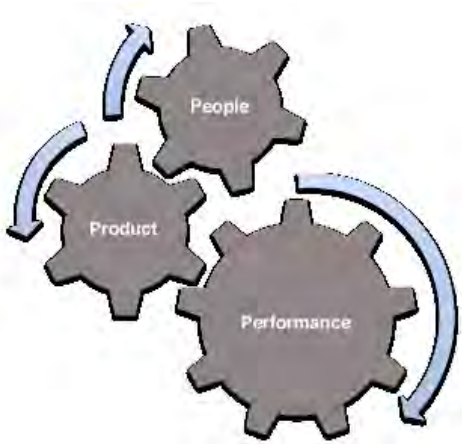
SERVICE MANUAL

Cobalt
Gas-Fired Heaters



SAMUEL JACKSON


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Table of Contents

We appreciate your business and hope you enjoy your Samuel Jackson Cobalt Gas-Fired Heater!

This manual contains information on the installation, startup, and operation of your Gas-Fired Heater. Including information regarding:

- Heater operation.
- Electrical installation.
- Gas piping and supply.
- Heater and Control Cabinet dimensions.
- Maintenance and troubleshooting.

When taking delivery of your new Heater, take a moment to familiarize yourself with the location of the less obvious items in the shipment. This service manual is normally shipped in the *BOX OF CONTROL PARTS*. Included in this box are the air temperature thermocouples, thermocouple extension wire, glass windows, air flow tubes, spark plug and flame rod wire and the gas inlet valve and purge assembly for the control cabinet.

We suggest that you check the contents of the box of control parts and then store them in a safe place until installation time. This will help prevent some of the items from being misplaced or being used for other jobs. Heater installation will then go smoothly with no delays waiting or looking for missing parts.

This manual gives general information on the location of thermocouples and optional moisture sensing equipment and the temperature control logic. If the Heater is part of a Samuel Jackson Drying System, more detailed information will be shipped to you under separate cover specifically for your system.

IS STARTUP ASSISTANCE PROVIDED?

Depending upon your location, a startup and inspection service may be provided with your new Heater free of charge by Samuel Jackson, Inc. Please contact us to make arrangements or for questions regarding startup services.

In the future when you require service, technical support, or parts please contact us by phone, fax, or email. Our engineers and service team are available to assist you in obtaining the best performance from your Samuel Jackson, Inc. products.

Again, thanks for choosing a Samuel Jackson Gas-Fired Heater!

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Warning

READ THIS CAREFULLY BEFORE OPERATING THIS SAMUEL JACKSON PRODUCT!

The Samuel Jackson product line consists of sophisticated technology capable of greatly enhancing a gin's productivity and efficiency. Improper use of these products could adversely affect those very same factors and potentially cause injury to gin personnel. For this reason, we include an extensive manual with every product. These manuals outline the proper and safe operating procedure for their respective product. **Do not operate any Samuel Jackson product without first reading the entire manual and all accompanying information.**

Sometimes there are updates added at the customer's discretion to products already in the field. We always refer customers to our website, www.samjackson.com, for the latest product information. The latest manual can be downloaded or printed from the website free of charge. In addition to printed literature, the website includes training videos on several popular products. When available, these videos are highly recommended for viewing before operating a respective product. If you do not have internet access, give us a call and we will gladly send you the latest product information.

DANGER: ***Please read and understand all the warnings below before operating or maintaining a Samuel Jackson product. If you do not understand, call Samuel Jackson at +1-806-795-5218 before proceeding. Failure to do so could result in injury or even death. (Si usted no entiende, llame a Samuel Jackson al +1-806-795-5218 antes de proceder. La falta de hacerlo podría causar lesion o muerte.)***

Electrical.
Most Samuel Jackson products use supply voltage between 110 and 480 volts AC. These levels are considered high voltage and are extremely dangerous. The ignition transformer voltage output is much higher than this.

Fire.
Samuel Jackson Humidaire Units and Heaters are combustion-based products. They ignite and burn fuel during operation. These products can reach very high temperatures inside and out. Allow combustion based products 15 minutes to cool before attempting any work.

Automatic Flame Ignition.
Some Samuel Jackson Humidaire Units and Heaters use technology to ignite automatically. If you do not see a flame, it does not mean that respective product is not in operation.

Access Doors.
Samuel Jackson products have access doors for added convenience of product maintenance. Access doors must not be opened while the equipment is in operation. Access doors should also remain closed while any connected equipment such as a fan or conveyor is in operation.

Replacement Parts.
When repairing or maintaining this equipment, use only Samuel Jackson approved parts.

Moving Parts.
Many Samuel Jackson products have moving or rotating parts. These parts could form pinch points or grab loose clothing or jewelry. Do not reach across or into any product while in operation. **WARNING: Remove power to the control cabinet before reaching inside the burner cabinet. Shutters may move without warning!**

Do not work on any Samuel Jackson product without first following OSHA Lockout/Tagout procedures. Confirmation by a licensed electrician that there is no electricity present is highly recommended. We recommend using a Samuel Jackson Authorized Technician for all work Samuel Jackson products. Additional safety information is located throughout this manual and should be read carefully before operating this Samuel Jackson product. If you have any questions about how to properly operate a Samuel Jackson product, please call +1-806-795-5218 before proceeding.

Safety Features of Gas-Fired Heaters

Many of the traditional safety features designed into drying Heaters are universal in nature. Cobalt Heaters have the capability of extending safety to cotton gins where traditional safety methods might leave a cotton gin vulnerable. Some of these special safety capabilities are outlined below:

- One design aspect aimed at performance, but contributing to safety, is the achievement of high flame electrode current. This prevents nuisance shutdowns by the flame safeguard device, which can drive operators to desperation. This is particularly helpful in foggy and rainy ambient conditions, when you need a drying heater the most.

- A static pressure switch is often used as a universal safety method to conclude that air is moving through the dryer. If a choke-up occurs in a cotton gin's pneumatic conveyance system, static pressure may still be present, and the burner may continue to operate. This can cause a fire. All newer model Samuel Jackson heaters measure velocity pressure as a difference in pressure sensed by orifices pointing upstream and downstream. This is a true indication of air flow through the heater. In order to give immediate burner shutoff and serve as a safety backup for the air flow sensor, we include a fan interlocking device for each burner.

- The supervisory control system performs several air flow tests and interlocks, including tests for a jammed or jumpered air flow sensor, presence of electrical fan interlocks, and warnings of impending chokages in the air stream.

- The advanced diagnostic systems on Cobalt Heaters are capable of self-diagnosis of malfunctioning or compromised valves, sensors, and related combustion control safety components. (*Please note that depending on local safety requirements, some of these capabilities may not be available to you in order to comply with specific regulations.) Any problems encountered in this diagnosis are recorded with the time, date, and operation conditions for later review, operator instruction, and correction.

* Sometimes local safety regulations give precedence to universally approved and mandated safeguards for all combustion systems in all industries. While well intentioned, sometimes these universal requirements preclude use of embedded specialized safety features from the manufacturer. Unfortunately, this one-size-fits-all approach to safety on a regulatory basis ignores the safety benefits of application or manufacturer-specific safeguards, requiring a choice between regulatory compliance and application-specific safety. Be advised that Samuel Jackson will always configure your Cobalt Heater to meet local safety regulations unless we are specifically instructed otherwise. Samuel Jackson recommends focusing on application-specific safety rather than regulatory compliance wherever it is practical and legal to do so.

Cobalt Heater Modes

The Cobalt Heaters can be configured for operation in one of two separate modes of operation. These modes are referred to as “Service” and “Compliance”. If the heater is being operated in Compliance mode, a servicing technician may on occasion temporarily reconfigure to Service mode in order to better diagnose and troubleshoot certain problems.

When operating in Compliance mode a Siemens Digital LME73 is employed for combustion control. An additional before-mix thermocouple with manual reset lockout controller is installed in the drying system and the heater employs two air flow sensing devices. A mechanical airflow sensor is connected to the Siemens Digital LME73 in accordance with local regulations. An additional analog sensor is connected to the heaters PLC to allow for simplified diagnostics of air problems that impact the heater's performance. Only the mechanical air flow sensor has direct control within the combustion safety provided by the Siemens Digital LME73. More details are provided throughout this manual.

Some of the feature differences are listed in the following table.

Mode Differences

Feature	Service	Compliance
Ignition interference with flame detection system	Yes	No
Compromised flame sensing electrode annunciation	Yes	No
Historical ignition failure reporting	Yes	No
Historical flame failure during operation reporting	Yes	No
Residual flame detection on shutdown annunciation	Yes	No

New Features

WHAT'S NEW IN THE COBALT HEATERS FOR THE EXPERIENCED SAMUEL JACKSON HEATER USERS?

The first thing you will notice is that the heater body looks slightly different but the control panel has totally changed! The Cobalt has been re-designed for efficiency, performance and best of all, ease of operation.

This section includes information for users with experience using older model Samuel Jackson Heaters who are making the transition to a new Cobalt Heater. New features and differences in operation are briefly summarized. More detail on specific features and options can be found in this manual under the appropriate section. In normal circumstances, the user may safely use the factory settings that are preprogrammed in the Heater.

Touch Screen Diagnostics – In earlier Samuel Jackson Heater models, a special test program is run to access diagnostics. For the Cobalt Heaters, the technician can activate diagnostic routines selectively from the color touch screen without the need for going through the sequence of a test program which may require the heater to be offline.

Automatic Shutter Adjustment – In previous heater models, the shutters had to be adjusted manually in order to reach an ideal velocity pressure. This required the heater to be shut down and the access doors removed. In the Cobalt Heaters, the shutters will power up and begin moving to a position that gives the heater the proper amount of air flow. The shutters will adjust as the heater is running, compensating for a change in air when there is dry or wet cotton being ginned.

Adaptive Low Fire – The Cobalt Heaters now automatically adjust the low fire position based on your heaters velocity pressure and airflow. A bigger flame is needed if there is a lot of air being pushed or pulled through the heater. However, when there is cotton in the line the amount of air is reduced. Because there is less air, but the same amount of flame, it is harder for a heater to reach lower temperatures if needed. The Cobalt heater automatically turns down the low fire fuel position, allowing lower temperatures to be easily maintained.

Moisture Mirror X Compatible – The Cobalt Heaters have Ethernet communications capability, which gives you the option of connecting it to a Moisture Mirror X. You may simply connect it using a standard Ethernet CAT-5e cable to a Samuel Jackson Moisture Mirror X. A single Moisture Mirror X will act as a common remote control for a maximum of eight Samuel Jackson Cobalt or Delta Heaters and four 1600 Series **Humidaire** Units at the same time. In addition to this, the Mirror X, when properly equipped with sensors, can control the temperature of the Heaters automatically while coordinating the interaction of all of your Sam Jackson moisture control products.

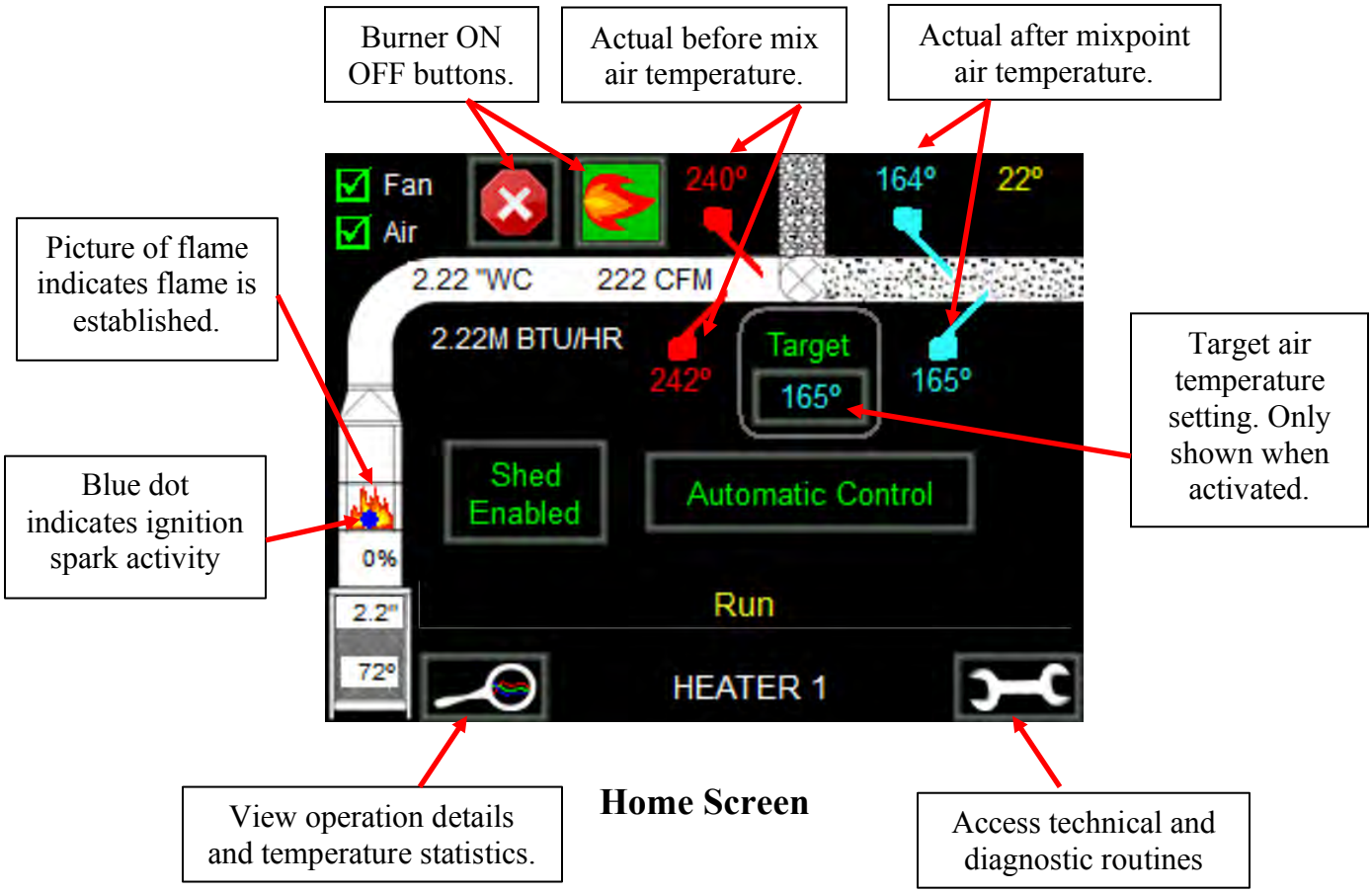
Heater Operation

HOW DO I TURN IT ON?

Refer to the *MOISTURE MIRROR X* section of manual for more information on operating the Heater remotely using the optional Moisture Mirror X color touch panel. The instructions below are for using the color touch panel mounted in the Control Cabinet door on the unit.

On the Cobalt Heater touch screen, the flame button  turns the Heater on.

The stop button  turns the Heater off.



Home Screen

WHY IS THERE A DELAY AFTER I TURN IT ON?

After the Heater start button is touched, the combustion control computer begins opening and closing valves to test the integrity of various safety switches.

These diagnostics are performed every time the Heater is started. They continue during operation and for approximately 20 minutes **after** shutdown.

If there is a problem detected by the Heater's control system, it will notify you on the touch screen with a brief description that includes an error or alarm number. This number will be helpful to the technician that offers assistance if you call the factory. Many problems are simple in nature (for instance a gas supply valve that is closed) and you may be able to correct it without assistance.

Alarms and errors are described more fully later in this manual. Alarms will warn until reset by pressing the "OK" button and errors will cause an immediate shutdown.

TIPS

Always leave power on the Heater during the gin season. There is a permanent memory in the combustion control computer that remembers when you turned off the power and did not permit the computer to check the gas valves. It will result in an error if power is removed before diagnostics are completed.

To prevent lightning damage to controls in the off-season, it is a good idea to turn power off to the control cabinet until it is needed again.

HOW DO I SET THE TEMPERATURES? (When not operating in automatic control.)

To set the temperature, select the Temperature Control Mode button (located in the middle of the screen) and select either “Manual” to change the after mix temperature or “Limited” to change the before mix temperature. Selecting “Automatic” will allow the Moisture Mirror X to change the after mix temperature automatically based on the moisture target.

After selecting either “Manual” or “Limited”, select “Target” on the home screen and enter the desired temperature.

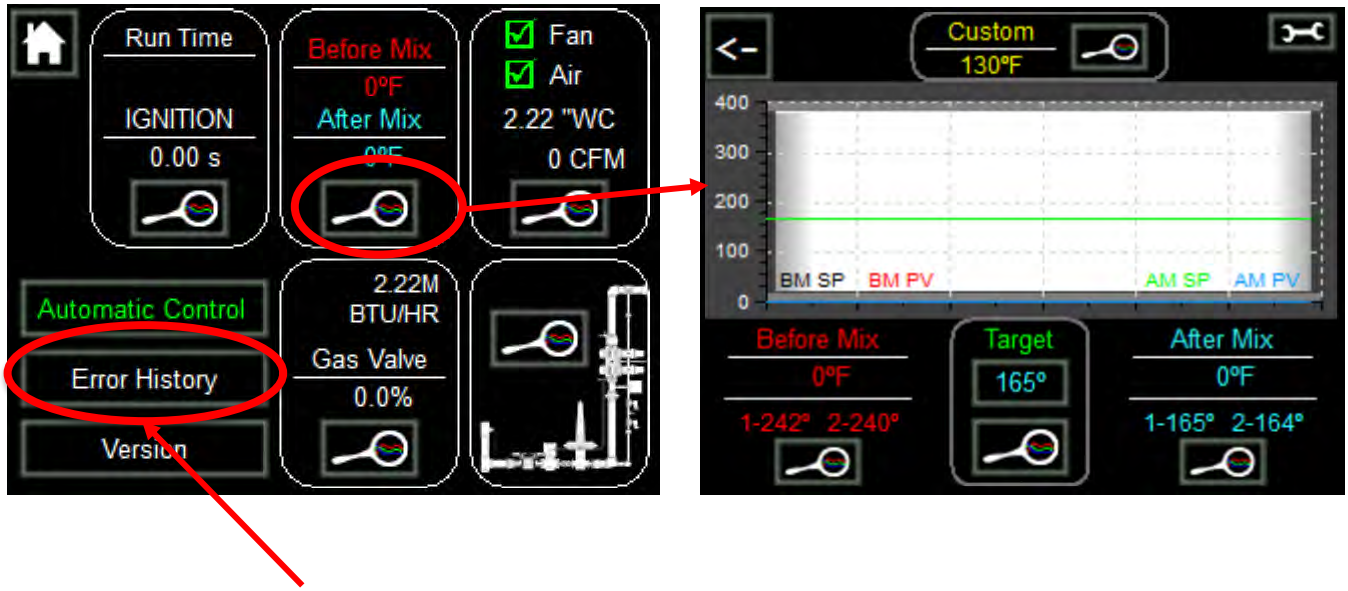
More details for operation with the Moisture Mirror X are described later in the manual.

CAN I SEE WHAT THE ACTUAL BEFORE AND AFTER MIXPOINT TEMPERATURES HAVE BEEN OVER THE LAST FEW HOURS?

The actual before and after mix point temperatures are graphed on a screen over time for the last 24 hours as well as a 1-hour graph. The 1-hour graph gives more resolution so that smaller trends can be seen easier.

If power is turned off to the Heater, this historical graph information is lost. On the Heater Status screen, press the graph button in the temperature box to pull up the graphs for the before mix and after mix temperatures.

Temperature Graph Screen



WHAT IS ERROR HISTORY?

"Error History" on the Heater status screen is designed to make troubleshooting easier for both the user and Samuel Jackson service personnel. This system remembers the last 64 errors and alarms, thus showing a history of past problems along with the time and date of each one. Errors are grouped by Error Number, so it takes less time to scan through the list and highlights repeat errors.

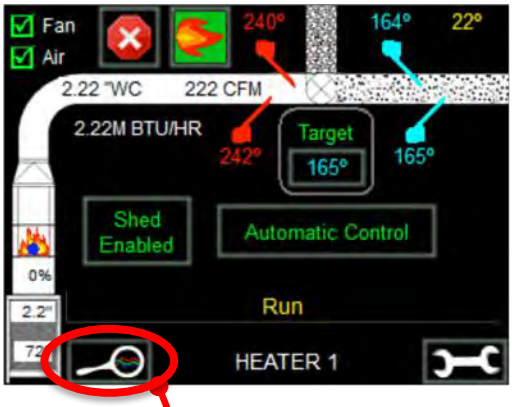
Navigating Important Menus

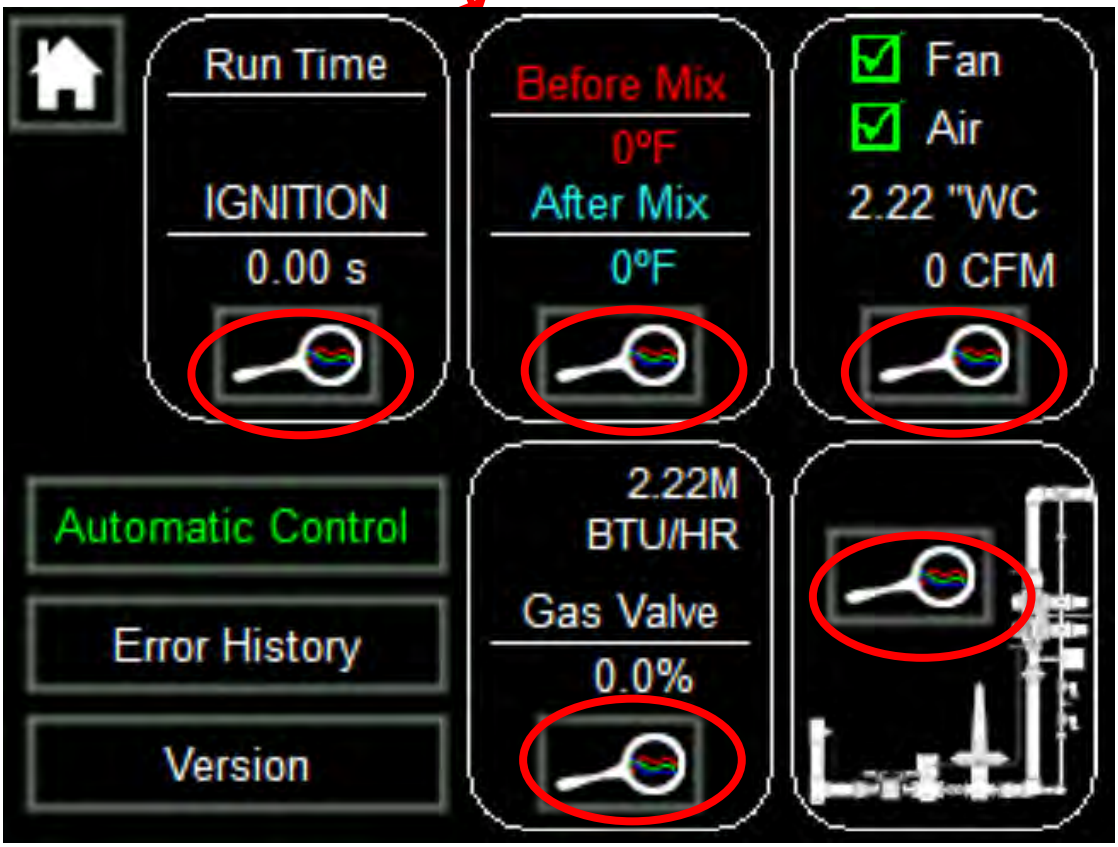
Heater Status Screen:

WHAT IS THE STATUS SCREEN?

The status screen has information regarding run time, heater temperature history, air flow history, gas valve position, error history, system tests and software version information.

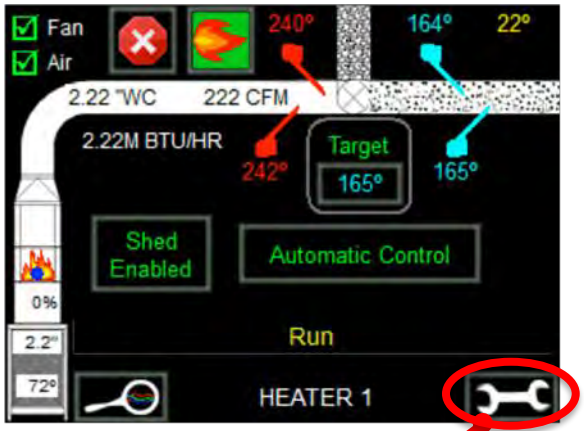
Selecting the Magnifying Glass  on the Home Screen will direct the user to the Heater Status Screen. Select the corresponding Magnifying Glass for even more status information!

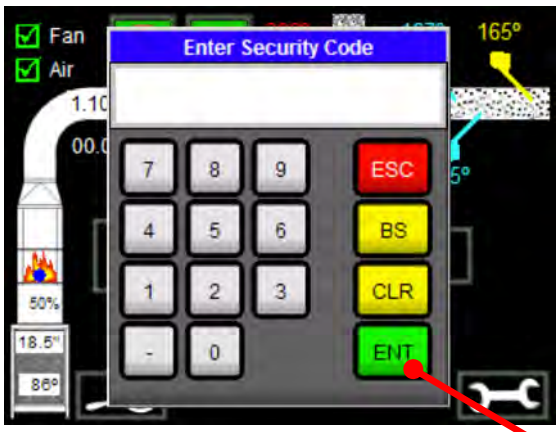


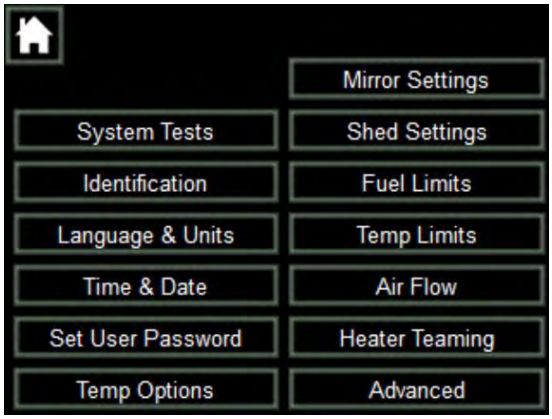


Heater Setup Screen:

Select the Wrench  on the Home Screen and enter the password. Default is 1234.







Select any of the menu items to change or adjust settings and features!

IS THERE ANYTHING I CAN DO TO ENHANCE FUEL EFFICIENCY?

AUTOMATIC DRYING TEMPERATURE CONTROL:
A variety of incoming seed cotton moisture sensors are available depending on the seed cotton hot air pickup method. These moisture sensors, when combined with a Moisture Mirror, allow automatic control of the dryer temperatures.

When wet cotton enters the drying system, the dryer temperatures are automatically and quickly raised often resulting in no loss of production. When dry cotton enters the system, the temperatures are automatically reduced saving fuel and possible fiber damage.

INSULATION:
Significant fuel savings will result from insulating the hot air pipes in the drying system, especially those pipes exposed to areas outside of the building. A cost-effective method of insulation is to wrap the air pipes with 4 inch thick fiberglass batt insulation. Cover the insulation with Cotton Koozie Shrink Wrap Film (part number 20750) and shrink in place with a propane powered heat gun. Heat guns are available from the factory for rental or purchase.

Applying Cotton Koozie Shrink Wrap Film over fiberglass batt insulation.

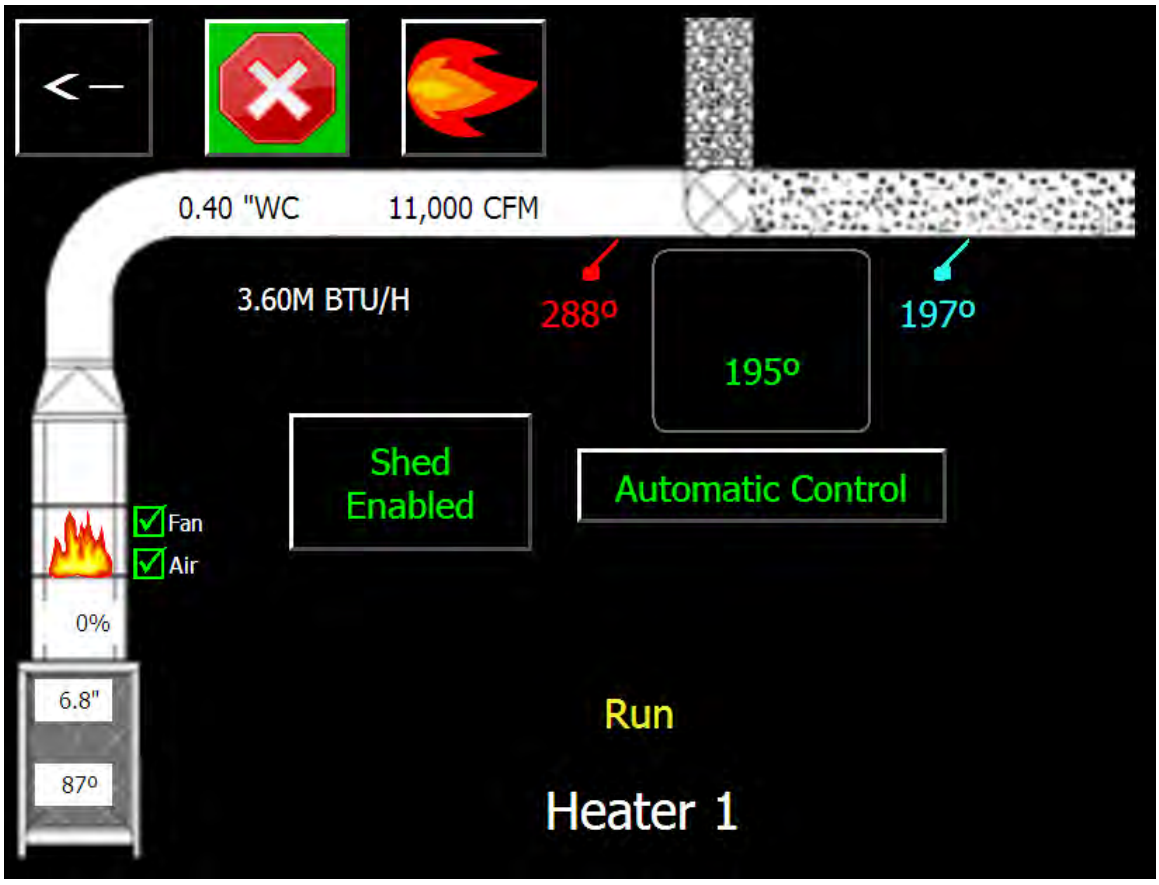
Moisture Mirror X Option

Remote Control and Optional Automatic Control

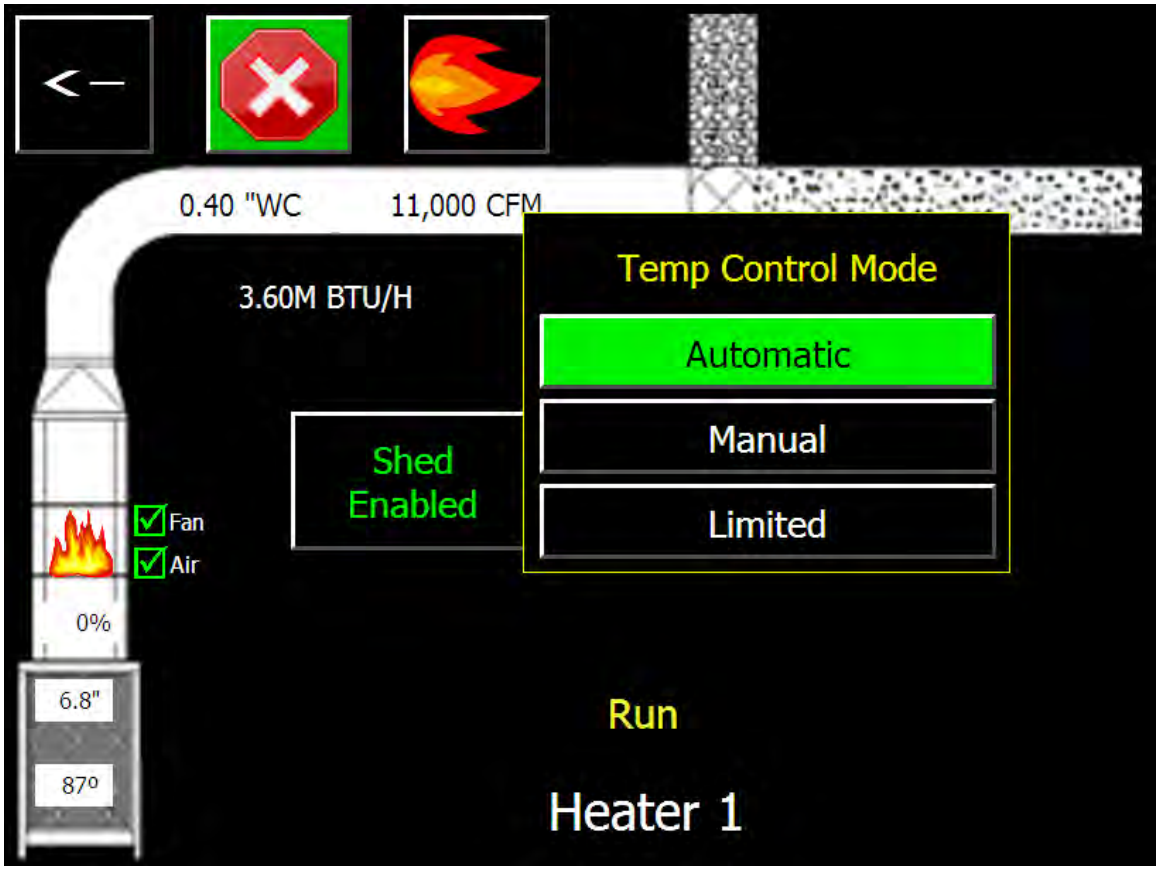
The Cobalt Heaters are compatible with the Ethernet Moisture Mirror X functions. This offers remote control (normally from ginner's console) of the unit via a CAT5 cable. The Moisture Mirror X has the ability to control up to eight Samuel Jackson Heaters. When the Moisture Mirror X is used with compatible moisture sensors, it offers automatic dryer temperature control.

Displayed on the Moisture Mirror X color touch panel are the start/stop operations, temperature settings, actual and target temperatures, and additional information such as runtimes. When an error or alarm occurs, this information is also displayed and can be cleared from the Moisture Mirror X console.

After pressing the desired Heater button, for instance "Heater 1", the screen below will appear. This is where you can start/stop, adjust temperatures, turn Shed on/off, and view error messages for the specific Heater.



Setting Heater Control Mode



Automatic: Each heater can be setup with automatic Moisture Mirror control based on desired after-dry moisture.

Manual: Allows the user to manually set the After Mix temperature target from either the Moisture Mirror or the Heater.

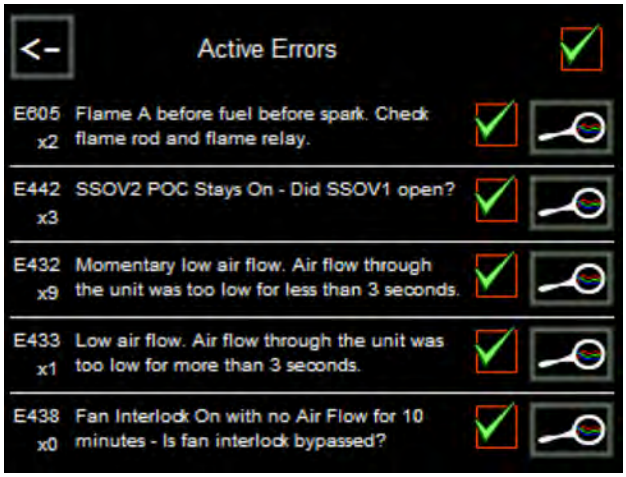
Limited: Allows the user to manually set the Before Mix temperature target from either the Moisture Mirror or the Heater.

Error & Alarm History

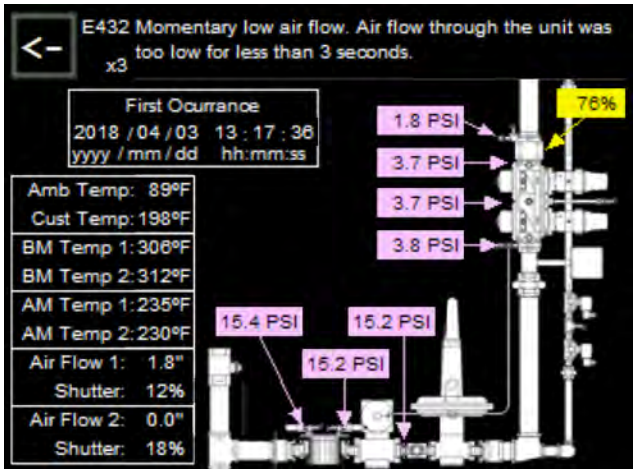
The error and alarm history is designed to make troubleshooting easier for both the user and Samuel Jackson service personnel. This system remembers the last 64 errors and alarms, thus showing a history of past problems.

Errors will pop up on the home screen as they occur.

To access the log, press the magnifying glass  on the home screen of the Heater, which brings up the heater status screen. Then press the "Error History" button. Active errors will be displayed.



Pressing the  on the error you want to investigate to bring up individual errors and to display the status of the heater just prior to the error



Error & Alarms Explanation

Errors will cause the Heater to automatically shut down. Alarms will permit the Heater to continue operating but will display warnings of conditions that may cause a shutdown if left unattended. In each case, a brief description of the error or alarm will be shown on the screen with an abbreviated remedy.

The display will continue to show the alarm or error until the “OK” button is pressed. The oldest unacknowledged alarm condition is shown even if the Heater shuts down due to an error. Pressing the “OK” button will show consecutive alarm conditions leading up to the shutdown error.

Example:
The flame rod is failing. This prevents the Heater from having a flame signal. Alarm code 601 (Burner A failed to ignite) is displayed and the status light flashes. While this is occurring, the burner is automatically restarting itself (three times max) attempting to light. The burner shuts itself down on error code 446 (Excessive flame failures) after 3 unsuccessful tries.

The display continues to show alarm code 601 although the status light is still flashing and the burner is shut down due to an error. Press the green check mark to clear each alarm code and then to clear error code 446. After error code 446 is cleared, the operator can attempt to restart the burner.

Error & Alarms List

ALARM 422
LOW FIRE SWITCH STAYS ON: Did the fuel mod motor fail to open?

ALARM 423
LOW FIRE SWITCH NEVER ON: Did the fuel mod motor fail to close?

ALARM 432
MOMENTARY LOW AIR FLOW: This ERROR is an indication that a choke of the air flow is occurring. It is displayed when the Air Flow Transducer (AFT) detects low air flow for less than 3 seconds. If air flow is ok, the low air flow limit may be set too high. See "AIR Flow" in the "Setup - Home" section of manual for adjustment.

ERROR 433
LOW AIR FLOW: This ERROR occurs when the air flow is interrupted for more than 3 seconds. Verify proper air flow and adjust alarm threshold of Air Flow Transducer (AFT) setting if necessary. See "AIR Flow" in the "Setup Home" section of manual for adjustment of the "alarm" threshold.

ERROR 435
UPSTREAM GAS LEAK DETECTED – CHECK SSOV1 FOR LEAKS: This is a serious ERROR caused by a leak in the SSOV1 (this is the "upstream" gas valve). In the "System Tests" section, select "Run New Leak Test" to access control of the fuel valves to determine the severity of the leak. This ERROR is normally a result of contamination under the valve seat of SSOV1. If severe contact the factory for service.

ALARM 438
FAN INTERLOCK BYPASSED: Samuel Jackson burner controls are provided with a fan interlock relay (FIR) to provide immediate shutdown of the burner when the air fan is turned off. This ERROR indicates that an electrical signal is being received through the fan interlock with no airflow present, effectively bypassing this important safety feature.

ALARM 439
AIR FLOW SENSOR BYPASSED: This ERROR indicates that air flow is being sensed from the Air Flow Transducer (AFT) with no fan interlock (FIR) signal present 10 minutes after turning the Heater off, effectively bypassing this important safety feature. Check the adjustment of the Air Flow Transducer alarm threshold and verify its operation. See "Air Flow" in the "Setup - Home" section of manual for adjustment of the limits.

ALARM 440
SSOV1 FAILED TO OPEN: A Proof of Closure (POC) switch on the bottom of first SSOV1 ("upstream" valve) that tells the PLC when the valve is closed and has failed. Check for loose wires and that SSOV1 valve is actually opening.

ALARM 441
SSOV1 FAILED TO CLOSE: The PLC was not able to verify that Safety Shut-Off Valve 1 (upstream SSOV1 valve) is opening and closing in a timely manner. If this problem persists, try the following: Check that SSOV1 opens and closes. Check operation of SSOV1 proof of closure switch (POC). Replace SSOV1 valve actuator and/or its proof of closure switch. See "FUEL SYSTEM" section of "TESTS" for testing of the valves.

ALARM 442
SSOV2 POC STAYS ON: A Proof of Closure (POC) switch on the bottom of first SSOV2 ("downstream" valve) that tells the PLC when the valve is closed and has failed. Check for loose wires and that SSOV2 valve is actually opening.

ALARM 443
SSOV2 POC NEVER ON: The PLC was not able to verify that Safety Shut-Off Valve 2 (downstream SSOV2 valve) is opening and closing in a timely manner. If this problem persists, try the following: Check that SSOV2 opens and closes. Check operation of SSOV2 proof of closure switch (POC). Replace SSOV2 valve actuator and/or its proof of closure switch. See "FUEL SYSTEM" section of "TESTS" for testing of the valves.

ERROR 445
FLAME FAILED IN OPERATION: The burner stopped after the flame was established. See care tips below.

TIPS

THE FOLLOWING MAINTENANCE TIPS WILL HELP TO MINIMIZE FLAME FAILURE ALARMS:

- Turn off power to the control panel.
- Clean the spark plug if it appears dirty.
- Scrape off the flame electrode and wipe the ceramic insulator with a clean cloth. Make sure the power is switched off before doing this.
- See the "BURNER ORIFICE ALIGNMENT" section in this manual for proper adjustment of the burner orifice to minimize carbon buildup on the flame electrode.
- Check operation of automatic shutters and adjust set-point lower if necessary.
- Inspect the flame rod wire for damaged insulation or exposed wires.
- Make sure the flame rod wire and spark plug wire are connected correctly. The flame rod wire is blue, the spark plug wire is black and looks like an automotive spark plug cable with copper wire core.

ERROR 446
EXCESSIVE FLAME FAILURES: During ignition and operation, flame failures are counted. When the total comes to 3, the PLC shuts the unit down on ERROR 446. Use the

error log to determine which ERRORS were logged before ERROR 446. Knowing which three previous ERRORS caused ERROR 446 may help determine the problem.

ALARM 450
POWER FAULT DURING OPERATION:

ERROR 465
EXTERNAL FLAME CONTROL ALARM: Check flame control for fault code.

ALARM 600
BOTH BURNERS FAILED TO IGNITE: Is fuel present? Is spark present?

ALARM 601
BURNER A FAILED TO IGNITE: Is fuel present? Is spark present?

ALARM 602
BURNER B FAILED TO IGNITE: Check for spark.

ALARM 603
BURNER A FAILED IN OPERATION. Increase minimum fuel valve during run or reduce air flow target.

ALARM 604
BURNER B FAILED IN OPERATION: Increase minimum fuel valve during run or reduce air flow target.

ERROR 605
FLAME A BEFORE FUEL BEFORE SPARK: Check flame rod and flame relay.

ERROR 606
FLAME B BEFORE FUEL BEFORE SPARK: Check flame rod and flame relay.

ERROR 607
FLAME A BEFORE FUEL DURING SPARK: Check for leaking fuel valves.

ERROR 608
FLAME B BEFORE FUEL DURING SPARK: Check for leaking fuel valves.

ALARM 609
BEFORE-MIX THERMOCOUPLE #1 REVERSED: Verify wiring per diagram.

ALARM 610
AFTER-MIX THERMOCOUPLE #1 REVERSED: Verify wiring per diagram.

ALARM 611
BEFORE-MIX THERMOCOUPLE #2 REVERSED: Verify wiring per diagram.

ALARM 612
AFTER-MIX THERMOCOUPLE #2 REVERSED: Verify wiring per diagram.

ALARM 613
BEFORE-MIX HIGH TEMPERATURE LIMIT: Check for low air flow.

ERROR 614
EXCESSIVE FLAME A AFTER SHUTDOWN: Check for leaking fuel valves.

ERROR 615
EXCESSIVE FLAME B AFTER SHUTDOWN: Check for leaking fuel valves.

ALARM 616
HOT BOX TRASH GATE OPEN FOR MORE THAN 20 SECONDS.

ERROR 617
PRESSURE BETWEEN SSOVS FELL MORE THAN 0.5PSI: Check SSOV2 for leaks.

ERROR 618
NO FAN INTERLOCK: Are all fans running?

ERROR 619
FUEL PRESSURE LOW AT FUEL INLET:

ERROR 620
FUEL PRESSURE TOO HIGH AT FUEL INLET:

ERROR 621
LOW PRESSURE AFTER FUEL FILTER: Replace fuel filter.

ERROR 622
LOW PRESSURE AFTER SLAM-SHUT VALVE: Open slam-shut valve or adjust slam-shut trip point higher.

ERROR 623
EXTERNAL HIGH TEMPERATURE LIMIT: Reset high temp limit controller on panel. Check for low air flow.

ALARM 624
NO SIGNAL - GAS PRESSURE #1: Check wiring or replace gas inlet pressure sensor.

ALARM 625
NO SIGNAL - GAS PRESSURE #2: Check wiring or replace pressure sensor after fuel filter.

ALARM 626
NO SIGNAL - GAS PRESSURE #3: Check wiring or replace pressure sensor after slam-shut valve.

ALARM 627
NO SIGNAL - GAS PRESSURE #4: Check wiring or replace pressure sensor before SSOV1.

ALARM 628
NO SIGNAL - GAS PRESSURE #5: Check wiring or replace pressure sensor between SSOV1 and SSOV2.

ALARM 629
NO SIGNAL - GAS PRESSURE #6: Check wiring or replace pressure sensor between SSOV2 and modulating valve.

ALARM 630
NO SIGNAL - GAS PRESSURE #7: Check wiring or replace pressure sensor after modulating valve.

ALARM 631
NO SIGNAL - AIR FLOW #1: Check wiring or replace air flow sensor #1.

ALARM 632
NO SIGNAL - AIR FLOW #2: Check wiring or replace air flow sensor #2.

ALARM 633
NO SIGNAL - AMBIENT TEMP: Check wiring to burner body. Replace ambient temp sensor.

ALARM 634
NO SIGNAL - BEFORE MIX TEMPERATURE #1: Check wiring to BM (red) thermocouple #1. Replace BM thermocouple.

ALARM 635
NO SIGNAL - BEFORE MIX TEMPERATURE #2: Check wiring to BM (red) thermocouple #2. Replace BM thermocouple.

ALARM 636
NO SIGNAL – AFTER MIX TEMPERATURE #1: Check wiring to AM (blue) thermocouple #1. Replace AM thermocouple.

ALARM 637
NO SIGNAL – AFTER MIX TEMPERATURE #2: Check wiring to AM (blue) thermocouple #2. Replace AM thermocouple.

ALARM 638
NO SIGNAL - CUSTOM TEMPERATURE: Check wiring to custom temp thermocouple. Replace thermocouple.

ALARM 639
NO SIGNAL - FUEL FLOW: Replace fuel flow sensor.

ERROR 640
HIGH GAS PRESSURE: Reset high gas pressure switch on gas train. Check regulator or supply.

ERROR 641
LOW GAS PRESSURE: Reset low gas pressure switch on gas train. Check supply, filter, or slam-shut.

ERROR 642
LOW AIRFLOW: Check for airflow problem. Check airflow switch.

ERROR 643
HIGH GAS PRESSURE PAST THE REGULATOR: Check the correct operation of the regulator.

ALARM 644
NO LEAK TEST LAST 7 DAYS: Test will automatically be performed at next shutdown.

ALARM 645
STARTUP TAKING TOO LONG: Reboot PLC or call factory.

Troubleshooting

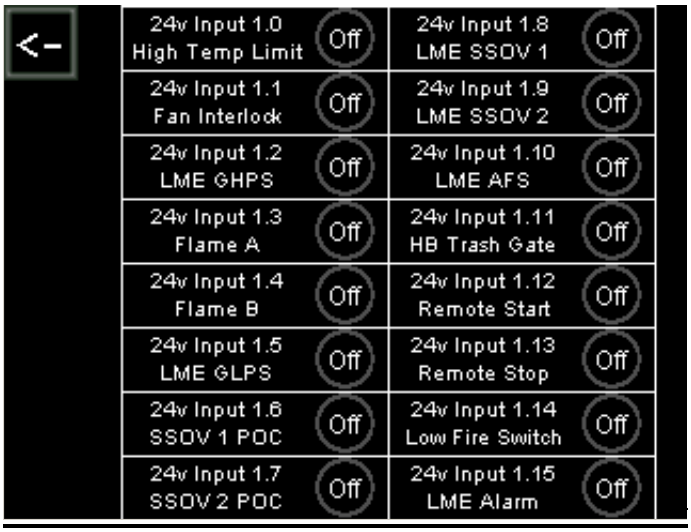
Using PLC input and output lights

Knowing the input and output conditions of the PLC can help diagnose problems, often without the need for an electrician or a voltmeter. Most of the voltage inputs and outputs (such as voltage signal showing on/off condition of a switch) have small red lights that are shown on the face of the PLC. Electrical Schematics (included in this manual and located on the inside door of the cabinet) show the input/output numbers for the PLC.

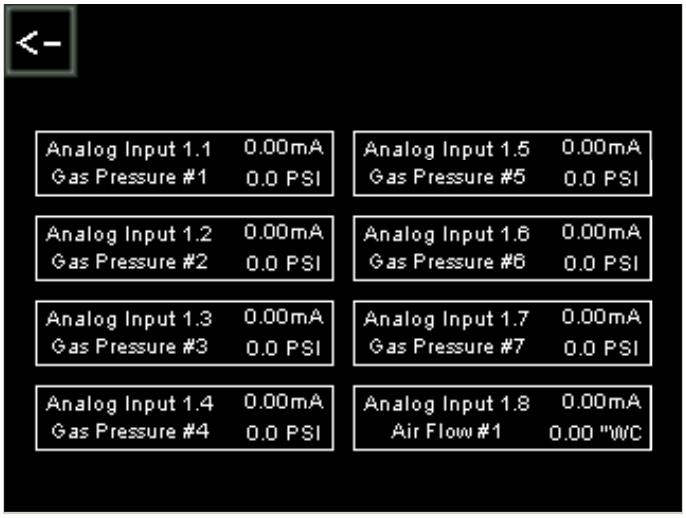
Using Touch Screen Diagnostic Display

From the Home screen, press the Magnifying Glass. In the lower-left corner press the Diagnostics button. You'll be taken to a page as shown below. Each card on the PLC is represented with an area that you can touch to show more detail on the condition of each input or output point.

Discrete input and output cards have screens as shown below. A description of the input type and internal reference number are followed by a short description of the point's use and then status of the input or output.



Analog input and output cards have screens as shown below. A description of the input type and internal reference number are followed by a short description of the point's use and then the milli-amp (mA) value that should be measured using a multimeter. A scaled engineering value is also provided for points that have one defined.



Test Functions

Note: The Cobalt Heater must be in Service Mode to run test functions on the safety valves.

Preliminary

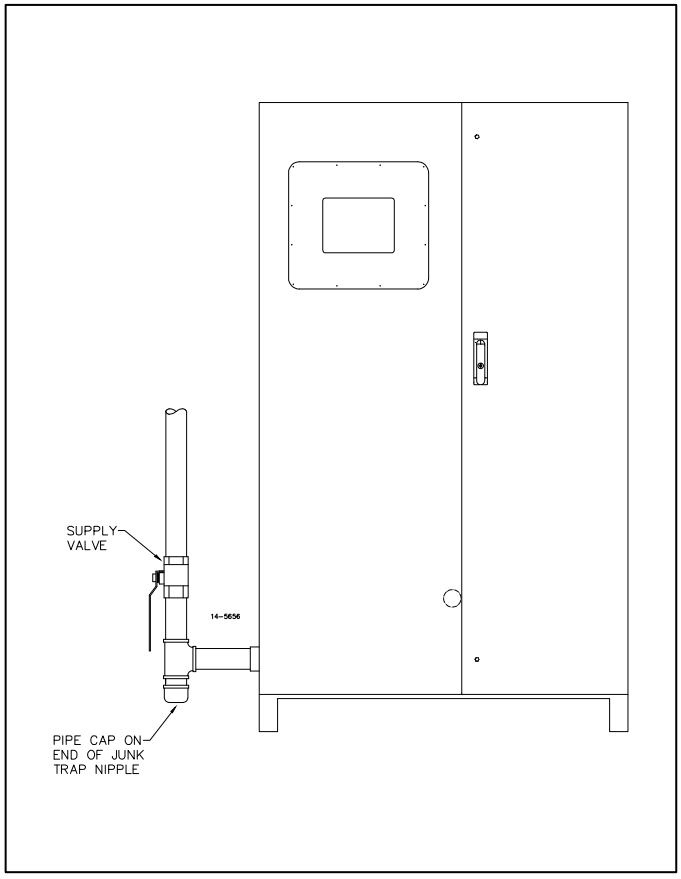
To test a new installation, first check that all necessary connections for electrical and gas are made. Make sure the supply voltage (120/208/240/277VAC) is landed on the proper terminal on the control panel. A transformer is standard on the Cobalt control cabinet and allows the use of these specific voltages without extra hardware. Natural gas or propane vapor supplied to the Heater should be regulated for 6 to 25 PSI (0.4 to 1.7 bars).

With electrical power off, prepare to purge the gas line of debris and air by closing off the gas supply valve before the Heater's regulator and having the main gas supply on. Open the pipe cap on the end of the short junk trap nipple under the supply valve and quickly open/close the gas supply valve several times. Debris in the pipe will blast out. Keep doing this until gas is noticeable then apply pipe sealant to pipe cap and replace on end of junk trap nipple.

While purging the gas line, make sure good ventilation is present and no one is smoking!

Do not use your hand to test for presence of junk in the gas line!

Gas Supply Inlet Valve and Junk Trap



Turn on the electrical power to the cabinet but leave the circuit breaker (CB) off. Check that power to terminals L and N on the electrical panel is between 103 and 125 VAC. Turn on the circuit breaker (CB).

Check that the thermocouples are connected and hooked to the correct terminals on the electrical panel. If a temperature shows 777 on the color touch panel, then the thermocouple is not connected. A good test to check that thermocouple is connected to correct panel terminals is to disconnect one of the wires in the thermocouple. The temperature displayed for that thermocouple (before mix or after mix) should be 777. When disconnecting a wire from the thermocouple, it is important to not let the wire touch the metal casing of the thermocouple. Doing so may cause a short, burning out a fuse or the PLC input.

To access the test program, select the wrench button  on the Home Screen and enter the password. Select "Test Program". This button is only displayed when the flame is off.

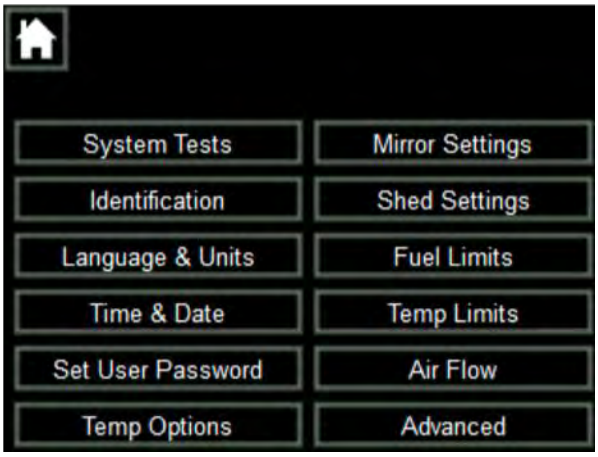
TIPS

The default password is 1234. The user can change this password after accessing the setup screen.

Heater Setup Screen

Press the "HOME" button to go to main (home) screen when finished.

Press "System Tests" to test key components in the heater.



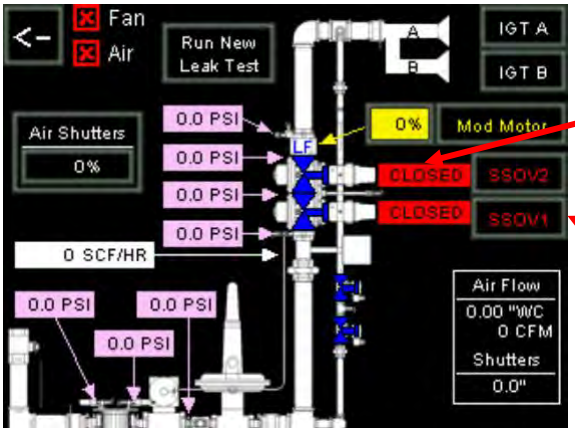
Safety Valves

Operating the safety valves (labeled SSOV1 and SSOV2) allows you to check several critical points of operation. Below is a suggested order of operations and things to verify during each.

1. Verify that gas pressure is present on the first 4 pressure readings, starting from the bottom-left. If the readings are different after the 3rd sensor, check to make sure that the slam-shut valve is open and working properly.

2. Press the button for SSOV1. Pressure should now read on the 5th sensor and the indicator should change from Closed to Opening to Open as the button is held down.

3. Press the button for SSOV2. Pressure should return to zero on the 5th sensor. You may not see the readings on the 6th and 7th sensors.



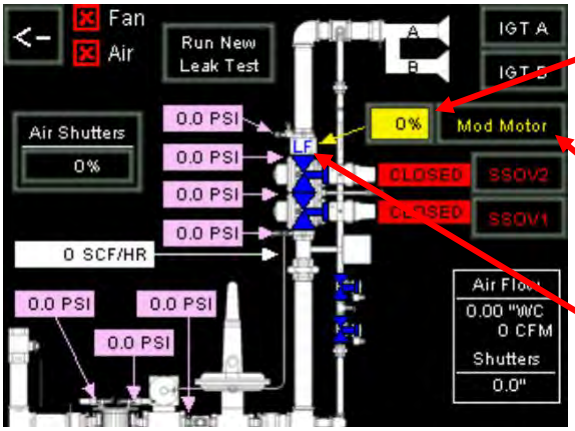
Indicates status of actuator and proof-of-closure switch

Applies power to Safety Shut-Off Valve actuator while pressed

Gas Pilot Valves are located on the right-hand side of the gas train. They are only used in Compliance mode and are not included in Service Mode tests.

Gas Valve Motor

The operation and adjustment of the Gas Valve Motor (GVM) is checked here. Select Mod Motor to supply 110V to GVM for testing.

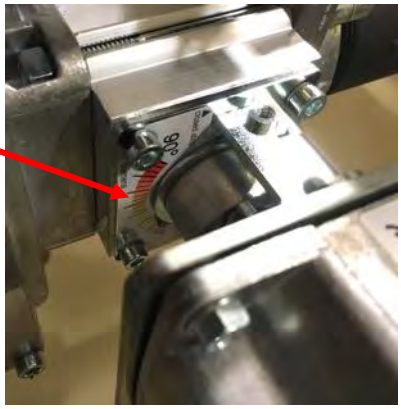


Select this button and enter a percentage for the valve to open. 4mA DC signal is supplied to valve for 0%, 20 mA DC for 100%.

Turns 120VAC power on/off to GVM.

"LF" indicates Low Fire switch is active

Gas Valve Motor (GVM)

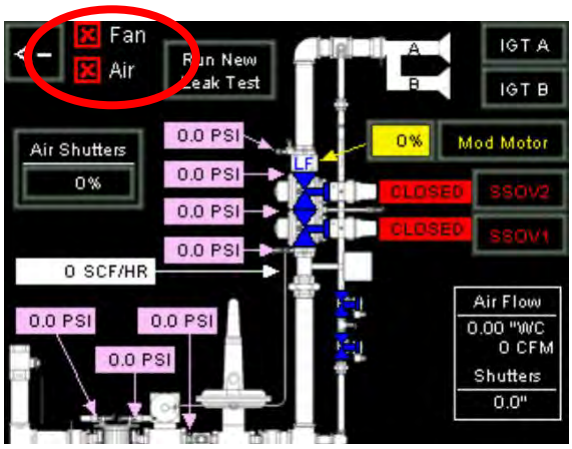


Gas Valve Position Indicator

AFS AND FAN INTERLOCK

The operation of the Air Flow Sensor (AFS) and Fan Interlock (FIR) can be checked here. Begin by adjusting the air in the drying system. When the air volume is satisfactory, the Heater will automatically open and close the shutters to reach the velocity pressure target (default 0.4" w.c.). This value will be used to calculate an estimated airflow in Cubic Feet per Minute (CFM) through the burner body. When the airflow is above the threshold for 20 seconds, the indicator will turn to a green check.

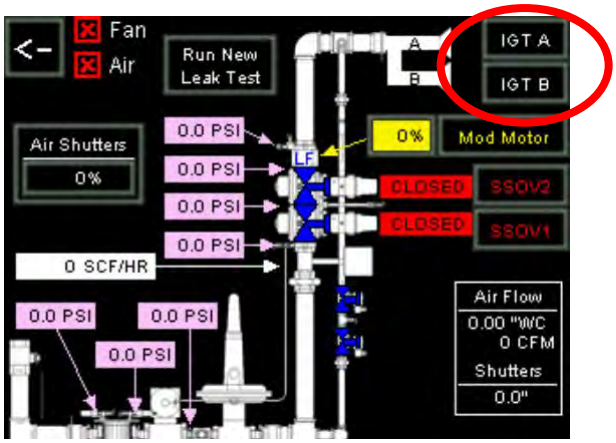
If the fan interlock is not installed, the heater will not light. There should be a green check mark next to "Fan".



IGNITION TRANSFORMER TEST

These buttons allow the user to activate the ignition transformers. Because gas may be present in an ignitable mixture, airflow must be detected for 20 seconds before the buttons will become active.

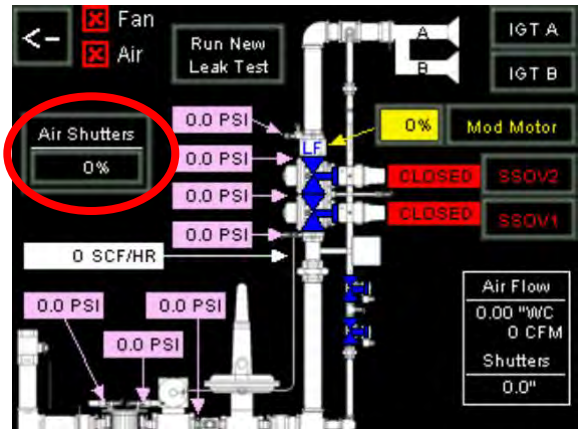
With the fans running, press "IGT A". A blue dot should appear to the left, confirming that the output is powered on. Do the same for "IGT B". If it is quiet in the gin, you should hear the hiss of the spark. You should be able to see a faint blue glow in the burner head while the ignition transformer is powered on. It may take more than one person to press the button and view the burner head at the same time. The spark electrode gap should be between 1/16 and 1/8 inch (1.5 to 3mm).



BURNER BODY SHUTTER TEST

Changing this value temporarily overrides the position of the shutters.

Enter 0% to close the shutters fully and 100% to open them fully. Verify that their movement is smooth throughout the range. See the section on shutter adjustment for more information on properly setting the automatic shutters.



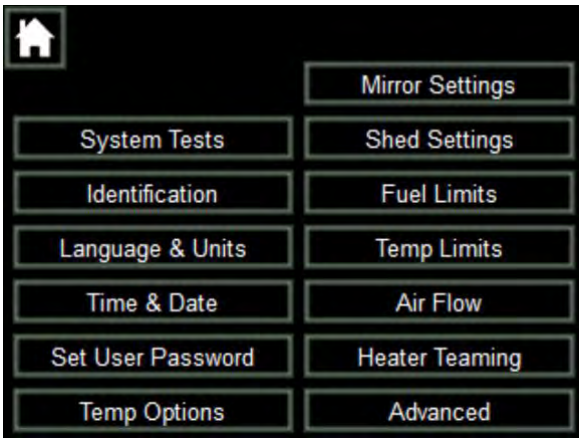
0% Position	100% Position

Additional Settings

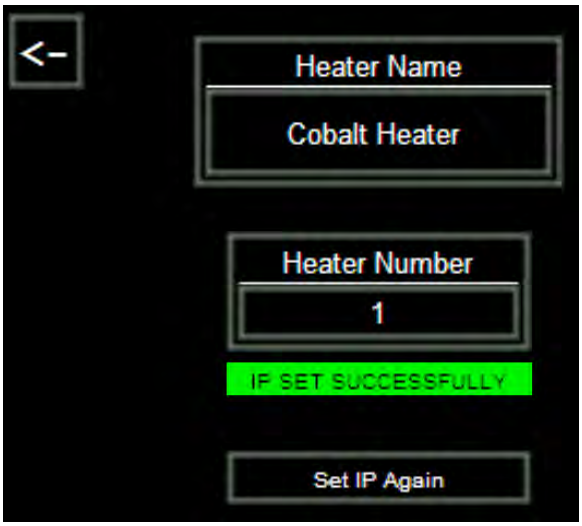
Additional adjustments are made from the Heater Setup screen.

Access the Setup screen by pressing the wrench button  on the color touch panel's home screen then enter the password.

Heater Setup Screen

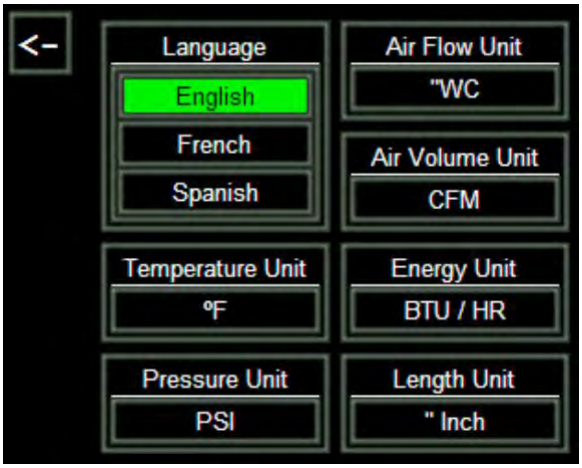


Identification



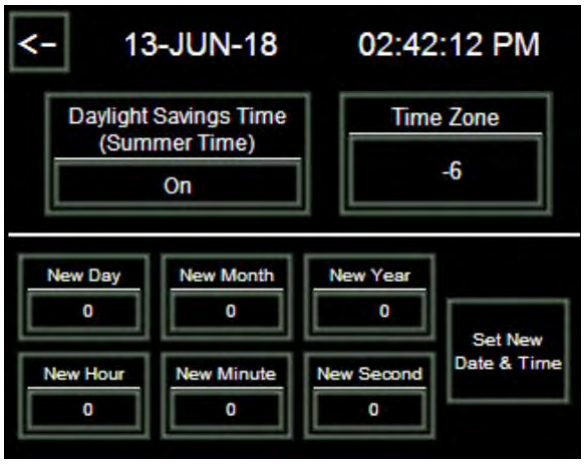
The name will be displayed on the heater's local screen as well as the Moisture Mirror X screen for easier identification.
The heater number controls communications with the Mirror and determines where the heater shows up on the Mirror home screen. Each heater in a gin must have a unique Heater Number or remote control will not work properly.

Language and Units



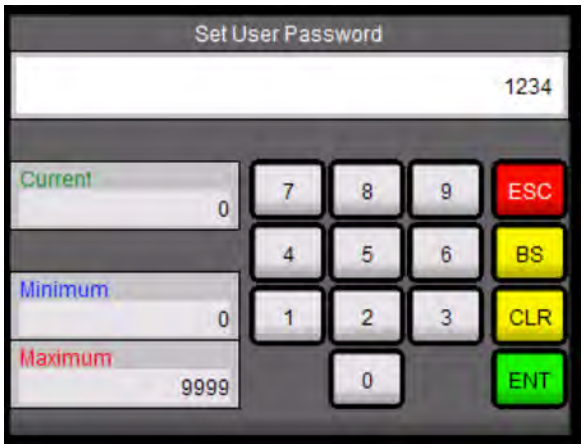
Select language between English, French, and Spanish.
Change Temperature, Pressure, Air Flow, Air Volume, Energy, and Length units.

Time & Date



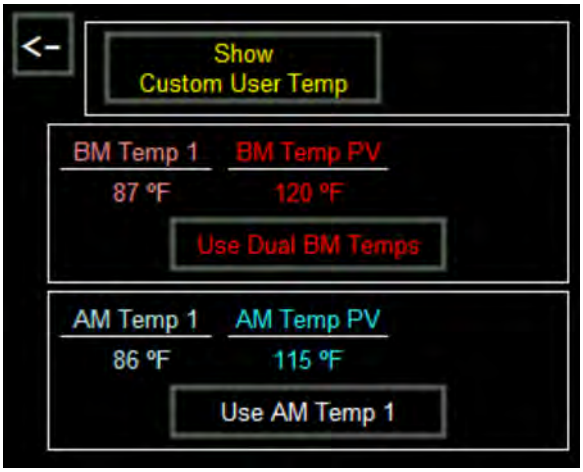
Type in the new time and date and then press “Set New Date & Time”. Be sure that you fill in all current information.

Set User Password



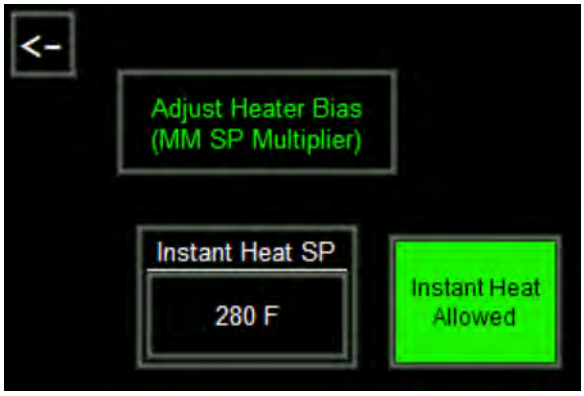
If you need to change the default password of 1234, press this button and type in your desired new password.

Temp Options



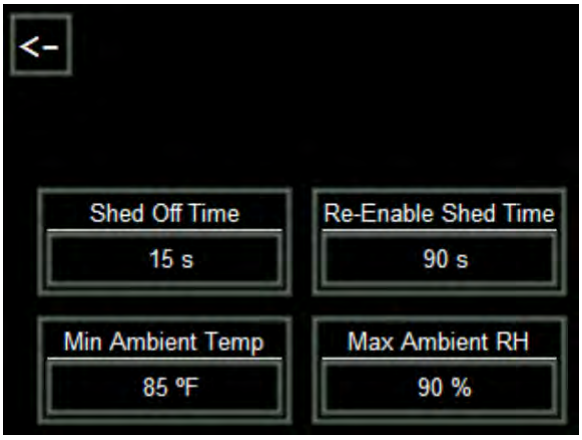
The Cobalt heater has inputs for 2 before-mix temperatures, 2 after-mix temperatures, and 1 custom temperature.
If both 4-20mA before-mix thermocouples are installed, the heater will base control off of the highest reading to ensure high temperature doesn't damage the material or equipment.
When two after-mix thermocouples are used, the lower reading is used for control to ensure that all material gets exposed to the desired drying temperature.
The custom user temperature is not used for control but is displayed, graphed, and logged for future reference.

Mirror Settings



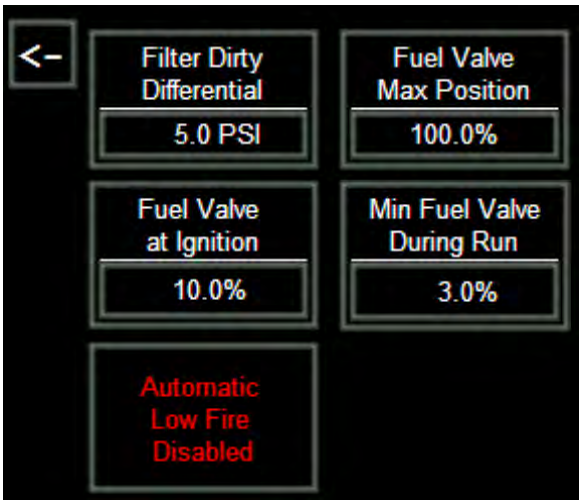
Press the button to adjust the automatic temperature setpoint bias on this heater. The setpoint from the Moisture Mirror X can be biased up or down by 100% in case a given heater needs to always run hotter or cooler than the Mirror would normally call for based on the incoming moisture and drying index settings.
Instant Heat is a new feature for Cobalt heaters where the user can press a button and have all heaters run to a specified temperature instantly for 10 minutes. This is useful for getting machinery up to temperature quickly or getting through an expected wetter section of material.

Shed Settings



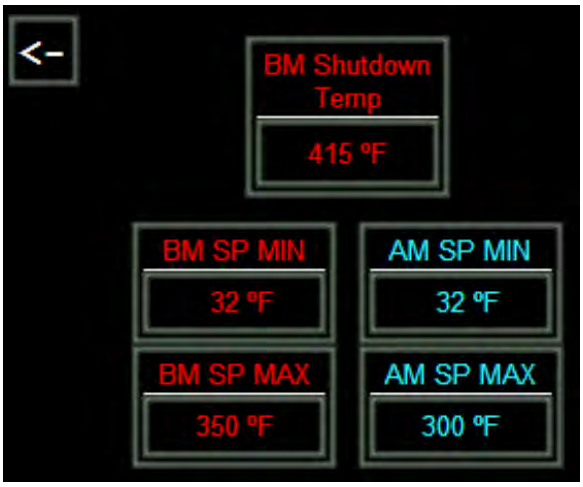
Shed Off Time is how long to keep the flame on after one of the conditions to turn the flame off is met.
Re-Enable Shed Time is how long to wait to re-enable Shed after it is manually turned off. Set this to 0 to never automatically re-enable Shed.
Min Ambient Temp keeps the flame on if the ambient temperature is below the setting.
Max Ambient RH keeps the flame on if the Relative Humidity is above this setting.

Fuel Limits



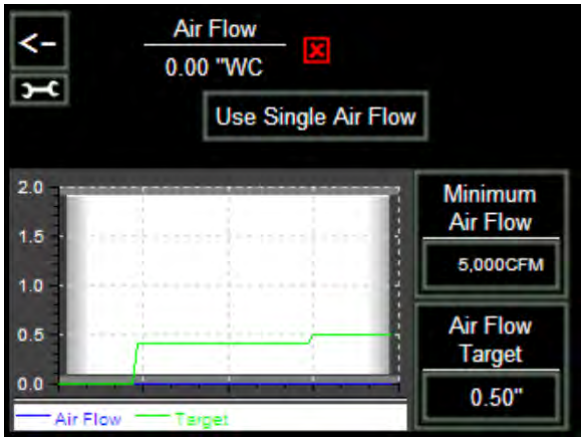
Filter Dirty Differential controls how much pressure drop has be measured across the gas filter before the 'Clean Gas Filter' error is triggered.
Fuel Valve Max Position limits the fuel valve to the set number at all times.
Fuel Valve at Ignition determines the fuel valve position that is used for ignition.
Min Fuel Valve During Run sets the minimum fuel valve position while flame is established.
Automatic Low Fire varies the minimum fuel valve position while flame is established based on the airflow through the heater. A higher Min Fuel Valve Multiplier will keep the valve open more. This setting may not function well on push-fans.

Temp Limits



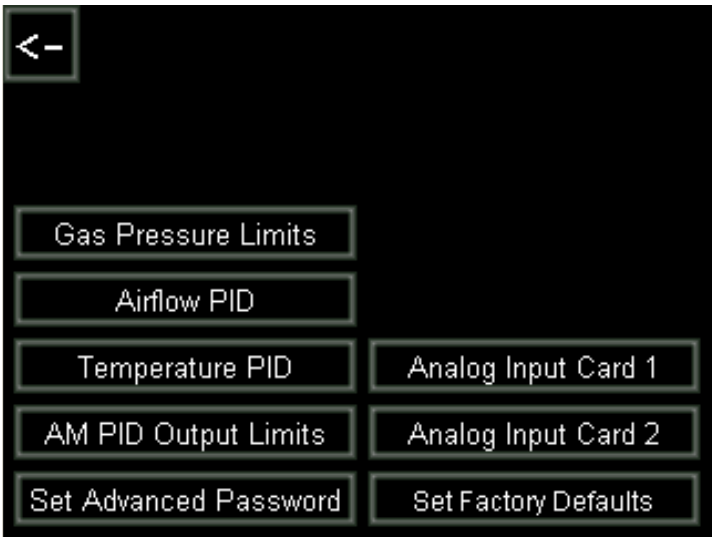
BM Shutdown Temp is the temperature that will trigger the heater to immediately shut down. This setting works with the dedicated High Temperature controller. Whichever is triggered first will stop the heater.
BM and AM SP MIN set the Minimum setpoint for the Before-Mix or After-Mix temperatures.
BM and AM SP MAX set the Maximum setpoint for the Before-Mix or After-Mix temperatures. It is recommended that the BM SP MAX be higher than the AM SP MAX to minimize windup in the control loop. The normal operating temperature drop between the two measurement points should be used to set the differential.

Air Flow



The shutters on the Cobalt burner body moves to maintain an Air Flow Target velocity pressure. This does not affect the volume of air going through the burner, only the velocity. Velocity above 0.40 in.wc. assures proper mixing of air and fuel in the burner head.
Since the shutters move automatically to maintain the set velocity, a calculated Minimum Air Flow is used to determine if airflow is sufficient to support combustion and cooling in the burner body. If this reading falls below the value set for more than 3 seconds, the heater will stop due to “Low Air Flow” (E443).

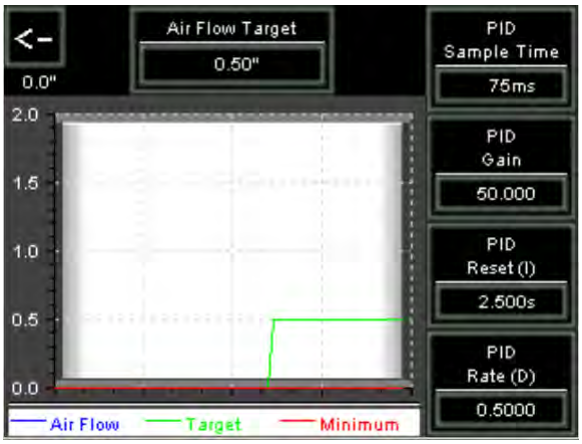
Advanced Settings



Gas Pressure Limits

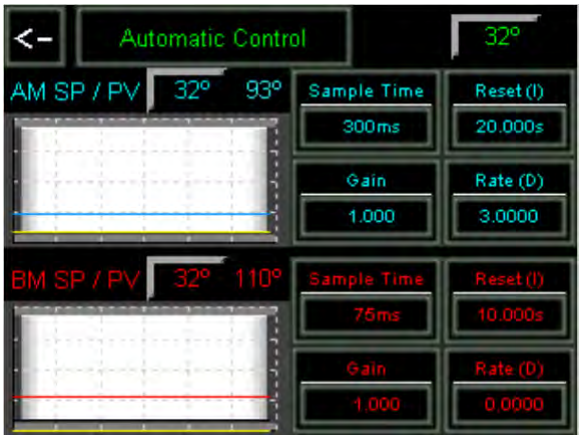
Max Leak Pressure Change sets the threshold for determining whether or not a leak is detected in Diagnostic mode.
Filter Dirty Differential is the pressure differential between GPT1 and GPT2 that triggers the alert to change the gas filter.
Min Incoming Pressure is the minimum pressure that the unit will operate on. Inlet pressure below this setting will trigger an alarm.
Max Incoming Pressure is the maximum pressure that the unit will operate with. An inlet pressure above this setting will trigger an error and stop the unit.

Airflow PID



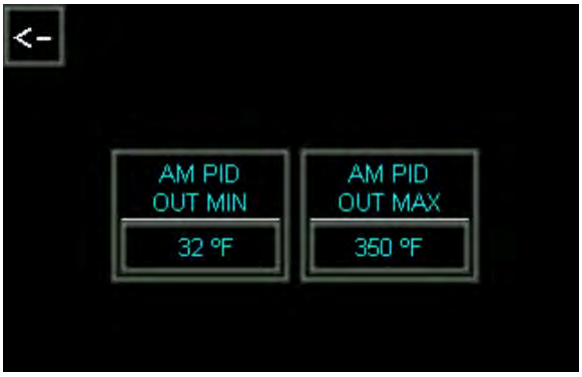
These settings control the action of the actuator that opens and closes the burner body shutters. Consult the factory for specific direction in changing these settings from default.

Temperature PID



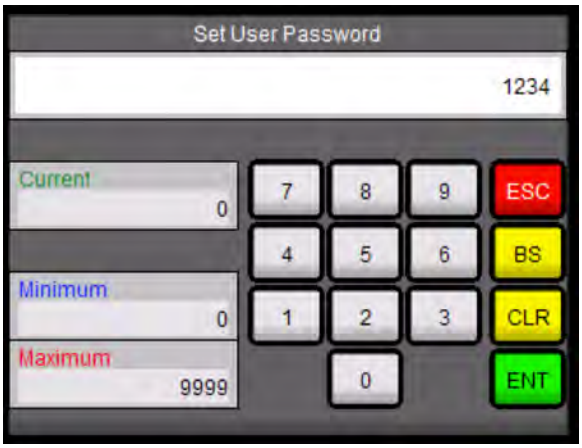
These settings control the action of the gas valve. Please consult the factory before making changes to these settings, as unstable temperature control can result.

AM PID Output Limits



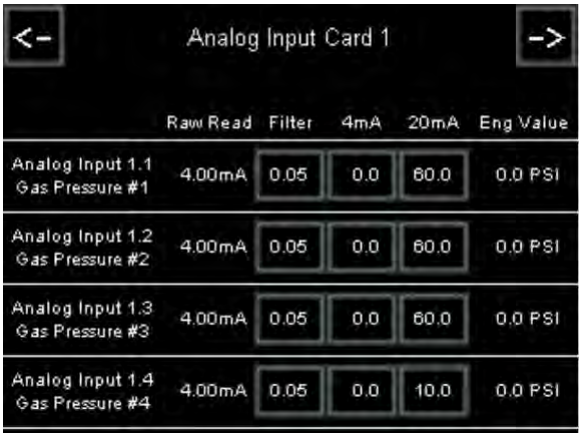
These limit the output of the After-Mix PID loop. Consult the factory before changing these values.

Set Advanced Password



Press this button and type in the new advanced password. Default is 4321

Analog Input Card 1, 2 & 3



These pages allow changes to the scaling of the analog inputs. If a new sensor with a different range is installed, the input point will need to have the 4mA and 20mA engineering values changed to match. Use the arrows in the top corners navigate to other input channels.

Set Factory Defaults

Press this button and type in the advanced password (default: 4321) to reset ALL settings to default.

INSTALLING AND WIRING THERMOCOUPLES

Where to Install Thermocouples

The thermocouples are color-coded to assist the user in the installation of the correct thermocouple in the before and after-mix locations.

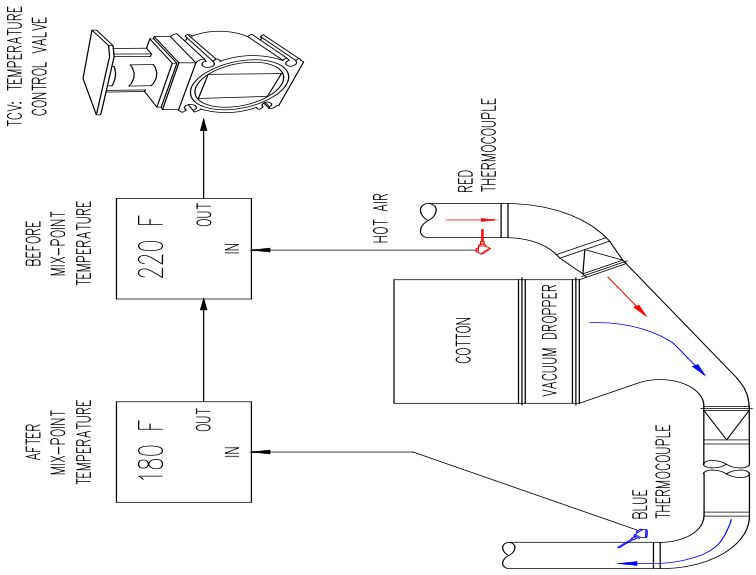
The thermocouples with red on the mounting threads are for installation before the mix-point. This is the high limit thermocouple. The stainless protection sheath is trimmed back exposing the sensing tip for fast response. This exposed thermocouple should not be used in pipes with cotton flow. The Cobalt control cabinet can accommodate two before-mix (red) control thermocouples. If both are connected, fuel valve control will be based on the highest reading. In case one fails, the other will automatically be used for control and the operator will be notified of the failure.

A J-type before-mix thermocouple is required and should be mounted near the before-mix control thermocouple. It functions as a dedicated, high-limit cutoff in both Compliance and Service mode.

The thermocouples with blue paint on the pipe threads are for installation after the mix-point. This is the primary thermocouple. The stainless sheath is left intact over the sensor bulb to protect it from abrasion. The Cobalt control cabinet can accommodate two after-mix (blue) thermocouples. If both are connected, temperature control will be based on the lowest reading to ensure that all material is adequately dried.

Referring to the following figure, placement of the after mix-point thermocouple (blue thermocouple) on the inner radius side after an elbow will protect it from abrasion. Angling the thermocouple 45 degrees in the direction of cotton flow will prevent cotton and trash from tagging on the thermocouple.

Basic Temperature Control



In Samuel Jackson drying systems, the after mix-point thermocouple is placed after the dryer's skimmer in the skimmed air. In some Samuel Jackson drying systems, one after mix-point temperature will be used for controlling the before mix-point temperatures of more than one Heater. The factory will recommend where to place the thermocouples.

For tower, vertical flow, Diamond K, and all other drying systems, the after mix-point thermocouple should be placed at the entrance of the dryer or in the transition immediately before the dryer. Due to the responsiveness of the temperature controls, placing this thermocouple too far away will cause control instability.

For Heaters operating with Hot Boxes and module feeders, with the cotton going to an unloading separator, place the after mix-point thermocouple in the seed cotton pipe before the unloading separator. Call the factory for information on feed control operation when used in conjunction with a module feeder and Heater.

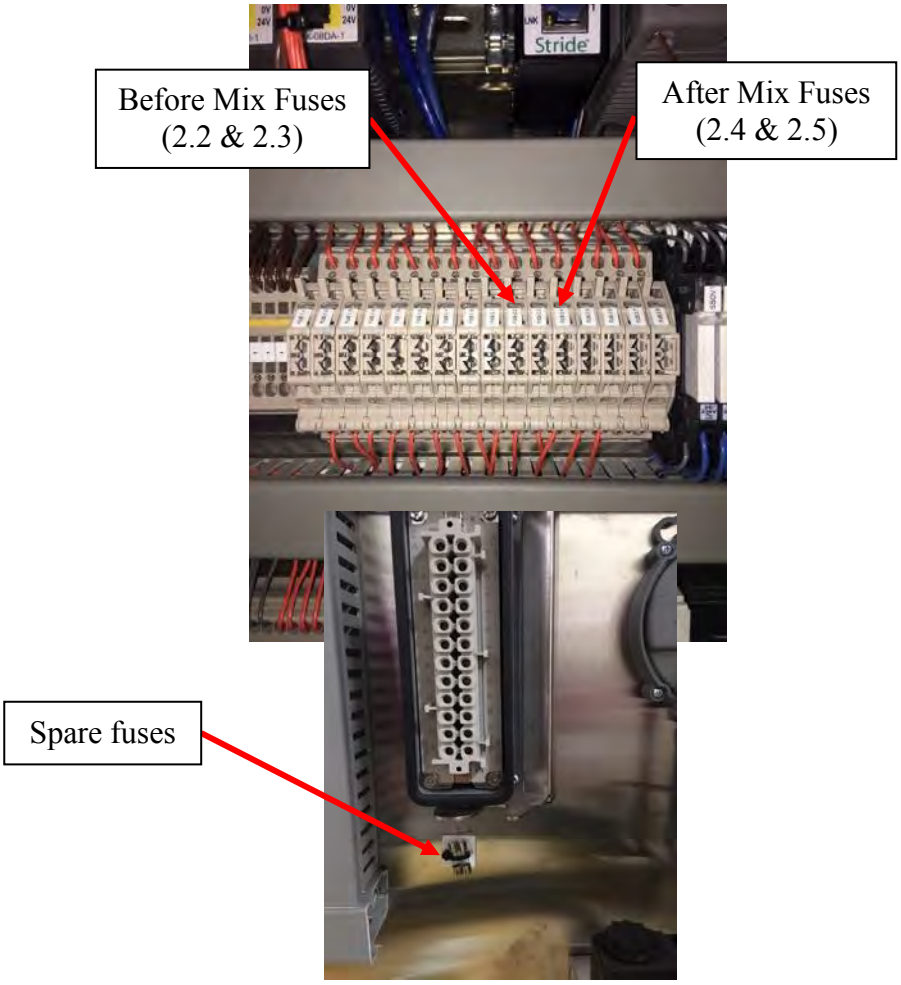
For systems that use pipe drying or do not have a dryer in the second stage, the after-mix thermocouple should be installed at the entrance of the incline cleaners.

WARNING!

Fan Current Interlock

The installing electrician must connect the fan current interlock relay to terminals "Fan" and "+" on the Heater Electrical Panel according to drawing CA14117 located later in this manual. This interlock is an extra safety device. It turns off the burner instantly when the fan motor stop button is touched or if fan current drops below current relay pickup. A relay for this purpose is supplied on the electrical panel of the Heater Unit. It is labeled FIR. The Heater's PLC control system will verify the presence of the fan interlock before permitting operation. If bypassed, the Heater will signal this as an error later in operation.

Analog Fuse Replacement for Thermocouples



The Cobalt Heaters are equipped with fuses for the thermocouples to prevent damage to the input card in case a thermocouple is wired incorrectly. In the event that a fuse is burned out, two spares are provided.

To replace a fuse, do the following:

- □ Make sure the Thermocouple is wired correctly.
- □ Pull the top tab. The fuse holder will rotate out.
- □ The fuse is secured on the right side of the fuse holder. Pry it out using a small screwdriver or similar instrument.
- □ Press the new fuse into position.
- □ Close the fuse holder.

If the fuse continues to burn out, check to see that there are no shorts in the wiring and that the thermocouples are not wired backwards. If needed, contact the factory to order more fuses (Part No. 22285).

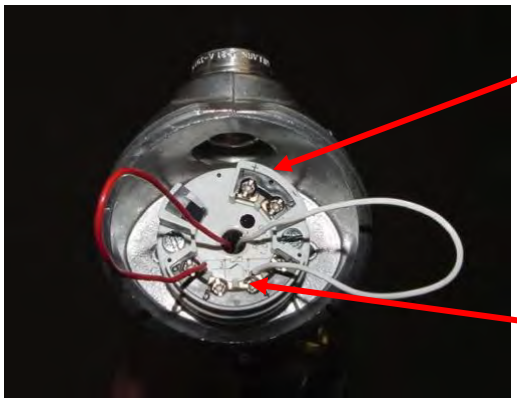
Electrical Installation Notes

SINGLE PHASE SUPPLY TO HEATER: Run 120-277VAC 50/60HZ power to the Heater from a 15-ampere fusible disconnect switch or circuit breaker which you will provide. Land the Neutral wire on terminal N, Ground wire on terminal G, and the Hot wire on the matching voltage terminal. A transformer is included to make sure that the voltage supplied to the electrical components is correct.

ETHERNET CABLE (CAT5 or CAT6): Ethernet cable is used when connecting the Heater to the optional Moisture Mirror X control system. The cable should be category 5, 5E, or 6 (CAT5, CAT5E, or CAT6) and should be of a 100% shielded type or run in a dedicated metal conduit. The maximum cable length is 330 feet (100 meters). Termination on both ends should be made with category 5, 5E, or 6 certified RJ-45 connectors and should follow either the 568A or 568B standard on both ends. Details on terminating Ethernet cables can be found on our website.

THERMOCOUPLE WIRING: (This information can also be found in the "Installing and Wiring Thermocouple" section.) The following rules need to be followed when wiring the thermocouple temperature sensors from the thermocouple to the Heater control panel. The signal from the temperature sensor is 4-20mA DC.

- **Always** use shielded, 2-conductor cable from the thermocouple to the control panel terminal blocks. Terminate the shield only on the cabinet end.
- **Never** run the shielded sensor wires with the power wiring (including 120 VAC control wires). You can run several shielded 4-20mA shielded wires together in the same conduit with other wires marked sensitive on the external connection diagram.



Connect 4-20mA signal wires from heater cabinet to terminals 1 **(+)**, 2 **(-)**.

Red **(-)** wire from Thermocouple junction goes to terminal 6, white **(+)** wire goes to terminal 4.

Cobalt Heater Installation Stub-Ups

NO.	DESCRIPTION	ROUTING AND NOTES
1	BURNER POWER	FROM POWER CENTER TO BURNER CABINET. 120-277 VAC 50/60 HZ, 15 A SUPPLY ½" CONDUIT, 3 - 14 GA WIRES
2	FAN INTERLOCK SIGNAL	FROM GIN CONSOLE OR MOTOR CONTROL CENTER TO BURNER CABINET. ONE ½" CONDUIT WITH TWO 16 GA WIRES FOR INTERLOCK SIGNAL (DRY CONTACT, 24VDC SOURCED FROM PANEL)
3	BURNER IGNITION TRANSFORMER WIRES RUN OVERHEAD	FROM BURNER CABINET TO THE BURNER BODY. ONE 1" STEEL CONDUIT WITH 3 14GA WIRES AND ONE ¼" PLASTIC AIR FLOW TUBE. *
4	BURNER FLAME ROD WIRES AND GROUND WIRE RUN OVERHEAD	FROM BURNER CABINET TO THE BURNER BODY. ONE 1" STEEL CONDUIT WITH 3 - 14 GA WIRES AND ONE ¼" PLASTIC AIR FLOW TUBE. *
5	BURNER BODY ANALOG	½" CONDUIT WITH 5 18 GA WIRES DO NOT RUN WITH AC VOLTAGE WIRES. OKAY TO RUN WITH OTHER THERMOCOUPLE OR DC VOLTAGE SENSOR WIRES
6	THERMOCOUPLES: PRIMARY (MARKED BLUE)	½" CONDUIT WITH SHIELDED 2 CONDUCTOR, 18 GA CABLE. DO NOT RUN WITH AC VOLTAGE WIRES. OKAY TO RUN WITH OTHER THERMOCOUPLE OR DC VOLTAGE SENSOR WIRES.
	HIGH LIMIT (MARKED RED)	HOT AIR BEFORE MIX POINT: ½" CONDUIT WITH SHIELDED 2 CONDUCTOR, 18 GA CABLE. DO NOT RUN WITH AC VOLTAGE WIRES. OKAY TO RUN WITH OTHER THERMOCOUPLE OR DC VOLTAGE SENSOR WIRES.
	HIGH TEMP (MARKED RED)	J-TYPE THERMOCOUPLE WIRE. CAN BE RUN IN SAME CONDUIT AS HIGH LIMIT THERMOCOUPLE.

Cobalt Heater Installation Stub-Ups (Continued)

7	GAS SUPPLY FOR BURNER	2" GAS SUPPLY LINE. NATURAL GAS OR PROPANE. 8 TO 25 PSI, 0.4 TO 1.7 BARS. SEE *RECOMMENDED MINIMUM PIPE SIZES* IN MANUAL FOR NOMINAL RECOMMENDED PIPE SIZES.
8	CONNECTION TO MIRROR X (OPTIONAL)	FROM BURNER CABINET TO MIRROR X: ½" STEEL CONDUIT WITH ONE CAT5B ETHERNET CABLE WITH RJ-45 TERMINATION (BOTH ENDS). DO NOT RUN WITH ANY AC POWER WIRES.
9	HOT BOX II TRASH GATE OPEN SWITCH (OPTIONAL)	½" CONDUIT, 3 -14 GA WIRES OKAY TO RUN WITH THERMOCOUPLE WIRE OR OTHER DC WIRES.

* FOLLOWING SUPPLIED WITH HEATER

¼" BLACK AIR FLOW TUBE - 25 FEET
¼" WHITE AIR FLOW TUBE - 25 FEET
BURNER FLAME ROD WIRE (BLUE) - 50 FEET
SHIELDED 2 CONDUCTOR, 18 GA CABLE - 200 FEET
J-TYPE THERMOCOUPLE WIRE – 100 FEET

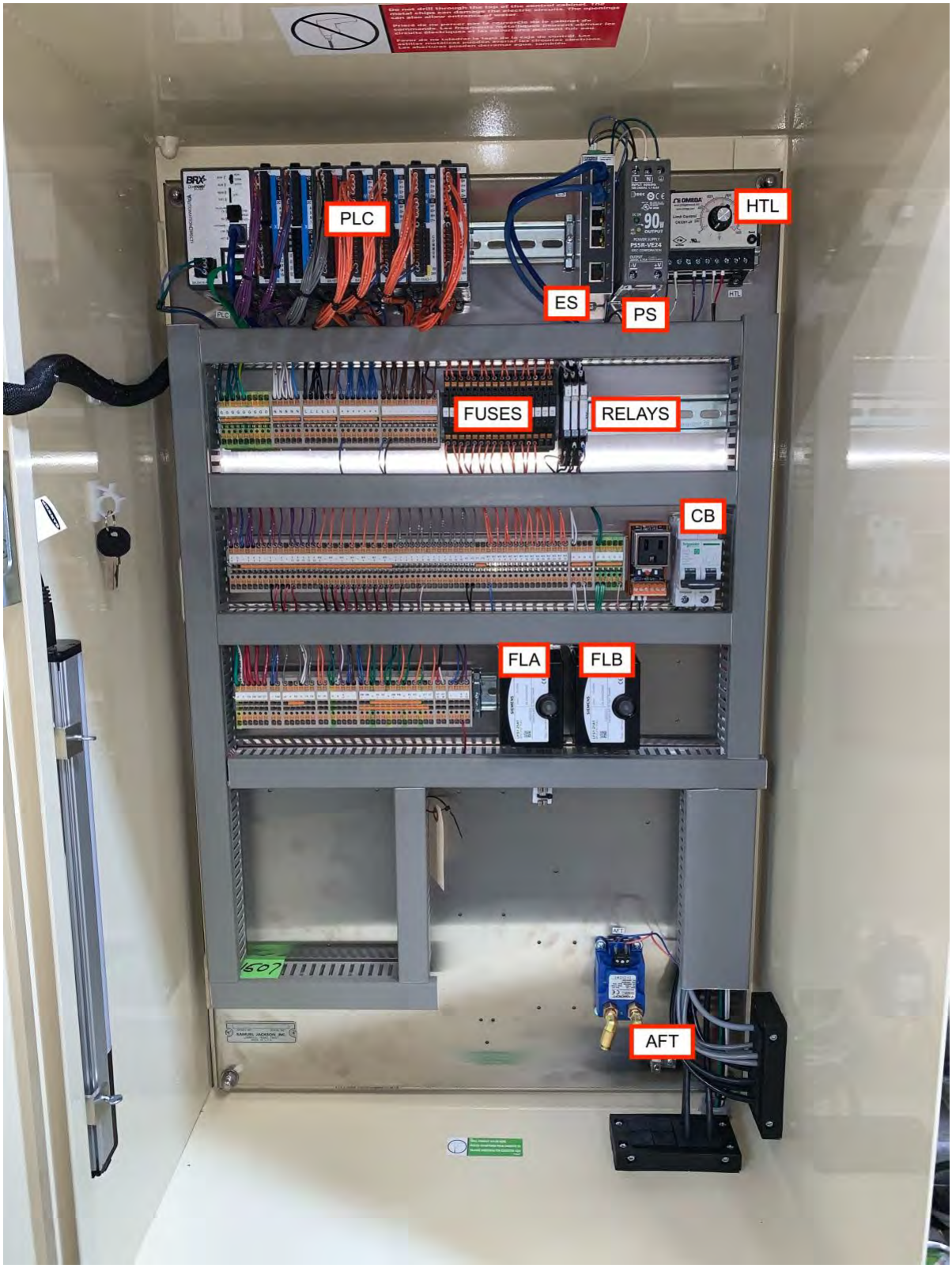
Component List for Cobalt Heaters

SYMBOL	PART NAME, NUMBER, MFR'S TYPE	LOCATION
AFS	AIR FLOW SWITCH 24595, DWYER 1710-0	CONTROL PANEL
AFT	AIR FLOW TRANSDUCER 22446, CX8FO12IW	CONTROL PANEL
BFLM	B FLAME MONITOR 26540, LFS1.21A1*	CONTROL PANEL
CB	CIRCUIT BREAKER 22174, MG17414	CONTROL PANEL
ES	ETHERNET SWITCH 23702C, 1240840000	CONTROL PANEL
FE	FLAME ELECTRODE 12399A, CA390	BURNER HEAD
FIL	FAN INTERLOCK RELAY 25107, TRZ 24-230VUC 1CO	CONTROL PANEL
FLA	FLAME RELAY A 26540, LFS1.21A1*	CONTROL PANEL
FLB	FLAME RELAY B 26540, LFS1.21A1*	CONTROL PANEL
GF	GAS FILTER 24350A SPARE FILTER ELEMENT AND COVER GASKET 24732	GAS TRAIN
GPG1	GAS PRESSURE GAGE 1 25666, 2 ½" DIAL, 0-60 PSI, ¼ NPT BACK CENTER	GAS TRAIN
GPG2	GAS PRESSURE GAGE 2 25665, 2 ½" DIAL, 0-10 PSI, ¼ NPT BACK CENTER	GAS TRAIN

SYMBOL	PART NAME, NUMBER, MFR'S TYPE	LOCATION
GPG3	GAS PRESSURE GAGE 3 25665, 2 ½" DIAL, 0-10 PSI, ¼ NPT BACK CENTER	GAS TRAIN
GPG4	GAS PRESSURE GAGE 4 25665, 2 ½" DIAL, 0-10 PSI, ¼ NPT BACK CENTER	GAS TRAIN
GPR	GAS PRESSURE REGULATOR 19240, 121-8HP	GAS TRAIN
GVM	GAS VALVE MOTOR 25162, SQM40.155R11	GAS TRAIN
HTL	HIGH TEMPERATURE LIMIT 24464, CN3261-JF	CONTROL PANEL
HTTC	HIGH TEMPERATURE THERMOCOUPLE (RED), BEFORE MIXPOINT 18065B, 8", TYPE 'J'	PIPING BEFORE MIXPOINT
IGP	IGNITER PLUG 12398A, CA475	BURNER HEAD
IGTA	IGNITION TRANSFORMER A 21706, 2260-TW	BURNER BODY
IGTB	IGNITION TRANSFORMER B 21706, 2260-TW	BURNER BODY
LBB	LUBRICATED BUSHING 25206	BURNER BODY
PLC	PROGRAMMABLE LOGIC CONTROL 25678, BX-DM1E-M-D, CPU 25679, BX-16ND3, DC INPUT 25680, BX-16TR, RELAY OUTPUT 25681, BX-08AD-1, 4-20mA INPUT 25682, BX-08DA-1, 4-20mA OUTPUT	CONTROL PANEL
PS	POWER SUPPLY, 120VAC TO 24VDC 25667, PS5R-VE24	CONTROL PANEL
RA	ROTARY ELECTRIC ACTUATOR 24926, AMQX24-MFT	BURNER BODY

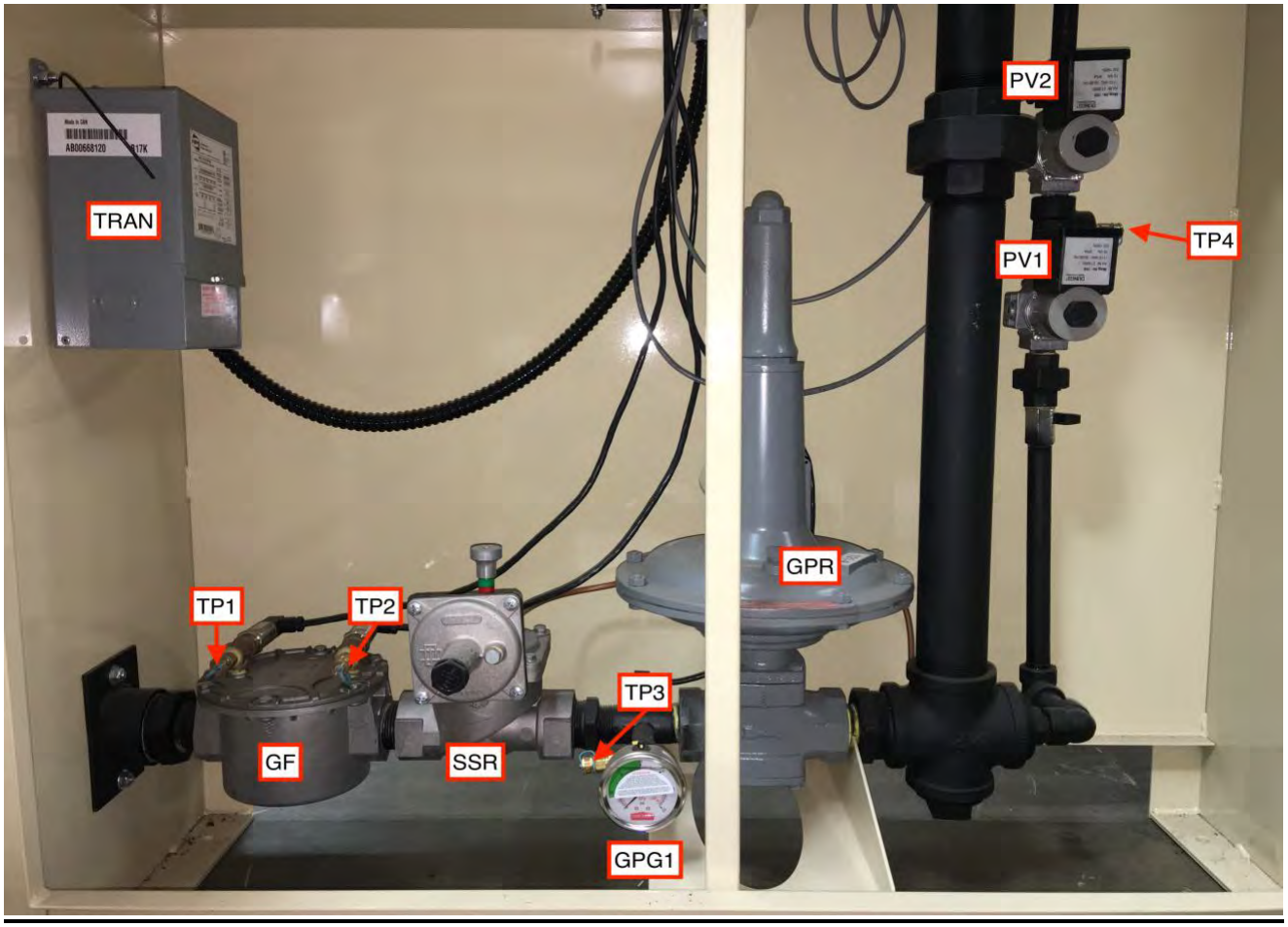
SYMBOL	PART NAME, NUMBER, MFR'S TYPE	LOCATION
SB	SHOULDER BOLT 24923	BURNER BODY
SSOV1	SAFETY SHUT OFF VAVLE 1 25157, SKP15.001E1	GAS TRAIN
SSOV 2	SAFETY SHUT OFF VALVE 2 25157, SKP15.001E1	GAS TRAIN
SSR	SLAM SHUT REGULATOR 24349A	GAS TRAIN
TCA	THERMOCOUPLE (BLUE), AFTER MIX-POINT 21708, 8", TYPE 'J', 0-777, 4-20mA	PIPING AFTER MIXPOINT
TCB	THERMOCOUPLE (RED), BEFORE MIX-POINT 21709, 8", TYPE 'J', 0-777, 4-20mA	PIPING BEFORE MIXPOINT
TFB	TEFLON BEARING 25205	BURNER BODY
TP	COLOR TOUCH PANEL 22045B, EA9-T6CL	CABINET DOOR
TP1	TEST PORT 1 24656, PETE'S PLUG 100	GAS TRAIN
TP2	TEST PORT 2 24656, PETE'S PLUG 100	GAS TRAIN
TP3	TEST PORT 3 24656, PETE'S PLUG 100	GAS TRAIN
TP4	TEST PORT 4 24656, PETE'S PLUG 100	GAS TRAIN
TP5	TEST PORT 5 24656, PETE'S PLUG 100	GAS TRAIN
TP6	TEST PORT 6 24656, PETE'S PLUG 100	GAS TRAIN
TP7	TEST PORT 7 24656, PETE'S PLUG 100	GAS TRAIN
TRAN	TRANSFORMER 25210, 120VAC TO 277VAC MULTI-TAP	GAS TRAIN
TCV	TEMPERATURE CONTROL VALVE 25161, VKP40.32	GAS TRAIN

Components Diagram - Control Cabinet

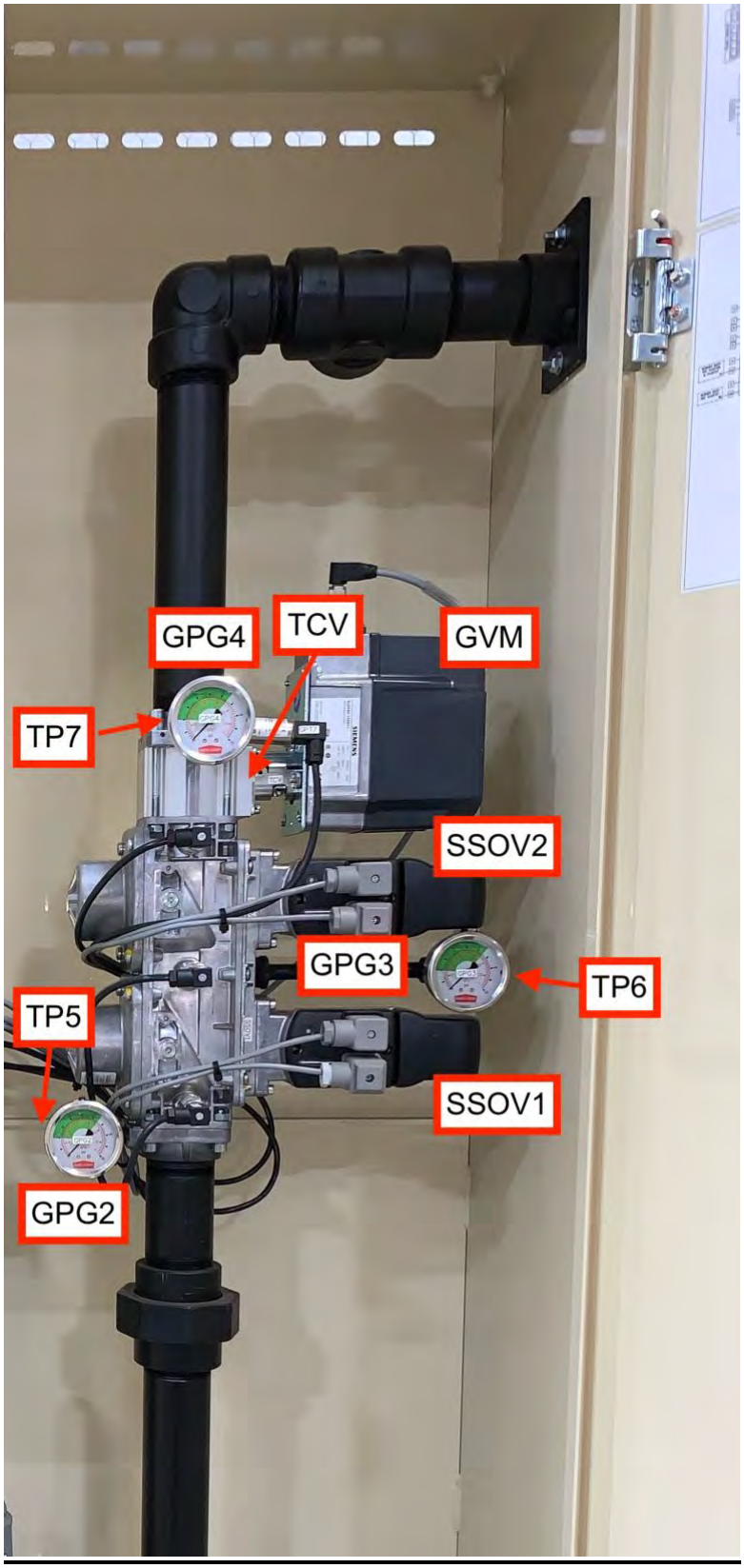


*FLA. FLB & BFLM. LFE 10 is shown. Replace with LFS1.21A1 Conversion Kit 26541 which contains new LFS1.21A1 (26540).

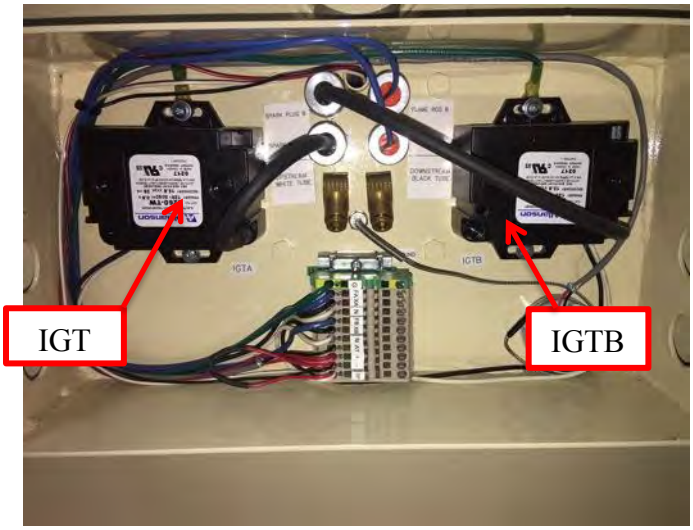
Components Diagram – Gas Train
Lower Section

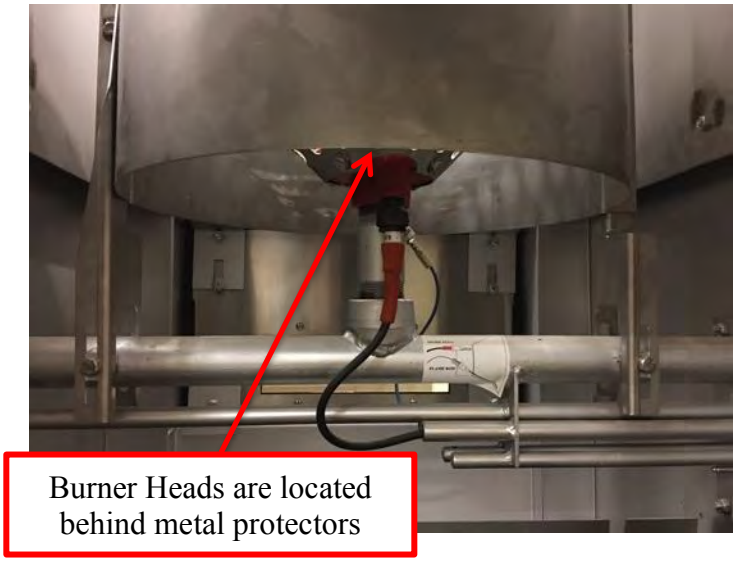


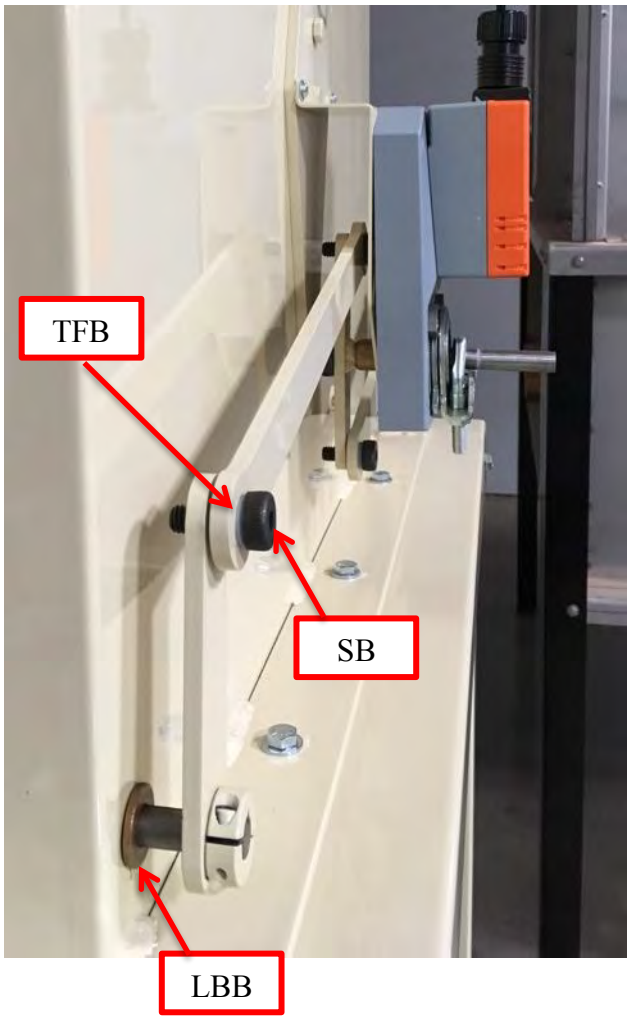
Components Diagram – Gas Train
Upper Section



Components Diagram – Burner Body







Automatic Air Shutters

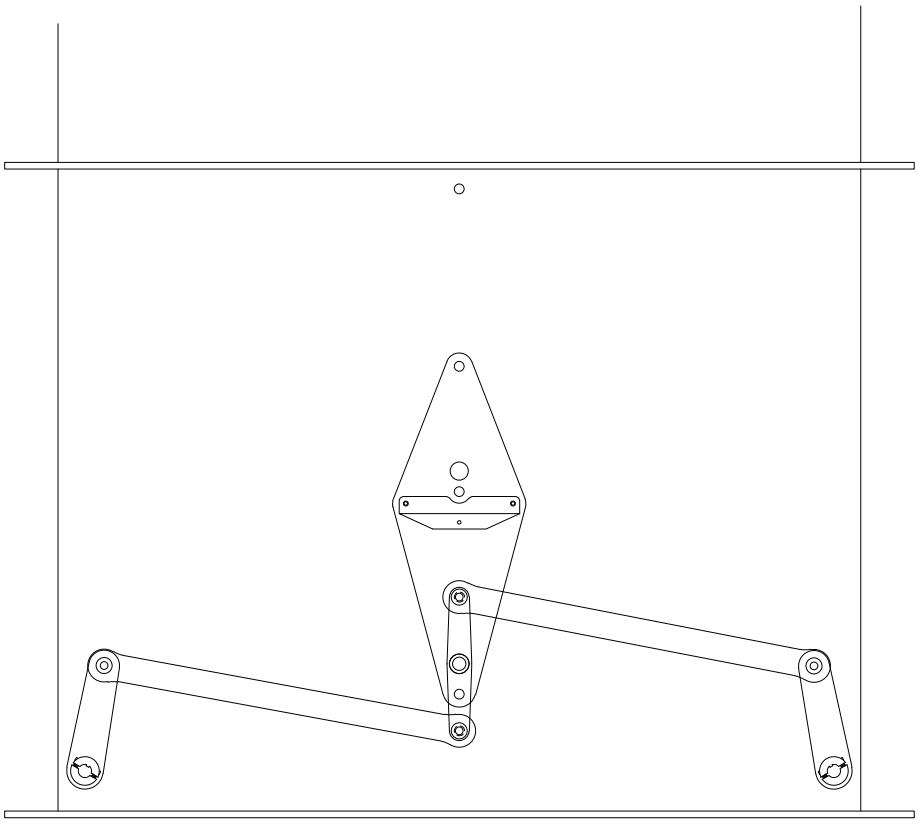
The Cobalt gas burner actively controls the air velocity by constantly adjusting the opening of the airflow shutters. This adjustment ensures that proper mixing of fuel and air happens at all airflow volumes throughout its operating range. This is entirely passive to the drying system and does not change the air volume through the heater or drying system an appreciable amount.

It is important that the proper size burner body is used for the airflow that is anticipated to go through it. Over-sizing the burner body can cause poor combustion quality and lead to lack of turndown and fires. Under-sizing a burner body can cause restriction in the airflow and difficulty lighting.

Single-head burner bodies have an operating airflow range from 5,000 CFM to 17,000 CFM.

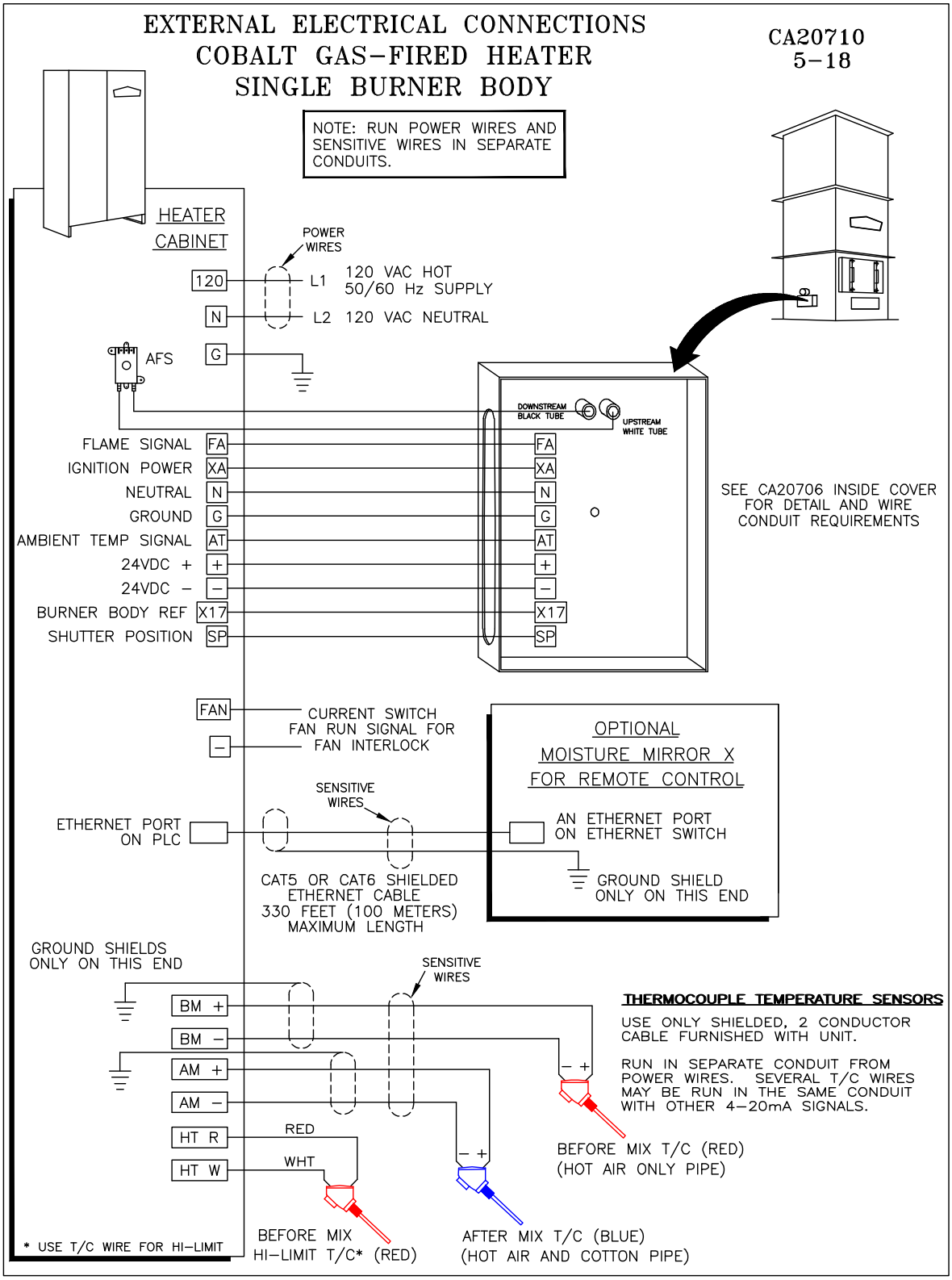
Dual-head burner bodies have an operating airflow range from 15,000 CFM to 32,000 CFM.

Linkage Alignment

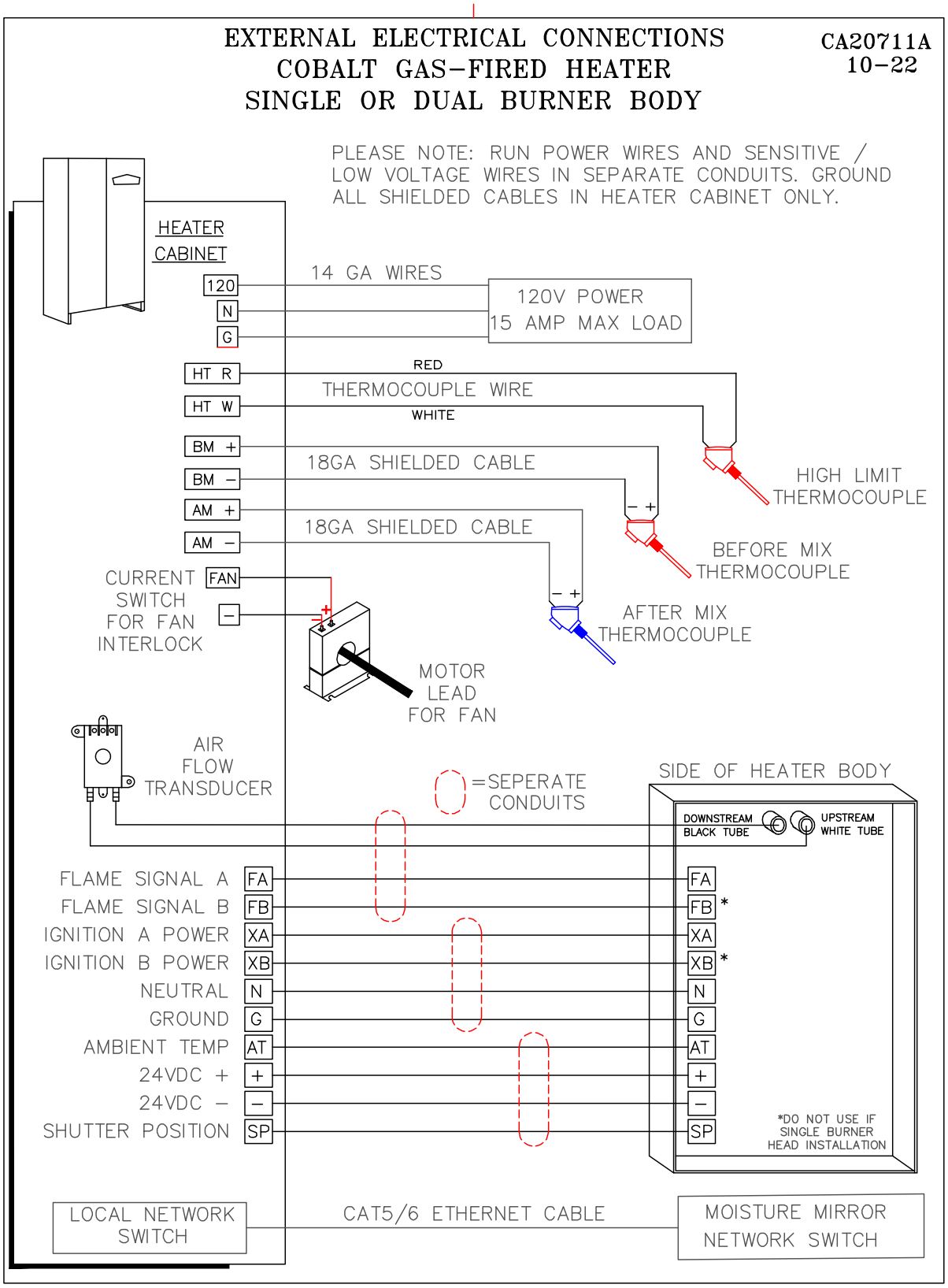


Cobalt Heater Wiring Schematics

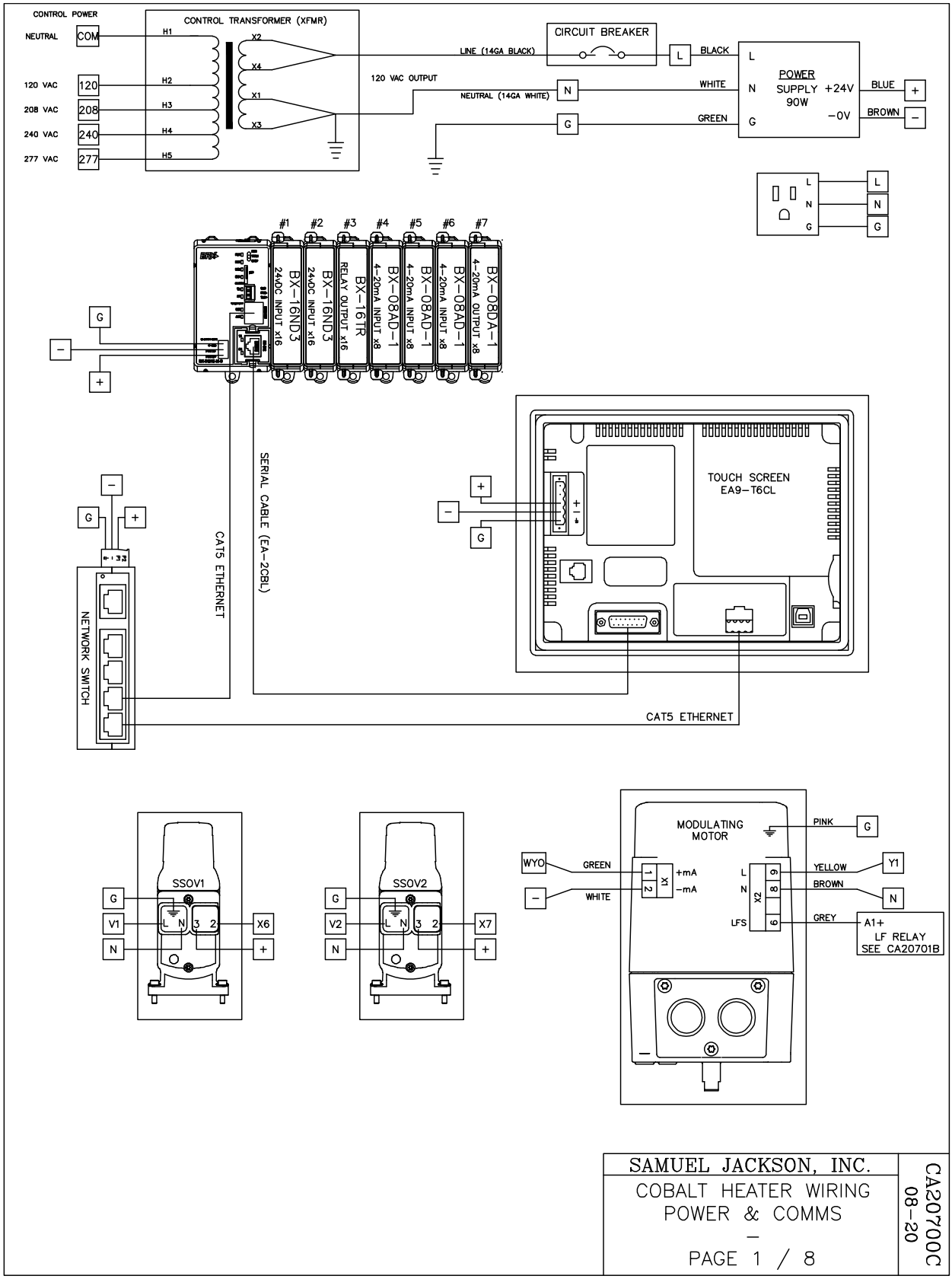
Basic External Electrical Connections (Cobalt 1)



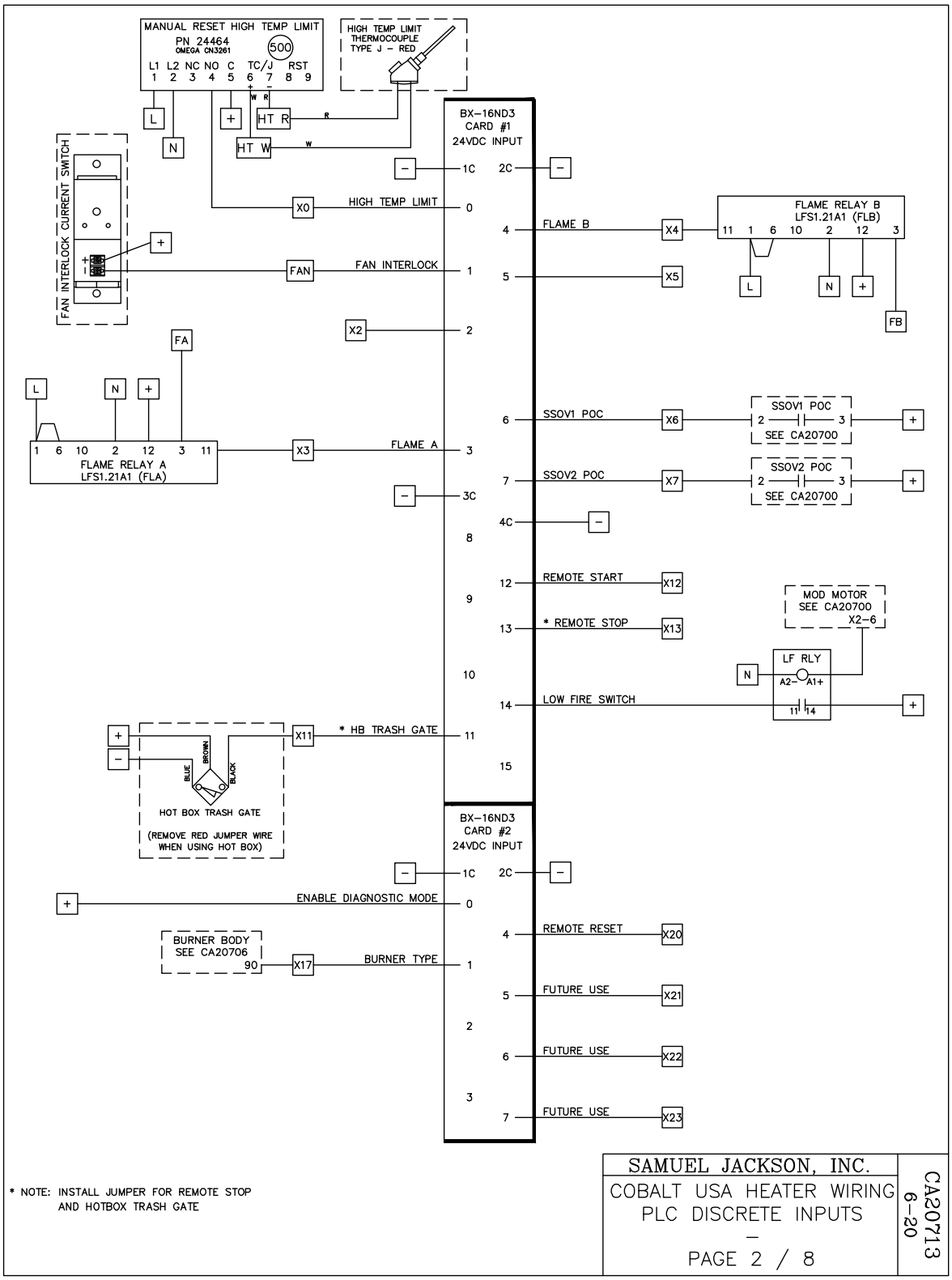
Basic External Electrical Connections (Cobalt 2)



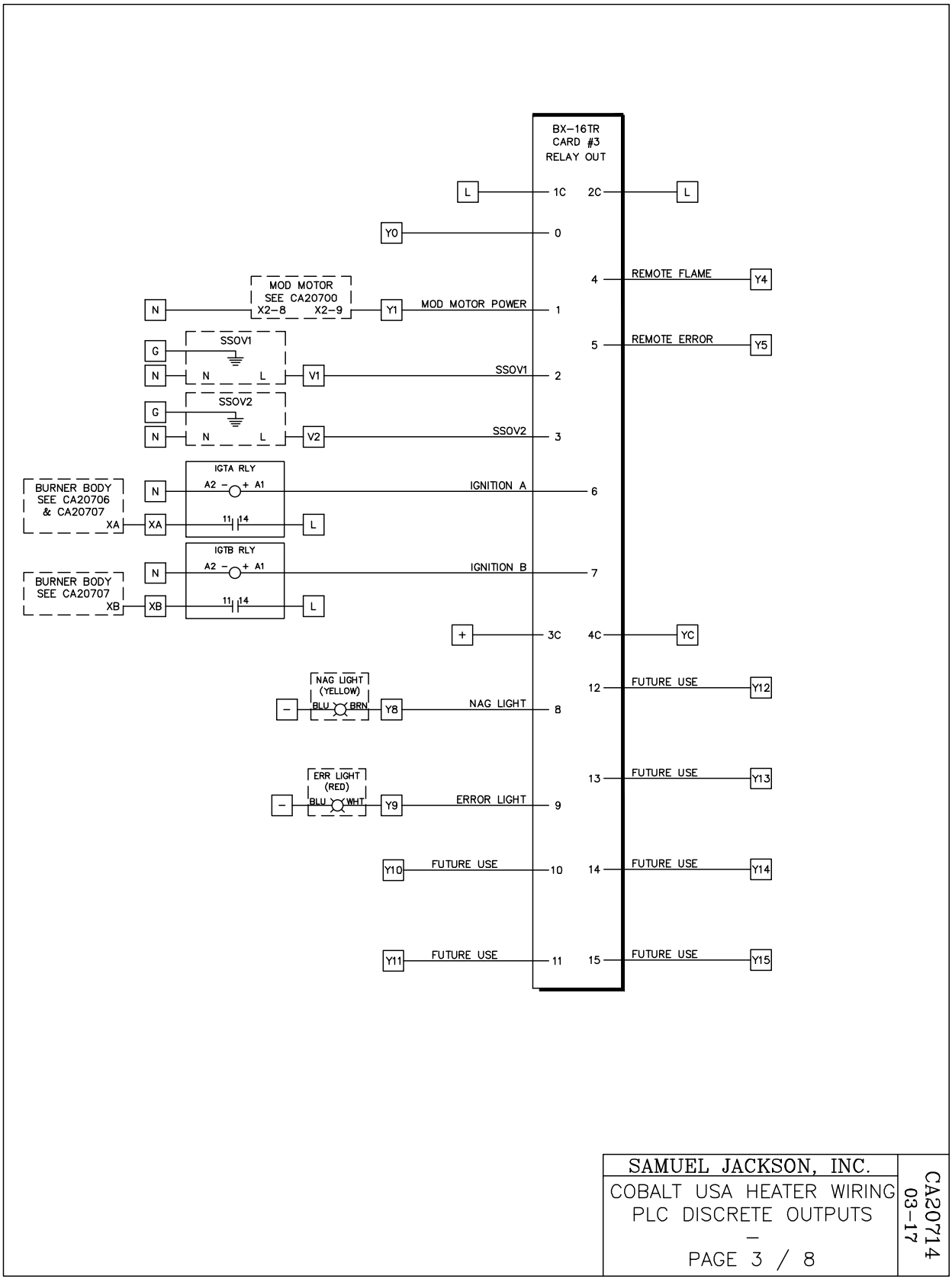
Power and Communications



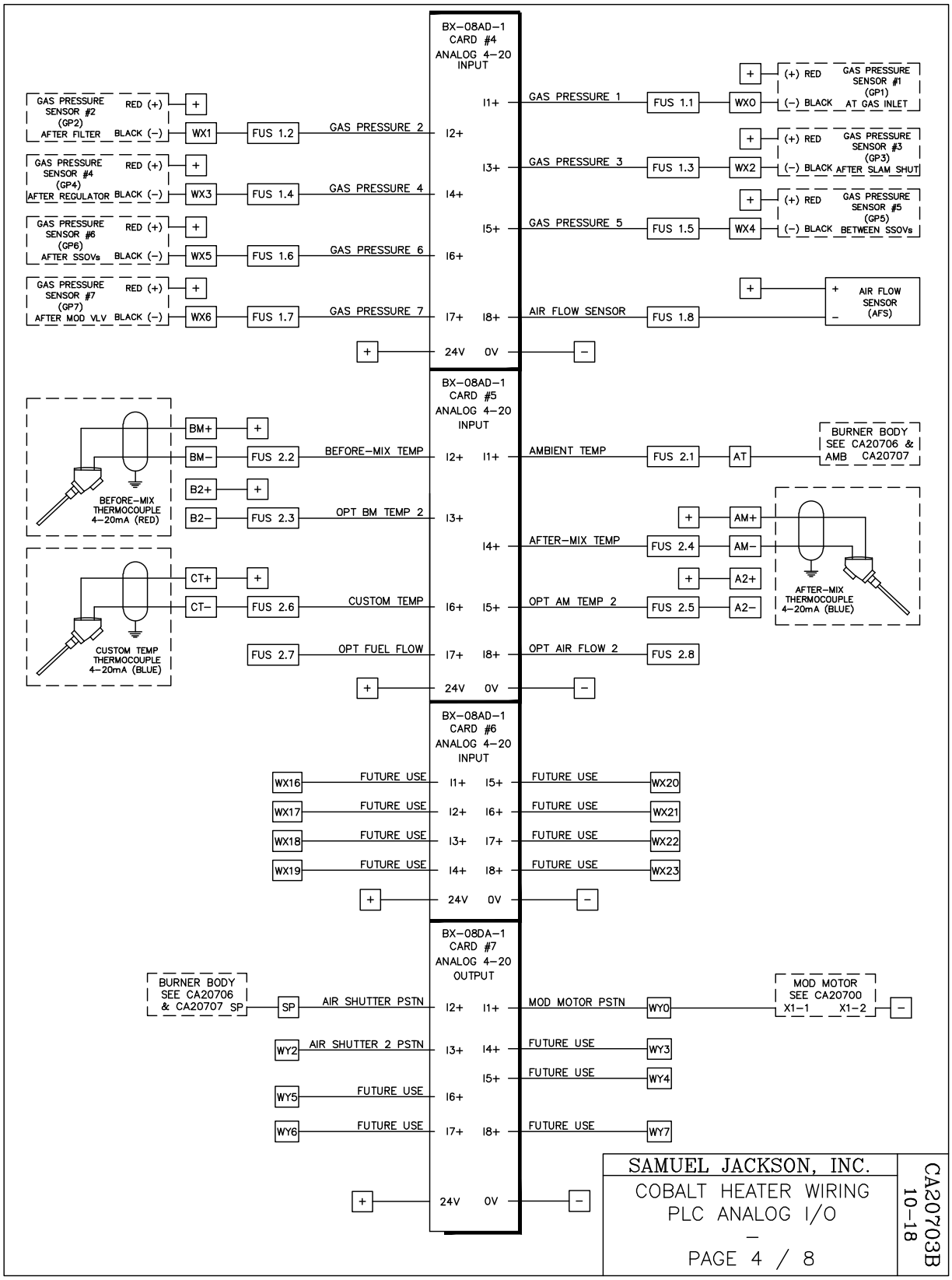
PLC Discrete Inputs



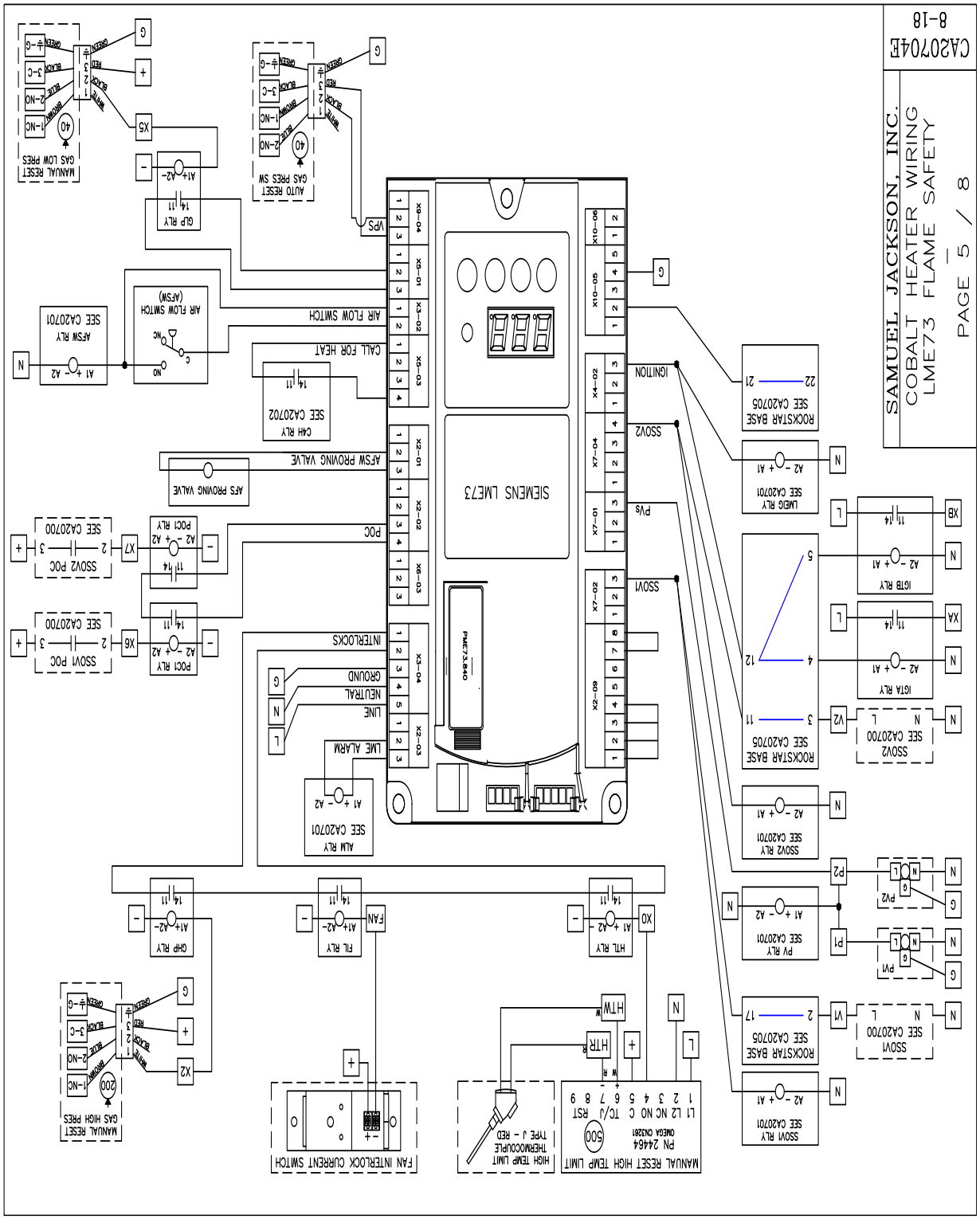
PLC Discrete Outputs



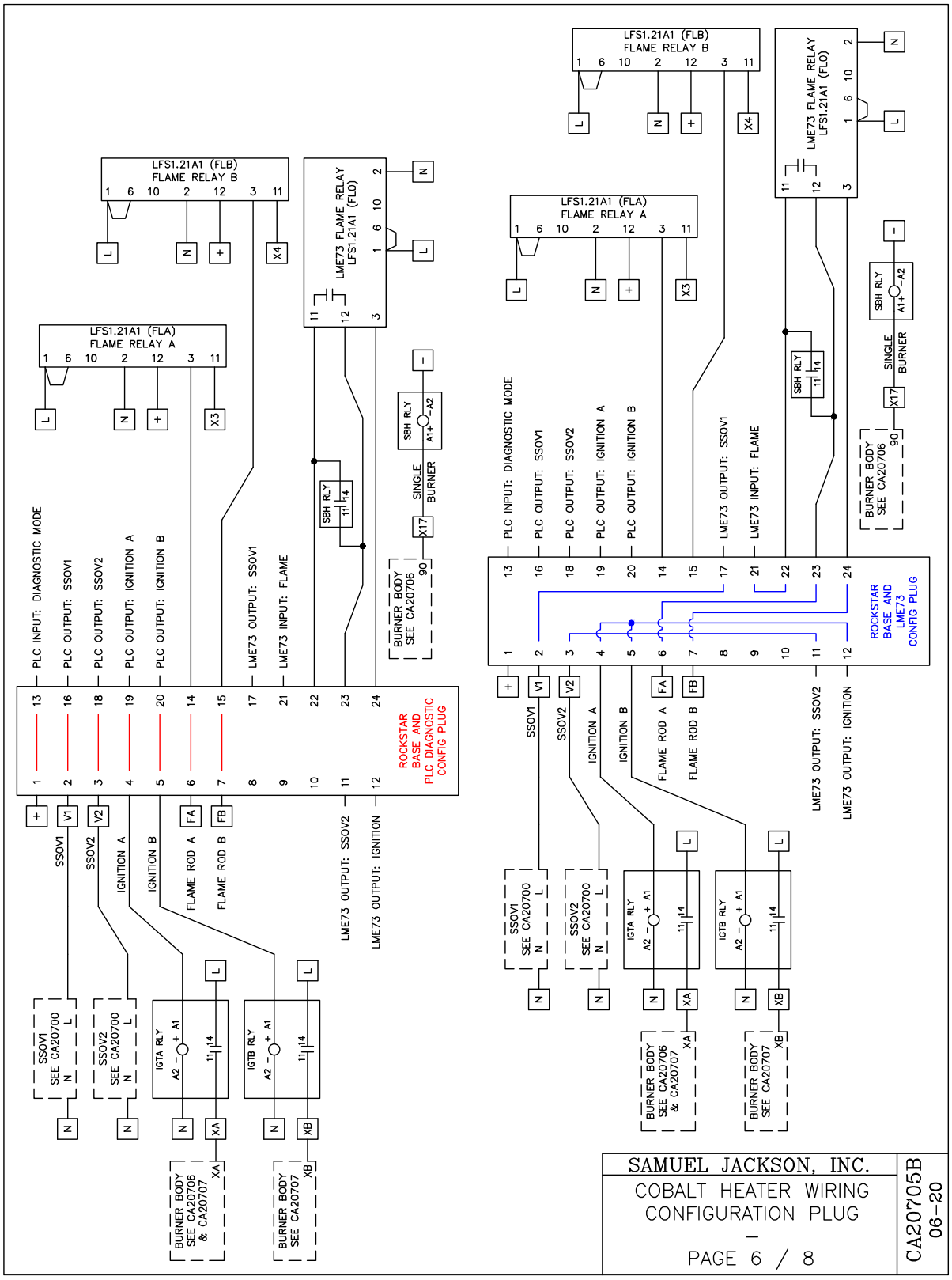
PLC Analog Inputs and Outputs



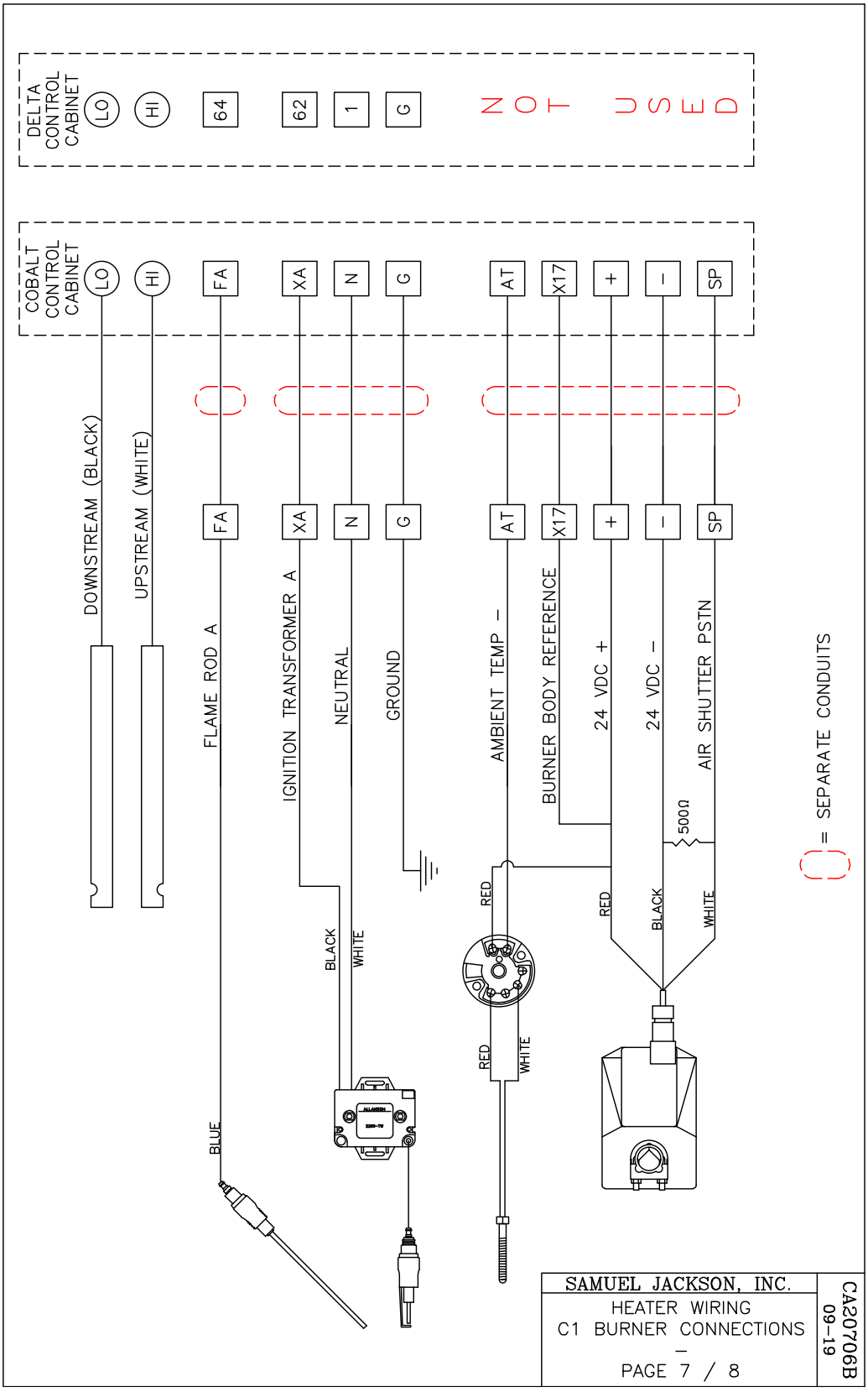
LME73 Flame Safety



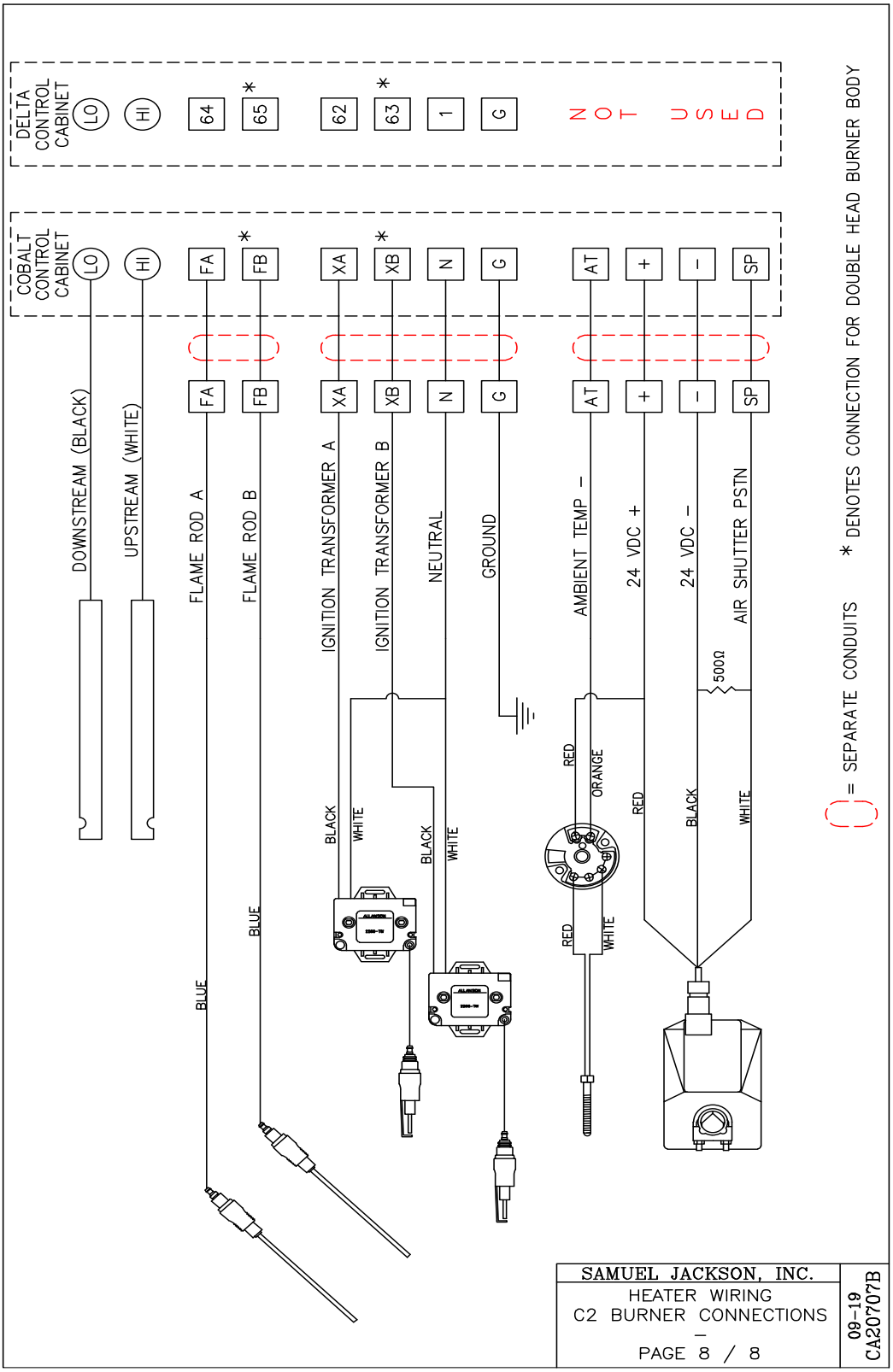
Configuration Plug



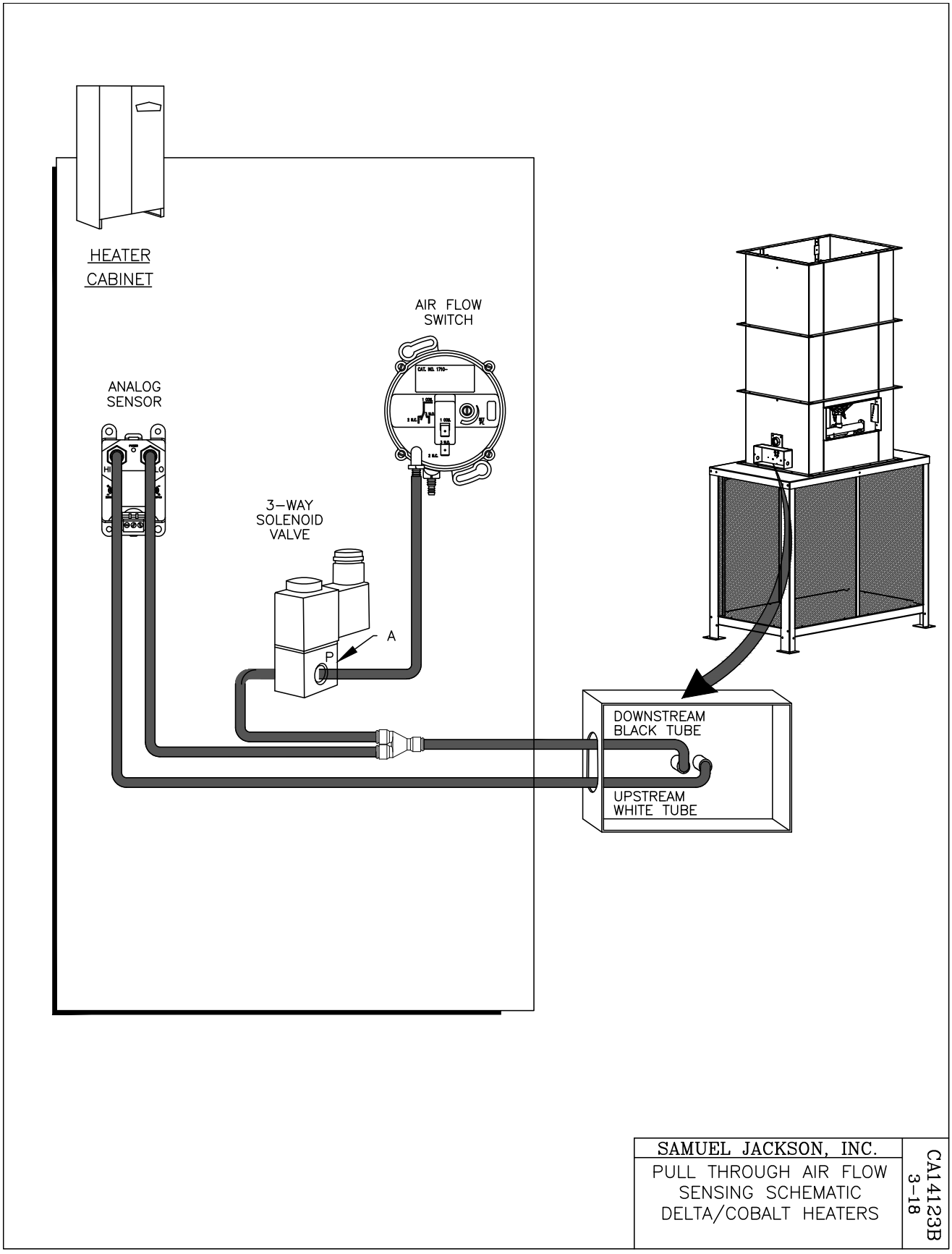
C1 Burner Connections



C2 Burner Connections

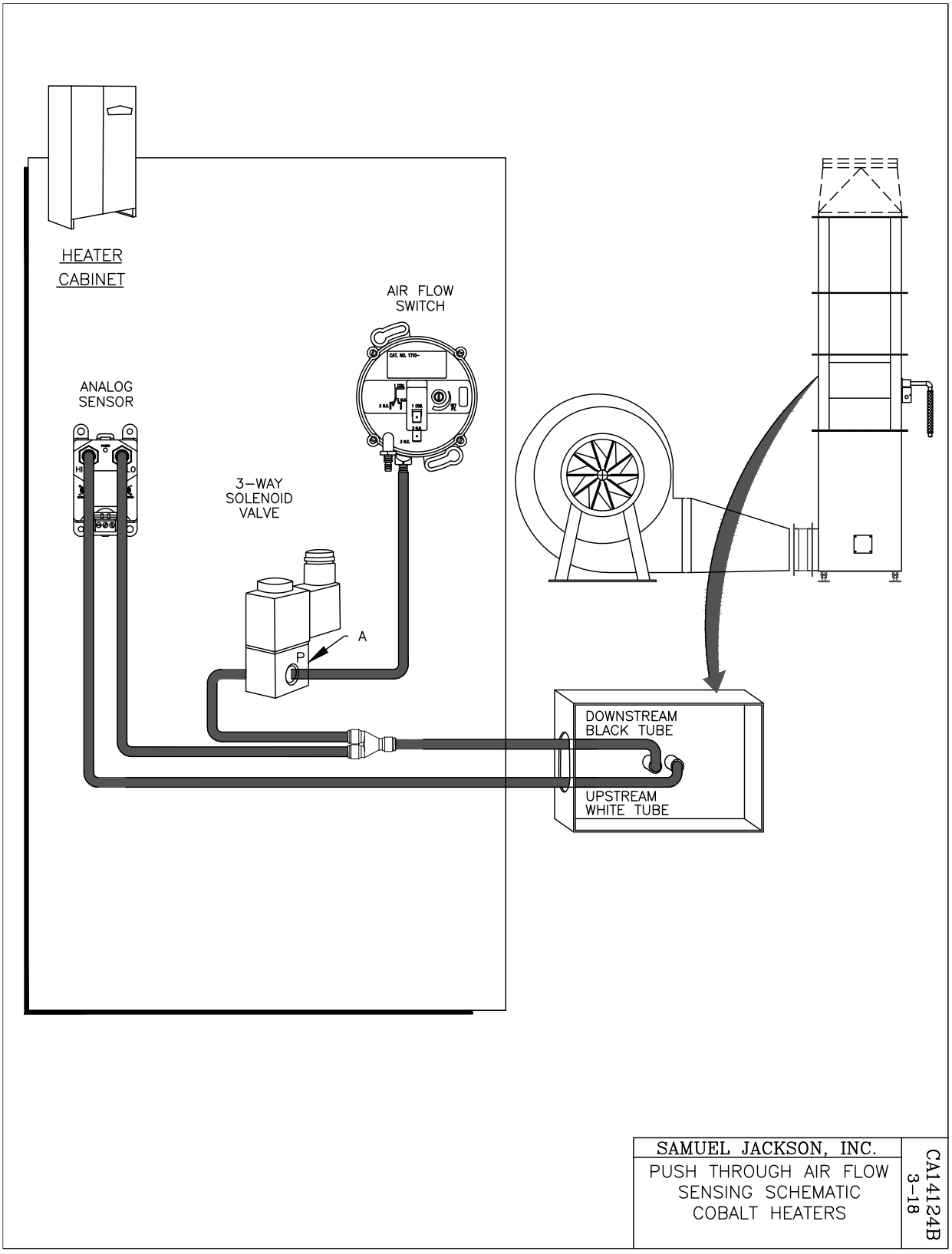


Typical Delta/Cobalt Air Flow Pneumatics Schematic – Pull Through

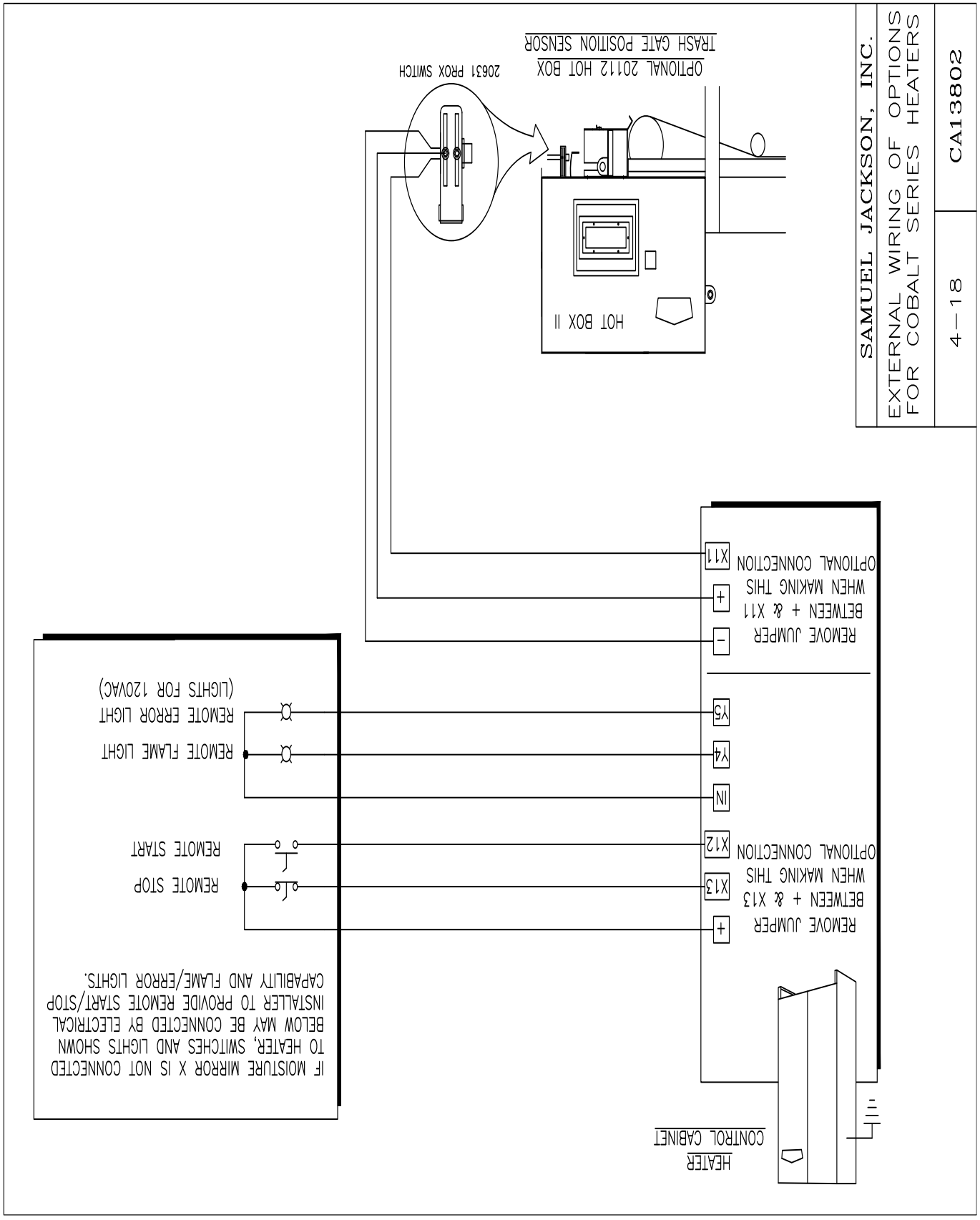


SAMUEL JACKSON, INC. PULL THROUGH AIR FLOW SENSING SCHEMATIC DELTA/COBALT HEATERS	CA14123B 3-18

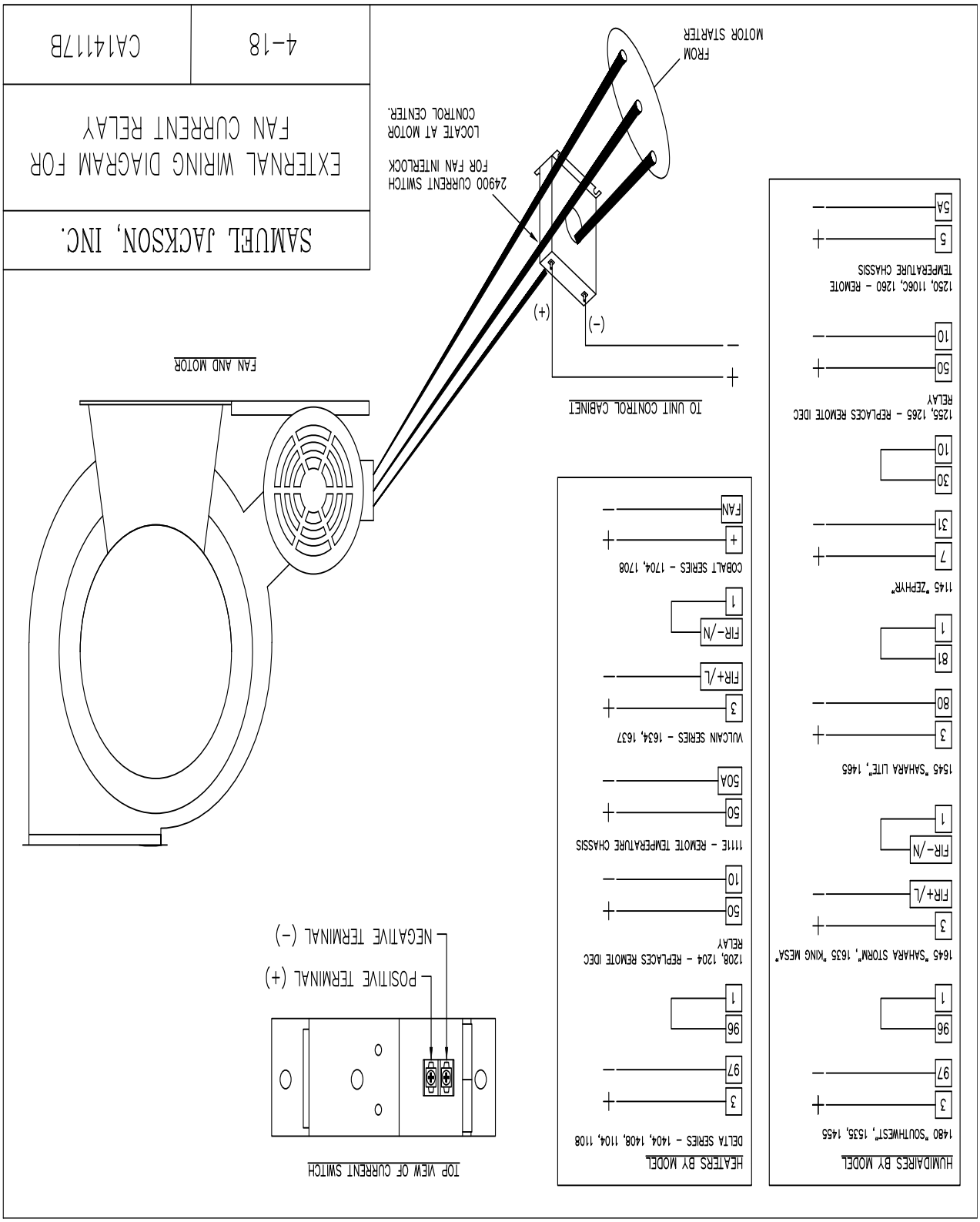
Typical Delta/Cobalt Air Flow Pneumatics Schematic – Push Through (Cobalt must use plenum)



External Wiring of Options



External Wiring Diagram For Fan Current Relay



Gas Piping

Size of pipe supplying gas to Heaters and other appliances should be large enough to prevent excessive pressure losses when all of them are in use. See the following Table of "Recommended Minimum Pipe Sizes" for Heater capacities, pipe lengths, and pressures.

Where LPG (Liquefied Petroleum Gas, Propane, Butane) is used as fuel, see the following Drawing, "Liquefied Petroleum Gas Tank Installation for Humidaire Units and Drying Heaters" for recommended practices.

Emergency shut-off valves should be provided to permit turning off the fuel in an emergency. They should be located so that they are accessible in an emergency situation.

IRI (Industrial Risk Insurers) and some state and local authorities require venting the gas regulator and the normally open vent valve.

NFPA (National Fire Protection Association) 86* states:

> 3-3.4.3.2 Regulators shall be vented to a safe location, where vented gas cannot re-enter the building without extreme dilution. The terminating end shall be protected against water entry and bug-screened. Vent pipe shall be of adequate size so as to not lengthen response time.
>
> 3-3.4.3.3 Vent lines from multiple regulators, where manifolded together, shall be piped in such a manner that diaphragm rupture of one will not backload the others.
>
> 3-3.4.3.4 Vents from gas pressure switches, but from no other devices, may be vented into the regulator lines provided that switch or regulator diaphragm failure will not backload the regulator.

Recommended Minimum Pipe Sizes

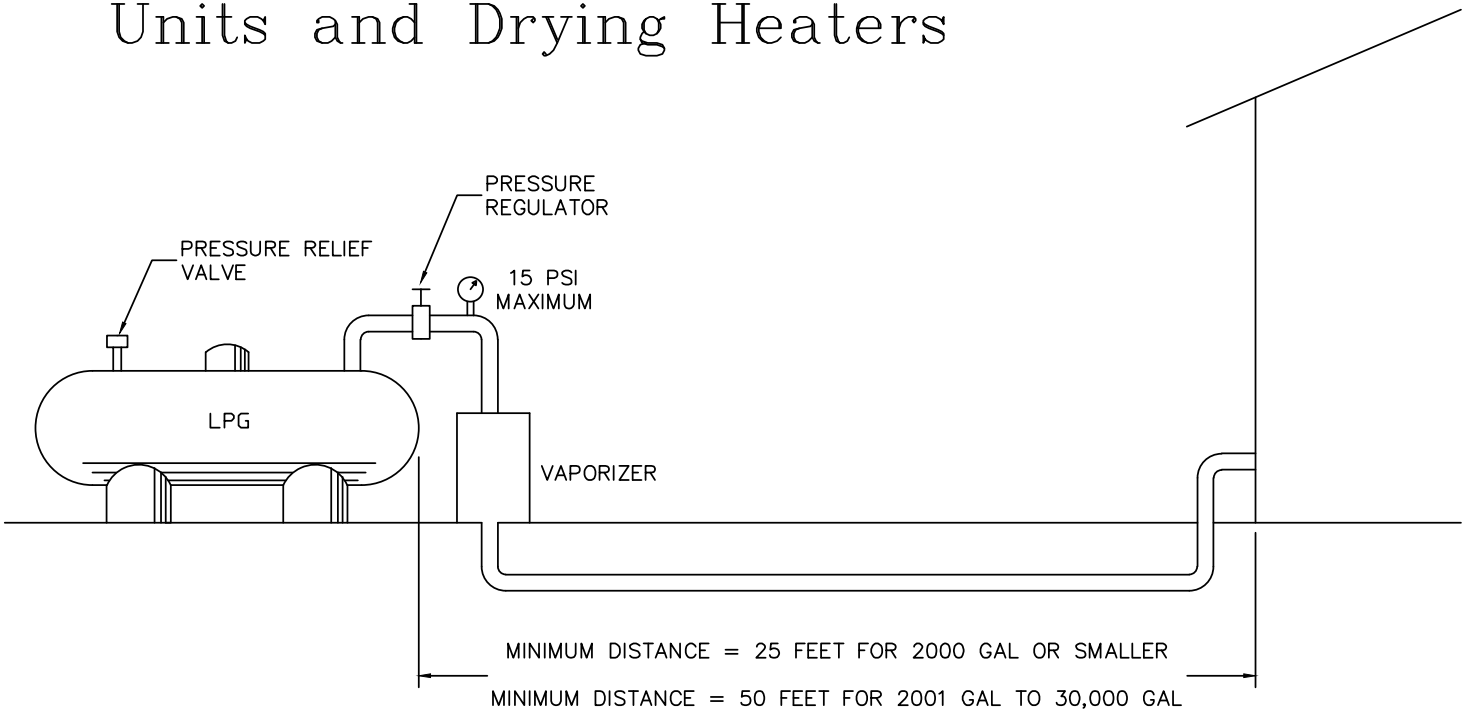
TOTAL HEATER CAPACITY MILLION BTU/HR	PIPE LENGTH FEET	RECOMMENDED MINIMUM PIPE SIZES				
		PRESSURE AT SERVICE REGULATOR OR VAPORIZER OUTLET, PSIG				
		NATURAL GAS			PROPANE *	
		6	10	15	10	15
2	100	1–1/4	1	3/4	3/4	3/4
	200	1–1/4	1	1	3/4	3/4
	500	1–1/2	1–1/4	1	1	3/4
4	100	1–1/2	1–1/4	1	3/4	3/4
	200	2	1–1/2	1–1/4	1	1
	500	2	1–1/2	1–1/4	1–1/4	1–1/4
8	100	2	1–1/2	1–1/4	1–1/4	1
	200	2–1/2	2	1–1/2	1–1/4	1–1/4
	500	3	2	2	1–1/2	1–1/2
16	100	3	2	1–1/2	1–1/2	1–1/4
	200	3	2–1/2	2	2	1–1/2
	500	4	2–1/2	2–1/2	2–1/2	2
24	100	3	2–1/2	2	2	1–1/2
	200	4	3	2–1/2	2–1/2	2
	500	5	3	2–1/2	2–1/2	2–1/2

* OR BUTANE

FILE: 14–1899

PIPE SIZES ARE NOMINAL DIAMETERS, SCHEDULE 40, AND ARE BASED ON 5 PSIG BEING REQUIRED AT INLETS OF COMBUSTION REGULATORS.

Liquefied Petroleum Gas Tank Installation for Humidaire Units and Drying Heaters



For LPG installations, the tank should be at least 1200 US gallons to provide adequate surface area to absorb heat of vaporization from the atmosphere. To be compatible with the quantity of LPG received in each delivery, a larger tank may be necessary. A battery of small tanks of the desired total capacity has more heat–absorbing area than one large tank.

Whether or not a vaporizer is used, make sure that a regulator reduces the pressure to 15 psi (1 bar) BEFORE the pipe goes underground. Otherwise, reliquefication will take place in the cool earth and cause MUCH trouble. If the gas line in the building feels extremely cold during operation, liquid is in the line and the situation should be corrected immediately.

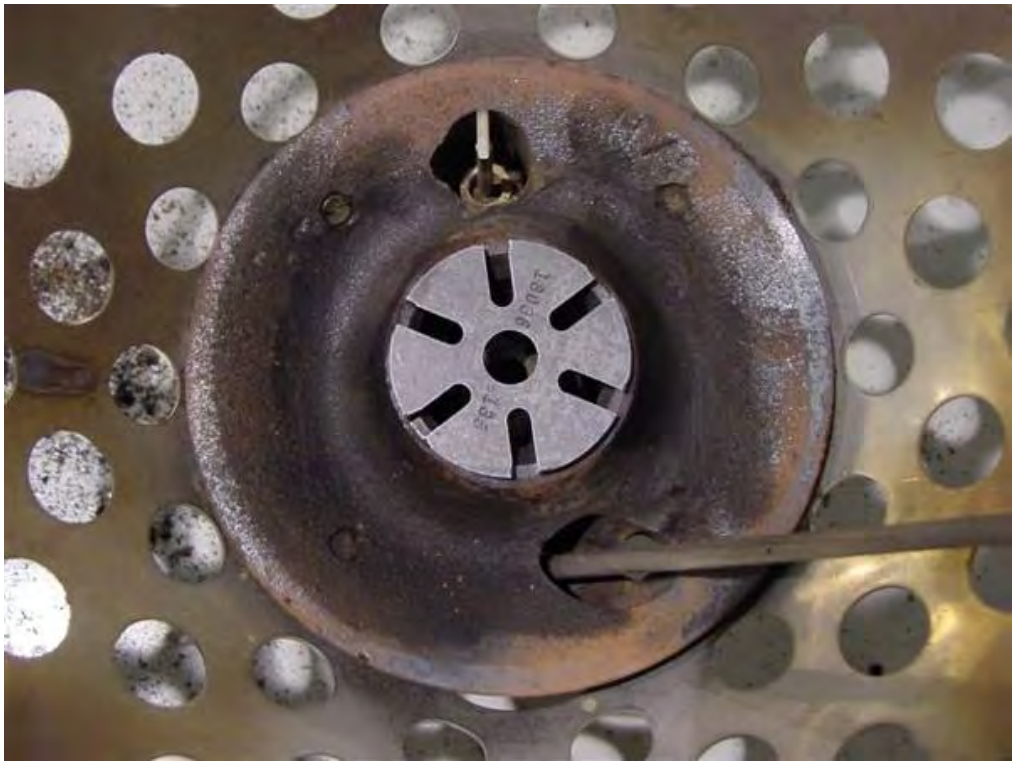
14–3566

Gas Train Layout

Burner Orifice Alignment

If you are experiencing excessive flame failures or difficulty establishing flame, check to make sure the orifice in your burner head is aligned correctly to the flame rod. Proper orifice alignment will also reduce the formation of soot and carbon on the flame rod especially when using propane or butane fuels.

The picture below shows the correct alignment of the orifice disk. The contoured stainless steel disk has been removed for illustration. Note that one of the orifice slots is pointed directly toward the spark plug.



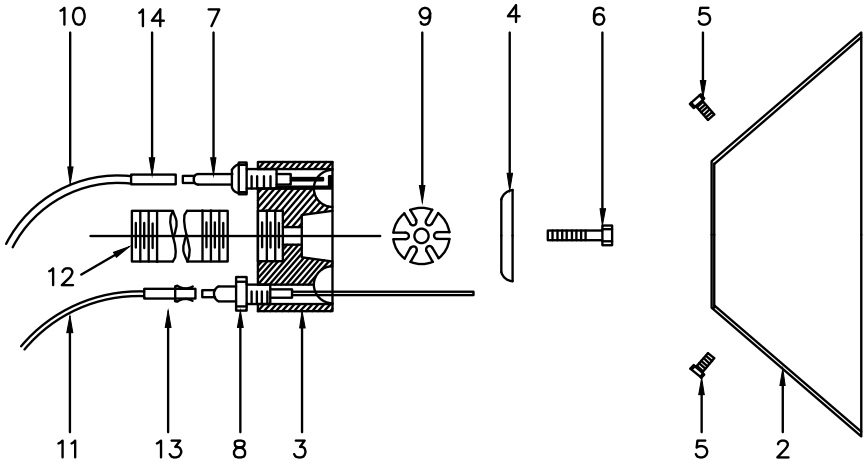
To adjust the orifice alignment, remove the contoured disk from the burner body by removing the 3/8 inch stainless steel cap screw. Rotate the orifice disk so that one of the slots is pointed directly at the spark plug. Insert a small screwdriver through the hole in the burner shell and into a slot in the orifice. Reinstall the contoured disk while using the screwdriver to keep the orifice from rotating.

After reinstalling the burner assembly, the flame rod should glow red hot while the flame is on improving ignition, reducing flame failures and reducing formation of soot and carbon on the flame rod.

13480A Burner Head Assembly

13480A BURNER HEAD ASSEMBLY

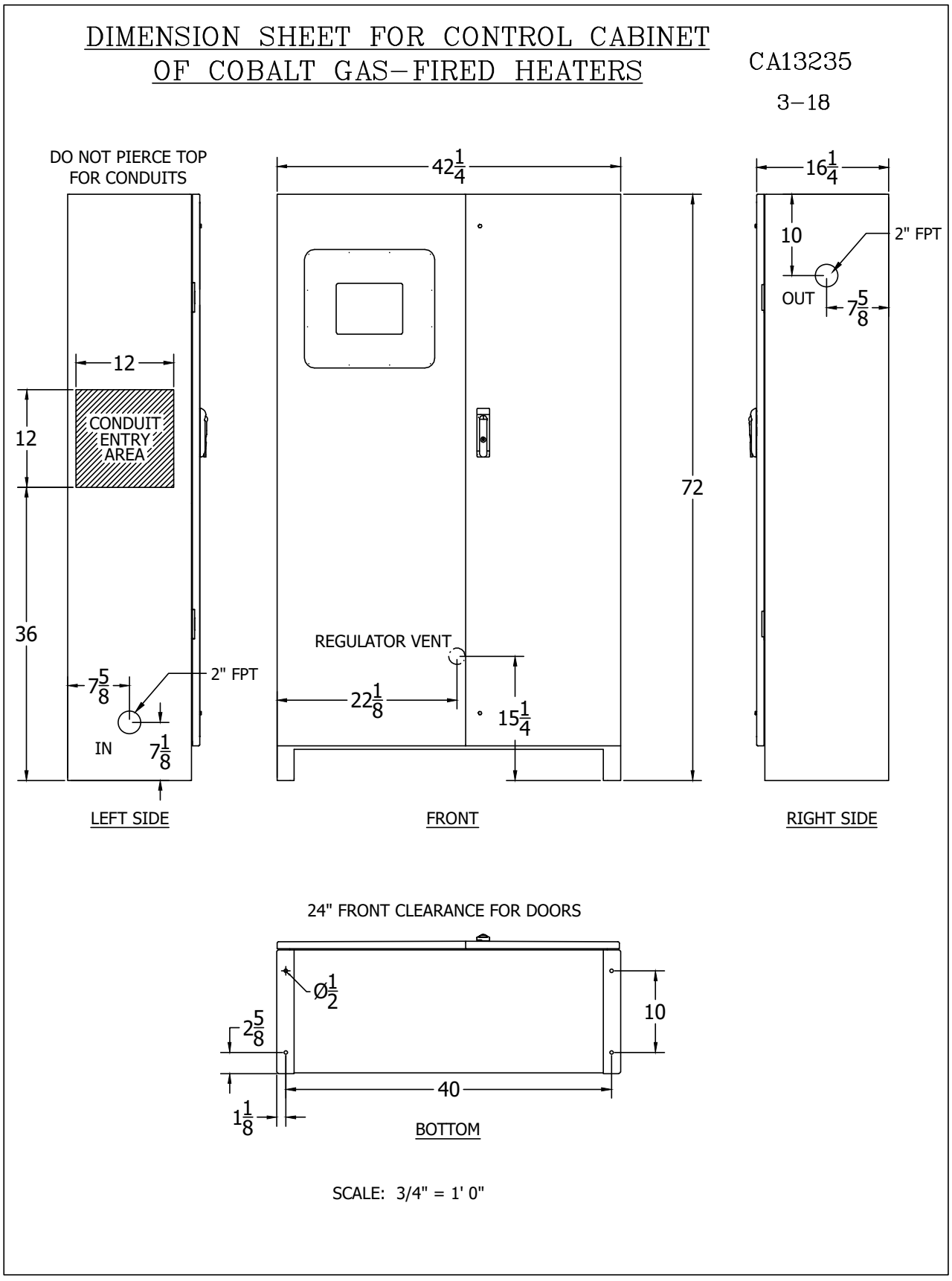
CAT3131B
5-04



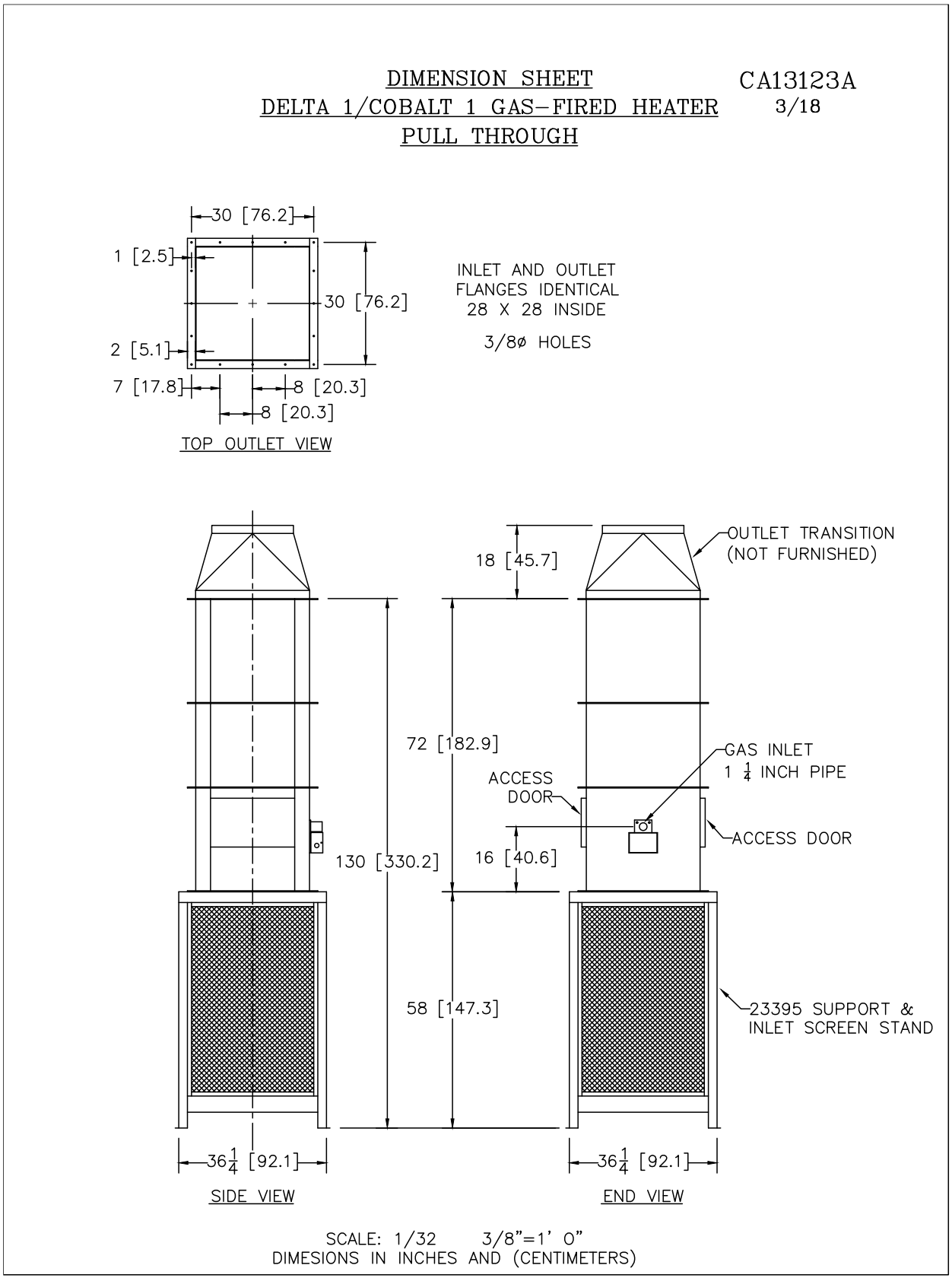
TOP VIEW

REF	QUANTITY	PART NO.	DESCRIPTION		
2	1	12975B	GAS BURNER SHELL		
3	1	14620	BURNER BODY USE 18000 FOR HIGH OUTPUT		
4	1	12985B	CONTOURED DISC		
5	4	15724	5/16 X 1/2 HX HD SS CAP SCREW		
6	1	15767	3/8 X 1 3/4 HX HD SS CAP SCREW		
7	1	12398A	SPARK PLUG, CA475		
8	1	12399A	FLAME ELECTRODE, CA390		
9	1		BURNER ORIFICE DISC ONE OF THE FOLLOWING:		
			SLOT	THICK	FLOW AREA
		18031	.080	.048	15
		18032	.114	.048	21
		18033	.103	.075	30
		18034	.149	.075	43
		18035	.216	.075	63
		18036	.179	.135	94
		18037	.286	.135	149
			PARTS NOT INCLUDED IN 13480A BURNER HEAD:		
10	1	11159	SPARK PLUG WIRE		
11	1	11158	FLAME ELECTRODE WIRE		
12	1	15189	1 1/4 X 4 BLACK PIPE NIPPLE		
13	1	13923	RAJAH TERMINAL		
14	1	13925	SPARK PLUG TERMINAL		

Control Cabinet Dimensions

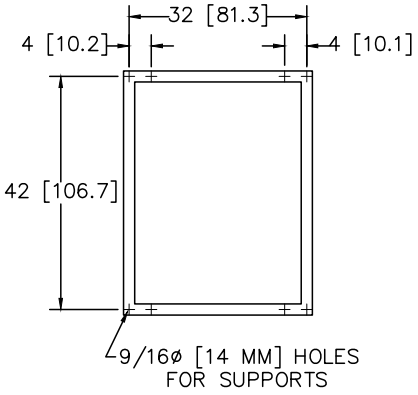


Typical Delta/Cobalt Burner Body Dimensions for Pull Through

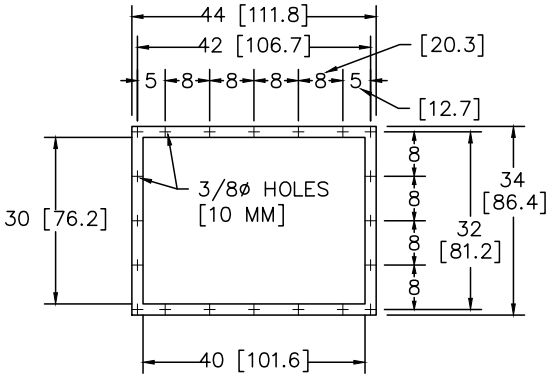


DIMENSION SHEET
DELTA 2/COBALT 2 GAS-FIRED HEATER
PULL-THROUGH

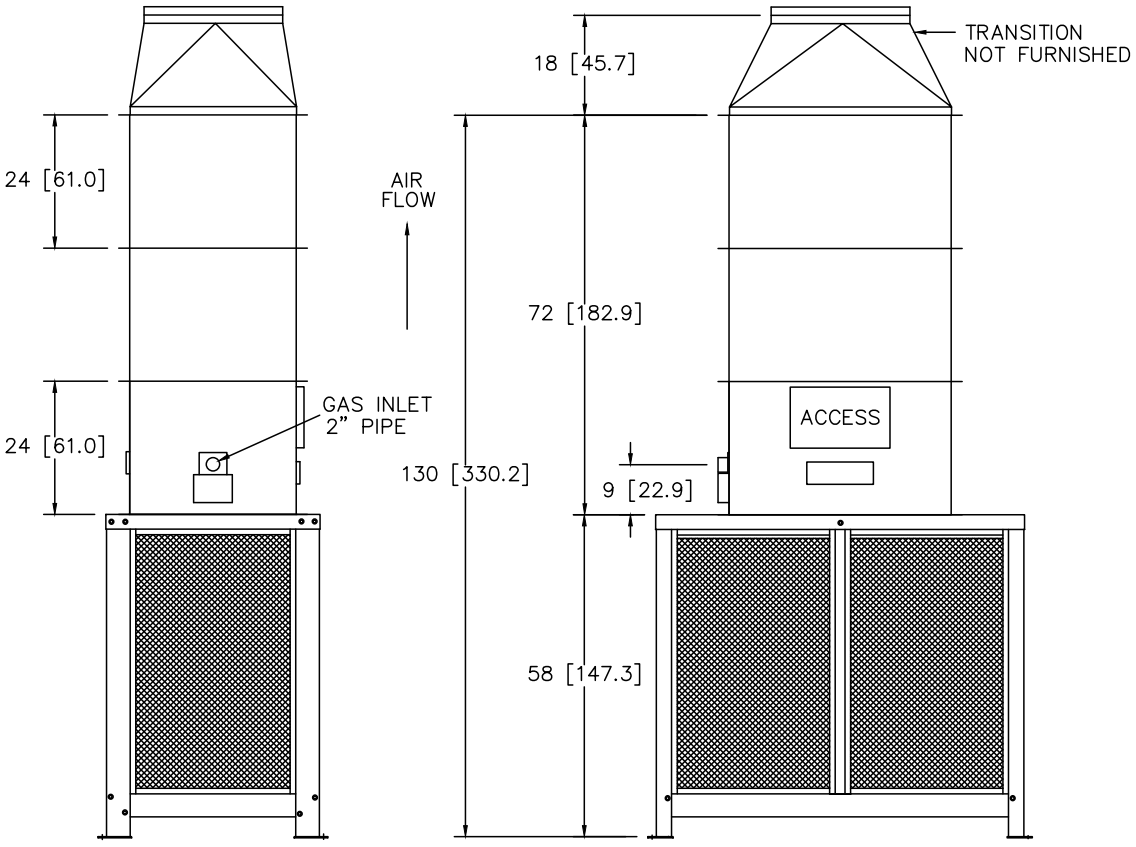
CA13221B
3-18



INNER FLANGES

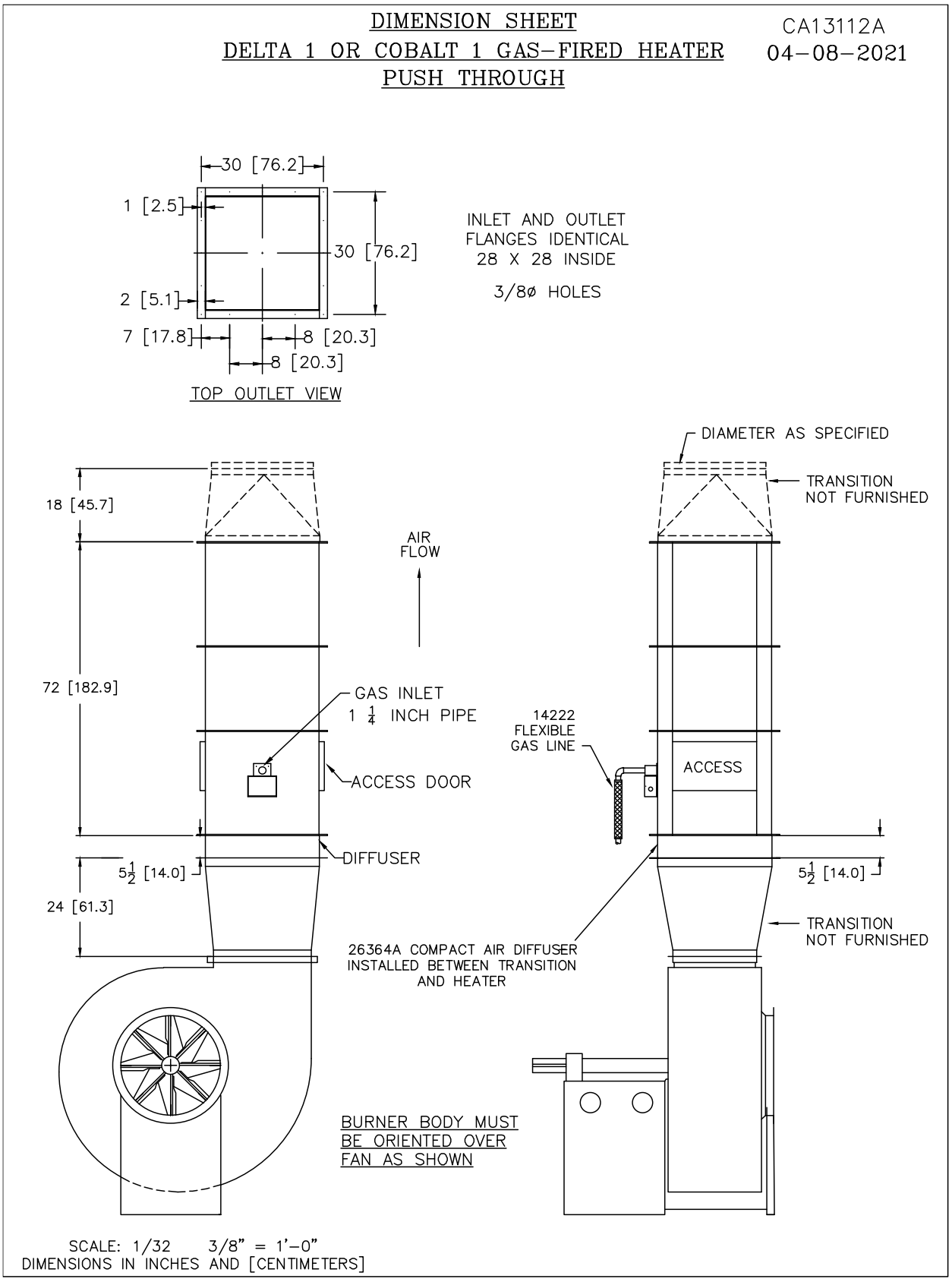


END FLANGES

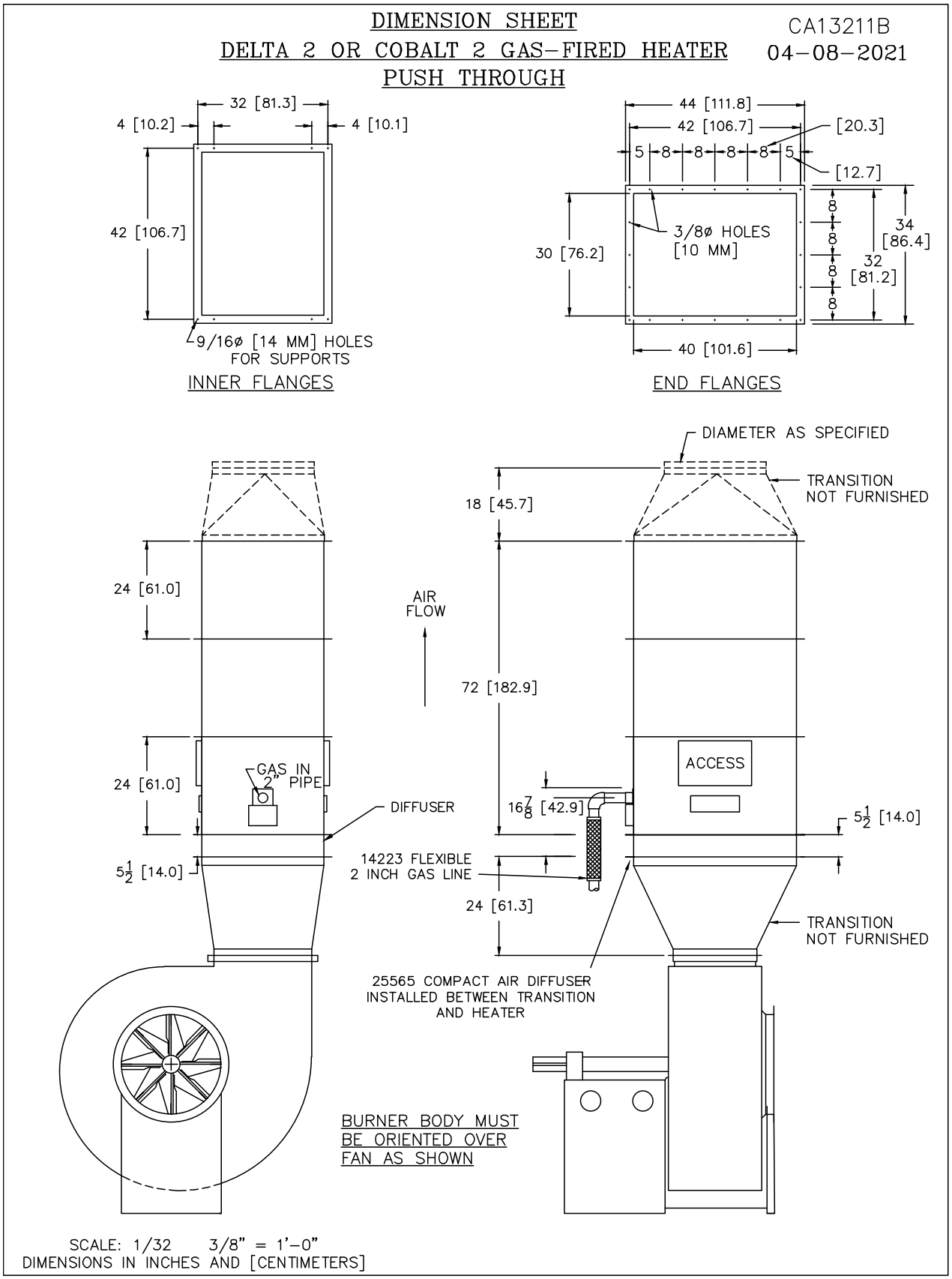


SCALE: 1/32 3/8" = 1'-0"
DIMENSIONS IN INCHES AND [CENTIMETERS]

For All Delta/Cobalt 1 Heaters:



For All Delta/Cobalt 2 Heaters:



Inlet Hole Patterns for 80047 & and 80057 Push Plenums

SAMUEL JACKSON, INC.

CA13192A

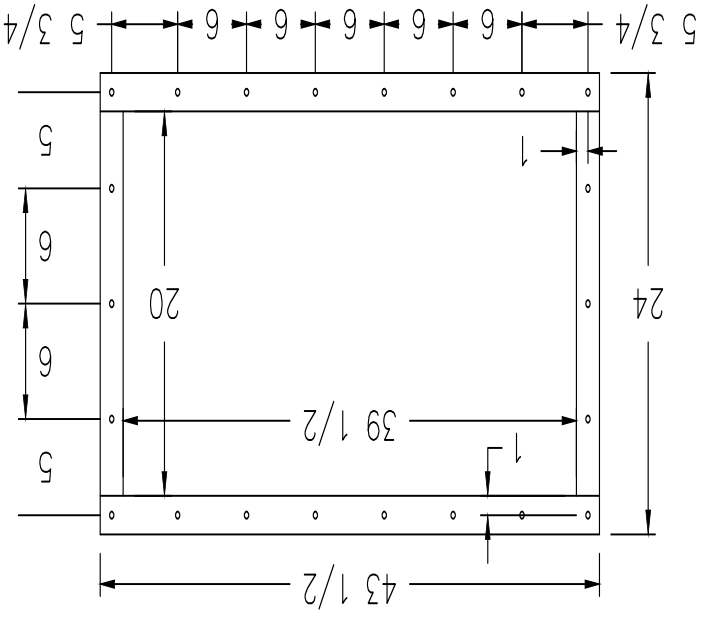
12-14

80047 & 80057 HEATER
PUSH PLENUM
INLET HOLE PATTERN

INLET BOLT HOLE PATTERN FOR
80057 PUSH PLENUM FOR
DELTA 2 GAS-FIRED HEATER

(7/16 ø HOLES)

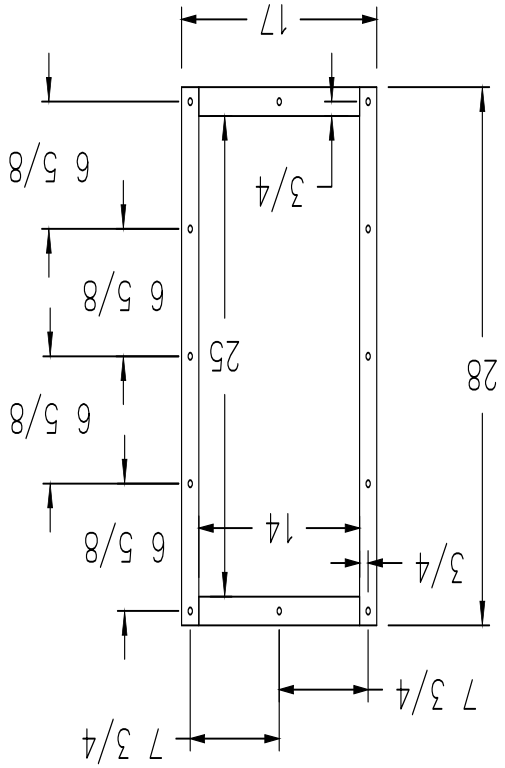
2 X 2 X 3/16
ANGLE FLANGE



INLET BOLT HOLE PATTERN FOR
80047 PUSH PLENUM FOR
DELTA 1 GAS-FIRED HEATER

(7/16 ø HOLES)

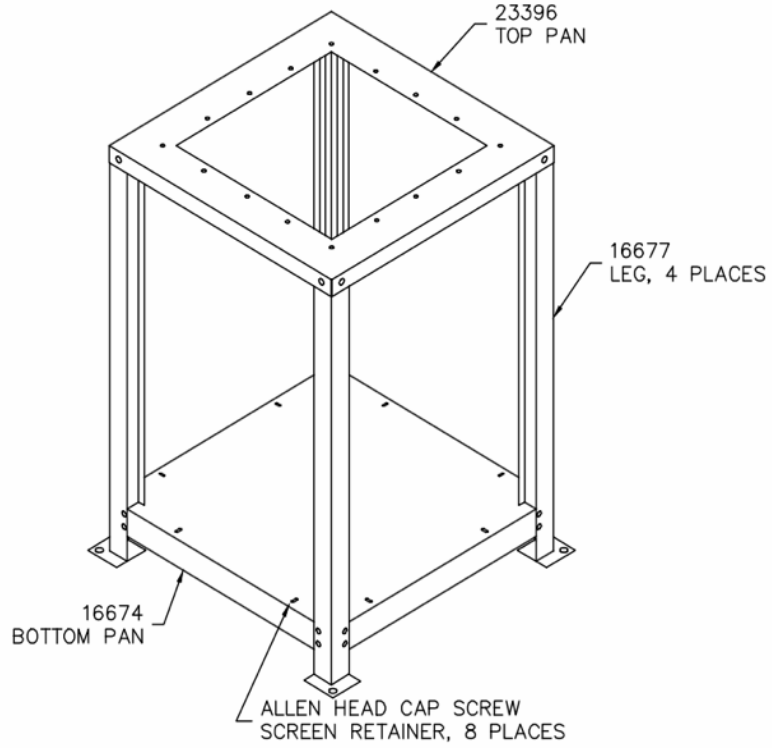
1 1/2 X 1 1/2 X 1/8
ANGLE FLANGE

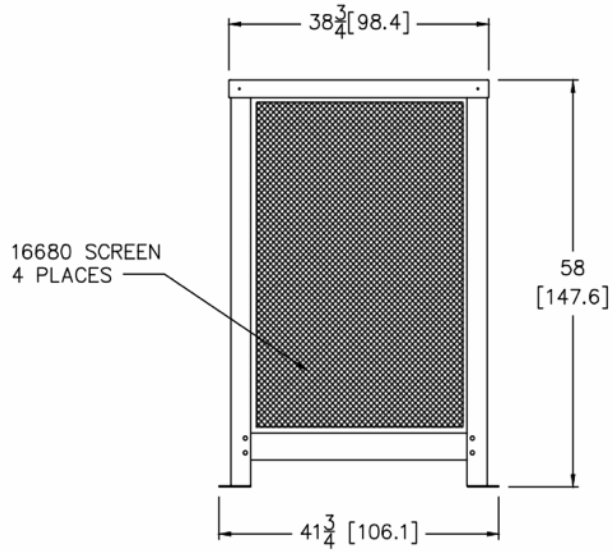


Assembly of Screen Stand

ASSEMBLY INSTRUCTIONS FOR 23395 SUPPORT AND SCREEN ASSEMBLY FOR DELTA/COBALT 1 HEATERS

CA13162B
3–20

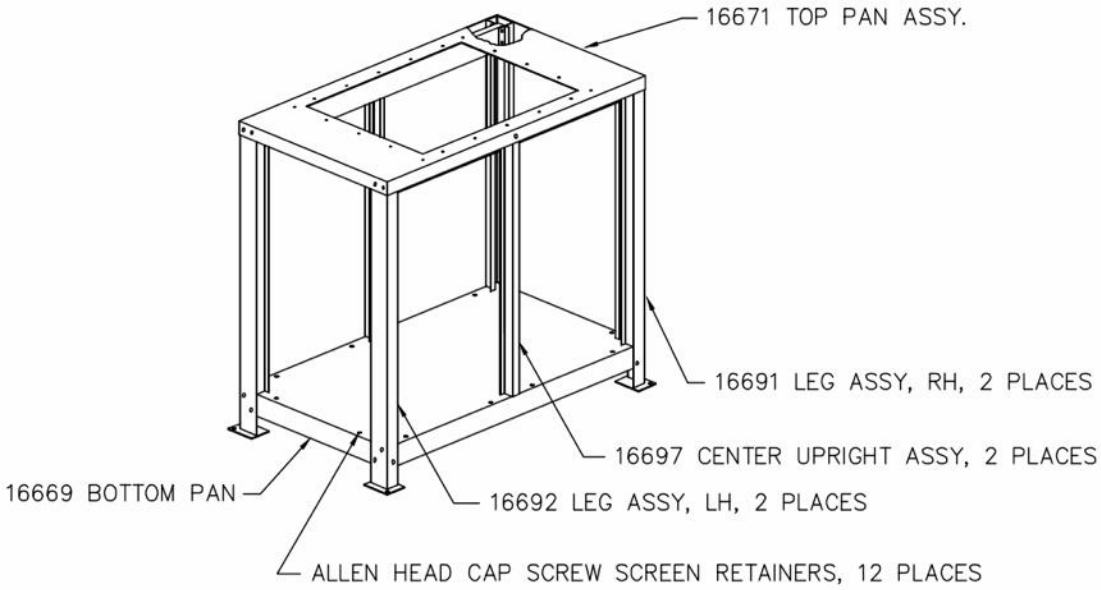


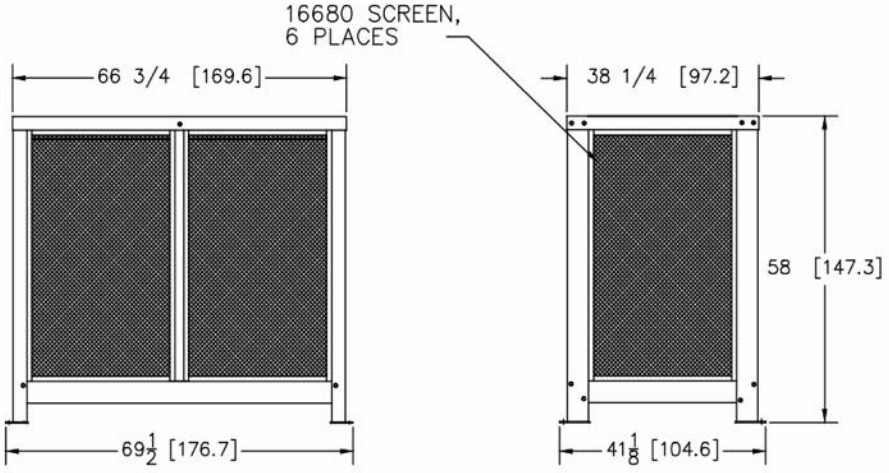


DIMENSIONS IN INCHES AND [CENTIMETERS]

ASSEMBLY INSTRUCTIONS FOR 16555 SUPPORT AND SCREEN ASSEMBLY FOR DELTA/COBALT 2 HEATERS

CA13261C
3-20





DIMENSIONS IN INCHES AND [CENTIMETERS]

LIMITED WARRANTY

SAMUEL JACKSON, INCORPORATED

For Commercial and Industrial Customers of Samuel Jackson Moisture Control Products

SAMUEL JACKSON, INCORPORATED ("Sam Jackson") warrants to its customers who purchase Sam Jackson products that its equipment is free from defects in material and workmanship under normal use and service for 12 months from the date of shipment from its Lubbock, Texas factory.

THIS WARRANTY DOES NOT EXTEND TO EQUIPMENT SUBJECTED TO MISUSE, NEGLECT, OR ACCIDENT: NOR DOES THIS WARRANTY APPLY UNLESS THE PRODUCT COVERED BY IT IS PROPERLY INSTALLED BY A QUALIFIED, COMPETENT TECHNICIAN, WHO IS LICENSED WHERE STATE AND LOCAL CODES REQUIRE, AND WHO IS EXPERIENCED IN MAKING SUCH INSTALLATIONS.

Equipment, which is defective in material or workmanship and within the warranty period, will be repaired or replaced, at Sam Jackson's option, in order to facilitate proper operation.

THIS WARRANTY IS LIMITED TO THE PRECISE TERMS SET FORTH ABOVE, AND PROVIDES EXCLUSIVE REMEDIES EXPRESSLY IN LIEU OF ALL OTHER REMEDIES, AND IN PARTICULAR THERE SHALL BE EXCLUDED THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. IN NO EVENT WILL SAM JACKSON BE LIABLE FOR ANY INCIDENTAL OR CONSEQUENTIAL DAMAGE OF ANY NATURE.

Sam Jackson neither assumes nor authorizes any person to assume for Sam Jackson any other liability or obligation in connection with the sale of this equipment, Sam Jackson's liability and Customer's exclusive remedy being limited to repair or replacement as set forth above.

SAMUEL JACKSON, INCORPORATED
3900 Upland Avenue Lubbock, Texas 79407

IMPORTANT!

The following notice affects your warranty.

Electrical Controls and Your Safety

Your new Sam Jackson product may be equipped with electrical controls, or designed to interact with controls on a related Sam Jackson product.

In the event that local, state, federal or other specified safety compliance is required, we will consider modifications to meet the particular requirements. Implementation of alternative safety devices may incur additional charges. No warranty of compliance with a particular standard is made in the absence of specific reference to it in our quotation.

If you modify, or permit others to modify, these controls without specific written permission from Sam Jackson, Inc. the warranty on your product will be void and there is a possibility of serious damage to machinery, damage to product, serious injury to personnel, or death. The modifier of the controls assumes all liability for these consequences.

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