Industrial Boiler MACT: CEM Requirements

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Overview: Boiler MACT
Boiler MACT
Testing and Monitoring Requirement

Testing
- Initial compliance tests (PM, HCl, Mercury, THC and Dioxins)
- Annual performance tests
- Annual tune-up for units < 10 MM Btu/hour in size and units in Gas 1 and Metal Process Furnaces subcategories
- Allows emission averaging among existing units in same subcategory

Monitoring
- **CO CEMs** for units with heat input capacity of 100 MM Btu/hour or greater
- **PM CEMs** for units combusting coal, biomass, or residual oil and having a heat input capacity of 250 MM Btu/hour or greater
- Process parameters (opacity, pressure drop, sorbent injection rate, fuel, etc.)

Continuous Compliance
- Demonstrated by maintaining operating limits (process parameters)
- Demonstrated by maintaining CEMs values (30 day average) below emission limits
PM CEMs in Wet and Dry Applications
Measuring Principle
Scattered light

- Optical principle
- When light hits the particle, it is scattered
- Relation between the scattered light intensity and dust concentration
- Usable for low to medium dust concentrations
Measuring Principle
Scattered light

- Light attenuation depends on different application parameters (E.g.: grain size, dust density, dust dispersion)
- Application specific regression curve through a gravimetric comparison measurement: $cc2E^2 + cc1E + cc0$
  - Relationship between $mA$ and dust concentration
- Data imported into dust measurement device

![Regression curve (Schematic)](image-url)
PM CEMs in Wet and Dry Applications

Dry gas

SP100

FWE200

Wet gas
Dry Stack Application:
Forward Scatter - Probe

- Different probe lengths available
- High gas temperatures (up to 752° F)
- HASTELLOY material for Corrosive gases
- Maintenance interval of 3 months
- Powder coated stainless steel housing
- Meets EPA Performance Spec 11

0 mg/m³ – 200 mg/m³
< 752° F

21in
Dry Stack Application:
Forward Scatter - Probe

Receiver optics
Sender
Receiver
Fibre optic cable
Receiver optics
Why a Bypass System?

- The light of the monitor attenuated through particles in the light beam.

- The water droplets must be eliminated.

- The heated Bypass System is the solution for a correct PM measurement in wet stacks.
Wet Stack Application
Scatter Forward Probe w/ bypass system

Sample Probe:

Gas temperature: 250 F for PVDF Probe
430 F for Hastelloy Probe
Wet Stack Application
Scatter Forward Probe w/ bypass system

Thermo cyclone:

Connection
cable for
heater and
temperature
sensor

Screw connection

Heater 1
Heater 2
Function of the measuring cell:
Wet Stack Application
Scatter Forward Probe w/ bypass system
PM CEMs in Wet and Dry Applications

- Proven technology
  - Over 15 years experience with scattered light devices.
  
- Continuous measurement
  - „real time“ not „mean time measurement

- Sensitive to low levels of dust concentration
  - < 5mg/m³
  - < 1 µm particle size

- Usable wet stacks by utilizing a bypass system

Scatter Light:

- Forward scattering light
- Scattering light angle: 15
CO CEM
CO CEMs
In-situ

Analyzer Versions

<table>
<thead>
<tr>
<th>Model</th>
<th>Component</th>
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<tr>
<td>All</td>
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<tr>
<td>GM 35 - 1</td>
<td>CO</td>
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<td>CO, H₂O</td>
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<td>CO, H₂O, CO₂</td>
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<td>H₂O</td>
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<tr>
<td>GM 35 - 7</td>
<td>CO₂</td>
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</tbody>
</table>
CO CEMs
In-situ

- IR Source
- Zero Point Reflector and blanking disk
- Reference filter
- Filter wheel for CO measurement
- Filter wheel for CO$_2$ / H$_2$O measurement
- Reflectometer - measuring probe
Analyzer Self Test: Check Cycle

Grid Filters
CO Probe
Blanking Diaphragm
Zero Point Reflector

Display on Recorder

CO CEMs
In-situ
CO CEMs

In-situ

GPP Probe (Gas Permeable Probe)

Features:

- Temperature measurement
- Pressure measurement
- Heater controller with special features
- Preheated test gas “routing”

Flange seal

Bellows for filter protection
CO CEMs
In-situ

- Proven technology
  - Large installed base in US emissions applications

- Quick, reliable response
  - No lag time due to sample transport
  - No loss in sample system

- No sample system to maintain

- Integral zero and span capability saves money on cal gas
Questions?

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