THE LINDE GROUP

THERMATRIX®. ES-100 flameless thermal oxidizer.

High destruction efficiency, low NOx, electrically operated

The ES-100 Flameless Thermal Oxidizer (FTO) reliably and cost-effectively treats Volatile Organic Compounds (VOCs) in fume streams and repeatedly demonstrates 99.9999% destruction efficiency (DE). The thermal oxidation is accomplished at ~1600°F to avoid production of thermal NOx and to minimize operating costs.

The patented Thermatrix® ES-100 FTO consists of a 36"-diameter carbon steel, refractory-lined oxidation vessel. The vessel contains three silicone-carbide spiral-wound electric resistance heater elements in 6"-diameter 310 SS protection tubes surrounded by a bed of randomly packed inert ceramic pieces (see illustration). The ES-100 is fully automatic and there are no moving parts in the oxidizer. In chlorinated or sulfonated service, alternate materials of construction and a small exhaust gas scrubber can be provided. The ES-100 requires 480V 3 phase 100 amp, 120V 1 phase 20 amp, and 5 scfm of instrument air at 80 psig.

How the ES-100 works

Fume entering the bottom of the ES-100 is distributed evenly across the ceramic bed by the fume distributor. As the hot ceramic pieces radiate their stored heat to the flowing fume, oxidation begins and the heat of oxidation is added to the ceramic bed. An array of thermocouples in a single thermowell located within the ceramic bed monitors the bed temperature and allows the integrated control system to increase or decrease the electrical power to maintain the oxidation zone at ~1600°F at all times. Electrical energy is only required as a supplement to the heat content of the fume and to preheat the ceramic bed during start-up. The oxidation products flow upward through the hot ceramic matrix where ample residence time, temperature, and excess oxygen complete the oxidation process.

Flameless, stable operation

Although the VOCs fully react with oxygen to form oxidation products, the ES-100 operates well below the Lower Flammable Limit (LFL) and there is never a flame in the oxidizer. The fume oxidizes as it passes through the oxidation zone releasing heat, which is transferred back and forth to the surrounding ceramic matrix in a "thermal flywheel". This large thermal mass gives the ES-100 excellent stability in operation. The excess oxygen, long residence time and excellent mixing result in the outstanding performance. The relatively mild oxidation conditions (~1600°F compared to ~3000-3500°F for flame-based oxidizers) ensures extremely high DE and ultra-low thermal NOx emissions, while minimizing power consumption.

Low cost versatility

The ES-100 is offered as a complete, pre-assembled and compact skid-mounted unit. The skid footprint for the ES-100 (see photo) is 5' by 6' with the stack exhausting ~15' above the oxidizer. The ES oxidizer meets Class I Div 2 Group D requirements and can be easily adapted to meet Zone I Class IIB T3 requirements. Its simplicity and portability make it a versatile piece of equipment for operation at remote locations near the fume source. The Thermatrix ES-100 is a standardized well-proven design that requires little customization and is therefore conservative on capital cost. Finally, the ES-100 is relatively easy to permit and requires minimal time to install and place into operation. The ES-100 FTO can treat up to 90 scfm of fume having 0 to 20 BTU/scf heat content or up to 140 scfm of fume having 20 to 40 BTU/scf heat content. Multiple ES-100s can be configured in parallel.

- → Pilot plant venting
- → Tank breathing
- → Direct process vents
- → Demonstrations

Linde Engineering's FTO technology has repeatedly demonstrated an organic waste destruction efficiency of 99.99% +, virtually undetectable NO_x and CO emissions, and dioxin and furan emissions that are less than 0.1 ng/m^3 TEQ. This unique performance assures regulatory compliance with a high degree of reliability.

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