

1.0 PURPOSE

This test is to be used by investigators to determine the maximum surface temperature of any external surface of a diesel power package.

2.0 SCOPE

This procedure applies to surface temperature tests conducted by the Mechanical & Engineering Safety Division on diesel power package components to determine compliance with the requirements of 30 CFR 7.101: "Surface Temperature Tests".

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. Dynamometers 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 TEST SAMPLES

6.1. N/A

7.0 PROCEDURES

- 7.1. 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.
- 7.2. 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).
- 7.3. 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.
- 7.4. 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.

- 7.5. 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).
- 7.6. 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).
- 7.7. 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.

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

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

8.0 TEST DATA

8.1. N/A

9.0 PASS/FAIL CRITERIA

9.1. The surface temperature of any external surface of the diesel power package shall not exceed 302 °F (150 °C) during the test.

9.2. Currently, MSHA sprays the components with temperature sensitive paint to ensure the component temperatures are below 302 °F (150 °C). Melting of the temperature sensitive paint is considered a failure. The Surface Temperature Testing Method could be subject to change if newer and better technologies become available in the future.