

**TYPICAL ENDOTHERMIC GAS GENERATOR
OPERATING PROCEDURES**

IMPORTANT NOTICE

The following procedure(s) are for reference only and provide basic guidelines based on the equipment provided by Atmosphere Engineering. Components mentioned within this procedure may or may not be present on a particular generator design. Final generator operating procedures shall be confirmed by generator manufacturer to ensure proper safety of personnel and equipment. Atmosphere Engineering assumes no liability for damage or injury associated with operator following these procedures.

TYPICAL ENDOTHERMIC GAS GENERATOR OPERATING PROCEDURES

1.0 Generator Operating Procedures

The EndoFlex™ endothermic gas generator is fitted with the latest technology to provide feedback to the operator regarding all critical system variables. Review the HMI Software Overview section of this manual and navigate through the different screens to become familiar with where critical information and alarm history will be located prior to operating the generator. Refer to the pipeline diagram for additional help locating any components detailed in the procedures below.

2.0 Generator Startup Procedures

2.1 Power On and Heat Up the Generator to Operating Temperature (1850-1950degF) GAS HEATED GENERATORS

- 2.1.1 Turn on the main power disconnect
- 2.1.2 Silence and acknowledge any alarm horn that has occurred during the power up sequence.
- 2.1.3 “Reset” the Temperature Limit Controller(s)
- 2.1.4 Using the HMI, set the desired temperature set point for each heating chamber.
[Note: if this is from a “cold” state, it is recommended to set the initial temperature set point to 1000degF and allow to reach and soak at this temperature for 30 minutes before raising to the desired operating temperature (1850degF)] A temperature ramping feature may be provided on the HMI. Review product manual for proper operation of the temperature ramping feature.
- 2.1.5 Start the Combustion Air Blower by pressing the “Start Combustion Air Blower” button located on the control enclosure and confirm that the “Combustion Air On” green light is illuminated (2-4 second delay).
- 2.1.6 Open the main gas supply manual valves (V001, V002)
- 2.1.7 Confirm the incoming gas pressure is at 14”wcg on the pressure gauge (G001) and adjust the main gas supply regulator (R001) if required.
- 2.1.8 Open the burner gas supply valve for the heating chamber that will be heated.
Module#1 Valve: V100, Module#2 Valve: V200
- 2.1.9 Turn the Heating Enable switch to ON for the heating chamber that will be heated.
- 2.1.10 After some purge time the burner will attempt to automatically ignite. A successful ignition will be indicated by the “Flame On” green light being illuminated on the front of the control enclosure. (Note: the purge timer can be seen if desired by watching the display located on the Honeywell flame safety relay inside the control enclosure. It may be necessary, if the burners are not tuned correctly, that the “reset” button on this relay may have to be manual pressed to initiate another purge sequence after a failed ignition attempt).
- 2.1.11 Wait for the temperature to reach the desired operating temperature (1850-1950degF).

2.2 Power On and Heat Up the Generator to Operating Temperature (1850-1950degF) ELECTRICALLY HEATED GENERATORS

- 2.2.1 Turn on the main power disconnect
- 2.2.2 Silence and acknowledge any alarm horn that has occurred during the power up sequence.
- 2.2.3 “Reset” the Temperature Limit Controller(s)
- 2.2.4 Using the HMI, set the desired temperature set point for each heating chamber.
[Note: if this is from a “cold” state, it is recommended to set the initial temperature set point to 1000degF and allow to reach and soak at this temperature for 30 minutes before raising to the desired operating temperature (1850degF)] A temperature ramping feature may be provided on the HMI. Review product manual for proper operation of the temperature ramping feature
- 2.2.5 Turn the Heating Enable switch to ON for the heating chamber that will be heated.
- 2.2.6 Wait for the temperature to reach the desired operating temperature (1850-1950degF).

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2.3 Start Making Endothermic Gas

- 2.3.1 Ensure the temperature of at least one heating chamber is at operating temperature (1850-1950degF).
- 2.3.2 Open the Reaction Gas Manual Valve (V004)
- 2.3.3 Confirm the Fire Check valve (V005) is open.
- 2.3.4 Open the Retort inlet valve(s) for all "hot" heating chambers.
- 2.3.5 [FOR MULTIPLE HEATING CHAMBERS] Isolate by either turning the Retort Selection switch(s) or confirm all retort inlet valves for any "cold" retorts are fully closed.
- 2.3.6 It is recommended that the manual valve that feeds the endothermic gas from the generator to the furnace should be closed during initial production of endothermic gas.
- 2.3.7 Turn on the Vent Pilot burner by opening the vent pilot gas manual valve (V003) and turning the Vent Pilot switch to "Enable or ON" on the front of the control enclosure and ensure the Vent Pilot On light is illuminated.
- 2.3.8 Confirm on the HMI the desired Endothermic Gas output pressure setpoint is correct (recommended 10-20"wcg)
- 2.3.9 Confirm on the HMI the desired Endothermic Gas dew point setpoint is correct (recommended 38-45F)
- 2.3.10 Confirm on the HMI the desired Min/Max Ratio Setpoints are within normal operating range.
Recommended Ratio Setpoints (Min/Max)
 - Natural Gas (2.50/3.00)
 - Propane Gas (7.50/8.50)
- 2.3.11 The "EndoInjector™ Ready" light should illuminate at this time.
(Note: If the EndoInjector™ Ready light is not illuminated, confirm on the HMI "status" screen that all requires alarms are OK (Green) and resolve any open alarm issue that could be disabling the system ready light. Refer to electrical prints as well to confirm what relays are required to be energized before the "ready" light is illuminated.)
Typical Required item before startup include:
 - Low temperature alarm
 - Fire check alarm
 - VFD Status Alarm
 - Vent Pilot Alarm
 - PLC Ready Alarm (aka. "Critical Alarm").
- 2.3.12 Press the "EndoInjector Start" button to begin making endothermic gas and watch the HMI to confirm the air and gas flow rates are controlling to the desired ratio setpoint and that the displayed endothermic gas flow is within the normal range of the generator.
[Note: the Vent Flow Control Valve (V006) or vent relief regulator should be set to provide approximately 50% generator capacity of endothermic gas flow to the burn off vent. This vent can be closed after flow is introduced to the furnace.
- 2.3.13 During initial startup it is recommended to review pipe tightness and confirm flame is ignited at the generator burn off.
- 2.3.14 Allow 20-45 minutes for the dew point to achieve desired set point (2-3 initial oscillations is normal)
- 2.3.15 When the furnaces are ready for endothermic gas, open the manual valves that provides endothermic gas to furnaces.

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4.2 Generator Shutdown Procedure

1. Stop Making Endothermic Gas
 - a. Close the manual valves that provides endothermic gas to furnaces.
 - b. Press the "EndoInjector Stop" button to stop producing Endothermic Gas
 - c. Close all retort inlet valves.
 - d. Turn off the Vent Pilot burner by turning the Vent Pilot switch to "OFF" on the front of the control enclosure and closing the vent pilot gas manual valve (V003).
 - e. Close the Reaction Gas Manual Valve (V004)

2. Turn off the Heat
 - a. Turn off the heat to the reaction chambers using the switch(es) provided on the generator control panel.
 - b. [Gas Heating Systems Only] Close the burner gas supply valve for the ReactionCore™ modules
Module#1 Valve: V100, Module#2 Valve: V200
 - c. [Gas Heating Systems Only] Close the main gas supply manual valves (V001, V002)
 - d. [Gas Heating Systems Only] Stop the Combustion Air Blower by pressing the "Stop Combustion Air Blower" button located on the control enclosure.
 - e. It is now safe to turn off the main power disconnect for the generator.