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# Pennsylvania Technical Advisory Committee Diesel Powered Equipment

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November 22, 2003

Joseph Scaffoni, Director  
Bureau of Deep Mine Safety  
Fayette County Health Center  
100 New Salem Road, Room 167  
Uniontown, Pa 15402

RECEIVED

DEC 15 2003

BUREAU OF DEEP MINE SAFETY

JAS  
WBB  
ADG

Re: Brookville – 20 Ton Locomotive Model  
Number 20T24OD with Cummins QSB C240  
Engine

Dear Mr. Scaffoni,

Article II-A of the Pennsylvania Bituminous Coal Mining Act of 1961 provides for the use of diesel powered equipment in underground bituminous coal mines. Section 224-A created a Technical Advisory Committee on Diesel Powered Equipment (TAC) for the purpose of advising the Secretary regarding implementation of Article II-A and evaluation of alternative technology or methods of meeting the requirements for diesel powered equipment as set forth in Article II-A.

Brookville Mining Equipment Corporation requested an alternate test to comply with CO emissions testing required by Sections 217- A and 218-A. The TAC along with representatives from the BDMS traveled to Brookville on November 20, 2003 in order to evaluate both the need for an alternate test procedure as well as the alternate test procedure it self.

### Investigation

We first installed an inline oil cooler to allow the engine to be torque stalled for the required 5 minutes. This test was run a number of times with the cooler inline. We then removed the cooler and found the engine could not be operated for more than 2 minutes with out the cooler. This is the basis for this recommendation.

Also during this testing a number of questions arose as follows:

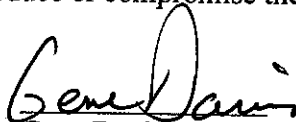
1. Since we do not have any lug curve numbers for the 190 HP version of this engine, we need to insure that a representative CO baseline number is being used for this engine. Although we are quite confident with the CO numbers recorded during testing, we are concerned that the newness of the test engine may not allow us to use these numbers as a baseline. We believe it will be necessary to conduct torque stall testing at the mine site after the engine is broken in to further verify our CO numbers.


2. During testing of the treated exhaust we did not record any CO emission numbers. It may be that this engine is that clean. However, we believe that it will be necessary to conduct the same type of test in the near future at the mine site in order to provide further verification of our findings.

3. Since this is the first turbocharged engine operating in Pennsylvania, we believe it is necessary to make note of the issue of "Turbo Lag". This is the time it takes the turbocharger to lean out the fuel that has been added during snap acceleration. We ran several tests on this and found the Lag Time to be between 1 minute and 1:15 seconds. During this period of time, it would not be unusual to see CO numbers in the 1000 ppm range. However, after this time period, the CO numbers settle into their baseline range of CO emissions. We believe this condition needs to be explained to the mechanics that will be performing the emissions testing of the engine so they will not be surprised when they first see this condition. It is imperative that CO emissions testing required by Sections 217-A and 218-A be performed when the equipment is at normal engine operating temperature (+350 degrees) and in a steady state condition of operation. "Turbo lag" is not a steady state condition of operation and CO emissions testing should not be conducted during the "turbo lag" period of time.

#### Recommendation

The TAC, as a result of its alternate testing, recommends approval of the attached alternate test procedure for the Brookville 20T24OD -20 Ton Locomotive equipped with a Cummins QSB C240 (190 HP) diesel engine and the DST after-treatment system, provided that the TAC set a date in the near future to further verify, at the mine site, the test results achieved at the Brookville Plant. The TAC does not believe the use of this alternate testing procedure will reduce or compromise the level of health and safety afforded by the law.

  
Gene Davis

  
Robert Du Breucq

*90-second*

**ALTERNATIVE STALL TEST PROCEDURE FOR PA STATE ACT 182, ARTICLE II-A  
DIESEL-POWERED EQUIPMENT**

**ALTERNATE PROCEDURE, Section 217-A:** (an alternative to items 8 through 14)

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.
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. Put the transmission in high gear.
7. With brake still applied, put the engine at full throttle to induce converter stall 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 converter stall.
9. Return engine to low idle and put transmission in neutral. Allow the torque converter temperature to stabilize.
10. Take an average of the three readings.
11. Comply with record-keeping requirements pursuant to Section 214-A.

**ALTERNATIVE PROCEDURE, Section 218-A:** (an alternative to items 10-14)

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.
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. Put the transmission in high gear.
7. With brakes still applied, put the engine at full throttle to induce converter stall 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 converter stall.
9. Return engine to low idle and put transmission in neutral. Allow the torque converter 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 217-A(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 214-A.

**ALTERNATIVE STALL TEST PROCEDURE FOR PA STATE ACT 182, ARTICLE II-A  
DIESEL-POWERED EQUIPMENT**

**ALTERNATE PROCEDURE, Section 217-A:** (an alternative to items 8 through 14)

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.
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. Put the transmission in high gear.
7. With brake still applied, put the engine at full throttle to induce converter stall 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 converter stall.
9. Return engine to low idle and put transmission in neutral. Allow the torque converter temperature to stabilize.
10. Take an average of the three readings.
11. Comply with record-keeping requirements pursuant to Section 214-A.

**ALTERNATIVE PROCEDURE, Section 218-A:** (an alternative to items 10-14)

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.
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. Put the transmission in high gear.
7. With brakes still applied, put the engine at full throttle to induce converter stall 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 converter stall.
9. Return engine to low idle and put transmission in neutral. Allow the torque converter 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 217-A(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 214-A.