RSI-W-3000 Furnace
Operation, Maintenance and Monitoring Plan

Complete Operating Instructions (SOP)

Turn power and fuel supplies to on and record the fuel reading.
Raise all doors and inspect all chambers.

1. Start combustion blowers (all blowers must be on for entire production day). Start "Primary 1", "Primary 2" "# 1 Retention chamber", "# 2 Retention chamber" and "Afterburner" burners by turning the selector switches to the on position. There is a 2 minute built in purge prior to ignition. Observe that each burner did in fact ignite by observing burner on lights and physically observing the flame by sight.
2. Close all doors.
3. Prepare work area for production day.
4. Install the afterburner data logger or recording chart.
5. Select material to be charged and load on trays. Note: Refer to "Items not to be charged into the chamber" as described by the permit, i.e. magnesium, cadmium, radioactive, PVC's, etc. materials.
6. **If applicable**, turn big house on and close stack cap. When the afterburner temperature has reached at least 1800 deg. F and the primary chambers have reached the desired set point, the furnace may be loaded.
7. The afterburner temperature is recorded as 15-minute block averages and also 3-hour block averages by a data logger or by a continuous chart recorder.
8. Turn the primary chamber burner to the off position by using gate switch or on/off selector switch.
9. Raise the primary charge door and load material into the chamber. Lower the door to1 foot open. Turn the burner on. Lower the door. Observe the primary temperature control for a temperature increase at a rate of 1 degree per second or observe that the combustible material has fully ignited. Turn burner off.
10. Observe the temperature controls. Note: Specifically observe that the afterburner chamber did not drop below 1800 deg. F. If said chamber does drop below the required temperature, the set point will need to be raised to prevent a violation during the time the door is open. The standard set point is 2250 deg. F to prevent a violation.
11. Record the charge time, material type, afterburner temperature and the size of the load in the "Daily Operators Log".
12. Repeat items "8" through "11" for the "# 2 Primary" chamber, 30 minutes after loading "#1 Primary" chamber.

13. Observe temperature controls throughout the operating day to assure proper operation of all chambers.
14. **If applicable**, observe the exit of the stack for emissions after each charge and make the proper adjustments to the draft controls if necessary.
15. When process day is complete, turn off all burners and leave the combustion fans on until the temperature has dropped below 700 deg. F.
16. Turn off the main fuel supply
17. Clean all chambers thoroughly.
18. Record the weight of material processed on the daily log sheet.

Spare Parts On Hand

Refer to the recommended spare parts list for items that need to be in your inventory. Keep an inventory list of parts on hand.

Maintenance Schedule

Furnace is to be maintained and records kept of the following:

1. **Weekly Inspection and Maintenance**

a) Inspect all chambers for refractory damage and repair as needed.
b) Inspect door raise cables for wear and replace if needed.
c) Inspect burner tube areas for blockage.
d) Clean blower fans.

2. **Bi-weekly Inspection and Maintenance**

a) Remove and clean igniters.
b) Inspect ignition cable and replace when necessary.
c) Clean UV Scanners.
d) Grease door raise bearings.
e) Oil any unsealed type motor bearings.

3. Monthly Inspection and Maintenance

a) Inspect and repair any structural area of the furnace.
b) Inspect and repair afterburner and stack refractory.
a) Perform leak test on all gas lines.

4. Semi-Annual Inspection and Maintenance if required (to be performed by RSI)

a) Calibrate all controls and data logger.
b) Inspect afterburner structural refractory areas.
c) Inspect structural areas.
d) Inspect, clean and service all burners.
e) Adjust all burner settings.
f) Observe overall furnace operation.
g) Check data logger/ chart records.
h) Operators training refresher course is performed and training certificates are issued where appropriate.

5. Annual Inspection and Maintenance (to be performed by RSI)

a) Inspect all burners, pilot light assemblies, and pilot light sensing devices for proper operation.
b) Clean the pilot light sensors.
c) Inspect the combustion air for proper adjustment.
d) Inspect baffles and other internal structures to ensure their structural integrity.
e) Inspect dampers, fans, and blowers for proper operation.
f) Inspect for proper sealing.
g) Inspect motors for proper operation.
h) Inspect the refractory lining of the combustion chamber. Clean and replace the refractory lining as necessary.
i) Inspect the shell of the afterburner for corrosion and hot spots.
j) For the burn cycle that follows the inspection, document the proper operation of the afterburner. Document adjustments to the afterburner.
k) Verify that the afterburner is in good operating condition.
l) Follow the operation, maintenance and monitoring plan when making repairs.

Monitoring

1. Afterburner temperature is recorded as 15-minute block averages and also3-hour block averages by a data logger or continuous chart.
2. Retain data logger discs for five (5) years. Retain charts for 5 years.
3. Manually record the afterburner temperature on the Daily Operators Log when recording the charge time and material.
4. Maintain a log of repairs performed and any periods of visible emissions.
5. If the temperature goes below 2200°F in the afterburner, follow the procedures in the Startup, Shutdown and Malfunction Plan, including completing the Malfunction Report with specifics on the date and time of emissions limits were exceeded and corrective action taken.

RSI W-3000 Furnace

Startup, Shutdown and Malfunction Plan

Startup:

1. Record the fuel reading before starting the furnace.
2. Visually inspect furnace for any broken equipment or items in need of repair.
3. Turn furnace primary holding and afterburners on.
4. Allow for afterburner temperature to reach 1800° F.
5. Begin loading material in the primary chambers, not exceeding permit limits.

Shutdown:

1. After the last load is done (no evident combustible material), turn off all burners.
2. Record the fuel meter reading after turning off furnace.
3. Weigh, number and record all loads.

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2. Close all doors.
3. Prepare work area for production day.
4. Install the afterburner data logger or recording chart.
5. Select material to be charged and load on trays. Note: Refer to "Items not to be charged into the chamber" as described by the permit, i.e. magnesium, cadmium, radioactive, PVC's, etc. materials.
6. When the afterburner temperature has reached at least 2200 deg. F and the primary chambers have reached the desired set point the furnace may be loaded.
7. The afterburner temperature is recorded as 15-minute block averages and also 3-hour block averages by a data logger or by a continuous chart recorder.
8. Turn the primary chamber burner to the off position by using gate switch or on/off selector switch.
9. Raise the primary charge door and load material into the chamber. Lower the door to1 foot open. Turn the burner on. Lower the door. Observe the primary temperature control for a temperature increase at a rate of 1 degree per second or observe that the combustible material has fully ignited. Turn burner off.

10. Observe the temperature controls. Note: Specifically observe that the afterburner chamber did not drop below 2200 deg. F. If said chamber does drop below the required temperature, the set point will need to be raised to prevent a violation during the time the door is open. The standard set point is 2250 deg. F to prevent a violation.
11. Record the charge time, material type, afterburner temperature and the size of the load in the "Daily Operators Log".
12. Repeat items "8" through "11" for the "# 2 Primary" chamber, 30 minutes after loading "#1 Primary" chamber.
13. Observe temperature controls throughout the operating day to assure proper operation of all chambers.
14. Observe the exit of the stack for emissions after each charge and make the proper adjustments to the draft controls if necessary.
15. When process day is complete, turn off all burners and leave the combustion fans on until the temperature has dropped below 700 deg. F.
16. Turn off the main fuel supply
17. Clean all chambers thoroughly.
18. Record the weight of material processed on the daily log sheet.

Possible Malfunctions and Corrective Actions:

For all malfunctions:

- Record the date and time the malfunction began and ended in the Malfunction Log.
- Record the corrective actions taken including the date and time the corrective action(s) began and when it was completed.

1. **Burner will not light or stay lit and or chamber will not reach set-point temperature**:
   a) Check that combustion blower is on and the airflow switch has closed to allow line voltage to the flame safety device. If blower is not operating check fuses or circuit breakers. If voltage is supplied to the motor and still does not work, replace the motor.
   b) Check flame safety relays for proper operation and replace if necessary.
   c) Check flame rod or UV scanner for proper operation and clean or replace if necessary.
   d) Check ignition electrode for proper operation and clean or replace if necessary.
   e) Check reset button on flame safety device for proper operation.
   f) Check that the proper fuel supply is present and all valves are open.

2. **Control does not display the temperature**:
   a) Check fuse and power to the control.
   b) If there is power at the control and still no temperature readout, perform the following test: Remove "positive" and "negative" thermocouple leads from the back of the control. Install a jumper wire between the terminals that the wire was

removed from. Observe the digital display for an ambient temperature display. If the display is present refer to item c.

c) Remove temperature probe and remove the element from the probe housing. Inspect the element for signs of damage or breaks. Check housing for pitting or burnout. Replace damaged items if necessary.
d) If there is still no temperature display after following items a, b, & c instructions, replace and program a new temperature control.
e) Do not operate the furnace until the new data logger or chart recorder is installed and operational.

3. **Data logger did not record temperatures properly or no readings whatsoever**:
   a) Observe the afterburner control temperature readout. If no digital display is present, follow the instruction for problem number 2. Note that the afterburner temperature probe has a double element, one for the control and one for the data logger.
   b) Check all connections from the probe to the data logger.
   c) Refer to the "Daily Operations Log" to see that furnace was operating during the temperature recording period.
   d) Check that the data logger was "Started" when connected to the computer using the Omni Log software management program.
   e) Check logger while connected to the computer for proper temperature range and type (as in C or F).
   f) Check internal battery power while connected to the computer.
   g) Program and install. Run the logger for a two hour test. Remove logger and download information to check for proper operation. Reinstall logger.
   h) Program and install the backup logger if necessary.

4. **Visible emissions are present out of the stack**:
   a) Turn "Primary" switch to the "off" position.
   b) Open the afterburner draft door to a 4" opening. Note: Close the afterburner draft door when combustible material is not present to prevent over cooling of the afterburner.
   c) Check material to find the source of excessive emissions and remove from all future charges.
   d) Record the time and duration of excessive emissions in the "Daily Operators Log".
   e) Note and record the afterburner temperature in said log.

5. **Data logger or chart records values less than 2200°F:**
   a) Noticed by the operator reading the digital temperature at the controller and noted on the "Daily Operators Log".
   b) Could occur due to a blown fuse in the burner or low air flow in the burner.
   c) Follow the corrective actions under item 1 above.
   d) Record the corrective action taken to bring the temperature back up to 2200°F.
   e) Record the date and time the corrective action began and the time it was completed on the Malfunction Log.

6. **If the malfunction is not identified here, modify this report within 45 days of the malfunction to include it and the corrective actions:**
   a) If emissions standard was exceeded, report the malfunction within 2 days to the proper "Air Quality Control Office".
   b) Submit a letter within 7 working days explaining the circumstances of the event, the reasons for not following this plan and whether or not any excess emissions and/or parameter monitoring exceedances have occurred.

Emergency Shutdown (in the event of interrupted fuel supply, fuel leak, or power outage)

1. Turn off main electrical supply and fuel supply.
2. Contact supervisor.
3. Supervisor is to contact the appropriate utility for leak checks or explanation of interrupted service.
4. Keep records of service interruptions and make notes on data logger spreadsheets should the afterburner temperature drop prior to the batch process completion

MALFUNCTION LOG

Type of Malfunction and Cause	Date and Time of Malfunction	Date and Time Corrective Action Began	Date and Time Corrective Action Ended	Corrective Action Taken