Oxidation Catalyst System to satisfy RICE NESHAP (40 CFR Part 63, Subpart ZZZZ) Requirements

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PART 1 GENERAL
1.0 SUMMARY

A. The 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 (CI) Engines:
   a. 100 ≤ hp ≤ 300, 230 ppmvd @ 15% O\textsubscript{2} of CO
   b. 300 < hp ≤ 500, 49 ppmvd @ 15% O\textsubscript{2} of CO or 70% reduction of CO
   c. 500 < hp, 23 ppmvd @ 15% O\textsubscript{2} of CO or 70% reduction of CO

2. Spark Ignited (SI) Engines, 100 ≤ hp ≤ 500:
   a. 2-Stroke Lean Burn Engines, 225 ppmvd @ 15% O\textsubscript{2} of CO
   b. 4-Stroke Lean Burn Engines, 47 ppmvd @ 15% O\textsubscript{2} of CO
   c. 4-Stroke Rich Burn Engines, 10.3 ppmvd @ 15% O\textsubscript{2} of formaldehyde
   d. Landfill/Digester engines, 177 ppmvd @ 15% O\textsubscript{2} of CO

3. Spark Ignited (SI) Engines, 500 < hp:
   a. 4-Stroke Lean Burn Engines, 47 ppmvd @ 15% O\textsubscript{2} of CO or 93% reduction of CO
   b. 4-Stroke Rich Burn Engines, 2.7 ppmvd @ 15% O\textsubscript{2} of CH\textsubscript{2}O 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. Project specific drawing of converter housing.
   3. 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 (CH\textsubscript{2}O) in grams/BHP-hr, where applicable
      G. Fuel Sulfur Level in ppm
      H. Exhaust Oxygen Content in percent

   4. 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

5. Operating and Maintenance 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 stationary applications. The supplier/manufacturer shall provide a 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 10 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. Supplier is to have products specifically designed for RICE NESHAP, 40 CFR 63 subpart ZZZZ, compliance.

F. 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 qualified mechanical contractor.

B. Standard shipping terms are FOB Destination, Prepaid and Add.

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.

1.5 PERFORMANCE GUARANTEE

A. All catalyst elements supplied under this Section shall be guaranteed to achieve the post-catalyst emissions by the supplier/manufacturer for the duration of 8,000 hours of operation from the date of the initial installation. The specifics of the guarantee 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 technical service staff with no less than (2) factory trained and certified emissions technical staff members. Technical staff member qualifications must be available for review and approval upon request.

B. Technical staff members 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:
   - GT Exhaust or approved equal

B. The engine(s) shall be furnished with a catalytic reduction system to bring exhaust emission reductions detailed in 1.0 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 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.

1. Shall be a rigid structure of a minimum material thickness of 14 GA, which will not warp or deform significantly during normal operation.

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

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

4. 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 flanges.
5. 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.

6. Door(s) shall be designed with non-asbestos gasket sealing to prevent exhaust gas from leaking to the atmosphere.

7. Shall be constructed of carbon steel, painted with high temperature black paint on the exterior only, or unpainted 304 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 (2) female NPT couplings with removable plugs for differential pressure and inlet temperature measurement upstream and downstream of the catalyst elements - (4) Couplings Total.

9. Shall provide a minimum of (1) female NPT coupling with removable plugs as required to meet RICE NESHAP certified compliance testing for emissions reduction upstream and downstream of the catalyst elements – (2) Couplings Total.

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

11. Shall have an engraved metal nameplate providing serial number and supplier/manufacturer product and contact information.

12. Shall have the option to have insulated blanket installed suitable for 1200°F and attached with stainless steel wire or Velcro.

13. Shall provide mounting accessories and piping adequate to maintain a minimum temperature of 550°F at the catalyst inlet, minimize backpressure, and designed to prevent thermal stress and isolate vibration to the exhaust system.

14. Supplier/manufacturer shall have the ability to provide all of following consistent with all requirements listed in Section 1.

15. Supplier/manufacturer shall supply site specific customized housings, if required.

B. Oxidation Catalyst Elements

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

   The substrate shall be a high-temperature rated alloy metal foil. The foil is packaged to create a honeycomb-like structure to maximize surface area without causing excessive exhaust backpressure.
2. 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.

3. The catalyst foil shall be 100% vacuum brazed for superior high temperature strength 
and durability to prevent telescoping of the foil under exhaust pressure conditions and 
mechanical shock, thus eliminating the need to substrate bracing.

4. The supplier/manufacturer of the catalyst shall have the ability to offer a range of 
washcoat formulations for various sulfur levels of diesel fuel designed to resist sulfur 
poisoning and limit the conversion of SO₂ to SO₃.

5. The catalytically active materials shall be a combination of Platinum Group Metals 
(PGM), including platinum. The PGM shall be deposited on the substrate via washcoat 
technology and cured under controlled high temperature/time conditions to ensure long 
life.

6. The catalyst foil shall be protected by a stainless steel mantle.

7. Catalysts shall be designed and guaranteed to reduce CO emissions by a minimum of 
70% at the end of the 8,000 hours of operation.

8. A single high temperature vermiculite impregnated fiberglass gasket shall be to seal the 
element within the housing.

9. Shall be designed for face 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).

10. The minimum catalyst inlet temperature is 550°F; 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 1,350°F.

11. The catalyst(s) must be removable via bolt-on access doors to allow for periodic 
inspections and maintenance activities.

### 2.2 Silencer / Muffler Body

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

2. 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 engineering analysis and/or installed in similar 
   applications.
3. Shall be designed as a standalone converter or as a combination converter/silencer. Silencer designs shall be available for residential, critical grade, super critical grade, and higher sound reduction.

4. 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.

2.4 Continuous Parametric Monitoring System (CPMS) and Data Logging System

1. CPMS system to be installed by a qualified electrical contractor.

2. Contractor is responsible for mounting monitor to specified location, providing proper power connection, and installing thermocouple and pressure transducer connections to monitor. Contractor is responsible providing connection tubing and routing for pressure transducer tubing as applicable to site requirements.

3. Contractor is responsible for verifying the proper operation of the monitor, including set points, warning lights, and alarms.

4. Shall log parameters for compliance requirements including catalyst inlet temperature and differential pressure across the catalyst system. Catalyst inlet data shall be logged as 15 minute increments and calculate and store a 4 hour rolling average. The system shall alarm when the parameters exceed the limits entered into the system by the Owner.

5. System software shall be plug-and-play in nature for collection of data and shall require no manipulation of data in order to generate compliance reporting. CPMS shall be able to compile a monthly report of monitored data for use by the Owner. Data content of the report shall be definable by the Owner.

6. Shall include necessary ancillary components including K-type thermocouples and differential pressure transducers with associated cable length as required to reach monitor.

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

A. User Interface
   a. The CPMS shall be user programmable from a keypad on the front display panel.
   b. The display shall be a back lit LCD display or an LED display.
   c. Catalyst Inlet Temperature Four Hour Rolling Average shall be displayed on the front panel display.
   d. The CPMS has the capability to communicate acquired data, calculated data, and monthly reports to Owner’s computer system via Modbus RS-485 interface.
PART 3 INSTALLATION

1. Contractor is to be fully insured.

2. Contractor to provide field labor and supervision, all equipment, consumables, project management, planning and scheduling, professional or subcontracted services and any expenses incurred for transportation, fuel, lodging, and logistics.

3. Contractor is responsible for disconnection, removal, rerouting, disposal and installation of exhaust system components.

4. Contractor is responsible for constructing and installing ladders and/or platforms in accordance to OSHA employee safety rules for access to catalyst and test ports, if applicable.

5. Contractor is to install exhaust system in accordance to the manufacturer's installation and operations manual and instructions.