Pennsylvania Technical Advisory Committee
On Diesel Powered Equipment

Stanley R. Geary
(724) 625-2936 (Home)
(717) 233-7900 (Office)
Email: srgeary@comcast.net

Ron Bowersox
(724) 726-8987 (Home)
(724) 479-8692 (Office)
Email: umwarbowersox@yahoo.com

September 22, 2006

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

RE: Brookville Equipment Corporation Daimler Chrysler OM904LA 100HP Diesel Power Package

Dear Mr. Sbaftoni:

Article II-A of the Pennsylvania Bituminous Coal Mine Act (the act) provides for the use of diesel-powered equipment in underground bituminous coal mines. Section 224-A of the act created a Technical Advisory Committee ("TAC") for the purpose of advising the Department regarding implementation of Article II-A and evaluation of alternative technology or methods for meeting the requirements of Article II-A.

Background

On June 23, 2006, Brookville Equipment Corporation (Brookville) submitted a request to the Bureau of Deep Mine Safety (BDMS") for evaluation and approval pursuant to Article II-A of the act of a Daimler Chrysler OM904LA 100HP engine (MSHA Approval No.7E-B098-0) with a M30 DST Management System in a Model ULPC 9 ton locomotive/15 man personnel carrier. Additionally, Brookville requested an alternative test procedure for the five minute carbon monoxide (CO) tests required under Sections 217-A and 218-A of the act. On June 23, 2006, the Director of BDMS requested the TAC to evaluate the diesel power package and to advise the Department regarding the TAC's recommendation as to whether the diesel power package meets the requirements of subsection 203-A(3) of the act and for the TAC's recommendation on Brookville’s request for an alternate test procedure for CO testing. The TAC was unable to begin its investigation until August 2006, because the equipment was not available until then.
The diesel power package includes the following items:

- Daimler Chrysler OM904LA 100HP turbo charged diesel engine (MSHA Certification No.7E-B098-0)
- Emissions Control System – DST Management System which includes:
  - Syncat Corporation M113-210-02 Oxidation Catalyst
  - Pass Tech. M150-301-01 heat exchanger
  - Dry Systems Technologies M 30 particulate filter (MSHA efficiency rating 96%)

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 8, 2006, the TAC and DEP representatives traveled to the Brookville facilities to inspect the diesel equipment package. On that date, 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 that testing are included in Attachment 2.

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 180° F, which is well below the 302° F allowed by Section 203-A (b)(4) of Article II-A. It is our belief that the heat exchanger will maintain the exhaust gas temperature well below the required 302° F.

The after-treatment system is fitted with a Dry Systems Technologies M 30 disposable filter. The filter is rated by MSHA at a 96% efficiency rating, which meets the requirements of Section 203-A (b)(1) of Article II-A. The engine and filter extrapolations show that the diesel power package will result in an average ambient concentration of .022 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 203-A (a)(1) Article II-A.

On August 8, 2006, measurements of the surface temperatures of the exhaust components of the diesel engine exceeded the 302 degree Fahrenheit limit for significant external surface temperatures of Section 203-A (b)(3) of Article II-A. Subsequently, the thickness of the HTI coating on the exhaust components was increased from 3/8” to 3/4”.

On September 22, 2006, the TAC traveled to Consol Energy’s Bailey Mine and inspected the equipment again for the purpose of observing the HTI coating and measuring engine surface temperatures. On that date significant external surface temperatures were less than 302 degrees Fahrenheit.
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 203-A of Article II-A of the act without reducing or compromising the level of health or safety afforded by the act.

Although the diesel powered package can withstand the emissions tests as described in Sections 217-A and 218-A of Article II-A, we recommend approval of the attached Alternative Stall Test Procedure (Attachment 3). Test results of both the required test and the alternate test confirm comparable results and as such we recommend the use of the alternate test.

**Recommendation**

Our recommendation is based upon the data supplied by Brookville, the results of the tests conducted on June 8, 2006, the engine surface temperature measurements conducted on September 22, 2006, as well as the data acquired and observations made during our investigation. The TAC has determined that the Daimler Chrysler OM904LA 100HP engine (MSHA Approval No.7E-B098-0) with a M30 DST Management System meets all requirements of Section 203-A of Article II-A of the Pennsylvania Bituminous Coal Mine 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. As discussed above, we are also recommending approval of an alternate test procedure for Sections 217-A and 218-A of the act.

\[Signature\]
Stanley Geary

\[Signature\]
Ron Bowersox
ATTACHMENT 1
## BROOKVILLE EQUIPMENT CORP.
### MODEL ULPC
Diesel 9-Ton Loco / 15-Man Personnel Carrier

### General Specifications of the Diesel-Powered Equipment Package

<table>
<thead>
<tr>
<th>Specification</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Engine Manufacturer</td>
<td>Daimler Chrysler</td>
</tr>
<tr>
<td>Engine Model</td>
<td>OM 904 LA</td>
</tr>
<tr>
<td>Horsepower</td>
<td>100 HP</td>
</tr>
<tr>
<td>Rated Speed</td>
<td>2200 RPM</td>
</tr>
<tr>
<td>Manufacturer's Maximum Recommended Exhaust Backpressure (in H₂O)</td>
<td>41 Inches Water Gauge</td>
</tr>
<tr>
<td>Maximum Exhaust Out Temperature</td>
<td>302 deg F</td>
</tr>
<tr>
<td><strong>MSHA Engine Approval</strong></td>
<td></td>
</tr>
<tr>
<td>MSHA Certification No.</td>
<td>7E-B098-0 (Part 7)</td>
</tr>
<tr>
<td>Rated Speed</td>
<td>2200 RPM</td>
</tr>
<tr>
<td>Rated Horsepower</td>
<td>100 HP</td>
</tr>
<tr>
<td>Exhaust GAS Flow (SCFM)</td>
<td>318 CFM @ 25 deg C</td>
</tr>
<tr>
<td>ISO 8178-1 Average DPM (gr/hr)</td>
<td>4.14 gr/hr</td>
</tr>
<tr>
<td>Average Ambient DPM Level (mg/m³)</td>
<td>0.022 mg/m³</td>
</tr>
<tr>
<td>MSHA Ventilation Rate (CFM)</td>
<td>4,500 CFM (Part 7)</td>
</tr>
<tr>
<td>Pa. State Ventilation Rate (CFM)</td>
<td>CFM (Part 32)</td>
</tr>
</tbody>
</table>

### Emissions Control System

<table>
<thead>
<tr>
<th>Name</th>
<th>Make</th>
<th>Model</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fuel Injection Pump</td>
<td>Bosch</td>
<td></td>
<td>0280746902</td>
</tr>
<tr>
<td>Oxidation Catalyst</td>
<td>Syncat Corp.</td>
<td></td>
<td>M113-210-02</td>
</tr>
<tr>
<td>Heat Exchanger</td>
<td>Paas Tech.</td>
<td></td>
<td>M150-301-01</td>
</tr>
<tr>
<td>DPM Filter</td>
<td>Dry Systems Technology M 30</td>
<td>Model Outer Filter Size</td>
<td>M 30</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Inner Filter Size</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Filter Length</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>16 x 12 in Diameter</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>10 x 6 in Diameter</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>20 in</td>
</tr>
<tr>
<td>Efficiency</td>
<td></td>
<td></td>
<td>96%</td>
</tr>
<tr>
<td>Recommended Exhaust Back-Pressure</td>
<td></td>
<td></td>
<td>25 Inches Water Gauge</td>
</tr>
</tbody>
</table>
ATTACHMENT 3
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.