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What is Oxidation?

Definition: $C_nH_{2m} + (n + m/2)\, O_2 \Rightarrow n\, CO_2 + mH_2O + \text{heat}$

Temperature: Based on the VOCs that need to be destroyed there is a temperature at which the compounds can be oxidized.

Time: Relates to how long a compound needs to be at a certain temperature in order for it to be oxidized.

Turbulence: A fixed condition built into the equipment design that ensures a proper mixture of VOCs and oxygen for combustion.

Specific compounds and desired destruction rate efficiency determine temperature and residence time. Proper Oxidation converts hydrocarbons to CO_2 and H_2O (vapor).

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Selecting A VOC Control System

Properly Characterize and Identify the VOC Laden Air Stream

Use Air Volume Reduction Strategies Whenever Possible

- Close Capture Hoods
- Permanent Total Enclosure (PTE)

Why? Oxidation is priced on cost per CFM exhaust.

Less CFM $\Rightarrow$ Smaller Oxidizer $\Rightarrow$ Lower Operation Costs

Oxidation Technology Selection:

- Effectiveness
- Energy Efficiency
- Affordability

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Regenerative Thermal Oxidizer

Typical Applications: Chemical, Composites, Metal Decorating, Expanded Polystyrene, Painting, Pharmaceutical, Wood Finishing, Coating, Printing

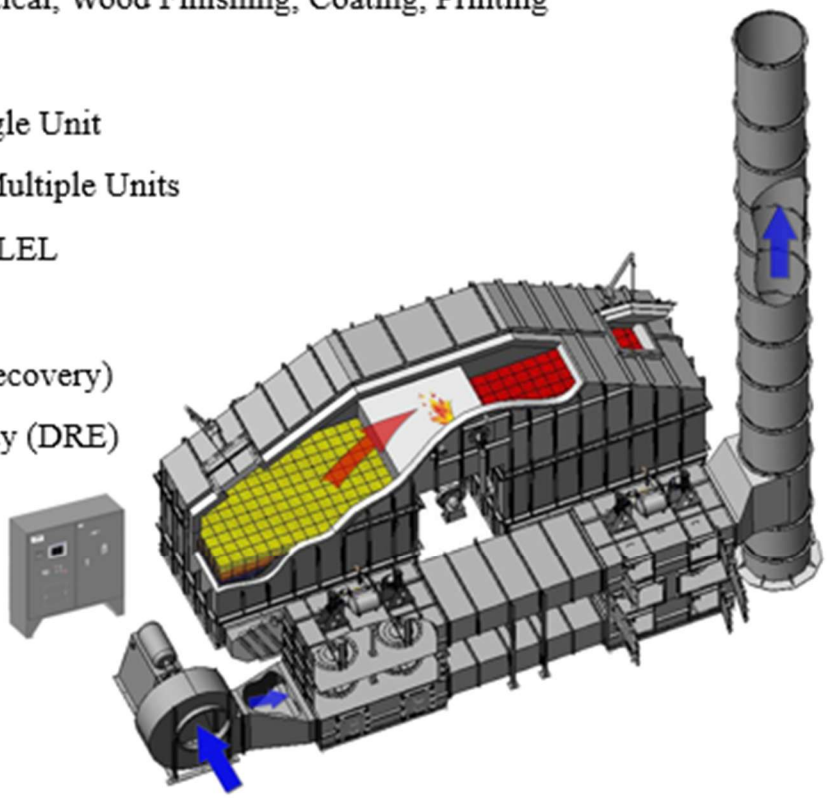
- Air Flow Range:

  3,000-70,000scfm / Single Unit

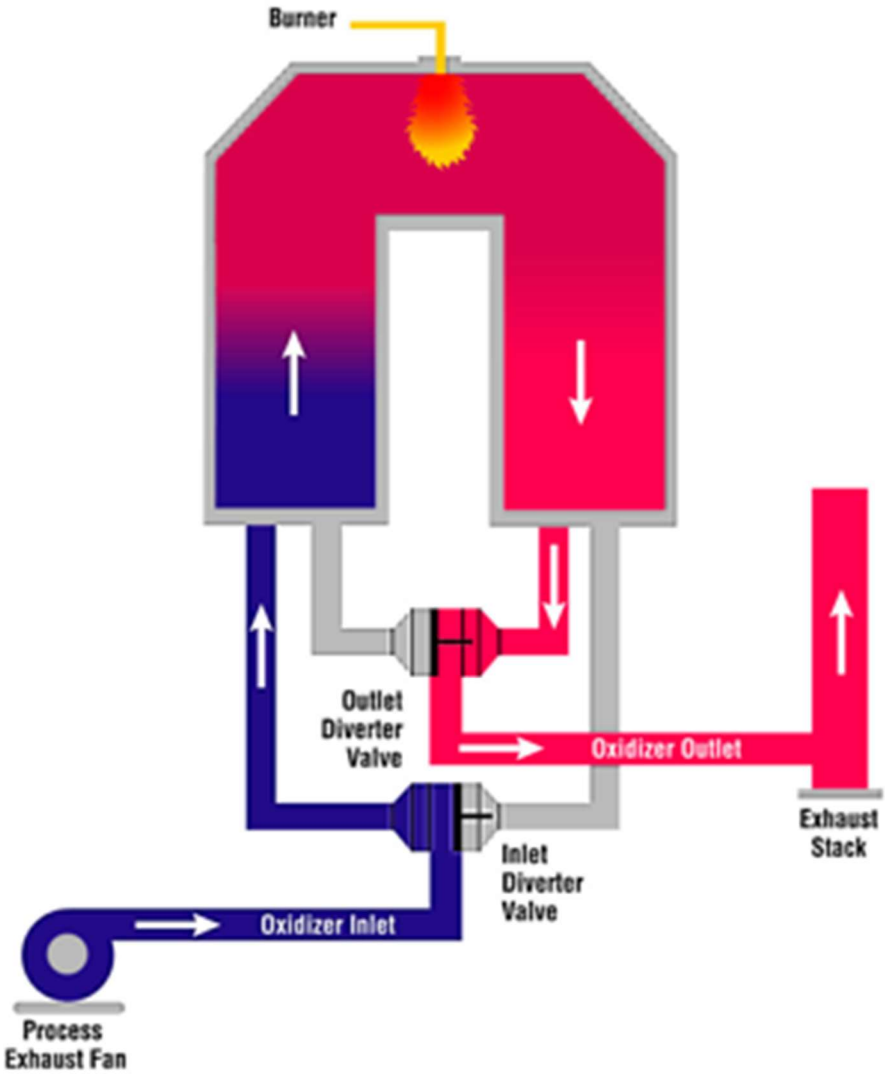
  70,000-500,000scfm / Multiple Units

- Concentration Range: 0%-25% LEL
- Energy-Efficient Operation

  (True 95%+ Thermal Energy Recovery)
- High Destruction Rate Efficiency (DRE)



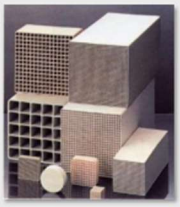
REGENERATIVE THERMAL OXIDIZER
MODE OF OPERATION



Types of RTO Heat Recovery Media

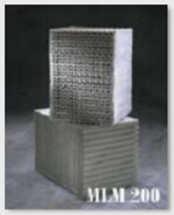
RANDOM PACKING

- Typically 1" or 1½"
- ½" – 3" Available



EXTRUDED HONEYCOMB MONOLITH

- Variety of cell sizes and wall widths
- Typical block size: 150 x 150 x 300



MULTI-LAYERED MEDIA

- Style and Size Options

Media Characteristics

	Measurement	English Units	Primary Influence in Heat Transfer
Bulk Density	Weight / Unit Volume	lb/ft^3	Thermal Storage – Heat Transfer Rate
Void Fraction	Open Volume / Unit Volume	%	Pressure Drop
Surface Area	Area / Unit Volume	ft^2/ft^3	Heat Transfer Efficiency & Rate

Media Comparison

	Saddles	Honeycomb Monolith	Multi-Layered
Capital Cost	Low	High	Medium
Installation Cost	Low, significant advantage for large systems	Higher	Higher
Bed Size (Steel Cost)	Large Cross Section, Tall Bed	Smaller Cross Section, Short Bed	Smaller Cross Section, Medium Bed

	Saddles	Honeycomb Monolith	MLM-180
Condensable Compounds	Excellent	OK	Excellent
Dirty Applications	Excellent	Not suited	Good
Clean Applications	Excellent	Excellent	Excellent

Option: Supplemental Fuel Injection (SFI)

Custom Designed Injection Quill

Additional Fuel Train Piping

Why Use Supplemental Fuel Injection?

- Reduces combustion air- flow, lowering operating costs
- Lower pilot rate for large burners
- Ultralow NOx emissions

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Option: Hot Side Bypass

- Allows unit to handle high VOC loads
- Damper position controlled by PLC and driven with pneumatic actuator with positioner
- 310 stainless steel shaft and blade
- Step seat in the refractory with no internal metal seat that can fail
- Damper position controlled by PLC and driven with pneumatic actuator with positioner
- Internally lined bypass duct to plenum of grade

Duct and plenum are internally insulated

3 Chamber RTO Design

- Six controlled butterfly valves
- Third can is purged following valve change to direct untreated VOCs into purification chamber
- 90 second cycle time per bed
- Shorter cycle time leads to higher thermal efficiency
- Higher destruction efficiencies than 2 chamber design
- Higher capital cost than 2 chamber

3 Chamber RTO Design – 99.5%+ D.R.E.