Title/Subject:	Standard Test Procedure – Diesel Power Package Exhaust Gas Cooling Efficiency Test	
M&ESD No. : 2	Version Date: 2005-02-04	Signature/Initial:

1.0 PURPOSE

This Standard Test Procedure (STP) is to be used by Mechanical & Engineering Safety Division (M&ESD) investigators to determine:

1.1 The maximum exhaust gas temperature at discharge from a wet exhaust conditioner before the exhaust gas is diluted with air.

1.2 The maximum exhaust gas temperature at discharge from a dry exhaust conditioner before the exhaust gas is diluted with air.

2.0 SCOPE

This procedure applies to exhaust gas cooling efficiency tests conducted by the Mechanical & Engineering Safety Division on diesel power package components to determine compliance with the requirements of 30 CFR 7.102: "Exhaust Gas Cooling Efficiency Test".

3.0 REFERENCES

3.1 30 CFR Part 7, Subpart F, "Diesel Power Packages Intended for Use in Areas of Underground Coal Mines Where Permissible Electric Equipment is Required"

3.2 30 CFR Part 36, Subpart C, "Approval Requirements for Permissible Mobile Diesel-Powered Transportation Equipment – Test Requirements"

4.0 DEFINITIONS

4.1 **Diesel Power Package** – A diesel engine with an intake system, exhaust system, and a safety shutdown system installed.

4.2 **Dry Exhaust Conditioner** – An exhaust conditioner that cools the exhaust gas without direct contact with water.

4.3 **Exhaust System –** A system connected to the outlet of the diesel engine which includes, but is not limited to, the exhaust manifold, the exhaust pipe, the exhaust conditioner, the exhaust flame arrester, and any adapters between the exhaust manifold and exhaust flame arrester.

4.4 **Flame Arrester –** A device so constructed that flame or sparks from the diesel engine cannot propagate an explosion of a flammable mixture through it.

4.5 **Wet Exhaust Conditioner –** An exhaust conditioner that cools the exhaust gas through direct contact with water, commonly called a water scrubber.

5.0 TEST EQUIPMENT

5.1 Dynamometer stand to provide loading on the engine.

5.2 Laminar air flow meter installed/connected into the air intake duct of the engine.

5.3 Methane analyzer for measuring/monitoring the percent of methane in the engine's intake air.

5.4 Pressure/vacuum sensors installed and located to measure the following:

5.4.1 Oil Pressure.

5.4.2 Exhaust Backpressure near the Exhaust Manifold Outlet.

5.4.3 Intake Vacuum Inby the Flame Arrester near the Intake Manifold.

5.4.4 Water Pump Outlet Pressure.

5.4.5 Laminar Flow Differential Pressure.

5.5 Thermocouples installed in the proper locations to measure the following temperatures:

5.5.1 Oil Temperature.

5.5.2 Fuel Temperature.

5.5.3 Intake Air Temperature (near intake manifold).

5.5.4 Test Cell Ambient Air Temperature.

5.5.5 Laminar Air Flow Temperature.

5.5.6 Raw Exhaust Gas Temperature near Exhaust Manifold Outlet.

5.5.7 Cooled Exhaust Gas Temperature.

5.5.8 Water Temperature into Engine.

5.5.9 Water Temperature Out of Engine.

5.5.10 Water Temperature Out of Exhaust Manifold.

5.5.11 Water Temperature Out of Exhaust Pipe.

5.5.12 Water Temperature Out of Air Compressor (if applicable).

NOTE: Depending on the design of the cooling system, thermocouples may be required in other locations.

6.0 PROCEDURE

6.1 Perform a detailed check of parts against the drawings and specifications submitted to MSHA under compliance with 30 CFR Part 7.97 to determine that the parts and drawings agree.

6.2 Fill the coolant system with a mixture of equal parts of antifreeze and water, following the procedures specified in the application, Part 7.97(a)(3).

6.3 If a wet exhaust conditioner is used to cool the exhaust gas, fill the exhaust conditioner to the high or normal operating water level and have a reserve water supply available, if applicable.

6.4 The engine shall be set to the rated horsepower specified in Part 7.97(a)(2).

NOTE: For laboratory test purposes, the fuel pump calibration for the

rated horsepower must be set between the nominal and the maximum fuel tolerance specification.

6.5 Install sufficient temperature measuring devices to determine the location of the highest coolant temperature. The temperature measuring devices shall be accurate to +/- 4 °F (+/- 2 °C).

6.6 Operate the engine at rated horsepower and with 0.5 +/- 0.1 percent, by volume, of methane in the intake air mixture until all parts of the engine, exhaust coolant system, and other components reach their respective equilibrium temperatures. The liquid fuel temperature into the engine shall be maintained at 100 °F (38 °C) +/- 10 °F (6 °C) and the intake air temperature shall be maintained at 70 °F (21 °C) +/- 5 °F (3 °C).

6.7 Increase the coolant system temperatures until the highest coolant temperature is 205 °F to 212 °F (96 °C to 100 °C), or to the maximum temperature specified by the applicant, if lower.

6.8 After all coolant system temperatures stabilize, operate the engine for 1 hour.

6.9 The ambient temperature shall be between 50 °F (10 °C) and 104 °F (40 °C) throughout the tests.

6.10 Install a temperature measuring device to measure the exhaust gas temperature at discharge from the exhaust conditioner. The temperature measuring device shall be accurate to +/- 4 °F (+/- 2 °C).

6.11 Determine the exhaust gas temperature at discharge from the exhaust conditioner before the exhaust gas is diluted with air.

7.0 ACCEPTABLE PERFORMANCE

7.1 The exhaust gas temperature at discharge from a wet exhaust conditioner before the exhaust gas is diluted with air shall not exceed 170 °F (76 °C).

7.2 The exhaust gas temperature at discharge from a dry exhaust conditioner before the exhaust gas is diluted with air shall not exceed 302 °F (150 °C).