

# CATALYTIC COMBUSTION

EMISSION TECHNOLOGIES





# FOUNDED IN INNOVATION

Catalytic Combustion Corporation was founded in 1950 by individuals who recognized the need for air pollution control. They developed and patented the first all metal catalyst to destroy volatile organic compounds (VOCs).

Catalyst technology is a significant factor in protecting our environment from hazardous air emissions. The technology continues to evolve and improve to become more effective and efficient in part due to the continuing work of the dedicated scientific team at Catalytic Combustion.

## **CATALYST TECHNOLOGY THE HEART OF AN EFFECTIVE EMISSION CONTROL SYSTEM**

Catalytic Combustion Corporation formulates, creates, and manufactures our own substrates and catalysts. Our precious metal selections and loadings are scientifically determined, and field verified for optimum performance and value. We design, engineer, and build the components and equipment to employ the catalysts as well.

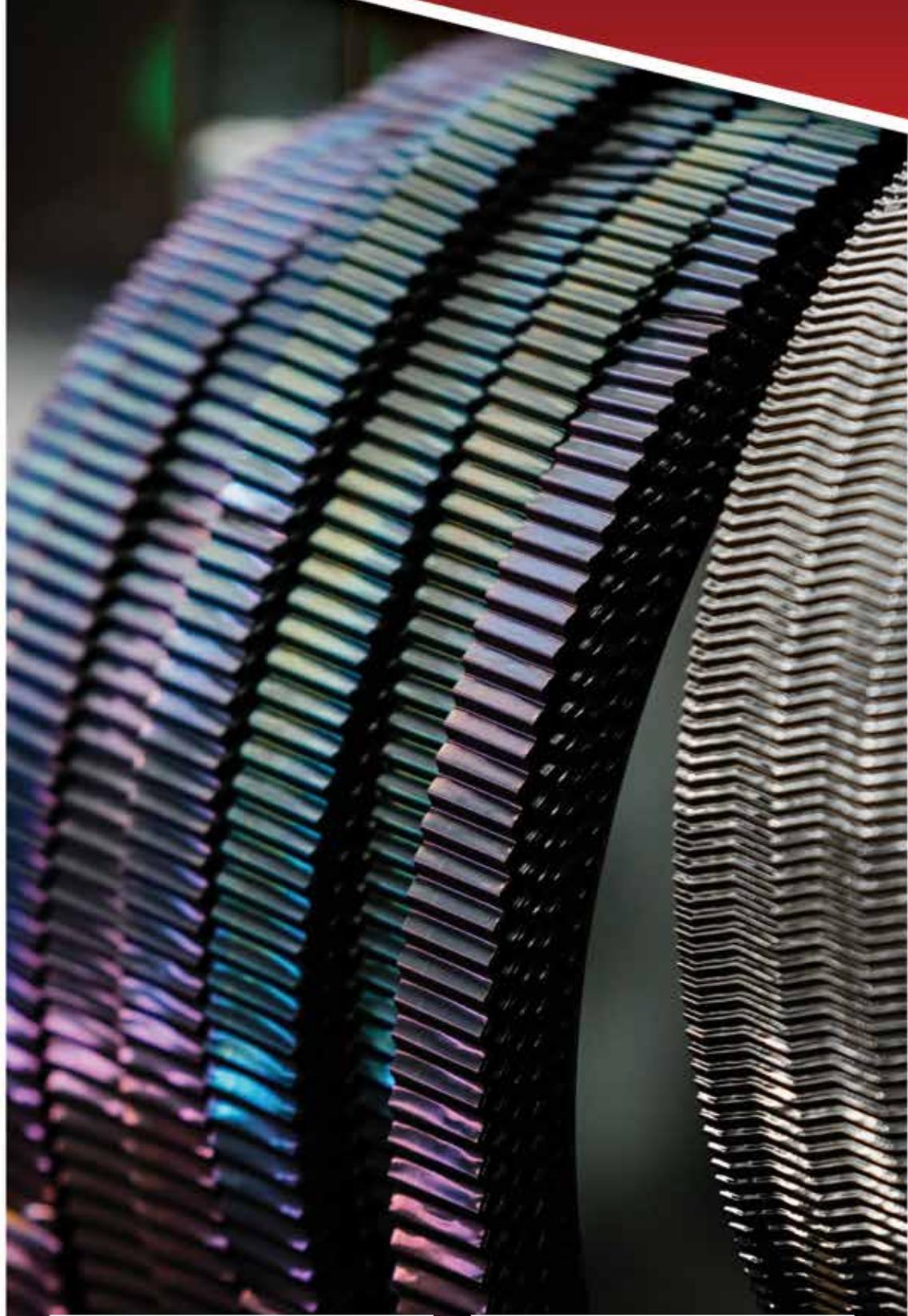
## **DEPTH OF KNOWLEDGE**

Our engineering capabilities include chemical, mechanical, electrical, industrial, and process which allow CCC to be your single source for a total emission solution and new product development. Expertise in programming and PLC allow your emission control system to function alongside your other existing systems seamlessly.



**BRAZING** is a metal-joining process that allows for stronger, more precise, and clean bond which can be coated or clad. Different than welding or soldering, brazing does not melt the base metal of the joint but instead uses capillary action with a filler metal into the joints.

**CPSI** is an abbreviation representing cell density referring to Cells Per Square Inch.



# SUBSTRATES

The substrate is the base layer upon which the catalyst is built. The majority of substrates for industrial engines are an Iron-Chrome-Aluminum alloy that has been formed into a .002 inch thick foil strip. Foil is preferred due to durability.

## Brazed Metal Foil Substrates

Metal foil substrates are available in an endless variety of shapes, sizes, and cell densities. Metal foil has low thermal mass relative to a comparable ceramic, so it heats up quickly. Metal foil can also be expanded to form a wire mesh-like material where the openings can be specifically tailored to meet your needs.

## Cell Density

A cell density of 100-320 cpsi (cells per square inch) is the range appropriate for use in the gas compression industry. Your individual project will be analyzed to find the optimum combination of cell density and catalyst size for best performance.

# COATING

## Washcoat

The role of the washcoat is to provide more surface area on which to deposit the precious metals on the catalyst and wash coating changes the available surface area dramatically. The work put into developing and refining wash coats is constantly ongoing to improve the efficiency and durability of a catalyst.

- Patented Alumina based wash coat with high surface area
- Includes additives for increased performance, stability, and longevity specific to formulation type
- Different wash coat application processes for different end uses

## Precious Metals

The precious metals platinum, palladium, and rhodium outperform other catalytically active elements in performance, durability, and offer a wide range of versatility for controlling pollutants.

Loading and ratios can vary greatly from one catalyst to another. There is a minimum load needed to cause a reaction, and a point where adding more does not improve catalyst performance.



# CATALYST FORMULATIONS

**Three Way Catalyst (TWC)** is a non-selective catalytic reduction product for rich burn natural gas propane and gasoline industrial engines, and chemical processes providing very high reduction rates of NO<sub>x</sub>, CO, HC, VOCs, and HAPs over a broad temperature operating range.

**Oxidation Catalyst** is designed for use in combined cycle gas turbine power plants, simple cycle gas turbine power plants, lean burn natural gas and diesel industrial engines, and for new installations for replacement/retrofit. Formaldehyde reduction technology available.

- Diesel Oxidation Catalyst (DOC)
- Standard Oxidation
- High VOC / HCHO
- Gas Turbine Oxidation with Sulfur Resistance

**Selective Catalytic Reduction (SCR)** is a compact solution to control NO<sub>x</sub>, CO, VOCs, HCs, PM and NH<sub>3</sub> slip in one engineered system which can also have integrated sound attenuation.

- Ceramic Fiber
- Metal Foil

**Particulate Matter**, or soot, can be controlled up to 99% from diesel engines. Eliminate black smoke and diesel exhaust odor.

- Diesel Particulate Filter (DPF)
- Diesel Oxidation Trap Catalyst (DOTC)





## CUSTOM SHAPES

Catalytic Combustion customizes elements for brand new catalysts and existing or aging catalysts in a retrofit situation. Whether your converter or combo housing is new or not, we can make a replacement element for it.

### **Non-Round and Rectangular Elements**

Catalytic Combustion manufactures brazed elements in any shape as a monolithic form which is then coated to provide you a high-performance catalyst.

### **Catalyst Frame**

The catalyst frame is constructed of 304SS with a c-channel design to eliminate banding or substrate by-pass.



## PERFORMANCE PARAMETERS

We offer various coatings for specific applications to optimize performance requirements for up to 99% control efficiencies:

### **Nitrous Oxides (NOx)**

- NSCR – Three Way Catalysts (TWC)
- SCR Diesel applications
- SCR Natural Gas applications

### **Carbon Monoxide (CO)**

Multiple formulations for traditional lean burn natural gas engines

### **Volatile Organic Compounds (VOC)**

- An increasing concern with the use of field gas on new lean burns
- Applications specific, temperature and fuel dependent

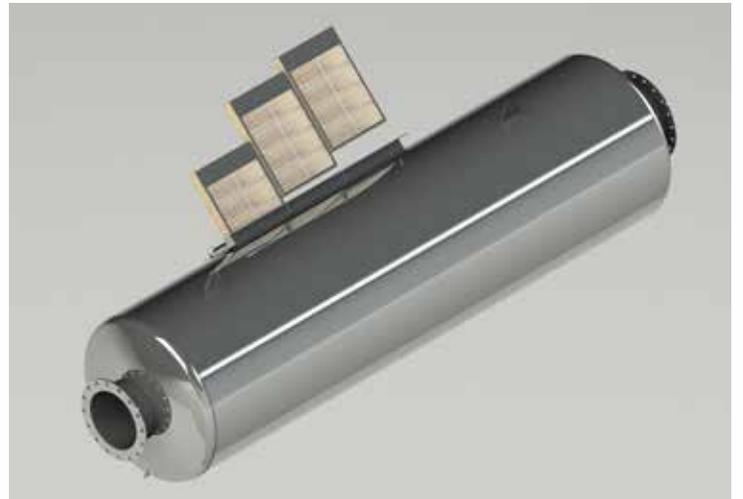
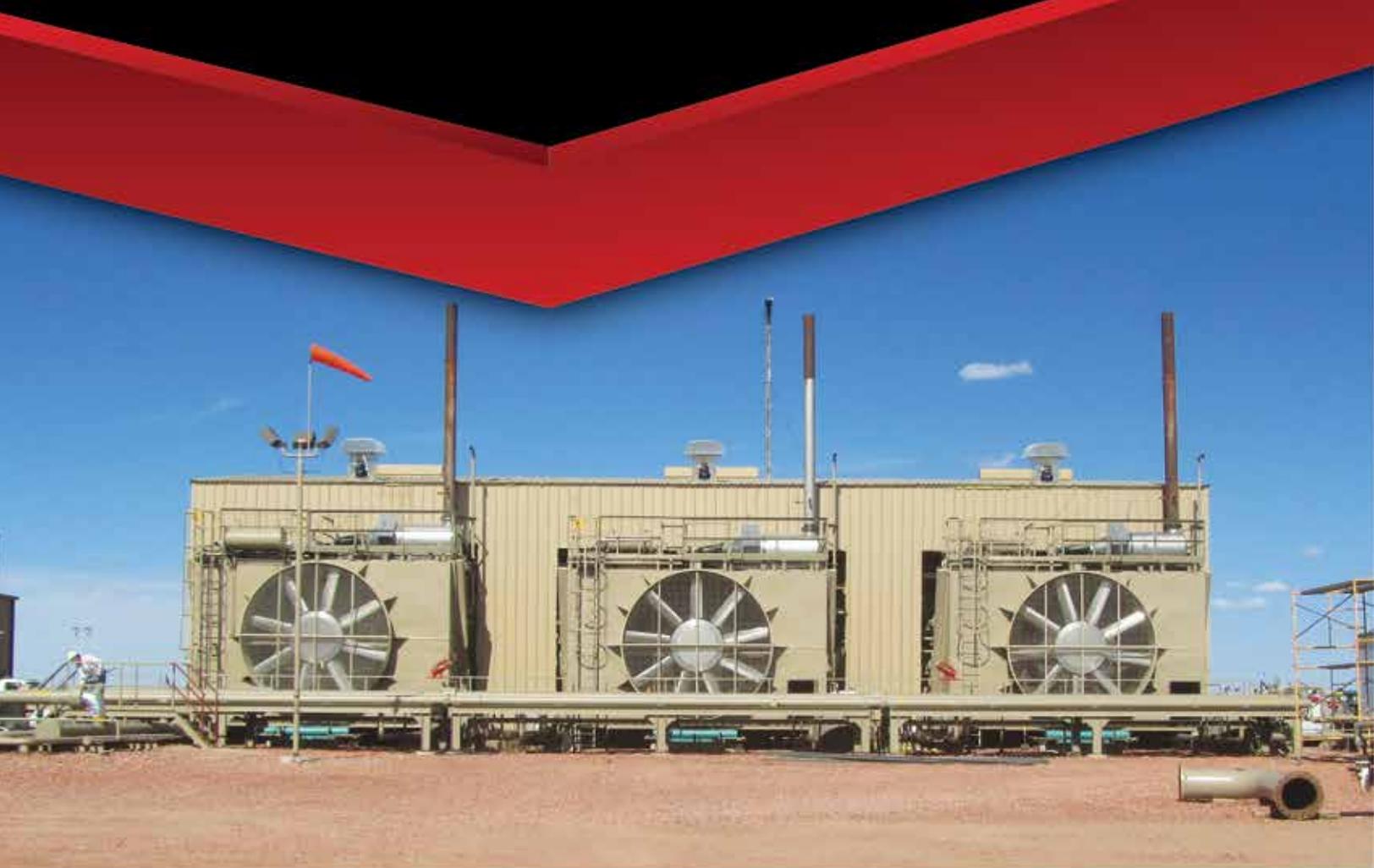
### **Formaldehyde (HCHO)**

- Increased attention with state and local agencies adding/increasing control measures

### **Particulate Matter (PM) using passive regeneration strategy**

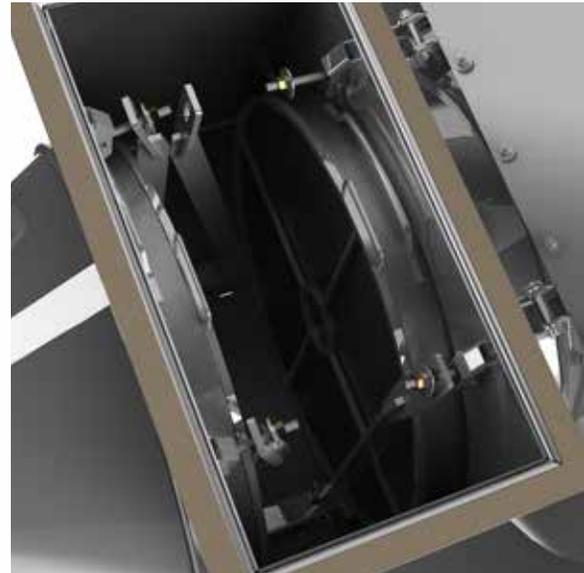
### **Sound**

- Up to 40+ dB(A) control



## Low Horsepower

- Integrated Catalytic Converter (ICC)
  - 100 HP to 400 HP
  - Non-serviceable catalyst element
  - Made of carbon or stainless steel
- Band Clamp Catalyst Housing (BCC)
  - 100 HP to 400 HP
  - Serviceable catalyst element
  - Sealing is created by v-band flanges, clamp, and gasket
  - Available as converter or with industrial grade silencing
  - Multiple element capacity
  - Carbon steel with high temperature black paint
- Perimeter Seal Catalyst Housing (PSC)
  - Round elements from 8" to 14.50" diameter
  - Flat tape perimeter seal gasket
  - Two element capacity
  - Critical and hospital grade sound attenuation
  - Configurable inlet/outlet arrangement



## Mid-Range Horsepower

- Face Seal Catalyst Housing (FSC)
  - 750 HP to 1800 HP
  - Round elements 17.50" to 35.50" diameter
  - Face seal metal core gasket
  - Two element capacity
  - Critical and hospital grade sound attenuation
  - Configurable inlet/outlet arrangements
- Parallel Flow Catalyst Housing (PFC)
  - 1300 HP to 2500 HP
  - Rectangular elements
  - Double bulb perimeter seal gasket
  - Parallel flow arrangement allows for reduced catalyst pressure drop
  - Modular element capacity approach
  - Standard construction is carbon steel
  - High-temperature black paint
  - Critical and hospital grade sound attenuation
  - Multiple variations of catalyst capacity and track systems



## Large Horsepower

- Ground Access Catalyst Housing (GAC)
  - 2000 HP to 5000 HP
  - Rectangular elements
  - Double bulb perimeter seal gasket
  - Installation option for easy access without ladder or platform



# WASHING & CLEANING

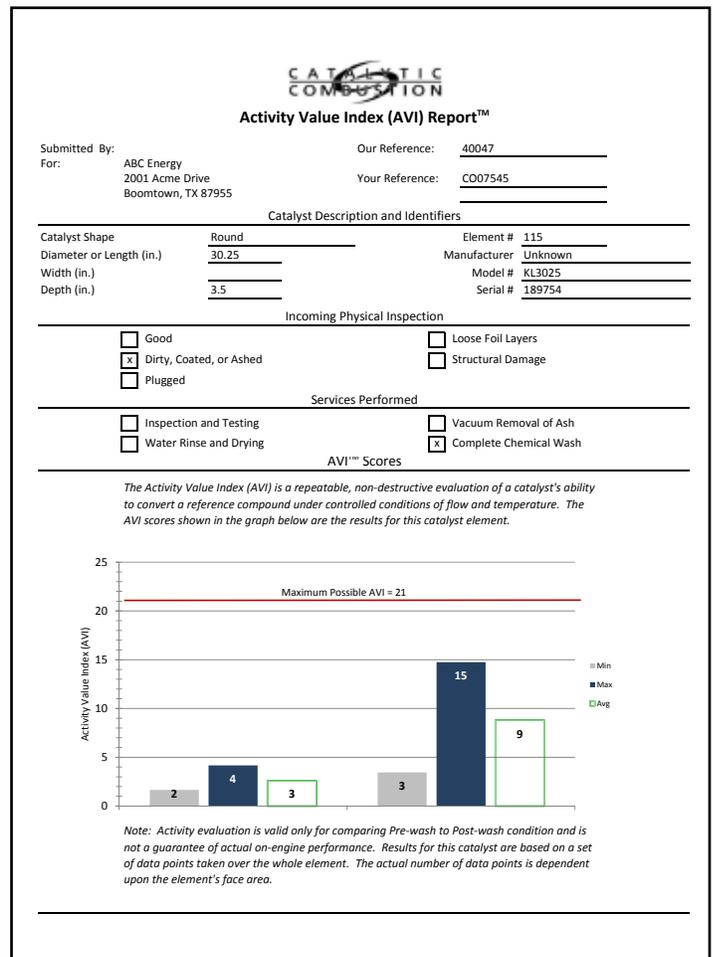
## How Good Is My Washed Catalyst?

Finally, there is a way to know. Catalytic Combustion Corp. (CCC) has developed the Activity Value Test System (AVTS™) that provides the ability to:

- Determine if a washed catalyst has any catalytic activity remaining
- Know how much improvement was gained by the washing process
- Decide if a washed catalyst is worth the time to re-install in your engine
- Save time and money before re-installation instead of scrambling to replace a washed element that does not perform as needed

## AVI™ Reporting and Interpreting AVTS Data

Understanding AVTS results is a critical part of this innovative and proprietary testing process. The Activity Value Index (AVI) Report score is used to help determine whether your washed catalyst is worth re-installing.



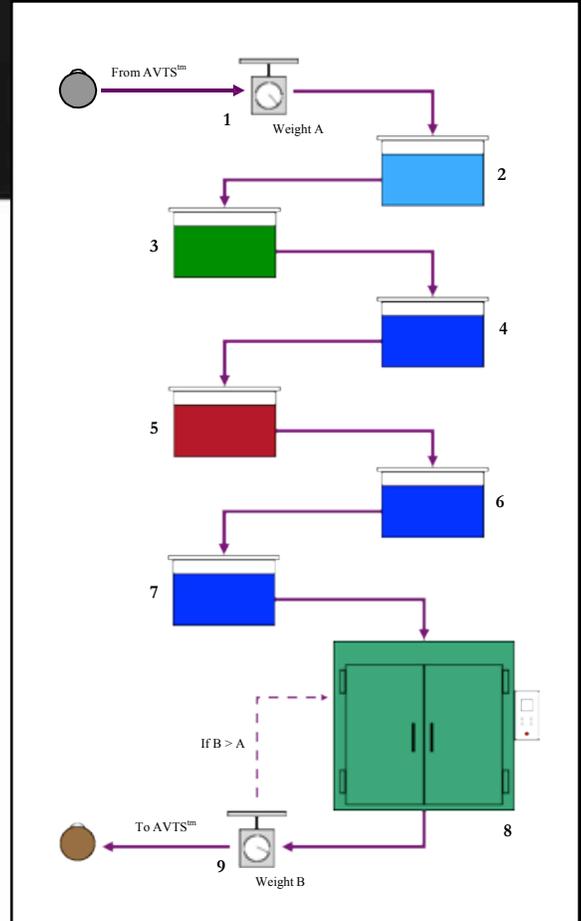
# INDUSTRY LEADING NINE-STEP PROCESS

Catalytic Combustion's advanced catalyst washing service includes a thorough physical exam of the element and the rigorous nine-step cleaning process that is highly effective in removing lubricating oil, ash, dirt, rust and carbon char.



**Catalysts that pass inspection and/or testing advance through our standard chemical washing process:**

- Step 1:** Record catalyst's initial weight
- Step 2:** Pre-rinse to remove loose material
- Step 3:** Bathe in a constantly agitated caustic solution
- Step 4:** Rinse in a distilled water bath
- Step 5:** Bathe in a constantly agitated acidic solution
- Step 6:** Rinse in a distilled water bath
- Step 7:** Bathe in a distilled water final bath to remove final trace elements of cleaning solutions
- Step 8:** Dry in a high temperature convection oven
- Step 9:** Record post weight. If B weight is greater than A weight, return to oven. Once finalized, the washed catalyst moves on for AVTS testing.





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Visit our website for locations of Field Offices and Distributors throughout North America.