

1.0 PURPOSE

The purpose of this document is to provide a procedure to be used by the Electrical Safety Division to determine if a representative sample of a methane monitoring system meets the vibration test requirements of 30 CFR 27.39(a).

2.0 SCOPE

This Standard Test Procedure (STP) applies to tests on all methane monitoring systems submitted for certification per 30 CFR Part 27. This STP will apply to tests on systems submitted for extension of certification and RAMPs only when the changes are judged to affect the vibration resistance of the system.

3.0 REFERENCES

30 CFR 27.39 Tests to determine resistance to vibration. (a) Laboratory tests for reliability and durability. Components, subassemblies, or assemblies that are to be mounted on permissible and approved equipment shall be subjected to two separate vibration tests, each of one hour duration. The first test shall be conducted at a frequency of 30 cycles per second with a total movement per cycle of 1/16 inch. The second test shall be conducted at a frequency of 15 cycles per second with a total movement per cycle of 1/8 inch. Components, subassemblies, and assemblies shall be secured to the vibration testing equipment in their normal operating positions (with shock mounts, if regularly provided with shock mounts). Each component, subassembly, and assembly shall function normally during and after each vibration test.

Note: The vibrating equipment is designed to impart a circular motion in a plane inclined 45° to the vertical or horizontal.

4.0 DEFINITIONS

4.1. Methane Detector - A component of a methane monitoring system that functions in a gassy mine, tunnel, or other underground workings to sample the atmosphere continuously and responds to the presence of methane.

4.2. Methane Monitoring System - A complete assembly of one or more methane detectors and all other components required for measuring and warning of the presence of methane in the atmosphere of a mine, tunnel, or other underground workings, and shall include a power shutoff component.

5.0 TEST EQUIPMENT

- 5.1. Adapter for applying gas to detector head (manufacturer's calibration cup).
- 5.2. Test gas consisting of methane and air.
- 5.3. Gas mixing/measuring equipment (if not using pre-mixed test gas) with the capability to give mixtures of 1.5 and 2.1 \pm 0.1 percent by volume [Modular Dyna-Blenders Models 8250].
- 5.4. A vibration table that is designed to impart a circular motion in a plane inclined 45° to the vertical or horizontal, at frequencies of 15 and 30 Hz, and with amplitudes of 1/16 in. and 1/8 in. [MRAD Model F2424(200)E-45 Degree].
- 5.5. Equipment to monitor the status of the power shut-off component.
- 5.6. Equipment (e.g., accelerometer/amplifier) with sufficient range and resolution to monitor the frequency and amplitude of the vibration table within \pm 2 Hz and \pm 0.02 in. (\pm 0.5 mm) [MRAD DIGI-VIB Model 437 ADF-2].
- 5.7. Gas analyzer with a range of at least 0 to 10 % volume methane-in-air; a resolution of at least 0.01 % volume methane-in-air, and accuracy of at least \pm 0.05 % volume methane-in-air [Horiba Model VIA-510].

6.0 TEST SAMPLES

One representative sample of a complete methane-monitoring system.

7.0 PROCEDURES

- 7.1. The tests shall be conducted in an ambient temperature of 25 \pm 10° Celsius.
- 7.2. Assemble and calibrate the methane-monitoring system per the manufacturer's recommendations. Analyze the calibration gas with the gas analyzer. Record the reading.
- 7.3. Secure the components (power supply, readout/control unit, sensor assembly) to be tested to the vibration testing equipment in their normal operating positions (with shock mounts, if specified with shock mounts).

- 7.4. Apply a gas mixture of 1.5 percent methane-in-air to the methane detector. Note display reading and alarm indicator status on the test sheet.
- 7.5. Apply a gas mixture of 2.1 percent methane-in-air to the methane detector. Note display reading, alarm indicator status, and power shutoff component status on the test sheet.
- 7.6. Operate the vibration table at a frequency of 30 ± 2 cycles per second with a total movement per cycle of 0.0625 ± 0.03 in. (1.6 ± 0.8 mm) for one hour. Monitor the amplitude and frequency of the table and the status of the power shutoff component. Note vibration table frequency and amplitude on the test sheet.
- 7.7. Every fifteen minutes (\pm five minutes), apply a gas mixture of 2.1 percent methane-in-air to the methane detector. Note alarm indicator status and power shutoff component status on the test sheet.
- 7.8. Operate the vibration table at a frequency of 15 ± 2 cycles per second with a total movement per cycle of 0.125 ± 0.03 in. (3.2 ± 0.8 mm) for one hour. Monitor the amplitude and frequency of the table and the status of the power shutoff component. Note the vibration table frequency and amplitude on the test sheet.
- 7.9. Every fifteen minutes (\pm five minutes), apply a known gas mixture of 2.1 percent methane or natural gas-in-air to the methane detector. Note alarm indicator status and power shutoff component status on the test sheet.

8.0 TEST DATA

- 8.1. Vibration table frequency at the beginning and end of testing at both frequencies.
- 8.2. Vibration table amplitude at the beginning and end of testing at both frequencies.
- 8.3. Power shutoff component status before, during, and after testing at both frequencies.
- 8.4. Display reading and Alarm indicator status before, during, and after testing at both frequencies.
- 8.5. Test equipment with calibration due dates.

- 8.6. Description of methane-monitoring system including manufacturer and model or type number.
- 8.7. Test gas concentration before, during, and after testing at both frequencies.
- 8.8. Ambient temperature.
- 8.9. Details (written or photographic) of the method used to secure the component(s) of the methane monitoring system to the vibration table.
- 8.10. Reference to the manufacturer's calibration procedure (document number, section, revision date, etc.).
- 8.11. The analyzed reading of the calibration gas.

9.0 PASS/FAIL CRITERIA

Each component, subassembly, and assembly shall:

- 9.1. Actuate a warning device when 1.5 percent methane-in-air is applied to the methane detector;
- 9.2. Actuate a warning device and power shutoff component when 2.1 percent methane-in-air is applied to the methane detector;
- 9.3. Not actuate these devices in fresh air before, during, and after each vibration test.