

MINUTES
Technical Advisory Committee on Diesel-Powered Equipment
New Stanton District Office
July 22, 2016

The Technical Advisory Committee on Diesel-Powered Equipment (TAC) held a regular meeting on July 22, 2016, in the Westmoreland Room at the DEP New Stanton District Office. The meeting began at 10 a.m.

Attendance:

Members Present:

Ron Bowersox
Paul Borchick

Others Present:

Art Brower, DEP, BMS
Ron Vlassich, Rosebud Mining
Gene Davis, Davis Training & Consulting
Marshall Williams, Brookville
Mark Crable, Royal Hydraulic
Colvin Carson, DEP, BMS
Chris Yeager, DEP, BMS
Chas Washlack, DEP, BMS
Vince Little, DEP, BMS
Jim Ross, DEP, BMS
Jeff Kerch, DEP, BMS
Rich Wagner, DEP, BMS

Minutes of the April 13, 2016, meeting were distributed and reviewed. TAC members Ron Bowersox and Paul Borchick approved the minutes with the following change:

The wraps ~~should~~ *shall* comply with the following conditions:

Old Business:

A discussion ensued regarding the marking of wraps with manufacturer's part numbers. It was decided all parts should be marked and a record kept in the equipment log book.

The Brookville representative asked what the procedure was to change from polyamide to a thermal wrap/blanket. The response was to send detailed information the Bureau's approval section for review and inclusion in the equipment's approval file.

Action on the Brookville Model 25T174D DPM filter revision

June 3, 2016	The request was received from the manufacturer
June 8, 2016	The Bureau requested the TAC to review and comment
June 30, 2016	The Bureau and TAC performed an inspection
June 30, 2016	The TAC issued their report recommending temporary approval
July 5, 2016	The client requested temporary approval for use until the TAC meeting
July 22, 2016	TAC issued formal approval

The TAC's detailed report is attached.

A discussion ensued regarding a typographical error in the Law. A letter to Industry and the Department will be issued by the Bureau Director to clarify as noted below:

Section 419. Exhaust gas monitoring and control.

- (a) Concentration.--In monitoring and controlling exhaust gases, the ambient concentration of exhaust gases in the mine atmosphere shall not exceed 35 parts per million for carbon monoxide and three parts per million for nitrogen dioxide. The concentration of these exhaust gases shall be measured at the equipment operator's or equipment attendant's position and *in*by the last piece of diesel-powered equipment operating in the same split of air. Measurements shall be made weekly or more often if necessary by a qualified individual and shall be conducted under the requirements of this section.

A copy of the Directors letter is attached.

New Business:

Gene Davis commented that MSHA is in the rulemaking process for a new diesel DPM regulation.

With no further business to discuss, the meeting was adjourned at 10:25 a.m.

The next meeting will be at 10 a.m. on October 12, 2016, at the DEP New Stanton Office, Westmoreland Room.

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

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Bureau of Mine Safety
New Stanton

June 30, 2016

Colvin Carson, Director
Bureau of Mine Safety
Department of Environmental Protection
131 Broadview Road
New Stanton, PA 15672

RE: Brookville Model 25T174D locomotive utilizing a Deutz BF6M2012C diesel engine (MSHA ID 07-ENA040008 - Part 7) 208HP @ 2500 RPM with an AirFlow Management System emissions control system using an MSHA Approved AirFlow ACSMNC DPM Filter / Diesel Oxidation Catalyst (87% Efficient).

Dear Mr. Carson:

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 June 3, 2016 Brookville Equipment Corp. submitted a request for evaluation of their Model 25T174D locomotive utilizing a Deutz BF6M2012C diesel engine (MSHA ID 07-ENA040008 - Part 7) 208HP @ 2500 RPM with an AirFlow Management System emissions control system using an MSHA Approved Airflow ACSMNC DPM Filter / Diesel Oxidation Catalyst (87% Efficient). This new passively regenerating diesel filter / DOC catalyst designed emissions control package replaced the previously approved DST emissions control package.

On June 8, 2016 the Director of BMS requested the TAC to evaluate the Brookville Model 25T174D locomotive engine and emission package and to advise the Department regarding the TAC's recommendation as to whether the referenced equipment meets requirements of Section 403 of the Act. The engine and emissions control package has not been previously approved under Section 403 of the Act.

The diesel power package includes the following items:

- Deutz BF6M2012C diesel engine (MSHA ID 07-ENA040008 - Part 7) 208HP @ 2500 RPM with an AirFlow Management System emissions control system
- MSHA Approved AirFlow ACSMNC DPM Filter / Diesel Oxidation Catalyst (87% Efficient).
- This new AirFlow system uses a fan forced air mixing box design to cool the exhaust gas that is exiting the system.

More detailed information on the specifications of the diesel power package is included on the General Specification Sheet which is attached as Attachment 1.

Investigation

On June 30, 2016 the TAC and DEP traveled to Bailey Mine in Wind Ridge, PA to inspect the equipment when it became available. 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. The CO measured on the clean side of the emissions control system was 2 ppm when measured during the stall test. The raw CO measured was 122 ppm during the stall test.

Monitoring of the exhaust gas temperature produced a high exhaust gas temperature reading of 110° F at the exit of the mixing box, which is well below the 302° F allowed by Section 403 (b)(4) of the Act. The maximum surface temperature observed was 292° F on the exhaust manifold, which is below the 302° F allowed by Section 403 (b)(3) of the Act. The maximum engine coolant temperature observed was 190° F, and the maximum engine oil temperature observed was 140° F. A smoke dot test was conducted on the exhaust system at the exit of the mixing box and the result yielded a number 1 on the smoke dot scale.

The after-treatment system is fitted with a MSHA Approved Airflow ACSMNC DPM Filter / Diesel Oxidation Catalyst rated at 87% efficient. The engine and filter extrapolations show that the diesel power package will result in an average ambient concentration of .042 mg/m³ of diesel particulate matter when diluted by 100% of the MSHA approval plate ventilation rate for this engine, which is well below the 0.12 mg/m³ requirement of Section 403 (a)(1) the Act. (Attachment 2)

In addition to the testing that was conducted, our investigation and our observations confirmed that the diesel power package is capable of meeting all the requirements of Section 403 of the Act.

The TAC had a few concerns regarding the mixing box that were addressed by the Bailey and Brookville representatives.

- There is a vacuum switch installed on the mixing box forced air fan that will shut down the engine in the event of a fan failure or air path obstruction, and also if the vacuum line is removed or cut. It was agreed this vacuum switch will be tested every 100 hour maintenance inspection for proper operation.
- A test was conducted to measure the surface temperature on the exhaust and mixing box immediately after the engine was shut down. This showed no significant increase in the surface temperature on any exhaust components, and all were maintained below 302° F.
- Since the forced air fan draws intake air into the mixing box, the TAC was concerned that there may be an accumulation of dust that may be deposited inside the mixing box. It was agreed that this area will be inspected and cleaned as needed during each 100 hour maintenance inspection.
- Since the AirFlow Model ACSMNC filter / catalyst system is a passively regenerated system, the results of the smoke dot test will determine when the components will be replaced. Any smoke dot test above a 3 will require the components to be replaced or regenerated (cleaned). Smoke dot tests will be conducted as part of every 100 hour maintenance inspection or more often if necessary.
- The TAC requested that the performance of this new designed emissions control system be closely observed. It was agreed that the mine will share by email with the TAC and DEP the first 3 full 100 hour maintenance inspection results which will include emission test results, smoke dot test results, vacuum switch shutdown test results (both plugged hose and disconnected hose), and maintenance records of any changed components on the emissions system.

Recommendation

Our recommendation is based upon the data supplied by Brookville Equipment Corporation, the results of the tests conducted on June 30, 2016, as well as the data acquired and observations made during our investigation. The power package utilizing a Deutz BF6M2012C diesel engine (MSHA ID 07-ENA040008 - Part 7) 208HP @ 2500 RPM with an AirFlow Management System emissions control system using an MSHA Approved Airflow ACSMNC DPM Filter / Diesel Oxidation Catalyst meets all requirements of Section 403 of Chapter 4 of the Pennsylvania Bituminous Coal Mine Safety Act. As such, we are recommending approval of the above described diesel power package with the following stipulations:

- There is a vacuum switch installed on the mixing box forced air fan that will shut down the engine in the event of a fan failure or air path obstruction, and also if the vacuum line is removed or cut. It was agreed this vacuum switch will be tested every 100 hour maintenance inspection for proper operation.
- Since the forced air fan draws intake air into the mixing box, the TAC was concerned that there may be an accumulation of dust that may be deposited inside the mixing box. It was agreed that this area will be inspected and cleaned as needed during each 100 hour maintenance inspection.
- Since the AirFlow Model ACSMNC filter / catalyst system is a passively regenerated system, the results of the smoke dot test will determine when the components will be replaced. Any smoke dot test above a 3 will require the components to be replaced or regenerated (cleaned). Smoke dot tests will be conducted as part of every 100 hour maintenance inspection or more often if necessary.
- The TAC requested that the performance of this new designed emissions control system be closely observed. It was agreed that the mine will share by email with the TAC and DEP the first 3 full 100 hour maintenance inspection results which will include emission test results, smoke dot test results, vacuum switch shutdown test results (both plugged hose and disconnected hose), and maintenance records of any changed components on the emissions system.

This recommendation is provided with the understanding that the General Specification Sheet (Attachment 1) be strictly adhered to.

If the Director should receive a request to use this equipment prior to the next scheduled TAC meeting, the TAC will recommend temporary approval until the next regular scheduled TAC meeting on July 22, 2016 at which time permanent approval will be recommended.



Paul Borchick



Ron Bowersox

**BROOKVILLE EQUIPMENT CORP.
MODEL 25T174D
Diesel 25 Ton Locomotive**

General Specifications of the Diesel-Powered Equipment Package

Engine Manufacturer		Deutz		
Engine Model		BF6M2012C		
Horsepower		208 HP		
Rated Speed		2500 RPM		
Manufacturer's Recommended Exhaust Back-pressure (InH2O)		40 Inches Water Gauge		
Maximum Exhaust Out Temperature		869 deg F		
MSHA Engine Approval		MSHA Part 7		
MSHA Certification No.		07-ENA040008		
Rated Speed		2500 RPM		
Rated Horsepower		208 HP		
Exhaust GAS Flow (SCFM)		1510.1 CFM		
ISO 8178-1 Average DPM (gr/hr)		5.578 gr/hr		
Average Ambient DPM Level (mg/m3)		0.011 mg/m3		
MSHA Ventilation Rate (CFM)		9,000 CFM (Part 7)	CFM (Part 32)	
Pa. State Ventilation Rate (CFM)				
Emissions Control System			AirFlow Management System	
Fuel Injection Pump	Make	Bosch		
	P/N	TBD		
Oxidation Catalyst	Make	ACSMNC		
	P/N	Low NO2 15" TBD		
Heat Exchanger	Make	Dry Systems Technologies		
	P/N	M190-301-01		
DPM Filter	Make	AirFlow	Model	MinNoCat DOC
	P/N	TBD		
	Air Rating (CFM)	3000		
	Surface Area (In3)	2,592		15"
	Efficiency			87%
	Recommended Exhaust Back-Pressure			25 Inches Water Gauge

CALCULATION: AMBIENT DPM EMISSION LEVEL FOR DUETZ BF6M2012C DIESEL ENGINE

RE: To meet the requirements of the Pennsylvania ACT 182 Diesel Powered Equipment Law, Section 203-A, a) 1), entitled Exhaust Emission Control

To comply with section 203-A-a-1, the tailpipe emissions for the equipment cannot exceed $0.12\text{mg}/\text{m}^3$, when diluted by 100% of the MSHA approval plate ventilation rate for that diesel engine.

For Brookville Equipment Corporation's request for BOTE approval for our Model 25T174D Locomotive, the Deutz BF6M2012C Diesel Engine with AirFlow Catalyst System Model ACSMNC, will be used at 208 hp @ 2500 rpm.

MSHA specifications for the Deutz BF6M2012C:
Approval No: 07-ENA040008
Ventilation Req't: 9,000 cfm

The MSHA approved ventilation rate for the Deutz is as follows:

Ventilation Rate: 9,000 cfm under MSHA approval 07-ENA040008

Using the equation:

$$\text{Ambient DPM Level} = \text{DPM}_{\text{AVG}} = \text{PT}/V_{\text{vent}}$$

Where:

V_{VENT} = Quantity of ventilation air req'd per MSHA 24/D88

$$= \frac{9,000 \text{ ft}^3}{\text{min}} \times \frac{1 \text{ m}^3}{35.31 \text{ ft}^3}$$

$$= 254.89 \text{ m}^3/\text{min}$$

Average DPM level over 8178-1 8 mode Test = 4.89 g/hr

Based on Southwest Research Institute testing filter efficiency was found to be 87%.
Therefore the DPM would be $4.89 \times .13 = 0.6357$ g/hr

PT = Average DPM level

$$\begin{aligned} &= \frac{0.6357 \text{ gr} \times 1000\text{mg}}{1\text{hour}} \times \frac{1\text{hour}}{60\text{min}} \\ &= 10.595 \text{ mg/min} \end{aligned}$$

SOLVE FOR AMBIENT DPM LEVEL:

$$\begin{aligned} \text{DPM}_{\text{AMB}} &= \frac{(10.595 \text{ mg/min})}{254.89 \text{ m}^3/\text{min}} \\ &= 0.042 \text{ mg.m}^3 \end{aligned}$$

CONCLUSION: To comply with section 203-A-a-1, the tailpipe emissions for the equipment cannot exceed 0.12 mg/m^3 , when diluted by 100% of the MSHA approval plate ventilation rate for that diesel engine with AirFlow Catalyst $0.042 \text{ mg/m}^3 < 0.12 \text{ mg/m}^3$, therefore, this engine package meets the requirement.

July 19, 2016

TO: All Commonwealth Bituminous Mining Operations

RE: Typographical Error in Section 419(A) of the Bituminous Coal Mine Safety Act
'and by' should be interpreted to read '*inby*'

During the July 13, 2016, meeting of the Technical Advisory Committee on Diesel-Powered Equipment (TAC), it was brought to the Department's attention that a typographical error exists in Section 419(A) of the Act. In the second sentence the statute states "The concentration of these exhaust gases shall be measured at the equipment operator's or equipment attendants position *and by* the last piece..." The italicized words indicate the error. The words 'and by' should read '*inby*.' This error was discussed with the TAC and the authors of the statute, and it was determined that the statute should be interpreted to read as if '*inby*' is substituted for 'and by.'

If you have any questions or need further clarification, please feel free to contact me at cocarson@pa.gov or 724.404.3141.

Sincerely,



Colvin C. Carson
Director

cc: Ron Bowersox, TAC
Paul Borchick, TAC