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

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Bureau of Mine Safety
Uniontown

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August 20, 2010

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

Sbaffoni
Bookshaw
McCaffrey
Antoon
Gaida
original/dunn

RE: A. L. Lee diesel compressor power pack utilizing a Deutz D2011LO2i -30 HP engine and a DST M70 DPM filter

Dear Mr. Sbaffoni:

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

A. L. Lee Corporation submitted a request to the Bureau of Mine Safety (BMS) for approval for an A. L. Lee diesel compressor power pack utilizing a Deutz D2011LO2i -30 HP engine and a DST M70 DPM filter

On May 12, 2010 the Director of BMS requested the TAC to evaluate the A.L. Lee compressor power pack 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 diesel power package includes the following items:

- Deutz D2011LO2i -30 HP @ 2800 RPM engine (MSHA Approval #07-ENA040010)
- Emissions Control System DST Management System
 - DST M80-233-02 oxidation catalyst
 - DST M70-417-01 DPM filter (96% efficient)
 - DST M195-301 -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 May 28, 2010 the TAC and DEP traveled to A.L. Lee Corporation to inspect the equipment when it became available. The TAC evaluated the engine and exhaust emissions package. This diesel compressor power pack was being utilized to power an A.L. Lee track mounted bulk rockduster.

Emissions testing of the engine and after-treatment system were performed, as well as exhaust gas temperature monitoring and stall test procedure. Since this diesel unit is not capable of inducing an engine stall the same as a wheeled transportation unit, an alternate method was needed. The engine stall was achieved by bringing the engine up to operating temperature and then while at full throttle, opening the valve on the compressor to divert compressed air to the diffuser vent line, which was regulated at 30 psi. The results of the emission tests showed the engine was performing within MSHA's approval specifications.

During the testing on May 28, 2010 there were several concerns from the TAC and DEP. Monitoring of the exhaust gas temperature produced a high exhaust gas temperature reading of 312° F, which is above the 302° F allowed by Section 403 (b)(4) of the Act. The maximum surface temperature observed was 425° F on the exhaust manifold after conducting all CO testing. This also exceeded the maximum 302° F allowed by Section 403. There were issues with several operator gages not working properly, as well as warning lights not working properly. It was agreed that changes and repairs to the unit were to be made and another TAC inspection would be necessary.

On August 3, 2010, after changes and repairs were completed on the power pack, the TAC and DEP re-inspected the unit. Emissions testing of the engine and after-treatment system were performed, as well as exhaust gas temperature monitoring and stall test procedure. The maximum surface temperature observed was 210° F, the maximum exhaust gas temperature measured was 238° F, and the maximum engine oil temperature observed was 205° F. These temperatures were in compliance with Section 403 of the Act.

The results of the emissions tests showed the engine was performing within MSHA's approval specifications. The after-treatment system is fitted with DST M70-417-01 DPM filter (96% efficient). The engine and filter extrapolations show that the diesel power package will result in an average ambient concentration of .051 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 .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.

Recommendation


Our recommendation is based upon the data supplied by A. L. Lee Corp, the results of the tests conducted on August 3, 2010, as well as the data acquired and observations made during our investigation. The TAC has determined that the A. L. Lee diesel compressor power pack utilizing a Deutz D2011LO2i -30 HP engine and a DST M70 DPM filter 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. This recommendation is provided with the understanding that the General Specification Sheet (Attachment 1) be strictly adhered to.

Additional TAC stipulations for approval:

- The unit must be attended during operation as required in Section 401(b) of the Act.
- The stall test procedure will be posted on the unit and all persons required to perform the 100 hour maintenance checks as required by Section 418 will be trained in how to perform the engine stall.
- The minimum quantities of ventilating air must be maintained at all times during operation as required by Section 404 of the Act.

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 October 13, 2010 at which time permanent approval will be recommended.


Paul Borchick


Ron Bowersox

APS ID: 715857

June 6, 2007

XXX EQUIPMENT CORP.
MODEL XXXXX
Personnel Carrier

General Specifications of the Diesel-Powered Equipment Package

Engine Manufacturer		DEUTZ		
Engine Model		D2011 L02i		
Horsepower		30.2 HP		
Rated Speed		2800 RPM		
Manufacturer's Recommended Exhaust Back-pressure (InH ₂ O)		20" H ₂ O		
Maximum Exhaust Out Temperature		1202° F		
MSHA Engine Approval		MSHA Part 7		
MSHA Certification No.		07-ENAO40010		
Rated Speed		2800 RPM		
Rated Horsepower		30.2 HP		
Exhaust GAS Flow (SCFM)		176.6 CFM		
ISO 8178-1 Average DPM (gr/hr)		3.26		
Average Ambient DPM Level (mg/m ³)		0.051 mg/m ³		
MSHA Ventilation Rate (CFM)		Part 7) 1500 CFM		
Pa. State Ventilation Rate (CFM)				
Emissions Control System				
Fuel Injection Pump	Make	MOTORPAL		
	P/N	428-7049		
Oxidation Catalyst	Make	DST		
	P/N	M80-233-02		
Heat Exchanger	Make	DST		
	P/N	M195-301-01		
DPM Filter	Make	DST	Model	M70
	P/N	M70-417-01	Filter Size	8"
	Air Rating (CFM)	600 CFM	Filter Length	16"
	Surface Area (in ²)	7870 SQ. IN.		
	Efficiency			96%
	Recommended Exhaust Back-Pressure			20" H ₂ O

Rev. 1 (April 28, 2004)

ATTACHMENT 1

CALCULATION: AMBIANT DPM EMISSION LEVEL FOR DEUTZ D2011LO2i 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 0.12mg/m³, when diluted by 100% of the MSHA approval plate ventilation rate for that diesel engine.

For A. L. Lee Corporation's request for BOTE approval for our Model 2011APO Diesel/Compressor Power Package the DEUTZ Diesel Engine will be used at 30.2 hp @ 2800 rpm.

MSHA specifications for the DEUTZ D2011LO2i:
Approval No. 07-ENA040010-0
Ventilation Req't: 1,500 cfm

The MSHA approved ventilation rate for the DEUTZ D2011LO2i is as follows:

Ventilation Rate 1,500 cfm under MSHA approval 07-ENA04001-0

Using the equation:

$$\text{Ambient DPM Level} = \text{DPM}_{\text{AVG}} = \text{PT} / \text{V}_{\text{VENT}}$$

Where:

$$\begin{aligned} \text{V}_{\text{vent}} &= \text{Quantity of ventilation air req'd per MSHA 24/D88} \\ &= \frac{1,500 \text{ ft}^3}{\text{min}} \times \frac{1 \text{ m}^3}{35.31 \text{ ft}^3} \\ &= 42.48 \text{ m}^3/\text{min} \end{aligned}$$

Average DPM level over 8178-1 8 mode test = 3.26 g/hr

Based on Southwest Research Institute testing, filter efficiency was found to be 96%.

Therefore the DPM would be $3.26 \times .04 = 0.130$ g/hr

$$\begin{aligned} \text{PT} &= \text{Average DPM level} \\ &= \frac{0.130 \text{ gr}}{1 \text{ hour}} \times \frac{1000 \text{ mg}}{1 \text{ gr}} \times \frac{1 \text{ hour}}{60 \text{ min}} \end{aligned}$$

$$= 2.17 \text{ mg/min}$$

ATTACHMENT 2 (1)