

## 1.0 PURPOSE

The purpose of this document is to provide a procedure to be used by the Electrical Safety Division to verify the manufacturer's stated accuracy for a methane gas detector that has capability of measuring a volume fraction up to 100 % methane in air. This test will be performed twice; one time before the drop test specified in ASTP2209 and one time after. The testing can be performed in conjunction with the Oxygen Deficiency Test specified in ASTP2235.

## 2.0 SCOPE

This STP applies to single or multi-gas detectors submitted for approval under either 30 CFR Part 18 or 22.

## 3.0 REFERENCES

- 3.1. 30 CFR Part 18 "Electric Motor-Driven Mine Equipment and Accessories"
- 3.2. 30 CFR Part 22 "Portable Methane Detectors"
- 3.3. 30 CFR Part 75.335(b), "Seal requirements, Sampling and Monitoring Requirements"
- 3.4. ASTP2209, "Drop Test of Methane-Indicating Detectors"
- 3.5. ASTP2235, "Oxygen Deficiency Accuracy Test"

## 4.0 DEFINITIONS

- 4.1. Multi-gas detector - a portable hand-held instrument fitted with multiple sensors capable of detecting more than one type of gas in the mine atmosphere.
- 4.2. Methane Detector - A device that may be used to detect the presence of methane in a gassy mine.
- 4.3. Methane indicating detector - A device that will show, within certain limits of error, on an adequate scale, the percentage of methane in a gassy atmosphere.
- 4.4. Final reading - display reading on the instrument after the test gas has been applied to the detector for at least two minutes.

## 5.0 TEST EQUIPMENT

- 5.1. Standard methane-in-nitrogen gas mixtures, with controllable regulators, of the following concentrations: 10.0%, 20.0%, 50.0%, 70%, and 90%. The volume fraction of the methane within the test gases shall be known to a relative expanded uncertainty of  $\pm 1$  % of the nominal value.
- 5.2. Gas mixing apparatus to supply methane-in-air mixture of 5.0% by volume. [Matheson Dynablender Model 8250]
- 5.3. 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 0.05% volume methane-in-air (for verifying the 5.0% methane-in-air test gas) [Horiba Model VIA-510].
- 5.4. Hose(s) and connectors, as needed.
- 5.5. Digital Thermometer. Minimum resolution of 0.20 degree Celsius and minimum range from 0 to 40 degrees Celsius (Fluke 2170A).

## 6.0 TEST SAMPLES

- 6.1. Four representative samples of the portable methane indicating detector/multi-gas detector of a quality design and construction consistent with that of the final manufactured product. If the detector includes an optional sampling pump, two of the samples should include the pump.
- 6.2. For pump or aspirated detectors, a sampling tube of specified maximum length and minimum inside diameter. If different maximum lengths of tubing are specified for tubing with different diameters, calculate the time necessary for a gas sample to travel the length of the tube to the detector. Select the sampling tube that would require the longest time to travel the length of the tube.
- 6.3. The manufacturer's calibration kit (including calibration adapter, calibration procedures, instruction manual, probes, and sampling lines).

## 7.0 PROCEDURES

- 7.1. Charge the detectors according to the manufacturer's instructions or install fresh batteries.

- 7.2. Calibrate the detectors according to the manufacturer's instructions. If more than one calibration procedure is included in the manufacturer's instructions, each specified procedure must be used on at least one test sample. If possible, analyze the calibration gas with the gas analyzer. Record the reading. Note: Do not recalibrate the detectors during the test.
- 7.3. Reapply the manufacturer's calibration gas (using manufacturer's calibration kit), and record the detectors' readings. Note: Testing may be stopped here if readings are not within manufacturer's published specifications, or if a proper calibration could not be performed.
- 7.4. Conduct the test in an ambient temperature of 25 ( $\pm$  10) °C. Record the ambient temperature on the test sheet.
- 7.5. Measure and record the length and inside diameter of any sampling tubes.
- 7.6. Check the zero and span readings of the gas analyzer. Calibrate if necessary.
- 7.7. Set the gas mixing apparatus to flow only air at the flow rate specified in the manufacturer's instruction manual.
- 7.8. **Diffusion Sample:**
  - 7.8.1. Note the fresh air reading.
  - 7.8.2. Apply the 5.0% methane gas (using the gas mixing apparatus) through the calibration adapter at the specified flow rate to the instrument. Note final reading.
  - 7.8.3. Apply the 10.0% methane through tubing connected to a calibration adapter. Ensure that the flow rate is as specified by the manufacturer. Note final reading.
  - 7.8.4. Apply the 20.0% methane through tubing connected to a calibration adapter. Ensure that the flow rate is as specified by the manufacturer. Note final reading.
  - 7.8.5. Apply the 50.0% methane through tubing connected to a calibration adapter. Ensure that the flow rate is as specified by the manufacturer. Note final reading.

- 7.8.6. Apply the 90.0% methane through tubing connected to a calibration adapter. Ensure that the flow rate is as specified by the manufacturer. Note final reading.
- 7.8.7. Remove gas and let the detector stabilize at room temperature for approximately 2 minutes. Note the fresh air reading
- 7.8.8. Repeat steps 7.8.1 through 7.8.7 on three additional samples if all four are diffusion type and one additional sample if the detector includes an optional pump.
- 7.9. Pump Sample:**
- 7.9.1. Connect one end of a tube from the output of the regulator on the appropriate cylinder. Connect the other end to a tubing "T" connector. Connect the opposite end of the "T" connector to the laboratory vent. Connect the remaining "T" connector to the instrument's pump input. The flow rate from the cylinder must be greater than the flow rate of the sampling pump. Note fresh air reading.
- 7.9.2. Apply the 90.0% methane from the appropriate cylinder. Note final reading.
- 7.9.3. Apply the 50.0% methane from the appropriate cylinder. Note final reading.
- 7.9.4. Apply the 20.0% methane from the appropriate cylinder. Note final reading.
- 7.9.5. Apply the 10.0% methane from the appropriate cylinder. Note final reading.
- 7.9.6. Apply the 5.0% methane gas (using the gas mixing apparatus). Note final reading.
- 7.9.7. Remove gas and let the detector stabilize at room temperature for approximately 2 minutes. Note the fresh air reading.
- 7.9.8. Repeat steps 7.9.1 through 7.9.7 on one additional sample.

## 8.0 TEST DATA

- 8.1. The manufacturer, model number, and serial number of each detector.
- 8.2. Model/part number and flow rate of the pump, if applicable.
- 8.3. Flow rate applied to the calibration adapter during testing.
- 8.4. Length and inside diameter of sampling tubing, if applicable
- 8.5. Test equipment identification (e.g. model number, part number, serial number(s)).
- 8.6. Ambient temperature.
- 8.7. Final reading of the detector when the various concentrations of methane were applied.

## 9.0 PASS/FAIL CRITERIA

The detector fails if any of the readings are not within the tolerance(s) specified by the manufacturer.