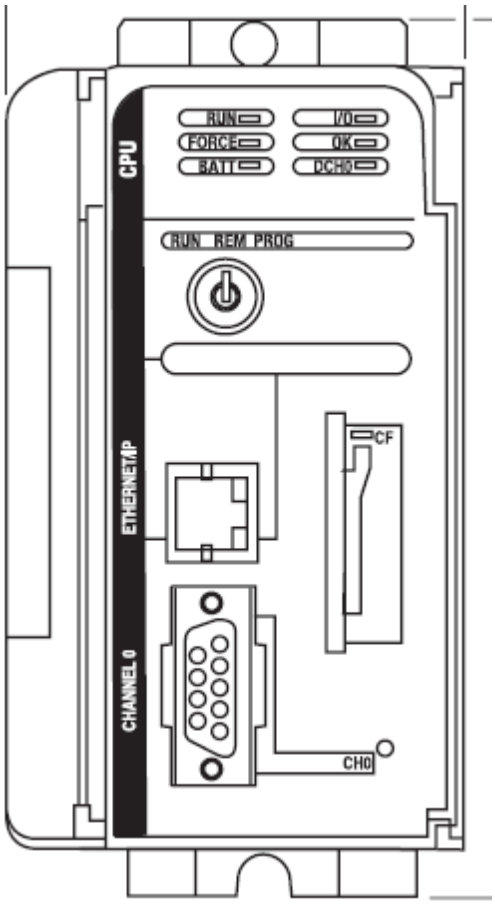
d. If on the “Top View” screen on the HMI the primary door is not closed, the door has not been shut properly. Adjust the limit switch lever arm if necessary. Check the limit switch and that the wiring is in working order.

e. If on the “Top View” screen on the HMI the secondary door is not closed, the door has not been shut properly. Adjust the limit switch lever arm, if necessary. Check the limit switch and that the wiring is in working order.

f. If fuel tank is low, system will not start. Tank on the HMI will be red, indicating the level is low and needs to be filled.

g. PLC Processor Problem



i. Check the run light on the PLC processor. If the run light is on, the PLC is ready.

ii. “OK light” is green = Controller is OK

iii. “OK light” is Red Flashing = this is a recoverable fault, check the PLC processor. This fault is very unlikely to occur.

iv. OK light is Red = this is a non-recoverable controller fault. Cycle Power. The OK LED should change to flashing red. If LED remains solid red, repl*ace the PLC. This fault is very unlikely to occur.*

v. *"Default Channel Zero (DCH0) light" is green = this indicates the PLC processor has lost the* program. The PLC is equipped with a flash card that will automatically load the program back onto the PLC

3.3.6.2 Possible Problems/Causes/Solutions

Problem	Causes	Solutions
Blower Fails to start	Breaker tripped	Turn power off at Main Disconnect Open Panel and check which breaker has tripped, turn back on
	Motor starters or contactor coil is burnt out	Locate contactor for blower and visually observe if the contactor is pulled in. Use a multi meter to check for voltage across the coil If there is voltage across the coil and the contactor is not pulled in, replace the contactor. *See Part IV Section 4 CMI 4.4.4/01-001G*
Secondary Burner won't ignite	Bad Electrodes	*Refer to Part IV Section 2 Preventive Maintenance Instructions (PMI) 01/02-002.D.01*
	Low Oil Pressure	Adjust pressure setting on burner pump by turning the screw located at the bottom of the pump. Turn clockwise to increase pressure and counter clockwise to decrease pressure.
	Fuel Line Leak	Visually inspect the lines for the leak Tighten any fittings that are near the leak
	Door Switch not making contact	Make sure main door is closed and latched shut Make sure limit switch is hitting striker plate.
	Bad Thermocouple	Replace thermocouple see Section IV Part 4 CMI 4.4.1/05-002A
Primary Burner won't ignite	Bad Electrode	*Refer to Part IV Section 2 PMI 01/02-002.D.01*
	Low Oil Pressure	Adjust pressure setting on burner pump by turning the screw located at the bottom of the pump. Turn clockwise to increase pressure and counter clockwise to decrease pressure.
	Fuel Line Leak	Visually inspect the lines for the leak Tighten any fittings that are near the leak
	Door Switch not making contact or broken	Make sure main door is closed and latched shut. Make sure limit switch is hitting striker plate.

Problem	Causes	Solutions
	Secondary temperature not at 1000°C	Wait until Secondary temperature is at 1000°C and try again
	Burner main switch is turned off	Turn switch on
	Burner alarm has been tripped	Acknowledge burn alarm and then hit the reset button on control panel
Persistent Black Smoke	Insufficient air supply to Secondary Chamber to completely consume emissions	Check to ensure combustion air blower/damper assembly is operating properly.
	Secondary Chamber is not hot enough.	Check that the Secondary temperature is operating at required temperature set point.
	Overloading or loading highly volatile material	Decrease load size on next batch (confirm by weighing), ensure the waste mix is correct.
	Burner failure	Check burner operation – if no flame or a poor flame is visible through the flame view port adjust air/fuel ratio
	Operation at too high a Primary Chamber temperature	Check/decrease primary chamber combustion air
Smoke coming out of Primary	Too much air	Check dampers on primary blower
	Too much volatile material loaded	Decrease load size on next batch (confirm by weighing), ensure the waste mix is correct.
	Primary Chamber temperature too high	Waste loaded may not be a good mix of heat value
Too much fuel usage	Too much secondary combustion air	Check/reduce secondary combustion air
	Too much air infiltration	Reduce air flow by adjusting the damper
	Fuel leakage	Check fuel trains and burners for fuel leakage
	Wet waste	Spread wet waste with other waste through several loads – do not charge all of the wet waste at one time
	Excessive draft	Check/reduce draft – check door seals and other seals for leakage adjust damper
	Burner setting too high	Check air/fuel mix
Waste Oil Burner		
Pump fails to start	Breaker tripped	Switch Breaker into off position and then switch to on position again. If breaker continues to trip, check for short in the system.
	Motor Starter	Check motor starter
	Overload	Reset overload

Problem	Causes	Solutions
Waste Oil Nozzle not turning on	A ball valve is closed	Ensure all ball valves are open.
	Solenoid Valve has failed	Diagnose if valve has failed. Replace if necessary See Part IV Section 4 CMI 4.4.5/02-003B (page 451)
	Fuel Leak	Check all pipes and hoses
	Secondary Chamber not at temperature	Wait until Secondary Chamber reaches 982°C.
System will not start when Solid is selected	Waste Oil burner is inserted into the back of the Secondary Chamber	Remove Waste Oil burner assembly from the Secondary Chamber.

3.3.6.3 In Case of Alarm

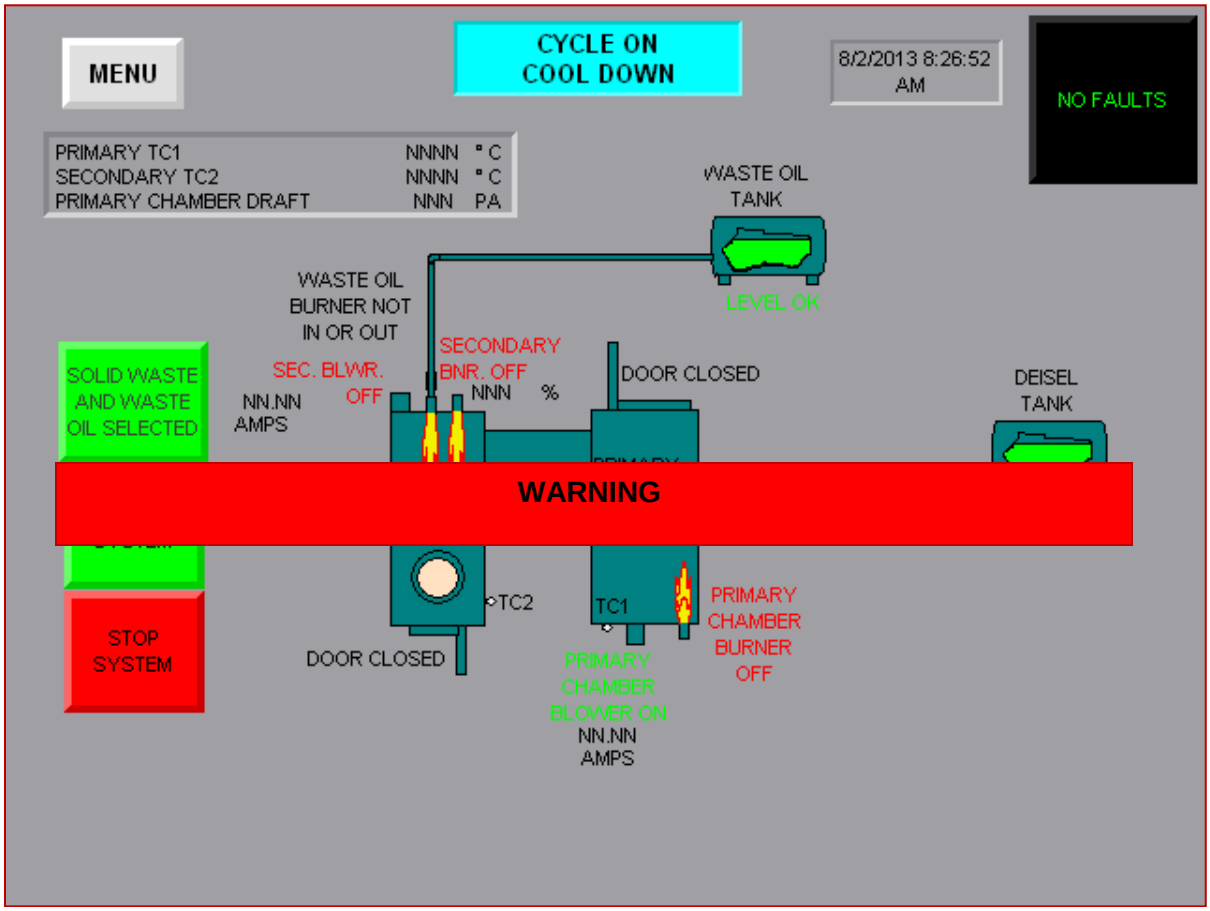
IF BURN IS IN PROGRESS DO NOT HIT EMERGENCY STOP BUTTON ON MAIN CONTROL PANEL.

a. Go to the manual slide gates on the Primary Chamber, located just after the blower, and close them all the way. This will help to put the fire in the chamber out.

b. Check alarms to see what the problem is.

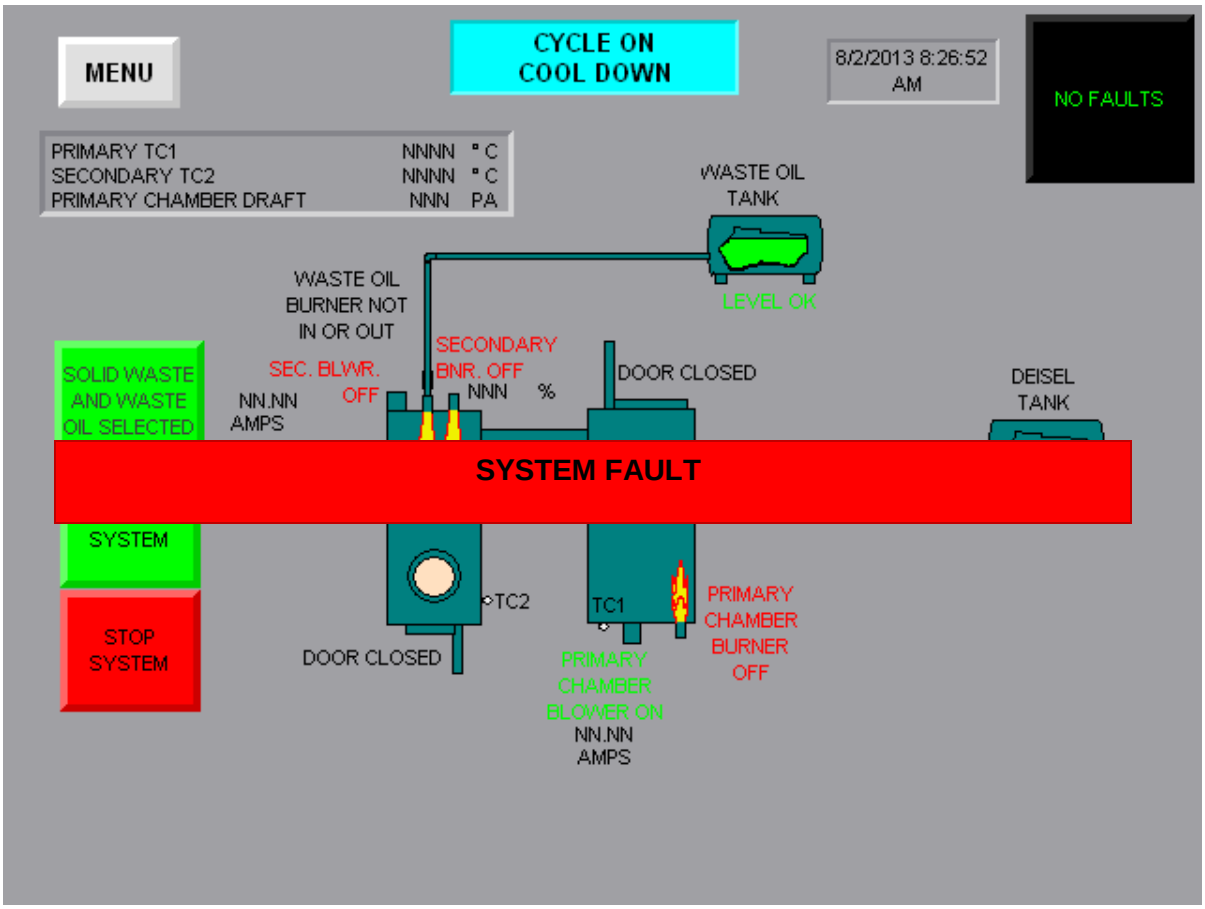
c. Do not open the doors of the Primary Chamber unless the temperature inside the chamber is below 90°C

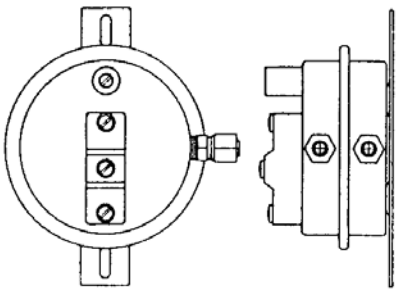
3.3.6.4 System Warnings

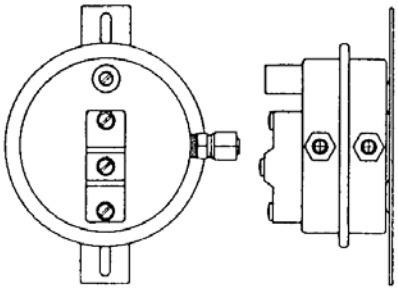


Warnings indicate that a non critical value or device has malfunctioned and requires an operator to review what may be causing this to occur. If not resolved some of the warnings may become a fault.

3.3.6.5 System Faults



ALARM	SOLUTION
The Primary Chamber thermocouple has faulted	Refer to *Part IV Section 2 PMI 05-002.W.01*
The Secondary Chamber thermocouple has faulted	Refer to *Part IV Section 2 PMI 05-002.W.01*
The primary burner is faulted	The primary burner has failed to light when it received a signal telling it to start. To reset the burner, press the reset button located on the Burner and look into sight glass for ignition:
	Check that the pressure is 1378 kPa
	If a spark is present and burner won't ignite: • Check fuel lines for leaks • Check that fuel pump is not clogged
	If no spark is present: • Clean electrodes
The secondary burner is faulted	The secondary burner has failed to light when it received a signal telling it to start. To reset the burner, press the reset button located on the Burner and look into sight glass for ignition:
	If a spark is present and burner wont ignite: • Check fuel lines for leaks • Check that fuel pump is not clogged
	If no spark is present: • Clean electrodes
The system has shut down due to primary blower low air flow.	Visually examine the primary blower for any obstructions that may be causing low air flow
	Check slide gate located between Primary chamber and blower, ensure it is open.
	Check damper assembly, ensuring modutrol crank arm is still connected and that butterfly damper is open, allowing air flow.
	Air proving switch may be defective. See *Part IV Section* 4 CMI 4.4.4/01-001A & 02-002A
	There are two ports on the air proving switch marked V and P. Ensure the inlet tube is attached to the port marked “P” for pressure. V stands for vacuum. Ensure the “V” port is open to atmosphere and is not blocked
	If no air restriction is observed (i.e. blockage in the tube) change the air proving switch see *Part IV Section* 4 CMI 4.4.4/01-001A & 02-002A
The primary blower motor breaker is tripped or open.	Turn power off on Control panel by turning the Main Disconnect to the off position CB1

ALARM	SOLUTION
	Open the main control panel and switch break switch to off and then to the on position “CB9”
The system has shut down due to secondary blower low air flow.	Visually examine the primary blower for any obstructions that may be causing low air flow
	Check slide gate located between Secondary chamber and blower, ensure it is open.
	Check damper assembly, ensuring modutrol crank arm is still connected *(if not see Part IV Section 2 PMI 01/02-001.W.01 Damper Crank Arm)* and that butterfly damper is open, allowing air flow.
	Air proving switch may be defective. See *Part IV Section* 4 CMI 4.4.4/01-001A & 02-002A
	There are two ports on the air proving switch marked V and P. Ensure the inlet tube is attached to the port marked “P” for pressure. V stands for vacuum. Ensure the “V” port is open to atmosphere and is not blocked
	If no air restriction is observed (i.e. blockage in the tube) change the air proving switch see *Part IV Section* 4 CMI 4.4.4/01-001A & 02-002A
The Secondary blower motor breaker is tripped or open.	Turn power off on Control panel by turning the Main Disconnect to the off position
	Open the main control panel and switch the breaker to off and then to the on position “CB10”
The Secondary blower variable frequency drive is faulted.	Push fault reset button on the Panel view
	If fault persist check the error code on the variable frequency drive and check OEM manual for troubleshooting alarm.
The burner fuel level is low.	Add fuel to the fuel tank and the alarm should reset itself
	If alarm persist replace the low level switch *as per* See *Part IV Section* 4 CMI 4.4.3/01-002G & 02-002G
Selected Solid & Waste Oil The waste oil burner is not in.	Check to see if the waste oil burner is pushed all the way into the Secondary Chamber. • Push waste oil burner all the way in, ensuring it makes contact with the limit switch • If the waste oil burner is all the way in and making contact with the limit switch, replace the limit switch. See Part IV Section 4 CMI 4.4.1/05-005A (page 436)

ALARM	**SOLUTION**
Solid Waste Only Selected The waste oil burner is not out.	Check to see if the waste oil burner is pulled all the way out of the Secondary Chamber • Pull waste oil burner all the way out, ensuring it makes contact with the limit switch • If the waste oil burner is all the way out and making contact with the limit switch, replace the limit switch. See Part IV Section 4 CMI 4.4.1/05-005A (page 436)
The waste oil burner is faulted.	The waste oil tank is empty, fill tank
	Check that the instrument air is going to the burner check the air pressure gauge on the burner and adjust regulator if necessary.
	Check that the fuel pump is in working condition
	Check that the waste oil breaker is not tripped “CB15”

4.0 MAINTENANCE INSTRUCTIONS

4.1 SUMMARY OF PREVENTIVE MAINTENANCE INSTRUCTIONS

IF APPLICABLE: The air compressor pump is shipped with break-in oil which should be changed after the first 8 hours of operation.

4.1.1 Daily Maintenance

Freq.	Routine	Component	Description
Daily	Inspection & Cleaning	Burners	Clean electrodes & HT Leads.
Daily	Inspection & Cleaning	Burners	Inspect fuel lines for leaks.
Daily	Inspection & Cleaning	Burners	Inspect nozzles in burners.
Daily	Inspection & Cleaning	Refractory	Check inside the Chambers for shrinkage or any exposed metal.

4.1.2 Weekly Maintenance

Routine	Component	Description
Inspection & Cleaning	Air compressor	Check oil level
Inspection & Cleaning	Air compressor	Check air filter
Inspection & Cleaning	Air compressor	Pull ring on safety valve and allow the ring to snap back to normal position (Check for free operation of the safety valve)
Inspection & Cleaning	Blowers and Assembly	Modutrol crank arm connected to damper.
Inspection & Cleaning	Blowers and Assembly	Slide gates are open.
Inspection & Cleaning	Burners	Clean photocell / UV Detector
Inspection & Cleaning	Burners	Clean the glass on the flame inspection window.
Inspection & Cleaning	Burners	Check diffuser disc.
Inspection & Cleaning	Waste Oil Burner Filter	Clean the canister filter
Inspection & Cleaning	Thermocouples	Remove and clean thermocouples as necessary – inspect for damage. Replace if necessary.

4.1.3 Monthly Maintenance

Routine	Component	Description
Inspection & Cleaning	Air compressor	Check all fasteners for proper tightness.
Inspection & Cleaning	Blowers and Assembly	Check the fan wheel for any wear or corrosion, as either can cause catastrophic failures
Inspection & Cleaning	Burners	Check flexible hoses to make sure that they are still in good condition.
Inspection & Cleaning	Burners	Pump delivery pressure must be stable. If the pressure is found to be unstable or if the pump runs noisily see manual for details.
Inspection & Cleaning	Burners	Check that no dust has accumulated inside the fan or on its blades.
Inspection & Cleaning	Burners	Check that all parts of the combustion head are in good condition, positioned correctly, free of all impurities, and that no deformation has been caused by operation at high temperatures.
Inspection & Cleaning	Refractory	Check the refractory in the Secondary Chamber for shrinkage, anything greater then 1.2cm should be patched (i.e. gaps between modules exposing metal surface)
Inspection & Cleaning	Waste Oil	Visually check all electrical components
Inspection & Cleaning	Waste Oil	Remove heater element from casing and inspect for build-up. Clean any deposits. When reinstalling the heater element always ensure the bundle will be restarted immersed. NEVER use the inline oil heater dry

4.1.4 Quarterly Maintenance

Routine	Component	Description
Lubrication Service	Air compressor	Change the oil
Inspection & Cleaning	Blowers and Assembly	Lubricate all bearings – lubrication intervals depend on operating speed (RPM). Clean cooling fan on motors.
Inspection & Cleaning	Blowers and Assembly	Check the V-belt drive (Secondary Blower) for proper alignment and tension (see manual). If belts are worn, replace them as a set, matched within manufacturer's tolerances.
Inspection & Cleaning	Burners	Check all components for heat damage.
Inspection & Cleaning	Refractory	Inspect door gasket for damage or heat damage. Replace segments, if necessary. Doors must close tightly and securely.
Inspection & Cleaning	Refractory	Check all refractory for damage. Patch or replace as needed. Patch if modules show a little gap and replace modules if the modules have shrunk excessively (greater than 1")
Inspection & Cleaning	Paint	Maintain paint exterior to protect metal from heat damage

4.1.5 Yearly Maintenance

Routine	Component	Description
Detailed Maintenance	Refractory	Replace door gasket
Inspection & Cleaning	Electrical	Check the limit switch

4.1.6 Level 2 and Level 3 Maintenance

Please refer to the OEM Manual for additional information regarding maintenance instructions for Level 2 and Level 3.

Periodicity	Level of Repair	Routine	Component	Description
24 Monthly	3	Detailed Maintenance	Refractory	Replace the door sills on Primary Chamber
24 Monthly	3	Detailed Maintenance	Refractory	Replace the door sills on Secondary Chamber
60 monthly	3	Detailed Maintenance	Refractory	Relining of Secondary Chamber.
60 monthly	3	Detailed Maintenance	Refractory	First stack section to be relined.
60 monthly	3	Detailed Maintenance	Fuel Tanks	Inspect Fuel tanks

4.2 PREVENTIVE MAINTENANCE INSTRUCTIONS

The following preventive maintenance instructions (PMI) are to be read in conjunction with the IPDs found in Section 4.3.

4.2.1 Instruction Classification

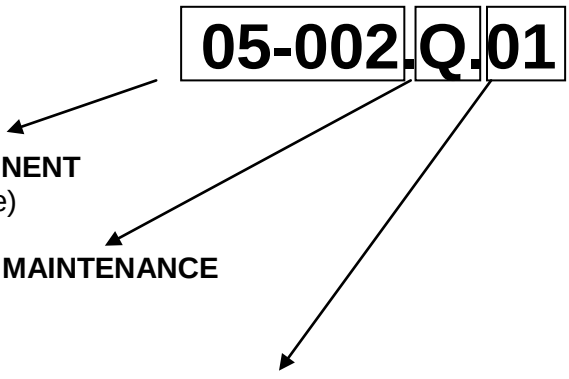
Each component is associated with an identification number, see table below:

System Component	Identification number
Primary Blower	01-001
Secondary Blower	02-001
Primary Burner	01-002
Secondary Burner	02-002
Air Compressor	03-001
Waste Oil Burner	02-003
Main Control Panel	03-010
Refractory	05-001
Thermocouple	05-002
Paint	05-003
Electrical	05-004
Limit Switch	05-005

To differentiate if the instruction is weekly, monthly, quarterly or yearly, the above identification number will be followed by a letter:

Daily: D
Weekly: W
Monthly: M
Quarterly: Q
Yearly: Y

For example**,**



SYSTEM COMPONENT
(eg. Thermocouple)

FREQUENCY OF MAINTENANCE
(eg. Quraterly)

MAINTENANCE INSTRUCTION NUMBER
(eg. Maintenance Routine #1)

4.2.2 Zero Mechanical State & Lock Out Instructions

Proper maintenance of the equipment is essential to ensure long term, reliable operation of the EWS model Incinerator. The preventive maintenance instructions are outlined in this section of the Facility Manual.

NOTE
The warranty will become void if proper maintenance is not performed as instructed.

4.2.2.1 Safety

During maintenance of the EWS mobile incinerator, it is very important to be aware of special hazards. Two safety programs are described in the following sections:

1. Zero Mechanical State
2. Power Lock Out Instructions

Failure to comply with these instructions during maintenance could result in injury or death. The responsibility for implementation of a comprehensive safety program rests with the operating staff and supervision. The safety instructions in this Facility Manual should be considered only as a starting point for the safety program at site.

ACCIDENTS CAN BE PREVENTED
A CAREFUL WORKER IS THE BEST SAFETY DEVICE

4.2.2.2 Zero Mechanical State

Zero Mechanical State (ZMS) exists when the possibility of an unexpected mechanical movement has been eliminated. During maintenance, it is mandatory to totally deactivate the incinerator so that there is no possibility of an unexpected machine movement. Power lock-out, described in the next section, is commonly used for this purpose. Most machines are powered by electrical, hydraulic or pneumatic drives. Energy may be stored in a shutdown machine in various ways: Air pressure in a cylinder, hydraulic fluid stored in pressurized hoses, or machine members whose weight can generate fluid pressure. Therefore, just cutting off the electrical power may not be enough to neutralize all power sources. Certain maintenance instructions at site should require ZMS condition as a matter of course.

4.2.2.3 Zero Mechanical State (ZMS) Checklist

1. Every electrical power source to the incinerator must be cut off and locked out (to prevent others who may not be aware of maintenance work from turning the power back on inadvertently).
2. Ensure that the mechanical potential energy of the incinerator is at its lowest practical value so that opening of pipe, tubing, hose or actuation of any valve will not produce an unexpected movement that could cause injury.

3. Check that there is no pressurized fluid (air, oil, gas or other) trapped in the incinerator lines, cylinders or other components. This will ensure that there will be no incinerator motion when a valve is actuated.

4. Secure loose or freely moving parts so that there is no possibility of accidental movement.

4.2.2.4 Power Lock Out Instructions

Unexpected operation of electrical equipment started by automatic or manual remote control may cause injuries to persons who happen to be nearby. For this reason, when repair work is to be done on motors or other electrical equipment the circuit should be opened at the switch box and the switch pad locked in the OFF position. Tag the switch with a lock out tag indicating who must be contacted before the power is turned back on again.

BECAUSE OF THE SEVERE CONSEQUENCES, INCLUDING DEATH, OF NOT PROPERLY LOCKING OUT ELECTRICITY SUPPLIES DURING MAINTENANCE, THE SUPERVISOR SHOULD ENSURE THAT THERE IS ONLY 1 KEY FOR THE LOCK USED TO LOCK OUT THE POWER SUPPLY.

For identification, locks may be color coded to indicate different crews or shifts.

The Supervisor should maintain the master key and list of key numbers, and should keep an extra key to each lock for his department. The master key should not be loaned out under any circumstances.

No matter what method is used to lock out power, strict discipline and constant supervision should be employed during any equipment maintenance work.

4.2.2.5 Power Lock Out Checklist

1. Alert the operator of the equipment.

2. Before starting the work on an engine, motor, line shaft or other power transmission equipment or power-driven machine, make sure it cannot be set in motion without your knowledge.

3. Place your own padlock on the control switch, lever, or valve, even if someone has locked the control panel before you. You will not be protected unless you put your own padlock on it. (Another maintenance person could remove their lock and then someone else could start the equipment if they were not aware of maintenance work being done.)

When you are finished working, remove your own padlock. Never permit someone else to remove it for you. Be sure you are not exposing someone else to danger by removing your padlock.

4.2.3 Daily Instructions

Primary & Secondary Chamber Burners: (01-002.D & 02-002.D)

Do not store flammable or hazardous materials in the vicinity of fuel burning appliances.

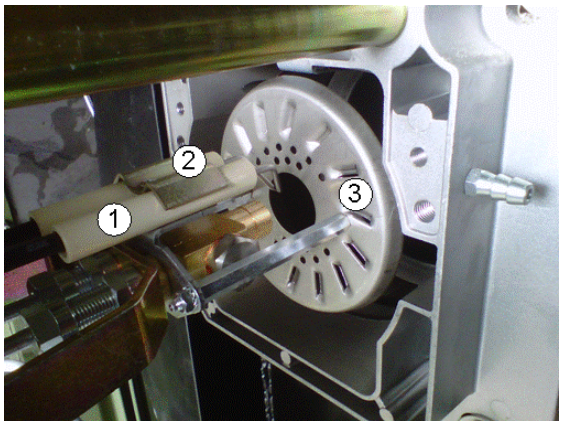
Improper installation, adjustment, alteration, service or maintenance can cause property damage, personal injury or death.

Burner shall be installed and maintained in accordance with manufacturer's requirements as outlined in the Burner manual, local codes and authorities having jurisdiction.

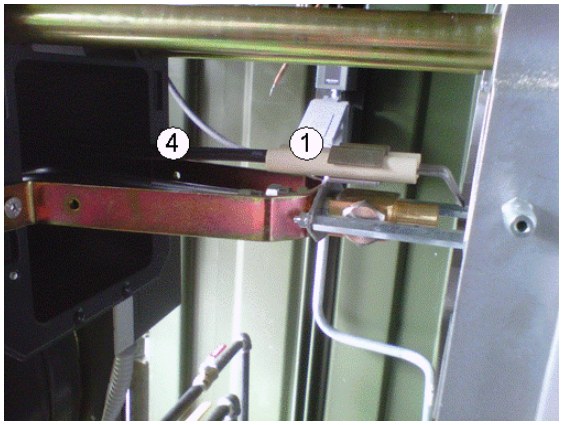
INSTRUCTION 01/02-002.D.01: INSPECTING AND CLEANING ELECTRODES AND HT LEADS

1. Remove the cover from the Burners as described in 01-002.W.01 and 02-002.W.01.

2. Inspect the electrodes for any soot build-up.



1. Electrode
2. U-bolt
3. Diffuser Disc

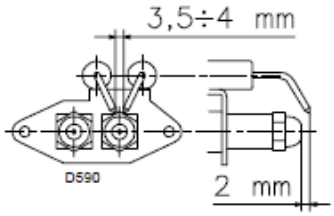


4. HT Leads

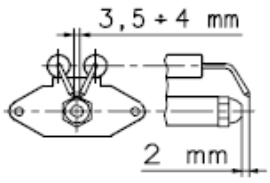
3. Clean/wipe down the ignition electrode with a cloth should there be a build-up of soot.

NOTE Do not use sand paper as this will increase the deposit of future soot.

4. If electrodes are damaged remove the screws and u-bolt (see above photo) and install new electrodes. When reinstalling the electrodes make sure that they are positioned as shown below.
5.



Primary Burner



Secondary Burner

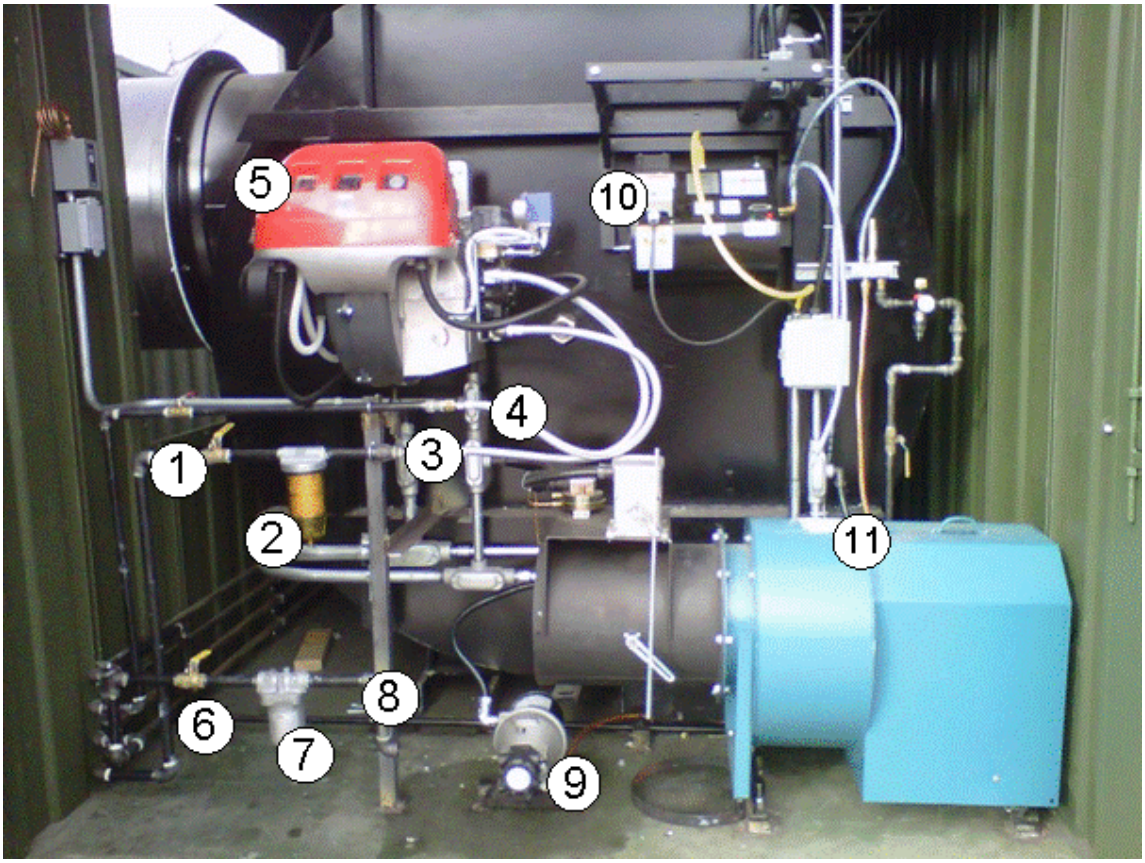
Check the High Temperature (HT) Leads for any heat damage. If HT Leads are severely damaged (i.e., you can see the wire beneath the sheathing) then replace. (See *Part IV Section 4 CMI 4.4.3/01-002A & 4.4.3/02-002A)*

INSTRUCTION 01/02-002.D.02: INSPECTING THE FUEL LINES

1. Visually inspect all fuel lines to the Primary and Secondary Burner as well as to the Waste Oil burner for any leaks.

2. The Primary and Secondary Burner have two oil lines, one feed and one return. The Waste Oil Burner only has one feed line.

3. If any leaks are observed tighten or replace the fitting where the leak is occurring



1. Fuel In Ball Valve
2. Fuel Filter
3. Fuel Line In
4. Fuel Line Out
5. Secondary Burner
6. Waste Oil Ball valve
7. Waste Oil Filter
8. Waste Oil Line In
9. Waste Oil J-pump
10. Waste Oil Burner
11. Secondary Blower

INSTRUCTION 01/02-002.D.03: INSPECT AND CLEAN BURNER NOZZLES

Primary Burner:

1. Remove the burner cover as outlined in 01/02-002.W.01 REMOVAL OF BURNER COVERS
2. Remove the centre retaining bolt.
3. Slide burner out.
4. Check nozzle. If there is carbon, remove the nozzle and clean.
5. Reinstall or replace if necessary

Secondary Burner:

1. Remove the burner cover as outlined in 01/02-002.W.01 REMOVAL OF BURNER COVERS
2. Remove the 4 retaining bolts on either side of the burner.
3. Slide burner out.
4. Check nozzle. If there is carbon, remove the nozzle and clean.
5. Reinstall or replace if necessary

Refractory: (05-001.D)

When working with the refractory make sure you use the proper tools; wear goggles, approved dust mask and gloves

INSTRUCTION 05-001.D.01: INSPECTING THE REFRACTORY

Ensure power is locked out.

Please follow all instructions outlined in *Section 4.2.2 Zero Mechanical State & Lock Out Instructions.*

1. Open Primary Chamber door by unlatching all four clamps.
2. Tie-off door to open position to ensure that it will not close unintentionally.
3. Enter Primary Chamber and check the refractory for shrinkage, any gap between the modules greater than 2.5 cm should be patched with the blanket refractory
4. Check for any exposed metal between the modules, if metal is exposed make sure to patch area with blanket material or new module (*Part IV Section 4 CMI 4.4.2/05-001A & 4.4.2/05-001B)*

4.2.4 Weekly Instructions

Primary & Secondary Chamber Blowers: (01-001.W & 02-001.W)

Do not attempt any maintenance on a fan unless the electrical supply has been completely disconnected and locked.

Please follow all instructions outlined in *Section 4.2.2 Zero Mechanical State & Lock Out Instructions.*

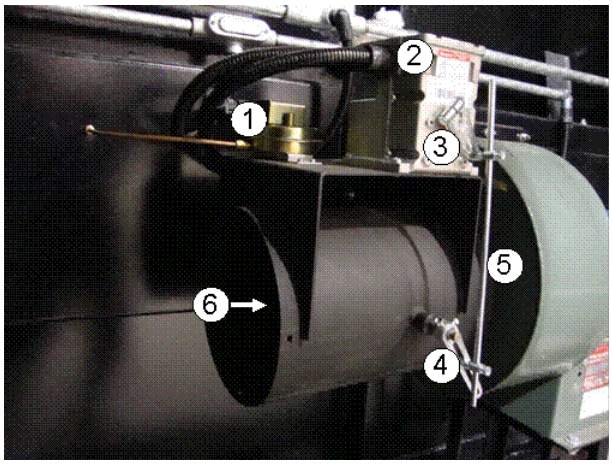
A fan can windmill despite removal of all electrical power therefore, take extra care when working with fans in the system.

The rotating assembly should be blocked securely before attempting maintenance of any kind.

INSTRUCTION 01/02-001.W.01: DAMPER CRANK ARM

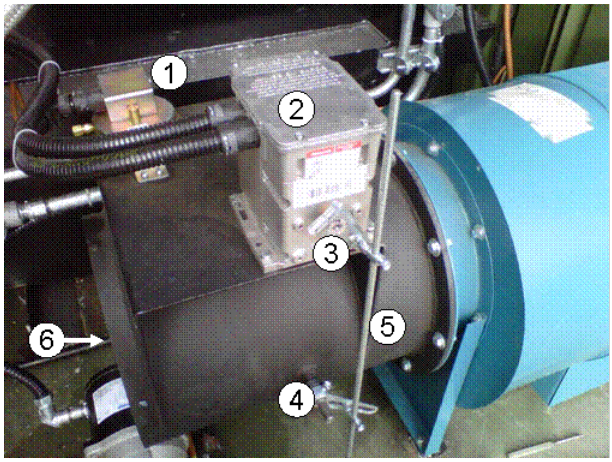
Check to see that the damper crank arm is connected to the damper and the rod.

Ensure mechanical linkage on damper is tight, if loose tighten with wrench.



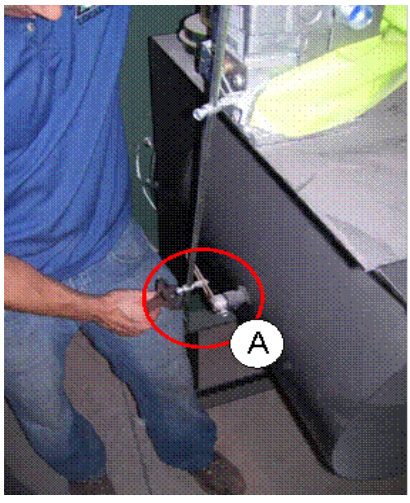
PRIMARY BLOWER

1. Air Proving Switch
2. Modutrol Motor
3. Motor Crank Arm
4. Damper Crank Arm
5. Rod
6. Damper



SECONDARY BLOWER

1. Air Proving Switch
2. Modutrol Motor
3. Motor Crank Arm
4. Damper Crank Arm
5. Rod
6. Damper



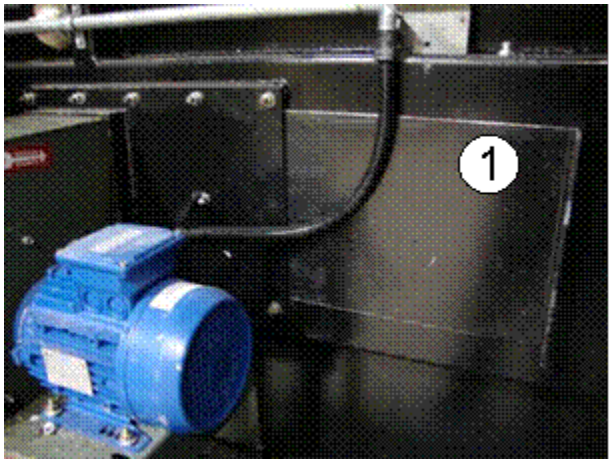
A. Damper Crank arm and connection to Damper and Rod

INSTRUCTION 01/02-001.W.02: SLIDE GATES

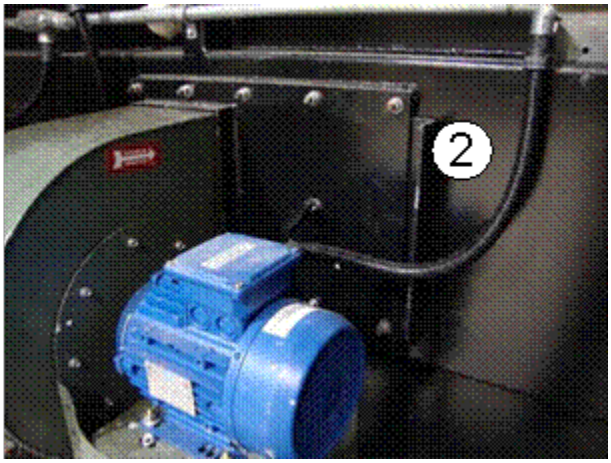
Check to see if slide gates move freely.

1. Move slide gate in and out to ensure free movement. If sticking, use lubricant to loosen. Lubricant should be rated for a high temperature (>150°F) application.

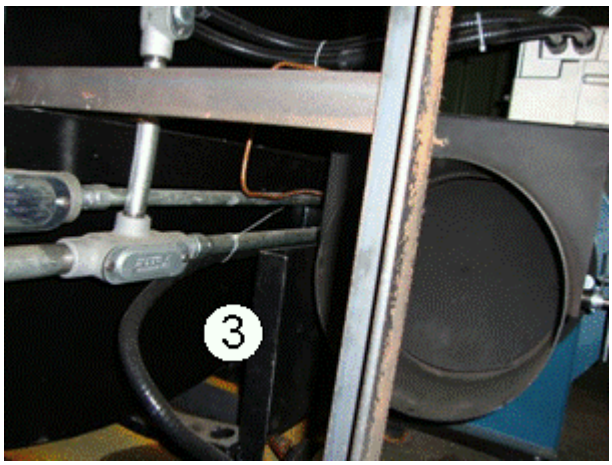
2. Gates must be opened to allow under fire air to enter the chamber. They should only be closed to reduce air in abnormal operating conditions.



1. Primary Chamber Slide Gate Open



2. Primary Chamber Slide Gate Closed



3. Secondary Chamber Slide gate Open

Primary & Secondary Chamber Burners: (01-002.W & 02-002.W)

 **Do not store flammable or hazardous materials in the vicinity of fuel burning appliances.**

Improper installation, adjustment, alteration, service or maintenance can cause property damage, personal injury or death.

Burner shall be installed and maintained in accordance with manufacturer's requirements as outlined in the Burner manual, local codes and authorities having jurisdiction.

INSTRUCTION 01/02-002.W.01: REMOVAL OF BURNER COVERS

Switch off the electrical power. Please follow all instructions outlined in *Section 4.2.2 Zero Mechanical State & Lock Out Instructions.* Cover must be removed to perform maintenance on burners.

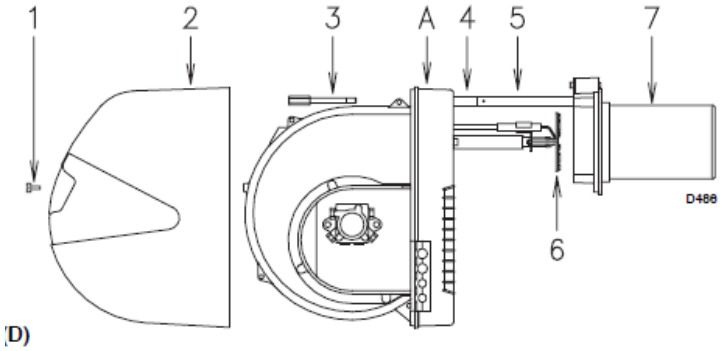
To remove the cover and to pull out the Primary or Secondary Burner, follow instructions below:

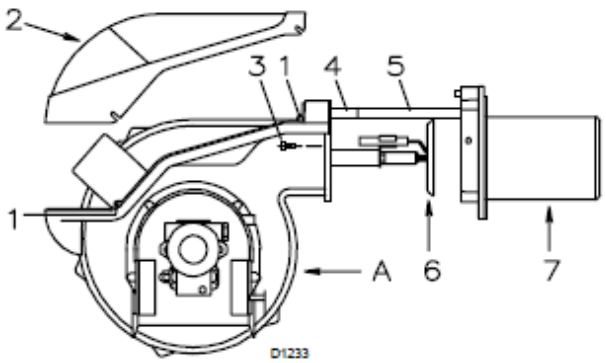
1. Loosen screw (Item #1, in the following diagrams) and withdraw the cover (Item #2, in the following diagrams)

2. Primary Burner has one screw to remove the cover. The Secondary Burner has four screws to remove the cover.

3. Remove bolt (Item #3) for the Primary Burner, or screws (Item #3) for the Secondary Burner.

4. Pull (Part A) backwards keeping it slightly raised to avoid damaging the diffuser disk (Item #6).





Primary Burner has 1 screw

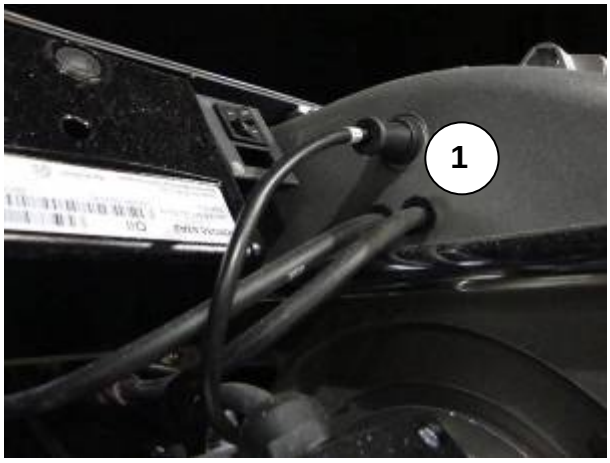
Primary

Secondary Burner has 4 screws (2 on each side)

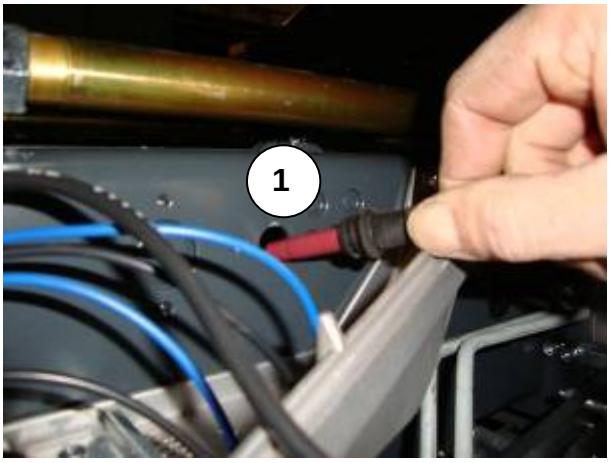
Secondary

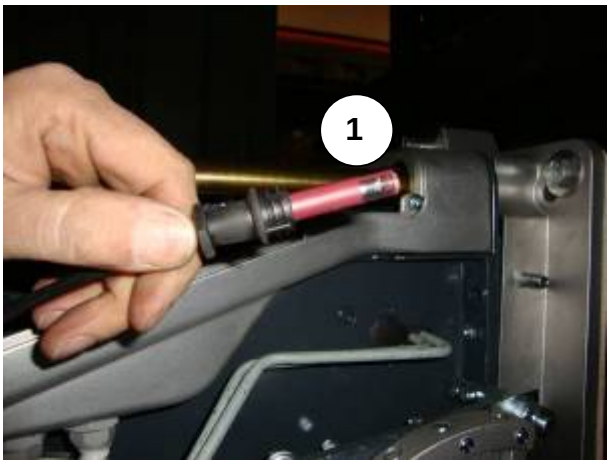
INSTRUCTION 01/02-002.W.02: CLEANING THE PHOTO CELL AND U.V. DETECTOR

1. Remove the cover from the Burners as described in Instruction 01/02-002.W.01.
2. Clean Photo Electric (P.E) cell with a wet cloth
3. P.E. cell (Item #1 on the Primary Burner photo) (Item #1 on the Secondary Burner photo) can be removed by pulling it outward forcefully. Ensure you take note of the position of the eye while removing, this will help when reinstalling.
4. Once cleaned insert P.E. cell back into position ensuring the eye is not facing directly into the chamber (where the flame will be) but on the same angle as before it was removed.
5. Reinstall burner cover.



Primary Burner PE Cell

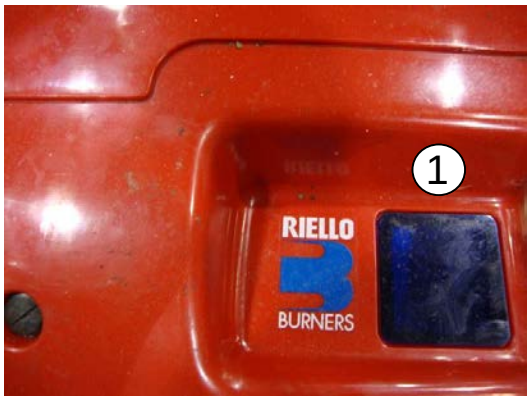




Secondary Burner

INSTRUCTION 01/02-002.W.03: CLEANING THE INSPECTION WINDOWS

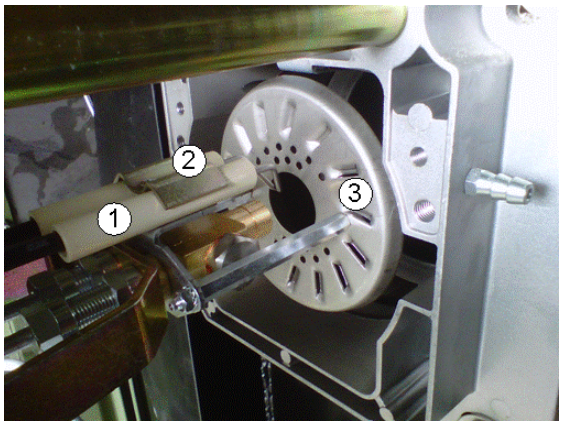
Clean the inspection windows with a wet cloth.



1. Primary Burner Inspection Window
2. Secondary Burner Inspection Window

INSTRUCTION 01/02-002.W.04: INSPECTING THE DIFFUSER DISC ASSEMBLY

1. Remove the cover from the Burners as described in 01/02-002.W.01.
2. Check the diffuser disc assembly and the diffuser disc for any heat damage
3. If any heat damage, deformation or excess rust is noted, replace. (*Part IV Section 4 CMI 4.4.3/01-002B)*



1. Electrode
2. U-bolt
3. Diffuser Disc

Air Compressor: (03-001.W)

INTAKE AIR. Can contain carbon monoxide or other contaminants. Will cause serious injury or death. This air compressor is not designed, intended or approved for breathing air. Compressed air should not be used for breathing air application.

HAZARDOUS VOLTAGE. Can cause serious injury or death. Disconnect power and bleed pressure from the tank before servicing.

MOVING PARTS. Can cause serious injury. Do not operate with guards removed. Machine may start automatically. Disconnect power before servicing.

HOT SURFACES. Can cause serious injury. Do not touch. Allow to cool before servicing. Do not touch hot compressor or tubing.

HIGH PRESSURE AIR. Bypassing, modifying or removing safety/relief valves can cause serious injury or death. Do not bypass, modify or remove safety/relief valves. Do not direct the air stream at body. Rusted tanks can cause explosion and severe injury or death. Drain tank before each use. Drain valve located at bottom of tank.

RISK OF BURSTING. Use only suitable air handling parts acceptable for pressure of not less than the maximum allowable working pressure of the machine.

Before maintenance is performed on electrical or rotating equipment make sure that the appropriate electrical disconnects are locked out/tagged out. Before removing the vessel access ports make sure that the equipment is off and cool.

NOTE
Too much or too little oil will harm the compressor.

INSTRUCTION 03-001.W.02: INSPECTING AIR FILTERS IN AIR COMPRESSOR

1. Remove both filter covers
2. Gently grab filter element and remove.
3. Visually inspect filter for damage or dirt.
4. If damaged, replace the filter. If dirty, blow out the filter with compressed air.
5. Reinstall the filters and their covers

INSTRUCTION 03-001.W.03: CLEANING AIR COMPRESSOR & CHECKING SAFETY VALVE

Cleaning

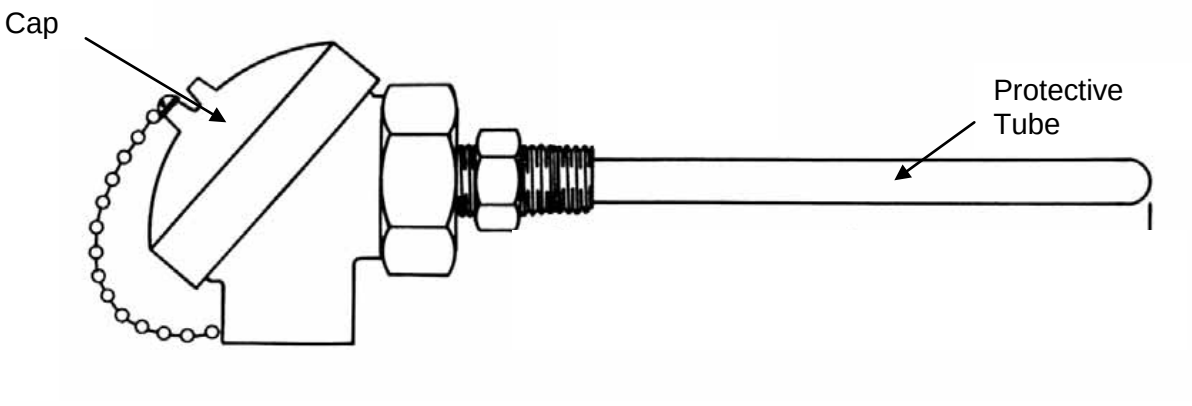
A dirty compressor will cause abnormally high temperature and result in oil carbonization on valve components. Clean all external parts of the compressor with compressed air. Concentrate the cleaning on the external fins where dirt can accumulate as cooling air is forced across them.

Check Safety Valve

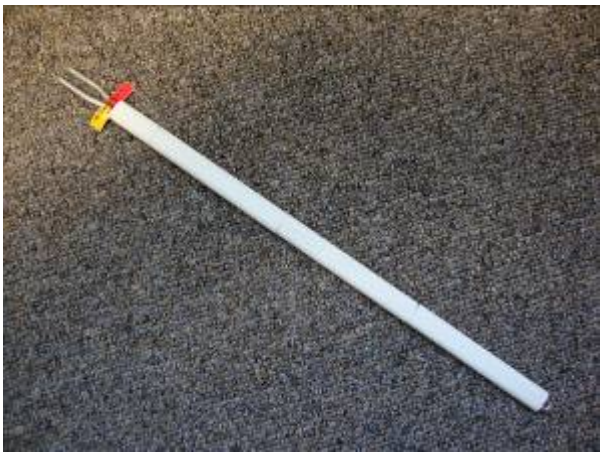
1. Check the safety valve manually by pulling ring or lever to make sure that it moves freely and is not siezed.
2. Allow the ring to snap back to normal position.

Thermocouple: (05-002.W)

When working with electrical components, ensure lock out instructions are being followed.



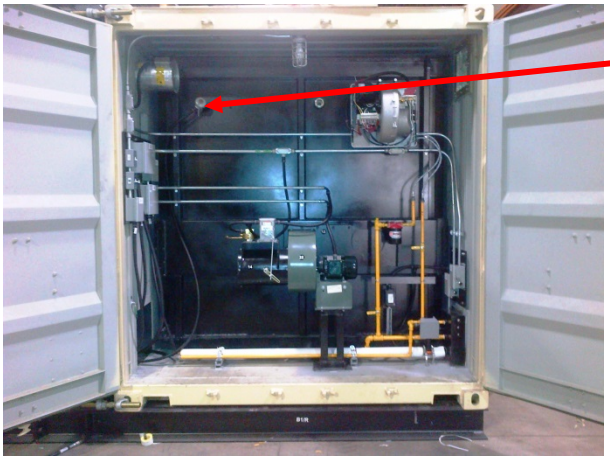
Thermocouple Assembly



Thermocouple Element

INSTRUCTION 05-002.W.01: INSPECT THERMOCOUPLE FOR DAMAGE

Turn main power to the system off - Remove thermocouple and visually inspect for damage. If damaged, see *Part IV Section 4 CMI 4.4.1/05-002A*



1. Primary Thermocouple (TC1)

2. Secondary Thermocouple (TC2) on Secondary Chamber Container

4.2.5 Monthly Instructions

Primary & Secondary Chamber Blowers: (01-001.M & 02-001.M)

Do not attempt any maintenance on a fan unless the electrical supply has been completely disconnected and locked. In many cases, a fan can windmill despite removal of all electrical power. The rotating assembly should be blocked securely before attempting maintenance of any kind.

Please follow all instructions outlined in *Section 4.2.2 Zero Mechanical State & Lock Out Instructions.*

INSTRUCTION 01/02-001.M.01: CHECK FAN WHEEL

1. Check the fan wheel for any wear or corrosion, as either can cause catastrophic failures, if left in operation.
2. The wheel can be accessed one of two ways.
   a. Remove the blower assembly from the unit and look down the outlet of the blower.
   b. Remove the damper assembly from the inlet of the blower and inspect by looking through the inlet of the blower.
3. Check also for the build-up of material which can cause unbalance resulting in vibration, bearing wear and serious safety hazards.
4. Clean the wheel as required.
5. If replacement is necessary follow these steps:

   a. Remove damper assembly from the unit

   b. Remove the blower assembly

   c. Remove the blower housing around the wheel

   d. Loosen all set screws that are located on the wheel.

   e. A puller may be required if the wheel hasn't been removed for some time.

   f. Ensure the shaft "key" is installed on the shaft before installing the new wheel.

   g. When installing a new wheel, the wheel should be positioned in the housing with the correct spacing between the edge of the inlet cone and the wheel. The wheel to cone clearance on the Primary Blower is 0.3175 cm.

   h. Ensure that the wheel is installed securely before reassembling the blower assembly.

   i. Install the blower assembly

   j. Install the damper assembly

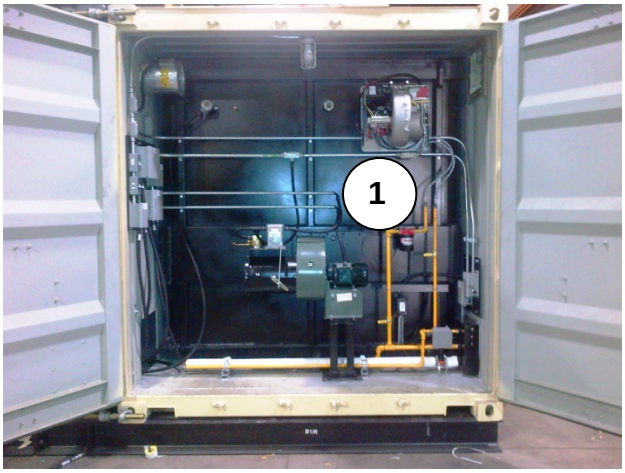
Primary & Secondary Chamber Burners: (01-002.M & 02-002.M)

Do not store flammable or hazardous materials in the vicinity of fuel burning appliances. Improper installation, adjustment, alteration, service or maintenance can cause property damage, personal injury or death. Refer to the Burner manual for instructional or additional information.

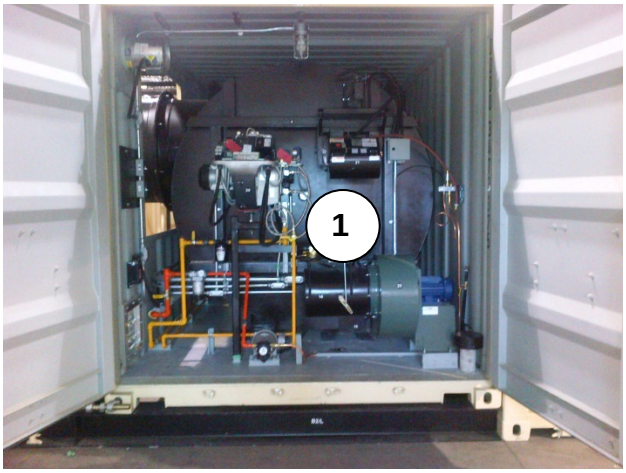
INSTRUCTION 01/02-002.M.01: CHECK FLEXIBLE OIL LINE

1. Check flexible oil lines to make sure that they are still in good condition. This includes frayed, leaking, or worn swivel joints.

2. If any type of damage is observed replace the flexible oil lines see *Part IV Section 4 CMI 4.4.3/01-002F & 4.4.3/02-0002F*



Primary Chamber Burner Flexible lines
(1 Above)



Secondary Chamber Burner Flexible Lines
(1 Above)

INSTRUCTION 01/02-002.M.02: INSPECT BURNER PUMP DELIVERY PRESSURE

1. Remove the cover from the Burners as described in Instruction 01/02-002.W.01.

2. The pump delivery pressure must be between 180-210 psi, and can be viewed on the gauge shown below.

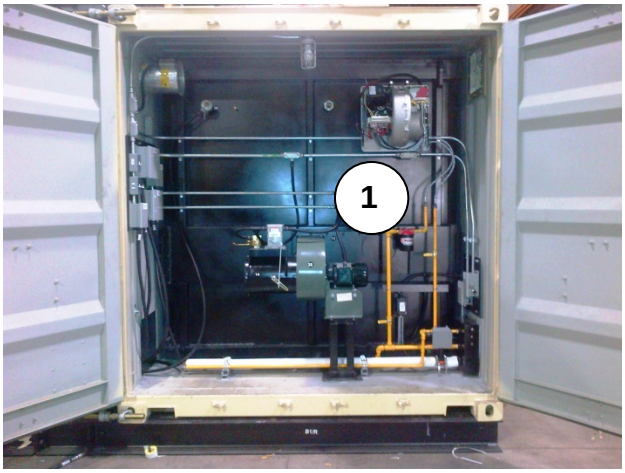
3. If the pressure is found to be unstable or if the pump is running noisily try the following:

a. Detach the flexible hose from the line filter (Shown below as #1).

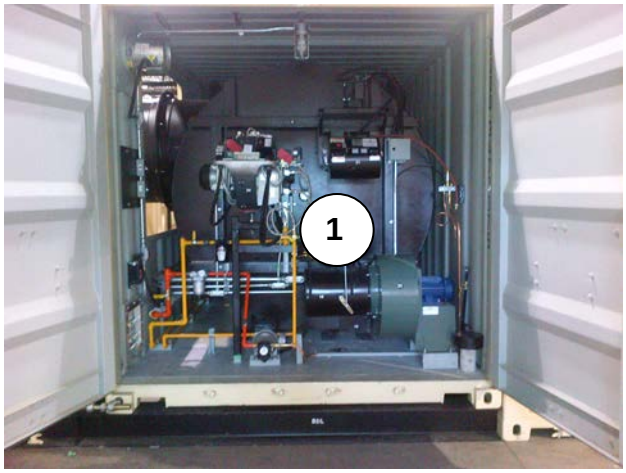
b. At the tank pour fuel into the supply line.

c. If there is fuel coming in through the filter it means the filter is not clogged. If no fuel is coming through the filter remove and replace.

d.



Primary Chamber Burner Flexible lines



Secondary Chamber Burner Flexible Lines

4. If the pump is found to be responsible:
   a. Loosen the bleed screw.
   b. Turn on the burner
   c. Once all the air has been bled out. Close the bleed screw.

   If the pump is still not working after these steps replace the pump: see *Part IV Section 4 CMI 4.4.7/01-002I or 4.4.7/02-002I.*

5. If the problem lies in the suction line, check to make sure that the filter is clean and that air is not entering the piping from a loose fitting or damaged line.

INSTRUCTION 01/02-002.M.03: CLEAN BURNERS OF DUST

1. Remove the cover from the Burners as described in Instruction 01/02-002.W.01.

2. Check that no dust has accumulated inside the burner fan or on fan blades.

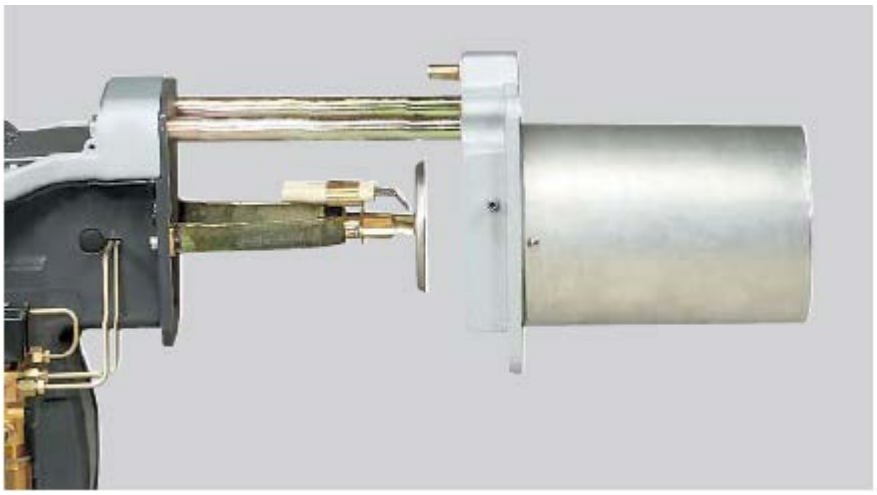
3. If any dust is visible take a clean soft cloth to the fan or the blades and wipe clean.

INSTRUCTION 01/02-002.M.04: CHECK BURNER COMBUSTION HEAD

1. Remove the cover from the Burners as described in Instruction 01/02-002.W.01.

2. Check that all parts of the combustion head are in good condition, free of all impurities, and that no deformation has been caused by operation at high temperatures.

(Below is an example of burner in good condition)



If damage is found, please refer to *Part IV Section 4 CMI 4.4.3/01-002D & 4.4.3/02-002D*

Refractory: (05-001.M)

When working with the refractory make sure you use the proper tools; wear goggles, dust mask and gloves

Please follow all instructions outlined in *Section 4.2.2 Zero Mechanical State & Lock Out Instructions.*

INSTRUCTION 05-001.M.01: INSPECT REFRACTORY

1. Ensure power is locked out.
2. Open Secondary Chamber door.
3. Fasten door open, ensuring it will not close by its own weight.
4. Enter Secondary Chamber and check the refractory for shrinkage, any gaps between the modules greater than 2.5 cm should be patched.
5. Fix gaps with supplied blanket by stuffing material into opening. (See *Part IV Section 4 CMI 4.4.2/05-001A)*
6. Check for any exposed metal, if metal is exposed make sure to patch area with blanket material or new module. (See *Part IV Section 4 CMI 4.4.2/05-001A & 4.4.2/05-001B)*
7. Pay special attention to areas where the junction boxes are located, as any excessive heat may melt the wires within the box.

Some cracking is normal, however if pieces are missing or have fallen out, (See *Part IV Section 4 CMI 4.4.2/05-001E)*

Air Compressor: (03-001.M)

 **INTAKE AIR. Can contain carbon monoxide or other contaminants. Will cause serious injury or death. This air compressor is not designed, intended or approved for breathing air. Compressed air should not be used for breathing air application unless treated in accordance with all applicable codes and regulations.**

 **HAZARDOUS VOLTAGE. Can cause serious injury or death. Disconnect power and bleed pressure from the tank before servicing. Compressor must be connected to properly grounded circuit. Do not operate compressor in wet conditions. Store indoors.**

 **MOVING PARTS. Can cause serious injury. Do not operate with guards removed. Machine may start automatically. Disconnect power before servicing. Lockout/Tagout machine.**

 **HOT SURFACES. Can cause serious injury. Do not touch. Allow to cool before servicing.**

 **HIGH PRESSURE AIR. Bypassing, modifying or removing safety/relief valves can cause serious injury or death. Do not bypass, modify or remove safety/relief valves. Do not direct air-stream at body. Rusted tanks can cause explosion and severe injury or death. Drain tank before each use. Drain valve located at bottom of tank.**

RISK OF BURSTING. Use only suitable air handling parts acceptable for pressure of not less than the maximum allowable working pressure of the machine.

INSTRUCTION 03-001.M.01: CHECK FASTENERS FOR TIGHTNESS

1. Check all fasteners for tightness (tighten as required).

2. Check the safety valve manually, by pulling ring or lever, to make sure that it is not stuck. Allow the ring to snap back to normal position

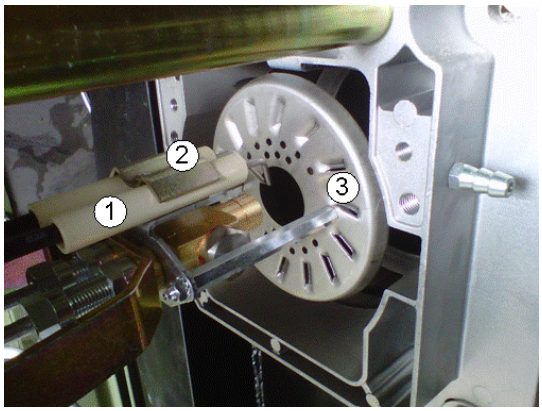
Quarterly Instructions

Primary & Secondary Chamber Burners: (01-002.Q & 02-002.Q)

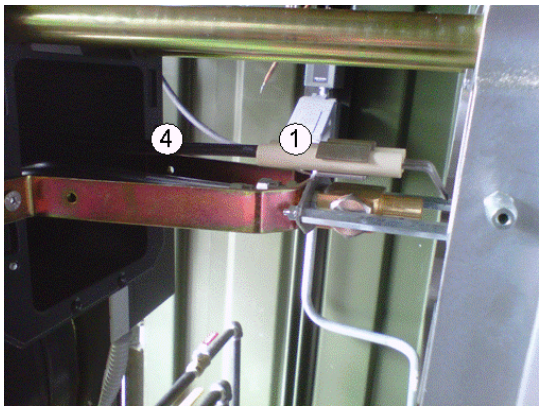
Do not store flammable or hazardous materials in the vicinity of fuel burning appliances. Improper installation, adjustment, alteration, service or maintenance can cause property damage, personal injury or death. Refer to the Burner manual for instructional or additional information.

INSTRUCTION 01/02-002.Q.01: INSPECT COMPONENTS FOR HEAT DAMAGE

1. Check all components for heat damage.
2. Look for excessive rust, deformation of all the parts including but not limited to the end cone and the diffuser disc.
3. Check to see that the High Temperature Leads (HT leads) are still intact and have not melted from any excessive heat coming back into the burner. If they are damaged replace with new HT Lead.
    a. The HT leads are attached to the control box and the electrode via a squeeze fitting. Remove the leads from the electrode and control box by simply pulling them out.



1. Electrode
2. U-Bolt
3. Diffuser Disc
4. HT Leads



End cone

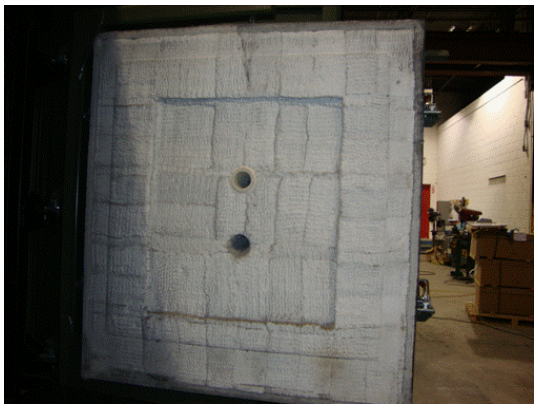
Refractory: (05-001.Q)

When working with the refractory make sure you use the proper tools; wear goggles, dust mask and gloves

Please follow all instructions outlined in *Section 4.2.2 Zero Mechanical State & Lock Out Instructions.*

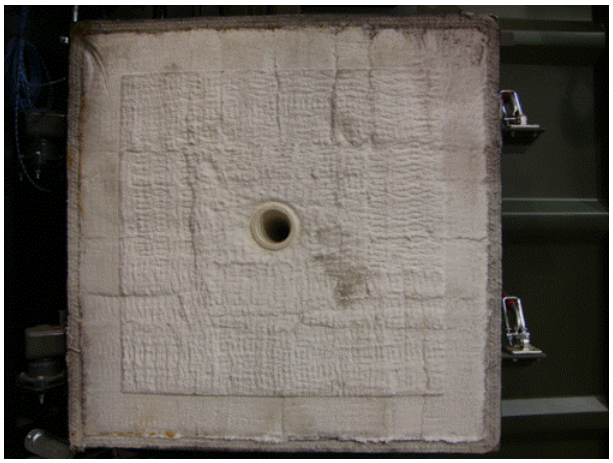
INSTRUCTION 05-001.Q.01: INSPECT DOOR GASKETS

1. Open Primary and Secondary Chamber doors.
2. Fasten doors open, ensuring the door will not close on its own.
3. Inspect door gasket for damage.
4. Replace any damaged segments of door gasket if necessary. Cut out the damaged section and replace with new door gasket. See *Part IV Section 4 CMI 4.4.2/05-001C*.
5. Doors must close tightly and securely, ensuring a good seal.



Primary Door (refractory lined)

1. Primary Door Gasket



Secondary Door (refractory lined)

1. Secondary Door Gasket

INSTRUCTION 05-001.Q.02: INSPECT REFRACTORY FOR SHRINKAGE

1. Ensure power is locked out.
2. Open Primary and Secondary Chamber doors.
3. Fasten doors open, ensuring they will not close on their own.
4. Enter Primary and Secondary Chamber and check the refractory for shrinkage, anything greater than 2.54 cm should be patched.
5. Check to make sure the anchoring of the modules is still strong and intact, if any modules seem loose replace complete module with new module.

A. REMOVAL: Remove existing Module (physically pull away existing refractory from underlying Module Anchor).

B. Remove welded stud from steel casing (cut with hack saw or other device between Module Anchor and Furnace Casing/Shell).

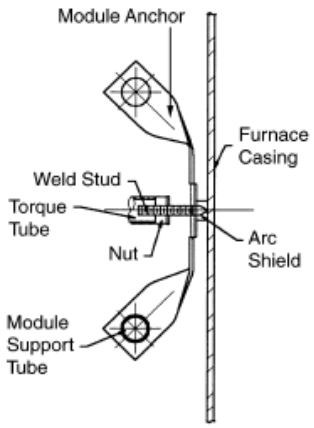


Figure 1: Side view of the Weld Loc Module

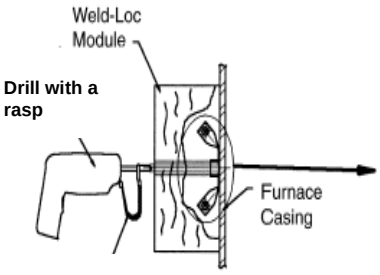


Figure 2: Stud Gun with rasp and Torque Tube.

A. INSTALLATION: Once the new module is in place take the stud gun with rasp to the Torque Tube and drill into place.

B. Once it has tightened the Torque Tube should come off with the drill.

Air Compressor (03-001.Q)

 **INTAKE AIR. Can contain carbon monoxide or other contaminants. Will cause serious injury or death. This air compressor is not designed, intended or approved for breathing air. Compressed air should not be used for breathing air application unless treated in accordance with all applicable codes and regulations.**

 **HAZARDOUS VOLTAGE. Can cause serious injury or death. Disconnect power and bleed pressure from the tank before servicing. Lockout/Tagout machine. Compressor must be connected to properly grounded circuit.**

 **MOVING PARTS. Can cause serious injury. Do not operate with guards removed. Machine may start automatically. Disconnect power before servicing. Lockout/Tagout machine.**

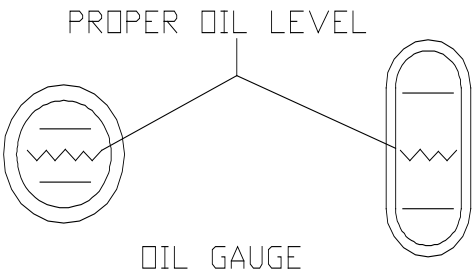
 **HOT SURFACES. Can cause serious injury. Do not touch. Allow to cool before servicing. Do not Touch hot compressor or tubing.**

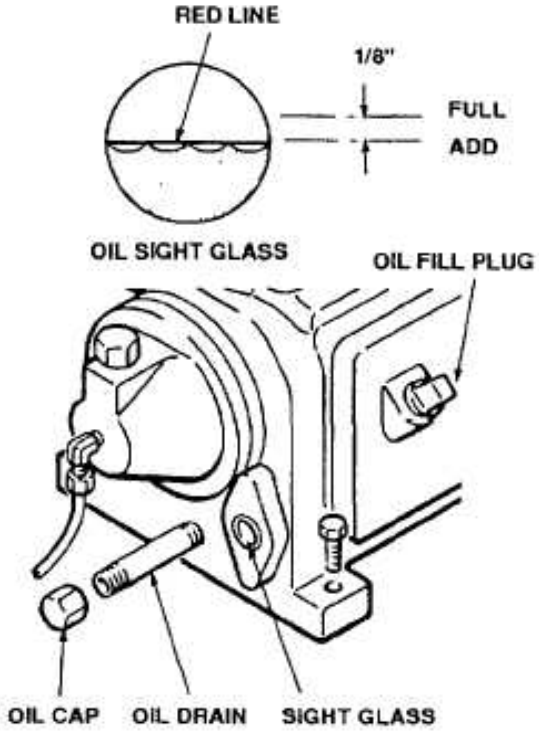
 **HIGH PRESSURE AIR. Bypassing, modifying or removing safety/relief valves can cause serious injury or death. Do not bypass, modify or remove safety/relief valves. Do not direct air-stream at body. Rusted tanks can cause explosion and severe injury or death. Drain tank before each use. Drain valve located at bottom of tank.**

 **RISK OF BURSTING. Use only suitable air handling parts acceptable for pressure of not less than the maximum allowable working pressure of the machine.**

INSTRUCTION 03-001.Q.01: CHANGE THE OIL

1. Change the oil





2. Remove the oil cap (above) to drain the oil.
3. Replace oil cap.
4. Refill the oil reservoir, using compressor oil, to the fill line as illustrated above.
5. Maintain oil level mid-way between the upper and lower lines of the crankcase sight gauge. See illustration above.

Paint: (05-003.Q)

Ensure proper ventilation and proper equipment is being used when using any paint product.

INSTRUCTION 05-003.Q.01: INSPECT AND MAINTAIN EXTERIOR PAINT

1. Maintain paint exterior to protect metal from heat and corrosion damage. This includes all components in the system including containers and incinerator components.

2. If discoloration is noted and painting needs to be performed, on areas where paint will be applied, you must do a light sanding before application.

3. Follow paint manufacturer's application instructions which will include surface preparation, priming and painting.

4. If components within the container need to be painted, for example the Primary Chamber or the Secondary Chamber, proceed as above. Use a type of paint that meets the following specifications:

Paint Specifications:

Incinerator Paint: This is the paint coated directly on the incinerator shell. This includes the following components:

1. Primary Chamber
2. Secondary Chamber
3. Breech Section
4. Hot Stack Section (Black)

Finish needs to be able to withstand temperatures in the 650-750°F (340-400°C) range.

Container Paint: Paint to conform to Customer outlined specifications.

Parts: There are no paint specifications for each individual component. This is left up to the discretion of the customer.

4.2.6 Yearly Instructions

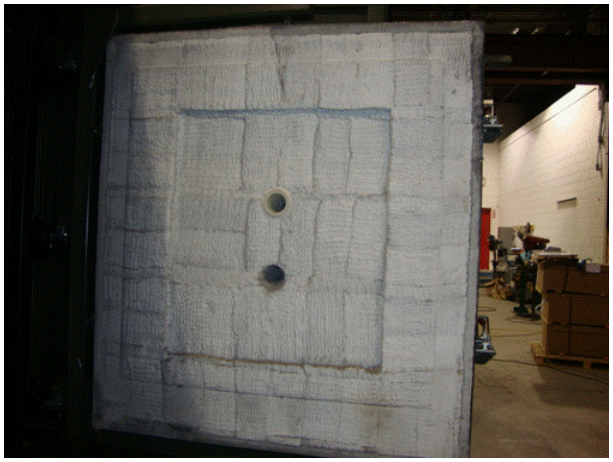
Refractory: (05-001.Y)

When working with the refractory make sure you use the proper tools; wear goggles, dust mask and gloves

INSTRUCTION 05-001.Y.01:
CHECK DOOR GASKET ALONG PRIMARY & SECONDARY CHAMBER DOORS

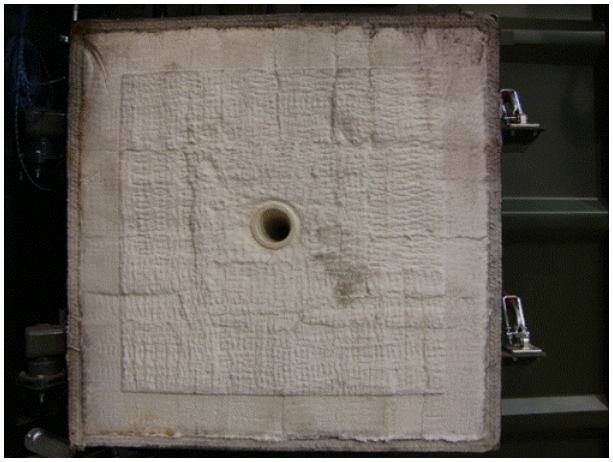
1. If required replace the door gasket. The gasket can last over 2 years but will depend on the careful use by the operator when loading and unloading.

2. Remove the damaged section of door gasket from door and reinstall new gasket



Primary Door (refractory lined)

Primary Door Gasket



Secondary Door (refractory lined)

Secondary Door Gasket

Electrical: (05-004.Y)

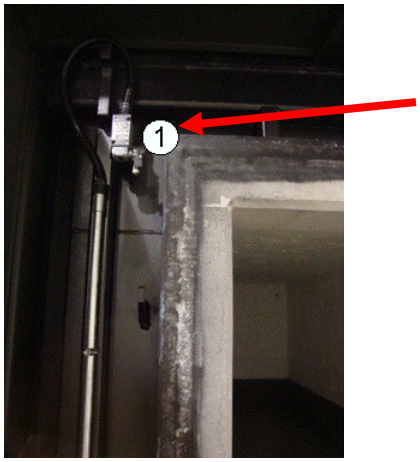
When working with electrical components ensure lock out instructions are being followed

Please follow all instructions outlined in *Section 4.2.2 Zero Mechanical State & Lock Out Instructions.*

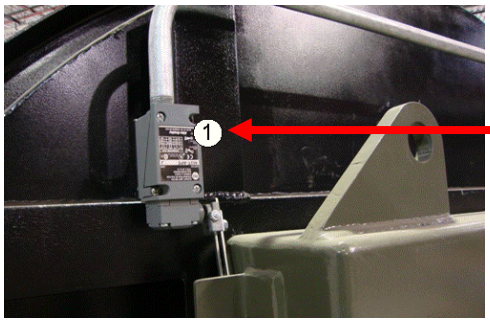
INSTRUCTION 05-004.Y.01: CHECK LIMIT SWITCHES

NOTE **System must not be running or in cool down to perform this inspection**.

1. Open Primary and Secondary Chamber doors and check top view screen on the HMI Panel view to ensure that it indicates door is open.
2. Close Primary and Secondary Chamber doors and check top view screen on the HMI Panel View to ensure that it indicates door is closed.
3. All limit switches located on the unit are checked this way.
4. Replace limit switches if necessary.



Primary Chamber Limit Switch



Secondary Chamber Limit Switch

5. See *Part IV Section 4 CMI 4.4.1/05-005A*.
6. Check all other limit switches in the system.

4.3 CORRECTIVE MAINTENANCE INSTRUCTIONS (CMI)

The following instructions relate to the replacement or correction (fixing) of components of the EWS Mobile Incinerator Package.

These Corrective Instructions are grouped in this section by the following:

4.4.1 General Corrective Maintenance Instructions
4.4.2 Refractory Corrective Maintenance Instructions
4.4.3 Primary & Secondary Burner Corrective Maintenance Instructions
4.4.4 Primary & Secondary Blower Corrective Maintenance Instructions
4.4.5 Main Control Panel Corrective Maintenance Instructions

As per the *Preventive Maintenance Instructions Section 4.2* of this *Manual*, the following table is utilized to identify the components of the system that require corrective maintenance.

System Component		**Identification number**	
Primary Burner		**01-002**	
	Replacing Fuel Filter		4.4.1/01-002A
Secondary Burner		**02-002**	
	Replacing Fuel Filter		4.4.1/02-002A
Thermocouple		**05-002**	
	Replacing Thermocouple		4.4.1/05-002A
Limit Switch		**05-005**	
	Limit Switch Replacement		4.4.1/05-005A
Container Door Gasket		**05-006**	
	Replacement of Container Door Gasket		4.4.1/05-006A
Refractory		**05-001**	
	Wall Refractory: Gaps between the Modules		4.4.2/05-001A
	Wall Refractory: Replacement of the Modules		4.4.2/05-001B
	Door Gasket		4.4.2/05-001C
	Castable Refractory		4.4.2/05-001D
	Temporary Repair of Castable		4.4.2/05-001E
Primary Burner		**01-002**	
	HT Lead & Electrode Replacement		4.4.3/01-002A
	Diffuser Disc Replacement		4.4.3/01-002B
	Nozzle Replacement		4.4.3/01-002C
	End Cone Replacement		4.4.3/01-002D
	Nozzle Assembly Repair or Replacement		4.4.3/01-002E
	Burner Flexible Oil Line Replacement		4.4.3/01-002F
	Low Level Switch Replacement		4.4.3/01-002G
	Inspection Window Replacement		4.4.3/01-002H
	Fuel Pump Replacement		4.4.3/01-002I
	Control Box Replacement		4.4.3/01-002J
	Oil Tube Replacement		4.4.3/01-002K
	Burner PE Cell & UV Detector Replacement		4.4.3/01-002L
	Burner Fan Motor Replacement		4.4.3/01-002M
Secondary Burner		**02-002**	
	HT Lead & Electrode Replacement		4.4.3/02-002A

	Diffuser Disc Replacement		4.4.3/02-002B
	Nozzle Replacement		4.4.3/02-002C
	End Cone Replacement		4.4.3/02-002D
	Nozzle Assembly Repair or Replacement		4.4.3/02-002E
	Burner Flexible Oil Line Replacement		4.4.3/02-002F
	Low Level Switch Replacement		4.4.3/02-002G
	Inspection Window Replacement		4.4.3/02-002H
	Fuel Pump Replacement		4.4.3/02-002I
	Control Box Replacement		4.4.3/02-002J
	Oil Tube Replacement		4.4.3/02-002K
	Burner PE Cell & UV Detector Replacement		4.4.3/02-002L
	Burner Fan Motor Replacement		4.4.3/02-002M
Primary Blower		**01-001**	
	Air Proving Switch Replacement		4.4.4/01-001A
	Damper Calibration		4.4.4/01-001B
	Modutrol Resistor Replacement		4.4.4/01-001C
	Damper Crank Arm Replacement		4.4.4/01-001D
	Motor Replacement		4.4.4/01-001E
	Modutrol Motor & Transformer Replacement		4.4.4/01-001F
	Replace the Blower Contactor		4.4.4/01-001G
Secondary Blower		**02-001**	
	Air Proving Switch Replacement		4.4.4/02-001A
	Damper Calibration		4.4.4/02-001B
	Modutrol Resistor Replacement		4.4.4/02-001C
	Damper Crank Arm Replacement		4.4.4/02-001D
	Motor Replacement		4.4.4/02-001E
	Modutrol Motor & Transformer Replacement		4.4.4/01-001F
	Replace the Blower Contactor		4.4.4/01-001G
Main Control Panel		**03-010**	
	Main Control Panel		4.4.6/03-010A
	Reboot PLC		4.4.6/03-010B
	PLC Parts Replacement		4.4.6/03-010C

4.3.1 General Corrective Maintenance Instructions

LIMIT SWITCH REPLACEMENT (4.4.1/05-005A)

1. Loosen the 2 screws holding the limit switch in place.
2. Remove limit switch, replace with a new one.
3. Take arm off of old body and mount to new.
4. Tighten the 2 screws holding the limit switch body.

REPLACING THERMOCOUPLE (4.4.1/05-002A)

The thermocouple will require routine replacement. The environment inside the incinerator will erode the protection tube to the point of failure. If the element is exposed to this environment it will be destroyed and will need to be replaced.

1. Unscrew thermocouple lid and remove wires.
2. Remove protection tube. To aid with this a vise and a pipe wrench will be needed.
3. Remove element and replace with new element and protection tube

4. Reinstall on incinerator.

5. After installation turn power back on. Observe the temperature reading of the thermocouple you were just working on. If the wires were installed incorrectly the temperature will read the opposite temperature. (I.e. 20°C would read as -20°C). If this is the case open the thermocouple housing and switch the wires.

REPLACING FUEL FILTER (4.4.1/01-002A AND 02-002A)

The fuel filter will require routine replacement to ensure clean fuel delivery to the Primary and Secondary Chamber burners.

1. Close the Ball Valve on the supply line.

2. Unscrew the used Red filter. Use a bucket to catch the surplus fuel when you unscrew the filter.

3. Before installing the filter lubricate the seal on the new filter.

4. Install the new filter, and open the supply line ball valve.

4.3.2 Refractory Corrective Maintenance Instructions

When working with the refractory make sure you use the proper tools; wear goggles, dust mask and gloves

WALL REFRACTORY: GAPS BETWEEN THE MODULES (4.4.2/05-001A)

The ceramic block refractory will shrink over time exposing the exterior metal shell. These gaps need to be filled in with ceramic refractory blanket.

1. Identify gaps in the chamber that are larger than 1” in width between the modules or if you can see exterior shell.

2. With a Utility knife cut a length of ceramic blanket that will fit in the gap between the modules.

3. Stuff the blanket into the space with a straight edge or ruler.

WALL REFRACTORY: REPLACEMENT OF MODULES (4.4.2/05-001B)

Excessive damage to a section of refractory may necessitate the replacement of modules in the incinerator. Such damage is largely due to mechanical wear. The following diagram walks through the removal and installation of new modules.

A. REMOVAL: Remove existing Module (physically pull away existing refractory from underlying Module Anchor)

B. Remove welded stud from steel casing (cut with hack saw or other device between Module Anchor and Furnace Casing/Shell)

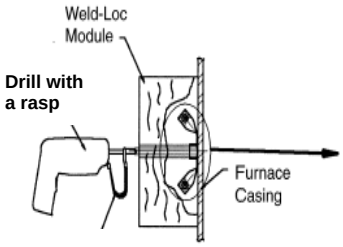


Figure 2: Stud Gun with rasp and Torque Tube (part of module assembly).

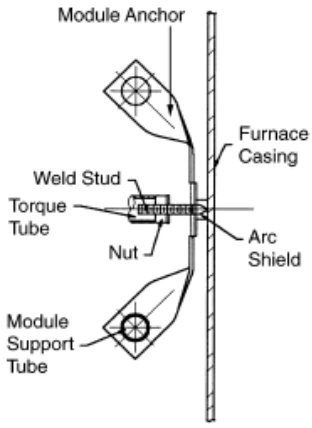


Figure 1: Side view of the Weld Loc Module

C. INSTALLATION: Once the new module is in place take the stud gun (PN: Eco-Stud; EIN: 11-E-S-01-04-016-016) with rasp to the Torque Tube and drill into place.

D. Once it has tightened the Torque Tube should come off with the drill.

DOOR GASKET REFRACTORY (4.4.2/05-001C)

The door gasket will degrade over time and will need to be replaced over time. The bottom of the door will see more degradation due to the waste burning in that vicinity.

1. Identify the damaged section of gasket that will need to be removed
2. With a utility knife cut out the section that needs to be replaced.
3. A new piece of gasket will need to be cut the same length as the removed piece.
4. With contact cement coat the gasket on one side and the door section and install.

CASTABLE REFRACTORY (4.4.2/05-001D)

Operators will notice that the castable refractory will show signs of minor cracking. The minor cracking is normal. Large sections of castable should not separate from the rest of the monolithic cast. Such occurrences are largely due to a sudden impact from machinery or

dropping of the units themselves. Mortar is supplied to help with a temporary repair while a permanent repair is resolved. Such permanent repairs are a third level repair and have to be considered on a case by case basis.

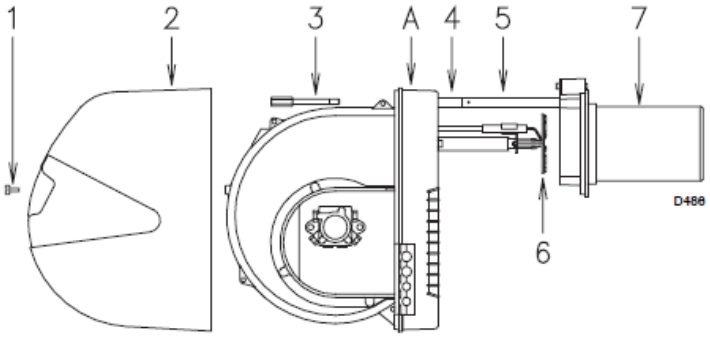
TEMPORARY REPAIR OF CASTABLE (4.4.2/05-001E)

1. Find the pieces of castable refractory that have separated.
2. Clean both the pieces of refractory and the area where the separation occurred.
3. Spread an even amount of high temperature mortar on the pieces and the area of separation.
4. Put the pieces back where they originated and support as necessary for a minimum of an hour while the mortar cures.

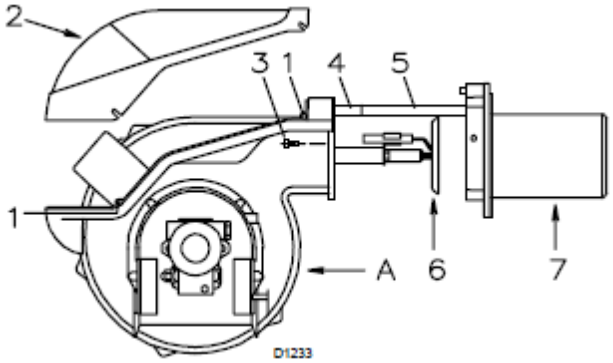
4.3.3 Burner Corrective Maintenance Instructions

Do not store flammable or hazardous materials in the vicinity of fuel burning appliances.

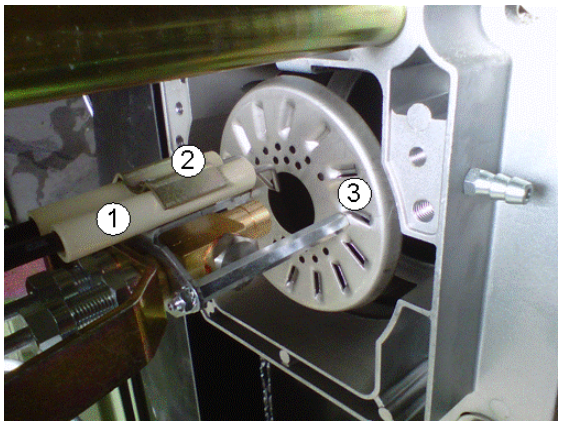
The Burners are pieces of equipment that will require routine corrective and preventive maintenance. Parts within this assembly will need to be repaired or replaced. The most common parts to be repaired or replaced are located at the front end of the burner where the parts are exposed to high temperatures.



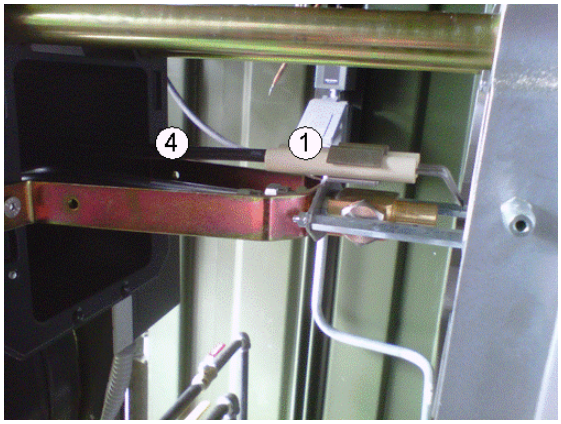
Front End Primary Burner



Front End Secondary Burner



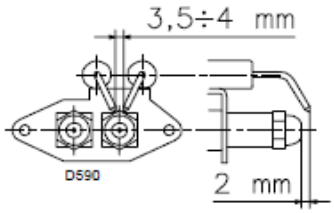
1. Electrode
2. U-bolt
3. Diffuser Disc



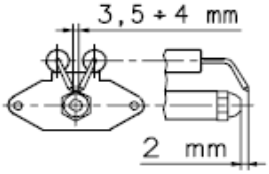
4. HT Leads

HT LEAD & ELECTRODE REPLACEMENT (4.4.3/01-002A & 02-002A)

1. In order to change out the HT leads or Electrode the U-Bolt will have to be removed
2. Remove the electrode by pulling the lead out of the white ceramic tube, replace and re-install.
3. To change the Leads the wire will need to be removed from the burner.
4. Pull the wire out of the burner housing through the rubber grommet.
5. The other end is connected to the back of the control box. Pull the wire straight out and the spring fitting will disengage.
6. Replace the lead with a new one reversing the above directions.
7. When reinstalling the electrodes make sure that they are positioned as shown below:



Primary Burner



Secondary Burner

DIFFUSER DISC REPLACEMENT (4.4.3/01-002B & 02-002B)

1. Locate the diffuser disc in the above pictures.
2. The disc assembly is secured to the nozzle housing by 2 hex nuts.
3. Remove these nuts and remove the assembly from the burner.
4. The disc is attached to the assembly with 2 screws.
5. Remove the screws and replace the disc.
    - Primary Chamber Burner diffuser disc
    - Secondary Chamber Burner diffuser disc
6. Reassemble.

NOZZLE REPLACEMENT (4.4.3/01-002C & 02-002C)

1. Locate the nozzle at the very front end of the burner just behind the diffuser disc.

2. Remove the nozzle with a wrench.

3. Install the new nozzle.
    - Primary Chamber Burner nozzle
    - Secondary Chamber Burner nozzle

END CONE REPLACEMENT (4.4.3/01-002D & 02-002D)

The End Cone is marked Item #7 in the first diagram of Section 4.4.3. The end cone will need replacement when the flame becomes unstable from too much heat damage.

1. Loosen and remove the 4 hex bolts that hold the burner on the flange.

2. Remove the burner completely from the incinerator. This will require more than one operator because the burner is heavy.

3. There are two screws that hold the End Cone on. Remove and save the screws for the new End Cone.

4. Install the new End Cone with the old screws.
    - Primary Chamber burner end cone
    - Secondary Chamber burner end cone

5. Reinstall the burner.

NOZZLE ASSEMBLY REPAIR OR REPLACEMENT (4.4.3/01-002E & 02-002E)

The nozzle assembly is subjected to high heat cycling. The heat cycling will eventually cause the seals and assembly to leak. The assembly will have to be replaced when this occurs. First identify the location of the nozzle assembly.

- Primary Chamber Burner nozzle assembly:
- Secondary Chamber Burner nozzle assembly:

The parts (seals, nozzle assembly) needed for these replacements are all included under one part number.

- Primary Chamber Burner nozzle assembly:
- Secondary Chamber Burner nozzle assembly:

Remove all connections to the nozzle assembly and replace with the above parts.

BURNER FLEXIBLE OIL LINE REPLACEMENT (4.4.3/01-002F & 02-002F)

1. Turn the inline ball valve to the closed position to isolate the fuel supply from the burner. This valve is located down line from the burner.

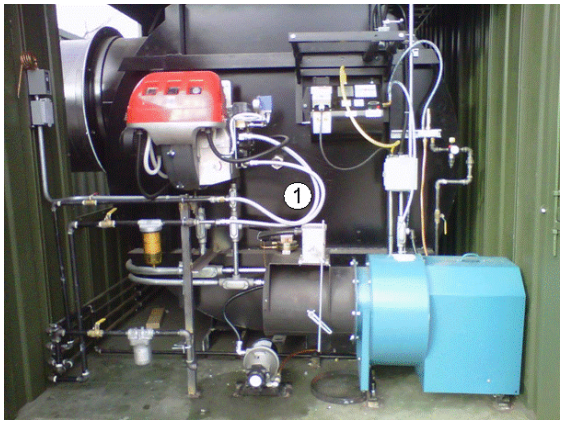
2. Remove flexible lines.

3. Replace with new lines.

    - Primary Chamber Burner flexible oil line:
    - Secondary Chamber Burner flexible oil line

4. Open ball valve.

Primary Chamber Burner Flexible lines (1 Above)



Secondary Chamber Burner Flexible Lines (1 Above)

LEVEL SWITCH REPLACEMENT (4.4.3/01-002G & 02-002G)

The level switch is located in the Diesel Tank.

NOTE

Tanks do not have to be emptied to replace.

1. Unplug the level switch from tank.

2. Disconnect the cord and remove the level switch.

3. Replace level switch and reconnect the cord.

4. Plug in the level switch to tank.

INSPECTION WINDOW REPLACEMENT (4.4.3/01-002H & 02-002H)

The inspection window can be identified as Item # 7 on IPD-I03 for the Primary Burner and Item # 32 on IPD-I04 for the Secondary Burner. To replace the window simply remove the old inspection window and replace with a new one:

- Primary Burner inspection window
- Secondary Burner inspection window

FUEL PUMP REPLACEMENT (4.4.3/01-002I & 02-002I)

Identify the pump on the burner you wish to replace the pump on:

- Primary Burner:
- Secondary Burner :

Remove all fuel connections to the pump with the appropriate wrench. Unbolt the pump from the main body of the burner and pull the pump away from the burner to remove.

Reinstall the new pump, and reattach all fuel connections.

- Primary Burner:
- Secondary Burner :

CONTROL BOX REPLACEMENT (4.4.3/01-002J & 02-002J)

Identify the control box on the burner you wish to replace the control box on:

- Primary Burner:
- Secondary Burner :

Ensure the power is off, unscrew the old control box, and install the new one.

- Primary Burner:
- Secondary Burner :

OIL TUBE REPLACEMENT (4.4.3/01-002K & 02-002K)

Oil tubes leak due to heat cycling which causes the fittings to fail or a loose fitting.

1. Identify the oil tubes on the Primary Burner and Secondary burner

2. First try tightening the fittings to see if the leak stops. If the leak does not stop:

3. Remove the old oil tubes with a wrench and install the new ones:

    - Primary Burner Tubes:
    - Secondary Burner Tubes

BURNER PE CELL & UV DETECTOR REPLACEMENT (4.4.3/01-002L & 02-002L)

Primary Burner: If the PE cell has been damaged, then it will need to be replaced. The PE cell while removed needs to be unplugged from the control box. This is accomplished by pulling the connection towards you. With the new PE cell install the control box end first by pushing the connection hard. Reinstall the PE cell in the burner.

Secondary Burner: If the UV Detector has been damaged, then it will need to be replaced. The UV Detector while removed needs to be unplugged from the control box. This is accomplished by pulling the connection towards you. With the new UV Detector install the control box end first by pushing the connection hard. Reinstall the UV Detector in the burner.

BURNER FAN MOTOR REPLACEMET (4.4.3/01-002M & 02-002M)

Identify the malfunctioning motor in the affected burner:

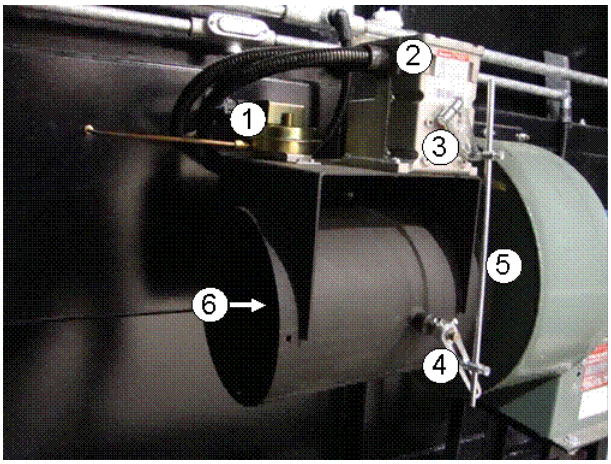
- Primary Burner –
- Secondary Burner -

Unbolt and remove the malfunctioning motor from the housing the burner. Disconnect all electrical connections. Reinstall the new motor exactly how the old motor was installed.

4.3.4 Primary & Secondary Blower Corrective Maintenance Instructions

Do not attempt any maintenance on a fan unless the electrical supply has been completely disconnected and locked. In many cases, a fan can windmill despite removal of all electrical power. The rotating assembly should be blocked securely before attempting maintenance of any kind.

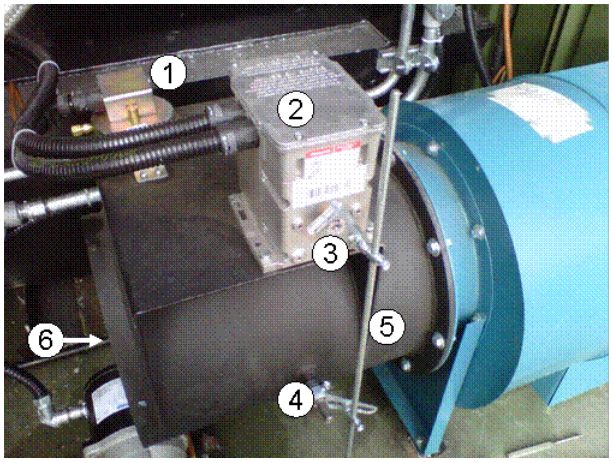
Primary Blower Assemblies are not a commonly repaired part on the incinerator. Parts within this assembly will need to be repaired or replaced. They are outlined below.



Primary Blower

1. Air Proving Switch
2. Modutrol Motor
3. Motor Crank Arm
4. Damper Crank Arm
5. Rod
6. Damper

Secondary Blower Assemblies are not a commonly repaired part on the incinerator. Parts within this assembly will need to be repaired or replaced. They are outlined below.



Secondary Blower

1. Air Proving Switch
2. Modutrol Motor
3. Motor Crank Arm
4. Damper Crank Arm
5. Rod
6. Damper

AIR PROVING SWITCH REPLACEMENT (4.4.4/01-001A & 02-001A)

1. Ensure all power is locked out.
2. Remove wiring from switch.
3. Remove tubing from switch.
4. Unscrew screws at the two locations and remove switch.
5. Reinstall new switch complete with tubing and wiring and then retighten.
6. Turn power back on.

DAMPER CALIBRATION (4.4.4/01-001B & 02-001B)

Sometimes the damper linkage will slip when the connections become loose (Items 3,4,5 in the Secondary Blower photo) In order to ensure that the linkage is correctly calibrated the operator will need to look at the display screen on the control panel while the unit is in operation

1. Read the %Open value on the control panel operator interface (PanelView) for the Primary Blower.
2. During operation the damper is factory preset to be 0% open, or fully closed.
3. Look inside the damper (Item 6) and ensure that the linkage is completely closed.
4. If it is then this maintenance is complete.
5. Should the damper be open even a small percentage the linkages are to be loosened and the damper adjusted to be completely closed, and then retighten.

MODUTROL RESISTOR REPLACEMENT (4.4.4/01-001C & 02-001C)

The Modutrol resistors are located inside the top lid of the Modutrol motor. Remove the lid to the Modutrol motor by unscrewing the top four (4) screws. The connection between the control panel and the Modutrol is made with a small white connector with 3 terminals. Jumpered between these terminals is the resistors.

Remove and replace the resistors one at a time to ensure the correct resistors are replaced. You identify the correct resistor by examining the color band on the center node of the resistor. Replace like resistors.

DAMPER CRANK ARM REPLACEMENT (4.4.4/01-001D & 02-001D)

The crank arm will only need to be replaced if the arm is damaged due to misuse. Identify the damper crank arm (Item #4 in the picture on the previous page).

Identify the location of the linkage on the rod and the damper arm with a marker, so the new crank arm will be in the same spot when reinstalled. Remove the connections to the crank arm and replace with the new one and ensure it is in the same spot as the old one.

MOTOR REPLACEMENT (4.4.4/01-001E & 02-001E)

Replacing the motor requires a second level maintenance. This information can be found in the OEM manual New York Blower, Installation, Maintenance and Operating, IM-160 Junior Fans.

MODUTROL MOTOR & TRANSFORMER REPLACEMENT (4.4.4/01-001F & 02-001F)

To replace a Modutrol motor requires all power to be off to the system as you will need to expose electrical connections. Firstly get the new motor and orientate the motor in the same direction as the old motor. Identify where the conduit is connected on the old motor and punch the connector holes for the new motor.

Removal

1. Remove and electrical terminations and remove the transformer.
2. Install the transformer in the new Modutrol motor.
3. Remove all conduit connections on the motor.
4. Remove the damper arm and linkage from the motor.
5. Unbolt the motor from the damper, and ensure all nuts and bolts are kept for the new motor install

Install

1. Bolt the new motor in the same orientation as the old motor.
2. Install the damper arm and linkage to the motor
3. Install all conduit connections

Terminate all electrical connections the same as the old motor.

REPLACE THE BLOWER CONTACTOR 4.4.4/01-001G

1. Turn off Main Disconnect.
2. Open Panel.
3. Remove the wires from blower contactor.
4. Pull the retaining clip up.
5. Tilt contactor forward and remove.
6. To reinstall tilt new contactor until it clicks back in.
7. Pull the retaining clip back down to lock.
8. Reinstall wires to contactor.
9. Close panel.
10. Turn power back on.

4.3.5 Main Control Panel Corrective Maintenance Instructions

MAIN CONTROL PANEL (4.4.6/03-010A)

All control panel diagnostics are to be completed by certified or trained technicians. Electrical drawings / diagrams are provided to aid electricians with any diagnostics. For reference the parts diagrams for the main control panels are drawings

REBOOT PLC (4.4.6/03-010B)

Turn Main Disconnect to the off position on the front of the Control Panel. Turn the main disconnect back on.

PLC PARTS REPLACEMENT (4.4.6/03-010C)

For detailed repair procedures, refer to the OEM Manual, Part IV Control Panel, PLC.

Read all warnings for procedures in each OEM Manual as they contain critical safety information. Disconnect the power from each component before starting each corrective maintenance procedure.

Component	Procedure	OEM Manual	Page No.
Panelview 1000-Series	Replacing the Battery	Panelview (2711P-T10C4A8)	130
Panelview 1000-Series	Replacing the Backlight	Panelview (2711P-T10C4A8)	126

Panelview 1000-Series	Load and SD card	Panelview (2711P-T10C4A8)	135
Panelview 1000-Series	Removing the Product ID Label	Panelview (2711P-T10C4A8)	134
Panelview 1000-Series	Replacing the Bezel	Panelview (2711P-T10C4A8)	124
Panelview 1000-Series	Cleaning the Display Window	Panelview (2711P-T10C4A8)	136
16 Point Relay Output Module	Replacing a Single Module	I/O Modules Compact 16-PointRelay Output Module (1756-OA16)	156
8 Channel Analog Output Module	Replacing a Single Module	Analog I/O modules Compact 1756-OF4 Analog Output Module	187
8 Channel Analog Input Card	Replacing a Single Module	Analog I/O Modules Compact 1756-IF8 Input Card	187
6 Channel Thermocouple Input Module	Replacing a Single Module	Analog I/O Compact 1756-IT6I Thermocouple Input Module	187

4.3.6 Additional Maintenance Instructions

For more detailed and additional maintenance instructions please refer to the OEM manuals for the Incinerator components.

ECO WASTE SOLUTIONS

Project Name: Mary River H34900
EWS Project: 13-2MS

Waste Incinerator Control Philosophy Rev.B

HATCH VENDOR DATA REVIEW

Doc Number	E349000-TX001-00-083-0001	Sub	03
Date Received	20 JUNE 13		

Review Grade

- ☐ C1 – Proceed to next submission & status
- ☐ C2 – Proceed with exceptions as noted to next submission & status
- ☐ C3 – Do not proceed, revise as noted & resubmit
- ☑ C4 - No further submission required - Complete
- ☐ No further submission required - Cancelled
- ☐ No further submission required - Superseded

Next Submittal Status

- ☐ Internal Review
- ☐ Certified Final
- ☐ Final
- ☐ As-Built

Next Submittal Date:

Package Coordinator: Name, Signature and Date: M Bellier 26/6/13

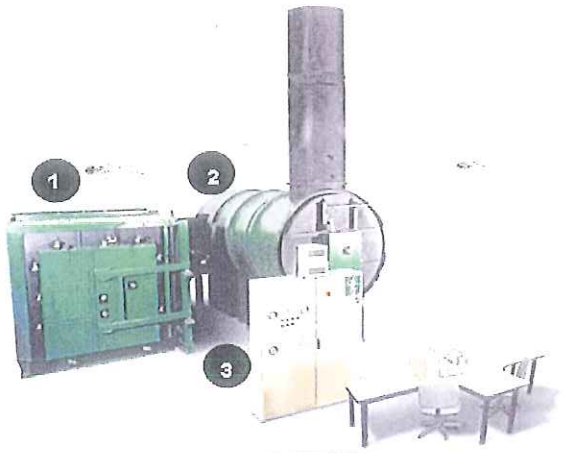
REVIEWED ONLY FOR GENERAL CONFORMANCE WITH DESIGN SPECIFICATIONS. ACCEPTANCE BY THE ENGINEER DOES NOT WARRANT OR REPRESENT THAT THE INFORMATION CONTAINED ON THIS DRAWING/DOCUMENT IS EITHER ACCURATE OR COMPLETE. THE SOLE RESPONSIBILITY FOR CORRECT DESIGN, DETAILS & DIMENSIONS SHALL REMAIN WITH THE PARTY SUBMITTING THE DRAWING/DOCUMENT.

Process Description

ECO WASTE SOLUTIONS INCINERATION TECHNOL

System components:

1. Primary Chamber
2. Secondary Chamber
3. Main Control Panel



COMPONENT	FUNCTIONAL OVERVIEW
Primary Chamber	In the first stage, a diesel fired burner is used to elevate the temperature of the **Primary Chamber** to ignite the waste. Once the Primary Chamber reaches a temperature of approximately 650-850°C, the burn process becomes self-fuelling and the burner will shut off. To save fuel and control temperatures, only when the energy contained within the waste is depleted, will the burner periodically turn on. At these operating temperatures, waste is allowed to fully combust and is rendered sterile. Waste is reduced in volume by over 90%. Independent tests have shown that the residual ash is non-hazardous, non-leaching and essentially inert. After enduring the combustion process, metals and glass remain intact. Preservation of metals and glass not only protects the refractory lining from damage caused by melted and fused metals and glass, but also allows for post-combustion recycling where possible.
Secondary Chamber	As waste burns in the Primary Chamber, gases containing the products of combustion enter the high temperature zone of the **Secondary Chamber** for cleansing. The Secondary Chamber is sized to retain the incoming gases for a minimum of 2 seconds at 1000°C. This chamber utilizes a packaged, high output, fully modulating diesel burner to maintain the required temperature (even in the absence of energy input from the first stage which is important when processing wet or low energy waste such as food). This stage employs a large blower, tightly controlled by the control system using a variable frequency drive on the motor. The blower creates the turbulence required to mix the gases and oxygenate them. This fosters the high efficiency combustion required to break hydrocarbon chains into carbon dioxide and water vapour.

Main Control Panel	There is one **Main Control Panel** for the incinerator package that controls all of the interconnecting modules. The Operator has one simple interface to start the equipment, view system status and change control settings if required. The system utilizes a PLC (programmable logic controller) to automate its functions. Incinerator critical process parameters such as temperature, combustion airflow, burner output are operated using EWS' patented system control program to maintain optimal combustion.

ECO WASTE SOLUTIONS BATCH SYSTEM OPERATING PHILOSOPHY

As per the specification, the incinerator will be located inside modified containers to be placed outdoors; the **Main Control Panel** will be placed in a small heated and insulated control room in a dedicated container.

There is no need for pre-sorting of the waste if source separation is practiced to keep inappropriate materials out of the waste feed.

The system operates in a batch style. It will be loaded using the front door of the **Primary Chamber**, it is expected that each day the **Primary Chamber** will be loaded to design capacity or at a minimum, to half capacity. If waste quantities are not sufficient to operate the machine daily, it can be used to store the waste until requirement is met.

Once loading is complete, the door is sealed shut and the **Secondary Chamber** is fired. The system is interlocked so that **Primary Chamber** waste is not allowed to combust until the **Secondary Chamber** is at operating temperature. Once this occurs, usually within the first 30 minutes of the cycle, the **Primary Chamber** cycle is initiated. During this phase, gaseous products of combustion produced from the solid waste burning in the **Primary Chamber** are burned off in the highly oxygenated, turbulent environment of the **Secondary Chamber** for a minimum of 2 seconds at a temperature of 1000°C to complete the combustion reaction.

In the **Secondary Combustion Chamber** the combustion gases are exposed a highly-oxygenated and extremely turbulent environment for a minimum of 2 seconds at a temperature of 1000°C to complete the combustion reaction.

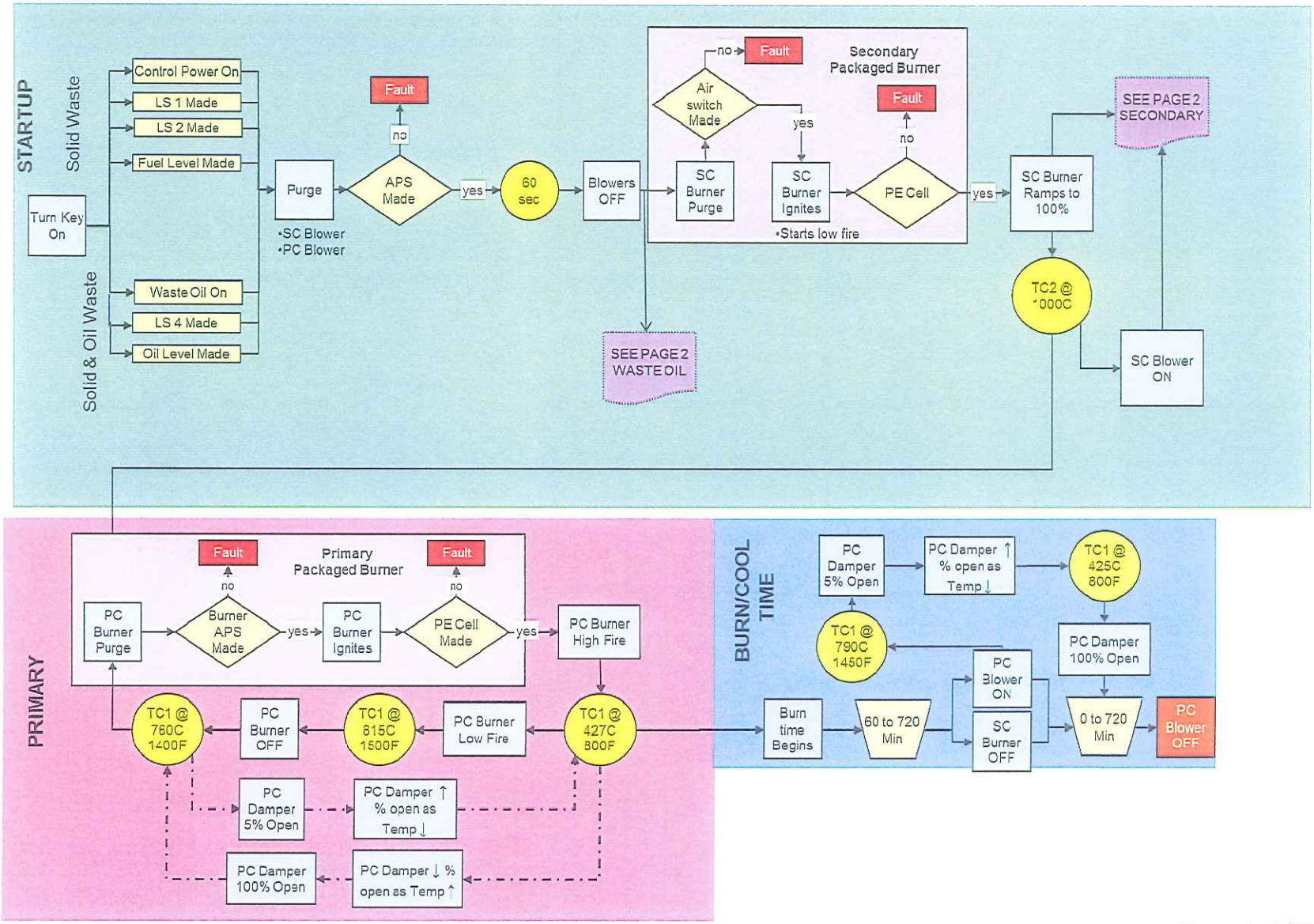
The system Primary Chamber full size front door allows for easy access to remove the ash daily.

The entire process will be controlled by the PLC in the **Main Control Panel**. All key operating parameters will be controlled to factory pre-set conditions programmed into the PLC. For simplicity of operation, the Main Control Panel has a touch-screen user interface with a full colour graphic display. The Operator can see the status of all of critical components and visual alarms for any malfunctions. The software also allows for logging and recording of system data, including historical trends. It is not necessary to constantly monitor the process. Various communication protocols are available to allow the incinerator PLC to communicate with the PCS or other remote computer.

ECO WASTE SOLUTIONS

Project Name: Mary River H34900
EWS project: 13-2MS

Waste Incinerator Control Block Diagram



- Dashed lines: ongoing damper adjustments
- Dotted lines: ongoing VFD adjustments

- TC1 = Primary Chamber Controlling Thermocouple
- TC2 = Secondary Chamber Controlling Thermocouple
- TC3 = Stack Thermocouple

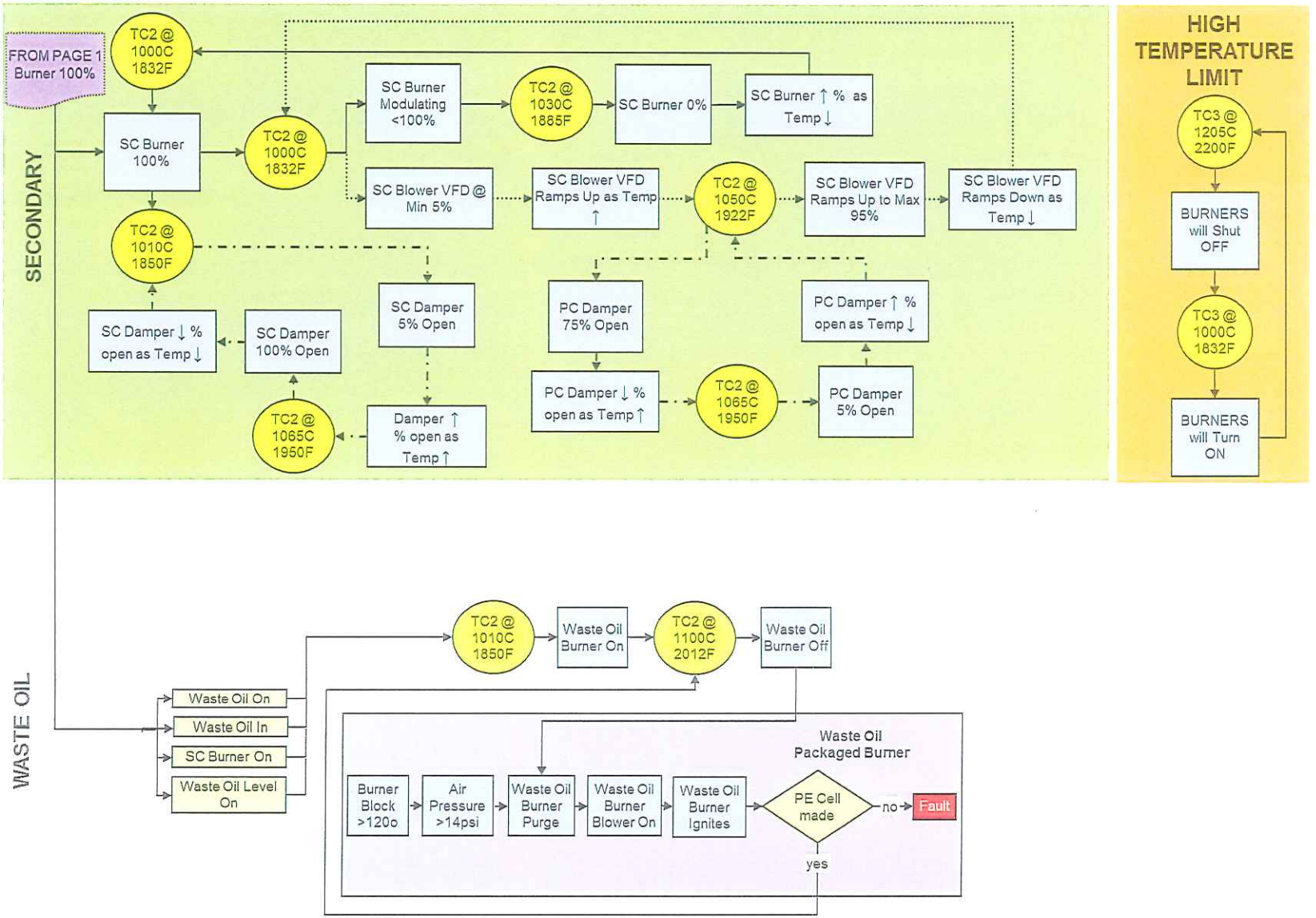
Adjustable Customer settings

Adjustable EWS only settings

ECO WASTE SOLUTIONS

Project Name: Mary River H34900
EWS project: 13-2MS

Waste Incinerator Control Block Diagram



Functional description document for burner management system can be located within the Riello / Clean Burn supplied User Manuals:

- **Primary Chamber Burners E349000-TX001-00-118-0001**
  Light oil burners Riello (RL 28/2)
  Low – High Operation
  Installation, use and maintenance instructions

- **Secondary Chamber Burners E349000-TX001-00-118-0002**
  Light oil burners Riello (RL 100/M)
  Low – High or Modulating Operation
  Installation, use and maintenance instructions

- **Waste Oil Burner E349000-TX001-00-118-0003**
  Multi Oil Burner Clean Burn CB550-S2
  Low – High Operation
  Installation, use and maintenance instructions

Control Loops

Loop Name	Secondary Chamber Burner Temperature Control
Control Algorithm	PID
Action	Reverse
Modes	Automatic
Process Variable	Secondary Chamber Thermocouple; PLC Tag: Secondary_Chamber_Temperature; Instrument / Equipment Tag: TE 1236
Set Point	1000° C
Controlled Variable	Secondary Burner; PLC Tag:Secondary_Burner_Percent_Fire; Instrument / Equipment Tag: BR 1210
Rate of Change Limit	None
Control Description	Regulates Output Of Secondary Burner to Maintain Constant Secondary Temperature

Loop Name	Waste Oil Temperature Control
Control Algorithm	On-Off
Modes	Automatic
Process Variable	Secondary Chamber Thermocouple; PLC Tag: Secondary_Chamber_Temperature; Instrument / Equipment Tag: TE 1236
Set Point	1010° C Switched On 1100° C Switched Off
Controlled Variable	Waste Oil Burner; PLC Tag: Start_Waste Oil Burner; Instrument / Equipment Tag: BR1206
Rate of Change Limit	None
Control Description	Regulates Output of Waste Oil Burner to Prevent Secondary Over Temperature

Loop Name	Primary Chamber Temperature Control
Control Algorithm	On-Off
Modes	Automatic
Process Variable	Primary Chamber Top Thermocouple; PLC Tag: Primary_Chamber_Top_Temperature; Instrument / Equipment Tag: TE 1231
Set Points	674°C switches from Low Fire To High Fire 704°C Switches from High Fire To Low Fire 760°C Switches from Off To Low Fire 815° C Switches from Low Fire To Off
Controlled Variable	Primary Burner; PLC Tag: Primary_Burner_Low_Fire; PLC Tag: Primary_Burner_High_Fire; Instrument / Equipment Tag: BR 1209
Rate of Change Limit	None
Control Description	Raises Primary Temperature to point where waste ignites.

Loop Name	Primary Chamber Damper Control
Control Algorithm	Inverse Ramp Calculation
$$CV = 100 - \frac{Pri_{1_{Damper_{MaxPosition_{Point}}}} - Pri_{1_{Damper_{MinPosition_{Point}}}}}{Pri_{1_{Damper_{HiTemp_{Point}}}} - Pri_{1_{Damper_{LoTemp_{Point\alpha}}}}} * \left(Primary_{1_{Chamber_{Top_{Temperature}}}} - Pri_{1_{Damper_{LoTemp_{Point}}}}\right)$$	
Modes	Automatic
Process Variable	Primary Chamber Top Thermocouple; PLC Tag: Primary_Chamber_Top_Temperature; Instrument / Equipment Tag: TE 1231
Set Points	**During Burn** Maximum Damper Position = 100%; High Temperature Point = 760; Minimum Damper Position = 5%; Low temperature Point = 427 **Cool Down** Maximum Damper Position = 100%; High Temperature Point = 760; Minimum Damper Position = 5%; Low temperature Point = 427
Controlled Variable	Primary Damper; PLC Tag:Primary_1_Damper_Position; Instrument / Equipment Tag: FV 1201
Rate of Change Limit	None
Control Description	**Purge** During the purge cycle the damper is set to 100% open and when the purge is complete the damper is set to 0%. **Cycle On** Controls air flow into primary, based on temperature to regulate combustion of waste and emission of smoke. The final primary damper position is the lower value of " **Primary Chamber Damper Control**" and "**Primary Chambers Damper Control For Secondary Cooling**".

Loop Name	Primary Chambers Damper Control For Secondary Cooling
Control Algorithm	Inverse Ramp Calculation
$$CV = 75 - \frac{Pri_{Damp_{Sec_{Cool_{Max_{Pos_{Pt_{From_{HMI}}}}}}}} - Pri_{Dam_{Sec_{Cool_{Min_{Pos_{Pt_{From_{HMI}}}}}}}}}{Pri_{Damp_{Sec_{Cool_{Hi_{Temp_{Pt_{From_{HMI}}}}}}}} - Pri_{Damp_{Sec_{Cool_{Lo_{Temp_{Pt_{From_{HMI}}}}}}}}} * \left(Secondary_{Chamber_{Temperature}} - Pri_{Damp_{Sec_{Cool_{Lo_{Temp_{Pt_{From_{HMI}}}}}}}}}\right)$$	
Modes	Automatic
Process Variable	Secondary Chamber Thermocouple; PLC Tag: Secondary_Chamber_Temperature; Instrument / Equipment Tag: TE 1236
Set Points	Maximum Damper Position = 75%; High Temperature Point = 1065; Minimum Damper Position = 27%; Low temperature Point = 1037
Controlled Variable	Primary Damper; PLC Tag: Primary_Damper_Position, Instrument / Equipment Tag: FV 1201
Rate of Change Limit	None
Control Description	**Purge** During the purge cycle the damper is set to 100% open and when the purge is complete the damper is set to 0%. **Cycle On** Controls air flow into primary to assist in cooling of secondary chamber. This is a separate control loop. The final primary damper position is the lower value of " **Primary Chamber Damper Control**".

Loop Name	Secondary Chamber Damper Control
Control Algorithm	Ramp calculation
$$CV = \text{Secondary}_{\text{Damper}_{\text{Min}_{\text{Pos}_{\text{From}_{\text{HMI}}}}}} + \frac{\text{Secondary}_{\text{Damper}_{\text{Max}_{\text{Pos}_{\text{From}_{\text{HMI}}}}}} - \text{Secondary}_{\text{Damper}_{\text{Min}_{\text{Pos}_{\text{From}_{\text{HMI}}}}}}}{\text{Secondary}_{\text{Damper}_{\text{Hi}_{\text{Temp}_{\text{From}_{\text{HMI}}}}}} - \text{Secondary}_{\text{Damper}_{\text{Lo}_{\text{Temp}_{\text{From}_{\text{HMI}}}}}}} * \left(\text{Secondary}_{\text{Chamber}_{\text{Temperature}}} - \text{Secondary}_{\text{Damper}_{\text{Lo}_{\text{Temp}_{\text{From}_{\text{HMI}}}}}}\right)$$	
Modes	Automatic
Process Variable	Secondary Chamber Thermocouple; PLC Tag: Secondary_Chamber_Temperature; Instrument / Equipment Tag: TE 1236
Set Points	Maximum Damper Position = 100%; High Temperature Point = 1065; Minimum Damper Position = 39%; Low temperature Point = 1010
Controlled Variable	Secondary Damper; PLC Tag: Secondary_Damper_Position; Instrument / Equipment Tag: FV 1202
Rate of Change Limit	None
Control Description	**Purge** During the purge cycle the damper is set to 100% open and when the purge is complete the damper is set to 0%. **Cycle On** Increases Airflow into Secondary Chamber as Secondary Chamber Temperature Increases to assist in Secondary Chamber cooling

Loop Name	Secondary Chamber Blower Control
Control Algorithm	Ramp calculation
$CV = \text{Secondary}_{\text{Blower}_{\text{Min}_{\text{Speed}_{\text{From}_{\text{HMI}}}}}} + \frac{\text{Secondary}_{\text{Blower}_{\text{Max}_{\text{Speed}_{\text{From}_{\text{HMI}}}}}} - \text{Secondary}_{\text{Blower}_{\text{Min}_{\text{Speed}_{\text{From}_{\text{HMI}}}}}}}{\text{Secondary}_{\text{Blower}_{\text{Hi}_{\text{Temp}_{\text{From}_{\text{HMI}}}}}} - \text{Secondary}_{\text{Blower}_{\text{Lo}_{\text{Temp}_{\text{From}_{\text{HMI}}}}}}} * \left(\text{Secondary}_{\text{Chamber}_{\text{Temperature}}} - \text{Secondary}_{\text{Blower}_{\text{Lo}_{\text{Temp}_{\text{From}_{\text{HMI}}}}}}\right)$	
Modes	Automatic
Process Variable	Secondary Chamber Thermocouple; PLC Tag: Secondary_Chamber_Temperature; Instrument / Equipment Tag: TE 1236
Set Points	Max Blower Speed = 95%(1350 RPM); High Temperature Point = 1095; Min Blower Speed = 10% (142 RPM); Low temperature Point = 1037
Controlled Variable	Secondary Blower; PLC Tag: Secondary_Blower_Speed; Instrument / Equipment Tag: SB 1202
Rate of Change Limit	None
Control Description	Increases Airflow into Secondary Chamber as Secondary Chamber Temperature Increases to assist in Secondary Chamber cooling

Interlocks

Device / Sequence:

- Burn Sequence and/or
- Manual Burner Startup interlocks.

Action:

- System does not start.
- If running, system will shut down all blowers, burners and close dampers.

Interlock Type	Location	Interlock	Description
Safety	Incinerator		E-Stop Button
Process	Primary Chamber	ZSC 1231 ✓	Primary Chamber Door Switch
Process	Secondary Chamber	ZSC 1232 ✓	Secondary Chamber Door Switch
Process	Primary Chamber Blower	PSH 1201 ✓	Primary Chamber Air Proving Switch
Process	Secondary Chamber Blower	PSH 1202 ✓	Secondary Chamber Air Proving Switch
Process	Primary Chamber	TE 1231 ✓	Primary Chamber Controlling Thermocouple defective TE-1231 = 1371°C
Process	Secondary Chamber	TE 1236 ✓	Secondary Chamber Controlling Thermocouple defective TE 1236 = 1371°C
Process	Primary Chamber Blower	MT 1201 ✓	Primary Chamber Blower Motor Overload
Process	Secondary Chamber Blower	MT 1202 ✓	Secondary Chamber Blower Variable Frequency Drive
Process	Fuel Storage Tank	LSL 1211 ✓	Low Level Switch
Process	Waste Oil Storage Tank	LSL 1206 ✓	Low Level Switch

Device / Sequence:

- Chamber temperature high limit

Action:

- All burners will shut down
- System will remain on – secondary blower and damper positions
- All burners will restart when lower temperature is reached (1010°C)

Interlock Type	Location	Interlock	Description
Process	~~Chamber~~ Secondary Chamber	TE 1236	High Temperature Limit Interlock Tripped when TE 1236 > 1200°C Reset when TE 1236 < 1010°C

Alarms

Instrument Equipment Tag:	Alarm Tag	Description	Initial Set Point	Time Delay	Conditioning	Priority
TE 1231 ✓	Primary_TC_Fault	The Primary Chamber Thermocouple is faulted.	None Thermocouples are monitored by the thermocouple input module which will set a fault bit for a defective thermocouple	Built into the Thermocouple module	None	Alarm and system shutdown Critical
TE 1236 ✓	Secondary_Chamber_TC_Fault	The Secondary Chamber Thermocouple is faulted.	None Thermocouples are monitored by the thermocouple input module which will set a fault bit for a defective thermocouple	Built into the Thermocouple module	None	Alarm and system shutdown Critical
BR 1209 ✓	Primary_Burner_Fault	The Primary Chamber Burner is faulted.	None The PLC monitors a fault signal from the burner	Built into the burner control box	None	Alarm only, no system shutdown Warning
BR 1210 ✓	Secondary_Burner_Fault	The Secondary Burner is faulted.	None The PLC monitors a fault signal from the burner	Built into the burner control box	None	Alarm only, no system shutdown Warning

Instrument Equipment Tag:	Alarm Tag	Description	Initial Set Point	Time Delay	Conditioning	Priority
BR 1205	Waste Oil_Burner_Fault	The Waste Oil Burner is faulted.	None The PLC monitors a fault signal from the burner	Built into the burner control box	None	Alarm only, no system shutdown Warning
PSH 1201	Pri_Blower_Delay_Air_Flow_Fault.DN	The system has shut down due to Primary Chamber Blower low air flow.	Factory Calibrated	10 seconds	None	Alarm and system shutdown Critical
PB 1201	Pri_Blower_Delay_OL_Fault.DN	The Primary Chamber Blower motor overload is tripped.	2.0 Amps	1 second	None	Alarm and system shutdown Critical
PSH 1202	Sec_Blower_Delay_Air_Flow_Fault.DN	The system has shut down due to Secondary Chamber Blower low air flow.	Factory Calibrated	20 seconds	None	Alarm and system shutdown Critical
SB 1202	Secondary_Blower_VFD_Fault	The Secondary Chamber Blower Variable Frequency Drive is faulted.	Factory Calibrated	Built into the VFD	None	Alarm and system shutdown Critical
ZSI 1205	Waste_Oil_Burner_Not_In_Fault	System shutdown due to Waste Oil Burner not all the way in when burning waste oil	None	None	None	Alarm and system shutdown Critical

Instrument Equipment Tag:	Alarm Tag	Description	Initial Set Point	Time Delay	Conditioning	Priority
ZSO 1205 ✓	Waste_Oil_Burner_Not_In_Fault	System shutdown due to Waste Oil Burner not all the way out when burning solid waste only	None	None	None	Alarm and system shutdown Critical
LSL 1211 ✓	Delay_Low_Fuel_Level.DN	The Burner fuel level is low.	10 " from bottom of tank	10 seconds	None	Alarm and system shutdown Critical