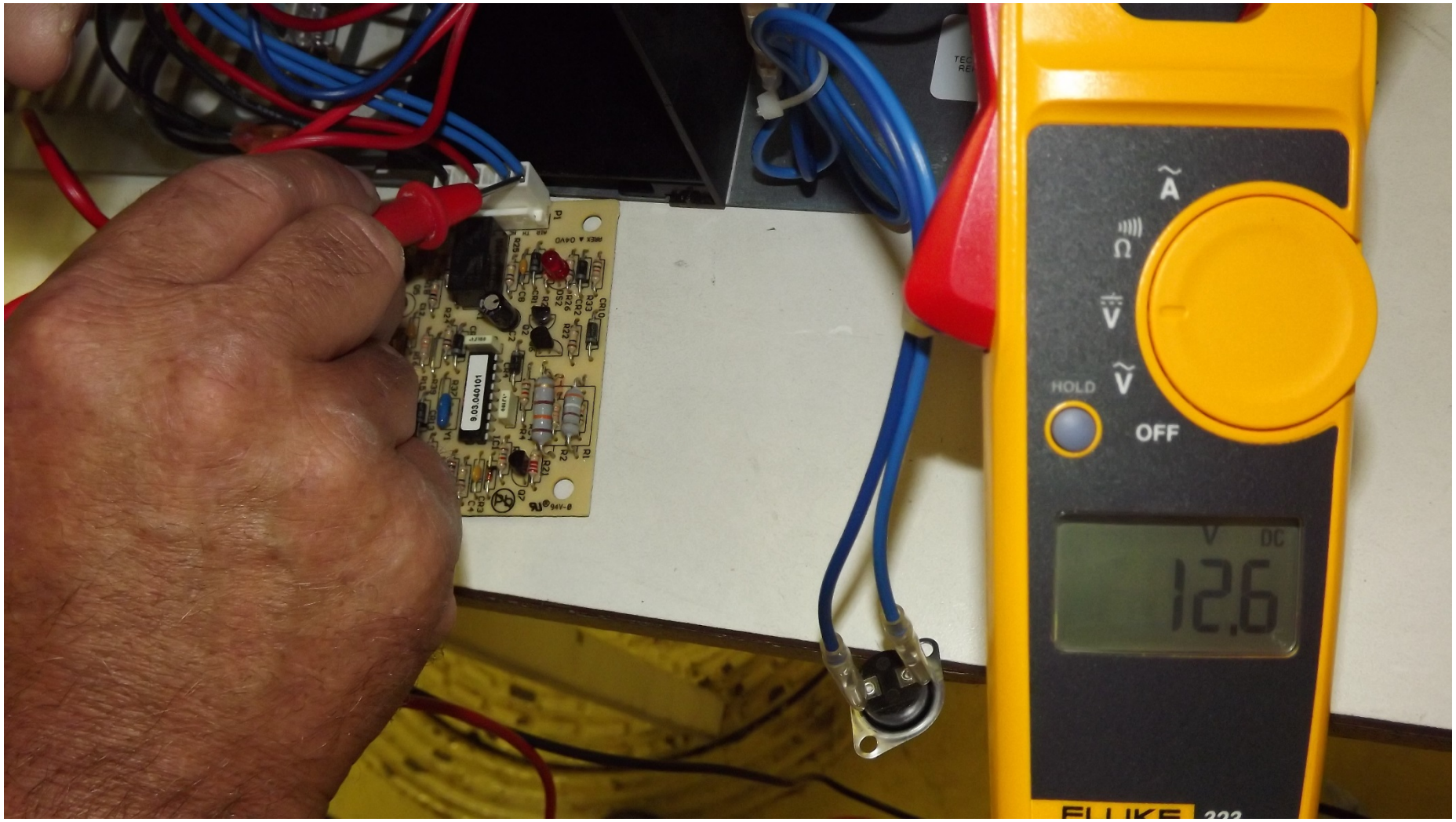
Checking power through the Limit Switch



Furnaces

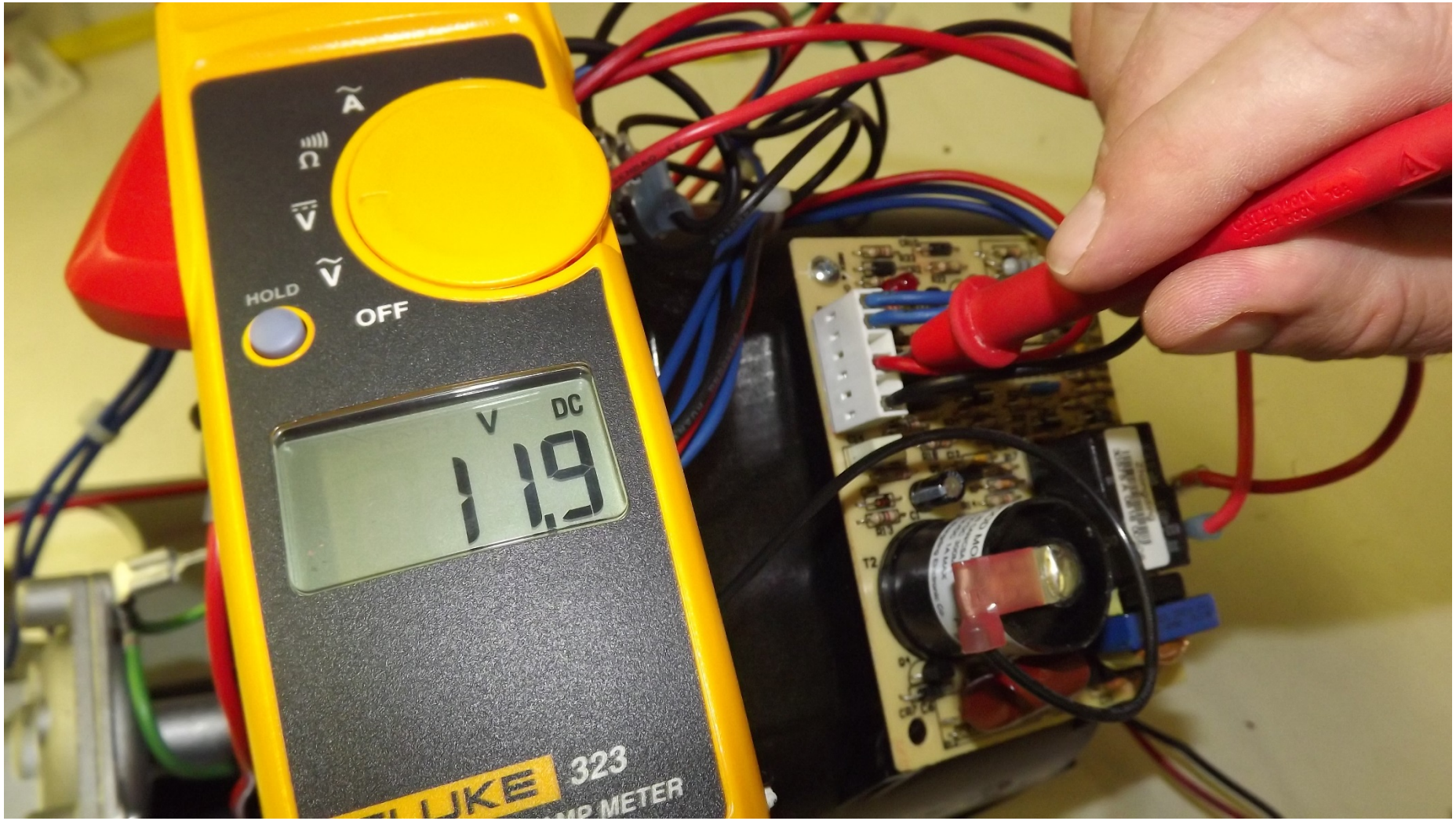
Ignition System

Checking if power is present from the Limit Switch.



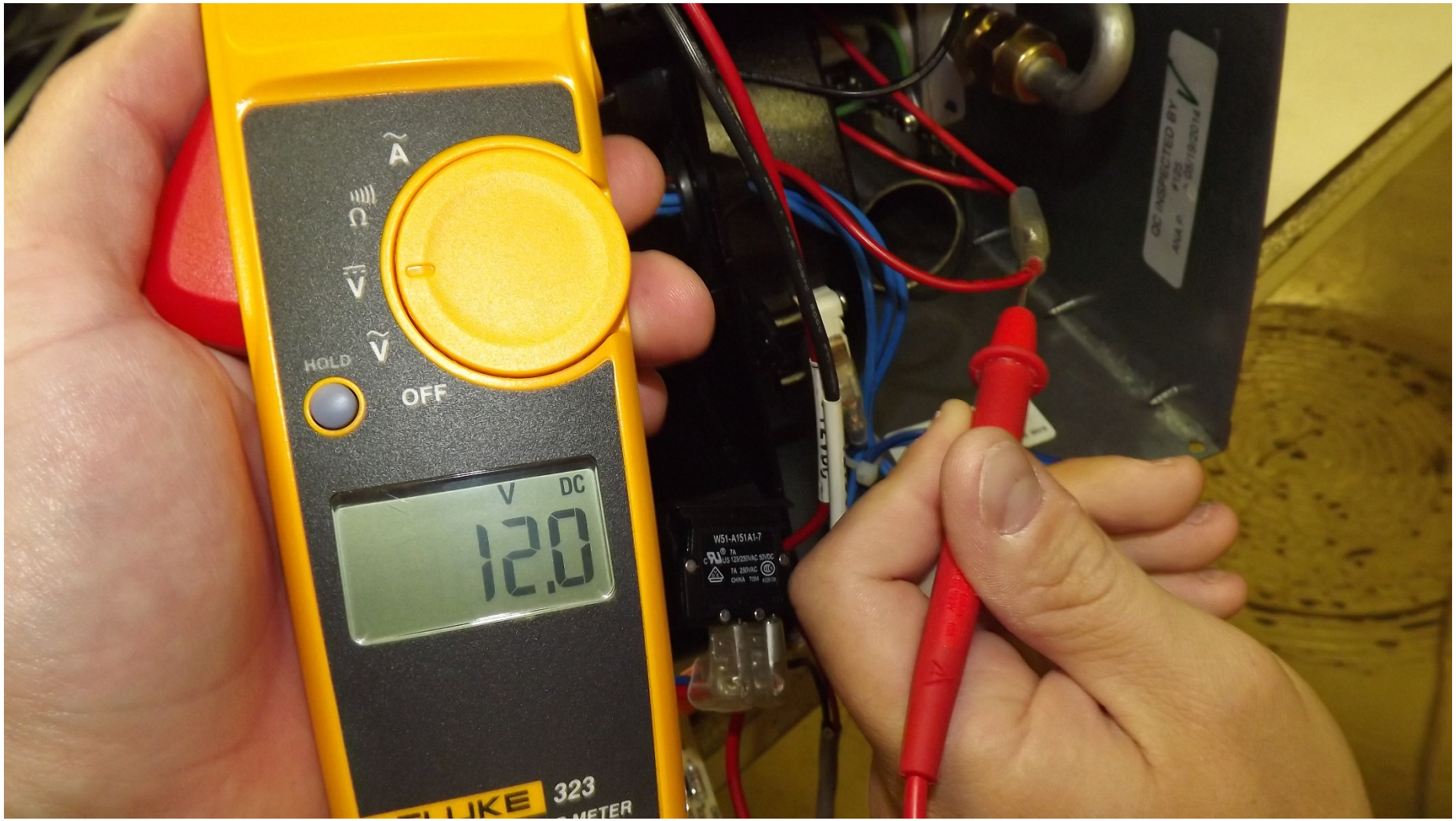
This is the blue wire marked I-1 on the wiring diagram we drew.

Then the Board sends power to the Gas Valve.



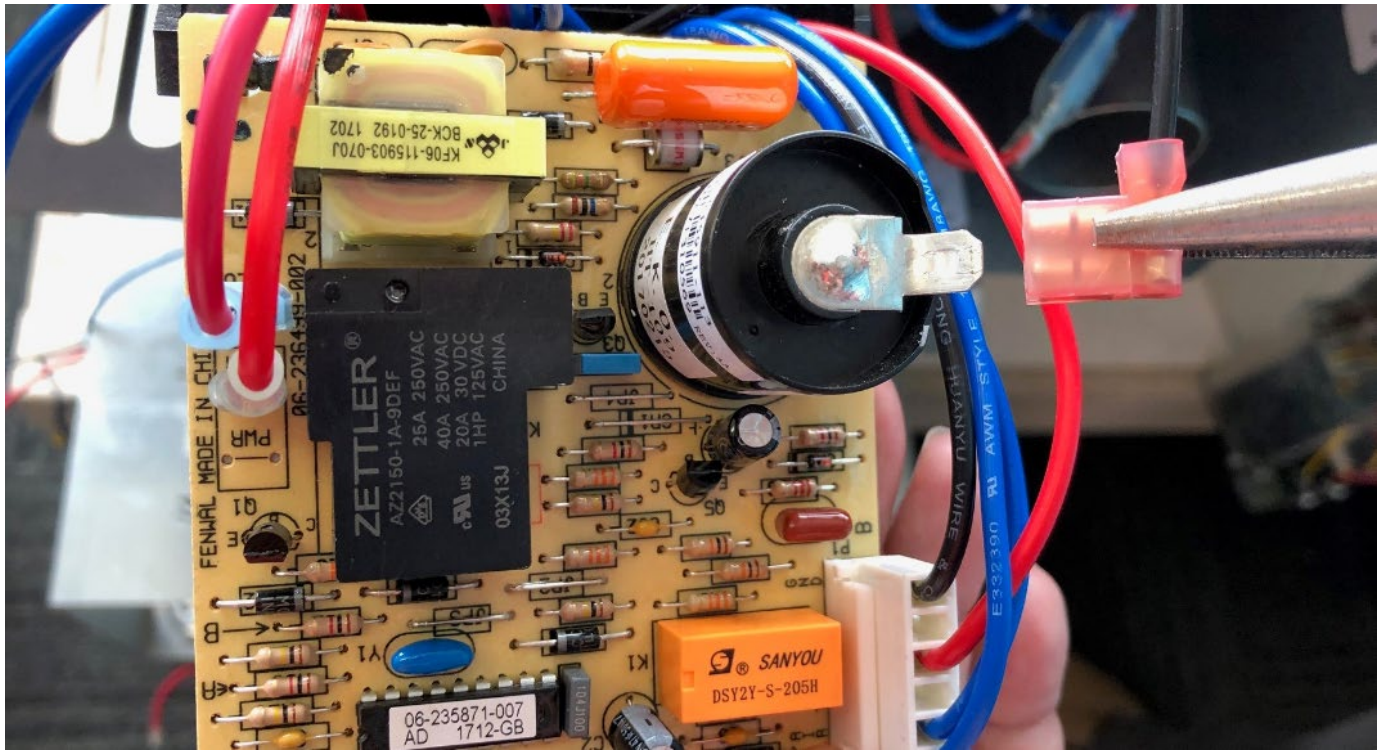
This is the red wire marked I-2 on the wiring diagram we drew.

Checking power is present at the Gas Valve.



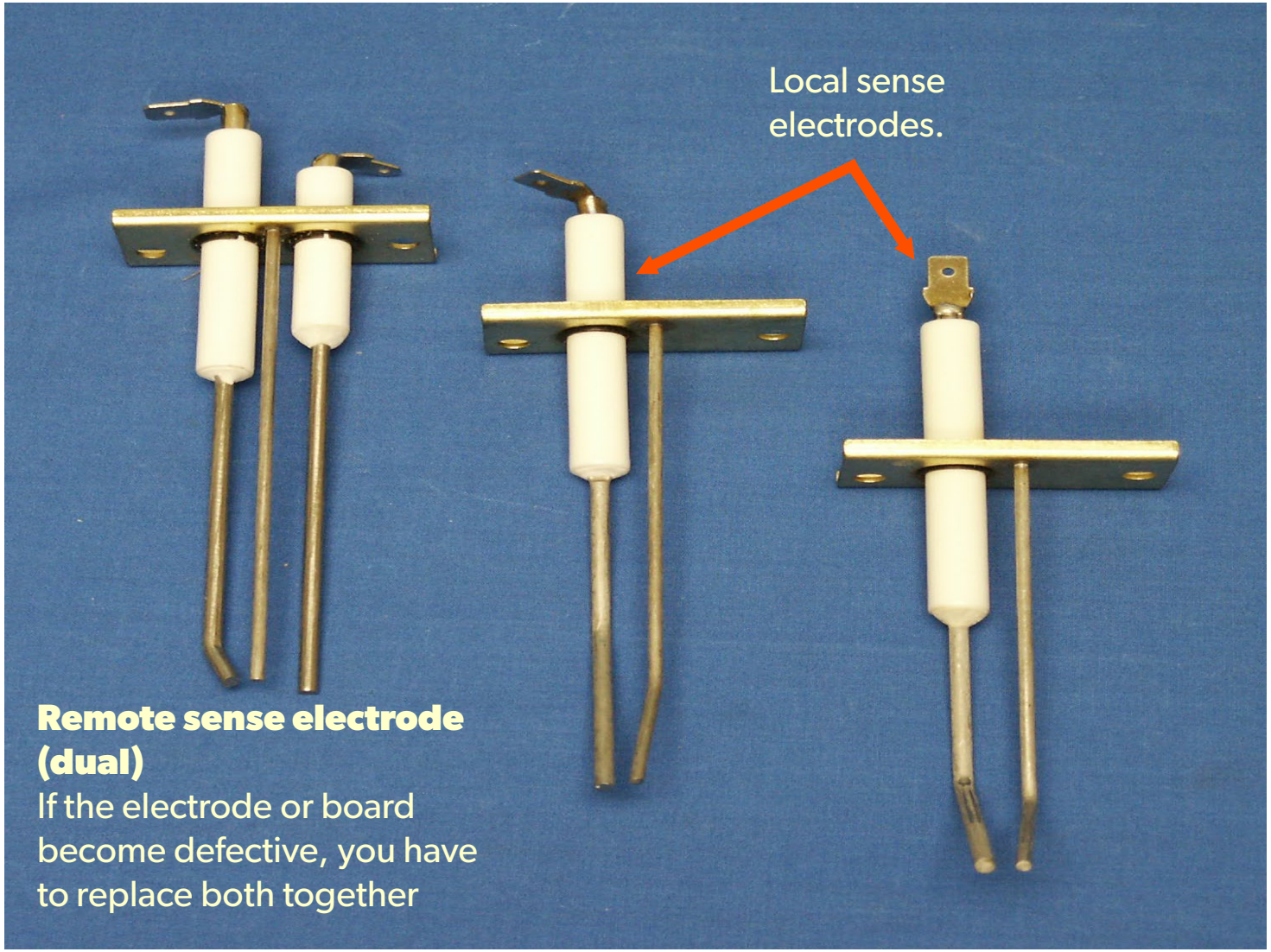
Electrode

The High Tension on the Circuit Board should now be carrying the voltage through the Electrode for spark and complete the ignition cycle. If you are not hearing the tick of the Electrode, it is possible either the Board or the Electrode is defective. A shorted electrode can cause the gas valve not to open.



A simple test would be to disconnect the Electrode wiring from the High Tension located on the Board, if it begins to spark, the Electrode is defective and needs replaced. If there isn't any spark coming from the High Tension, the Board is defective and will need to be replaced.

Generations of Electrodes

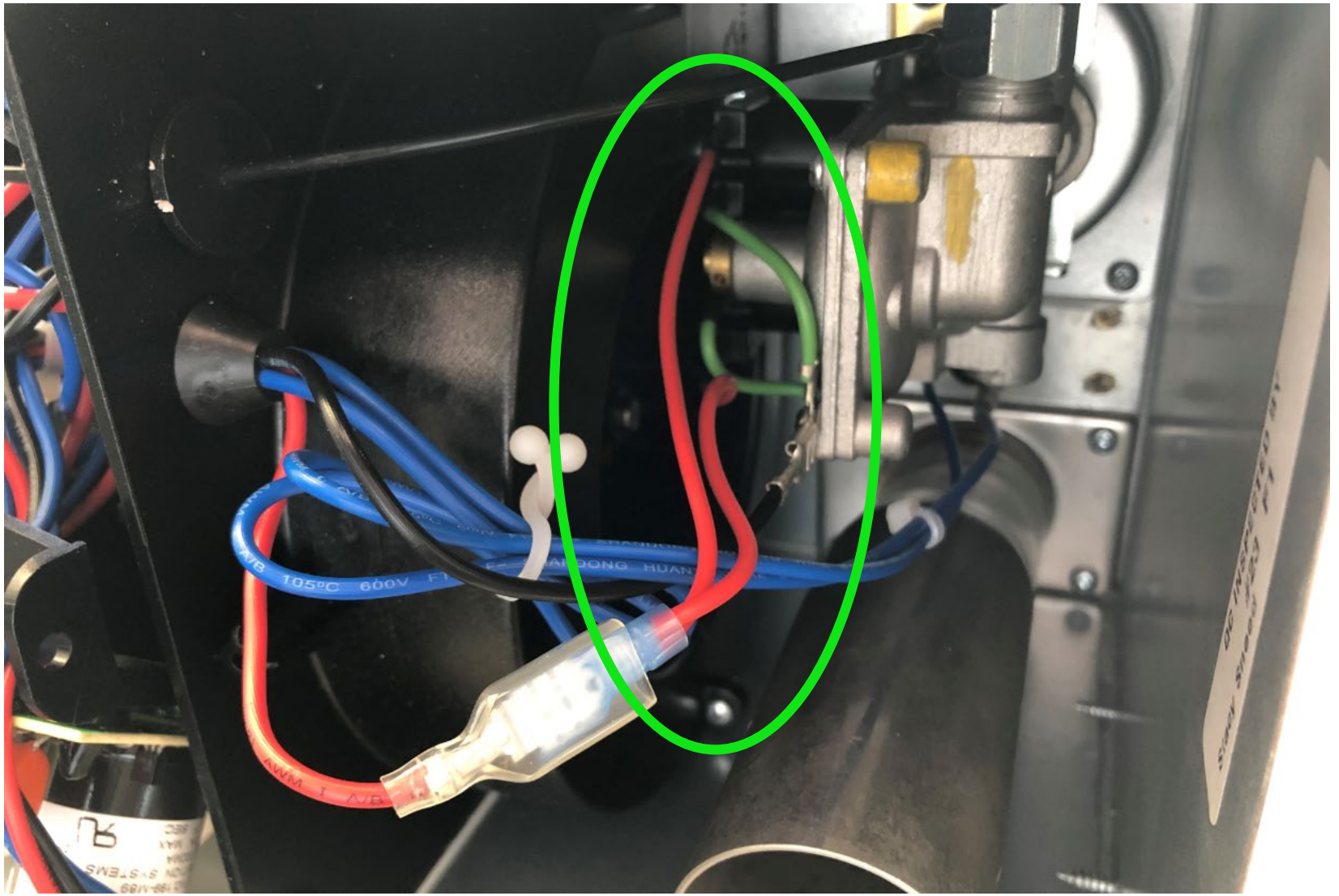


Should have 1/8” gap. If adjustment is needed, bend ground wire as to not damage the electrode.

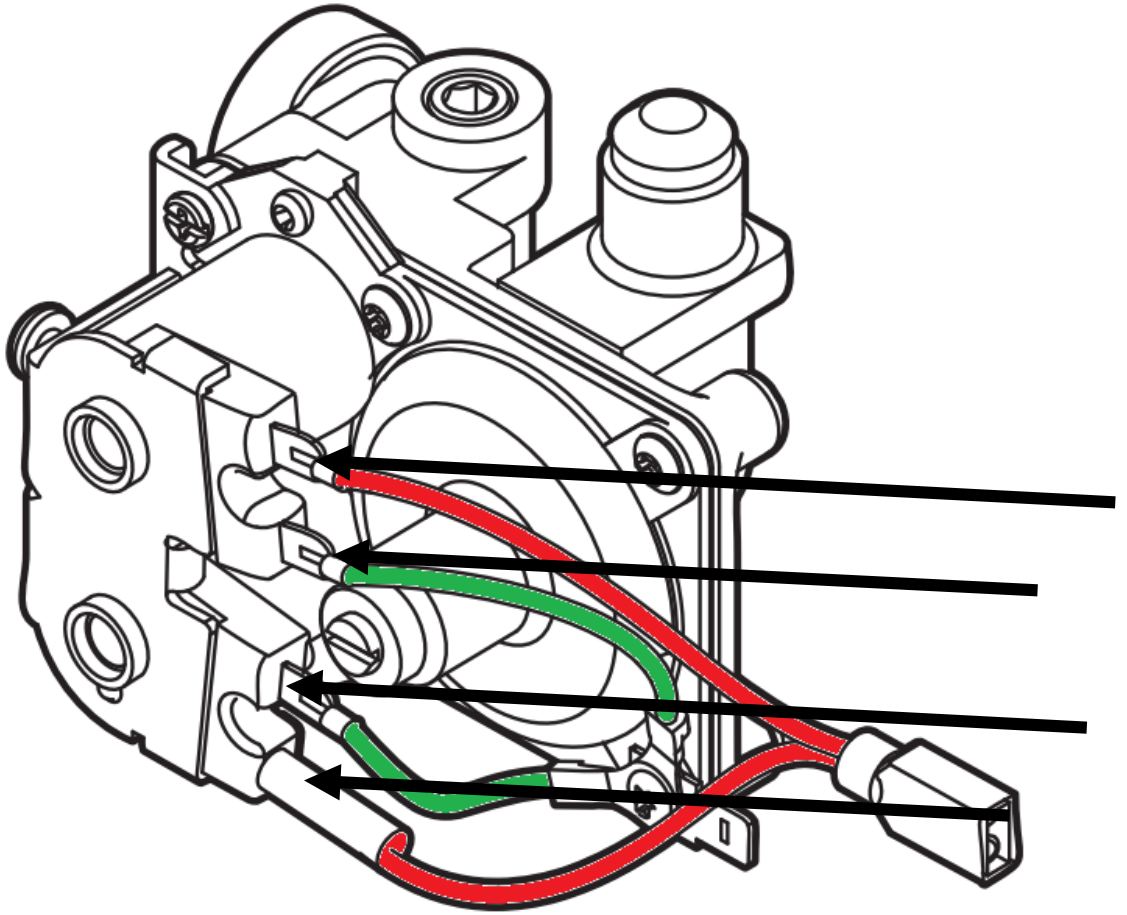
Furnaces

Burner System
Gas Valve Testing

Power coming out of the gas valve splits into two circuits to power both coils (parallel circuit).

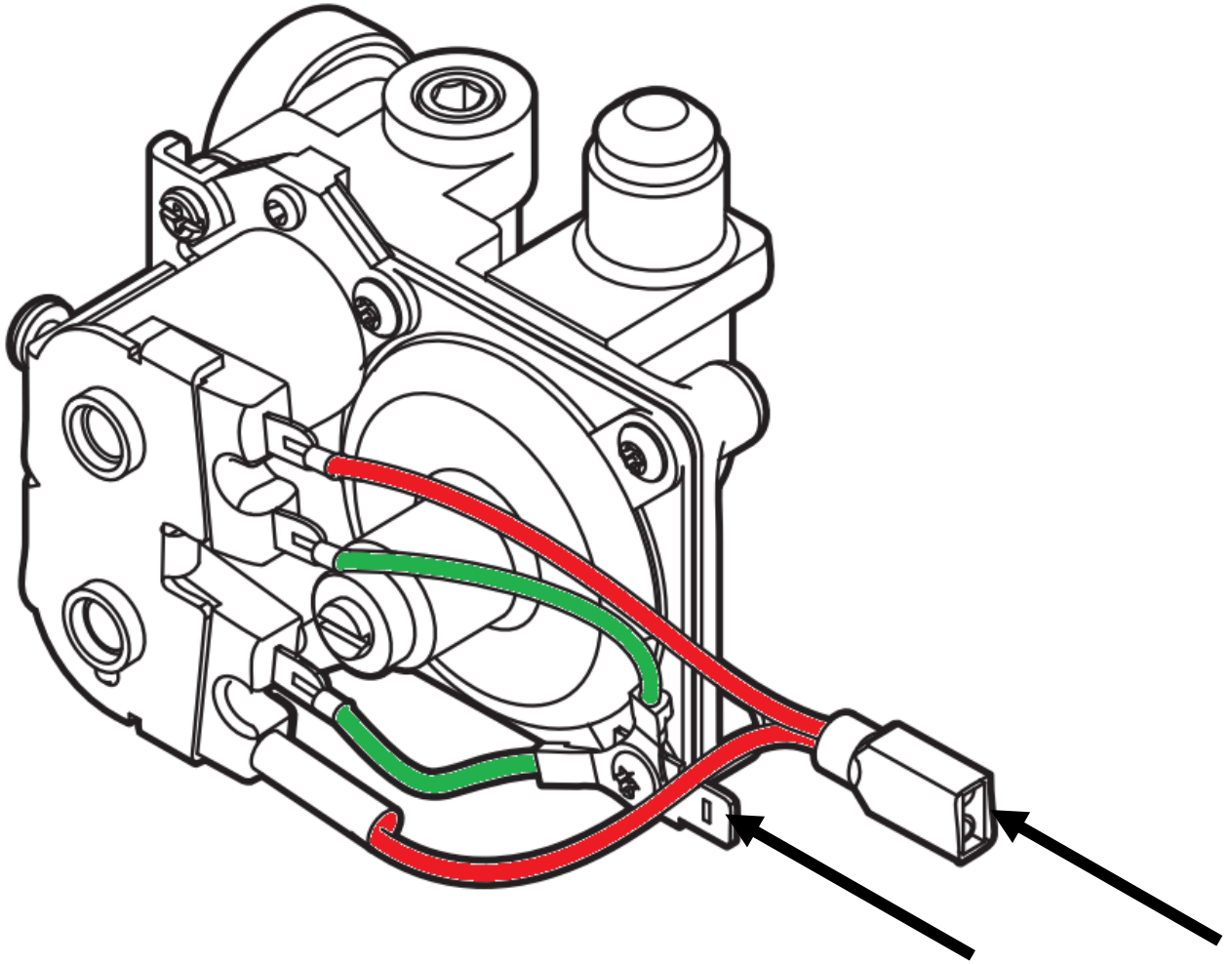


Testing coils isolated



You see between 30-50 ohms (per coil) when isolated.

Testing coils NOT isolated

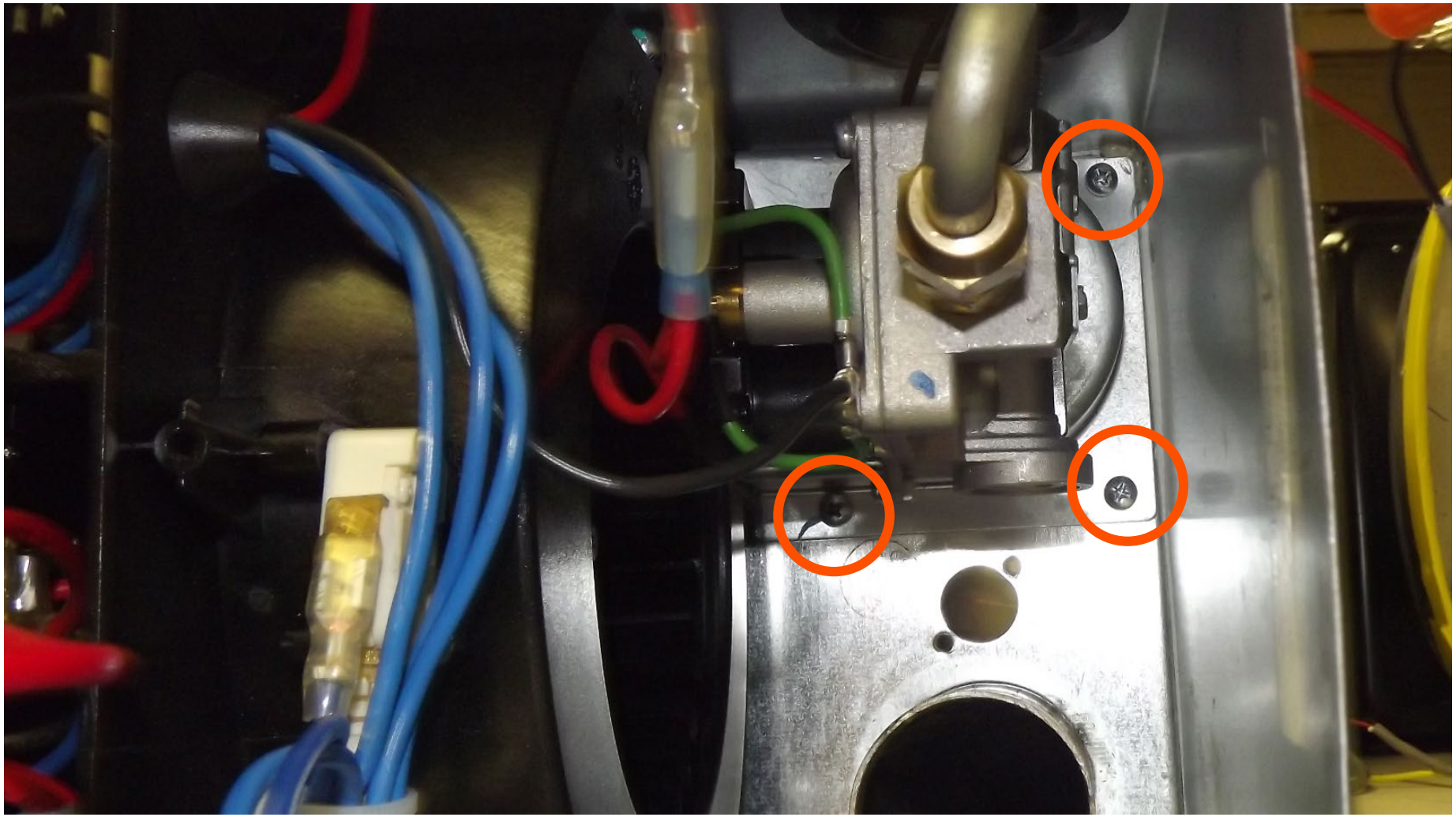


You see between 15-25 ohms when not isolated.

Furnaces

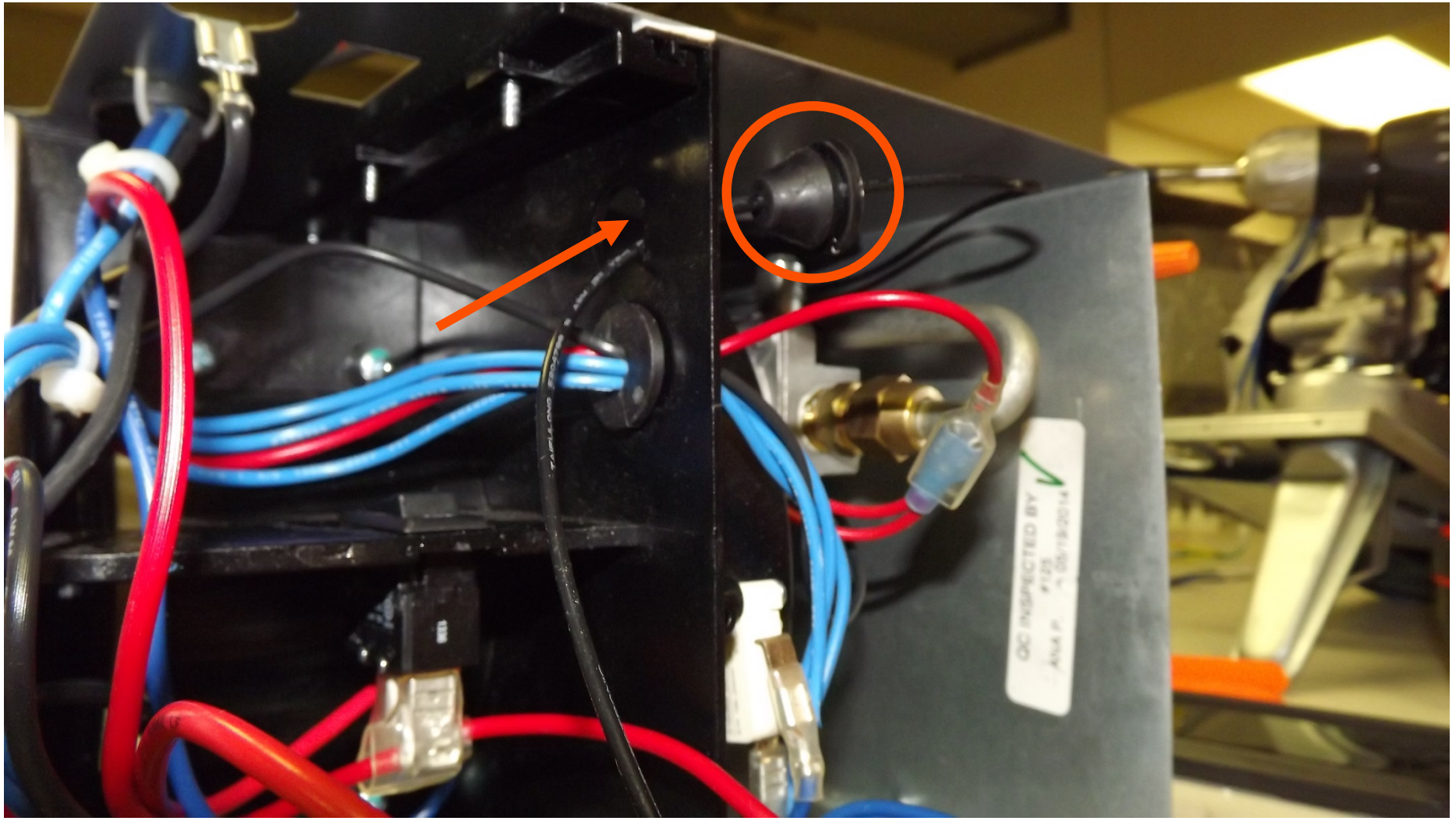
Removal of the Burner & Gas Valve

To remove the Burner & Valve Assembly.



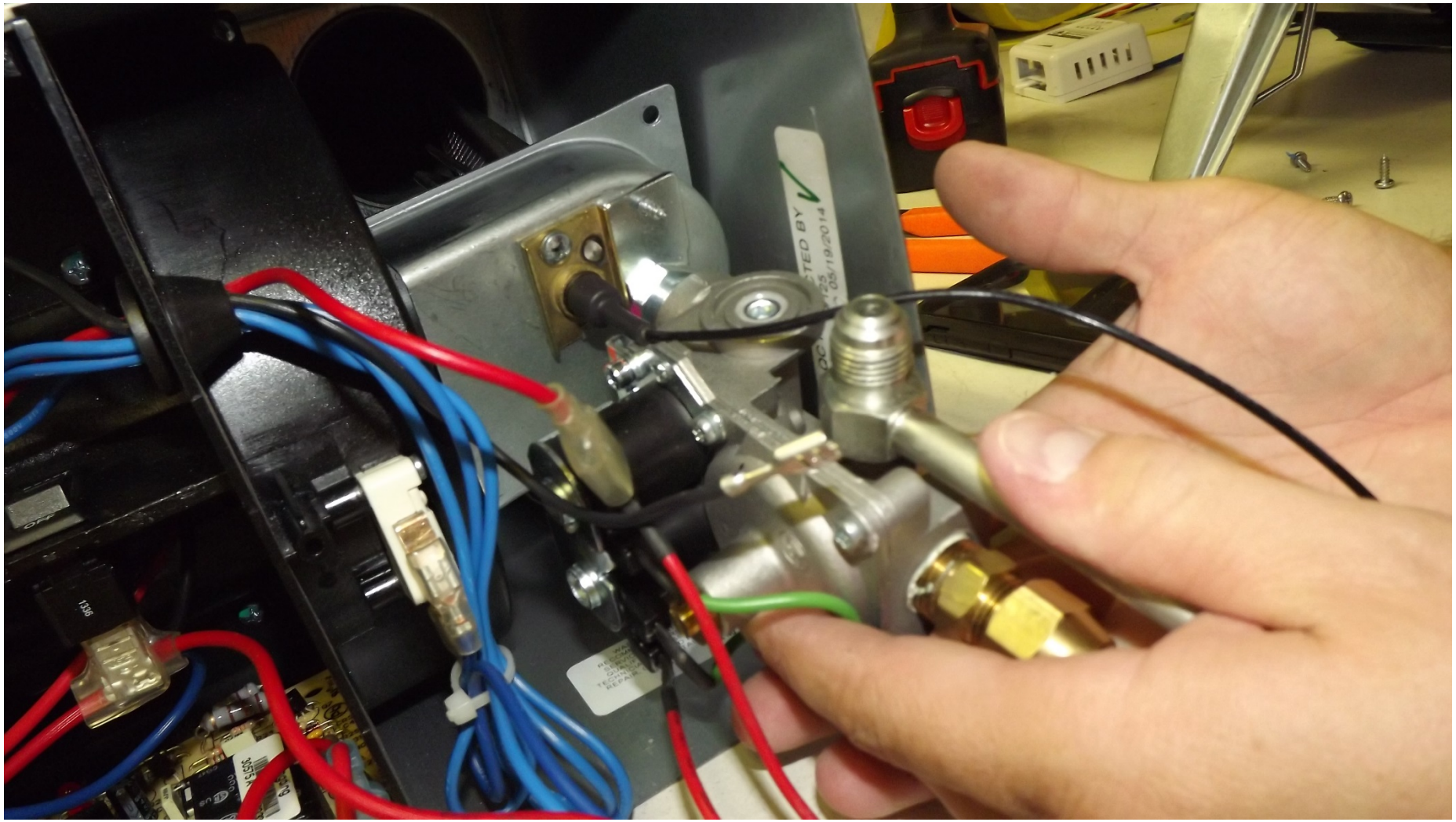
First, remove these three screws.

To remove the Burner & Valve Assembly.



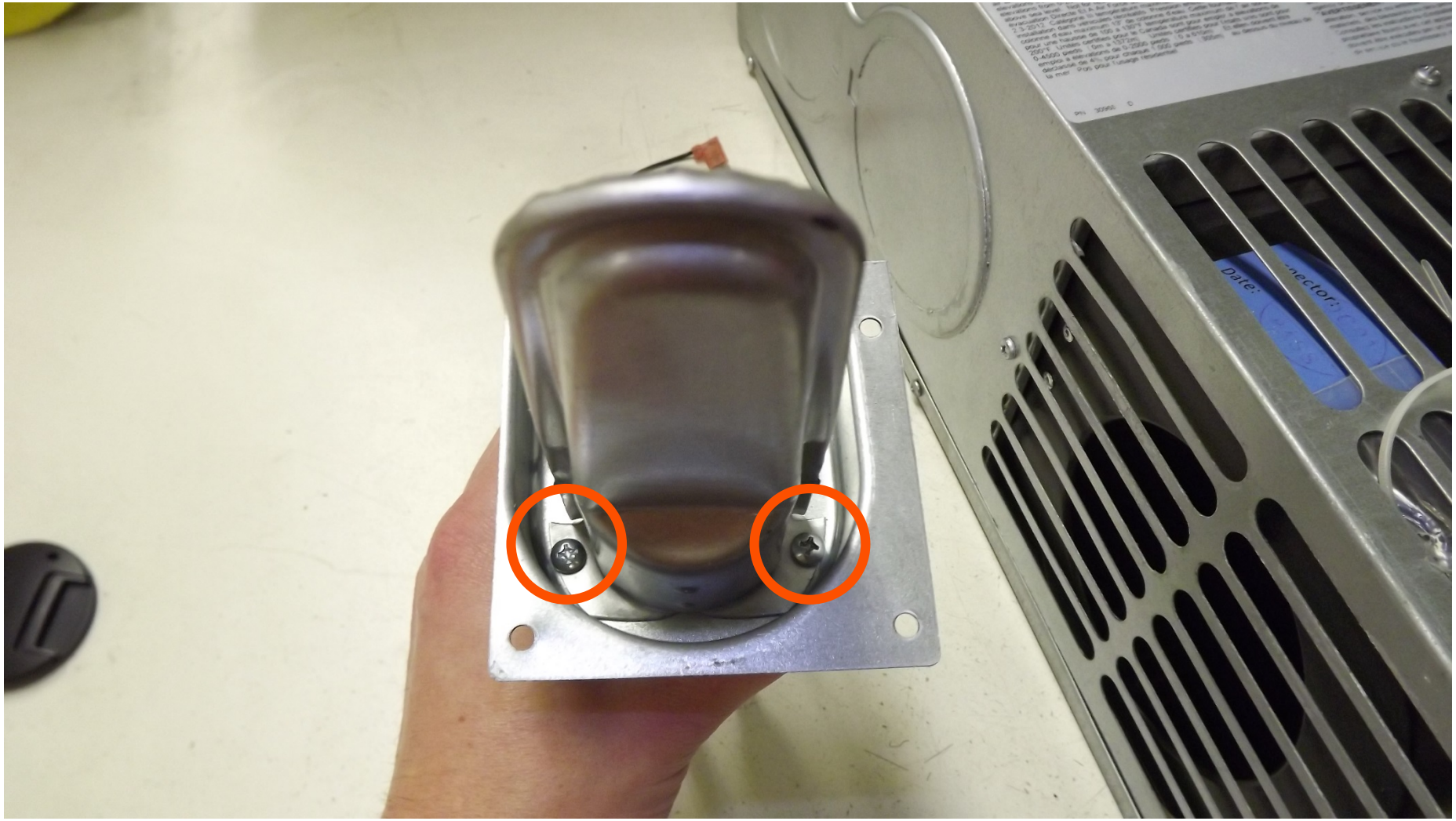
Be sure to remove the grommet and pass the electrode through.

To remove the Burner & Valve Assembly.



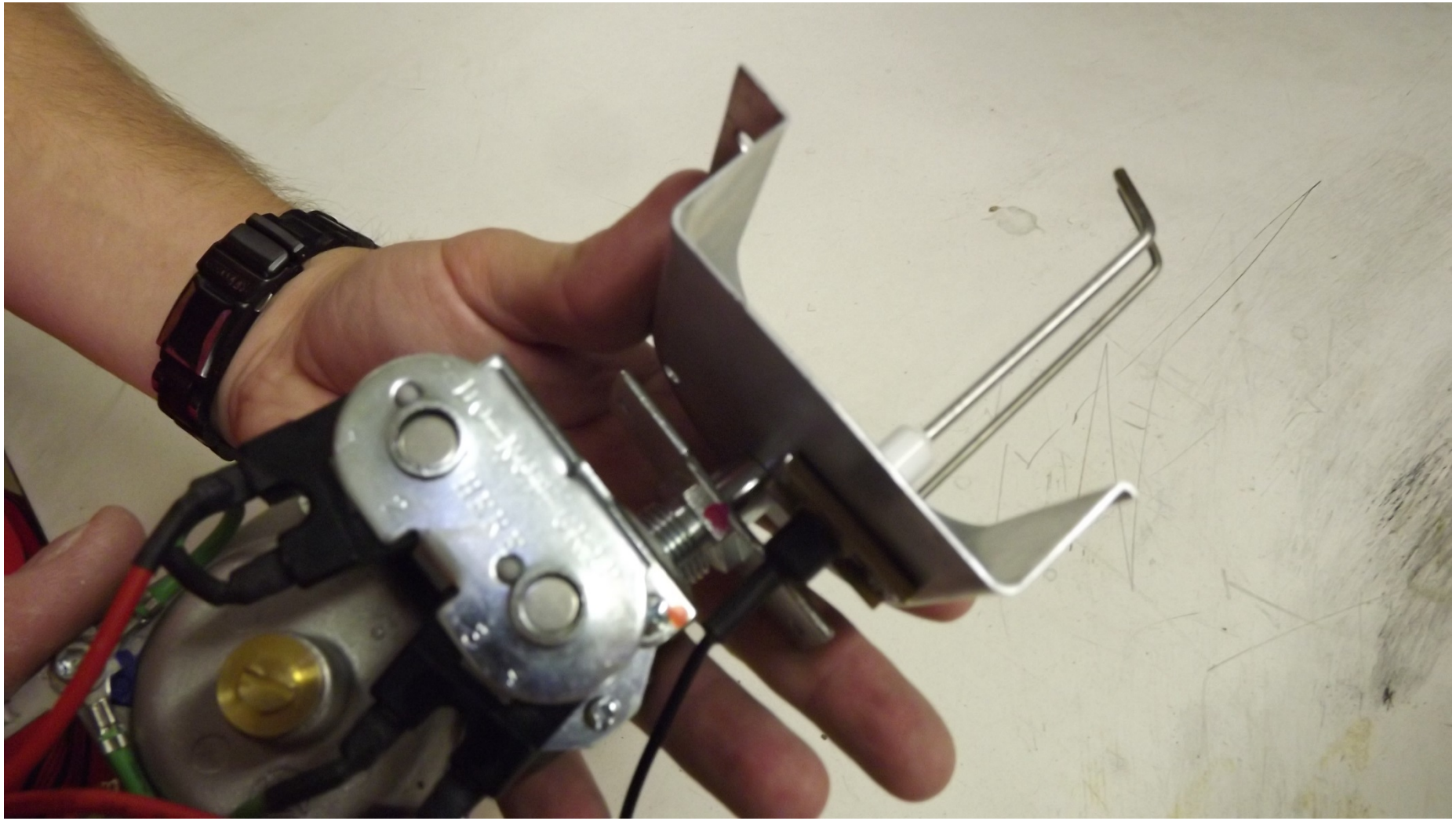
Next, pull the complete assembly out.

To separate the Burner and Valve.



Start by removing these two screws.

To separate the Burner and Valve.



The Burner/Ignitor assembly then slides apart from the Gas Valve.

Verify the orifice is the correct size.

Once the valve assembly is removed you can see the sizing.

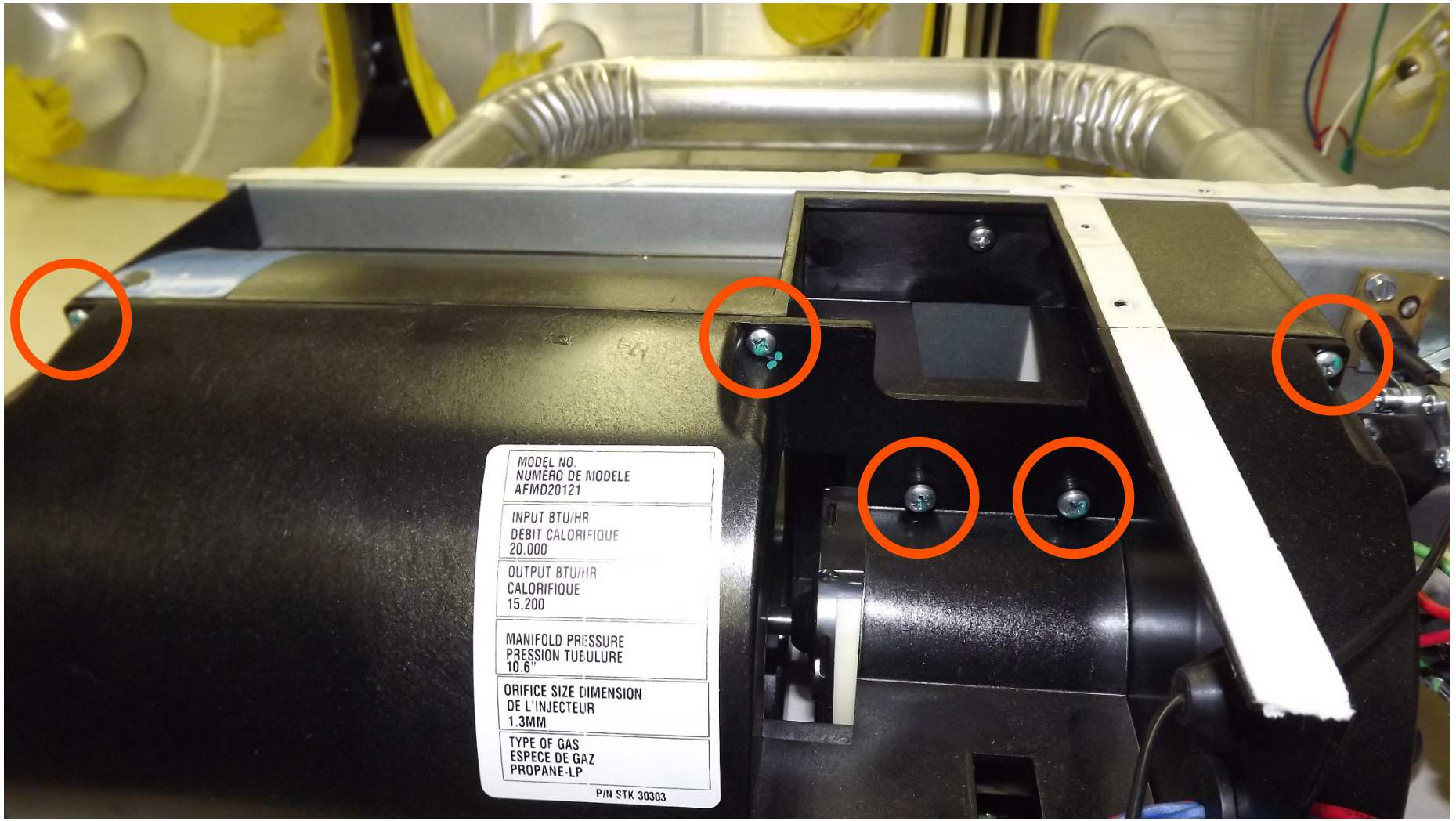
Burnt through Burner head.

Caused by improper combustion, low gas pressure, or improper burn due to blockage. This is not covered under warranty.

Furnaces

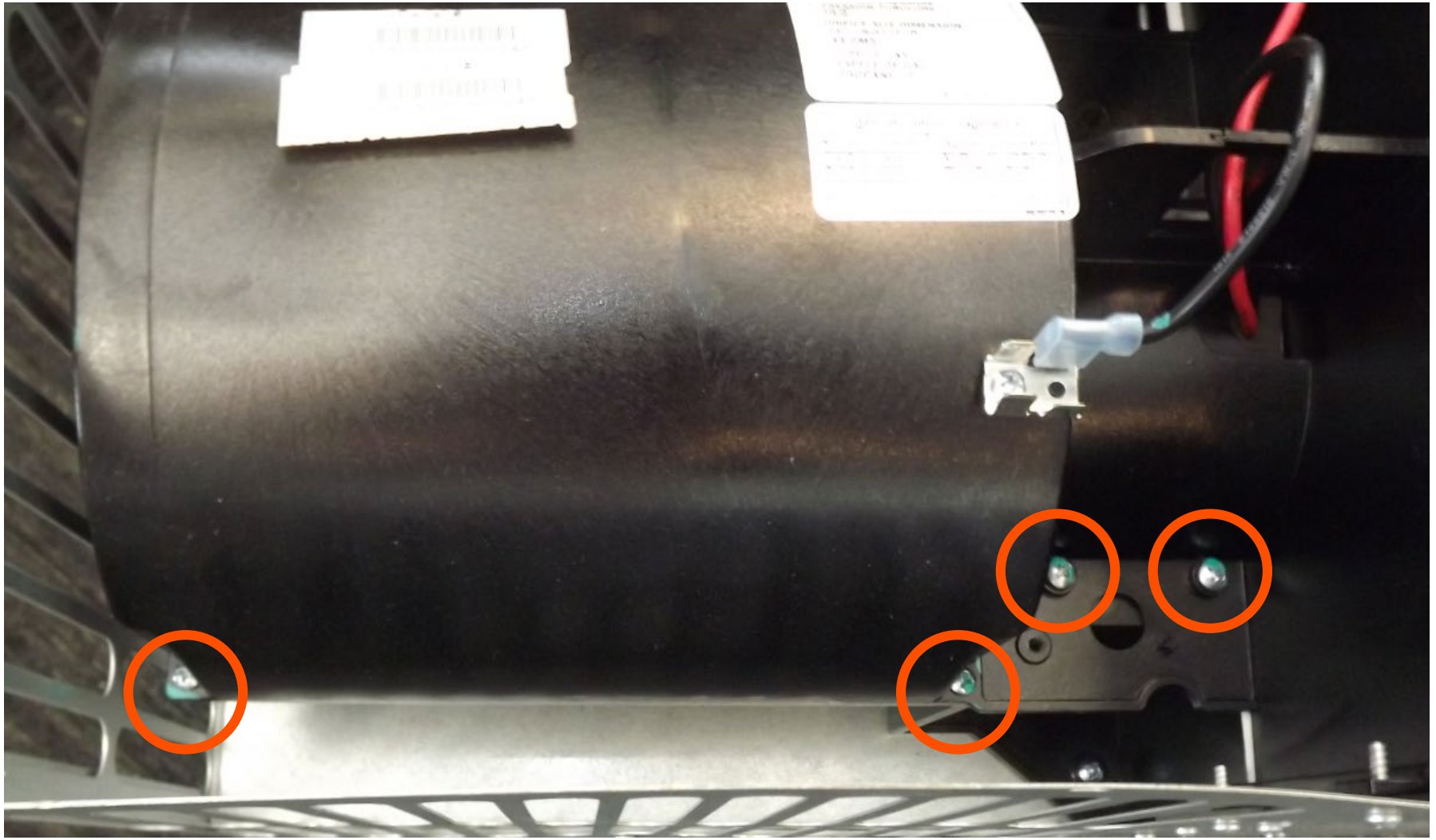
Blower Assembly

To disassemble the Blower.



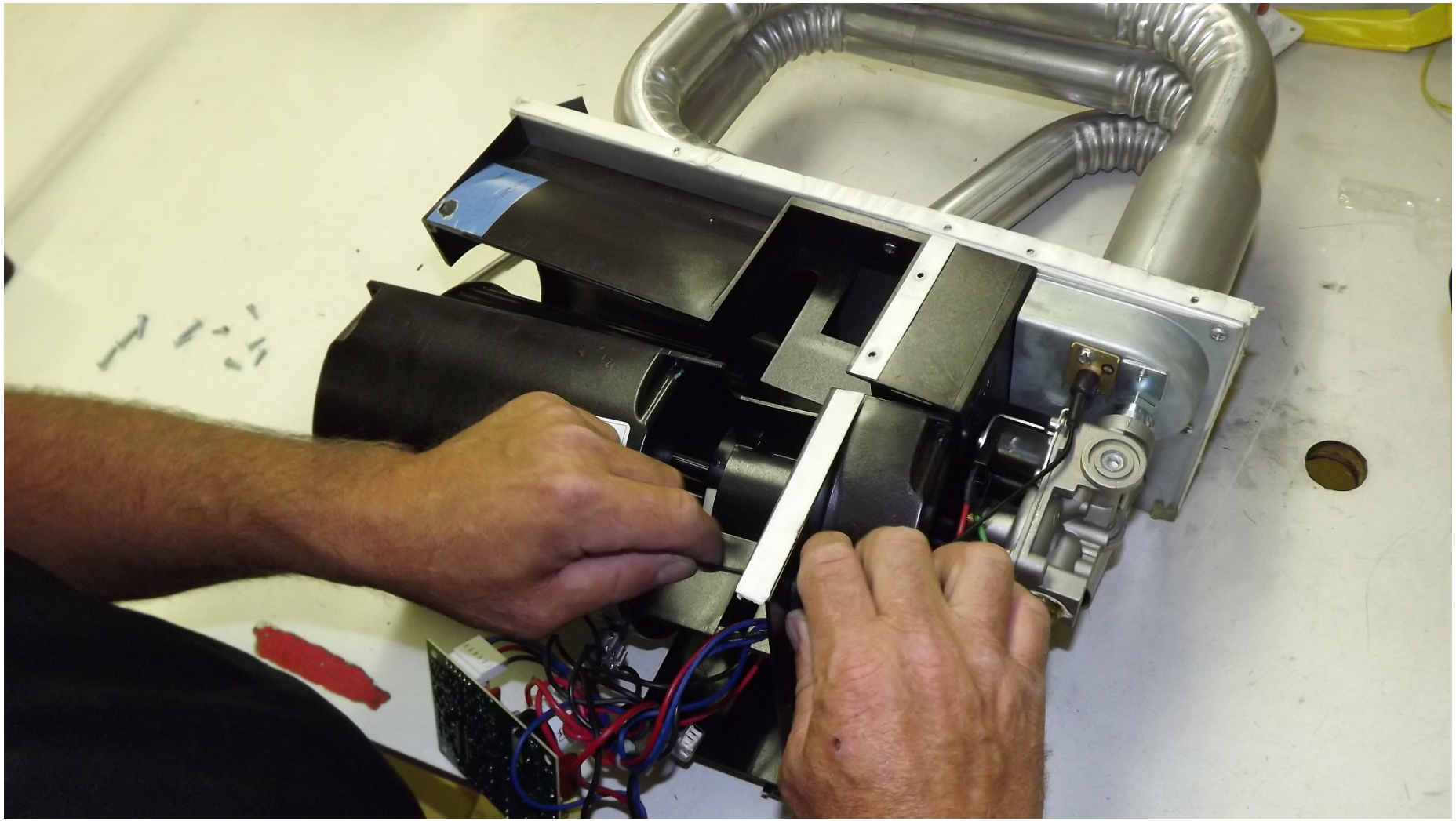
Start by removing these top five screws.

To disassemble the Blower.



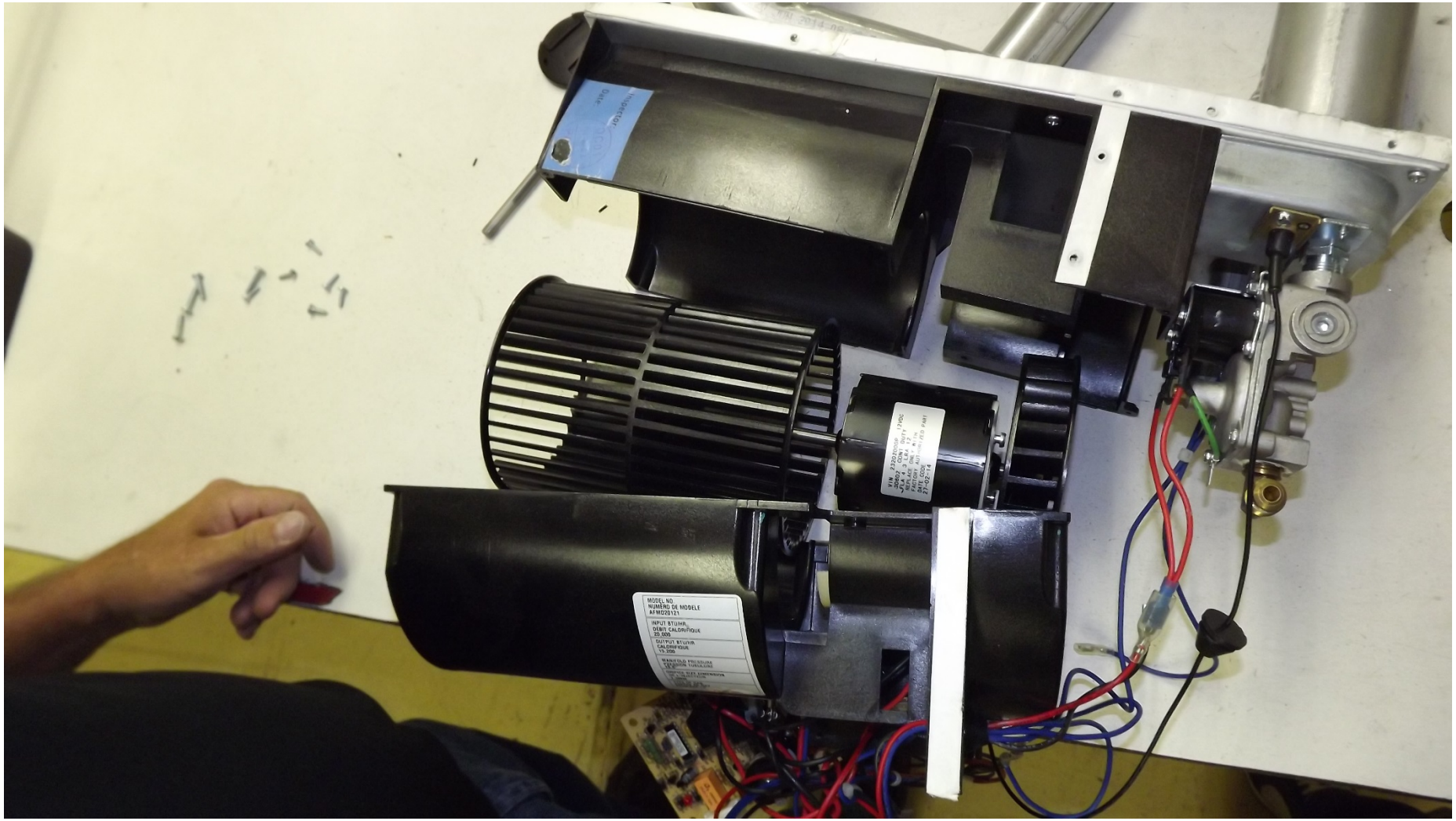
Next, remove the bottom four screws.

To disassemble to Blower.



You can then begin to separate the two halves of the housing.

To disassemble to Blower.



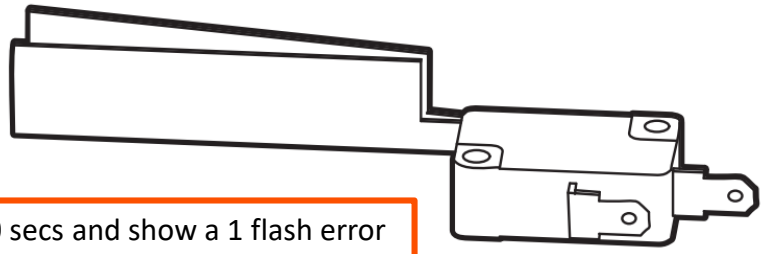
Once the housing is apart you will have access to the Blower.

Troubleshooting & Common Symptoms

Sail Switch Common Issues

Sail Switch issues will have the possibility to create a few symptoms:

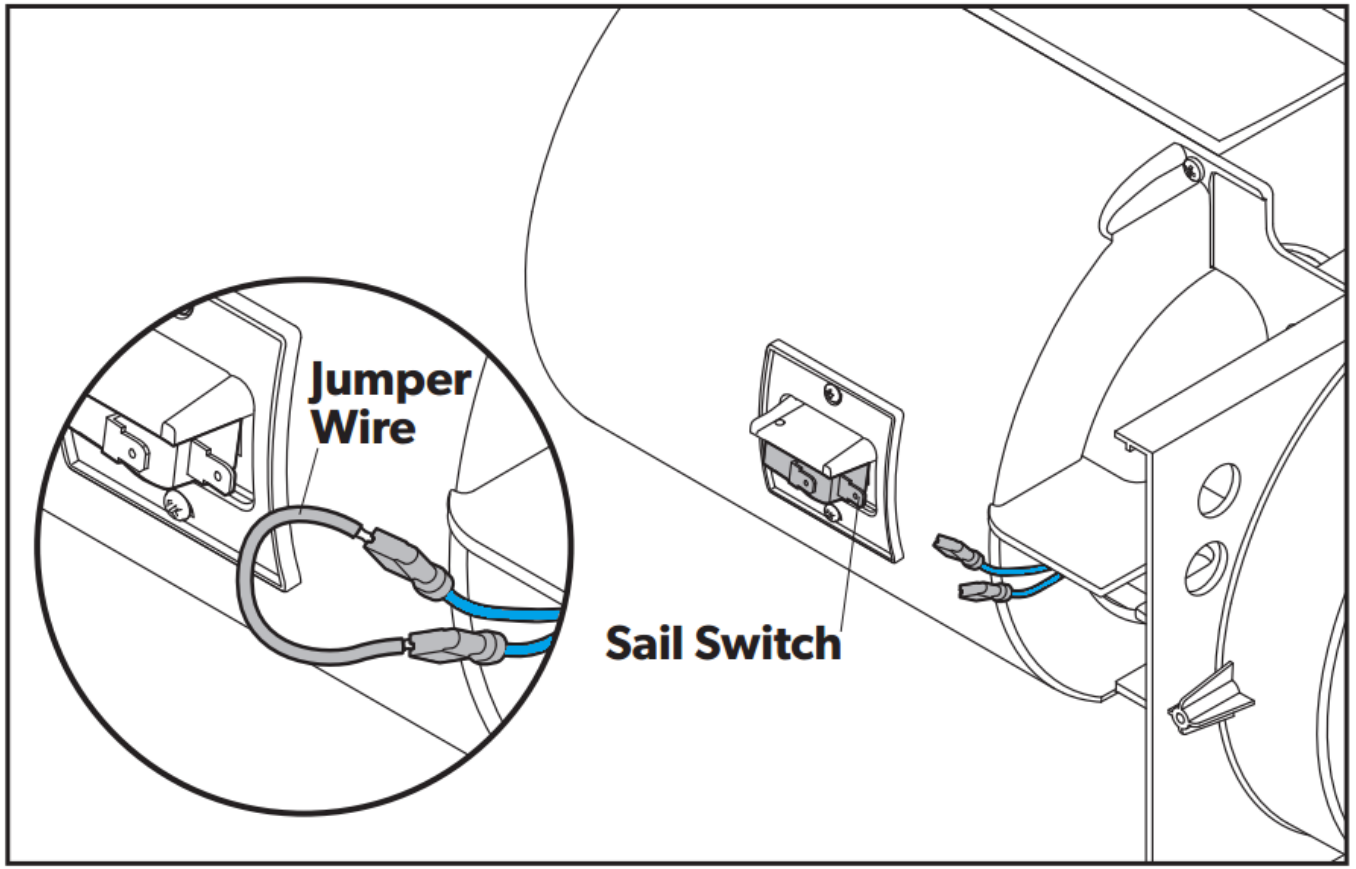
- Fan comes on but gas valve does not open and electrode does not spark.
  - Sail switch is stuck open.
- Thermostat is calling for activation but no response from the furnace.
  - Sail switch is stuck closed.
- Unit comes on and lights but will not stay light. Keeps lighting and going out.
  - Sail switch is fluttering, keeps opening and closing.



*Will attempt ignition for 30 secs and show a 1 flash error code on control board indicating an air flow / limit fault.

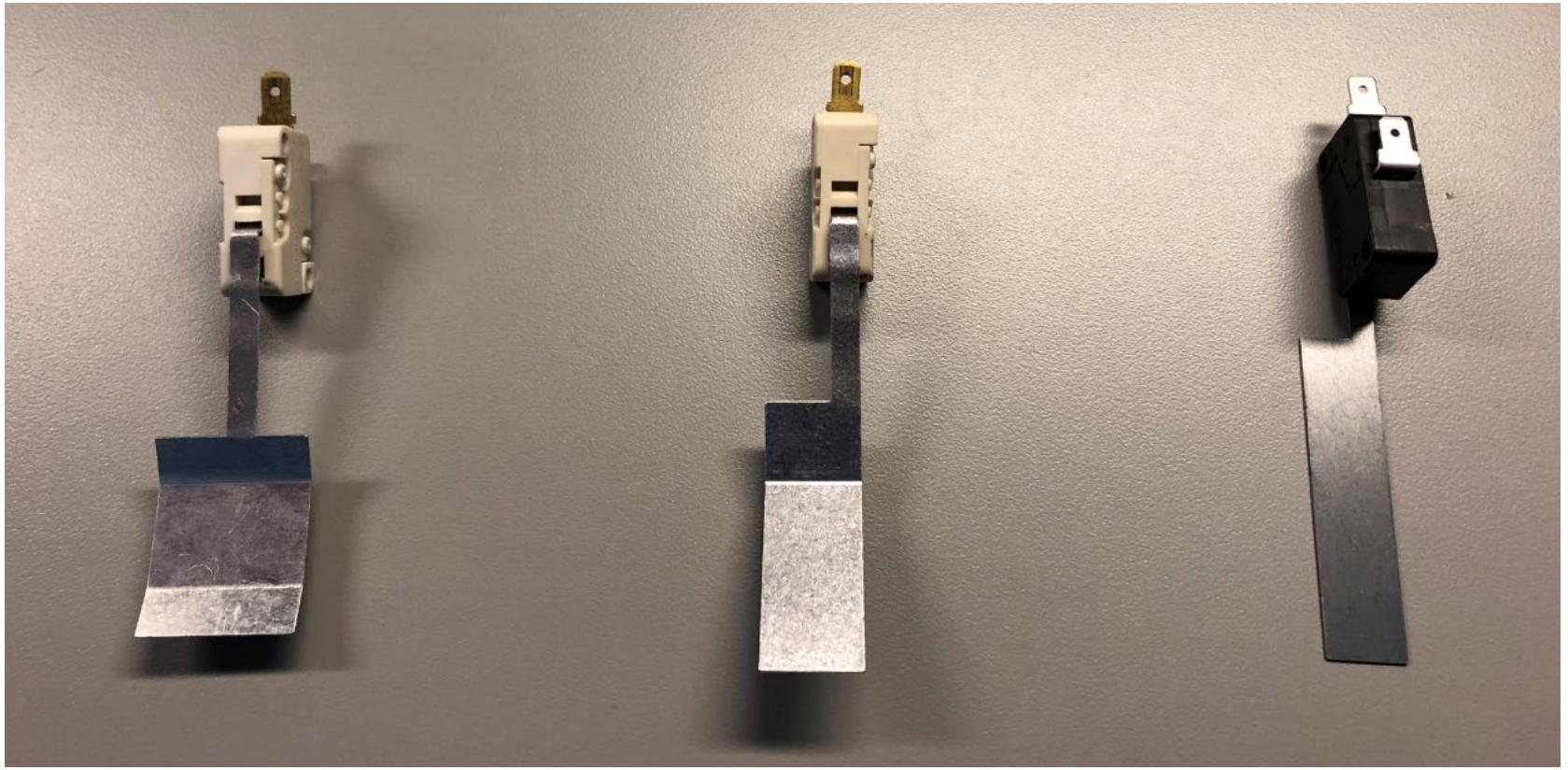
Symptom	Cause	Solution
No Fan Operation – Error Code Present	Stuck Closed	Replace
Will Not Stay Lit – No Error Code Present	Sail is Fluttering	Replace
No Ignition – Error Code Present	Stuck Open	Replace

Sail Switch Common Issues



To verify if the sail switch is the issue, jump the sail switch. In cases where the fan motor runs however, **DO NOT** jump the leads prior to the motor starting or you will lock the furnace out. Wait for the motor to start running for a few seconds, then put your jumper across the leads. If the unit lights, and starts running correctly, replace the sail switch.

Replacement Sail Switches



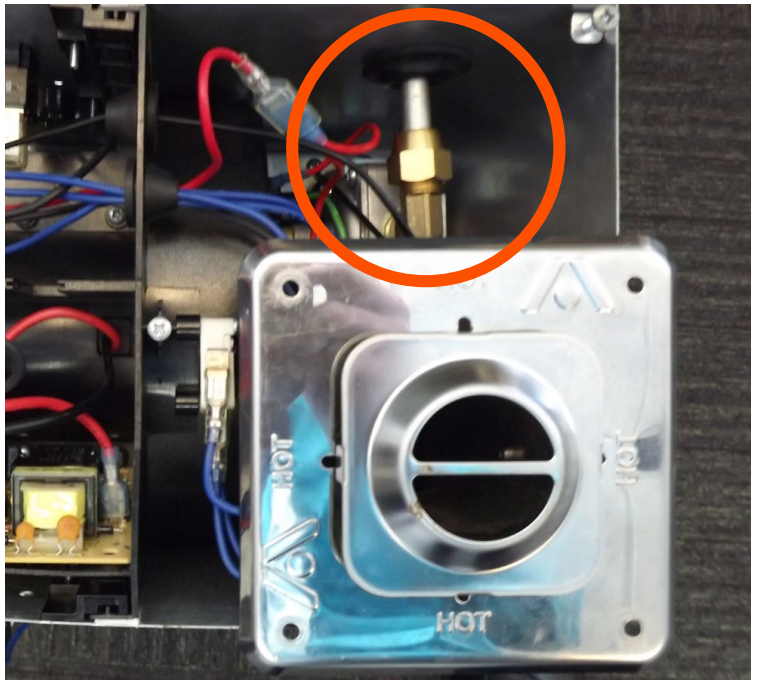
PN: 31093
AFS Prior to SN: 724

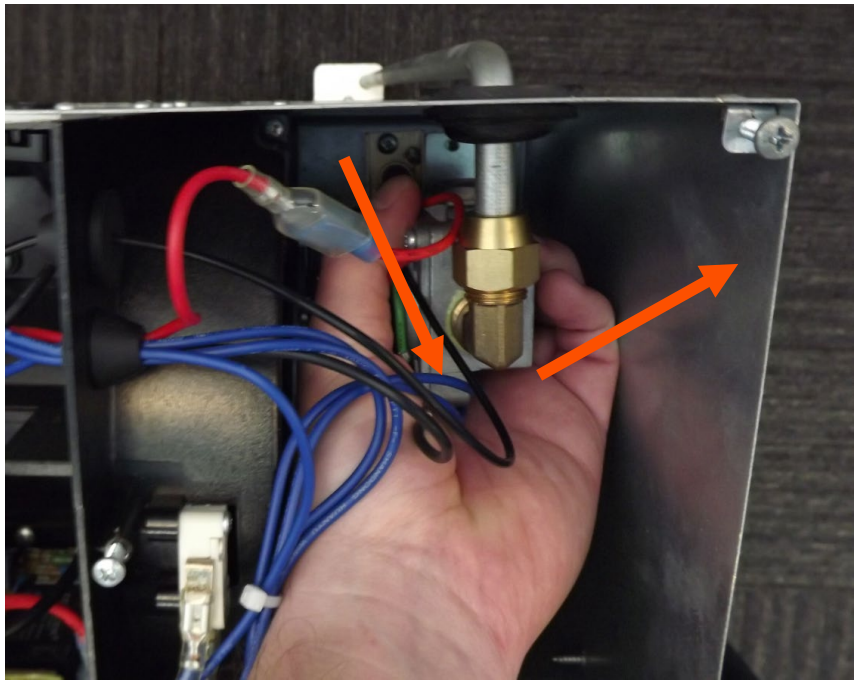
PN: 31094
AFM Prior to SN: 724
AFLD Prior to SN: 729
AFLA Prior to SN: 816

PN: 33081
AFS Serial 724 +
All DFS

PN: 33082
AFM Serial 724 +
AFLD Serial 729 +
AFLA Serial 816+
All DFM
All DFL

Ignition System Common Symptoms





Symptoms of the furnace lighting, going out, over and over, never locking out; units with extended manifold gas lines that run to the back of the furnace are often carried by this line at the production level of the RV. This bends the gas valve ever so slight out of position to create this issue. Units without the extended line that show signs of this problem originate from the connection of the gas line and not double wrenching the line, again, bending the gas valve out of position just enough to create a problem.

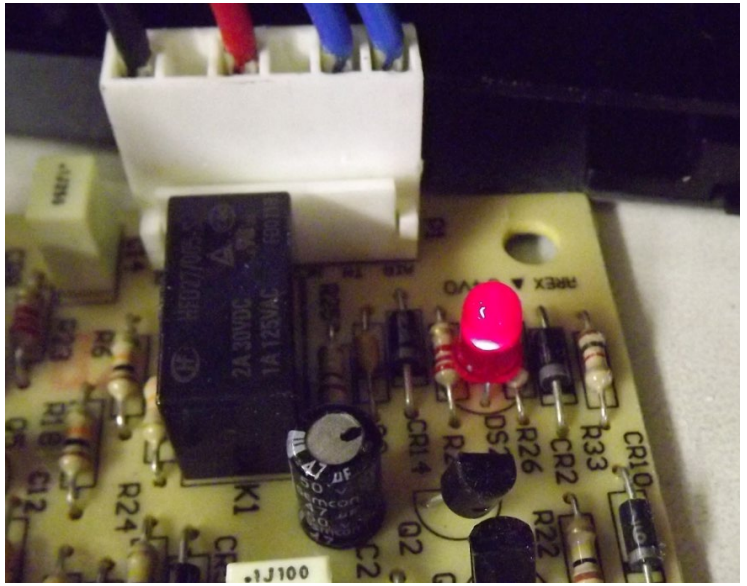
The fix in this case is to get the gas line back in to position. Grab the gas valve and pull down hard and slightly to the right (5 o'clock).

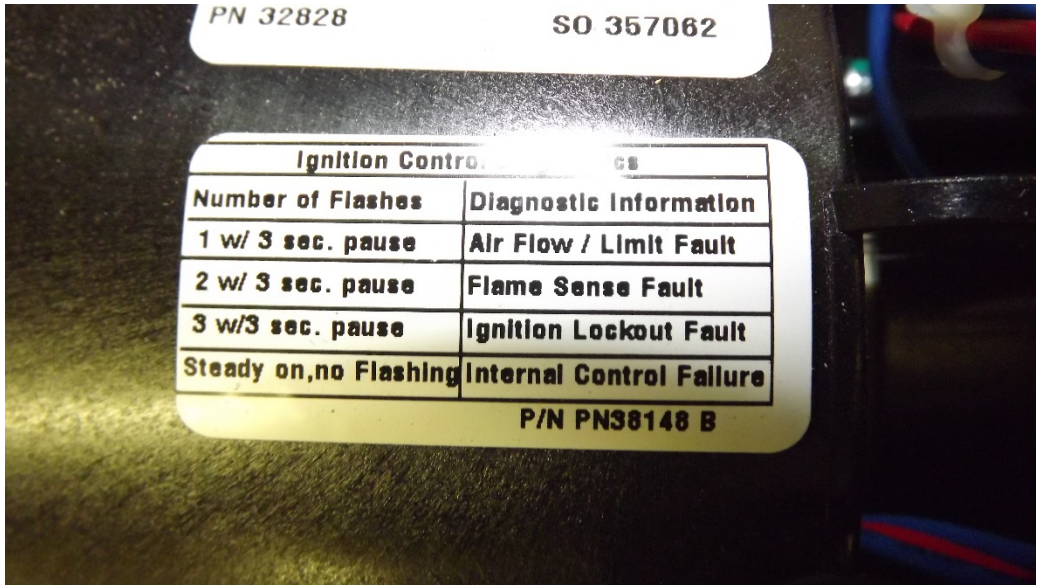
This adjustment is not covered under warranty as this is caused during installation and is not a Dometic defect.

Circuit Breaker Switch Tripping?

- High Motor Amperage.
- Poor Return Airflow.
- Doubles as a Thermal Switch (Excessive Heat can trip Switch).
- Voltage drop through the Switch while under a load indicates a weak Switch.
- Excessive tripping could indicate a weak switch once other items are confirmed not be an issue.

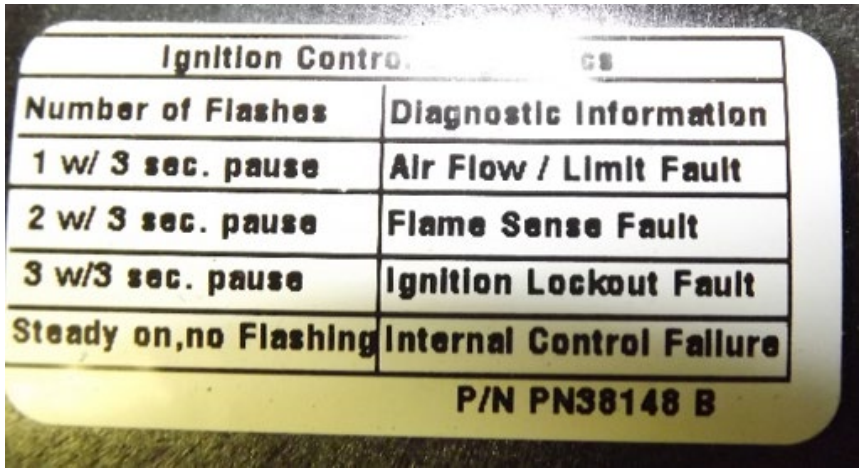
Control Board Fault Codes





The control board has a red fault light located on it to signify a specific error and help lead you into a certain direction to diagnose problems. Depending on the number of flashes followed by a 3 second pause, this will indicate a specific fault as pictured above.

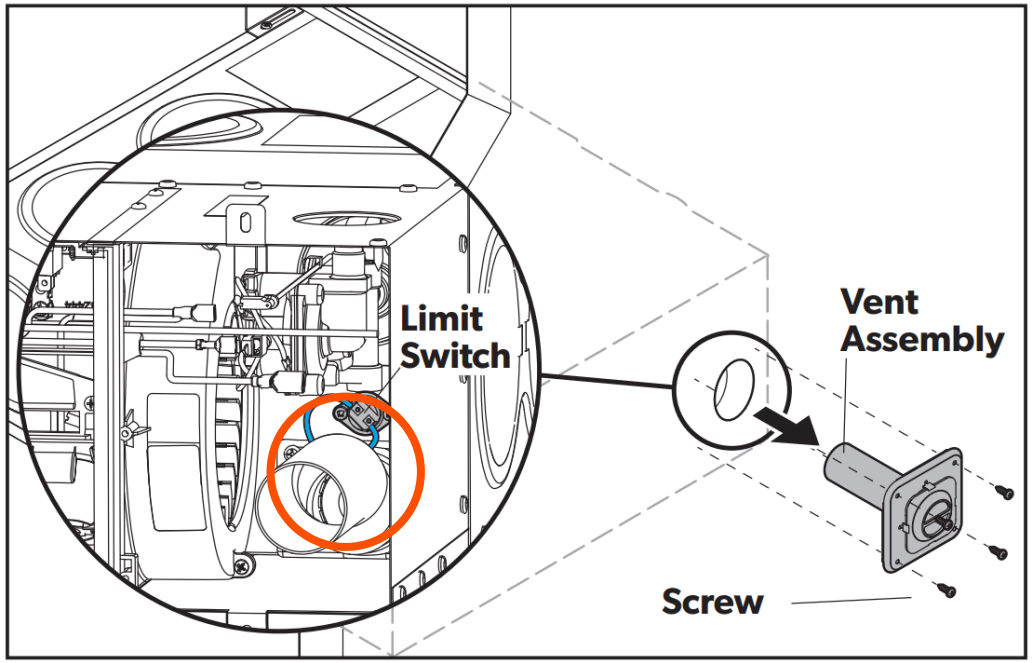
Control Board Fault Codes Cont.

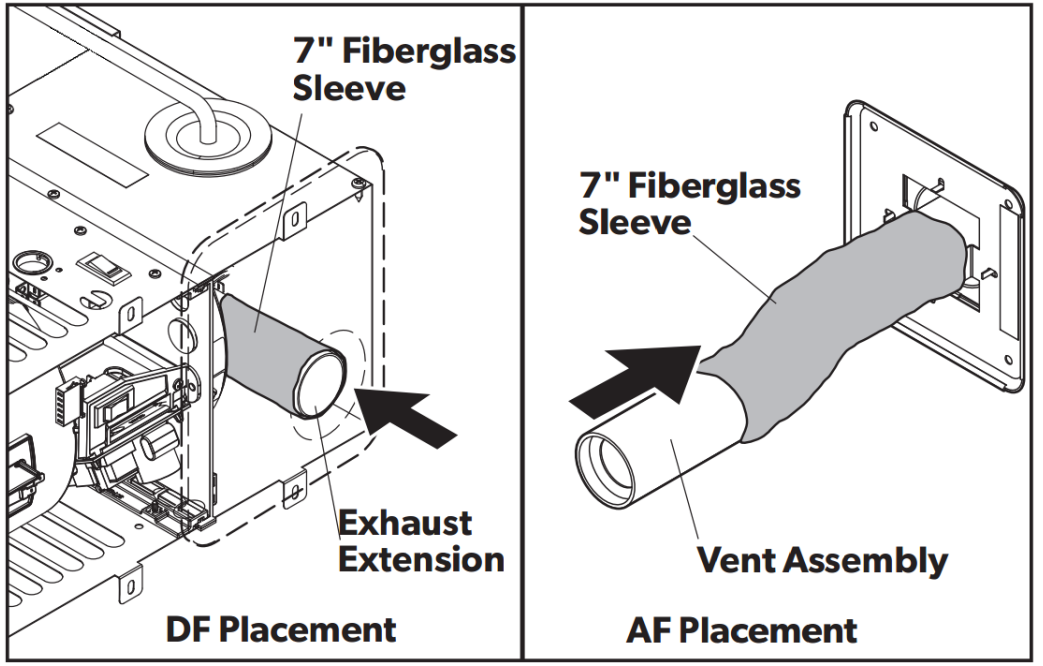


Error Code	Most Likely Cause	Solution
1 Flash w/ 3 sec Pause	Sail Switch Faulty	Replace Sail Switch
2 Flash w/ 3 sec Pause	Faulty Electrode or Control Board	Try a new Electrode - if problem persists, replace the Control Board
3 Flash w/ 3 sec Pause	Low Gas Pressure or Dirty Heat Exchanger	Verify Water Columns of Gas Pressure – Clean the Heat Exchanger

Limit Switch Rework (TSB)

AFS, AFM, DFS, DFM, Serial Number Range: 73985322 - 81099541





Remove the vent / door assembly and inspect the exhaust vent area. Visually examine the limit switch wires for evidence of the following conditions:

- Wires laying on the exhaust vent tube.
- Melting at any point along the length of the wire.

If either of these conditions exists, contact Dometic Tech Service for authorization prior to any repair. If no damage is present, proceed with this field repair.

Installing the fiberglass sleeve:

- For DF units: slide the fiberglass sleeve over the exhaust extension.
- For AF units: slide the fiberglass sleeve over the vent assembly.

Re-install the vent assembly.

Air Flow Issues

AF models have a possibility to run into problems due to incorrect exhaust tubes being installed for the corresponding size furnace.

Symptoms would be:

- Improper burn / sooting
- Will not light all together
- Lights and goes out repeatedly

This creates an improper gas-to-air mixture. This is an installation issue as these exhaust tubes get mixed up at the manufacturing level or in the aftermarket.

Verify you have the correct exhaust tube for the AF model by looking at the sticker on the rear of the vent. It will list which models the tube is compatible with, make sure the model you are working on is listed on this sticker.

NOTE: The DF model furnaces remedied this issue by having the tube pre-built within the furnace. This eliminates them being mixed up during installation or aftermarket.

Any Questions?

- Sales Department (Dealers Only) 1-800-366-3842
- Technical Services (Dealers Only) 1-800-216-5115
- Retail (Retail Customers Only) 1-800-544-4881

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