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

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March 21, 2007

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

RE: Brookville Equipment Corporation Brookville Model 15S Diesel 15 Ton Scoop  
with a Deutz BF4M2012C 138HP Diesel Power Package

Dear Mr. Sbaffoni:

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.

**Background**

On December 23, 2005, 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 Deutz BF4M2012C 138HP engine (MSHA Approval No. 07-ENA040003-0) with a M30 DST Management System in a Brookville Model 15 S Diesel rubber tired tractor. 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 December 28, 2005, 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 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 March 2007, because the equipment was not available until then.

The diesel power package includes the following items:

- Deutz BF4M2012C 138HP turbo charged diesel engine (MSHA Certification No. 07-ENA040003-0 Part7)
- Emissions Control System – DST Management System which includes:
  - Syncat Corp. Oxidation Catalyst
  - Paas Technologies heat exchanger
  - Fleet Guard or DST particulate filter (MSHA efficiency rating 96.9%)

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 March 1, 2007, the TAC and DEP representatives traveled to the Brookville facilities to inspect the rubber tired tractor. On March 1, 2007 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 55° 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.

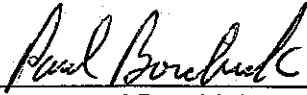
The after-treatment system is fitted with a Fleet Guard or DST disposable filter. The filter is rated by MSHA at a 96.9% efficiency rating, which meets the requirements of Section 203-A (b)(1) of Article II-A. The engine and filter extrapolations show that the diesel power package will result in an average ambient concentration of .013 mg/m<sup>3</sup> 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/m<sup>3</sup> requirement of Section 203-A (a)(1) Article II-A.

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). Also, our test results of both the required test and the alternate test confirm comparable results and as such we will 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 March 1, 2007, as well as the data acquired and observations made during our investigation. The TAC has determined that the Deutz BF4M2012C 138HP engine (MSHA Approval No. 07-ENA040003-0) 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.



Paul Borchick



Ron Bowersox

**BROOKVILLE EQUIPMENT CORP.  
MODEL 15S  
Diesel 15 Ton-Scoop**

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

Engine Manufacturer		Duetz		
Engine Model		BF4M2012C		
Horsepower		138 HP		
Rated Speed		2500 RPM		
Manufacturer's Recommended Exhaust Back-pressure (InH <sub>2</sub> O)		30 Inches Water Gauge		
Maximum Exhaust Out Temperature		914 deg F		
<b>MSHA Engine Approval</b>		<b>MSHA Part 7</b>		
MSHA Certification No.		07-ENA040003-0 (Part 7)		
Rated Speed		2500 RPM		
Rated Horsepower		138 HP		
Exhaust GAS Flow (SCFM)		953 CFM @ 500 deg C @ 2500 RPM		
ISO 8178-1 Average DPM (gr/hr)		0.142 gr/hr (2.367 mg/min)		
Average Ambient DPM Level (mg/m <sup>3</sup> )		0.013 mg/m <sup>3</sup>		
MSHA Ventilation Rate (CFM)		6,500 CFM (Part 7)	CFM (Part 32)	
Pa. State Ventilation Rate (CFM)				
<b>Emissions Control System</b>			<b>DST Management System</b>	
Fuel Injection Pump	Make  P/N	Bosch - belt driven rotary fuel lift pump.		
Oxidation Catalyst	Make  P/N	Syncat Corp.  M241-260-01		
Heat Exchanger	Make  P/N	Paas Tech.  M30-411-01		
DPM Filter	Make	Fleet Guard	Model	M 30
	P/N	M 30	Filter Size	16 x 12 in Diameter
	Air Rating (CFM)	345 CFM	Filter Length	20 in
	Surface Area (in <sup>3</sup> )	42,231 in <sup>3</sup>		
	Efficiency			
	Recommended Exhaust Back-Pressure			25 Inches Water Gauge

5 MIN. RAW

#2007-03-01 11:07:44#

Time(h:m:s)	O2(%)	CO(ppm)	NO(ppm)	NO2(ppm)	NOx(ppm)	SO2(ppm)	CxHy(%)	CO2(%)	T Gas(F)	T Amb(F)	ETA	Lambda	Comments:
0:00:02	15.6	105	525	48	573	0	0	4	55	44.6	99.3	3.89	
0:00:11	15.5	105	528	48	576	0	0	4	54	44.5	99.3	3.82	
0:00:21	15.5	106	524	48	572	0	0	4	54	44.4	99.3	3.82	
0:00:31	15.5	106	511	49	560	0	0	4	54	44.3	99.3	3.82	start
0:00:41	13.6	121	451	45	496	0	0	5.4	54	44.3	99.4	2.84	
0:00:51	12.4	126	403	38	441	0	0	6.3	54	44.2	99.6	2.44	
0:01:02	11.9	96	424	35	459	0	0	6.7	54	44.1	99.6	2.31	
0:01:11	11.7	79	436	33	469	0	0	6.8	54	44	99.6	2.26	
0:01:21	11.6	70	449	32	481	0	0	6.9	54	43.9	99.6	2.23	
0:01:31	11.5	65	455	31	486	0	0	7	54	43.8	99.6	2.21	
0:01:41	11.4	62	458	30	488	0	0	7	53	43.7	99.6	2.19	
0:01:52	11.4	61	465	29	494	0	0	7	53	43.6	99.6	2.19	
0:02:02	11.4	61	473	28	501	0	0	7	53	43.5	99.6	2.19	
0:02:12	11.4	60	477	28	505	0	0	7	53	43.5	99.6	2.19	
0:02:21	11.2	60	482	28	510	0	0	7.2	53	43.4	99.6	2.14	
0:02:31	11.2	60	487	27	514	0	0	7.2	54	43.3	99.6	2.14	
0:02:41	11.2	60	492	27	519	0	0	7.2	53	43.3	99.6	2.14	
0:02:51	11.2	59	497	27	524	0	0	7.2	53	43.2	99.6	2.14	
0:03:01	11.2	59	496	26	522	0	0	7.2	53	43.1	99.6	2.14	
0:03:12	11.2	59	496	25	521	0	0	7.2	52	43	99.6	2.14	
0:03:22	11.2	59	497	24	521	0	0	7.2	53	42.9	99.6	2.14	
0:03:42	11.2	60	502	24	526	0	0	7.2	52	42.9	99.6	2.14	
0:03:51	11.2	60	505	24	529	0	0	7.2	52	42.8	99.6	2.14	
0:04:01	11.2	60	510	23	533	0	0	7.2	52	42.7	99.6	2.14	
0:04:11	11.2	60	510	23	533	0	0	7.2	52	42.7	99.6	2.14	
0:04:21	11.2	60	514	23	537	0	0	7.2	52	42.7	99.6	2.14	
0:04:32	11.1	60	518	22	540	0	0	7.3	52	42.6	99.7	2.12	
0:04:42	11.1	60	520	22	542	0	0	7.3	52	42.6	99.7	2.12	
0:04:51	11.1	60	523	22	545	0	0	7.3	52	42.5	99.7	2.12	
0:05:01	11.1	60	524	22	546	0	0	7.3	52	42.5	99.7	2.12	
0:05:11	11.1	60	527	22	549	0	0	7.3	52	42.4	99.6	2.12	
0:05:21	11.1	60	531	21	552	0	0	7.3	52	42.3	99.6	2.12	
0:05:32	11.1	60	533	21	554	0	0	7.3	52	42.3	99.6	2.12	end

ATTACHMENT 2 (1/4)

5 MIN. TREATED

#2007-03-01 11:16:14#

Time(h:m:s)	O2(%)	CO(ppm)	NO(ppm)	NO2(ppm)	NOx(ppm)	SO2(ppm)	CxHy(%)	CO2(%)	T Gas(F)	T Amb(F)	ETA	Lambda	Comments:
0:00:02	18.5	19	112	10	122	0	0	1.8	53	41.6	98.3	8.4	
0:00:12	18.5	12	123	11	134	0	0	1.8	54	41.5	98.1	8.4	
0:00:22	18.5	7	127	11	138	0	0	1.8	54	41.5	98.1	8.4	start
0:00:32	18.4	5	130	12	142	0	0	1.9	54	41.5	98.2	8.08	
0:00:42	18.4	3	133	12	145	0	0	1.9	54	41.5	98.2	8.08	
0:00:52	17.9	2	135	12	147	0	0	2.3	54	41.5	98.5	6.77	
0:01:02	17.5	2	129	11	140	0	0	2.6	54	41.5	98.7	6	
0:01:12	17.3	2	127	10	137	0	0	2.7	53	41.5	98.8	5.68	
0:01:22	17.2	2	127	10	137	0	0	2.8	53	41.5	98.8	5.53	
0:01:31	17.2	2	127	10	137	0	0	2.8	53	41.6	98.8	5.53	
0:01:41	17.1	2	128	10	138	0	0	2.9	53	41.6	98.9	5.38	
0:01:51	17.1	2	128	10	138	0	0	2.9	53	41.6	98.9	5.38	
0:02:02	17.1	2	128	10	138	0	0	2.9	52	41.6	99	5.38	
0:02:12	17.1	2	128	10	138	0	0	2.9	52	41.6	99	5.38	
0:02:22	17.1	2	128	10	138	0	0	2.9	52	41.6	99	5.38	
0:02:32	17.1	2	129	10	139	0	0	2.9	53	41.6	98.9	5.38	
0:02:42	17.1	2	129	10	139	0	0	2.9	53	41.6	98.9	5.38	
0:02:52	17.1	2	129	10	139	0	0	2.9	52	41.6	99	5.38	
0:03:02	17.1	2	130	10	140	0	0	2.9	52	41.6	99	5.38	
0:03:12	17.1	2	130	10	140	0	0	2.9	52	41.6	99	5.38	
0:03:22	17.1	2	130	10	140	0	0	2.9	52	41.6	99	5.38	
0:03:32	17.1	3	130	10	140	0	0	2.9	52	41.6	99	5.38	
0:03:42	17.1	2	130	10	140	0	0	2.9	52	41.6	99	5.38	
0:03:52	17.1	3	131	10	141	0	0	2.9	52	41.6	99	5.38	
0:04:02	17.1	2	131	10	141	0	0	2.9	52	41.6	99	5.38	
0:04:12	17.1	2	131	10	141	0	0	2.9	52	41.6	99	5.38	
0:04:22	17.1	2	132	10	142	0	0	2.9	52	41.7	99	5.38	
0:04:32	17.1	2	132	10	142	0	0	2.9	52	41.7	99	5.38	
0:04:42	17.1	2	132	10	142	0	0	2.9	52	41.7	99	5.38	
0:04:52	17.1	2	133	10	143	0	0	2.9	52	41.7	99	5.38	
0:05:02	17.1	2	133	10	143	0	0	2.9	52	41.7	99	5.38	
0:05:12	17.1	2	133	10	143	0	0	2.9	51	41.7	99.1	5.38	
0:05:22	17.1	2	133	10	143	0	0	2.9	51	41.7	99.1	5.38	end

90 SEC. RAW

#2007-03-01 11:27:42#

Time(h:m:s)	O2(%)	CO(ppm)	NO(ppm)	NO2(ppm)	NOx(ppm)	SO2(ppm)	CxHy(%)	CO2(%)	T Gas(F)	T Amb(F)	ETA	Lambda	Comments:
0:00:04	18.2	50	142	9	151	0	0	2.1	50	42.1	98.9	7.5	
0:00:14	18.2	40	183	9	192	0	0	2.1	50	42.1	98.9	7.5	start
0:00:24	15.4	49	448	17	465	0	0	4.1	50	42.1	99.6	3.75	
0:00:34	12.6	73	438	20	458	0	0	6.2	50	42.1	99.6	2.5	
0:00:44	11.6	74	461	23	484	0	0	6.9	50	42.1	99.7	2.23	
0:00:54	11.2	71	476	24	500	0	0	7.2	50	42.2	99.7	2.14	
0:01:04	11.1	67	486	25	511	0	0	7.3	50	42.2	99.7	2.12	
0:01:14	11	64	497	25	522	0	0	7.3	50	42.2	99.7	2.1	
0:01:24	11	62	501	25	526	0	0	7.3	50	42.3	99.7	2.1	
0:01:34	11	61	506	25	531	0	0	7.3	50	42.3	99.7	2.1	
0:01:44	11	60	512	25	537	0	0	7.3	50	42.3	99.7	2.1	end

90 SEC. TREATED

#2007-03-01 11:24:23#

Time(h:m:s)	O2(%)	CO(ppm)	NO(ppm)	NO2(ppm)	NOx(ppm)	SO2(ppm)	CxHy(%)	CO2(%)	T Gas(F)	T Amb(F)	ETA	Lambda	Comments:
0:00:03	18.4	0	119	11	130	0	0	1.9	49	41.7	98.9	8.08	
0:00:13	18.4	0	119	11	130	0	0	1.9	49	41.7	98.9	8.08	start
0:00:23	18.4	0	121	11	132	0	0	1.9	49	41.7	98.9	8.08	
0:00:33	18.4	0	122	11	133	0	0	1.9	49	41.7	98.9	8.08	
0:00:43	17.9	0	130	11	141	0	0	2.3	49	41.7	99.1	6.77	
0:00:53	17.4	2	128	10	138	0	0	2.6	49	41.8	99.2	5.83	
0:01:03	17.2	2	126	10	136	0	0	2.8	50	41.8	99.2	5.53	
0:01:13	17.1	2	126	10	136	0	0	2.9	49	41.8	99.3	5.38	
0:01:23	17.1	2	127	10	137	0	0	2.9	49	41.8	99.3	5.38	
0:01:33	17	2	128	10	138	0	0	2.9	49	41.8	99.3	5.25	
0:01:43	17	2	129	10	139	0	0	2.9	49	41.9	99.3	5.25	end

ATTACHMENT 2 (4/4)



**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.

January 24, 2007

Bill Brookshar  
Bureau of Deep Mine Safety  
Fayette County Health Center  
100 New Salem Road, Room 167  
Uniontown, PA 15401

Subject: Brookville Equipment Corporation  
Request for modification approval and a  
Request to the Technical Advisory Committee

Dear Sirs:

Brookville Equipment Corporation is applying for a modification approval of a Brookville Model 15S with the Pennsylvania Deep Mine Safety, and is requesting that the Technical Advisory Committee review the enclosed information and make a determination that it meets the requirements of Section 203A(1), (2), and (3).

Also, Brookville Equipment Corporation is requesting the alternative test procedure be used for CO sampling, instead of the 5 minute testing under 217-A and 218-A of the Pennsylvania Diesel Law. The alternative sampling method consists of samples taken at 60, 75, and 90 seconds.

This information was previously reviewed by the TAC in early '06 but do to production rescheduling the machine was pushed back unit now. The unit is now in our final assembly and should be ready to run and ready for inspection as early as next week. I would like to schedule any testing and inspection of this machine at your earliest convenience.

Please review this request, and if you have any questions, please call me anytime.

Best regards,

Eli Schmader  
Engineer  
Ph: 814-849-6052  
Fax: 814-849-5229

En: (4 copies)  
MSHA Approval Request Letter  
Original Pre-approval Request Letter and Response  
Approval Application  
Original Unit Approval Letter BOTE-D 1881-02  
MSHA Engine Approval Letter  
General Specifications  
Engine Specifications  
Engine Horse Power and Torque Curves  
Eight Mode Test  
Torque Curve Test Results  
Calculations

RECEIVED

JAN 26 2007

BUREAU OF MINE SAFETY