



# pennsylvania

DEPARTMENT OF ENVIRONMENTAL PROTECTION

BUREAU OF MINE SAFETY

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January 10, 2013

Mr. Gene Davis  
Rosebud Mining Company  
301 Market Street  
Kittanning, PA 16201

RE: ECS Model S18 silicone carbide exhaust filter (87% efficient) in a Caterpillar Model 482D Diesel Scoop equipped with a Deutz BF4L2011 78HP@2800 RPM engine with an ECS Model AZ27 diesel oxidation catalyst and a Bucyrus Model 399823 heat exchanger

Dear Mr. Davis:


Chapter 4 of the "Bituminous Coal Mine Safety Act" (the Act) provides for the use of diesel-powered equipment in underground bituminous coal mines. Section 424 of the act created a Technical Advisory Committee ("TAC") for the purpose of advising the Department regarding implementation of Chapter 4 and evaluation of alternative technology or methods for meeting the requirements of Chapter 4.

On October 15, 2012, Gene Davis on behalf of Rosebud Mining Company sent a request for a 100 hour evaluation test period at the Twin Rocks Mine for this piece of equipment. On December 11, 2012, the TAC received the report of the test results.

On December 20, 2012, the TAC gave recommended approval in the enclosed report with the understanding that the General Specification Sheet (Attachment 1) must be strictly adhered to. They recommended final approval at the meeting on January 9, 2013.

If you have any questions on this request, please contact Joseph Scaffoni at [jscaffoni@pa.gov](mailto:jscaffoni@pa.gov) or at 724-439-7469.

Sincerely,

  
Joseph A. Scaffoni  
Director  
Bureau of Mine Safety

cc: Bowersox  
Borchick

Enclosure(s)

JAS/cd

bcc: Kerch  
Brower  
Antoon  
Gaida  
Dunn/TAC file

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**Pennsylvania Technical Advisory Committee  
On Diesel Powered Equipment**

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RECEIVED  
DEC 31 2012  
Bureau of Mine Safety  
Uniontown

December 20, 2012

Joseph Scaffoni, Director  
Bureau of Mine Safety  
Fayette County Health Center  
100 New Salem Road, Room 167  
Uniontown, Pa. 15401

RE: TAC recommendation on Rosebud Mining request for approval to use a ECS Model S18 silicone carbide exhaust filter (87% efficient) in a Caterpillar Model 482D Diesel Scoop equipped with a Deutz BF4L2011 78 HP @2800 RPM engine with a ECS Model AZ27 diesel oxidation catalyst and a Bucyrus Model 399823 heat exchanger.

Dear Mr. Scaffoni:

Chapter 4 of the "Bituminous Coal Mine Safety Act" (the Act) provides for the use of diesel-powered equipment in underground bituminous coal mines. Section 424 of the act created a Technical Advisory Committee ("TAC") for the purpose of advising the Department regarding implementation of Chapter 4 and evaluation of alternative technology or methods for meeting the requirements of Chapter 4.

### **Background**

On October 15, 2012 Gene Davis on behalf of Rosebud Mining submitted a request to the TAC for a 100 hour evaluation test period at the Twin Rocks Mine to use a ECS Model S18 silicone carbide exhaust filter (87% efficient) in a Caterpillar Model 482D Diesel Scoop equipped with a Deutz BF4L2011 78 HP @2800 RPM engine with a ECS Model AZ27 diesel oxidation catalyst and a Bucyrus Part # 399823 heat exchanger. Rosebud requested the test period to evaluate the alternate filter in the previously approved package which utilized a FST-115-26 paper filter to see if they could get increased filter life from the alternate filter.

The TAC approved the 100 hour test period on November 19, 2012 after visiting the Twin Rocks Mine and inspecting the alternate filter installation. Emissions and a smoke dot test were performed and the TAC found that the alternate diesel package met all requirements of Chapter 4 of the Bituminous Coal Mine Safety Act. Rosebud agreed to report their findings and test results to the TAC upon completion of the 100 hour test period.

On December 11, 2012 the TAC received the report of the test results from Gene Davis. The test showed positive results in regard to extending the filter life with no issues. There were 2 filters installed during the test period, and the smoke dot test conducted on both filters was read as #1.

Rosebud requested the TAC to evaluate for approval the diesel engine and exhaust emissions package utilizing the ECS S-18 diesel exhaust filter as described below in the CAT 482D diesel scoop.

The Caterpillar 482D Diesel Scoop alternate filter package is equipped with a:

- Deutz BF4L2011 78HP @ 2800 RPM engine MSHA Certification number 07 ENA040004-1 (Part 7)
- ECS Model AZ27 diesel oxidation catalyst
- Bucyrus (CAT) Part # 399823 Heat Exchanger
- ECS - S18 silicone carbide exhaust filter (87% efficient)

More detailed information on the specifications for the alternate Model 482D Scoop diesel power packages are included on the General Specification Sheet attached. (Attachment1)

### **Investigation**

On November 19, 2012 the TAC traveled to Rosebud Mining Twin Rocks Mine in Nanty Glo, PA to conduct emissions test and evaluate the CAT 482D diesel scoop. The TAC evaluated the engine and exhaust emissions package.

Emissions testing of the engine and after-treatment system were performed, as well as exhaust gas temperature monitoring and stall test procedure. The results of the emission tests showed the engine was performing within MSHA's approval specifications. A smoke dot test was conducted and the result indicated #1.

The results of the emissions tests showed the engine was performing within MSHA's approval specifications. The after-treatment system is fitted with ECS S-18 DPM silicone carbide exhaust filter (87% efficient). The engine and filter extrapolations show that the diesel power package will result in an average ambient concentration of .046 mg/m<sup>3</sup> of diesel particulate matter when diluted by 100% of the MSHA approval plate ventilation rate for this engine, which is well below the .12 mg/m<sup>3</sup> requirement of Section 403 (a)(1) the Act. (Attachment 2)

### Recommendation

Based on the information received, our investigation and our discussions the TAC believes that the diesel power package utilizing the ECS S-18 silicone carbide exhaust filter is capable of meeting all requirements of Section 403 of Chapter 4 of the Act without reducing or compromising the level of health or safety afforded by the Act.

As such, we are recommending approval of the Rosebud Mining request to use a ECS Model S18 silicone carbide exhaust filter (87% efficient) in a Caterpillar Model 482D Diesel Scoop equipped with a Deutz BF4L2011 78 HP @2800 RPM engine with a ECS Model AZ27 diesel oxidation catalyst and a Bucyrus Model 399823 heat exchanger. This recommendation is provided with the understanding that the General Specification Sheet (Attachment 1) be strictly adhered to.

As with all ceramic filters the TAC recommends that a smoke dot test be conducted during every 100 hour maintenance period and the results recorded on the 100 hour maintenance report. If the result of the smoke dot test is above #3 the equipment must be removed from service and corrective action taken to bring the smoke dot result below #3.

Should the Director receive a request for temporary approval for use prior to the next TAC meeting, the TAC will recommend temporary approval until the next scheduled TAC meeting on January 9, 2013 at which time permanent approval will be recommended.



Paul Borchick



Ron Bowersox

## General Specification Sheet

EQUIPMENT MANUFACTURER ROSEBUD MINING COMPANY MODEL RMC-RV1 DATE 8-6-12

### I. Engine

Manufacturer	Deutz	Particulate Index (PI)	2500
Manufacturer Address	3883 Steve Reynolds Blvd. Norcross, Ga. 30093		
Engine Model No.	BF4I2011	Gaseous Ventilation Rate (CFM)	6000
Engine Serial No.		Raw DPM (gr/hr)	3.71
HP/RPM (rated)	78@2800	MSHA Part 7 Approval #	07-ENA-040004-1
Low Idle (RPM)	900	MSHA Part 7 Ventilation Rate (CFM)	6000
Max. Dirty Intake Air Restriction H <sup>2</sup> O	26	Type of Aspiration	Turbo
Max. Allowed Backpressure H <sup>2</sup> O	30	Turbocharger Boost (psi)	17 max
High Idle (RPM)	3100	Fuel Delivery System	Mechanical
Water-jacketed components	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	Engine Cooling via	oil

### II. Particulate Filter

Manufacturer	Engine Control System (ECS) Or Filter Testing Service		
Manufacturer Address	165 Pony Drive Newmarket, Ontario, Canada, L3Y7V1		
Model Number	FST-115-26 or-ECS-S18	System Type	High Temp Paper or Ceramic SIC
MSHA Efficiency Rating	95% (SIC 87%)	MSHA Approved	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
Treated DPM mg/m <sup>3</sup> when diluted w/100% Part 7 ventilation rate (show calc on separate sheet)	w/Paper .018 SIC W/SIC .046		

### III. Catalyst

Manufacturer	Engine Control System (ECS)
Manufacturer Address	165 Pony Drive New Market, Ontario, Canada
System Name	A-Z Severe Duty
Model Number	AZ-27

### IV. Flame Arrestor

Manufacturer	Controls & Instrumentation Company, Inc.		
Manufacturer Address	7950 West Winds Blvd. Concord, NC 28027		
System Name	CIC		
Model Number	804/D-II-C4C	MESG	Group D vapor Service

### V. Heat Exchanger

Manufacturer	Bucyrus	Model or Part #	399823
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### VI. Fire Suppression System

ATTACHMENT 1

# DPM Calculation Sheet

Engine Model	Deutz BF4L 2011
MSHA Number	07-ENA040004
Ventilation Rate	6,000 cfm
Filter Type	Ceramic (SIC)
Filter Efficiency	87%

## Convert DPM From (grams/hr) to (mg/min)

$$(3.7\text{g/hr.}) \times (1\text{hr./}60\text{min}) \times (1000\text{mg/g}) = 61.66\text{ mg/min}$$

## Convert Ventilation Rate from cfm to m<sup>3</sup>/min.

$$(6000\text{ ft}^3/\text{min}) \times (.028315\text{ m}^3/\text{ft}^3) = 169.89\text{ m}^3/\text{min.}$$

## Divide DPM (mg/min) by Ventilation Rate (m<sup>3</sup>/min.)

$$(61.66\text{mg/min}) \div (169.89\text{ m}^3/\text{min.}) = .36\text{ mg/m}^3.$$

## Solve for Ambient DPM Level AT 87% Filter Efficiency

$$.36\text{ m}^3/\text{min} \times (100-87\% \text{ Filter Efficiency}) = .046\text{ mg/ m}^3$$