



September 9, 2015

West Virginia Department of Environmental Protection  
Air Quality Division  
601 57<sup>th</sup> Street, SE  
Charleston, WV 25304

ID. No. 061-00221 Reg. 665-C556  
Company WV Rehab Hosp Health South Mtn View  
Location Morgantown Region II  
Initials wvg

~~Mr. Brown~~

Attached is G65-C General Permit application for a Volvo TWD1643GE 917 hp emergency engine-generator located at the HealthSouth Mountain View Regional Rehabilitation Hospital in Morgantown, WV. All documents are included with this cover letter as well as on the enclosed CD-ROM.

If you have any questions, please contact myself [trisha.victor@cerio.biz](mailto:trisha.victor@cerio.biz) or 571-293-2332.

Thank you for your assistance,

Trisha Victor

VP, Environmental Solutions

Cerio LLC



*Entire Document*  
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WEST VIRGINIA  
 DEPARTMENT OF ENVIRONMENTAL PROTECTION  
 DIVISION OF AIR QUALITY  
 601 57<sup>th</sup> Street, SE  
 Charleston, WV 25304  
 Phone: (304) 926-0475 • www.dep.wv.gov/daq

**APPLICATION FOR GENERAL PERMIT REGISTRATION**  
 CONSTRUCT, MODIFY, RELOCATE OR ADMINISTRATIVELY UPDATE  
 A STATIONARY SOURCE OF AIR POLLUTANTS

CONSTRUCTION     MODIFICATION     RELOCATION     CLASS I ADMINISTRATIVE UPDATE  
 CLASS II ADMINISTRATIVE UPDATE

**CHECK WHICH TYPE OF GENERAL PERMIT REGISTRATION YOU ARE APPLYING FOR:**

- |   |  |
|---|--|
| <input type="checkbox"/> <b>G10-D</b> – Coal Preparation and Handling                                   | <input type="checkbox"/> <b>G40-C</b> – Nonmetallic Minerals Processing                  |
| <input type="checkbox"/> <b>G20-B</b> – Hot Mix Asphalt   | <input type="checkbox"/> <b>G50-B</b> – Concrete Batch                                   |
| <input type="checkbox"/> <b>G30-D</b> – Natural Gas Compressor Stations                                 | <input type="checkbox"/> <b>G60-C</b> - Class II Emergency Generator                     |
| <input type="checkbox"/> <b>G33-A</b> – Spark Ignition Internal Combustion Engines                      | <input checked="" type="checkbox"/> <b>G65-C</b> – Class I Emergency Generator           |
| <input type="checkbox"/> <b>G35-A</b> – Natural Gas Compressor Stations (Flare/Glycol Dehydration Unit) | <input type="checkbox"/> <b>G70-A</b> – Class II Oil and Natural Gas Production Facility |

**SECTION I. GENERAL INFORMATION**

1. Name of applicant (as registered with the WV Secretary of State's Office): <b>West Virginia Rehabilitation Hospital, Inc.</b>		2. Federal Employer ID No. (FEIN): <b>55-0670907</b>	
3. Applicant's mailing address: <b>3660 Grandview Parkway, Ste. 200</b> <b>Birmingham, AL 35243</b>		4. Applicant's physical address: <b>same</b>	
5. If applicant is a subsidiary corporation, please provide the name of parent corporation:			
6. <b>WV BUSINESS REGISTRATION.</b> Is the applicant a resident of the State of West Virginia? <input checked="" type="checkbox"/> YES <input type="checkbox"/> NO IF YES, provide a copy of the Certificate of Incorporation/ Organization / Limited Partnership (one page) including any name change amendments or other Business Registration Certificate as Attachment A. IF NO, provide a copy of the Certificate of Authority / Authority of LLC / Registration (one page) including any name change amendments or other Business Certificate as Attachment A.			

**SECTION II. FACILITY INFORMATION**

7. Type of plant or facility (stationary source) to be constructed, modified, relocated or administratively updated (e.g., coal preparation plant, primary crusher, etc.): <b>Emergency Engine Generator</b>	8a. Standard Industrial Classification (SIC) code: <b>8069</b>	AND	8b. North American Industry System (NAICS) code: <b>622310</b>
9. DAQ Plant ID No. (for existing facilities only): _____	10. List all current 45CSR13 and other General Permit numbers associated with this process (for existing facilities only): N/A _____		

**A: PRIMARY OPERATING SITE INFORMATION**

11A. Facility name of primary operating site:  <b>HealthSouth Mountain View Regional Rehabilitation Hospital</b>	12A. Address of primary operating site:  Mailing: <b>1160 Van Voorhis Road Morgantown, WV 26505</b> Physical: <u>same</u>	
13A. Does the applicant own, lease, have an option to buy, or otherwise have control of the proposed site? <span style="float:right"><b>● YES    9 NO</b></span> IF YES, please explain: <u>Applicant leases/operates the facility</u>  IF NO, YOU ARE NOT ELIGIBLE FOR A PERMIT FOR THIS SOURCE.		
14A. For <b>Modifications or Administrative Updates</b> at an existing facility, please provide directions to the present location of the facility from the nearest state road; For Construction or Relocation permits, please provide directions to the proposed new site location from the nearest state road. Include a <b>MAP</b> as Attachment F.  From Rt. 19/7 Monongalia Blvd, Turn Right onto Van Voorhis Road (Rt. 705) to the rehab hospital _____  _____		
15A. Nearest city or town:  <b>Morgantown</b>	16A. County:  <b>Monongalia</b>	17A. UTM Coordinates: Northing (KM): <b>4390149.50</b> _____ Easting (KM): <b>589060.28</b> _____ Zone: <b>17S</b> _____
18A. Briefly describe the proposed new operation or change (s) to the facility: <b>New Construction of Emergency Engine Generator</b>		19A. Latitude & Longitude Coordinates (NAD83, Decimal Degrees to 5 digits): Latitude: <b>39.656512</b> _____ Longitude: <b>-79.961841</b> _____

**B: 1<sup>ST</sup> ALTERNATE OPERATING SITE INFORMATION (only available for G20, G40, & G50 General Permits)**

11B. Name of 1 <sup>st</sup> alternate operating site:  <u>N/A</u>	12B. Address of 1 <sup>st</sup> alternate operating site:  Mailing: _____ Physical: _____  _____
13B. Does the applicant own, lease, have an option to buy, or otherwise have control of the proposed site? <span style="float:right"><b>9 YES    9 NO</b></span> IF YES, please explain: _____  IF NO, YOU ARE NOT ELIGIBLE FOR A PERMIT FOR THIS SOURCE.	

<p>14B. <input type="checkbox"/> For <b>Modifications or Administrative Updates</b> at an existing facility, please provide directions to the present location of the facility from the nearest state road;</p> <p><input type="checkbox"/> For Construction or Relocation permits, please provide directions to the proposed new site location from the nearest state road. Include a <b>MAP as Attachment F.</b></p> <p>_____</p> <p>_____</p>		
15B. Nearest city or town:	16B. County:	17B. UTM Coordinates: Northing (KM): _____ Easting (KM): _____ Zone: _____
18B. Briefly describe the proposed new operation or change (s) to the facility:		19B. Latitude & Longitude Coordinates (NAD83, Decimal Degrees to 5 digits): Latitude: _____ Longitude: _____

**C: 2<sup>ND</sup> ALTERNATE OPERATING SITE INFORMATION (only available for G20, G40, & G50 General Permits):**

11C. Name of 2 <sup>nd</sup> alternate operating site:  N/A	12C. Address of 2 <sup>nd</sup> alternate operating site:  Mailing: _____ Physical: _____	
<p>13C. Does the applicant own, lease, have an option to buy, or otherwise have control of the proposed site? <span style="float:right">9 YES    9 NO</span></p> <p><input type="checkbox"/> IF YES, please explain: _____</p> <p>_____</p> <p><input type="checkbox"/> IF NO, YOU ARE NOT ELIGIBLE FOR A PERMIT FOR THIS SOURCE.</p>		
<p>14C. <input type="checkbox"/> For <b>Modifications or Administrative Updates</b> at an existing facility, please provide directions to the present location of the facility from the nearest state road;</p> <p><input type="checkbox"/> For Construction or Relocation permits, please provide directions to the proposed new site location from the nearest state road. Include a <b>MAP as Attachment F.</b></p> <p>_____</p> <p>_____</p>		
15C. Nearest city or town:	16C. County:	17C. UTM Coordinates: Northing (KM): _____ Easting (KM): _____ Zone: _____
18C. Briefly describe the proposed new operation or change (s) to the facility:		19C. Latitude & Longitude Coordinates (NAD83, Decimal Degrees to 5 digits): Latitude: _____ Longitude: _____

<p>20. Provide the date of anticipated installation or change:</p> <p style="margin-left: 20px;">_06_ / _15_ / _15_</p> <p><input type="checkbox"/> If this is an <b>After-The-Fact</b> permit application, provide the date upon which the proposed change did happen: :</p> <p style="margin-left: 20px;">_ / _ / _</p>	<p>21. Date of anticipated Start-up if registration is granted:</p> <p style="margin-left: 20px;">_08_ / _01_ / _15_</p>
<p>22. Provide maximum projected <b>Operating Schedule</b> of activity/activities outlined in this application if other than 8760 hours/year. (Note: anything other than 24/7/52 may result in a restriction to the facility's operation).</p> <p>Hours per day <u>24</u> Days per week <u>7</u> Weeks per year <u>52</u> Percentage of operation _____</p>	

### SECTION III. ATTACHMENTS AND SUPPORTING DOCUMENTS

<p>23. Include a check payable to WVDEP – Division of Air Quality with the appropriate <b>application fee</b> (per 45CSR22 and 45CSR13).</p>
<p>24. Include a <b>Table of Contents</b> as the first page of your application package.</p>
<p>All of the required forms and additional information can be found under the Permitting Section (General Permits) of DAQ's website, or requested by phone.</p>
<p>25. Please check all attachments included with this permit application. Please refer to the appropriate reference document for an explanation of the attachments listed below.</p> <ul style="list-style-type: none"> <li>9 ATTACHMENT A : CURRENT BUSINESS CERTIFICATE</li> <li>9 ATTACHMENT B: PROCESS DESCRIPTION</li> <li>9 ATTACHMENT C: DESCRIPTION OF FUGITIVE EMISSIONS</li> <li>9 ATTACHMENT D: PROCESS FLOW DIAGRAM</li> <li>9 ATTACHMENT E: PLOT PLAN</li> <li>9 ATTACHMENT F: AREA MAP</li> <li>9 ATTACHMENT G: EQUIPMENT DATA SHEETS AND REGISTRATION SECTION APPLICABILITY FORM</li> <li>9 ATTACHMENT H: AIR POLLUTION CONTROL DEVICE SHEETS</li> <li>9 ATTACHMENT I: EMISSIONS CALCULATIONS</li> <li>9 ATTACHMENT J: CLASS I LEGAL ADVERTISEMENT</li> <li>9 ATTACHMENT K: ELECTRONIC SUBMITTAL</li> <li>9 ATTACHMENT L: GENERAL PERMIT REGISTRATION APPLICATION FEE</li> <li>9 ATTACHMENT M: SITING CRITERIA WAIVER</li> <li>9 ATTACHMENT N: MATERIAL SAFETY DATA SHEETS (MSDS)</li> <li>9 ATTACHMENT O: EMISSIONS SUMMARY SHEETS</li> <li>9 OTHER SUPPORTING DOCUMENTATION NOT DESCRIBED ABOVE (Equipment Drawings, Aggregation Discussion, etc.)</li> </ul> <p>Please mail an original and two copies of the complete General Permit Registration Application with the signature(s) to the DAQ Permitting Section, at the address shown on the front page of this application. Please DO NOT fax permit applications. For questions regarding applications or West Virginia Air Pollution Rules and Regulations, please refer to the website shown on the front page of the application or call the phone number also provided on the front page of the application.</p>

**SECTION IV. CERTIFICATION OF INFORMATION**

This General Permit Registration Application shall be signed below by a Responsible Official. A Responsible Official is a President, Vice President, Secretary, Treasurer, General Partner, General Manager, a member of a Board of Directors, or Owner, depending on business structure. A business may certify an Authorized Representative who shall have authority to bind the Corporation, Partnership, Limited Liability Company, Association, Joint Venture or Sole Proprietorship. Required records of daily throughput, hours of operation and maintenance, general correspondence, Emission Inventory, Certified Emission Statement, compliance certifications and all required notifications must be signed by a Responsible Official or an Authorized Representative. If a business wishes to certify an Authorized Representative, the official agreement below shall be checked off and the appropriate names and signatures entered. Any administratively incomplete or improperly signed or unsigned Registration Application will be returned to the applicant.

FOR A CORPORATION (domestic or foreign)

G I certify that I am a President, Vice President, Secretary, Treasurer or in charge of a principal business function of the corporation

FOR A PARTNERSHIP

G I certify that I am a General Partner

FOR A LIMITED LIABILITY COMPANY

G I certify that I am a General Partner or General Manager

FOR AN ASSOCIATION

G I certify that I am the President or a member of the Board of Directors

FOR A JOINT VENTURE

G I certify that I am the President, General Partner or General Manager

FOR A SOLE PROPRIETORSHIP

G I certify that I am the Owner and Proprietor

G I hereby certify that (please print or type) *John P. Whittington, Executive Vice President of HealthSouth Corporation, the Manager of Applicant, is an Authorized Representative and in that capacity shall represent the interest of the business (e.g., Corporation, Partnership, Limited Liability Company, Association Joint Venture or Sole Proprietorship) and may obligate and legally bind the business. If the business changes its Authorized Representative, a Responsible Official shall notify the Director of the Office of Air Quality immediately, and/or,*

*I hereby certify that all information contained in this General Permit Registration Application and any supporting documents appended hereto is, to the best of my knowledge, true, accurate and complete, and that all reasonable efforts have been made to provide the most comprehensive information possible*

Signature \_\_\_\_\_  
(please use blue ink) Responsible Official Date

Name & Title *John P. Whittington, Executive Vice President of HealthSouth Corporation, the Manager of Applicant*  
(please print or type)

Signature *John P. Whittington* \_\_\_\_\_ *8/15/15* \_\_\_\_\_  
(please use blue ink) Authorized Representative (if applicable) Date

Applicant's Name *West Virginia Rehabilitation Hospital, Inc.* \_\_\_\_\_

Phone & Fax *205-970-7316* \_\_\_\_\_ *205-262-8007* \_\_\_\_\_  
Phone Fax

Email *john.whittington@healthsouth.com ; david.stephen@healthsouth.com* \_\_\_\_\_

## General Permit G65-C Registration Section Applicability Form

General Permit G65-C was developed to allow qualified registrants to seek registration for emergency generator(s).

General Permit G65-C allows the registrant to choose which sections of the permit that they wish to seek registration under. Therefore, please mark which sections that you are applying for registration under. Please keep in mind, that if this registration is approved, the issued registration will state which sections will apply to your affected facility.

Section 5	Reciprocating Internal Combustion Engines (R.I.C.E.)*	<input checked="" type="checkbox"/>
Section 6	Tanks	<input checked="" type="checkbox"/>
Section 7	Standards of Performance for Stationary Compression Ignition Internal Combustion Engines (40CFR60 Subpart IIII)	<input checked="" type="checkbox"/>
Section 8	Standards of Performance for Stationary Spark Ignition Internal Combustion Engines (40CFR60 Subpart JJJJ)	<input type="checkbox"/>

\* **Affected facilities that are subject to Section 5 may also be subject to Sections 7 or 8. Therefore, if the applicant is seeking registration under both sections, please select both.**

## EMERGENCY GENERATOR ENGINE DATA SHEET

Source Identification Number <sup>1</sup>		EG 1	
Engine Manufacturer and Model		Volvo TWD1643GE	
Manufacturer's Rated bhp/rpm		917	
Source Status <sup>2</sup>		NS	
Date Installed/Modified/Removed <sup>3</sup>		4 <sup>th</sup> Qtr 2015	
Engine Manufactured/Reconstruction Date <sup>4</sup>		2015	
Is this a Certified Stationary Spark Ignition Engine according to 40CFR60 Subpart IIII? (Yes or No) <sup>5</sup>		YES	
Is this a Certified Stationary Spark Ignition Engine according to 40CFR60 Subpart JJJJ? (Yes or No) <sup>6</sup>		NO	
Engine, Fuel and Combustion Data	Engine Type <sup>7</sup>	N/A	
	APCD Type <sup>8</sup>	N/A	
	Fuel Type <sup>9</sup>	2FO	
	H <sub>2</sub> S (gr/100 scf)		
	Operating bhp/rpm	876	
	BSFC (Btu/bhp-hr)		
	Fuel throughput (gal/hr)	55.5	
	Fuel throughput (MMft <sup>3</sup> /yr)	N/A	
	Operation (hrs/yr)	500	
Reference <sup>10</sup>	Potential Emissions <sup>11</sup>	lbs/hr	tons/yr
MD	NO <sub>x</sub>	10.46	2.61
MD	CO	0.76	0.19
MD	VOC	0.20	0.05
AP	SO <sub>2</sub>	1.19E-03	2.97E-04
MD	PM <sub>10</sub>	0.14	0.04
AP	Formaldehyde	6.04E-04	1.51E-04

1. Enter the appropriate Source Identification Number for each emergency generator. Generator engines should be designated EG-1.

2. Enter the Source Status using the following codes:

NS	Construction of New Source (installation)	ES	Existing Source
MS	Modification of Existing Source	RS	Removal of Source

### STORAGE TANK DATA SHEET

Source ID # <sup>1</sup>	Status <sup>2</sup>	Content <sup>3</sup>	Volume <sup>4</sup>	Dia <sup>5</sup>	Throughput <sup>6</sup>	Orientation <sup>7</sup>	Liquid Height <sup>8</sup>
T01	NEW	Diesel	1,000	81	27,750	HORZ	15

1. Enter the appropriate Source Identification Numbers (Source ID #) for each storage tank located at the compressor station. Tanks should be designated T01, T02, T03, etc.
2. Enter storage tank Status using the following:
 

EXIST Existing Equipment	NEW Installation of New Equipment
REM Equipment Removed	
3. Enter storage tank content such as condensate, pipeline liquids, glycol (DEG or TEG), lube oil, etc.
4. Enter storage tank volume in gallons.
5. Enter storage tank diameter in feet.
6. Enter storage tank throughput in gallons per year.
7. Enter storage tank orientation using the following:
 

VERT Vertical Tank	HORZ Horizontal Tank
--------------------	----------------------
8. Enter storage tank average liquid height in feet.

**EMERGENCY GENERATOR EMISSION SUMMARY SHEET FOR CRITERIA POLLUTANTS**

Emergency Generator Location: <u>HealthSouth Mountain View Regional Rehab Hospital</u>		Registration Number (Agency Use) <u>G65-C</u>													
Source ID No.	Potential Emissions (lbs/hr)										Potential Emissions (tons/yr)				
	NOx	CO	VOC	SO <sub>2</sub>	PM <sub>10</sub>	NOx	CO	VOC	SO <sub>2</sub>	PM <sub>10</sub>	NOx	CO	VOC	SO <sub>2</sub>	PM <sub>10</sub>
EG1	10.46	0.76	0.20	1.19E-03	0.14	2.61	0.19	0.05	2.97E-04	0.04					
<b>Total</b>	<b>2.03</b>	<b>0.15</b>	<b>0.04</b>	<b>0.19</b>	<b>0.03</b>	<b>0.51</b>	<b>0.04</b>	<b>0.01</b>	<b>0.05</b>	<b>0.03</b>	<b>0.04</b>	<b>0.01</b>	<b>0.05</b>	<b>0.01</b>	<b>0.01</b>

Criteria Pollutant Emission Factors

Engine Generator	Each (kw)	Each (hp)	Generator Hours (hr/yr)	NO <sub>x</sub> Emission Factor <sup>1</sup> (g/kWh-hr)	CO Emission Factor <sup>1</sup> (g/kWh-hr)	VOC Emission Factor <sup>1,2</sup> (g/kWh-hr)	PM Emission Factor <sup>1,2</sup> (g/kWh-hr)	SO <sub>x</sub> Emission Factor (g/bhp-hr)
Gen 1	574	917	500	7.04	0.51	0.14	9.50E-02	5.98E-04

1. Emissions Factors are the maximum of either manufacturer's nominal data (\*1.25 to present a NTE value) and from EPA's AP-42 Section 3.2, Table 3.2-1 for SO<sub>x</sub>.

2. Conservatively assume PM=PM<sub>2.5</sub>=PM<sub>10</sub>.

Total Engine Emissions

Engine	NO <sub>x</sub> Emissions		CO Emissions		VOC Emissions		PM Emissions		SO <sub>x</sub> Emissions	
	lb/yr	tpy	lb/yr	tpy	lb/yr	tpy	lb/yr	tpy	lb/yr	tpy
Gen 1	10.46	2.61	0.76	0.19	0.20	0.05	1.41E-01	3.53E-02	1.18E-03	2.97E-04
TOTAL		2.61		0.19		0.05		0.04		2.97E-04

Hazardous Air Pollutant Emissions

	Number of Units	Generator Hours (hours/ generator/yr)
Emergency Generators	1	500

Hazardous Air Pollutant Emissions

Hazardous Air Pollutant	Emission Factor <sup>1</sup> (lb/MMBtu)	Emission Factor (lb/gal)	Emissions Per Unit <sup>2</sup> (lb/hour)	Emissions Per Unit (tpy)
Acetaldehyde	2.52E-05	3.48E-06	1.93E-04	4.83E-05
Acrolein	7.88E-06	1.09E-06	6.04E-05	1.51E-05
Arsenic Unlisted Compounds	4.00E-06	5.52E-07	3.06E-05	7.66E-06
Benzene	7.76E-04	1.07E-04	5.94E-03	1.49E-03
Benzo - a pyrene	2.57E-07	3.55E-08	1.97E-06	4.92E-07
Beryllium metal (unreacted)	3.00E-06	4.14E-07	2.30E-05	5.74E-06
Cadmium metal	3.00E-06	4.14E-07	2.30E-05	5.74E-06
Chromic Acid (VI)	3.00E-06	4.14E-07	2.30E-05	5.74E-06
Hexane	2.69E-02	3.71E-03	2.06E-01	5.15E-02
Formaldehyde	7.89E-05	1.09E-05	6.04E-04	1.51E-04
Lead Unlisted Compounds	9.00E-06	1.24E-06	6.89E-05	1.72E-05
Manganese Unlisted Compounds	6.00E-06	8.28E-07	4.60E-05	1.15E-05
Mercury Vapor	3.00E-06	4.14E-07	2.30E-05	5.74E-06
Naphthalene	1.30E-04	1.79E-05	9.96E-04	2.49E-04
Nickel Metal	3.00E-06	4.14E-07	2.30E-05	5.74E-06
Selenium Compounds	1.50E-05	2.07E-06	1.15E-04	2.87E-05
PAH <sup>3</sup>	2.12E-04	2.93E-05	1.62E-03	4.06E-04
Toluene	2.81E-04	3.88E-05	2.15E-03	5.38E-04
Xylene	1.93E-04	2.66E-05	1.48E-03	3.70E-04

Assume

0.138 MMBtu/lb (the high heat value of diesel)

<sup>1</sup> Emission factors from EPA AP-42 Table 3.4-3 and Table 3.4-4.

<sup>2</sup> To be conservative and simplify the calculations, the maximum fuel consumption of 55.5 gal/hr was used for each engine.

<sup>3</sup> POM is assumed to equal PAH.

<sup>4</sup> Since PAH includes naphthalene, the total only includes the non-naphthalene portion of PAH so that naphthalene is not counted twice.

**Toxic Air Pollutant Emissions**

	Number of Units	Generator Hours (hours/ generator/yr)
Emergency Generators	1	500

**Toxic Air Pollutant Emissions**

Hazardous Air Pollutant	Emissions Per Unit <sup>2</sup> (lb/hour)	Emissions Per Unit (tpy)
Styrene	6.35E-06	1.59E-06
Ethylbenzene	1.32E-05	3.30E-06
Methanol	1.63E-03	4.08E-04
Vinyl Chloride	3.83E-06	9.58E-07
Chloroform	7.32E-06	1.83E-06

Assume 0.138 MMBtu/lb (the high heat value of diesel)

<sup>1</sup> Emission factors from EPA AP-42 Table 3.4-3 and Table 3.4-4.  
<sup>2</sup> To be conservative and simplify the calculations, the maximum fuel consumption of 55.5 gal/hr was used for each engine.

## VOLVO PENTA GENSET ENGINE

# TWD1643GE

613 kW (834 hp) at 1500 rpm, 674 kW (917 hp) at 1800 rpm

The TWD1643GE is a powerful, reliable and economical Generating Set Diesel Engine built on the dependable in-line six design.

### Durability & low noise

Designed for easiest, fastest and most economical installation. Well-balanced to produce smooth and vibration-free operation with low noise level.

To maintain a controlled working temperature in cylinders and combustion chambers, the engine is equipped with piston cooling. The engine is also fitted with replaceable cylinder liners and valve seats/guides to ensure maximum durability and service life of the engine.

### Low exhaust emission

The state of the art, high-tech injection and charging system with low internal losses contributes to excellent combustion and low fuel consumption.

The TWD1643GE is certified for EPA Tier 2. An additional feature is that TWD1643GE fulfils EU Stage 2 exhaust emission levels.

### Easy service & maintenance

Easily accessible service and maintenance points contribute to the ease of service of the engine.

### Technical description

#### Engine and block

- Optimized cast iron cylinder block with optimum distribution of forces without the block being unnecessarily heavy.
- Wet, replaceable cylinder liners
- Piston cooling for low piston temperature and reduced ring temperature
- Tapered connecting rods for reduce risk of piston cracking
- Crankshaft induction hardened bearing surfaces and fillets with seven bearings for moderate load on main and high-end bearings
- Case hardened and Nitrocarburized transmission gears for heavy duty operation
- Keystone top compression rings for long service life
- Viscous type crankshaft vibration dampers to withstand single bearing alternator torsional vibrations
- Replaceable valve guides and valve seats
- Over head camshaft and four valves per cylinder

#### Lubrication system

- Full flow oil cooler
- Full flow disposable spin-on oil filter, for extra high filtration
- The lubricating oil level can be measured during operation



### Features

- Tropical cooling system (55°C)
- Fully electronic with Volvo Penta EMS 2
- Dual frequency switch (between 1500 rpm and 1800 rpm)
- High power density
- Emission compliant
- Low noise levels
- Low fuel consumption
- Gen Pac configuration
- Compact design for the power class

- Gear type lubricating oil pump, gear driven by the transmission

#### Fuel system

- Non-return fuel valve
- Electronic unit injectors
- Fuel prefilter with water separator and water-in-fuel indicator / alarm
- Gear driven low-pressure fuel pump
- Fine fuel filter with manual feed pump and fuel pressure switch
- Fuel shut-off valve

#### Cooling system

- New TWD-cooling system with optimized priority and cold start valves
- Two water cooled charge air coolers
- Efficient cooling with accurate coolant control through a water distribution duct in the cylinder block. Reliable sleeve thermostat with minimum pressure drop
- Belt driven, maintenance-free coolant pump with high degree of efficiency
- Coolant filter as standard

#### Turbo charger

- Efficient and reliable dual stage turbochargers

- Intermediate charge air coolers for both turbochargers
- Waste gate system for the high pressure turbocharger

#### Electrical system

- Engine Management System 2 (EMS 2), an electronically controlled processing system which optimizes engine performance. It also includes advanced facilities for diagnostics and fault tracing
- The instruments and controls connect to the engine via the CAN SAE J1939 interface, either through the Control Interface Unit (CIU) or the Display Control Unit (DCU). The CIU converts the digital CAN bus signal to an analog signal, making it possible to connect a variety of instruments. The DCU is a control panel with display, engine control, monitoring, alarm, parameter setting and diagnostic functions. The DCU also presents error codes in clear text.
- Sensors for oil pressure, oil temp, boost pressure, boost temp, exhaust temp, coolant temp, fuel temp, water in fuel, fuel pressure and two speed sensors.

**VOLVO  
PENTA**

# VOLVO PENTA

NO: 164015

## EXHAUST EMISSION DECLARATION

The emission data in this declaration are measured according to the test procedures specified below and on one member engine of the engine type. Emission data may vary among production engines.

### TECHNICAL SPECIFICATION

Engine type: TWD1643GE  
Specification: 869523  
Module No: 138052022  
Rated crankshaft power \*): 674 kW  
Rated speed: 1800 rpm  
\*) Stand-by power without fan acc. to ISO 3046.

### TEST INFORMATION

Test conditions: 40 CFR part 89  
Test identification: 29003822  
Test date: December 4, 2006  
Test cycle: 5-mode US constant speed test cycle

### EXHAUST EMISSIONS (weighted cycle)

CO (g/kWh)	0,41
HC (g/kWh)	0,11
NOx (g/kWh)	5,63
PM (g/kWh)	0,076

### EXHAUST EMISSIONS (per cycle mode)

Mode	#	1	2	3	4	5
Power	(kW)	668	503	335	167	67
NOx	(g/h)	3427	2716	1892	1009	629
HC	(g/h)	43	36	32	31	44
CO	(g/h)	486	179	68	83	155
CO <sub>2</sub>	(kg/h)	441	324	219	120	64
NOx	(ppm)	629	599	540	441	386
HC	(ppm)	23	23	26	40	81
CO	(ppm)	138	61	30	56	147
CO <sub>2</sub>	(%)	7,85	6,93	6,06	5,1	3,8
O <sub>2</sub>	(%)	10	11,23	12,45	13,75	15,55

### TA-Luft

Test identification: 29003831  
Test date: December 4, 2006

Mode	#	1	2	3	4
Power	(kW)	616	462	308	154
Nox (O <sub>2</sub> )	(g/Nm <sup>3</sup> )	1.9	2.1	2.0	2.0
HC (O <sub>2</sub> )	(mg/Nm <sup>3</sup> )	20	23	31	51
CO (O <sub>2</sub> )	(mg/Nm <sup>3</sup> )	238	110	76	163
PM (O <sub>2</sub> )	(mg/Nm <sup>3</sup> )	27	17	13	26

\* PM is calculated from multifilter measurements with AVL Smart Sampler.

### SMOKE

Opacity (%): Acc: n.a., Lug: n.a., Peak: n.a.

Gothenburg 2006-12-07

  
Hanna Wahlström

AB Volvo Penta  
47 436, Engine Emission Certification



# State of West Virginia



## Certificate

*I, Natalie E. Tennant, Secretary of State of the State of West Virginia, hereby certify that*

### HEALTHSOUTH CORPORATION

a corporation formed under the laws of Delaware filed an application to be registered as a foreign corporation authorizing it to transact business in West Virginia. The application was found to conform to law and a "Certificate of Authority" was issued by the West Virginia Secretary of State on March 15, 1994.

I further certify that the corporation has not been revoked by the State of West Virginia nor has a Certificate of Withdrawal been issued to the corporation by the West Virginia Secretary of State.

Accordingly, I hereby issue this

## CERTIFICATE OF AUTHORIZATION

Validation ID:3WV25\_KJ4PG

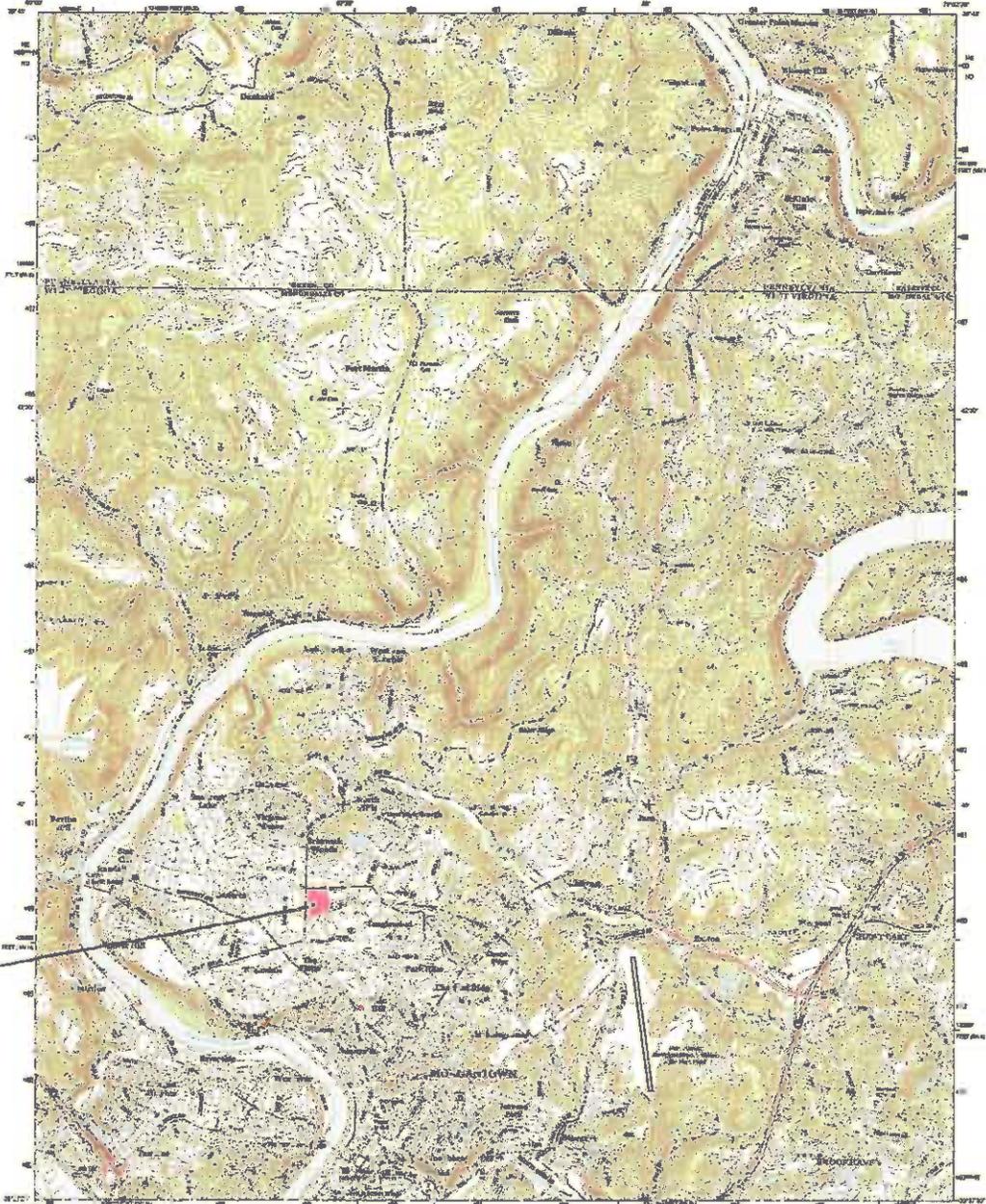


*Given under my hand and the Great Seal of the State of West Virginia on this day of June 03, 2015*

*Natalie E. Tennant*

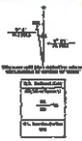
Secretary of State





Hospital  
Location

Approved for the United States Geological Survey  
Publication "Scale of 1:250,000"  
This map is published by the United States Geological Survey  
under authority of the Secretary of the Interior, U.S. Department of the Interior  
Washington, D.C. 20548



SYMBOLS

Boundary	—	Intermittent	—
Supervisory	—	Intermittent	—
Proposed	—	Intermittent	—
Proposed	—	Intermittent	—
Proposed	—	Intermittent	—

1	2	3	4
5	6	7	8
9	10	11	12
13	14	15	16

MORGANTOWN NORTH, WV-PA  
2014