- Network Solutions Application Note -

Thermal Oxidizers

Summery:

Thermal oxidizers, also known as fume incinerators or afterburners, are widely used to control air emissions. Many processes, such as paint baking, drying of printing inks and curing of certain polymers, evolve vapors of flammable, toxic solvents. In the baking or curing oven, these solvent vapors pose an explosion or fire hazard, so they are diluted well below their lower limit of flammability by adding large amounts of dilution air. This contaminated air is then exhausted from the oven and passed through a thermal oxidizer to destroy the solvents.

Keywords: air pollution, regenerative thermal oxidizer, catalytic oxidizer, afterburner, VOCs, Nox, HAPs

Application Overview:

A well-designed, well-run thermal oxidizer is capable of destroying over 99% of the solvent vapors. However, heating all the dilution air up to the proper temperature consumes large amounts of fuel. On units without heat recovery, it isn't unusual for the oxidizer to consume more fuel than the process whose emissions it controls. In recent years, however, most thermal oxidizers have been fitted with waste heat recovery devices (either recuperators or regenerators) to capture waste heat from the oxidizer exhaust and recycle it, either to the incoming fume stream or back to the oven. This reduces the amount of fuel needed to operate the entire process.

One control zone is necessary for oxidizers without heat recovery or those with recuperative or small regenerative heat exchangers. Large regenerative oxidizers often have two or more burners. In theory, these can be operated as a single control zone, although some customers may want to split the system into two zones to insure temperature uniformity from one end of the oxidizer to the other.

A single oxidizer may be used to control the emissions from 4 or 5 process ovens. Output volumes from these ovens will vary over the course of the day, and on some days, one or more of the ovens may be shut down. Consequently, the oxidizer's combustion system has to maintain a given operating temperature over a wide range of fume flow rates.

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Temperature recording is becoming mandatory on these installations because of the need to retain documentation of the pollution control process for air quality authorities. Points such as inlet and outlet temperature, combustion chamber temp and analytical values is VOC concentrations are measured.

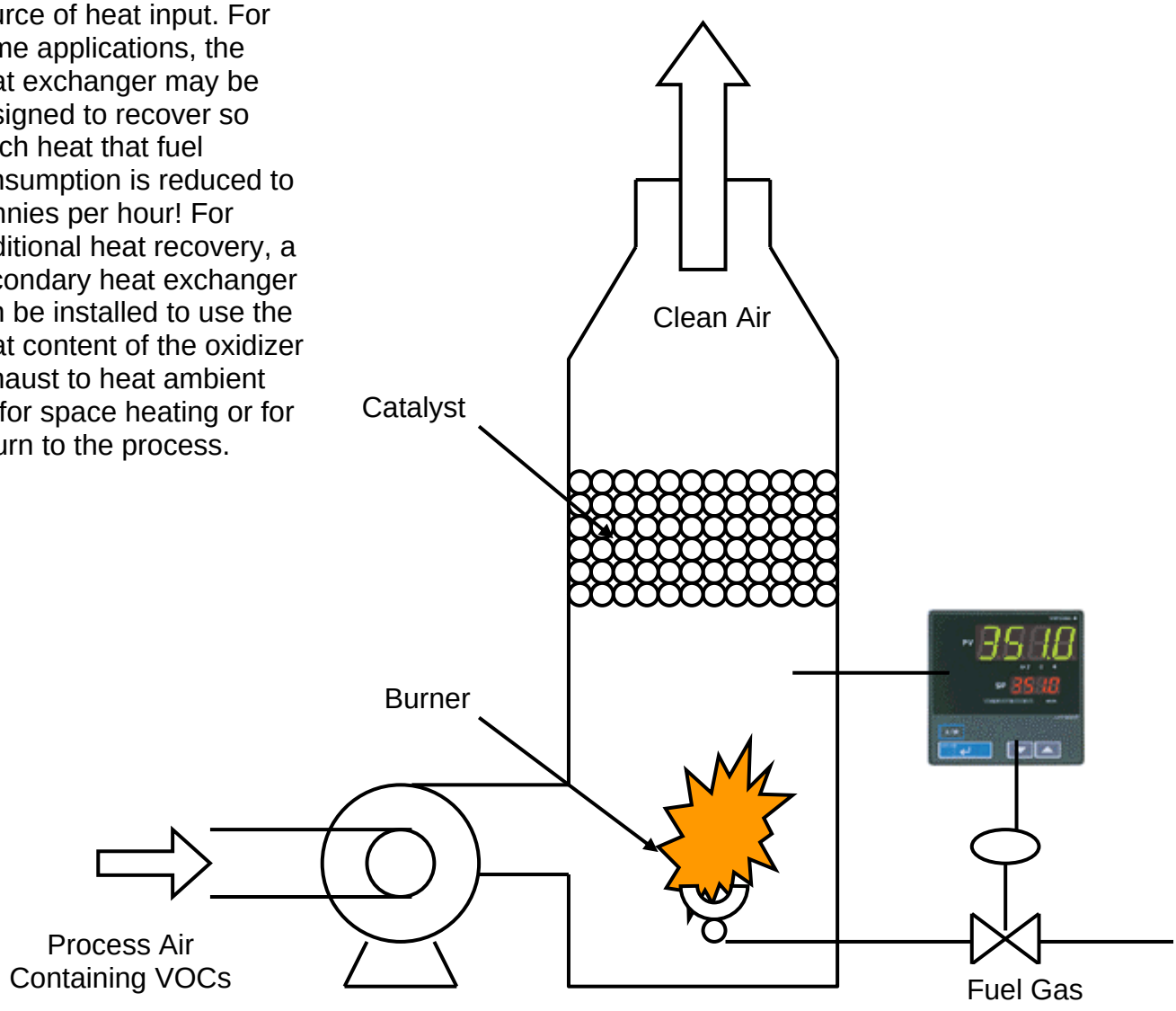
Temperature Limit Controllers could be used for one of two reasons**:**
1. Excess temperatures can quickly damage a thermal oxidizer, especially the heat exchanger, so they must be equipped with an excess temperature limit control system. This system will shut down the fuel supply to the burner and interrupt the flow of fumes to the oxidizer if a dangerous over temperature situation occurs. If it's impractical to interrupt the fume flow, then it's permissible to dilute the fume stream with additional fresh air or to bypass some of the fume stream around the heat exchanger.
2. Air quality codes may require the addition of a low temperature limit controller to interrupt the flow of fumes to the oxidizer if its operating temperature falls below the minimum required for acceptable.

Yokogawa Solution:
The CX2000 is going to be the best bet for overall oxidizer control and monitoring. Also a combination of Green series and DX would work as well. Limit controllers will need to be the UT350L or UT150L if they are needed. Just know the requirements for the oxidizers are going to be quite varied and that we have the product to meet any oxidizer requirement.

Catalytic Oxidizer: How It Works

Catalytic Oxidation is a proven technology used in selective applications to greatly reduce emissions due to VOCs, hydrocarbons, odors, and opacity in process exhaust. The catalyst converts exhaust preheated to 600 to 750 degrees F primarily to CO2 and H2O. A properly designed system can achieve destruction efficiencies of 95 to 99%. In theory, a catalyst promotes oxidation without being altered or consumed.

Where fuel consumption is a major consideration, the use of a primary heat exchanger. Is recommended. It transfers part of the heat content of the hot exhaust to the incoming process exhaust. The VOCs, when oxidized, become another source of heat input. For some applications, the heat exchanger may be designed to recover so much heat that fuel consumption is reduced to pennies per hour! For additional heat recovery, a secondary heat exchanger can be installed to use the heat content of the oxidizer exhaust to heat ambient air for space heating or for return to the process.



Catalytic oxidizer in its simplest form