Specification: RICE NESHAP Oxidation Catalyst System

PART 1 GENERAL

1.0 SUMMARY

A. The NESHAP Oxidation Catalyst System shall be designed and manufactured in order to meet the least stringent requirement according to EPA RICE NESHAP Rule 40 CFR Part 63, Subpart ZZZZ rule, where applicable.

1. Compression Ignited Engines:

   a. $100 \leq$ hp ≤ 300, 230 ppmvd @ 15% O_2 of CO
   b. $300 <$ hp ≤ 500, 49 ppmvd @ 15% O_2 of CO or 70% reduction of CO
   c. $500 <$ hp, 23 ppmvd @ 15% O_2 of CO or 70% reduction of CO

2. Spark Ignited Engines, $100 \leq$ hp ≤ 500:

   a. 2-Stroke Lean Burn Engines, 225 ppmvd @ 15% O_2 of CO
   b. 4-Stroke Lean Burn Engines, 47 ppmvd @ 15% O_2 of CO
   c. 4-Stroke Rich Burn Engines,10.3 ppmvd @ 15% O_2 of formaldehyde
   d. Landfill/Digester engines, 177 ppmvd @ 15% O_2 of CO

3. Spark ignited engines, $500 <$ hp:

   a. 4-Stroke Lean Burn Engines, 47 ppmvd @ 15% O_2 of CO or 93% reduction of CO
   b. 4-Stroke Rich Burn Engines, 2.7 ppmvd @ 15% O_2 of CH_2O or 76% reduction of formaldehyde

B. Major sources are defined as any site emitting either 10 or more tons per year of any one HAP (e.g., formaldehyde) or 25 tons or more per year of any combination of HAPs (e.g., formaldehyde, acrolein, etc.). Area sources are defined as any site that is not a major source.

1.1 SUBMITTALS

A. The system supplier/manufacturer must provide the following product description and data.

1. Drawings, catalog cuts, brochures, and other materials required to completely describe the system and equipment being furnished.

2. Oxidation Catalyst System design shall be based on the following base engine exhaust data:

   a. Engine Power in BHP or kW
   b. Exhaust Temperature at the location of the catalyst in °F
   c. Exhaust Flow Rate in lbs/hr or acfm
   d. Allowable Exhaust Back Pressure Limit in inches of water column (“WC)
   e. Carbon Monoxide (CO) in grams/BHP-hr, where applicable
   f. Formaldehyde (CH2O) in grams/BHP-hr, where applicable
   g. Fuel Sulfur Level in ppm
   h. Exhaust Oxygen Content in percent

3. Guaranteed post-catalyst emissions at the stable design point for the Oxidation Catalyst System shall include:

   a. Carbon Monoxide (CO) in grams/BHP-hr, where applicable
   b. Formaldehyde (CH2O) in grams/BHP-hr, where applicable

4. O&M Manuals including installation guidelines for the converter housing and catalyst shall be provided in hard copy with the equipment and available electronically for review upon purchase.

1.2 SUPPLIER/MANUFACTURER QUALIFICATIONS

A. The Oxidation Catalyst System shall be successfully proven in similar NESHAP stationary applications. The supplier/manufacturer shall provide a complete list of such installations upon request.

B. Supplier/manufacturer to have successfully commissioned at least (5,000) Oxidation Catalyst System units installed on stationary reciprocating internal combustion engines within the United States.

C. Supplier/manufacturer to have a minimum of 18 years aftermarket retrofit experience supplying Oxidation Catalyst Systems equipment for stationary reciprocating internal combustion engines within the United States.

D. Supplier/manufacturer to show proof of supplying aftermarket emission control systems to multiple engine makes and models.

E. All dimensions of both the catalyst housing and catalyst element shall be verified for accuracy by the supplier/manufacturer prior to shipment.

1.3 DELIVERY, STORAGE AND HANDLING

A. Equipment, material and spare parts will ship to customer complete, for installation by others.

B. Standard shipping terms are Ex Works.

1.4 MAINTENANCE

A. The supplier/manufacturer shall maintain an adequate stock, within the United States, of maintenance/replacement parts for the system, including complete catalyst elements.

B. Supplier/manufacturer shall provide a free catalyst washing service for the duration of the catalyst lifetime. The catalyst life shall be defined as 4 years under normal engine operation. This typically amounts to 2 to 4 washes in the lifetime of the catalyst element.

1.5 WARRANTY

A. All equipment supplied under this Section shall be warranted to achieve the guaranteed post-catalyst emissions by the supplier/manufacturer for the duration of 36 months or 1800 hours whichever occurs first from the date the product is complete and available for shipment. The specifics of the warranty should be included within the quotation.

B. The supplier/manufacturer shall provide a written guarantee of performance tied directly to the engine supplier/manufacturer's written guarantee and shall be evaluated on stated levels of pollutants.

1.6 COMMISSIONING AND FIELD SERVICE SUPPORT

A. Supplier/manufacturer shall have a United States based service department staffed with no less than (2) factory trained and certified emissions technicians. Service technician qualifications must be available for review and approval upon request.

B. Service technicians must be qualified to train operating personnel on the general operating, maintenance and troubleshooting of the system.

PART 2 PRODUCTS

2.0 CATALYTIC REDUCTION SYSTEMS FOR ENGINE EXHAUST

A. Available oxidation catalyst reduction system supplier/manufacturers:

1. MIRATECH Corporation.

B. The engine(s) shall be furnished with a catalytic reduction system to bring warranted exhaust emission reductions detailed in 1.0.A.3 of this specification.

C. Site specific customized products should be made available that minimize or eliminate the need for modifications in existing piping and support structures, if required.

2.1 OXIDATION CATALYST SYSTEM COMPONENTS

A. Oxidation Catalyst Reactor Housing

1. Shall contain an insertion track system, which allows catalyst elements to be slid into place from outside the housing. If required, flexibility to add catalysts for future further emission reductions should be made available.

2. Shall be a rigid structure of a minimum material thickness of 12 GA, which will not warp or deform significantly during normal operation.

3. Transition pieces shall be Non Code Standard F&D Dished Head in order to minimize welds and optimize structural integrity.

4. Shall be designed to allow for thermal expansion differences within the housing, while preventing exhaust gas from leaking past the catalyst.

5. The housing shall be complete with inlet and outlet flanged pipe sections designed for bolting to the exhaust gas ductwork. Connection to the engine exhaust system will be via standard ANSI 150 lb pattern, flat faced flanges.

6. Shall be equipped with a bolted on access door(s) to the catalyst elements. The door(s) shall incorporate a handle and can be easily removed without the assistance of lifting equipment and be on the top or the side of the housing. Door(s) shall be designed with non-asbestos gasket sealing to prevent exhaust gas from leaking to the atmosphere. Bolt in, clam shell, or other catalyst access designs that require disassembling exhaust piping for catalyst removal will be deemed unacceptable.

7. Shall be constructed of carbon steel, painted with high temperature black paint on the exterior only, or unpainted 304L stainless steel, based on the recommendation of the supplier/manufacturer. Fabrication steel is 14 gauge or thicker to provide structural support and rigidity.

8. Shall provide a minimum of (3) ½-inch NPT couplings for differential pressure and inlet temperature measurement upstream and downstream of the catalyst elements.

9. Flange bolt holes shall straddle the vertical centerline or slip flanges may be provided, if required.

10. Shall have an engraved metal nameplate providing serial number and supplier/manufacturer reference material.

11. Shall have the option to be insulated.

12. Supplier/manufacturer shall have the ability to provide all of following consistent with all of the requirements listed in this Section 2.1.A: standalone converter and combination converter/silencer. Supplier/manufacturer shall supply site specific customized housings, if required.

    a. Inline Catalyst Only Housing

        i. Shall minimize impact on backpressure

    b. Catalyst/Silencer Housing

        i. Supplier/manufacturer shall incorporate support structures including skirt, feet, and trunnion mounts, if required. Self supported housings incorporating skirt, feet, or trunnions shall be successfully proven by finite element analysis and in similar installed applications.

        ii. Supplier/manufacturer shall design the catalyst access at ground level if piping permits it in the design. This requires that the inlet piping enters the housing adequately above ground level to allow for the incorporation of the design.

        iii. Shall be designed as a standalone converter or as a combination converter/silencer. Silencer designs shall be available for critical grade, hospital grade, and higher sound reduction.

        iv. If a silencer is currently installed, the supplied Catalyst/Silencer Housing shall be designed such that the backpressure is equivalent to or lower than the existing system backpressure and maintain equivalent or better sound reductions.

B. Oxidation Catalyst Elements

1. The catalyst element shall be composed of a substrate, washcoat, and catalytically active materials.

2. The substrate shall be a high-temperature rated alloy metal foil. The foil is packaged to create a honeycomb-like structure to provide numerous small channels for the exhaust to flow through the element. The channels shall provide a high surface area and multiple turbulent zones without causing excessive exhaust backpressure.

3. The supplier/manufacturer of the catalyst substrate shall have the ability to offer various cell densities (CPSI) in order to provide an optimized solution for performance and backpressure.

4. The catalyst foil shall be made of turbulence-optimized substrate with active anti-telescoping technology; therefore, eliminating the need for substrate support that will impede flow across the catalyst and increase the system cost.

5. The washcoat shall be composed on a high surface area alumina-based material, with additives designed to resist sulfur poisoning and to limit the conversion of SO_2 to SO_3.

6. The catalytically active materials shall be a combination of Platinum Group Metals (PGM), including platinum. The PGM shall be deposited on the washcoat by chemisorption.

7. The catalyst element shall be wrapped with a 304L stainless steel band.

8. A combination sealing plate/lifting handle shall be welded to the band. The plate shall be constructed of 304L stainless steel.

9. A single high temperature vermiculite impregnated fiberglass gasket shall be wrapped around the element to seal it within the housing. The top surface of the sealing plate shall be sealed against the door when it is installed.

10. Shall be designed for perimeter sealing of the catalyst within the housing in order to allow for ease of installation/removal of catalyst element(s) and robust performance throughout the life of the catalyst element(s). Face sealing catalyst designs shall be deemed unacceptable as the sealing mechanism degrades as a consequence of thermal cycles.

11. The minimum catalyst inlet temperature is 450°F, however, higher temperatures will lead to higher reduction percentages. The catalyst substrate and metal foil shall not sinter or degrade when exposed to exhaust temperatures up to 1,250°F.

12. The catalyst(s) must be removable via bolt-on access doors. This will allow for the element(s) to be sent to the supplier/manufacturer for periodic washes and allows easier replacement of damaged/poisoned catalyst(s).

C. CPMS and Data Logging System

1. Shall log parameters for compliance requirements including catalyst inlet temperature and differential pressure across the catalyst system.

2. System software shall be plug-and-play in nature for collection of data and shall require no manipulation of data in order to generate monthly reporting.

3. Shall include necessary ancillary components including a K-type thermocouple/transmitter and differential pressure gauge/transmitter.

4. Shall be completely contained within a NEMA 4X enclosure.