

California ARB Verification Testing of the CBS™ Soot Filter for Stationary Diesel Applications

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▶▶ ARB Stationary Verification Process

▶▶ Emissions Testing

- Need over 85% Reduction of PM for Level III Verification
- No Significant Increase in Other Pollutants

▶▶ Durability Testing

- 500-Hours of Durability for Standby Generator and Water Pump Applications
- 1000-Hours of Durability for Prime Power Applications
- Must Cold Start and Idle for 30 Minutes 24 Times in a Row, 6 Times

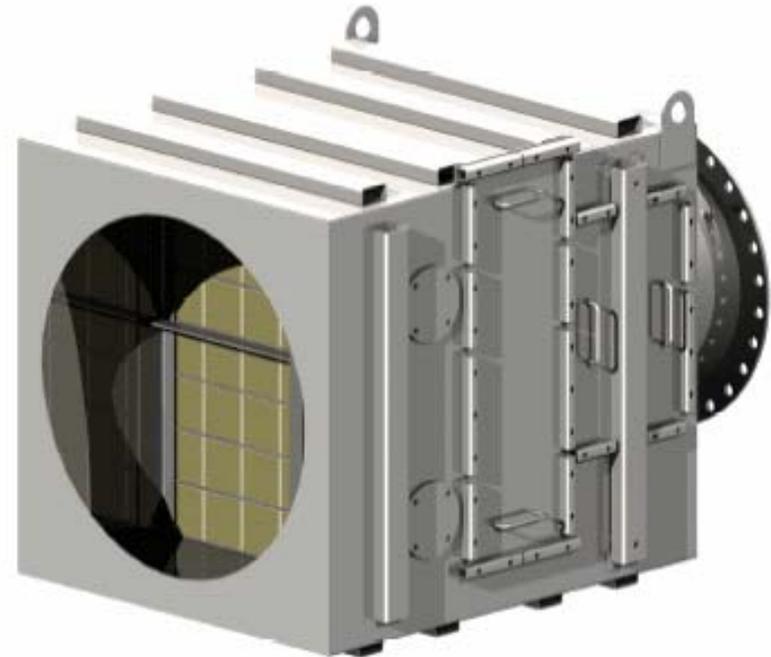
▶▶ Field Testing

- Must have Field Applications with Letters from Users

▶▶ CBS Soot Filter

Passive Regeneration

- ▶▶ Designed for stationary applications.
- ▶▶ The particulate is “regenerated” by oxidation in the exhaust due to the temperature and catalyst on the filters.
- ▶▶ Stacked filter blocks in housings for engines up to 7 MW



▶▶ CBS Technology Details

▶▶ Design

- Designed and Manufactured by HUG Engineering in Switzerland
- Rugged Design Using Silicon Carbide Filter Material
- Relatively Low Backpressure
- Access Ports for Filter Removal and In-Place Cleaning
- Coating is Sulfur Tolerant

▶▶ INSTALLATION

- Flanged Inlet and Outlet to Connect to Exhaust Pipe.
- Standard Design Mounts Horizontally
- Lifting Lugs and Mounting Feet on Housing

▶▶ OPERATIONAL DETAILS

- Fittings Provided for Temperature and Pressure Measurements
- Pressure Drop Monitor Included with System

▶▶ TESTING & PERFORMANCE-

- Over 85% Reduction of PM 10 and PM 2.5

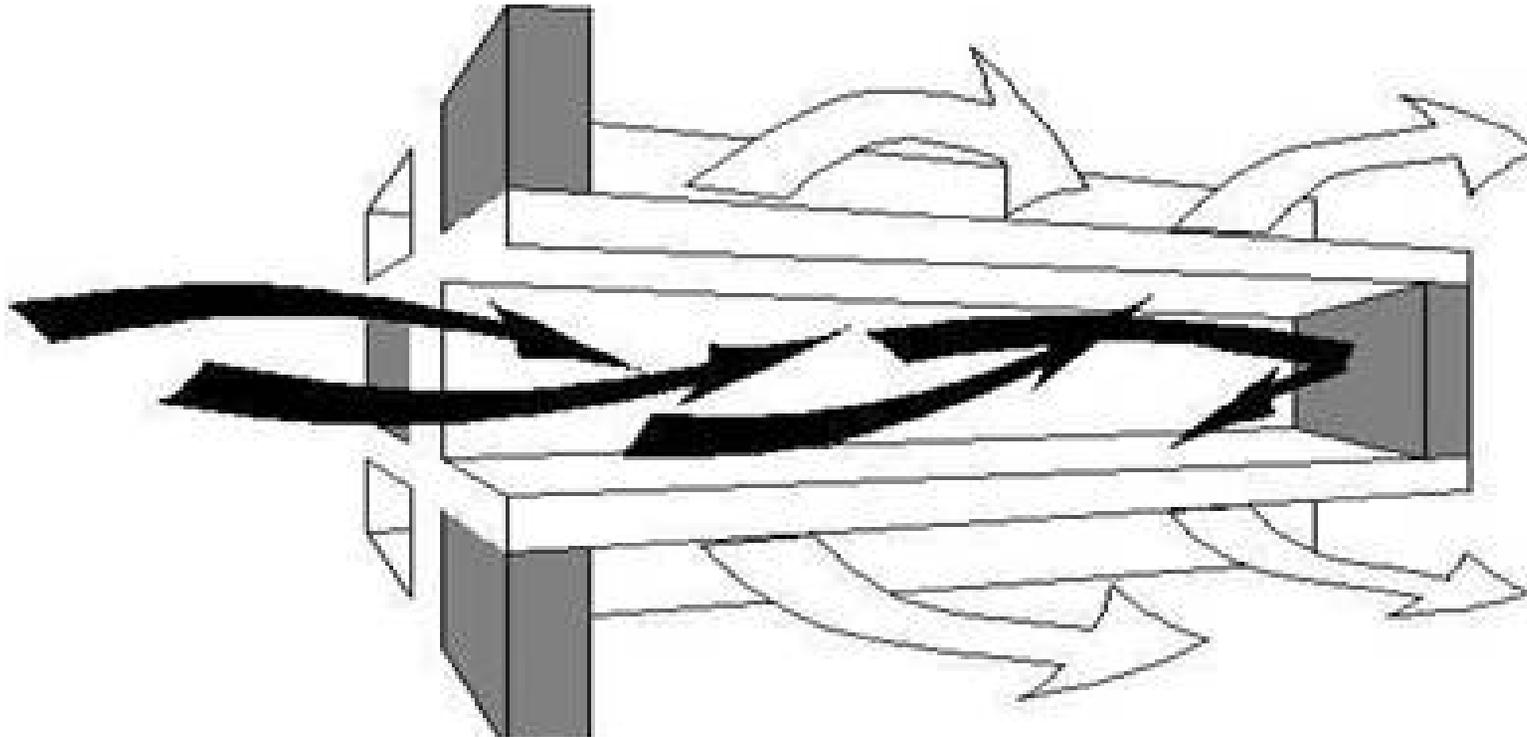
▶▶ CBS Filters

Silicon Carbide Filters

- ▶▶ The Particulate is trapped on the surface of a catalyzed, high temperature, wall flow, porous Silicon Carbide filter.
- ▶▶ Silicon Carbide provides superior thermal durability over metal fiber and cordierite filters
- ▶▶ Following regeneration, the soot leaves only a small amount of ash on the surface that can be blown off or washed off during maintenance periods.
- ▶▶ Sulfur Tolerant Catalyst Applied to Reduce Regeneration Temperature



▶ CBS Filters – Wall Flow



▶▶ CBS Test at CE-CERT

- ▶▶ **CAT 3406C Diesel Genset and Electrical Load Bank**
 - 350 kW at Full Load
- ▶▶ **Standard CARB “Red Dye” Diesel Fuel**
- ▶▶ **CBS-9 Particulate Trap**
- ▶▶ **Exhaust Piped into Mobile Emissions Trailer After Filter**
- ▶▶ **Detailed Emissions Measurements in Triplicate**

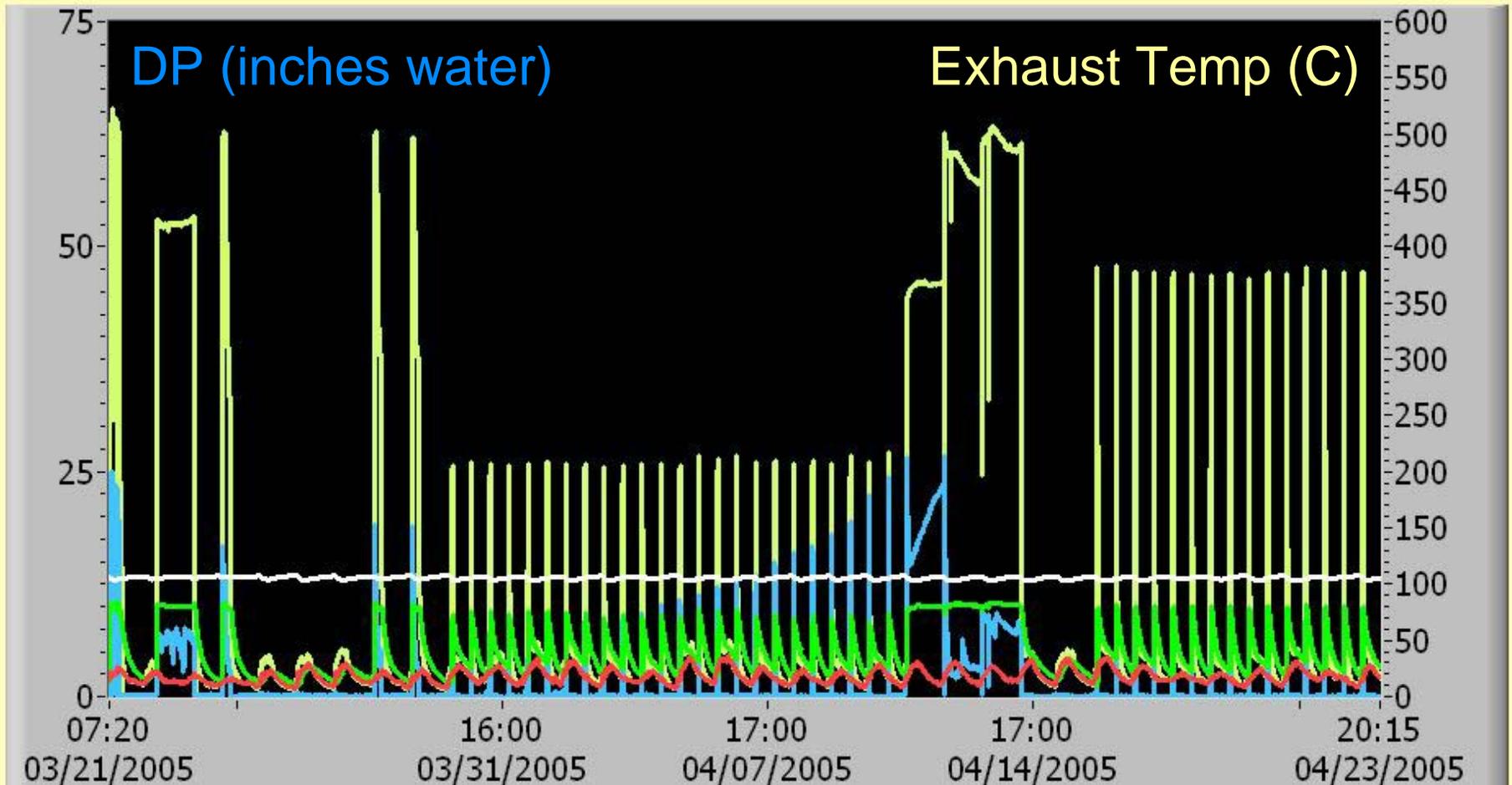


▶▶ Emissions Test Results

- ▶▶ ISO 8170 Weighted Averages
- ▶▶ Percent Reduction from Baseline without Filter:

Operating Time Prior to Test	PM2.5	CO	HC	NOx
0-Hours	93%	49%	75%	-3.3%
167-Hours	97%	41%	88%	-3.1%

▶▶ 24, 30-Minute Cold Start Cycles



▶ LIPA Project – 24, 2MW Diesels



▶▶ CBS Summary

CBS Benefits

- ▶▶ **Sizes for Engines from 150kW to 7 MW**
- ▶▶ **Can Go 12 Hours Between High Temperature Operation**
- ▶▶ **Ultra-Low Sulfur Diesel Fuel NOT Required**
- ▶▶ **Robust Design Provides Fail Safe Operation**
- ▶▶ **Modular Components for Service and Maintenance**
- ▶▶ **Competitively priced**
- ▶▶ **Proven in Stationary Power Generation Applications**
- ▶▶ **Easy Installation and Start-up**
- ▶▶ **Poison Resistant**
- ▶▶ **Low Back Pressure – Within Engine Manufacturer Specifications**
- ▶▶ **Provides ~25 dBA of Sound Reduction**
- ▶▶ **No specific NO/NO₂ ratio required**
- ▶▶ **No specific NO_x/PM ratio required**

►► For Additional Info Contact:

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