

# CATHOX NEWSLETTER

## INTRODUCTION

A **C**atalytic **T**hermal **O**xidizer (CATHOX) is an advanced system used to keep SMT reflow ovens clean and free of contamination. The CATHOX utilizes a nanomaterial-based catalyst system that thermo-chemically decomposes organic materials outgassed from solder paste, bare boards, and components during the reflow soldering process.

The catalyst system in the CATHOX enables the oxidation of volatile compounds (VOCs) at lower temperatures compared to traditional thermal oxidation methods like pyrolysis. This ensures that gaseous, liquid, and crystalline residues are removed from the process gas, effectively and economically in energy terms. It maintains to keep the heating zones clean by transforming the residues into carbon dioxide. This process is environmentally friendly since CO<sub>2</sub> is a non-toxic, non-flammable, and it leaves no residues. CO<sub>2</sub> is not poisonous; as a gas, CO<sub>2</sub> itself will not hurt you. This is an important fact to remember, as carbon dioxide is a vital part of the environment. The human breathing mechanism actual revolves around CO<sub>2</sub>, not oxygen. Without carbon dioxide, humans wouldn't be able to breathe.



## CATHOX UNIT

The CATHOX is integrated in the zones of the Centurion reflow oven. The gas is circulated by the over and under pressure from the heating zones. The flow changes when the fan speed varies but with standard settings the content of each zone is cleaned by CATHOX every 3 minutes (Single zone CATHOX fan speed 60 Hz).

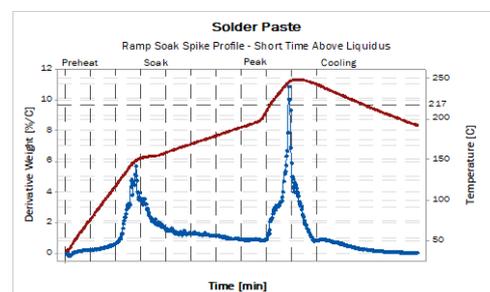
## REFLOW PROCESS

In the reflow process the assembly including printed circuit board, solder paste, and components are heated confirm a predefined heating profile. There are many chemical reactions taking place during this process. First there is the evaporation of the solder paste solvents in the preheating zones. During the entire process the solder mask is outgassing.

In the peak zones the activators of the solder paste react with the Cu and Sn-Oxides from the metallization.



Organic esterification reactions in the flux system:



The Thermogravimetric Graph of solder paste during the reflow. The blue line represents evaporation of the paste. Most outgassing from the solder paste is in the beginning of the peak zones at the point where the solder starts to melt.

## CATHOX CONFIGURATION

CATHOX is a flux decomposition solution for different levels of solder paste usage. For the high-volume lines the Centurion+ is designed offering the full CATHOX capacity. The overall oven catalyst capacity is determined by the number of CATHOXs in the oven.

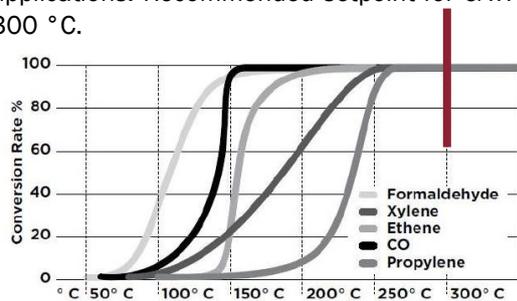
SMD lines that consume low or medium amounts of solder paste can do with a standard CATHOX configuration. Dual lines and/or pin in paste applications that consume more solder paste should be equipped with a heavy-duty configuration.



## CATHOX TEMPERATURES

Catalysis is different from Pyrolysis that is also used in some reflow ovens. Pyrolysis is a thermal decomposition process that occurs at elevated temperatures and absence of Oxygen (500 – 700 °C).

Catalysis is a process in which the catalyst increases the rate of chemical reaction without being consumed or undergoing a permanent chemical change. Catalysts work by lowering the activation energy required for a reaction to proceed, thus speeding up overall reaction time. It is widely used in various industrial processes, including petroleum refining, chemical synthesis, and environmental applications. Recommended setpoint for CATHOX is 300 °C.



## CATHOX BURN FUNCTION

A CATHOX burn function is built in the Centurion software to increase the performance of the CATHOX. The burn option increases the temperature of the catalyst to 400 °C for 30 minutes. It is recommended to do this every week before or after machine stop or maintenance. The goal is to burn of the residues that are on the nano-coated surface of the catalyst. These residues maybe there from chemicals that have not completely been decomposed and may have an impact on the efficiency of the catalyst.

This function can only be executed if the oven is updated with the stainless-steel tubing and graphite gaskets for temperature reasons.

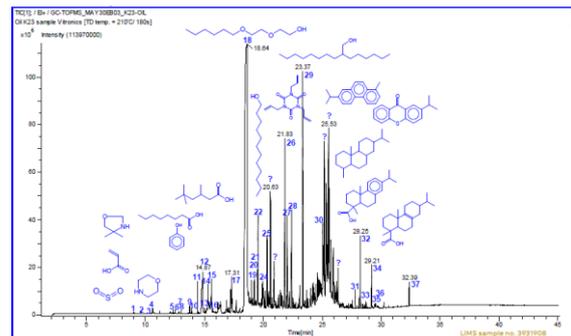
The maintenance of the CATHOX is limited to once a year replacing ceramic balls in the filter.

## CATHOX UPDATES

Over the years, the CATHOX system has been updated with several improvements to be compatible with higher temperatures. This includes graphite gaskets, flexible stainless-steel tubes, and PGM catalyst material. With this update the default temperature of the CATHOX increased to 300 °C for all zones.

## REMAINING RESIDUES

Although the CATHOX cleans the gasses in the reflow process there are still residues in the cooling zones. In the cooling zones the temperatures are below 100 °C which makes gasses condensate before entering the CATHOX. The solder paste outgasses about 5-10% of its chemistry in the cooling. Most of the contamination is caused by outgassing of the solder mask. Melamine resin residues are present in the remaining residues.



GC separation and Mass Spectrometry showed the chemical composition of the residues found in the first cooling zone.

## CONTACT

For further information contact your ITW EAE contact or visit our website: [www.itweae.com](http://www.itweae.com)