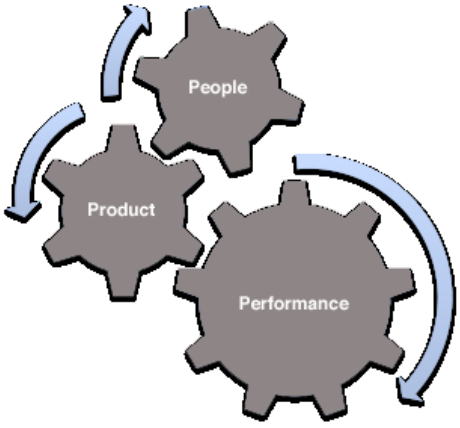
SERVICE MANUAL

Vulcain
Oil-Fired Heaters



SAMUEL JACKSON

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We appreciate your business and hope you enjoy your Samuel Jackson Oil-Fired Heater

This manual contains information on the installation, startup, and operation of your Oil-Fired Heater. Included is information on:

- Heater operation.
- Electrical installation.
- Oil 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 two 4-20 mA air temperature thermocouples and 2-wire shielded thermocouple extension wire 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 people are available to assist you in obtaining the best performance from your Samuel Jackson, Inc. products.

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

SAMUEL JACKSON, INCORPORATED
3900 UPLAND AVENUE LUBBOCK, TEXAS 79407
TELEPHONE 806-795-5218 OR 800-862-9966
TELEFAX 806-795-8240
Email: engineering@samjackson.com
Internet: www.samjackson.com

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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 806-795-5218 before proceeding. Failure to do so could result in injury or even death. (*Si usted no entiende, llamar a Samuel Jackson en 806-795-5218 antes de proceder. La falta de hacer tan podía dar lugar alesión o aún a 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.

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.

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

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.

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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 806-795-5218 before proceeding.

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Safety Features of Oil-Fired Heaters

Many of the traditional safety features designed into drying Heaters can be tampered with and circumvented if the operating personnel are desperate to maintain production. An important, but hidden, safety feature in all Samuel Jackson Heaters is their dependable performance. Each Heater is completely assembled in the factory and tested before shipment. In many instances, a factory representative performs startup of the Heater in the field to insure trouble-free performance and customer satisfaction. Safety features which are not ordinarily used on drying Heaters for the cotton industry are outlined below:

- A static pressure switch is often used on older Heaters to infer that air is moving through the dryer. If a choke occurs, static pressure is still present and the burner continues to operate. This can cause a fire. All Samuel Jackson Heaters use an air flow transducer which measures the difference in pressure sensed by orifices pointing upstream and downstream. In order to give immediate burner shutoff, and serve as a safety backup for the airflow switch, we include a fan interlock device for each burner.

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

- Prior to each ignition stage, the heater performs a routine test to check the fuel and air valves. This routine is repeated for the life of the Heater. The combustion control computer checks for other safety and performance problems and notifies the operator with descriptions. The PLC maintains an error history with the time and date that each problem occurred.

- When the burner flame goes out during operation on older Heaters, it is customary for the flame safeguard relay to fire the sparkplug immediately in an attempt to reignite. If air flow has been choked enough to produce an explosive mixture, this can be serious. If our burner should flameout, it will first close the oil valve, then wait for air to purge the drying system. It then proceeds to restart the burner, observing all safety precautions, including checking for flame relay problems.

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New Features

What's new in the Vulcain for experienced Samuel Jackson Heater users?

The following information is for those users with experience using older model Samuel Jackson Heaters who are making the transition to the new 1500 series Heaters. 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.

Oil Friendly – A Fuel Filter is used to remove contaminants and water from the fuel, elongating your machine's life. The Vulcain also has an integrated fuel metering capability, meaning it can tell you how much fuel has been used. The fuel Flow Meter is pass through, which requires less maintenance to keep the fuel flowing smoothly.

Touch Screen Diagnostics – In earlier Samuel Jackson Heater models, diagnostics are accessed by running a special test program. On the model 1500 series, the technician can activate diagnostic routines selectively from the color touch screen without the need for going through the sequence of a test program.

Touch Screen Temperature Control – Earlier Samuel Jackson Heater models used Honeywell UDC-3300's for temperature control. On the model 1500 series Heaters, the temperature is adjusted on the color touch screen mounted on the Heater cabinet or with the optional Moisture Mirror X. The Heater's onboard PLC takes care of temperature control action. This control action allows for a number of diagnostic checks of the temperature control system not possible with the previously used method.

Moisture Mirror 2X, 3X and 4X Compatible – The model 1500 series Heaters have Ethernet communications capability which gives you the option of connecting it to a Moisture Mirror 2X, 3X, or 4X. You may simply connect it using a standard Ethernet CAT-5e cable to a Samuel Jackson Moisture Mirror X. A single Mirror will act as a common remote control for a maximum of eight Samuel Jackson 15XX 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.

24 Hour Temperature Graphs – The actual before and after mixpoint temperatures are digitally graphed on an easily accessible screen. Buttons on this screen allow the user to scroll to different times over the last 24 hours to view these temperatures.

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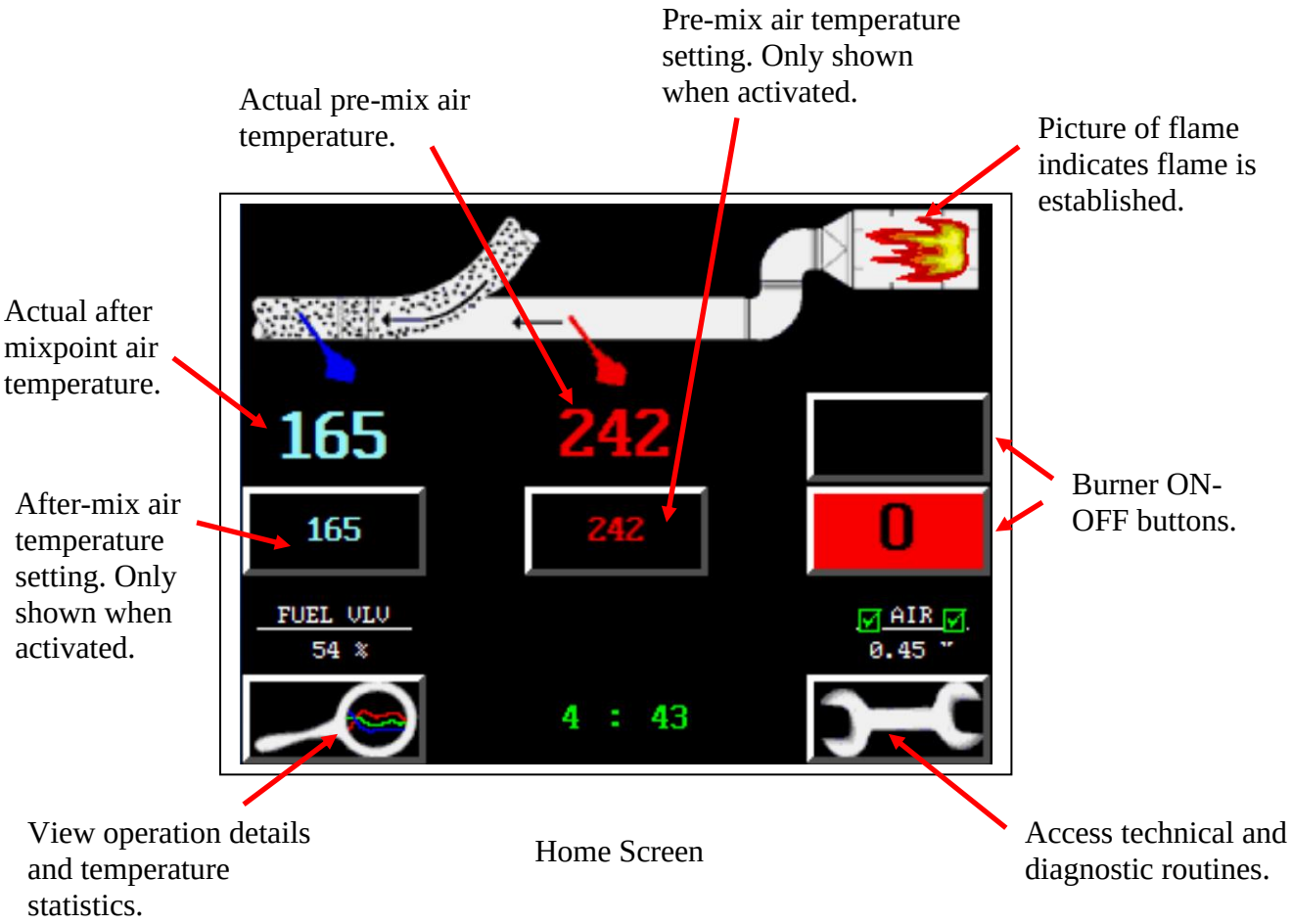
Heater Operation

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 upper cabinet door on the unit.

Touch the button on the right side of the screen marked with an "I" to turn on the Heater. The button marked with "0" is the corresponding OFF button.



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 a diagnostic 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 fuel supply valve that is closed) and you may be able to correct it without assistance.

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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. If it finds a problem with one of these devices, it alerts the operator with an ALARM or ERROR message that corresponds to the problem. These diagnostics are performed every time the Heater is started.

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 safety systems. 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.

WHERE DO I INSTALL THE THERMOCOUPLES?

The thermocouples are color-coded to assist the user in the installation of the correct thermocouple in the before and after-mix locations. A thermocouple with red on the mounting threads is 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.

A thermocouple with blue paint on the pipe threads is 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.

Referring to the following figure, placement of the after mix-point 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.

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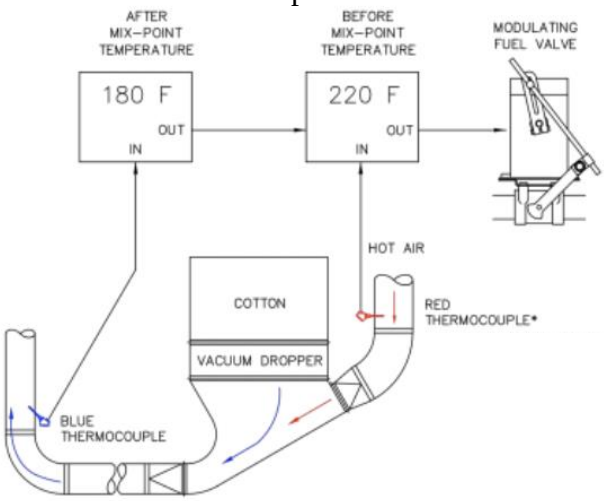
Basic Temperature Control



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 drying systems and dryers that contain cleaning cylinders, this after mix-point thermocouple should be placed in the top of the tower or in the transition immediately before the tower. Due to the responsiveness of the temperature controls, placing this thermocouple farther down in the tower will cause control instability.

For Heaters operating with Hot Boxes and module feeders, with the cotton going to an unloading separator, place the primary 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.

See the "*ADDITIONAL SETTINGS*" section in this manual for more information on setting the temperature control action of the Heater.

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

The setpoint temperature is set on either the color touch panel located at the Heater or on the optional Moisture Mirror X screen. To set the temperature, touch the

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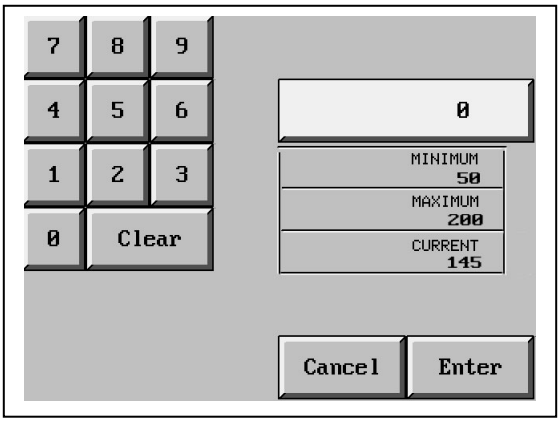
highlighted temperature button box under the actual temperature. The screen shown next will come up. Enter the new temperature setting then press “ENTER”. The after mixpoint temperature is normally the temperature adjusted.

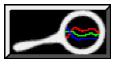
Temperature Setpoint Screen



If the Heater is operating with a Moisture Mirror X and automatic temperature control based on incoming seed cotton moisture is active, the after mixpoint temperature is adjusted automatically and the setpoint button will not be shown. More details for operation with the optional Moisture Mirror X are described later in the manual.

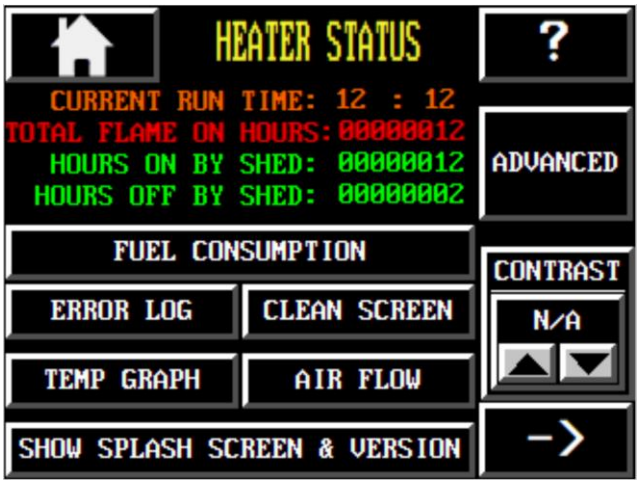
WHAT IS THE STATUS SCREEN?

The status screen shows operation details and statistics for the Heater including run times and fuel valve position. The Error Log, Air Flow Status, and display of software version number are also accessed here.

Press the magnifying glass 

on the Home Screen to switch to the STATUS screen.

Heater Status Screen



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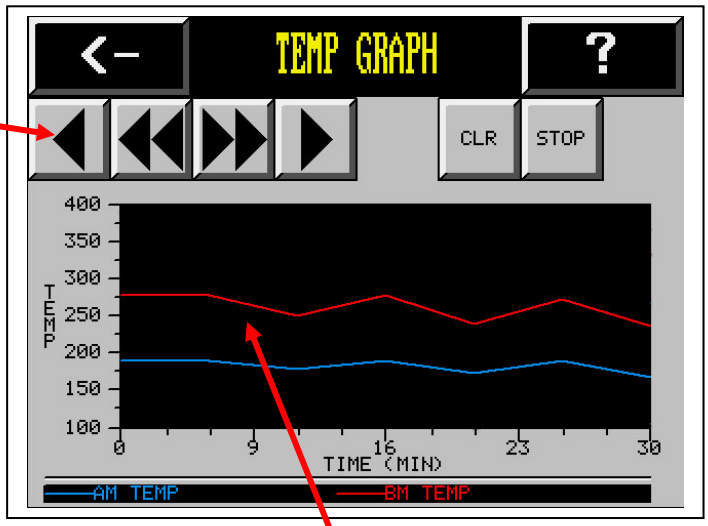
CAN I SEE WHAT THE ACTUAL BEFORE AND AFTER MIXPOINT TEMPERATURES HAVE BEEN OVER THE LAST FEW HOURS?

The actual before and after mix point temperatures are graphed on a screen over time for the last 24 hours. If power is turned off to the Heater, this historical graph information is lost. Press "TEMPERATURE GRAPH" button on the Heater Status screen to pull up the graphs for the temperatures.

Temperature Graph Screen

Use these buttons to scroll through time period.



Red line is before mixpoint (BM), blue line is after mixpoint (AM)

WHAT IS THE ERROR & ALARM LOGGING SYSTEM?

The *ERROR & ALARM LOGGING SYSTEM* is designed to make troubleshooting easier for both the user and Samuel Jackson service personnel. This system remembers the last 500 ERRORS and ALARMS, thus showing a history of past problems along with the time and date of each one.

WHAT IS THE "TEST PROGRAM"?

The *TEST PROGRAM* can be activated by a qualified service man to test a new installation. This feature allows the serviceman to proceed through a series of tests where individual components of the Heater can be calibrated and adjusted. It may also be used in the future by the operator or service man to troubleshoot a problem.

The test program is also performed on each new Heater before it leaves the factory. See the *TEST PROGRAM* section of manual for more information.

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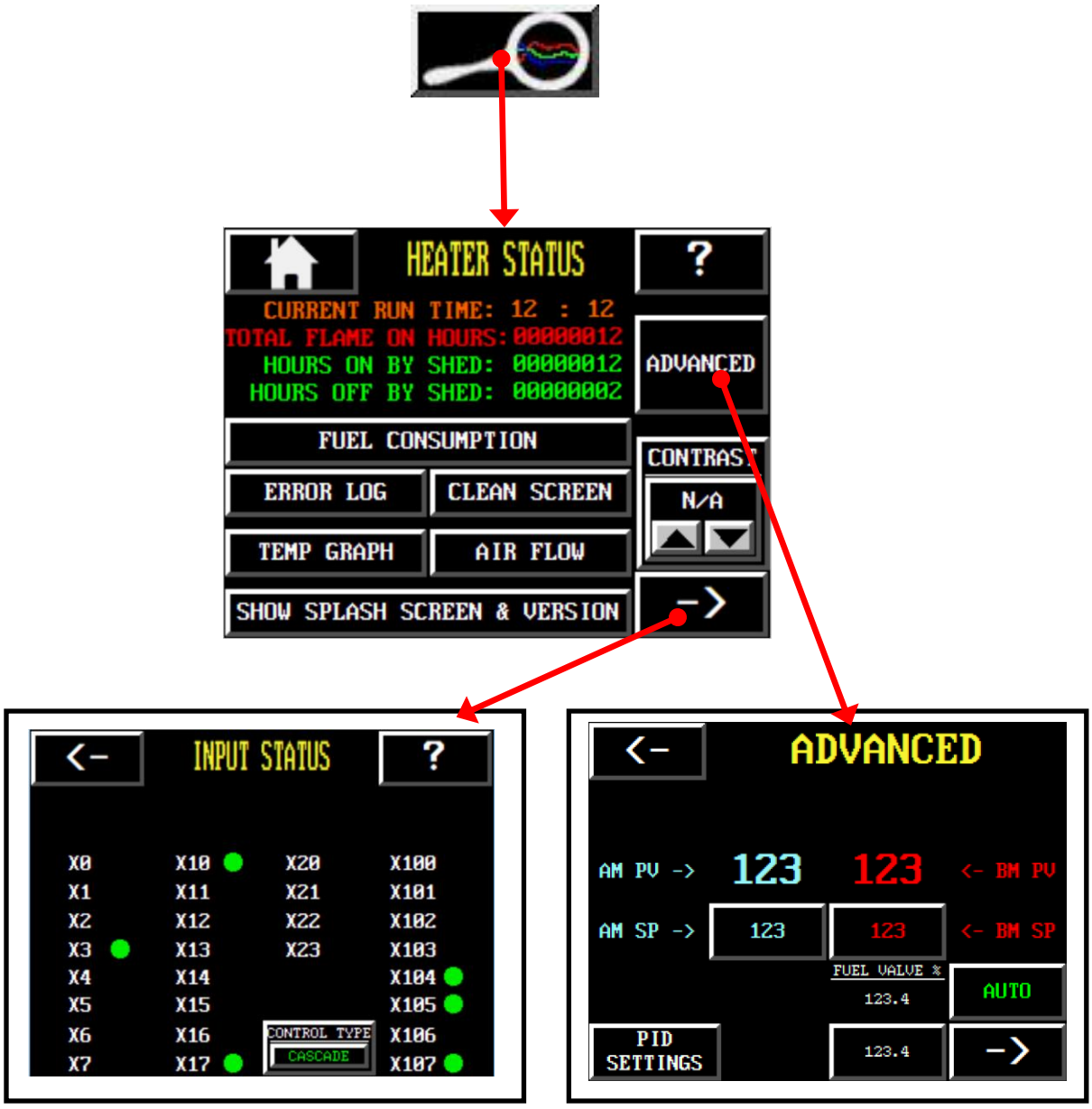
Navigating Important Menus

MAGNIFYING GLASS → HEATER STATUS



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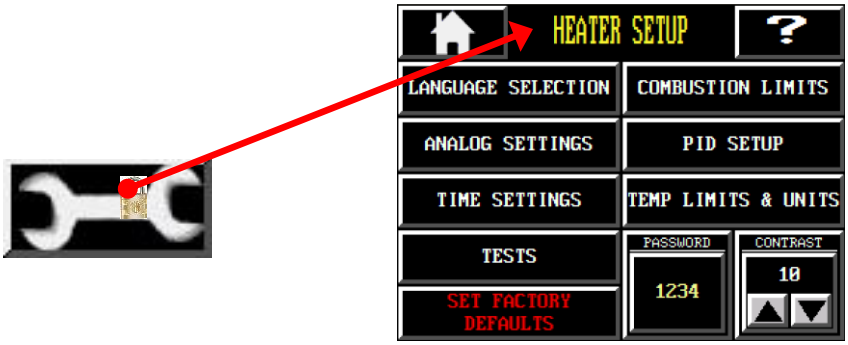
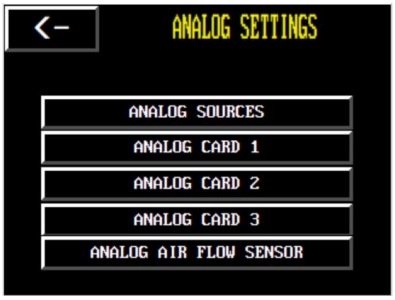
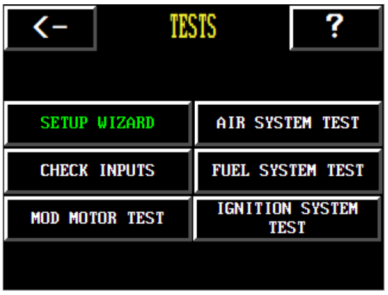
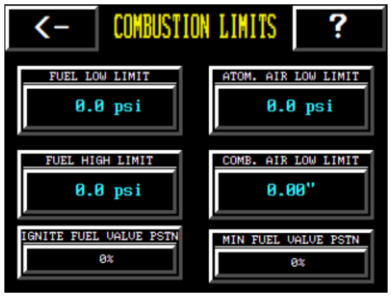
WRENCH →HEATER SETUP

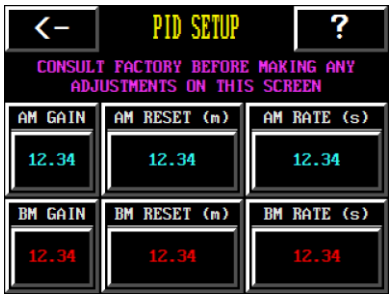


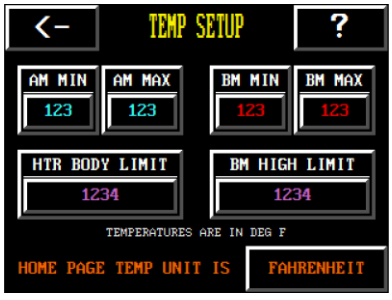
Under heater setup, press the button to proceed to the corresponding menu below.

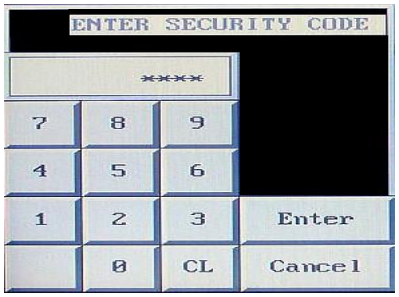












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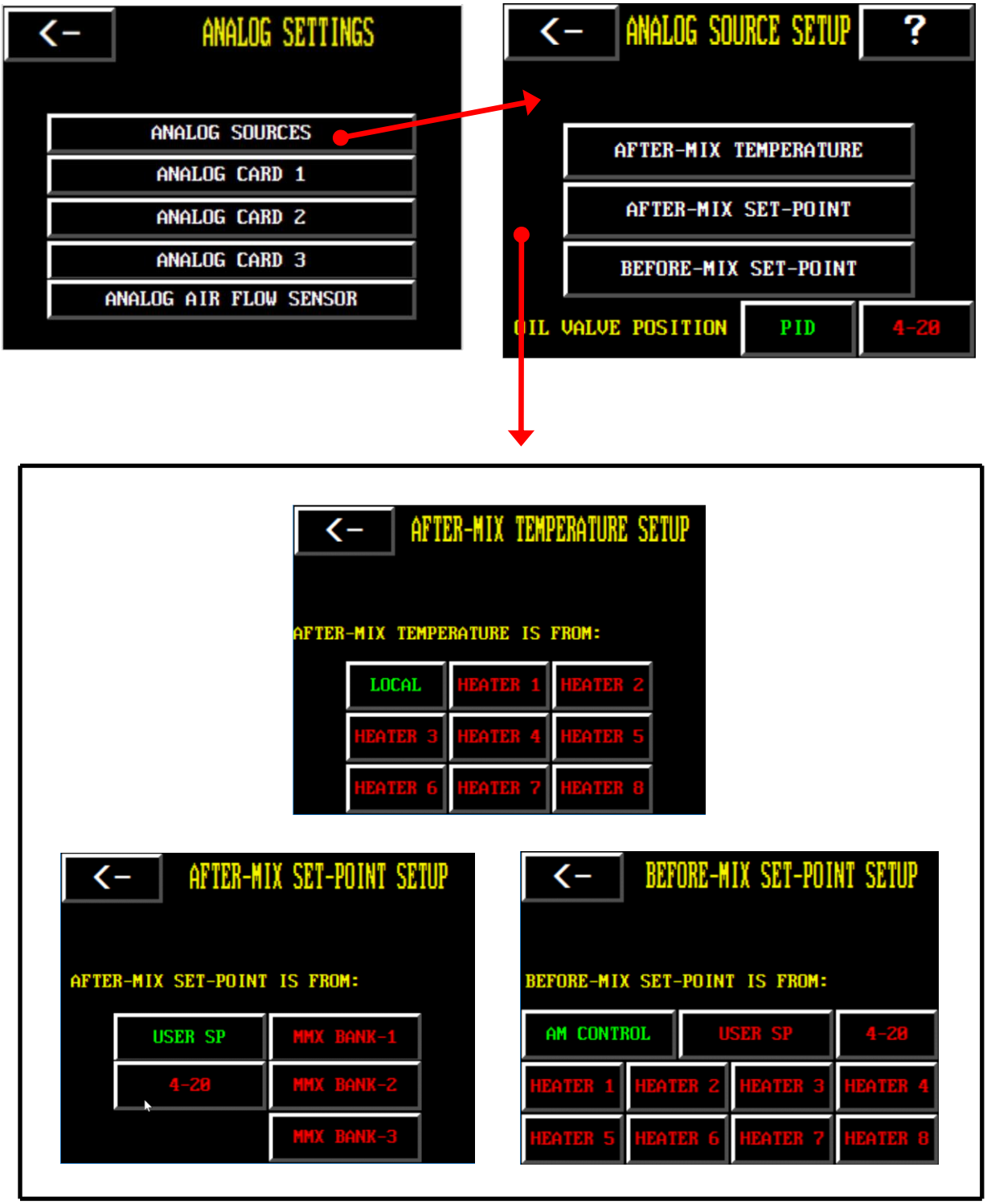
ANALOG SETTINGS → ANALOG SOURCES



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Enhancing Fuel Efficiency

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.

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Moisture Mirror X Option

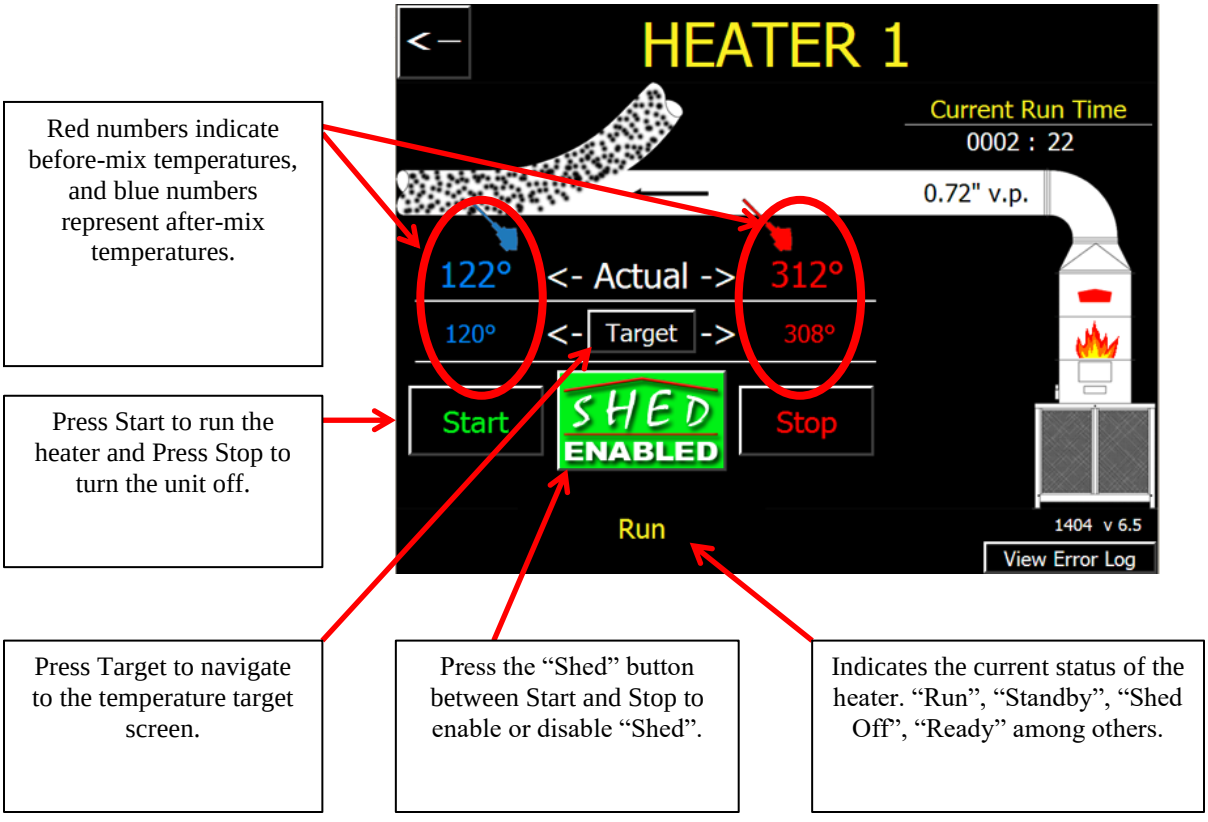
Remote Control and Optional Automatic Control

The 1500 series Heaters are compatible with the optional Moisture Mirror X offering remote control (normally from ginner's console) of the unit via a CAT5 ethernet connection. It has the ability to control up to eight Samuel Jackson Heaters and four Samuel Jackson Humidaire Units.

When the Moisture Mirror X is equipped with compatible moisture sensors at various stages in the ginning process it offers automatic dryer temperature control. It can also automatically adjust the water temperature setpoint on the lint moisture Humidaire Unit supplying moist air to moist air applicators like the Steamroller and Super Grid. Refer to the Moisture Mirror X manual for more information on features, connections and compatible moisture sensors.

Displayed on the Moisture Mirror X are the START / STOP operations, temperature settings, actual and target temperatures, and 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. Here you can start/stop, adjust temperatures, and view error messages for the specific Heater.



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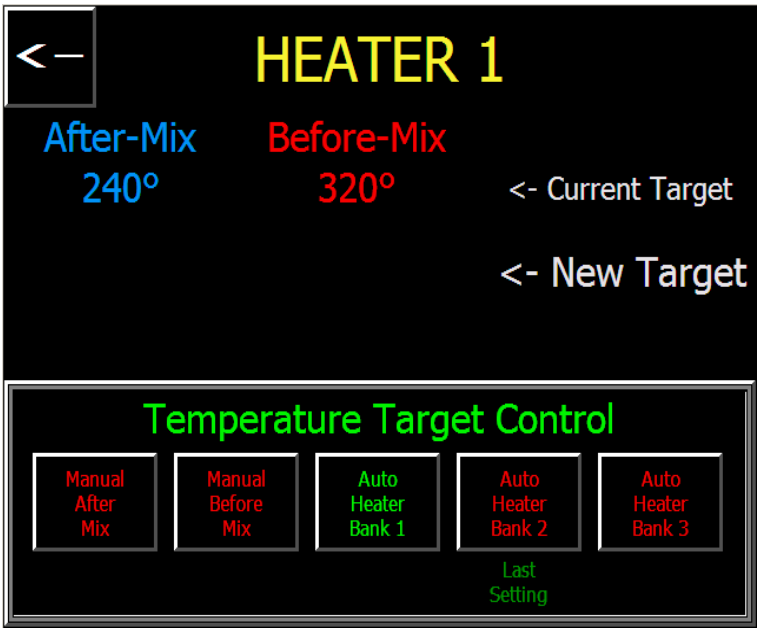
To access screens that require a password, 1234 is the default user password. If there is any question about a making a change to a default setting, press the large question mark button ("?").

Heater Target Screen

Selecting the Target button on the Moisture Mirror X "Heater 1" Screen will direct the user to the Heater 1 Target Screen.

If manual Before-Mix/After-Mix is active, you can manually change heater temperatures at the Moisture Mirror or Heater Cabinet. To change the temperature manually at the Mirror, press the box underneath the temperatures to navigate to a numerical keypad. When you have typed in the desired temperature, press ENT and then press Set Now underneath the number you just entered. When Heater Banks are active, the Mirror will automatically control the Heater After-Mix set point.

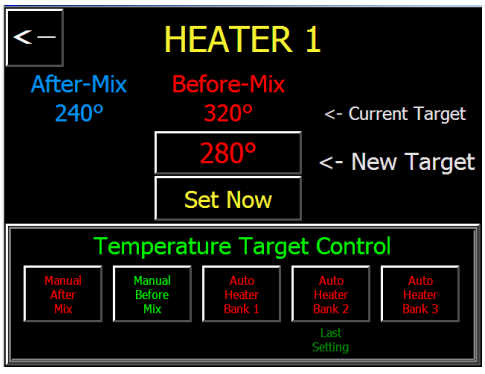


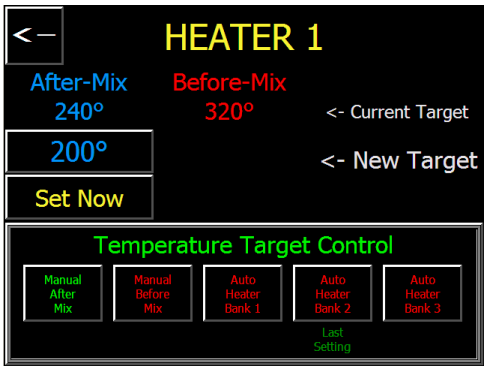
Auto Heater Control: Each heater can be setup with automatic Moisture Mirror control using one of 3 heater banks.

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

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

By pressing either manual button the heater can then be controlled by manually putting in either a Before-Mix or After-Mix temperature target. These options can be seen in the following two screenshots.





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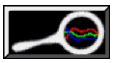
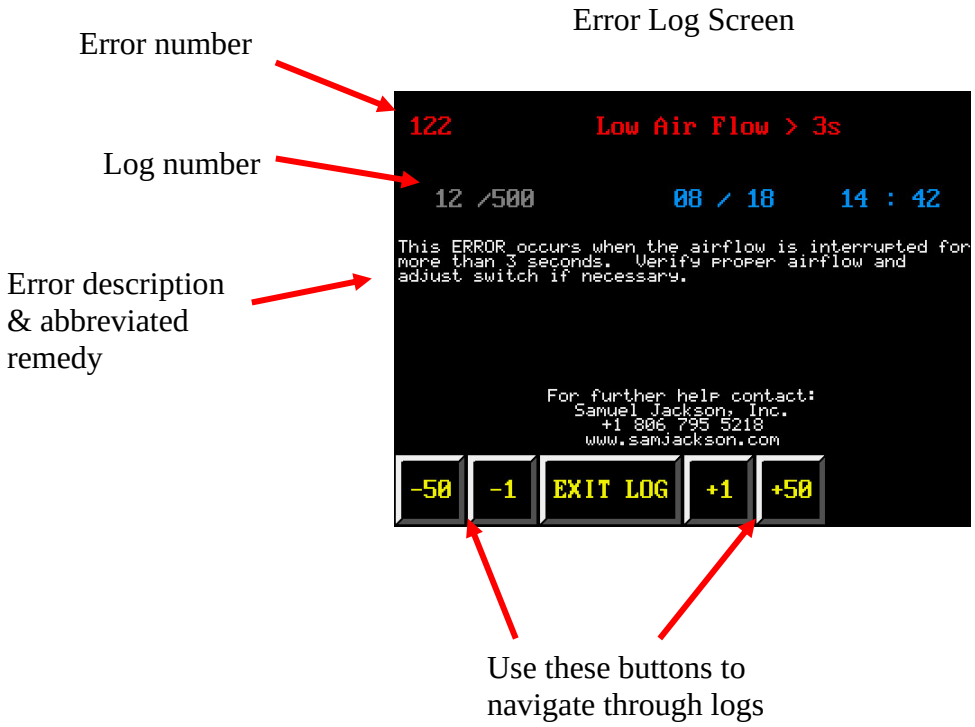
Error & Alarm Logging System

The *ERROR and ALARM LOGGING SYSTEM* is designed to make troubleshooting easier for both the user and Samuel Jackson service personnel. This system remembers the last 500 ERRORS and ALARMS, thus showing a history of past problems.

To access the log, press the magnifying glass 

on the color touch panel's Home Screen, which brings up the STATUS screen. Then press "VIEW ERROR LOG" button. Navigate through the log history by pressing the -1 or +1 buttons or press the -50 or +50 buttons to step through 50 events at a time. Note that the time and date of each occurrence are shown. The "EXIT LOG" button returns you to the Home Screen.

Error Log Screen



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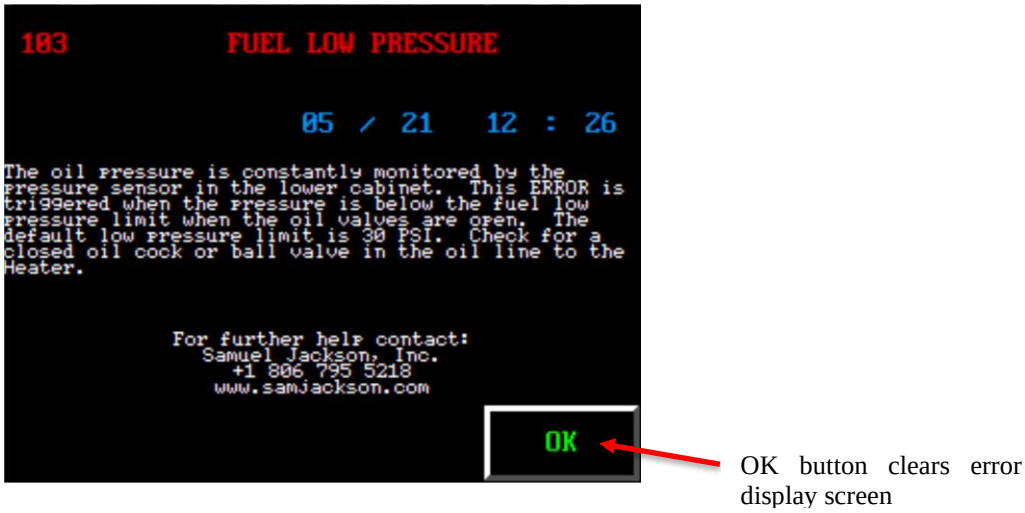
Error & Alarms Explanation

For software versions 1.0 and later

PRELIMINARIES -- ERRORS will cause the Heater to automatically shut down. ALARMS will permit the Heater to continue operation but warn of conditions which may cause a shutdown if left unattended. In each case, a brief description of the ERROR or ALARM will be shown on the color touch screen along with an abbreviated remedy.

The display will continue to show the ALARM or ERROR until the OK button is pressed. Only one ALARM or ERROR condition is displayed at a time. 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.

Active ERROR/ALARM Screen



EXAMPLE: The flame doesn't light on the first attempt. ALARM code 151 (Flame Failed) 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 144 (Excessive flame failures) after 3 unsuccessful tries. The display continues to show ALARM code 151 although the status light is still flashing and the burner is shut down due to an ERROR. Press OK to clear each ALARM code and then to clear ERROR code 144. After ERROR code 144 is cleared, the operator can attempt to restart the burner.

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ERROR 103

FUEL LOW PRESSURE: During operation, the fuel pressure is constantly monitored by the pressure transducer in the lower cabinet. This ERROR is triggered when the pressure is below the current oil low pressure limit. The default low limit is 30 psi but can be changed in the settings menu. Check fuel pump rotation when restart is attempted. It should rotate counter clockwise when viewed from the motor side of the pump. If fuel pump rotates correctly, check the following: Check for empty oil supply tank. Look for a closed valve in the supply pipe. Clean all three oil filters (to the right of the control cabinet, inside the lower cabinet, and on the burner head). Check for oil leaks, which could let air leak into supply pipe and cause pressure to fluctuate. Run the test program to adjust the oil pressure. Remember that the oil pressure determines the maximum heat output.

ERROR 104

FUEL HIGH PRESSURE: During operation, the fuel pressure is constantly monitored by the pressure transducer in the lower cabinet. This ERROR is triggered when the pressure is above the current oil high pressure limit. The default high limit is 80 PSI, but can be changed in the settings menu. Check to see if the Fuel Pressure Relief Valve (FPR) is jammed shut or its discharge connection is closed off. If this is not the case, check to see if the Oil High Pressure High Limit has been set to a pressure lower than the setting of the FPR. The pressure transmitter could be defective.

ALARM 121

LOW AIR FLOW < 3 SECONDS: This ALARM is an indication that a choke of the airflow is occurring. It is displayed when the air flow switch goes off and comes back on in less than 3 seconds. If air flow is ok, limits may be set too tight. See Air system section in *TEST PROGRAM* section of manual for adjustment of limits.

ERROR 122

LOW AIR FLOW > 3 SECONDS: This ERROR occurs when the airflow is interrupted for more than 3 seconds. Verify proper airflow and adjust lower limit of switch if necessary. See Air system (Air system & Fan Interlock) section in *TEST PROGRAM* section of manual for adjustment of limits.

ERROR 131

USER SPECIFIED TIME FOR SHUTDOWN: Some countries require that gas-fired combustion products turn off once every 24 hours as a safety measure. To accommodate operators that need to comply with this regulation, this error will force the Heater to shut down once a day at a user defined time. This error will only occur if it is enabled.

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ERROR 141

FAN INTERLOCK BYPASSED: Samuel Jackson Heaters are provided with a fan interlock relay (FIR) to provide immediate shutdown of the Heater when the fan(s) are 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.

ERROR 142

DEFECTIVE AIRFLOW SENSOR (AFT): This error indicates that an electrical signal is being received from the air flow transducer with no fan interlock signal present 10 minutes after turning the Heater off, effectively bypassing this important safety feature. Check the adjustment of the air flow transducer (AFT) and verify its operation.

ERROR 143

NO FAN INTERLOCK, ARE ALL FANS ON?: This error is caused when an attempt is made to start or operate the burner when no fan interlock signal is present. A fan interlock relay is supplied with the unit to provide instant shutdown when the fan(s) stop. The installing electrician is responsible for wiring the coil of this relay (FIR) to the fan circuit.

ERROR 144

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 144. Use the error log to determine which alarms the flame failure triggered. Knowing which three alarms caused the error will help determine the problem.

ALARM 146

BURNER FAILED TO IGNITE: This ALARM means that the burner head in the Heater failed to light during ignition sequence. See the maintenance tips later in this section.

ALARM 151

FLAME FAILED: This ALARM means that the burner failed after the flame had been established. See maintenance tips below.

TIPS

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

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- Clean the spark plug if it appears dirty. Look for oil on the spark igniter. See drawing in Service Manual entitled *ADJUSTMENT OF 12796 AND 14200 SPARK IGNITORS* for correct adjustment.
- Check for proper clamping position of the spark igniter. See drawing for this adjustment.
- Make sure that the oil purge in the test program was complete and that you see fuel rising in the Flow Meter (FF) without air bubbles when ignition is attempted. Verify that the small purge cock at the burner head is closed.
- If you see a flame in the viewing window of the burner, but the flame light does not come on, suspect a defective Flame Scanner (FS) or a defective Flame Relay (FLR). Unscrew FS and test it with a lighted match while watching for light on FLR.

ERROR 153

FLAME BEFORE FUEL, BEFORE SPARK: This ERROR is normally caused by a malfunction or tampering with the flame relay (FLA).

ERROR 160

BEFORE MIX-POINT TEMPERATURE SENSOR WIRING REVERSED: The before mix-point temperature shows air getting cooler after flame is established indicating reversed thermocouple wiring. If this problem persists, try the following:

- In the junction head of the red Thermocouple, check that RED wire is connected to negative (-) junction and WHITE wire is connected to positive (+) junction on transmitter. Reversing these wires will cause this problem.
- Refer to *ELECTRICAL INSTALLATION NOTES* section in this manual for more information.

ERROR 161

AFTER MIX-POINT TEMPERATURE SENSOR WIRING REVERSED: The after mix-point temperature shows air getting cooler after flame is established indicating reversed thermocouple wiring. If this problem persists, try the following:

- In the junction head of the blue Thermocouple, check that RED wire is connected to negative (-) junction and WHITE wire is connected to positive (+) junction on transmitter. Reversing these wires will cause this problem.
- Refer to *ELECTRICAL INSTALLATION NOTES* section in this manual for more information.

ERROR 162

BURNER BODY HIGH TEMP LIMIT BEFORE FLAME ESTABLISHED: The burner body high temperature limit was reached before a flame was established. This error can occur when the high temperature limit is set too low (and easily exceeded by normal operating temperatures). It can also occur if Type-K thermocouple wire has not been used to connect the thermocouple to the temperature controller, or if the wire is loose or disconnected.

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ERROR 163

BURNER BODY HIGH TEMPERATURE LIMIT: The burner body high temperature limit was reached while a flame was established. This error can occur when the high temperature limit is set too low (and easily exceeded by normal operating temperatures). It can also occur if Type-K thermocouple wire has not been used to connect the thermocouple to the temperature controller, or if the wire is loose or disconnected.

ERROR 164

BM TEMPERATURE SENSOR BURNOUT: The integrity of the thermocouple wiring and thermocouple is checked during the pre-ignition checks each time the Heater is started. This error occurs when the before mix-point thermocouple connection is an open circuit indicating a loose wire or a failed thermocouple sensor.

ERROR 165

AM TEMPERATURE SENSOR BURNOUT: The integrity of the thermocouple wiring and thermocouple is checked during the pre-ignition checks each time the Heater is started. This error occurs when the after mix-point thermocouple connection is an open circuit indicating a loose wire or a failed thermocouple sensor.

ERROR 170

LOW PLC BATTERY: The battery in the PLC is low and needs replacing. The Heater will continue to operate with a low battery or without a battery, but all custom user settings will be lost.

ERROR 171

BEFORE MIX HIGH TEMPERATURE LIMIT EXCEEDED: This error will shut the Heater down to excessively high temperatures before the mixpoint which the modulating gas valve and controls are unable to constrain. Check for the following:

- Deficient air volume, especially when cotton begins to enter the system.
- Chokes in the air system.

ALARM 175

HOT BOX TRASH GATE OPEN FOR MORE THAN 20 SECONDS: This ALARM is optional for users of the Samuel Jackson Hot Box II. The pivoting trash gate on the Hot Box II has remained open for more than 20 seconds allowing outside air to leak into the drying system. This condition greatly hurts the performance of the drying system. Check for junk jamming the trash gate open.

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ERROR 176

HOT BOX TRASH GATE OPEN FOR MORE THAN 2 MINUTES: This ERROR is similar to ALARM 175 except the trash gate on the Hot Box II has remained open for more than 2 minutes. The burner will shut down and this ERROR will be displayed after resetting ALARM 175.

ERROR 177

POWER FAULT DURING OPERATION: This error means that electrical power was disconnected while the burner was on or during the 5 minute cool-down stage of shutdown. Check for faulty supply wiring connections.

ERROR 401

REMOVE JUMPER FROM ANALOG CARD #1: The analog input card #1 for the PLC has a jumper in place that needs to be removed. Consult the factory for help.

ERROR 402

REMOVE JUMPER FROM ANALOG CARD #2: The analog input card #2 for the PLC has a jumper in place that needs to be removed. Consult the factory for help.

ERROR 403

REMOVE JUMPER FROM ANALOG CARD #3: The analog input card #3 for the PLC has a jumper in place that needs to be removed. Consult the factory for help.

ERROR 404

ANALOG INPUT 1.1 (BEFORE MIX TEMPERATURE) FAILED: The analog input is less than 4mA DC from the before mix thermocouple. First check that all wires are firmly attached in the circuit, that there is no broken wire and that fuse 1.1 is not blown.

ERROR 405

ANALOG INPUT 1.2 (AFTER MIX TEMPERATURE) FAILED: The analog input is less than 4mA DC from the after mix thermocouple. First check that all wires are firmly attached in the circuit, that there is no broken wire and that fuse 1.2 is not blown.

ERROR 406

ANALOG INPUT 1.3 (HEATER BODY TEMPERATURE) FAILED: The analog input is less than 4mA DC from the heater body temperature transducer. First check that all wires are firmly attached in the circuit, that there is no broken wire and that fuse 1.3 is not blown.

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ERROR 408

ANALOG INPUT 2.1 (AIR FLOW) FAILED: The analog input is less than 4mA DC from the air flow transducer. First check that all wires are firmly attached in the circuit, that there is no broken wire and that fuse 2.1 is not blown.

ERROR 409

ANALOG INPUT 2.2 (COMBUSTION AIR PRESSURE) FAILED. The analog input is less than 4mA DC from the combustion air pressure transducer. First check that all wires are firmly attached in the circuit, that there is no broken wire and that fuse 2.2 is not blown.

ERROR 411

ANALOG INPUT 2.4 (FUEL PRESSURE) FAILED: The analog input is less than 4mA DC from the fuel pressure transducer. First check that all wires are firmly attached in the circuit, that there is no broken wire and that fuse 2.4 is not blown.

ERROR 412

ANALOG INPUT 3.1 (ATOMIZING AIR PRESSURE) FAILED. The analog input is less than 4mA DC from the atomizing air pressure transducer. First check that all wires are firmly attached in the circuit, that there is no broken wire and that fuse 3.1 is not blown.

ERROR 418

FUEL OVERLOAD ERROR: Reset the overload relay before clearing the error with the reset button. This diagnostic is not active in the test program, although the overload relay continues to protect the fuel pump motor. The following should be checked before continuing operation following this error.

- Verify setting of overload relay OPOL at 0.85 amperes.
- Verify voltage at one of the following, 380/50 or 415/50.
- Check for low voltage condition.
- Verify free rotation of motor and pump shaft.
- Verify fuel oil high pressure is not set too high.

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ERROR 419

COMBUSTION FAN OVERLOAD: Reset the overload relay before clearing the error with the reset button. This diagnostic is not active in the test program, although the overload relay continues to protect the combustion fan motor. The following should be checked before continuing operation following this error.

- Verify setting of overload relay CAFOL at 2.8 amperes.
- Verify voltage at one of the following, 380/50 or 415/50.
- Check for low voltage condition.
- Verify free rotation of motor shaft and fan impeller.

ERROR 422

MODULATING MOTOR FAILED TO OPEN: The modulating valve on the burner head failed to open in a timely fashion. Check that the modulating motor is functioning and that the low fire sensor (LFS) is operating and adjusted correctly.

ERROR 423

MODULATING MOTOR FAILED TO CLOSE: The modulating valve on the burner head failed to close in a timely fashion. Check that the modulating motor is functioning and that the low fire sensor (LFS) is operating and adjusted correctly.

ERROR 424

ATOMIZING AIR PRESSURE FAILURE: The atomizing air pressure fell below 60 psi (default). This may be caused by an inadequate air compressor, a closed valve in the supply line or an unusual usage of compressed air elsewhere in the plant. Dependable air pressure is essential for the proper operation of the burner.

ERROR 425

COMBUSTION AIR PRESSURE NOT SATISFIED: This error occurs when the Combustion Air Pressure Transducer (CAT) senses insufficient combustion air pressure during certain steps of the operating program. Check for proper rotation of the combustion air fan motor FM, and make sure the overload relay CAFOL for this motor is not tripped. Reset CAFOL if tripped. After verifying good combustion air pressure (through the tubes going to CAT), check for proper operation of CAT.

ERROR 449

FLAME ON TOO LONG: This error occurs when a flame signal has been received for greater than 10 seconds during shutdown mode.

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ERROR 454

AIR FLOW UNCHANGED: The Air Flow Transducer (AFT) reading has not changed in over a minute, indicating that the transducer may not be working correctly or may be damaged or bypassed.

ERROR 458

COMBUSTION AIR ON TOO LONG: This error occurs when the combustion air fan has been on for greater than 20 seconds during the ignition process and may impede the attempt to ignite. The combustion fan must be turned off when ignition is attempted in order for a flame to be established. Once a flame is established, the combustion fan will be turned on again and tested to ensure it does not blow out the flame. If this error occurs, check for proper wiring of the combustion fan.

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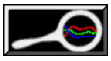
Troubleshooting

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. The "*ELECTRICAL SCHEMATIC WITH PLC INPUTS/OUTPUTS FOR VULCAIN HEATERS*", included in this manual and on the inside door of the cabinet, show the input/output numbers for the PLC.

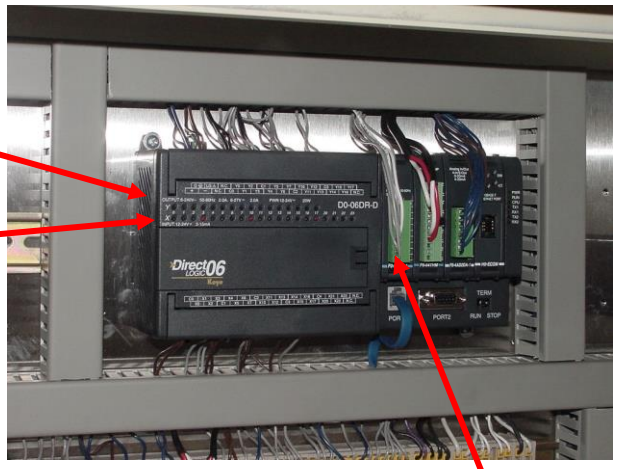
Input lights for X0 through X23 are shown on the PLC. Input lights for X100 through X107 are not shown on the PLC so a screen on the color touch panel shows all of the input conditions. A green light beside the input number indicates an "on" condition.

Press the magnifying glass 

on the Home Screen to access the Heater Status screens, then go to the second page.

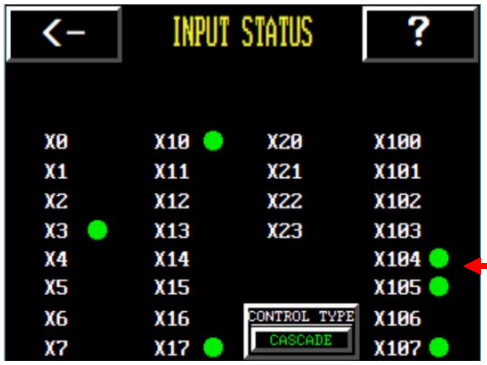
Output lights for outputs Y0 through Y23

Input lights for inputs X0 through X23



Inputs on this card are for X100 through X107 and do not have indicator lights

Heater Status Screen, Page 2, showing input conditions



A green light next to an input means that input is "on".

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Test Program

For software versions 1.0 and later

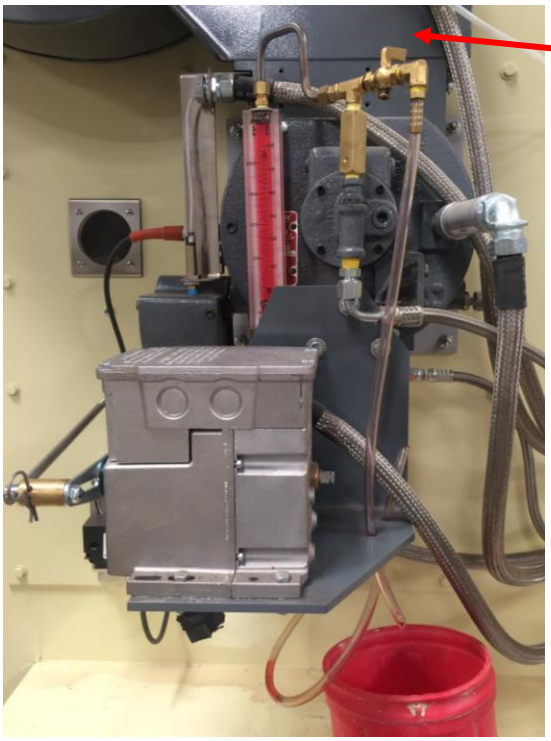
PRELIMINARY:

To test a new installation, first check that all necessary connections for electrical and fuel are made. Standard 3-phase electrical power supplies are 415 VAC/50 HZ or 380 VAC/50HZ.

Turn on the electrical power to the cabinet, but leave the circuit breaker (CB) off. Check that power to terminals 1 and 2 on the electrical panel is between 110 and 125 VAC.

Check that the thermocouples are connected and hooked to the correct terminals on the electrical panel and then turn on the circuit breaker (CB). 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 at the thermocouple. The temperature displayed for that thermocouple (before or after mixpoint) should be 777.

Oil Burner Head and Purge Line



Oil cock at back of burner head
(Open to Purge)

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Prepare to purge the oil line of air by opening the cock at the back of the burner head and opening the oil valve. The oil mod motor may need to be partially opened in order to purge air. Air is present in the line if the pressure gauge needle bounces or if air bubbles are in the flow meter. Oil pressure should be regulated to 20 psi for HO-1 and 60 psi for HO-4 and HO-7.

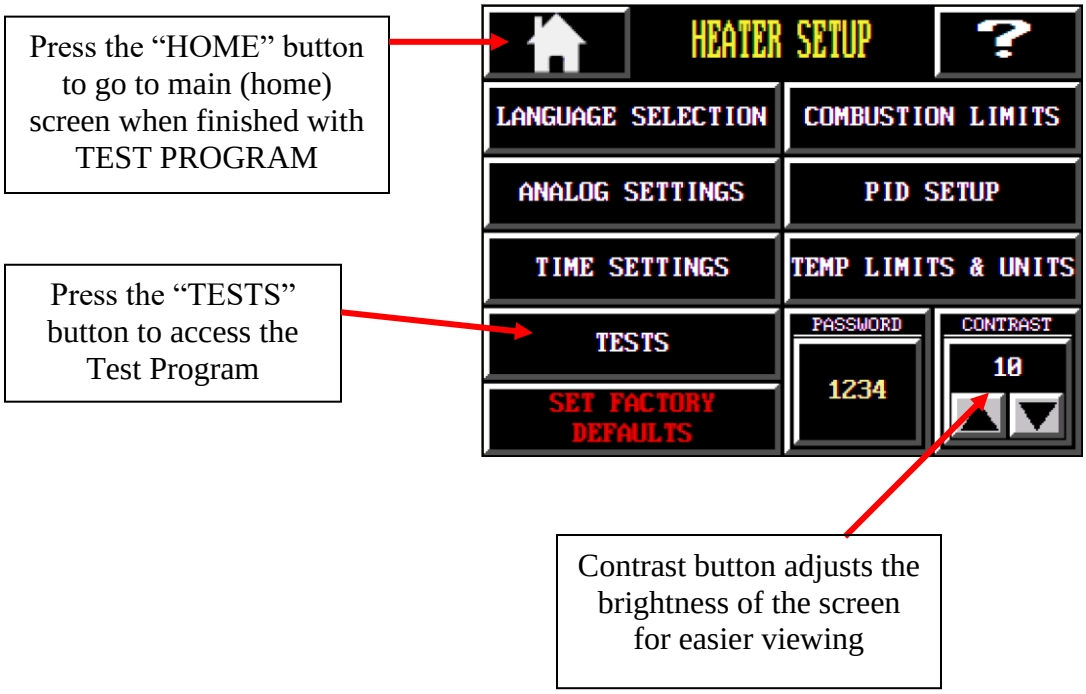
Tighten the adjustment screw to raise the pressure or loosen the adjustment screw to lower the oil pressure. It should be noted that the atomizing air pressure should be set at 50 psi for HO-1 and 120 psi for HO-4 and HO-7.

The *TEST PROGRAM* offers a methodical way to correct problems. Access it by pressing the wrench button 

on the color touch panel's home screen. The SETUP screen shown below will come up. Pressing the "TESTS button accesses the *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.



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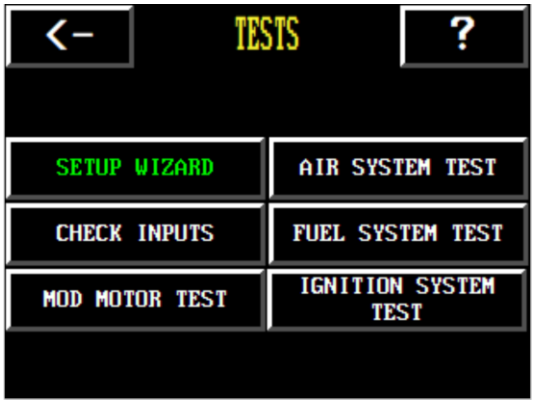
Access to the *TEST PROGRAM* is denied if a jumper wire is not in place between terminals 30 and X3 on the electrical panel for “remote stop” signal (Input X3). If the optional “remote stop” feature is used, then this jumper is removed when installing a normally closed operator switch.

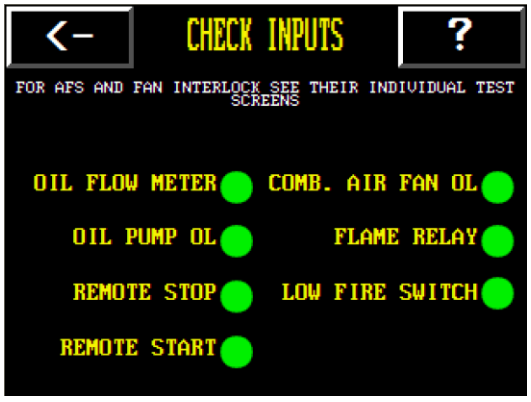
TEST PROGRAM screen



Now methodically press each button on the TEST PROGRAM screen to check and make adjustments before attempting to light the unit. An alternative method that automatically steps through all the tests is the “Setup Wizard”. See the ***SETUP WIZARD*** section for details.

CHECK INPUTS

Several important inputs to the PLC are checked here. If the light to the left of the component is green, the input condition is ok. If it is red, then the component may have failed, may not be connected properly, or is out of adjustment.



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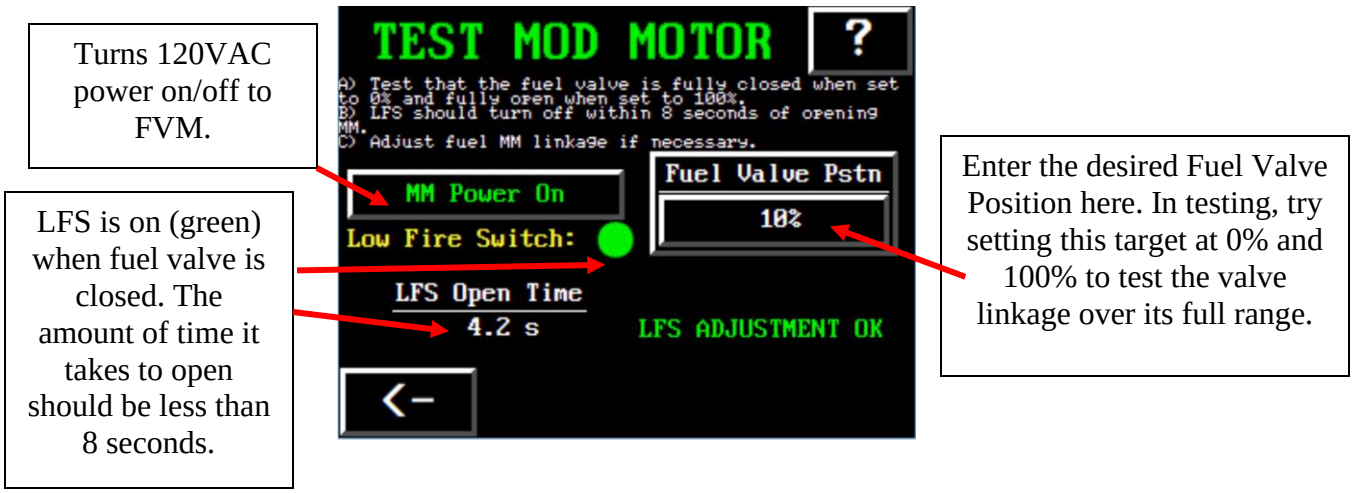
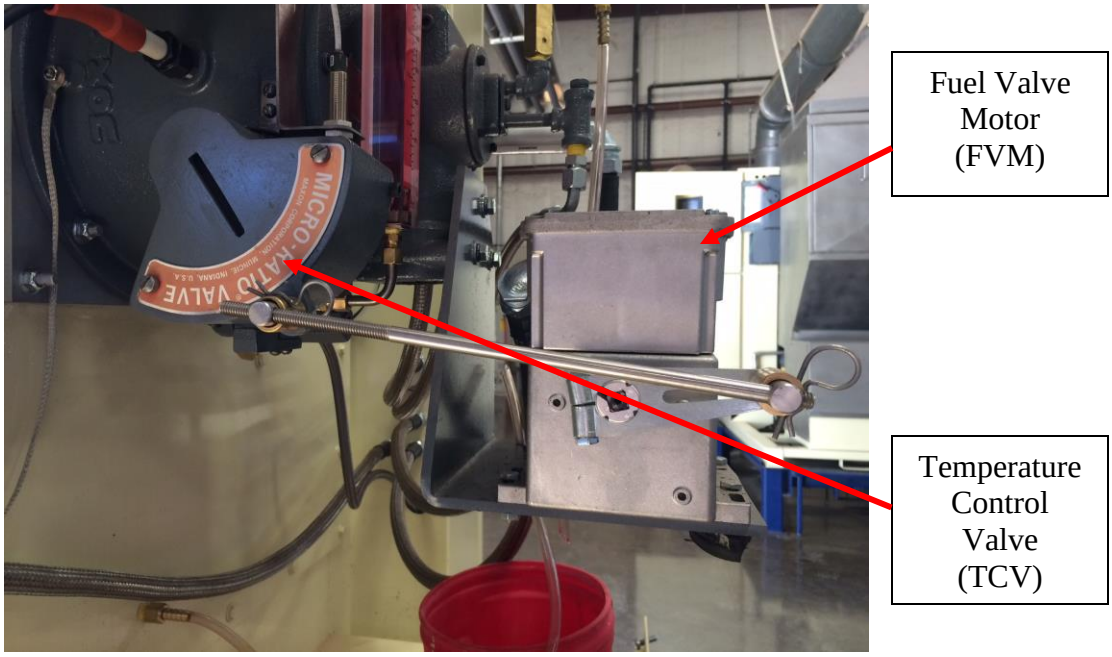
MOD MOTOR TEST

The setup, operation and adjustment of the Fuel Valve Motor (FVM) is checked here.



The linkage from the Fuel Valve Motor (FVM) to the Temperature Control Valve (TCV) has been adjusted at the factory for correct travel. TCV is shown in closed position below. It travels 90 degrees for fully open while FVM linkage arm travels 160 degrees.



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AIR SYSTEM (& FAN INTERLOCK) TEST

The operations of the Air Flow Transducer (AFT) and Fan Interlock Relay (FIR) are checked here. To adjust and test the air flow range settings for the AFT, touch the page back button **(←)** to go back to the Test Program screen, then touch the ← button to go back to the HEATER SETUP screen. Now press the "ANALOG SETTINGS" button and then ANALOG CARD 2 button. This will take you to the ANALOG CARD 2 setup screen.

Observe the Air Flow (V.P.) reading. This is the velocity pressure through the burner body in the area of the burner heads. The velocity pressure should be about 0.4 inches water column.

If the V.P. is too low, the flame may be wavering and the Air Flow Transducer AFT not responsive. If the VP is too high, the burner may be hard to light requiring a higher setting of the low fire switch LFS position, and burner may roar at high output.

Now go back to the TEST PROGRAM and the AIR SYSTEM TEST screen. Both lights should be green. If the Air Flow Transducer light is red, the range settings for the air flow or the airflow itself may need to be adjusted. If the Fan Interlock light is red, the fan interlock (FIR) is not working.

FUEL SYSTEM TEST

Operation of the atomizing air valve, combustion air fan, oil pump, oil valve, and fuel valve motor (FVM) are checked here. Each component may be tested as follows:

Atomizing Air Valve: Open the Atomizing Air Valve. Check that the atomizing air pressure reading is displayed on the right side of the page and shows a reading of 50 PSI for HO-1 and 120 PSI for HO-4 & HO-7. You should also hear a loud hiss if the gin is quiet enough and the PLC light for Y12 should light up. Close the valve or leave it open before checking other components.

Combustion Air Fan: Turn on the Combustion Air Fan. Check that the combustion air velocity pressure reading is displayed on the right side of the page and shows a reading of 2" water column. You should also hear a loud roar while the fan is on, and the PLC light for Y16 should light up. Turn the fan off or leave it on before checking other components.

Oil Pump: Turn on the Oil Pump. Check that the fuel pressure reading is displayed on the right side of the page and shows a reading of 60 PSI. While the oil pump is on, the shaft on the motor below the electrical control panel should be spinning and the PLC light for Y17 should light up. If the gin is quiet, you may also hear the motor turn. Turn the pump off or leave it on before checking other components.

Oil Valve: Open the Oil Valve. The light for Y13 on the PLC should light up. If the gin is quiet, the valve below the electrical cabinet should be heard clicking on and off. If the gin is loud, it is also possible to feel the valve open and close as the oil valve is turned on or off. Close this valve after it has been checked to prevent fuel pooling in the heater.

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Fuel Valve (Mod Motor) Position: This check is similar to that given by the more thorough setup instructions on the MOD MOTOR TEST page. Turn on the Mod Motor Power and set the Fuel Valve Position to 100% to ensure that the valve opens fully and the Low Fire Switch (LFS) turns off (red). Set the Fuel Valve Position to 0% to close the valve and ensure that the LFS turns on (green). The minimum allowable Fuel Valve Position may also be set on this page.

TEST INTERFERENCE (& IGNITION)

Operation of the ignition transformer and spark plug is checked here. Electrical interference between the spark plug and flame sensor is also checked.

The fan must be running at least 20 seconds before you are able to access this screen. Operation of the fan is verified by both the Air Flow Transducer (AFT) and the Fan Interlock Relay (FIR) being satisfied.

Touch the “IGT” button. The green light should remain green at all times. If it is quiet in the gin, you should hear the hiss of the spark. The spark electrode gap should be between 1/16 and 1/8 inch (1.5 to 3mm). If the light turns red indicating interference, check the path of the spark plug wire from the ignition transformer to the burner head. See the page *ADJUSTMENT OF 12796 AND 14200 SPARK IGNITORS* for information on setting the oil spark plug.

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Setup Wizard

For software versions 1.0 and later

Located on the TEST screen is the “Setup Wizard” button. Press it to enter a test program that will guide you systematically through all of the checks that should be completed before attempting to light and operate the Heater. Use the ← and → buttons to navigate back to the previous step or to go forward. You may back out and exit the Wizard at any point in the program.

Step 1
Select if this Setup Wizard will appear as the first default screen on the next power-up. The password can be modified here.

Step 2
The overload relays settings are checked here. The combustion air fan motor overload relay should be set on 6.5 amps, the fuel pump motor overload relay should be set on 0.8 amps for HO-4 and HO-7. For HO-1, the combustion air fan motor overload relay should be set on 2.5 amps, the fuel pump motor overload relay should be set on 0.8 amps and the main fan overload relay should be set on 5.5 amps.

Step 3
The rotation of the oil pump and combustion air fan are checked here as well as the rotation of the main fan for HO-1.

 ***If the rotation is wrong, disconnect 3 phase power to the Heater Unit following OSHA lockout/tag-out procedures before proceeding.***

Swapping the positions of two of the 3∅ wires at the supply side of the motor contactor will reverse the rotation. After checking the wires, a final time for tightness, reconnect the power.

Step 4
Turn on power to the fuel modulating motor and then set the fuel valve position to 100% to test the operation of the low fire switch (LFS). The low fire switch should turn off with 8 seconds of the fuel valve beginning to move open. Set the fuel valve position to 0% to close the fuel valve, and wait until the modulating motor stops moving if this test needs to be performed again.
Refer to the MOD MOTOR TEST page in the TESTS section outside of this Wizard for a more detailed description of the fuel valve operation and adjustments.

Step 5
A list of inputs to the PLC that are expected to be on are listed here. The light will be green and indicate ON if the condition of certain inputs to the PLC are satisfied.

Step 6
The Atomizing Air Valve and Oil Valve are checked here. Pressing the corresponding button will turn the valve on and off. Each valve should be turned off before exiting this page.

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Step 7
Turn on the main air fan. The Fan Interlock and Air Flow Switch lights should be green and the actual air velocity pressure will be shown.
Turn on the Combustion Air Fan by pressing the button and verify that the combustion air velocity pressure reading is displayed on the right side of the page and shows a reading of 2" water column.
Open the Atomizing Air Valve by pressing the button and verify that the atomizing air pressure reading is displayed on the right side of the page and shows a reading of 50 psi for HO-1 and 120 psi for HO-4 and HO-7.

Step 8
This screen allows to purge the oil line with the oil pump on and the oil valve opened. The fuel pressure is displayed on the top of the screen. The oil pressure should be set at 20 psi for HO-1 and 60 psi for HO-4 and HO-7. Refer to the beginning of the Test Program section for a more detailed description of the purge line operation and oil pressure adjustment.

Step 9
The main air fan must be on for this step. The Fan Interlock and Air Flow Switch indicator lights should be green. Press the "Ignition Transformer Off" button to turn the ignition transformer on. The "Flame Signal" indicator should remain green (signifying OFF) when the ignition is transformer is on. For safety, the "Transformer Off" button will not be available until both the fan interlock and air flow conditions are satisfied for 20 seconds.

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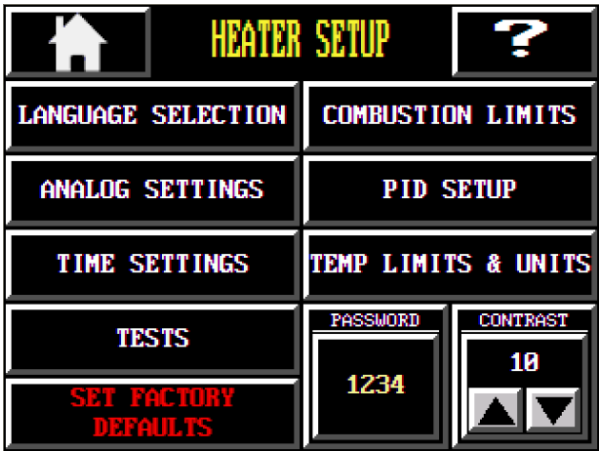
Additional Settings

For software versions 1.0 and later

After completing the *TEST PROGRAM*, some additional adjustments are made from the SETUP screen. Access the SETUP screen by pressing the

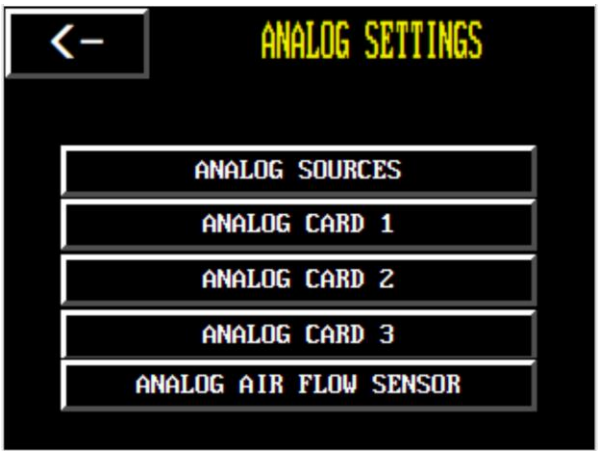
on the color touch panel's home screen then enter the password. The "SET FACTORY DEFAULTS" button returns all custom settings back to factory defaults. The TESTS features are described in the prior section of this manual. Descriptions for the rest of the setups are shown below.

Heater Setup Screen



ANALOG SETTINGS

Analog Settings Screen



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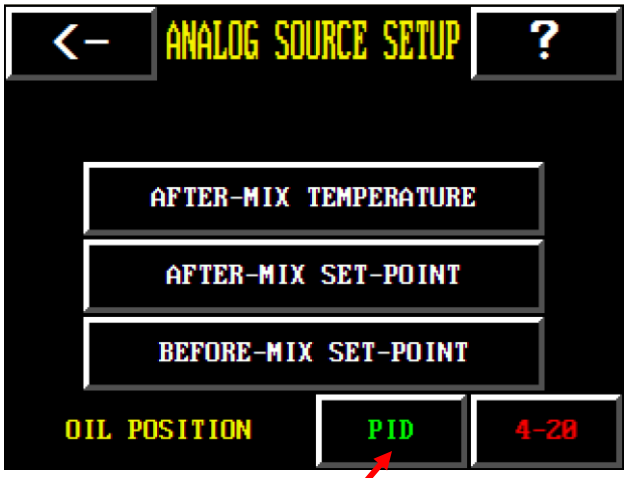
The “ANALOG SOURCES” and the “ANALOG CARD” buttons will activate screens that the factory may ask you to access under special circumstances.

During Heater Commissioning, the technician will use the “ANALOG SOURCES” button to access screens for setting up the logic for temperature sensing and control. A brief explanation of these screens and the control logic follow. Please consult with the factory before making any changes to the control settings on these screens.

Pressing the “ANALOG SOURCES” button brings up the following screen.

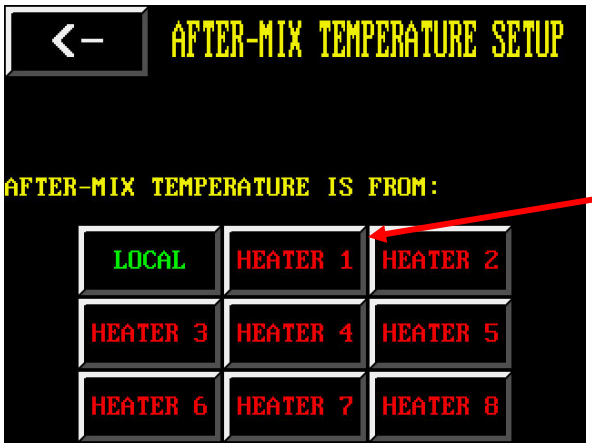
Analog Source Setup Screen



The “PID” button is normally left green indicating internal control is used for setting fuel valve motor (FVM) position.

Now press the “AFTER-MIX TEMPERATURE” button. Normally, the “LOCAL” button is activated here. Active is indicated by green word color. “LOCAL” indicates that this Heater control is responsible for internally setting the after mix temperature setpoint.

After-Mix Temperature Setup Screen



“HEATER 1”, “HEATER 2”, etc. buttons refer to the Ethernet port ID number of the Heater that the after mix thermocouple is connected to for some drying systems.

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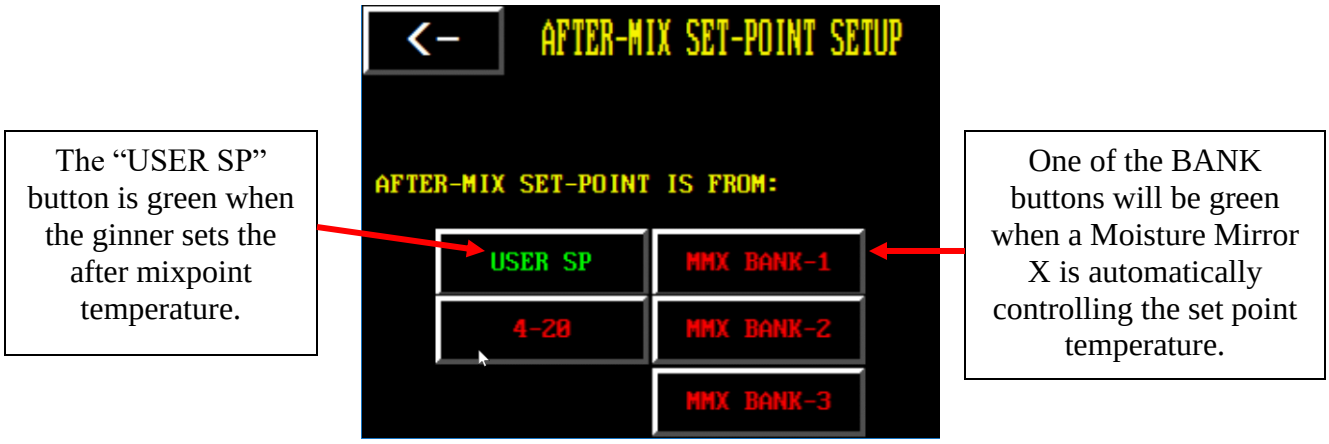
When more than one Heater is used in a Samuel Jackson drying system, it is common to have one after mix temperature controlling the before mixpoint set points of all the Heaters. The "HEATER 1", "HEATER 2", etc. buttons are referring to which Heater is connected to the after mixpoint thermocouple. Heater 1 will have its network ID set for Heater number 1 by the setting of the DIP switches on its Ethernet port card on the Heater's PLC.

Network ID number settings for Heaters 1 – 8 are shown on the drawing titled "*NETWORK ID SETTING FOR VULCAIN OIL-FIRED HEATERS*" included in this manual.

Go back to the ANALOG SOURCE setup screen by pressing the ← button. Press the "AFTER-MIX SET-POINT" button. If no automatic dryer temperature control is available, the ginner (user) will set the after mixpoint temperature. This is activated when the "USER SP" button is green.

After-Mix Set-Point Setup Screen



If the Moisture Mirror X is used with an incoming moisture sensor, then select "MMX BANK-1" button. The BANK-2 and BANK-3 buttons are used when multiple stages of Heaters are connected and the user wants the temperatures to be different between the stages.

For example, more heat for collision air and less heat for the Hot Box pickup for a Samuel Jackson Collider Drying System may be desirable. The percentage of difference between the banks is set on one of the additional settings screens accessed from the INCOMING MOISTURE screen of the Moisture Mirror X.

Go back to the ANALOG SOURCE setup screen by pressing the ← button. Press the "BEFORE-MIX SET-POINT" button. On this screen, normally the "AM CONTROL" button is selected and will be green. This means that the before mixpoint temperature is set automatically based on the after mixpoint control. This is the default setting.

As the actual after mixpoint temperature changes based on incoming cotton moisture conditions, the before mixpoint temperature setpoint is automatically changed to maintain the desired after mixpoint temperature. This temperature control logic has been a standard on Samuel Jackson Heaters for a number of years.

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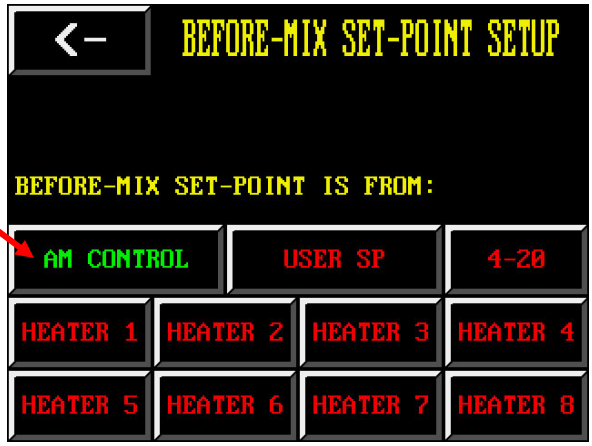
Before-Mix Set-Point Setup Screen

The default is for "AM CONTROL" to be active, so this button is green.



TIME SETTINGS

- SET TIME & DATE: Clock time and date are set here. Be aware that if a Moisture Mirror X is connected to the Heater, the Moisture Mirror X has priority over time and date settings making changes to time and date via the color touch panel at the unit null and void.

- AUTOMATIC SHUTDOWN TIMER: Some countries require that gas-fired combustion products turn off once every 24 hours as a safety measure. This feature is used to activate an automatic 24-hour shutdown. If enabled, every day at a user specified time, the Heater will automatically shut down and ERROR 131 will be shown.

COMBUSTION LIMITS

The low and high limits involved in the combustion process are set on this page.

Fuel Low Limit is the minimum fuel pressure allowed for the heater to continue running. The default is 30 PSI.

Fuel High Limit is the maximum fuel pressure allowed for the heater to continue running. The default is 80 PSI.

Atomizing Air Low Limit is the minimum atomizing air pressure allowed for the heater to continue running without going into an emergency stop. The default is 20 PSI.

Combustion Air Low Limit is the minimum atomizing air pressure allowed for the heater to continue running without going into an emergency stop. The default is 0.5 inches water column.

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Ignite Fuel Valve Position is the position that the fuel mod motor valve needs to reach before the burner attempts to ignite. The default is 0%.

Minimum Fuel Valve Position is the lowest position that the fuel mod motor valve is allowed to reach during heater operation. The default is 0%.

PID SETUP

The control action of the Temperature Control Valve TCV is determined by the "tuning" values called the PID. The PID values are labeled as GAIN, RESET and RATE for both before mix point and after mix point temperature action on the PID SETUP screen. The default values work for most installations. Consult the factory before adjusting these values.

TEMP LIMITS & UNITS

The set point temperature ranges for modulating before and after mix point temperatures are set in this screen. The high limit kill point is also set here.

Default values are:

Before Mixpoint (BM Min. and BM Max.)
95° F [35° C] for minimum
350° F [177° C] for maximum

High limit kill point for Before Mixpoint (BM High Limit)
415° F [213° C]

After Mixpoint (AM Min. and AM Max.)
95° F [35° C] for minimum
300° F [149° C] for maximum

Heater Body Limit
200° F [93° C] for maximum
If the temperature of the heater body itself reaches this limit, it will immediately shut down.

If the user wants the temperature units displayed in Celsius on the home page, then touch the button next to "HOME PAGE TEMP UNIT IS" to toggle between Celsius and Fahrenheit.

PASSWORD

The default password is 1234. Touch the "PASSWORD" button to go to a screen that allows you to change the default password. The password can be a 1 to 4 digit number.

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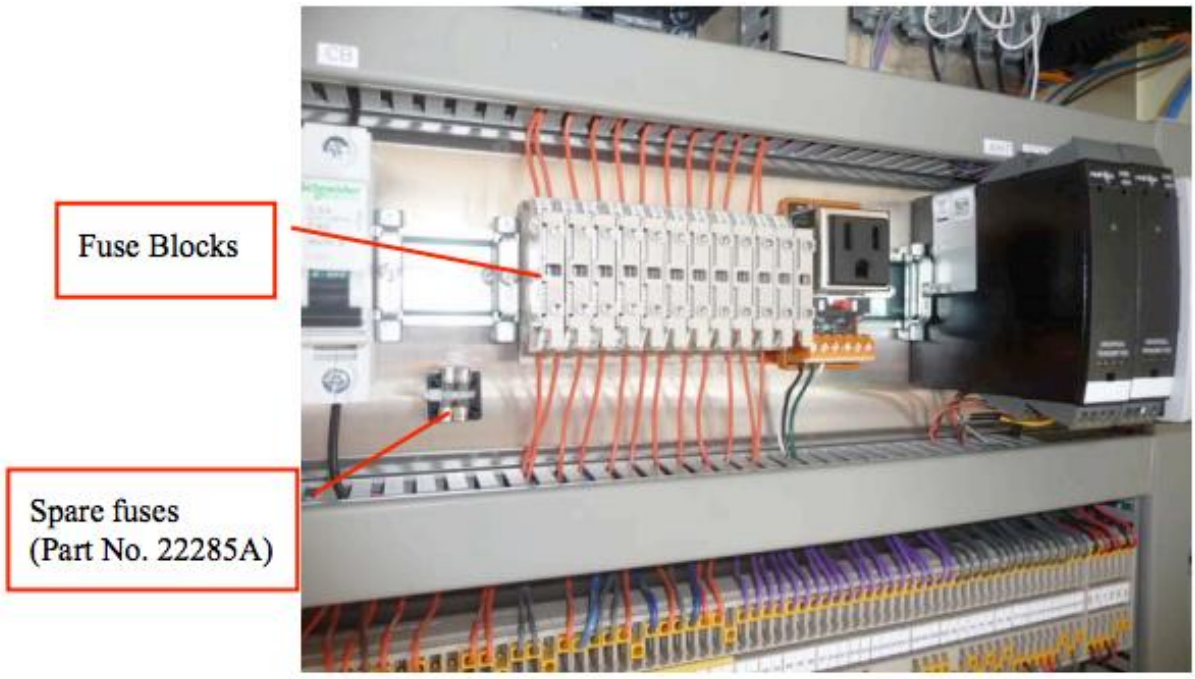
Analog Fuse Replacement



Your Vulcain Heater is equipped with 32 mA fast blow fuses on analog 4-20 mA DC inputs to prevent damage to the input cards in the event that the analog sensors are 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 or other analog transmitter device is wired correctly using the correct hookup wire.
- □ Type J thermocouple wire cannot be used to connect the 4-20mA transmitter type thermocouples to the unit.
- □ 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. 22285A).

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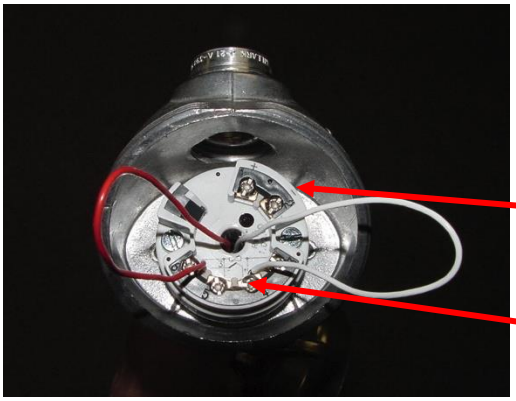
Electrical Installation Notes

THREE PHASE SUPPLY TO HEATER: Run 380VAC 50HZ power to the Heater from a 30-ampere fusible disconnect switch or circuit breaker which you will provide.

CAT5E SHIELDED ETHERNET CABLE: CAT5E shielded ethernet cable is used when connecting the Heater to the optional Moisture Mirror X control. RJ-45 termination is used for both cable ends. 330 feet (100 meters) is the recommended maximum cable run length.

THERMOCOUPLE WIRING: 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. Do not use Type J thermocouple wire for hookup.
- **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.



Part No. 21708 & 21709 Type 'J' Thermocouple shown with 4-20mA Transmitter in junction head.

Connect 4-20mA signal wires from one TC to heater cabinet to terminals BM+, BM—, and from the other TC to terminals AM+, AM—.

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

WARNING!

FAN INTERLOCK: The installing electrician must connect a fan run interlock signal of 120VAC (or 240VAC if 240VAC relay is supplied) to terminals FIR+/- on the Heater Electrical Panel. This interlock is an extra safety device. It turns off the burner instantly when the fan motor stop button is touched. 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.

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Additional Installation Notes

FUEL OIL: Kerosene should be used whenever it is available because of its low sulfur content. Connect the pipe supplying the fuel oil to the gate valve connection as indicated on the side of the control cabinet. Make sure that the pipe supplying the unit is free of debris and, after running the unit for several hours, check and clean the fuel oil filter on the oil supply line for any residual debris it may have collected.

We recommend to position the fuel supply tank in an elevated position in relation to the machine in order to assure optimal fuel pressure and volume. The installing plumber will take care that no portion of the fuel piping is lower than the fuel pump. This will improve the operation of the fuel pump and will make the purging of the fuel oil system easier.

Recommended Fuel and Atomizing Air pressure settings

Machine	Fuel	Atomizing Air
HO-1	20 psi	50 psi
HO-4	60 psi	120 psi
HO-7	60 psi	120 psi

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Installation Stub-Ups for HO-7-Vulcain and HO-4-Vulcain

NO.	DESCRIPTION	ROUTING AND NOTES
1	BURNER 3-PHASE POWER	FROM POWER CENTER TO BURNER CABINET. 3 – 10 GAUGE WIRES, 415 VAC OR 380 VAC, 6 HP, ¾ CONDUIT, 30 A BREAKER. MOTOR STARTER AND 120 V CONTROL TRANSFORMER ARE IN HEATER CABINET.
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 (120 VAC, 240 VAC, OR 24 VDC)
3	THERMOCOUPLES	FROM BURNER CABINET TO:
	AFTER MIX-POINT THERMOCOUPLE (MARKED BLUE)	ENTRANCE OF TOWER OR SECOND-STAGE SKIMMER AIR OUTLET OF COLLIDER DRYING SYSTEM. (SEE *HEATER OPERATION* SECTION FOR MORE INFORMATION ON THERMOCOUPLE LOCATIONS)
	HIGH LIMIT BEFORE MIX-POINT THERMOCOUPLE (MARKED RED)	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.

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NO.	DESCRIPTION	ROUTING AND NOTES
4	FUEL OIL SUPPLY FOR BURNER	½" PIPE KEROSENE or DIESEL 30 TO 80 PSI, 2.1 TO 5.5 BAR
5	COMPRESSED AIR SUPPLY FOR HEATER	3/8" PIPE (HO-7) 12 SCFM @ 100 PSI, 6.9 BAR (HO-4) 6 SCFM @ 100 PSI, 6.9 BAR
6	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.
7	HOT BOX II TRASH GATE OPEN SWITCH (OPTIONAL)	½" CONDUIT, 3 -14 GA WIRES OKAY TO RUN WITH THERMOCOUPLE WIRE OR OTHER DC WIRES.

* SHIELDED 2 CONDUCTOR, 18 GA CABLE - 200 FEET

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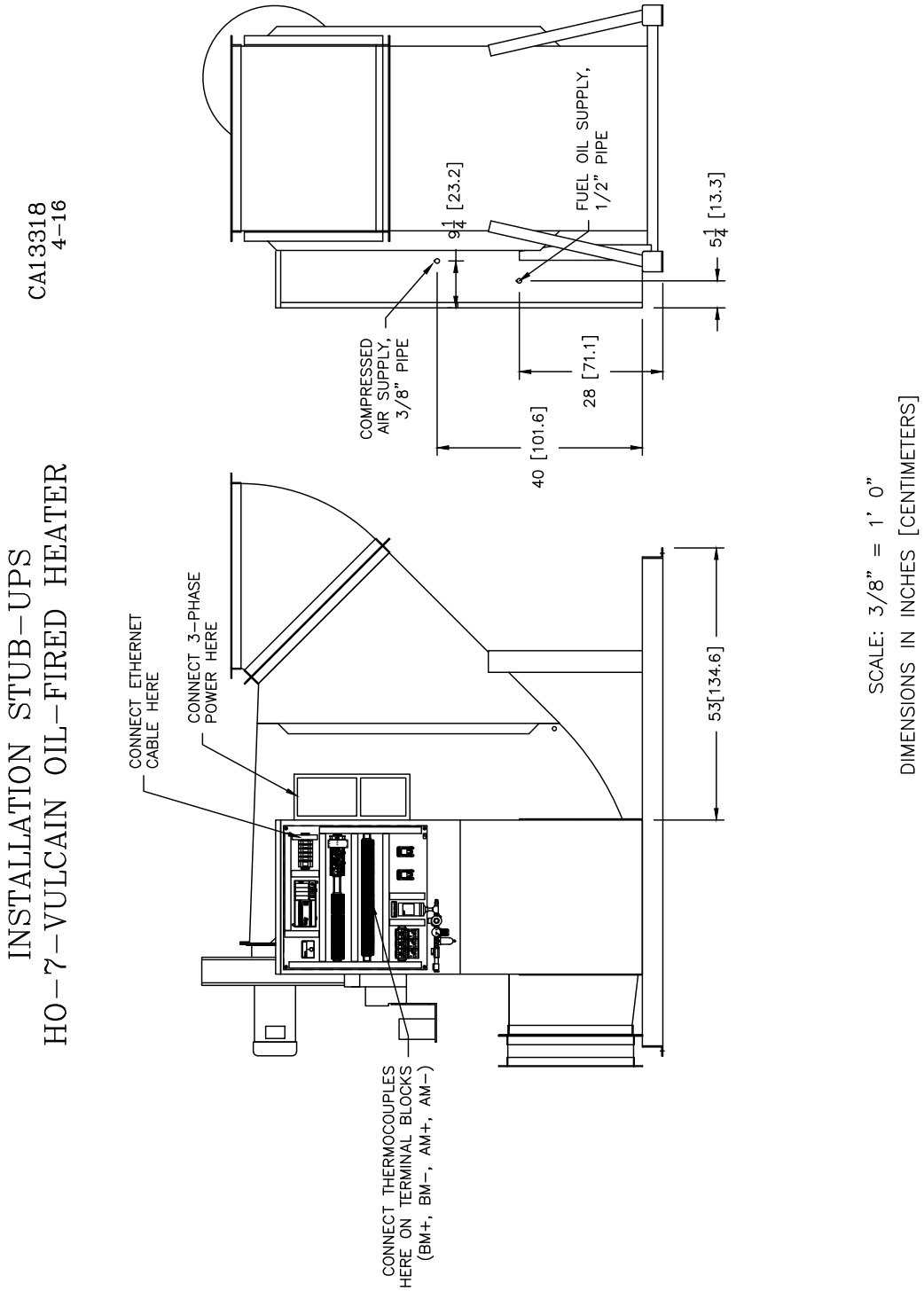
Installation Stub-Ups HO-7-Vulcain



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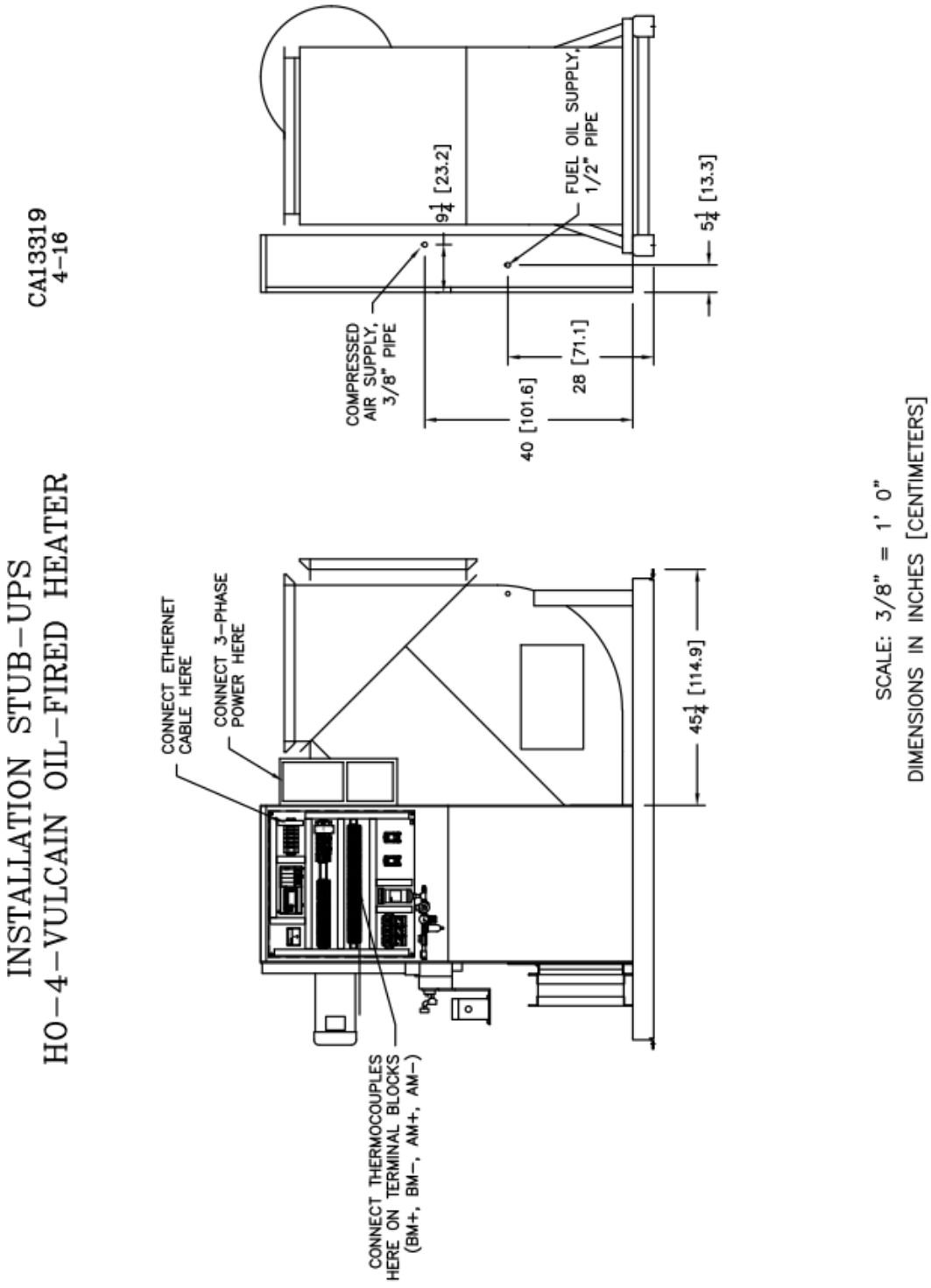
Installation Stub-Ups HO-4-Vulcain



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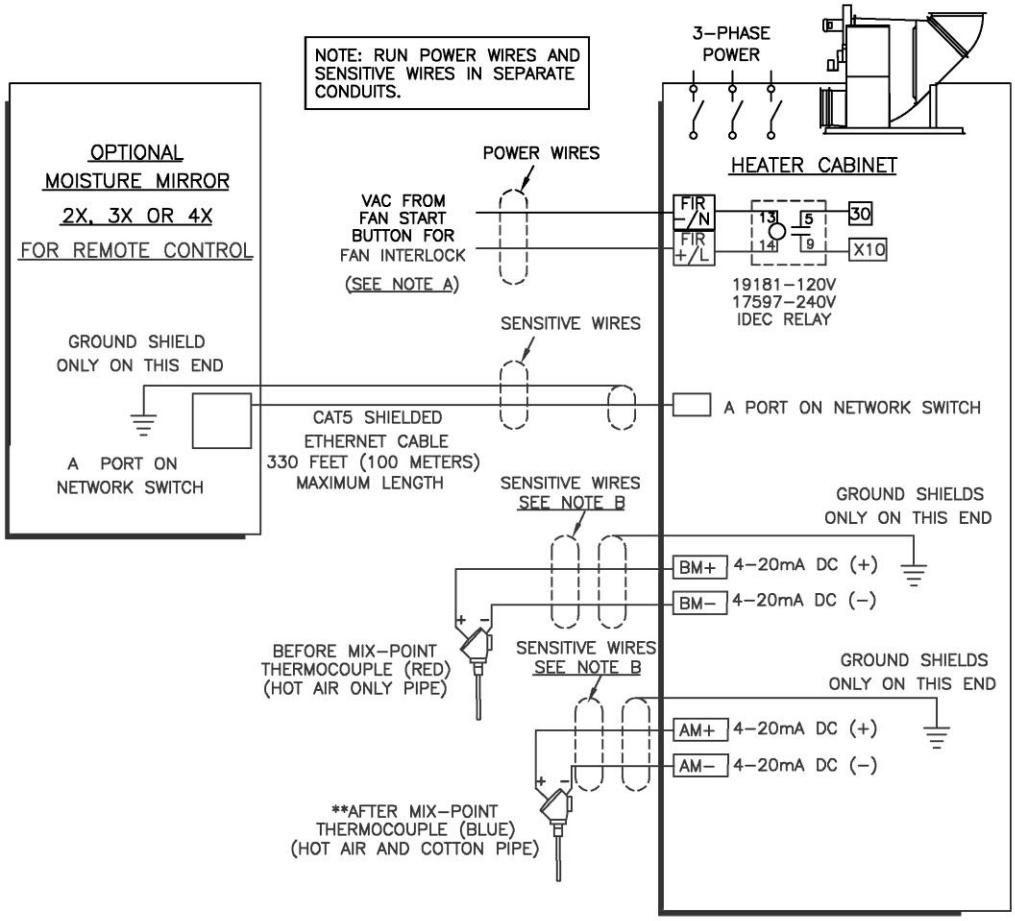
External Electrical Connections for Vulcain Heaters

EXTERNAL ELECTRICAL CONNECTIONS
HO-7-1537, HO-4-1534, AND HO-1-1531
VULCAIN OIL-FIRED HEATERS
WITH OPTIONAL MOISTURE MIRROR REMOTE CONTROL

CA13332B
4-18



NOTE A: INSTALLING ELECTRICIAN IS RESPONSIBLE FOR CONNECTION OF THE NORMALLY OPEN **INTERLOCK** TO THE HEATER FAN.

NOTE B:
THERMOCOUPLE TEMPERATURE SENSORS

USE ONLY SHIELDED, 2 CONDUCTOR CABLE FURNISHED WITH UNIT.

**
AFTER MIX-POINT THERMOCOUPLE

OPTIONAL ON HO-1-1531
REQUIRED ON ALL OTHERS

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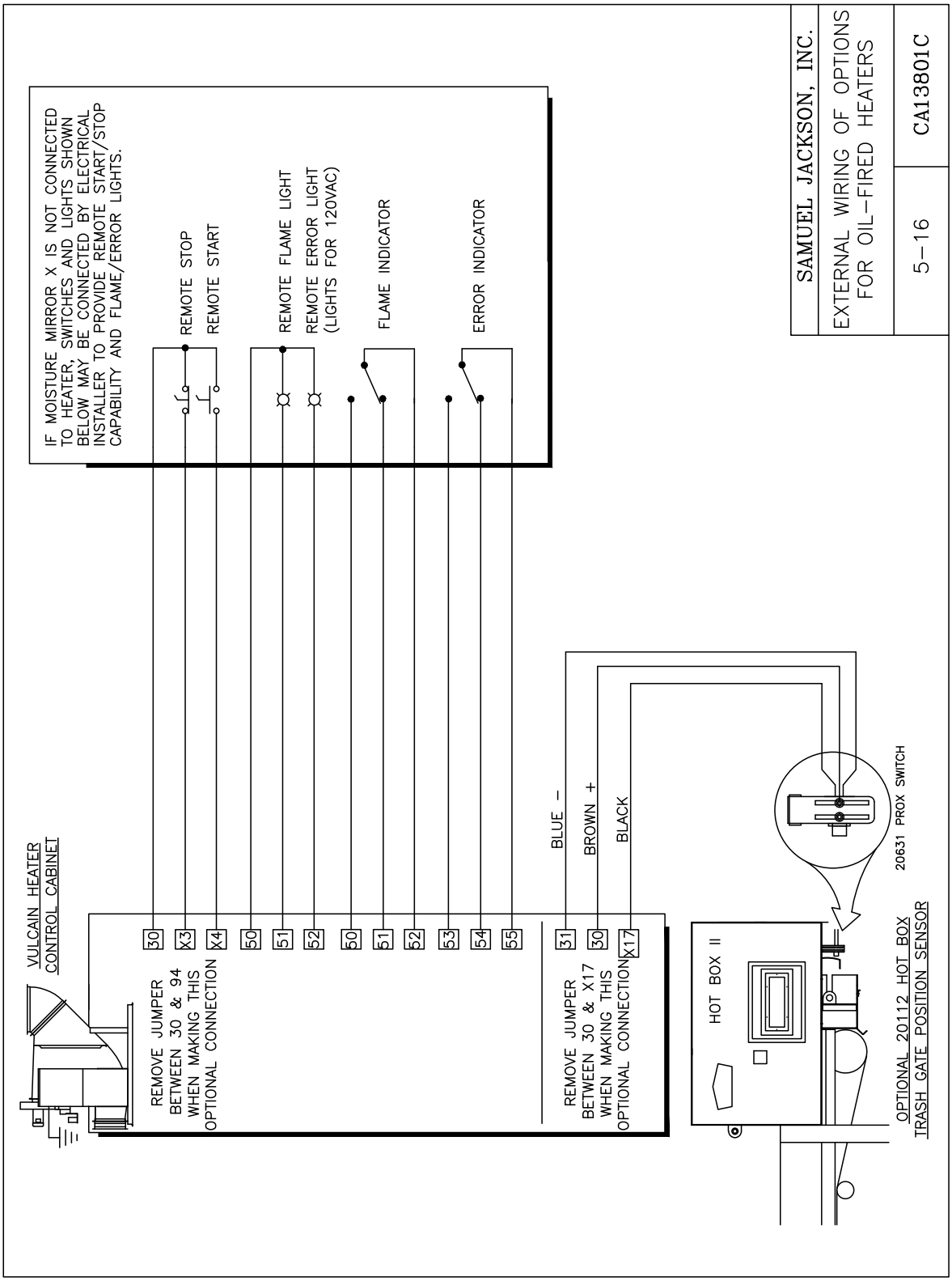
Electrical Connection of Options for Vulcain Heaters



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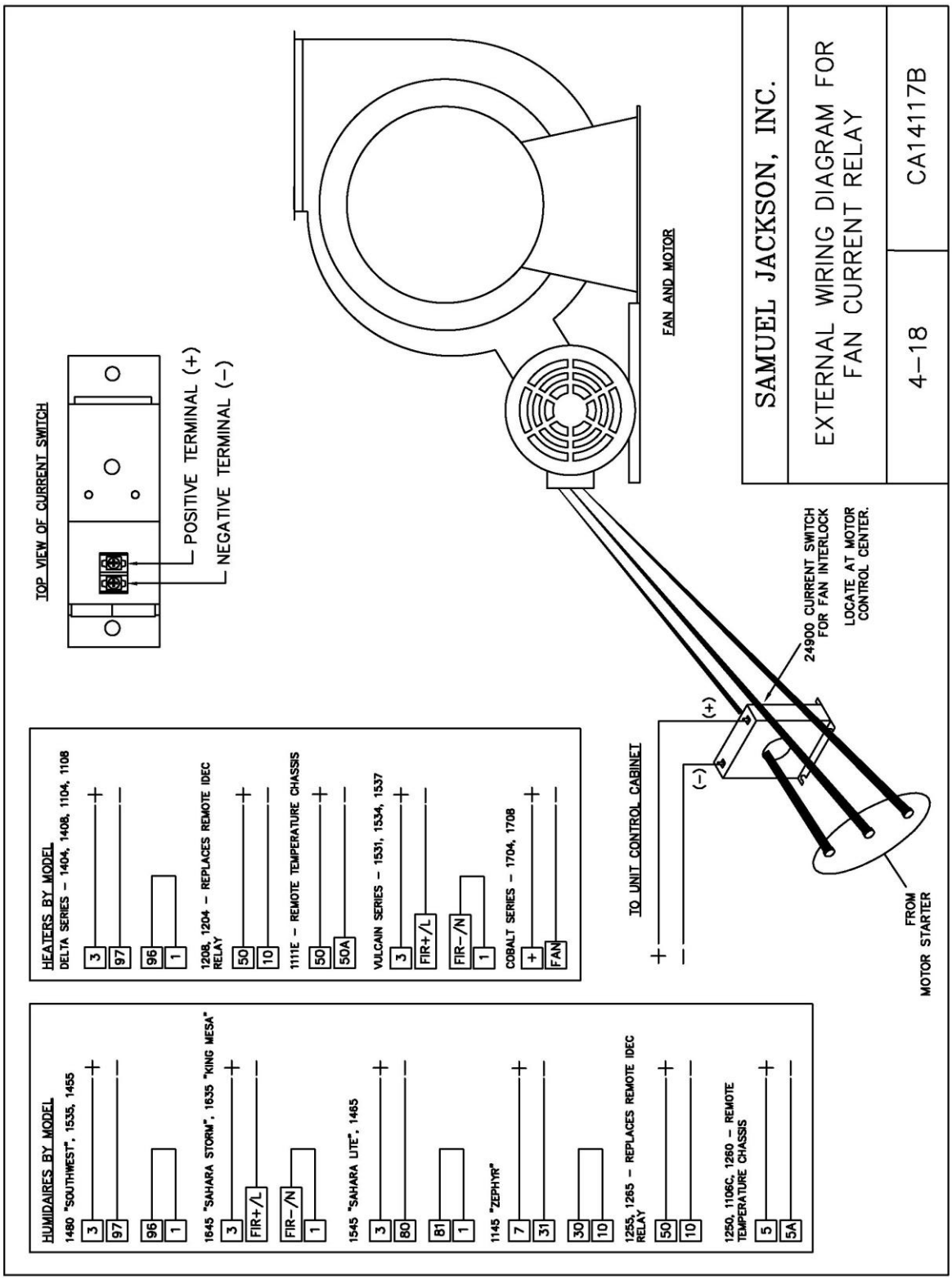
External Wiring Diagram for Fan Current Relay



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Network ID Settings

NETWORK ID SETTINGS FOR HEATERS

CA15001D
4/16

HEATER # 1

ETHERNET CARD
H0-ECOM100

10B-T PORT

MODULE ID	
SW	51
0	ON
1	ON
2	OFF
3	OFF
4	ON
5	ON
6	OFF
7	ON

HEATER # 2

ETHERNET CARD
H0-ECOM100

10B-T PORT

MODULE ID	
SW	52
0	OFF
1	OFF
2	ON
3	OFF
4	ON
5	ON
6	OFF
7	ON

HEATER # 3

ETHERNET CARD
H0-ECOM100

10B-T PORT

MODULE ID	
SW	53
0	ON
1	OFF
2	ON
3	OFF
4	ON
5	ON
6	OFF
7	ON

HEATER # 4

ETHERNET CARD
H0-ECOM100

10B-T PORT

MODULE ID	
SW	54
0	OFF
1	ON
2	ON
3	OFF
4	ON
5	ON
6	OFF
7	ON

HEATER # 5

ETHERNET CARD
H0-ECOM100

10B-T PORT

MODULE ID	
SW	55
0	ON
1	ON
2	ON
3	OFF
4	ON
5	ON
6	OFF
7	ON

HEATER # 6

ETHERNET CARD
H0-ECOM100

10B-T PORT

MODULE ID	
SW	56
0	OFF
1	OFF
2	OFF
3	ON
4	ON
5	ON
6	OFF
7	ON

HEATER # 7

ETHERNET CARD
H0-ECOM100

10B-T PORT

MODULE ID	
SW	57
0	ON
1	OFF
2	OFF
3	ON
4	ON
5	ON
6	OFF
7	ON

HEATER # 8

ETHERNET CARD
H0-ECOM100

10B-T PORT

MODULE ID	
SW	58
0	OFF
1	ON
2	OFF
3	ON
4	ON
5	ON
6	OFF
7	ON

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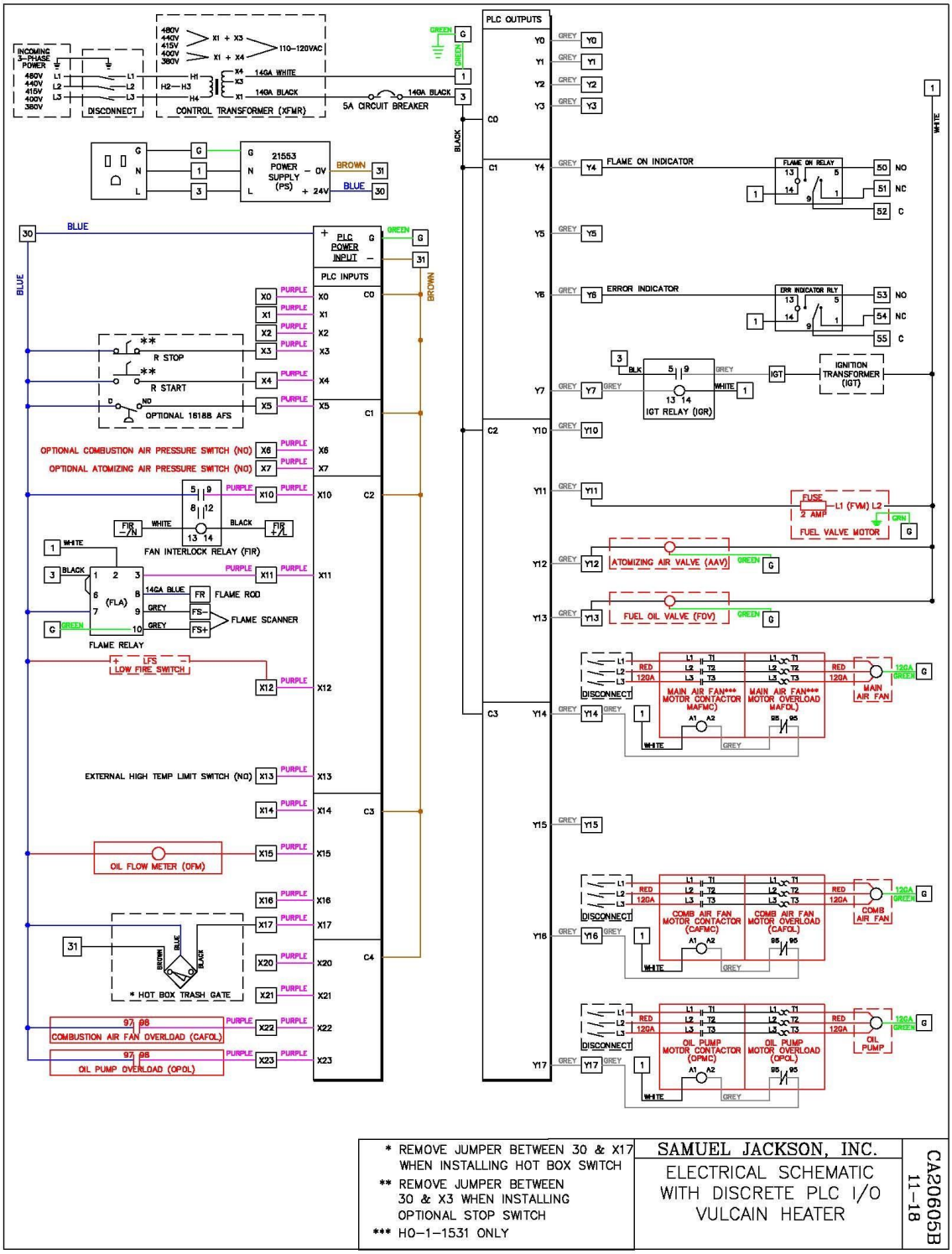
Electrical Schematic with Discrete PLC I/O



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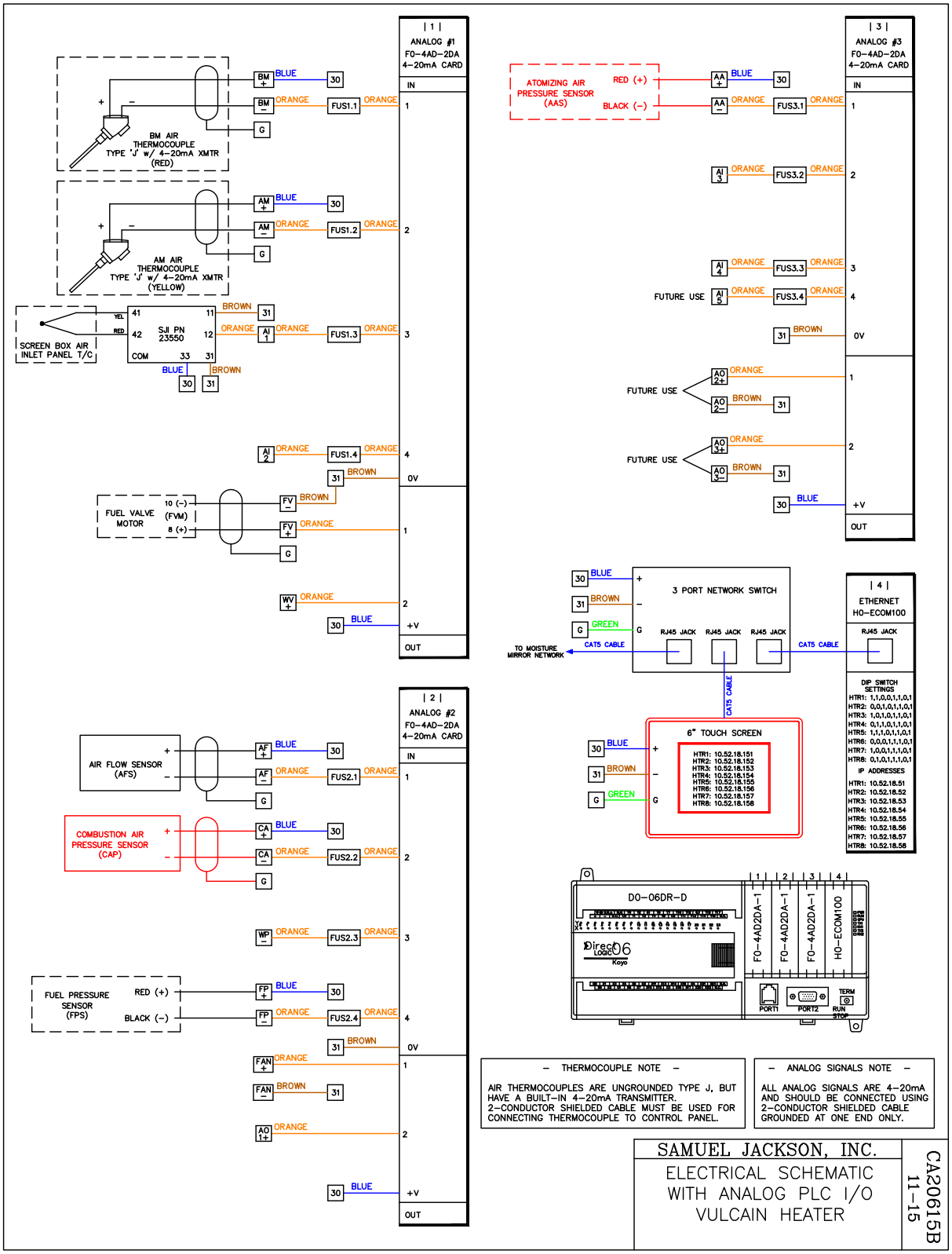
Electrical Schematic with Analog PLC I/O



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Component List for HO-7-Vulcain & HO-4-Vulcain

SYMBOL	PART NAME, NUMBER, MFR'S TYPE	LOCATION
AAP	ATOMIZING AIR PRESSURE TRANSDUCER 25507 628-11-GH-P1-E2-S1	UPPER CABINET
AAV	ATOMIZING AIR VALVE 13598, 25005	UPPER CABINET
AFT	AIR FLOW TRANSDUCER 22446, CX 8 FO1 42 2IW	UPPER CABINET
AIHT	AIR INLET HIGH TEMPERATURE CONTROLLER (FACTORY SET TO 200° F) 23550, IAMS0001 & THERMOCOUPLE, 20514B, KTN-F6-F3B108-3	UPPER CABINET
APG	AIR PRESSURE GAUGE 13706, 0-160 PSI	UPPER CABINET
APR	AIR PRESSURE REGULATOR 13594A, R07-200-RNKA	UPPER CABINET
CAF	COMPRESSED AIR FILTER 13593A, F07-200-MITA	UPPER CABINET
CAFMC	COMBUSTION AIR FAN MOTOR CONTACTOR 22072, LC1D25F7	UPPER CABINET
CAFOL	COMBUSTION FAN OVERLOAD 14736B, LRD08	UPPER CABINET
CAT	COMBUSTION AIR PRESSURE TRANSDUCER 22446, CX 8 FO1 42 2IW	UPPER CABINET
CB	CIRCUIT BREAKER 17427, NRS1100 17413, SOCKET FOR BREAKER	UPPER CABINET
CT	CONTROL VOLTAGE TRANSFORMER 16480A, 500 VA, E500TF	BOX BELOW DISCONNECT SWITCH
F4	IGNITION RELAY 17446, RH1B-U 120VAC	UPPER CABINET
FF	FUEL FLOW METER 24102	BURNER

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SYMBOL	PART NAME, NUMBER, MF'S TYPE	LOCATION
FIR	FAN INTERLOCK RELAY 19181, RH2B-AC120, 120VAC OR 17597, RH2B-U, 240VAC OR 20124, RH2B-U, 24VDC	UPPER CABINET
FLR	FLAME RELAY 20107, LFE10	UPPER CABINET
FM	COMBUSTION AIR FAN MOTOR, 5 HP 14376, VM3613	BURNER
FOV	FUEL OIL VALVE 16384, M8263B206V	LOWER CABINET
FP	FUEL PUMP 16334, 1300099	LOWER CABINET
FPG	FUEL PRESSURE GAUGE 13706, 0-160 PSI	LOWER CABINET
FPOL	FUEL PUMP OVERLOAD 14737B, LRD05	UPPER CABINET
FPR	FUEL PRESSURE RELIEF VALVE 12385 FOR HO-4/HO-7 VULCAIN 26542 FOR HO-1 VULCAIN	LOWER CABINET
FPT	FUEL PRESSURE TRANSDUCER 25507 628-11-GH-P1-E2-S1	UPPER CABINET
FS	FLAME SCANNER 20244, QRA2	BURNER
FUSE	FUSE FOR 4-20MA ANALOG INPUT 22285A, 32mA 5mm X 20mm	UPPER CABINET
FVM	FUEL VALVE MOTOR 21560, M7284A1012	BURNER
IG	IGNITION ELECTRODE 14200, CS 13508, FOR HO-4-VULCAIN 12796, CS 13508, FOR HO-7-VULCAIN	BURNER
IGT	IGNITION TRANSFORMER 21706, 2260-TW	BEHIND CABINET
LFS	LOW FIRE SWITCH 16848, BZE6-2RN80	BURNER
NS	NETWORK SWITCH 23702F, SE2-SW5U	UPPER CABINET

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SYMBOL	PART NAME, NUMBER, MFR'S TYPE	LOCATION
OF	OIL FILTER 24106, GTB228 FUEL FILTER REPLACEMENT CARTRIDGE 24303,GTB22-30	BELOW CONTROL VOLTAGE TRANSFORMER
ONOZ	OIL NOZZLE SUB-ASSEMBLY 25508 FOR HO-1 & HO-4-VULCAIN 25509 FOR HO-7-VULCAIN	BURNER
OPM	FUEL PUMP MOTOR, 1/3HP 14735, M3458	LOWER CABINET
OPMC	OIL PUMP MOTOR CONTACTOR 22072, LC1D25F7	UPPER CABINET
PLC	PROGRAMMABLE LOGIC CONTROL 26790, DL06 PLC ASSEMBLY	UPPER CABINET
PS	POWER SUPPLY, 120VAC TO 24VDC 21553, PS5R-SD24	UPPER CABINET
SCR1	FUEL STRAINER ½ INCH 16382 WITH 16383 SCREEN	LOWER CABINET
SCR2	FUEL STRAINER ¼ INCH 9991 WITH 9992 SCREEN	BURNER HEAD
TCA	THERMOCOUPLE (BLUE), AFTER MIX-POINT 21708, 8", TYPE 'J', 0-777, 4-20mA TRANSMITTER	PIPING AFTER MIXPOINT
TCB	THERMOCOUPLE (RED), BEFORE MIX-POINT 21709, 8", TYPE 'J', 0-777, 4-20mA TRANSMITTER	PIPING BEFORE MIXPOINT
TP	COLOR TOUCH PANEL 22045B, EA9-6IN	UPPER CABINET DOOR

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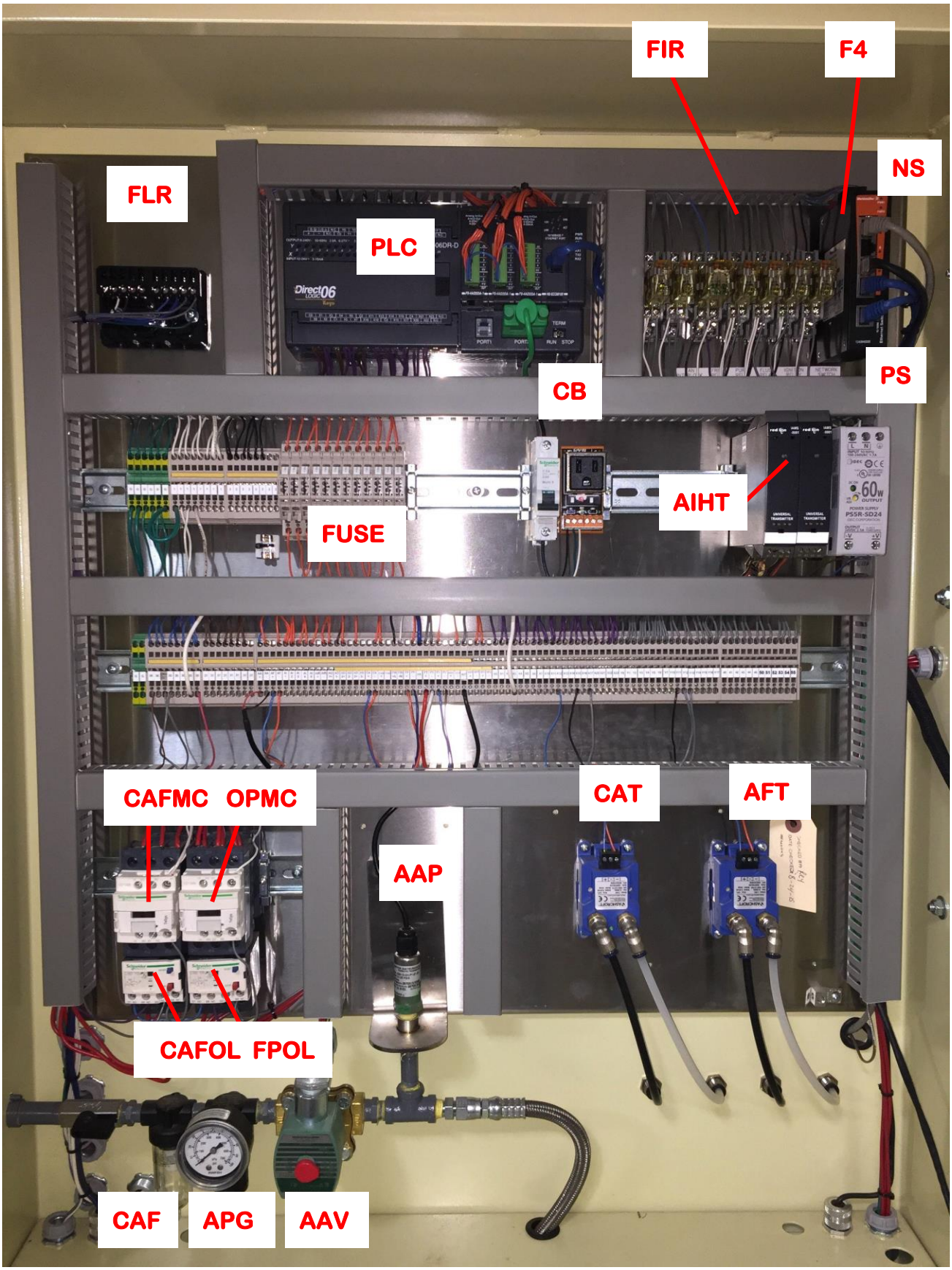

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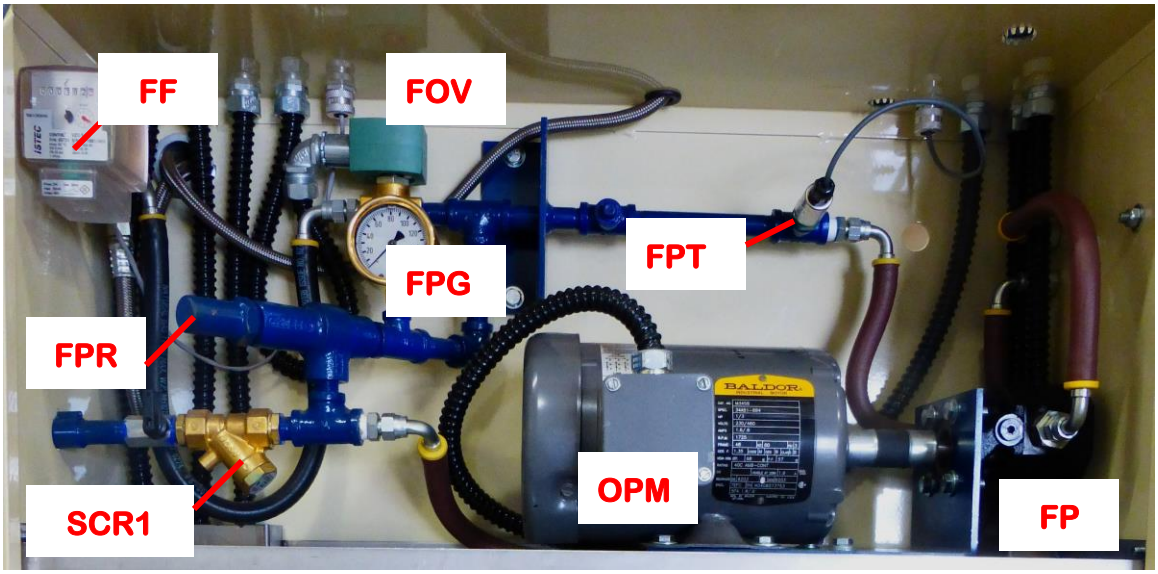

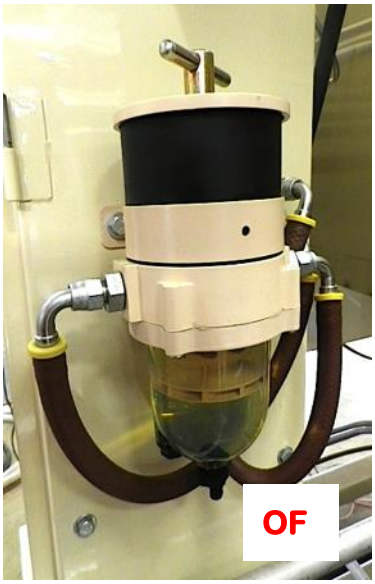

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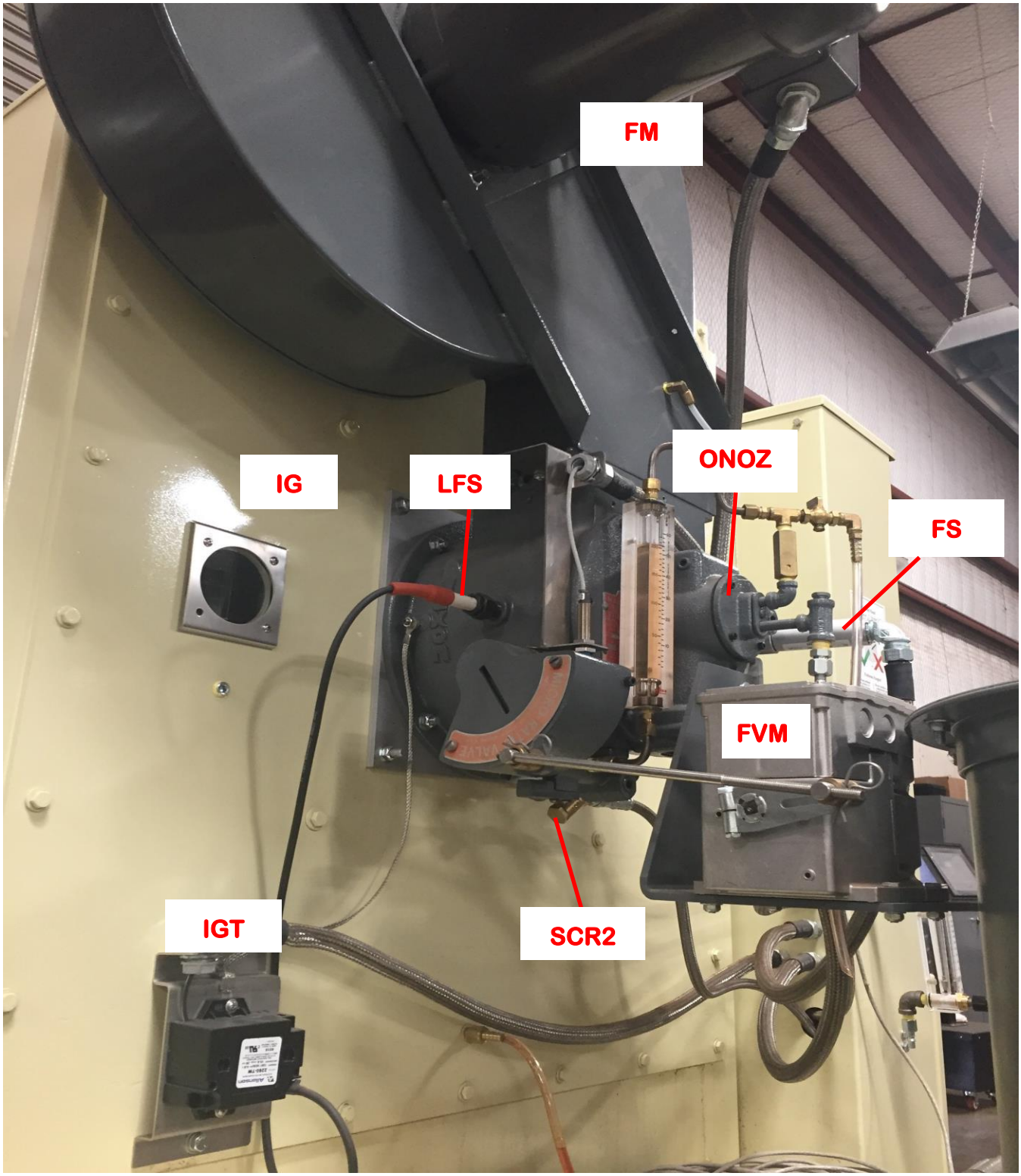

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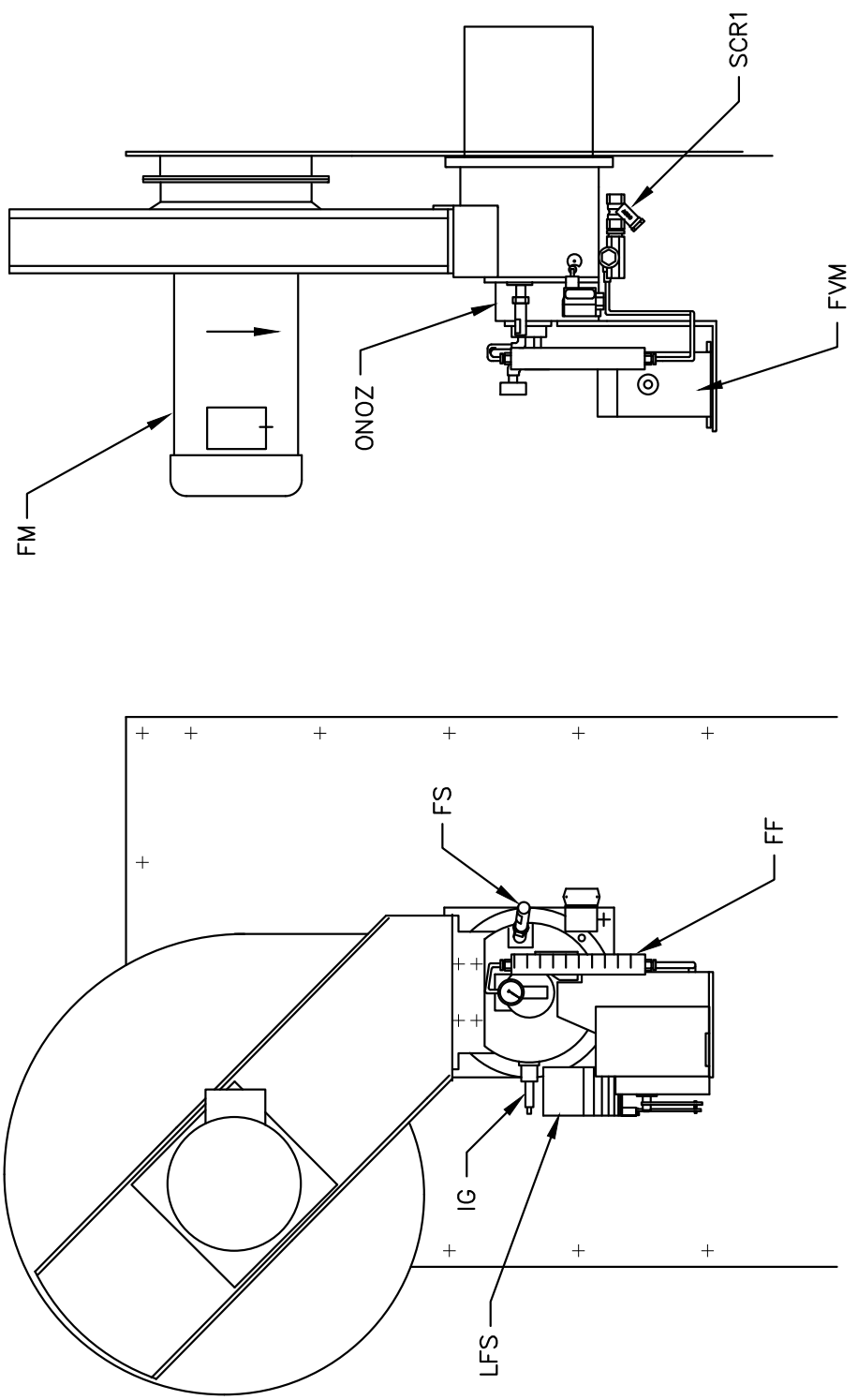
Oil Burner Head Components for HO-7 and HO-4 Vulcain



CA13328A
5-16

OIL BURNER HEAD COMPONENTS
HO-7 AND HO-4 OIL-FIRED HEATERS

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Burner Head Sub-Assembly Maintenance

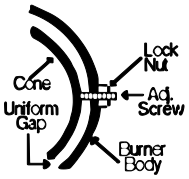
Model "500-SP" OVENPAK® Gas/Oil Burners **CAT 3590 1-94**

Suggested Maintenance/Inspection Procedures

Discharge sleeve and cone alignment

Centering of the mixing cone provides a small annular opening for the flow of some cooling combustion air along and inside the discharge sleeve wall. We suggest periodic inspection from the discharge side of the burner to assure this critical alignment is maintained.

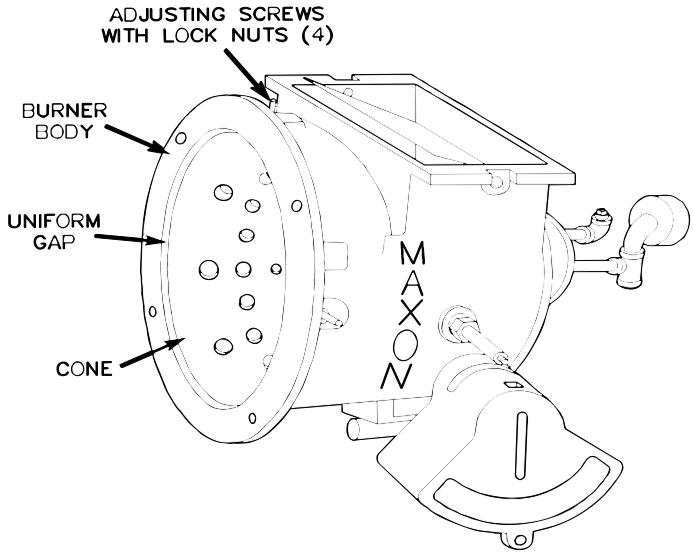
Inside inspections (from discharge end of burner) can spot possible mixing cone or discharge sleeve deterioration before performance is drastically affected.



Check specifically that mixing cone is centered within burner body and discharge sleeve, so as to give the intended flow of cooling air along the sleeve. If necessary, re-adjust by loosening the four lock nuts (see sketch) and turning the four adjusting screws to center cone within the opening.

Back each screw off 1/4 turn (to allow for thermal expansion of hot mixing cone) then hold in position and turn all four lock nuts down snugly.

CAUTION: OVER-TIGHTENING ADJUSTING SCREWS CAN GREATLY REDUCE CONE AND DISCHARGE SLEEVE LIFE.



Critical check points in oil line

1. Pump (wear, lubrication)
2. By-pass valve (loose packing)
3. Strainer (filled with scale, etc.)
4. Filters (plugged)
5. Regulator (not bottomed)
6. Viscosity no higher than 50 SSU (about 45ºF with #2 oil)

Critical check points in compressed air line

1. Compressor (lubrication, water accumulation)
2. Filters (plugged)
3. Water traps (full)
4. Regulator (set to give desired pressure)

Critical check points on burner

1. Oil control valve (working smoothly)
2. Oil nozzle (clean, no nicks or scratches)
3. Oil insert (plugged)
4. Universal screw carrier snug on operating shaft
5. Set collar tight and snug on operating shaft
6. Set screws holding cone backed off 1/4 turn and locked
7. Cone mounted concentrically in housing
8. Cam strips and/or plunger cap wear

WARNING: If burner is run on oil, but subject to long intervals of gas-only firing, the oil line, components and piping should be blown clear at shutdown to prevent start-up difficulties during later oil light-off.

Filter maintenance

Filters MUST be kept clean for optimum burner performance. They should be inspected regularly (experience will dictate the required frequency) and cleaned as needed.

To clean washable/replaceable elements, remove from burner, then vacuum to remove dry accumulations. Wash in warm soapy water, wring gently and dry before replacing in filter assembly.

To clean permanent elements, remove from burner, vacuum or blow clean of excess dirt, then wash in soap and water (or solvent, if necessary), dry, re-coat (if desired) and re-install.

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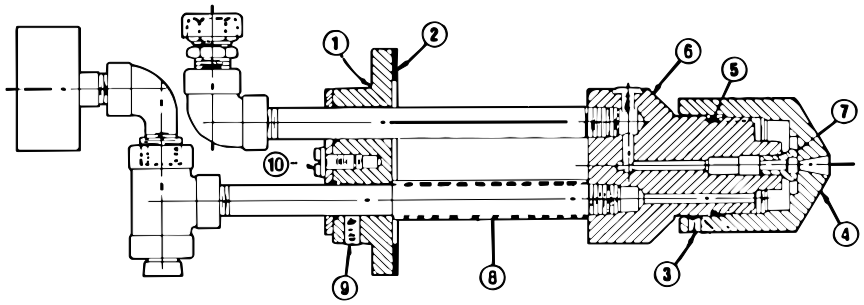
Suggested Maintenance/Inspection Procedures

To clean oil nozzle sub-assembly

1. Disconnect the oil and compressed air lines at burner and remove the four socket head cap screws holding tube retainer ① to burner.
2. Carefully withdraw the oil nozzle sub-assembly. Save the gasket ②.
3. If a new nozzle sub-assembly is to be installed, replace gasket ② and reverse steps 1 and 2. If the nozzle itself is to be changed or cleaned, loosen the set screw ③.
4. Unscrew nozzle ④ from nozzle sub-assembly. Be careful not to damage the O-ring ⑤ or the insert ⑦. Remove the O-ring ⑤ and save if undamaged.
5. Clean nozzle ④ and insert ⑦. Do not nick or dent the leading edge. Use compressed air or a solvent that will remove all foreign particles. Do **not use an abrasive.**
6. Re-install VITON O-ring ⑤ or **replace if damaged.** For a replacement, use a VITON O-ring, **size #122 (1-1/8" x 3/32")** on 508, 515, EBC-2, and EBC-3 burners (including older versions). On larger burners, such as the 525, 535, 550, EBC-5, and EBC-6, use size #126 (1-3/8" x 1-9/16" x 3/32").
7. Spacer bushing ⑧ should be tightly held between nozzle body ⑥ and tube retainer ①. If adjustment is necessary, loosen Allen screw ⑨ and cap screw ⑩, then slide tube retainer ① towards nozzle body ⑥ as far as possible. Re-tighten Allen screw ⑨ and cap screw ⑩.
8. Re-install oil nozzle ④ on the body ⑥. A drag will be felt when the nozzle contacts O-ring. Continue to screw the nozzle onto the body until insert ⑦ is contacted. Do **not exceed 150 in-lbs torque under any circumstances.** (If nozzle is seated too hard on the insert or if oil nozzle does not contact, poor burner performance will result.) Do **not use pipe dope, permatex, etc. on threads.**
9. Tighten set screw ③; **it must not protrude from nozzle.**
10. Insert oil nozzle sub-assembly in burner. Make sure gasket ② is in place, then re-install and tighten the four socket head cap screws, holding tube retainer ① in place.
11. Reconnect the oil and compressed air lines, then fire burner and check compressed air pressure and oil flow to insure that nothing has changed. Following established light-off procedure, check pressures, oil flow, main flame, etc.



SAMUEL JACKSON INCORPORATED
P. O. BOX 16587 / LUBBOCK, TX 79490 / U S A
TELEPHONE 806-795-5218 FAX 806-795-8240

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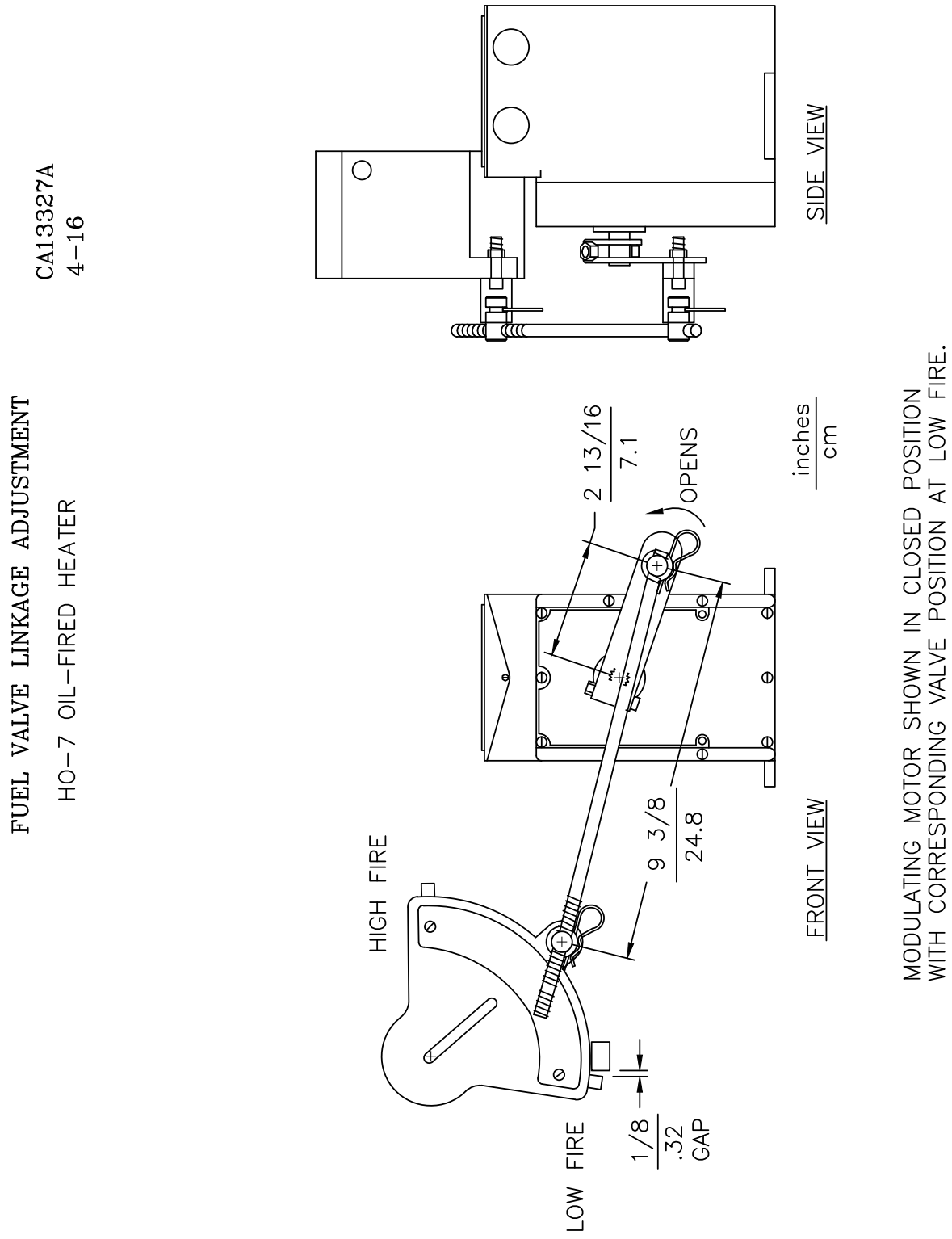
Fuel Valve Linkage Adjustment for HO-7-Vulcain



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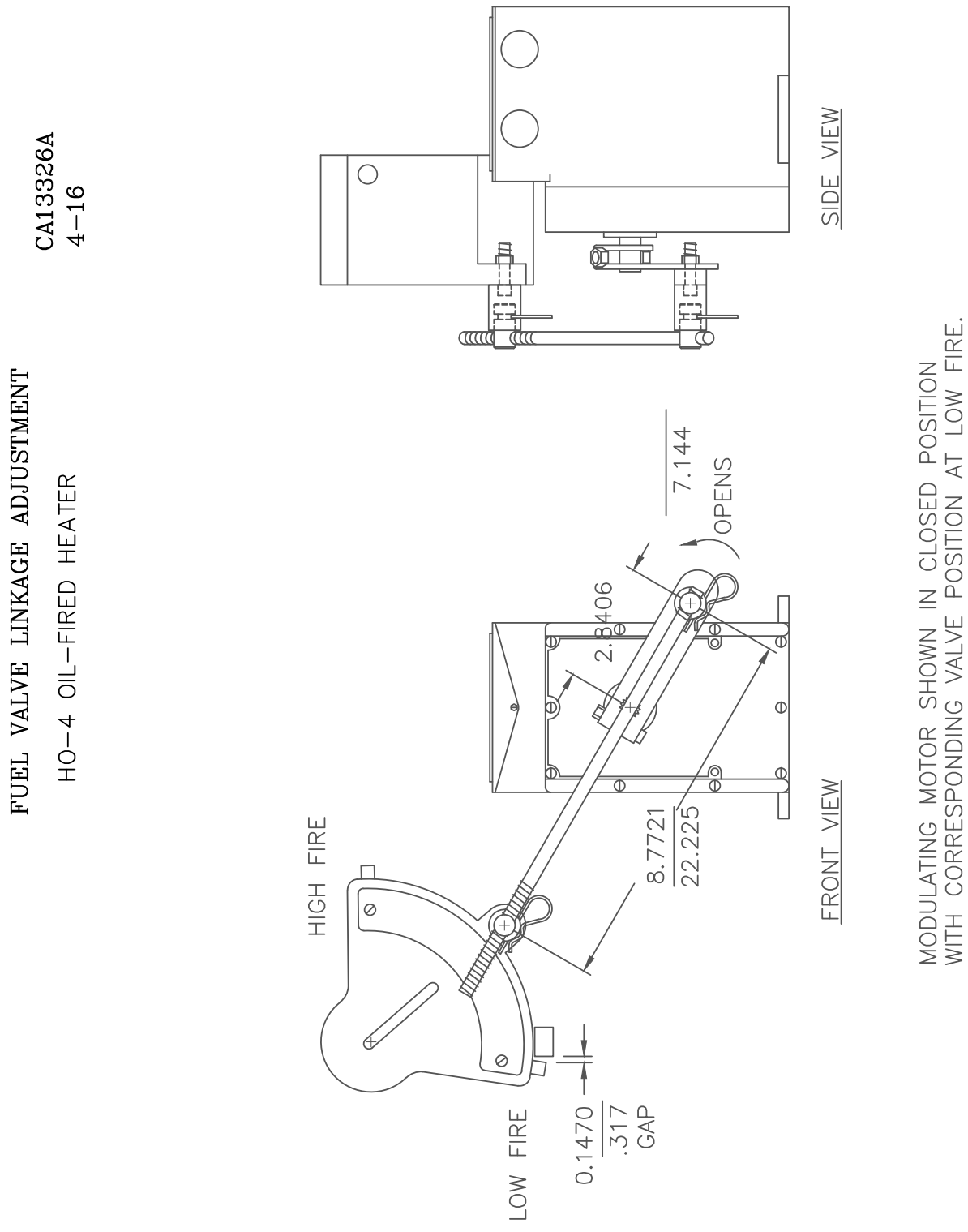
Fuel Valve Linkage Adjustment for HO-4-Vulcain



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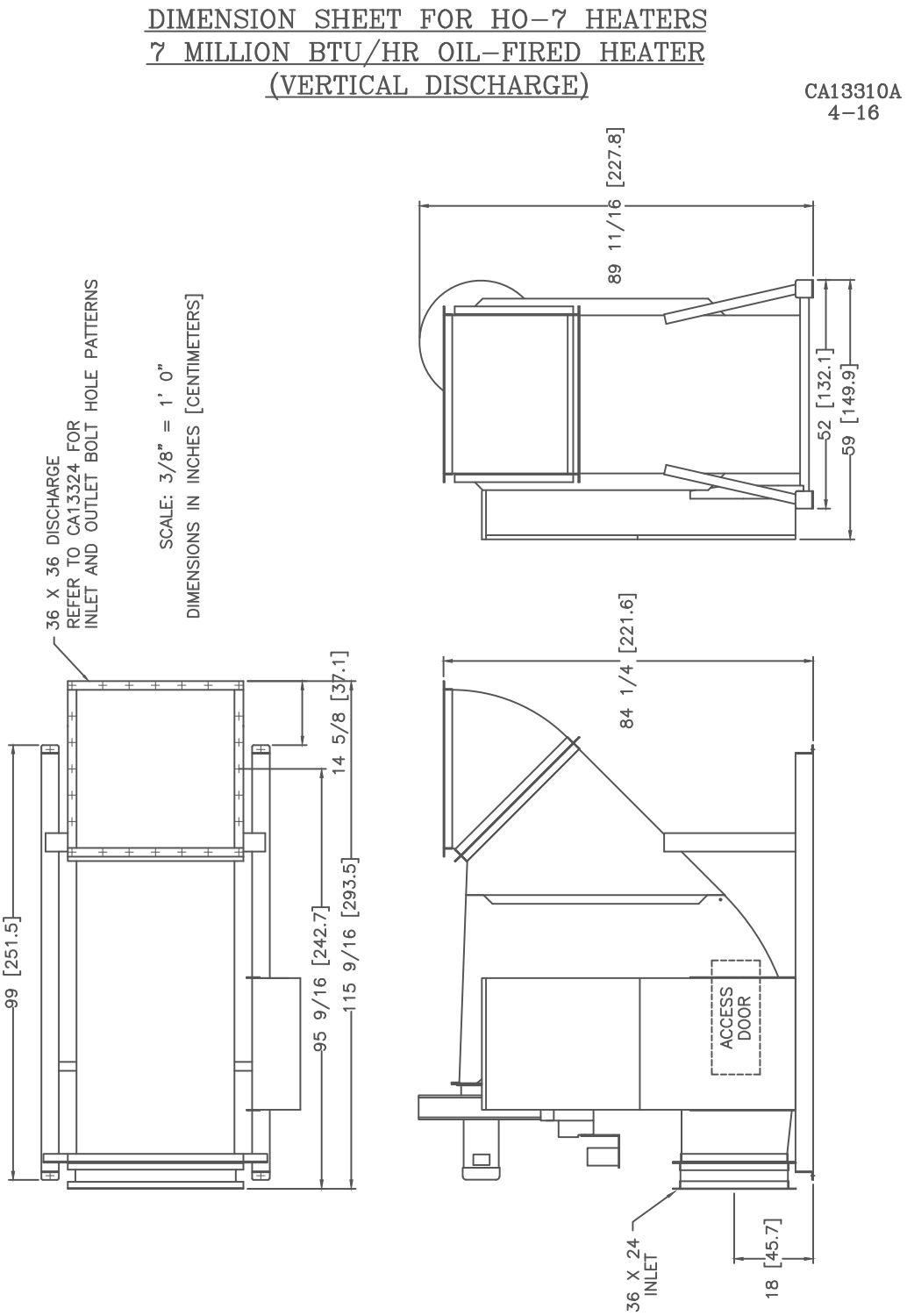
Dimension Sheet for HO-7-Vulcain w/ Vertical Discharge



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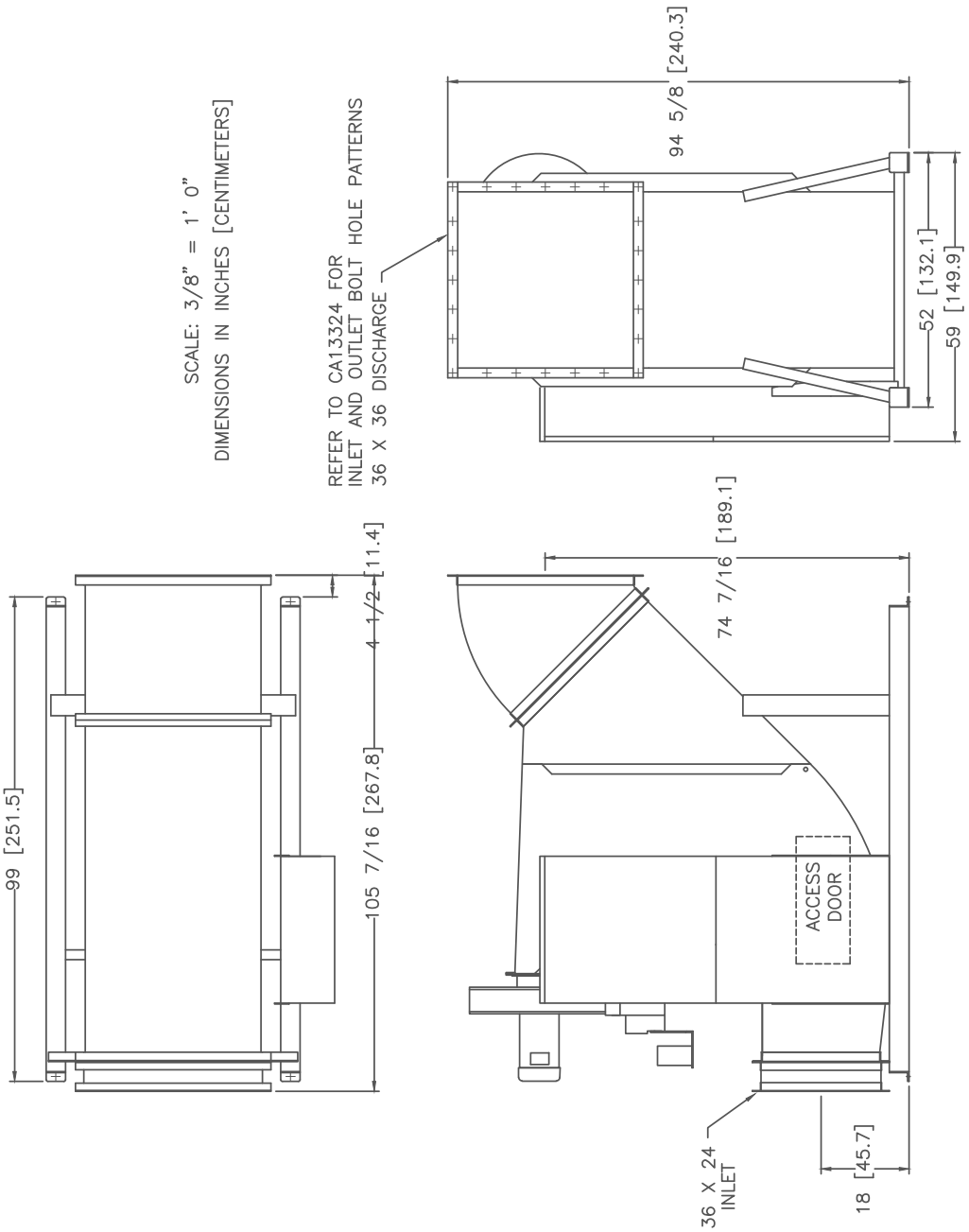
Dimension Sheet for HO-7-Vulcain w/ Horizontal Discharge

DIMENSION SHEET FOR HO-7 HEATER
7 MILLION BTU/HR OIL-FIRED HEATER
(HORIZONTAL DISCHARGE)

CA13311A
4-16



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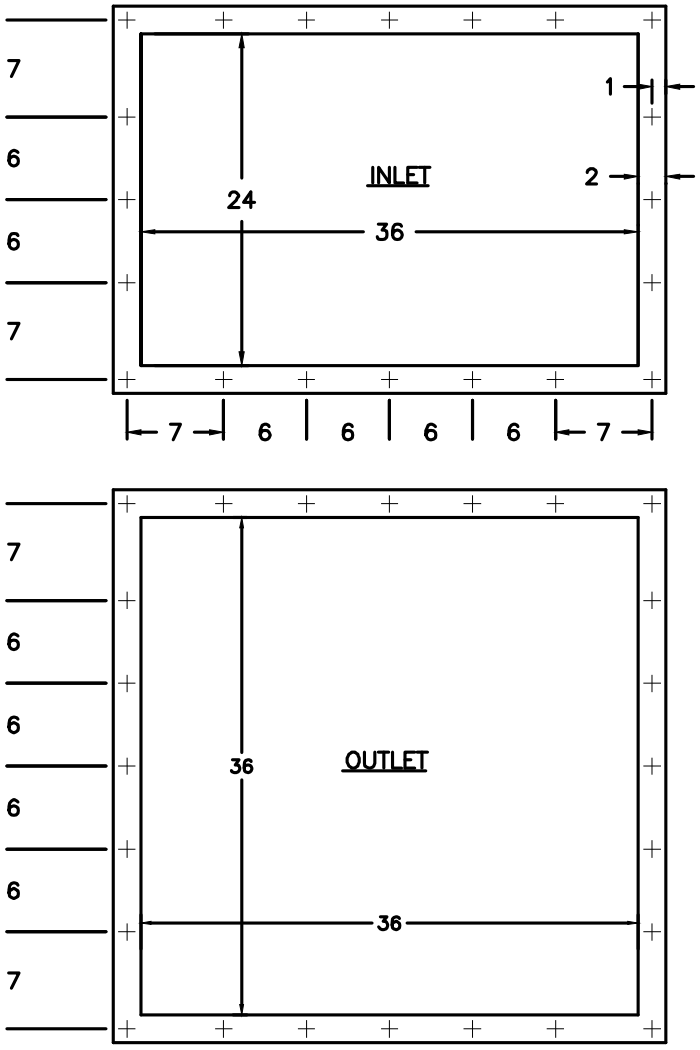
Inlet and Outlet Hole Pattern for HO-7-Vulcain

INLET AND OUTLET HOLE PATTERN FOR HO-7 HEATER

CA13324A
4-16



HOLES 3/8ø
2 X 2 X 1/8 ANGLES
SCALE: 1" = 1' 0"

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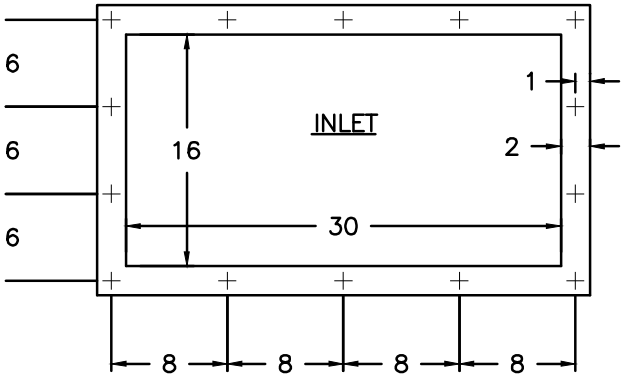
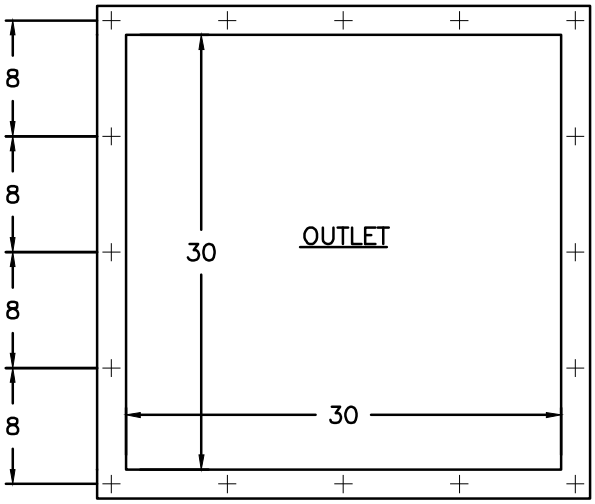
Inlet and Outlet Hole Pattern for HO-4-Vulcain

INLET AND OUTLET HOLE PATTERN FOR HO-4 HEATER

CA13325A
4-16





HOLES 3/8ø

2 X 2 X 1/8 ANGLES

SCALE: 1" = 1' 0"

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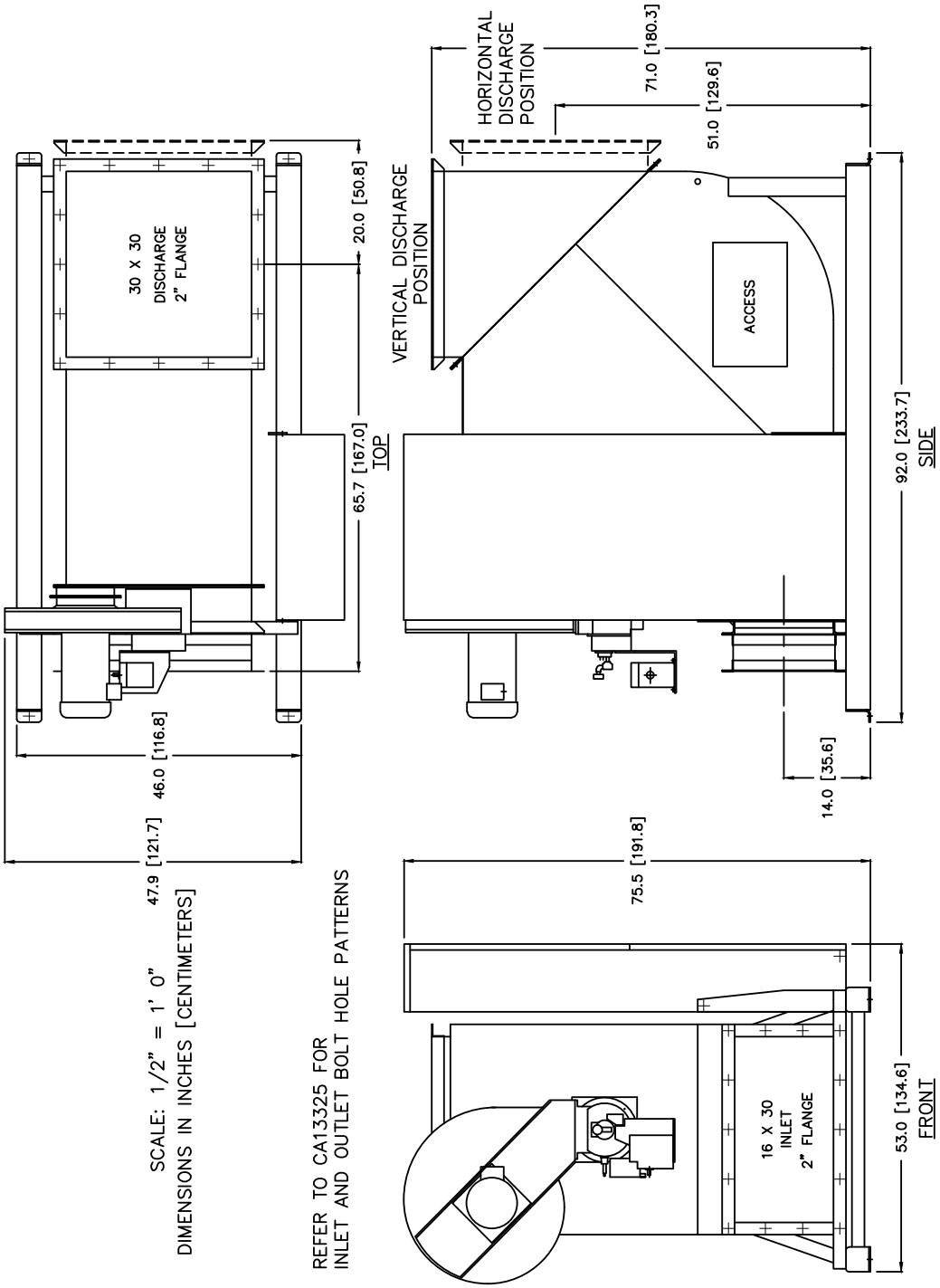
Dimension Sheet for HO-4-Vulcain

DIMENSION SHEET FOR HO-4 HEATER
4 MILLION BTU/HR OIL-FIRED HEATER

CA13312A
4-16



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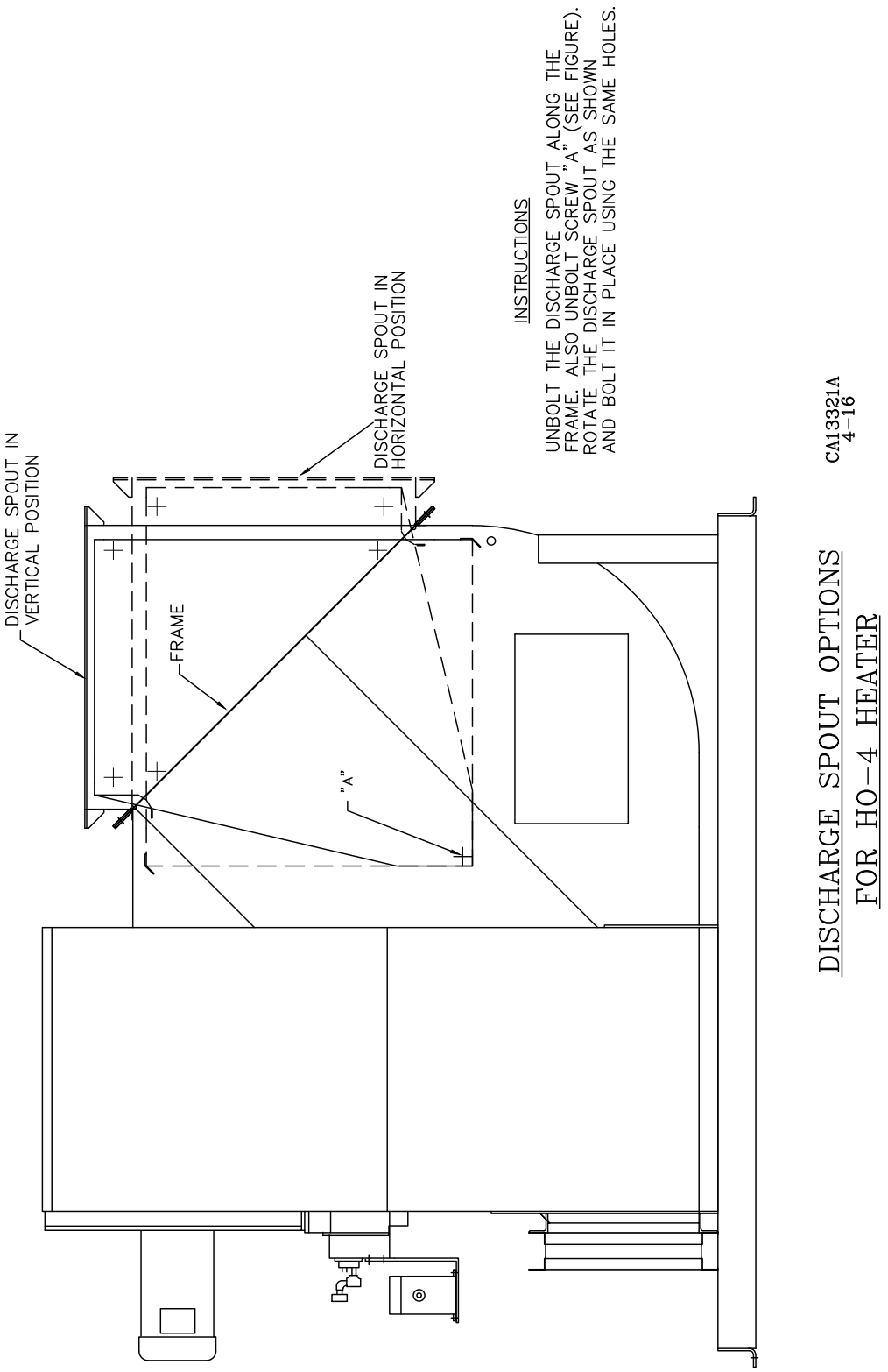
Discharge Options for HO-4-Vulcain



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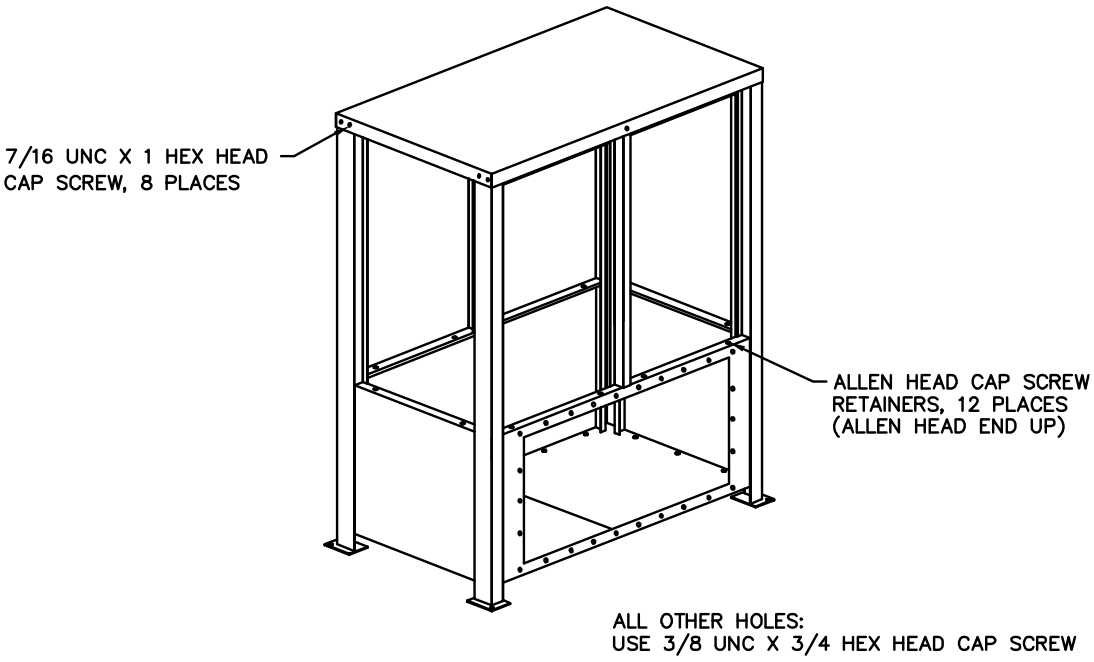
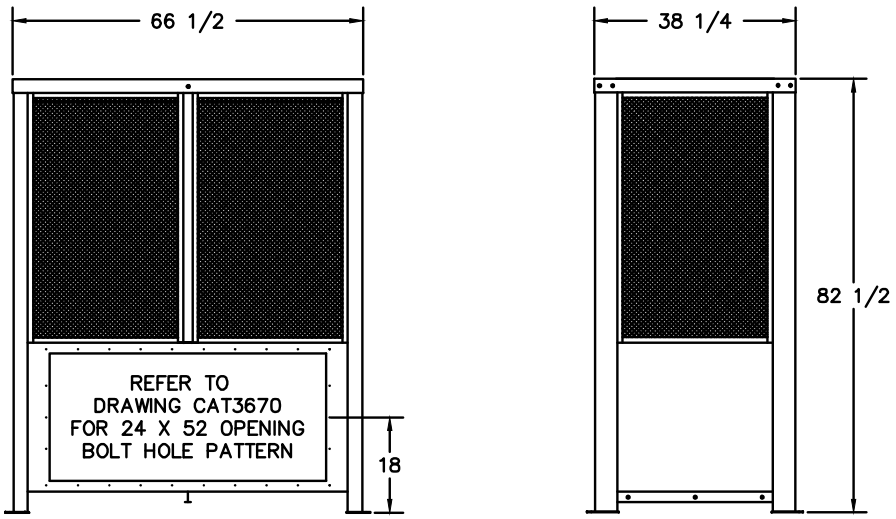
Assembly Detail of Inlet Screen Assembly

ASSEMBLY DETAIL OF 80080 INLET SCREEN ASSEMBLY FOR HO-7 AND HO-4 HEATERS

CA13320A
4-16





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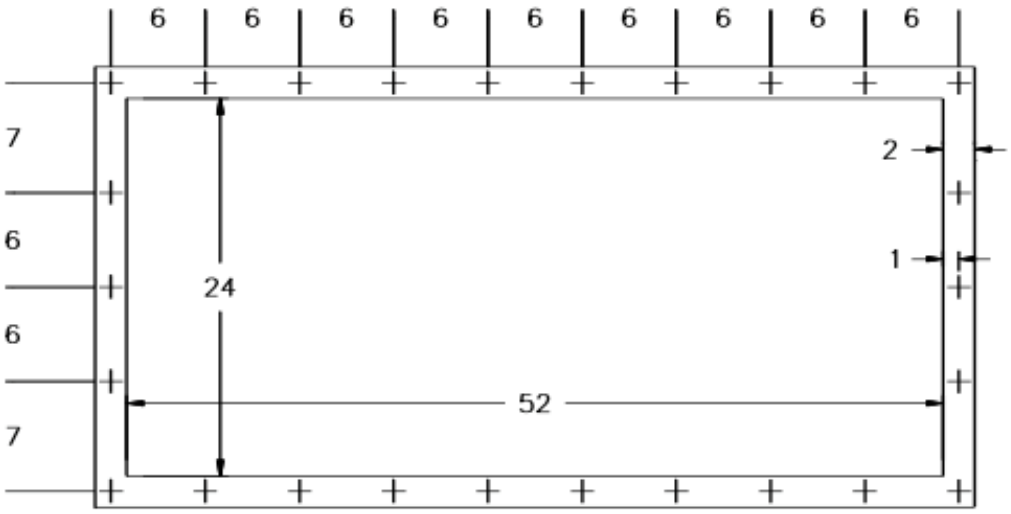
Outlet Hole Pattern for Inlet Screen Assembly

OUTLET HOLE PATTERN
FOR
80080 INLET SCREEN ASSEMBLY

CAT3670
8-91



HOLES 3/8ø
2 X 2 X 1/8 ANGLES
SCALE: 1" = 1' 0"

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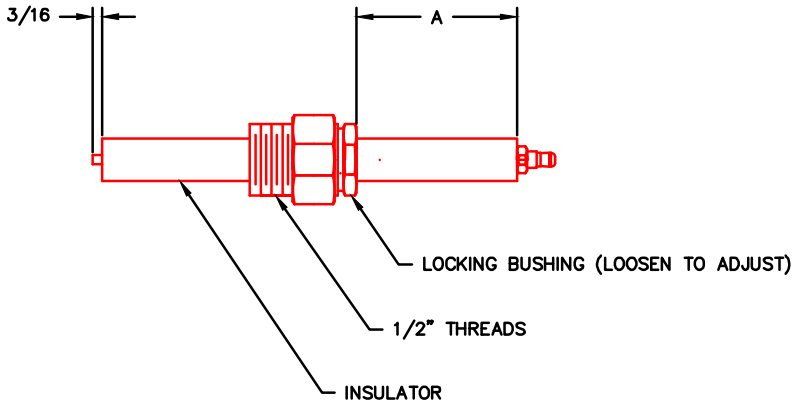
Adjustment of 12796 and 14200 Spark Ignitors

ADJUSTMENT OF _12796 AND 14200 SPARK IGNITORS

14-2378F

4-16



PART NO.	FOR SAMUEL JACKSON MACHINES	DIMENSION A MM	INCHES
12796	HU-60-1065 HO-7-1114 HO-7-1137 HO-7-1237 HO-7-1637	25	1.00
14200	HO-4-1112 HO-4-1112A HO-4-1118 HO-4-1234 HU-60-1105 HU-60-1200 HU-60-1260 HU-60-1265 HU-60-1465 HU-80-1545	40	1.56

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Warranty and Safety Notices

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.

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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.

Samuel Jackson, Incorporated
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