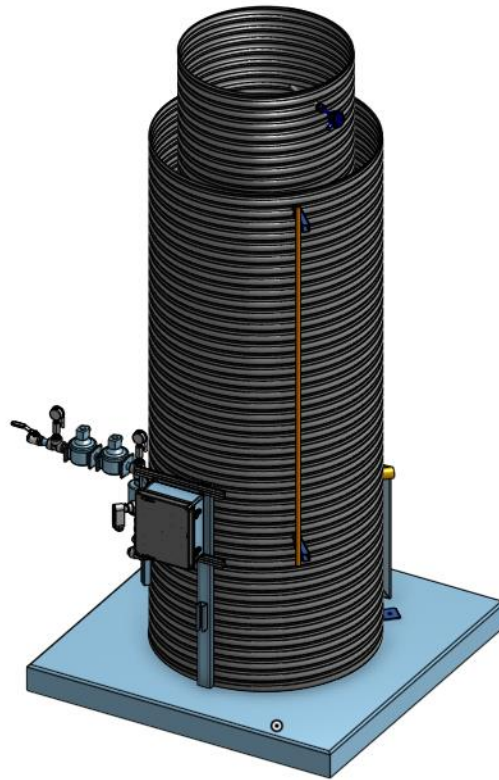




Emission Rx

E-Series Enclosed Combustor Operating Manual



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Warning

Emission Rx (ERX) combustors are intended to combust mixtures of hydrocarbon gasses at elevated temperatures. Take caution while working on (or in proximity) to the equipment to ensure the internal and surrounding atmosphere is clear of explosive gas mixtures. Check shell temperatures before touching. Component temperatures should be verified to be safe for handling prior to any maintenance activities. For no reason should any of the included safety devices (high limit switches, shutoff valves, etc.) be removed, bypassed or altered from their intended state of operation. Serious injury or damage to the equipment could occur.

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1 Product Description

Congratulations on your purchase of an *Emission Rx* E-Series enclosed combustor. The E-Series combustor has been designed to effectively manage, through highly efficient combustion, waste gas from processes that produce unusable or unwanted hydrocarbon vapours. *Emission Rx* combustors are designed for long life, low maintenance and simple operation.

It is important that operators familiarize themselves with operating conditions including flow rates, pressures and waste gas compositions (heating value) to ensure the combustor is utilized within the designed capacity range. As the E-Series combustor is not designed with a supplemental fuel gas system, the waste gas provided must be sweet (<1 mol% H₂S) and have a minimum heating value of 20 MJ/m³.

The combustor consists of four (4) key components:

- Air Intake
- Burner
- Combustion Chamber
- Pilot System (for those equipped)
- Burner Management System (BMS)

In addition to these four components, there are a series of safety and control systems employed as well, including:

- Stack Top Exhaust High Temperature Thermocouple
- Burner Flame Detection
- Waste Gas Inline Flash Arrestor
- Automated Waste Gas Shutdown Valve

1.1 Air Intake

E-series combustors are designed with the air intakes near the top of the stack. The air is drawn in through natural draft, down an annulus between an outer structural shell and an inner combustion chamber shell where it feeds the burner near the bottom of the stack (see figure below). This annulus provides a cooling mechanism for the internal and external shells by utilizing the required combustion air as a convection cooling agent. It also preheats the combustion air offering high efficiency combustion in all operating climates while offers the ultimate protection of operations external to the equipment.

The air intake is equipped with flame arresting screens on the inner shell where the air enters the combustion chamber. This keep the flame contained in the combustion chamber, preventing flame from travelling up the annulus of the combustor.

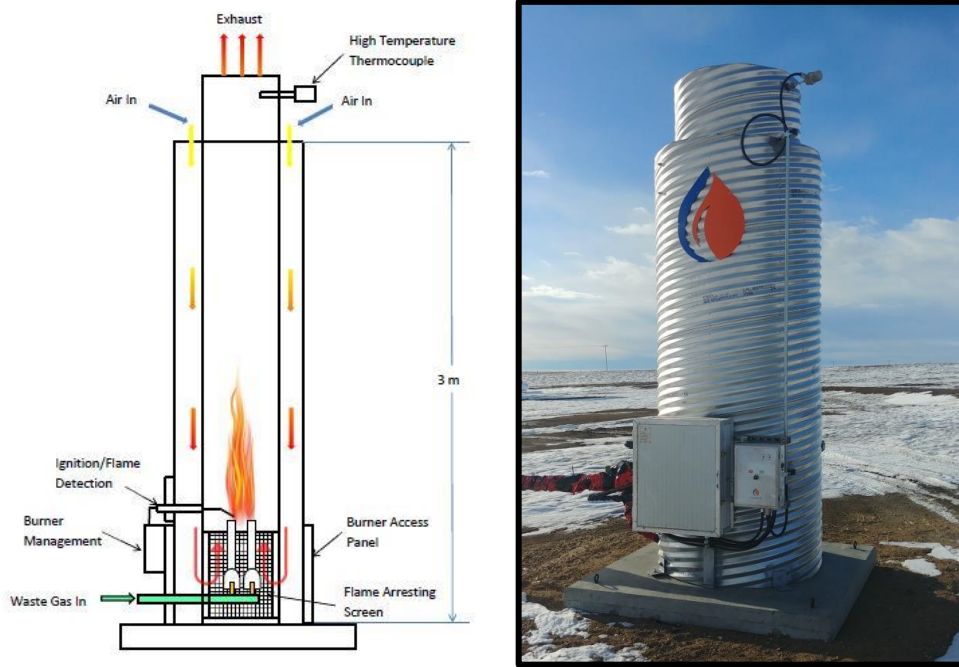


Figure 1 – ERx E-Series Combustor

1.2 Combustion Chamber

The combustion chamber or stack section is constructed from high temperature-resistant aluminized steel and encloses the combustion process. The stack height has been engineered to ensure adequate time for the combustion process to be completed.

1.3 Pilot System (for those equipped)

The pilot system ensures that any waste gas entering the unit is ignited upon entry and ensures there is no buildup of combustible gasses inside the unit which could become an explosion hazard. The pilot operates continuously whenever the combustor is turned on. The system is controlled by a pressure regulator, a gas shutoff solenoid, and a series of manual isolation valves and pressure indicating gauges

1.4 Burner Management System (BMS)

The control system consists of a prepackaged CSA certified burner management system (BMS). It is used to set up system parameters such as temperature monitoring, burner sequencing, pressure monitoring and ESD parameters. It is located on the front of the unit and provides a user interface to observe and set these system parameters. The control system also has hardwired contacts for remote start, remote stop, and ESD signals as well as an optional MODBUS interface.

In an effort to reduce operator intervention due to loss of gas, this unit is equipped with an automatic reset function. Should the combustor go down on flame fail, the BMS will automatically try to relight the combustor approximately every 2 minutes. This interval can be adjusted or the reset function can be disabled completely. Speak to an Emission Rx representative for guidance on how to make a change if desired.



Figure 2 – Control System Front Panel

1.5 Stack Top Exhaust High Temperature Thermocouple

The combustor is equipped with a K-type probe thermocouple inserted into the combustion chamber near the exit of the stack. The thermocouple sends a temperature signal to the BMS which monitors the exhaust gas temperature and indirectly, the combustion temperature to ensure the equipment is operating within its temperature limits. If the unit exceeds a safe operating temperature, the equipment is immediately shutdown by closing the inlet solenoid valve. The BMS will wait for the temperature to drop before it can be reset.

1.6 Burner Flame Detection

The burners use an ionization flame rod to verify presence of a flame. If for any reason the flame is extinguished or becomes unstable, the control system shuts

down the equipment immediately by closing the inlet solenoid valve. The unit will attempt to relight the burner three (3) times before completely shutting down.

1.7 Waste Gas Inline Flame Arrestor

The waste gas inlet train incorporates an inline flame arrestor that prevents the transmission of flame back down the waste gas line (flashback) to the source. The arrestor is designed to briefly halt a flame propagation thereby effectively isolating the unit from any upstream equipment.

If there is evidence of sustained flashback events on the arrestor such as discoloration, peeling paint or warmer than the usual surface temperature, shut down the combustor immediately and examine the arrestor for any operational deficiencies.

2 Control Configuration

The below information outlines the setup and configuration of the control system (BMS) on the combustor.

The configuration and calibration menus in the BMS are accessed by pressing the buttons on the user interface of the BMS. A snapshot of the panel is shown below.

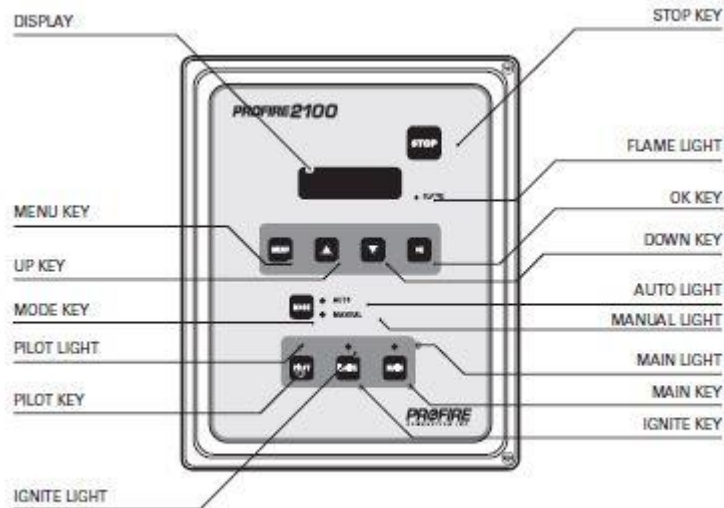


Figure 3 – Profire 2100 User Interface Panel

Menus 1-3 and the Quick Set point Adjust feature is typically not password protected. Should password protection be enabled the password is:

- Up, down, up, up

Menus 4-7 are always password protected. The default password for these menus is:

- Up, down, up, up, down, up

Note that the BMS must be in a non-operational state to access these menus, only Quick Set point Adjust features can be modified (Process Set point).

Due to the automatic reset function, to effectively access the Profire menus without being interrupted by the automatic reset turn the dial on the reset relay to 1d (day). When complete turn the dial back to 1 m (minute)

2.1 Configuration Items

Item #	Description	Available Options	E-Series Combustor Setting	Notes
Setpoints (Menu 1)				
1	Pilot Off Setpoint	1 to 1349°C	85 C	Not Used
	Low Fire Setpoint	2 to 1349°C	Hidden	Not Used
	Process Setpoint	1 to 1349°C	579 C	Not Used
	Low Temp Alarm Setpoint	Disabled, 1 to 1349°C	Disabled	Not Used
	Deadband	1 to 150°C	2	Not Used
	Aux Setpoint	0 to 1350°C	Hidden	Not Used
	PID – Proportional Band	0.0 to 999.9%	10	Not Used
	PID – Integral	0.0 to 999.9 min/rst	4	Not Used
	PID – Derivative	0.0 to 999.9 min	0	Not Used
System Setup (Menu 4)				
	Auto Restart	On/Off	On	Enables system to restart from a power failure or high voltage event
	Purge Time	10 - 900 sec	10 sec	
	Pilot to Main Delay	5 - 600 sec	5 sec	
	Restart Attempts	0 - 3	3	
	Level Event Restart	On/Off	Off	
	Pressure/Level Delay	On/Off	Off	
	Pressure Restart	On/Off	On	Allows the system to automatically restart when a low pressure event clears.
	Alarm Mode	Alm when Off, No Alm When Off	No Alm when Off	
	Password Enable	On/Off	Off	
	Display Sleep	Never, After 10 Min	Never	
	Pilot Valve Power Setting	Off, 80%, 60%, 40%, 20%	Off	
	Main Valve Power Setting	Off, 80%, 60%, 40%, 20%	Off	
	System Voltage Setting	12V, 24V	24V	
	Temperature Display Units	Fahrenheit, Celsius	Celsius	
	Commission Date Entry	DD-MMM-YYYY	TBD	
	Commission Location Entry	A-Z, 0-9, -/	TBD	14 Characters Max
	Reset to Factory Defaults	Yes/No	No	
Control Setup (Menu 5)				
	High Temp ESD Setpoint	2 to 1350°C	580 C	
	Process Control Input	Process TC, AUX TC	Process TC	Stack Exit Temperature
	Low Fire Enable	Disabled, on at Proc Setpnt, on at Low Fire Setpnt	Disabled	Not Used

	Low to High Fire Delay	30 - 300 sec	Hidden	Not Used
	Pilot Off Enable	Disabled, Enabled	Disabled	Not Used
	Aux Temp Mode	Disabled, Display Only, Temp Main Ctl, Temp ESD	Disabled	Not Used
	4-20 Output Mode	Valve Control 1, Valve Control 2, Temp Output	Temp Output	
	4-20 Low Fire Setting	0 to 70%	40%	Not Used
	4-20 Gain Setting	0.1 to 1%/s	0.5 %/s	Not Used

For further information on the controller configuration, please see the control system operating manual.

Standard setting for the automatic relay is 50% of 1m for both sets of dials. See section 6.1 for temporarily disabling the automatic reset function.

2.2 Pilot Configuration (for those equipped)

Pilot gas line pressure should be set between a 1 and 3 psig. Setting the pressure outside of this range may result in poor light-off or flame signal performance or excessive pilot gas consumption.

3 Start Up

3.1 Equipment Walk-Around

- a) A visual inspection of the combustor and associated equipment should be done prior to starting the unit to ensure all equipment is intact and in working order.
- b) All waste gas piping and pilot tubing connections should be checked to ensure there is no potential for leaks.
- c) Ensure all gauges are properly reading 0 psig.
- d) Ensure all cabling is clear of any hotspots.
- e) Ensure anchor bolts are tight.
- f) Ensure the pilot inlet manual ball valve and the waste gas manual ball valve is in the closed position.
- g) Check the surroundings for the presence of combustibles by checking personal gas monitor reading. If the LEL reading is above 0% determine the source of the gas release and make necessary repairs prior to proceeding.
- h) Ensure power is supplied to the unit and that the BMS is on.

3.2 Lighting the combustor

- a) Open the manual waste gas valve
- b) Turn the power on to the Profire at the **main power on/off switch**



Figure 4 – Profire Main Power ON/OFF Switch Location

- c) The Profire will automatically go through its startup sequence.
- d) After the BMS has determined that a flame has been established the BMS will display the flame quality.
- e) Confirm the main burner is lit by observing the flame through the provided sight glass located 180 degrees to the pilot at the same elevation.

4 Operating the Combustor

Normal operation of the E-Series combustor does not require operator intervention. Observations should be made on routine operator rounds noting waste gas pressure and flame pattern (observed through the provided sight glass) to ensure no abnormal conditions exist. Ensure the waste gas pressure maintains greater than **0.5 oz/in²** on the waste gas burner. Failure to do so can result in combustion to occur inside the burner nozzle, which in turn causes premature failure of the burner assembly.

If flame or smoke is evident from the top of the stack, an *Emission Rx* representative should be contacted immediately as it could be an indication of burner damage or over-ranging of the equipment.

5 Shut Down

Shutting down the unit is a simple procedure.

- a) Close the manual ball valve on the waste gas inlet
- b) Turn the power off at the Profire at the **main power on/off switch**



Figure 5 – Profire Main Power ON/OFF Switch

6 Troubleshooting

6.1 Profire 2100 Diagnostics

Refer to the appropriate Profire 2100 manual for detailed diagnostic information. Due to the automatic reset function, to effectively access the Profire menus without being interrupted by the automatic reset turn the time dial on the reset relay to 1d (day). When complete turn the dial back to 1 m (minute)

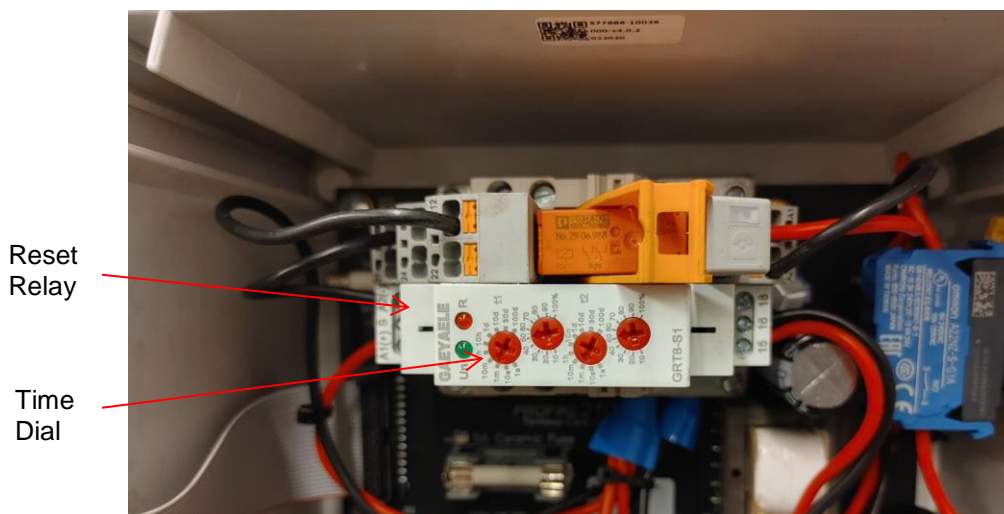


Figure 6 – Automatic Reset Relay

6.2 General Troubleshooting

PROBLEM	CAUSE	SOLUTION
Flames visible from the stack top	<ul style="list-style-type: none"> Failed waste gas shutdown valve Too much gas flow Waste gas too rich Damaged burner components Plugged air intakes 	<ul style="list-style-type: none"> Inspect and clean air intakes Repair or replace waste gas shutdown valve Decrease gas flow to the unit Replace burner nozzles
Smoke visible from the stack top	<ul style="list-style-type: none"> Excessive liquid carryover Damaged burner components 	<ul style="list-style-type: none"> Investigate upstream FKOD Purge lines Replace burner nozzles
Main burner not lighting	<ul style="list-style-type: none"> Alignment of main burner off Waste gas line not purged completely of air and/or inert gasses 	<ul style="list-style-type: none"> Re-try lighting procedure 3-5 times Inspect ignition rod position and adjust as necessary Inspect burner nozzle for damage and/or plugging
High temperature shutdown (stack top)	<ul style="list-style-type: none"> Air intake arrestors plugged Damaged cabling Bad termination Unit over ranged 	<ul style="list-style-type: none"> Reduce gas flow to the unit Inspect and replace any damaged cabling Inspect terminations and do a point to point continuity test
Burner not extinguishing on shutdown	<ul style="list-style-type: none"> Leaking waste gas solenoid 	<ul style="list-style-type: none"> Rebuild or replace waste gas solenoid
Excess backpressure created by unit	<ul style="list-style-type: none"> Inline arrestor plugged Burner orifices too small Plugged burner orifices 	<ul style="list-style-type: none"> Clean and inspect waste gas inline flame arrestor Inspect burner orifices for plugging Install larger orifices (contact Emission Rx rep prior to changing orifice size)

7 Preventative Maintenance

Emission Rx E series combustors are built for reliability and long life. To ensure you get the most out of your investment in an E series combustor a preventative maintenance schedule should be followed to ensure no unexpected issues arise resulting in operational delays.

Maintenance on the E series combustor is relatively light duty and the equipment is designed to have easy access to components whenever possible.

All preventative maintenance items assume normal operation. If any process upsets have occurred, an inspection should be done immediately to ensure all components remain in working order.

Emission Rx approved technicians can be scheduled and made available for any of your maintenance needs, including preventative maintenance items. Please contact and Emission Rx representative to schedule a service.

7.1 Preventative Maintenance Plan (PMP) Schedule

PMP Activity	Signs of Wear Causing Need for Repair/Replacement	Maintenance Intervals			
		3 months	6 Months	Annually	Bi-Annually
Inspect concrete pad	<ul style="list-style-type: none"> Significant cracking (1/8" or greater). Significant spalling (greater than 6" diameter) 	Y			
Inspect inner stack seal to concrete (E48 and smaller)	<ul style="list-style-type: none"> Damage to silicone bead Missing silicone 	Y			
Inspect stack top thermocouple	<ul style="list-style-type: none"> Significant blackening or spalling of thermo-well sheath Significant heat damage to internal probe Visual damage to any components 	-	Y	-	-
Inspect cabling*	<ul style="list-style-type: none"> Discoloration or shrinking of outer sheath 	-	Y	-	-
Inspect air arrestor screens	<ul style="list-style-type: none"> Dirt or debris evident on arrestor screen Damage to screen 	Y	-	-	-
Inspect for debris at bottom of annulus	<ul style="list-style-type: none"> Remove any debris build up 	-	Y	-	-
Inspect inline arrestor	<ul style="list-style-type: none"> Any signs of heat damage High pressure drop 	-	Y	-	-
Inspect burner nozzles/orifices	<ul style="list-style-type: none"> Signs of heat damage on burner tip components Clogging or plugging of orifices 	-	-	Y	-
Clean air arrestor screens*	N/A	-	Y	-	-
Clean inline arrestor*	N/A	-	-	Y	-
Replace stack top thermocouple*	N/A	-	-	-	Y
Replace burner tips and orifices*	N/A	-	-	-	Y

* Cleaning or replacement only required if warranted by inspection.

For any service requests or inquiries, please contact your Emission Rx representative to help with any maintenance items or to schedule a site service visit.



Emission Rx

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