

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

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Paul Borchick

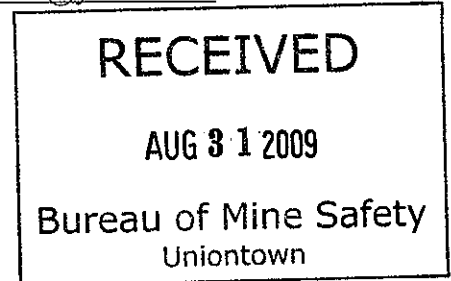
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August 20, 2009

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



RE: Engine and emissions control package evaluation under Sections 403, 417 and 418 of the Act for a Cummins A1700 37HP Engine with Rhomac DEC4252 emissions control system using an ENK Model 25-19175 DPM filter and a Clean Air Model CPD-0466-BCCN40MM oxidation catalyst in a Rhomac Model PC732 diesel rubber tire personnel carrier.

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 June 9, 2009 Rhomac, Inc. submitted a request to the TAC and Bureau of Mine Safety (BMS) for approval for a Rhomac Model PC732 rubber tire personal carrier using a Cummins A1700 37HP Engine with a Rhomac DEC4252 emissions control system using an ENK Model 25-19175 DPM filter and a Clean Air Model CPD-0466-BCCN40MM oxidation catalyst. The engine and emissions control package has not been previously approved under Section 403 of the Act.

Rhomac also requested an alternative 90 second test procedure for CO. With the implementation of the Bituminous Coal Mine Safety Act in January 2009, the required CO tests under Sections 417 and 418 of the Act are the 90 second tests, so TAC evaluation is needed.

On June 15, 2009 the Director of BMS requested the TAC to evaluate the Rhomac Model PC732 rubber tire personal carrier using a Cummins A1700 37HP Engine with a ENK Model 25-19175 DPM filter and a Clean Air Model CPD-0466-BCCN40MM oxidation catalyst 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:

- Cummins A1700 37HP @ 2800 RPM diesel engine (MSHA Certification No. 07-ENA060011)(Part 7)
- Rhomac DEC 4252 Emissions Control System
 - Clean Air Model CPD-0466-BCCN40MM oxidation catalyst
 - ENK Model 25-19175 DPM filter (MSHA efficiency rating 95 %)
 - Air cooled 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 August 6, 2009 the TAC and DEP traveled to Rhomac, Inc. in Mount Storm, WV 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. At the end of the 90 second CO tests the Raw CO was measured at 121ppm, and the Treated CO was measured at 67ppm. The results of the emission tests showed the engine was performing within MSHA's approval specifications.

Monitoring of the exhaust gas temperature produced a high exhaust gas temperature reading of 190° F, which is well below the 302° F allowed by Section 403 (b)(4) of the Act. It is our belief that the heat exchanger will maintain the exhaust gas temperature well below the required 302 ° F. The maximum surface temperature observed was 215° F on the exhaust manifold after conducting all the CO testing.

The after-treatment system is fitted with an ENK Model 25-19175 DPM filter. The filter is rated by MSHA at a 95 % efficiency rating. The engine and filter extrapolations show that the diesel power package will result in an average ambient concentration of .049 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)

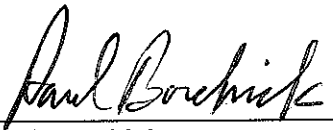
In addition to the testing that was conducted, our investigation and our observations confirmed that the diesel power package is capable of meeting all the requirements of Section 403 of the Act.

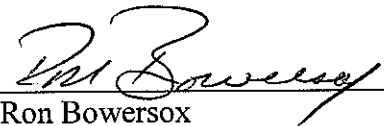
Recommendation

Our recommendation is based upon the data supplied by Rhomac, the results of the tests conducted on August 6, 2009, as well as the data acquired and observations made during our investigation. The TAC has determined that the Cummins A1700 37HP Engine with a Rhomac DEC4252 emissions control system using an ENK Model 25-19175 DPM filter and a Clean Air Model CPD-0466-BCCN40MM 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. This recommendation is provided with the understanding that the General Specification Sheet (Attachment 1) be strictly adhered to.

No TAC action is required on the request for the 90 second alternate CO test since this test is the standard under Chapter 4 of the Pennsylvania Bituminous Coal Mine Safety Act. (Attachment 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 October 14, 2009 at which time permanent approval will be recommended.


Paul Borchick


Ron Bowersox

General Specification Sheet

I. Engine

Manufacturer	Cummins	High Idle (RPM)	3300
Manufacturer Address	Box 3005 Columbus, IN. 47202-3005	Particulate Index (PI)	2000 cfm
Model Number	A1700	Gaseous Ventilation Rate (CFM)	2000 cfm
Serial Number	70016921	Raw DPM (gr/hp)	3.18 g/hr
Horsepower	37@2800 rpm	MSHA 7E Approval Number	07-ENA060011
Max. dirty Intake Air Restriction (H²O)	25"	Type of Aspiration	Natural
Max. Allowed Backpressure H²O	40"	Fuel Delivery System	Mechanical Injection
Turbocharger Boost Pressure	N/A	Low Idle (RPM)	900

RHOMAC DEC 4252 EMISSION CONTROL SYSTEM

II. Particulate Filter

Manufacturer	ENK Industrial & Battery CO. INC.
Manufacturer Address	4420 Veterans Memorial Dr. Fairfield, Al. 35064 Ed Molish-(205-786-4566
Model Number	ENK Part. No. 25-19175
System Type	Disposable
Efficiency Rating	95%

III. Catalyst

Manufacturer	CleanAir Systems Inc
Manufacturer Address	4379 Center Place Santa Fe, NM. 87507
System Name	Platinum based oxidation catalyst
Model Number	CPD 0466 BCCN40MM

DPM Calculation Sheet

Engine Model	Cummins A1700
MSHA Number	07-ENA060011
Ventilation Rate	2,000 cfm
Filter Type	ENK - Paper
Filter Efficiency	95%

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

$$(3.18\text{g/hr.}) \text{ :- } (1\text{hr./}60\text{min}) \times (1000\text{mg/g}) = 53 \text{ mg/min}$$

Convert Ventilation Rate from cfm to m³/min.

$$(2000 \text{ ft}^3/\text{min}) \times (.028315 \text{ m}^3/\text{ft}^3) = 56.63 \text{ m}^3/\text{min.}$$

Divide DPM (mg/min) by Ventilation Rate (m³/min.)

$$(53\text{mg/min}) \text{ :- } 56.63 \text{ m}^3/\text{min.} = .988 \text{ mg/m}^3.$$

Solve for Ambient DPM Level AT 95% Filter Efficiency

$$.988 \text{ m}^3/\text{min} \times (100-95\% \text{ Filter Efficiency}) = .049 \text{ mg/ m}^3$$

EMISSION TEST PROCEDURE FOR PENNSYLVANIA
DIESEL-POWERED EQUIPMENT

Hydraulic Stall

Baseline Procedure Section 417

1. Place the equipment into an intake entry. Make sure no personnel are in front of or behind the equipment during test.
2. Set the brakes and chock the wheels.(if applicable)
3. Start the diesel engine and allow it to warm up to operating temperature.
4. Install the carbon monoxide CO sampling devices into the untreated exhaust gas port provided.
5. Allow CO sampling device to stabilize.
6. Induce a load on the engine.
7. With load induced, put the engine at full throttle for 90 seconds. Stop test immediately if any controls or indicators are not in their operating range, or if equipment moves while at stall.
8. Record three CO readings at 60, 75, and 90-second intervals during stall.
9. Return engine to low idle with no load. Allow hydraulic fluid temperature to stabilize.
10. Take an average of the three readings.
11. Comply with record-keeping requirements pursuant to Section 414.

100 hour test procedure Section 418

1. Place the equipment into an intake entry. Make sure no personnel are in front of or behind the equipment during test.
2. Set the brakes and chock the wheels.(if applicable)
3. Start the diesel engine and allow it to warm up to operating temperature.
4. Install the carbon monoxide CO sampling device into the untreated exhaust gas port provided.
5. Allow CO sampling device to stabilize.
6. Induce a load on the engine.
7. With load induced, put the engine at full throttle for 90 seconds. Stop test immediately if any controls or indicators are not in their operating range, or if equipment moves while at stall.
8. Record three CO readings at 60, 75, and 90-second intervals during stall.
9. Return engine to low idle with no load. Allow hydraulic fluid temperature to stabilize.
10. Take an average of the three CO readings.
11. Install the carbon monoxide CO sampling device into the treated exhaust gas port provided.
12. Repeat steps (5) thru (10).
13. If CO reading for untreated exhaust gas is greater than twice the baseline established under 417(b), or if the CO reading for treated exhaust is greater than 100 ppm, the equipment has failed and must be serviced and retested before it is returned to regular service; and
14. Comply with record-keeping requirements pursuant to Section 414.