



October 18, 2016

Mr. Cameron Miller
Brookville Services, LLC
4 South Pickering Street
Brookville, PA 15825

Re: Brookville 25T174D Locomotive Filter
MODEL: 25 Ton Loco; **SERIAL NO.:** 9198; **VOLTAGE:** n/a; **HP:** 208
APSID NO: 923685
APPROVAL NO. BOTE-DEES 50-14
Modification from a fan cooled exhaust system to a liquid cooled system

Dear Mr. Miller:

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 September 16, 2016, Brookville Services, LLC submitted a request to the Technical Advisory Committee ("TAC") and Bureau of Mine Safety to have this piece of equipment inspected. On September 19, 2016, The DEP Bureau Director requested the TAC to review and comment on this request.

The TAC and DEP traveled to Bailey Mine in Wind Ridge, PA to conduct their investigation and issued their report recommending temporary approval on October 5, 2016. Permanent approval was recommended at the TAC meeting on October 12, 2016.

Based on the recommendation of the TAC and the equipment approval staff, your request for approval is granted.

If you have any questions on this request, please contact me at either cocarson.pa.gov or at 724.404.3154.

Sincerely,

A handwritten signature in black ink, appearing to read "Colvin C. Carson".

Colvin C. Carson
Director

Enclosure(s)

cc: Ron Bowersox, TAC
Paul Borchick, TAC

Pennsylvania Technical Advisory Committee On Diesel Powered Equipment

Paul Borchick

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Ron Bowersox

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October 5, 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 Model M15S15 DPM Filter / ACSMNC Diesel Oxidation Catalyst (87% Efficient) and a DST M190-301-01 Heat Exchanger.

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 September 16, 2016 Brookville Equipment Corp. submitted a request for evaluation of their 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 Model M15S15 DPM Filter / ACSMNC Diesel Oxidation Catalyst (87% Efficient) and a DST M190-301-01 Heat Exchanger. This new designed emissions control system utilizes a DST heat exchanger which replaced the previously approved package that utilized a fan forced air mixing box to cool the exhaust gas.

On September 19, 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
- AirFlow Management System emissions control system using an MSHA Approved AirFlow Model M15S15 DPM Filter / ACSMNC Diesel Oxidation Catalyst (87% Efficient)
- DST M190-301-01 Heat Exchanger

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 September 29, 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 6 ppm when measured during the stall test. The raw CO measured was 150 ppm during the stall test.

Monitoring of the exhaust gas temperature produced a high exhaust gas temperature reading of 160° F at the exit of exhaust pipe, which is well below the 302° F allowed by Section 403 (b)(4) of the Act. The maximum surface temperature observed was 250° 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 165° 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 Model M15S15 DPM Filter / ACSMNC 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)

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


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.

Recommendation

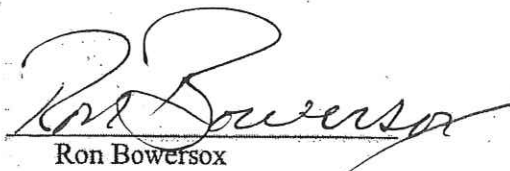
Our recommendation is based upon the data supplied by Brookville Equipment Corporation and Bailey Mine, the results of the tests conducted on September 29, 2016, as well as the data acquired and observations made during our investigation. The power package utilizing a Deutz BF6M2012C diesel engine (MSHA ID 07-ENA040008 - Part 7) 208HP @ 2500 RPM with an AirFlow Management System emissions control system using an MSHA Approved AirFlow Model M15S15 DPM Filter / ACSMNC Diesel Oxidation Catalyst (87% Efficient) and a DST M190-301-01 Heat Exchanger 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.

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 October 12, 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 (InH ₂ O)		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/m ³)		0.011 mg/m ³		
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 P/N	Bosch 17-10938		
Oxidation Catalyst	Make P/N	ACSMNC Low NO ₂ 15" 08-19429		
Heat Exchanger	Make P/N	Dry Systems Technologies M190-301-01		
DPM Filter	Make P/N	AirFlow 08-19429	Model M15S15	MinNoCat DOC
	Air Rating (CFM)	3000		15"
	Surface Area (In ³)	2,592		
	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

$$= \frac{0.6357 \text{ gr} \times 1000 \text{ mg}}{1 \text{ hour} \quad 1 \text{ gr}} \times \frac{1 \text{ hour}}{60 \text{ min}}$$

$$= 10.595 \text{ mg/min}$$

SOLVE FOR AMBIENT DPM LEVEL:

$$\text{DPM}_{\text{AMB}} = \frac{(10.595 \text{ mg/min})}{254.89 \text{ m}^3/\text{min}}$$

$$= 0.042 \text{ mg.m}^3$$

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.