1.0 PURPOSE

This test procedure is used by the Electrical Safety Division to determine if samples of portable methane indicating detectors or a multi-gas detector that has methane detection capability meet the requirements of 30 CFR Section 22.7(d)(2).

2.0 SCOPE

To provide a person knowledgeable in the appropriate technical field with a written procedure that will assure consistent repeatable test data and results independent of the person conducting the test.

3.0 REFERENCES

3.1. 30CFR Section 22.7(d)(2) (Appendix 1)

3.2. ACRI2001 "Criteria for the Evaluation and Test of Intrinsically Safe Apparatus and Associated Apparatus".

4.0 DEFINITIONS

4.1. Replacement ratio - The ratio of the carrier/air flow rate in liters per minute to the free space volume in liters of the test box, less any sample(s) drawn from the test box.

4.2. Free space volume - The volume of the test box minus the volume of the detectors and other devices located within the test box.

4.3. Methane detector - A device that may be used to detect the presence of methane in a gassy mine.

4.4. 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.

4.5. Multi-Gas Detector/Monitor - A device that may be used to detect the presence of methane and other gases in a gassy mine.

5.0 TEST EQUIPMENT

5.1. Calibration Gas Cylinder (8.5xx% Methane with Nitrogen Balance)

5.2. A test box large enough for the number of test samples to be tested. The box must have at least three inlet/outlet ports - an inlet in a lower section of the

box, an outlet in an upper section of the box on the side opposite the inlet, and an outlet for connection of the gas measuring instrument in the center of the box.

5.3. An environmental chamber capable of housing the test box and detectors tested outside of the test box (if applicable). It must maintain interior temperatures between 50 °F and 70 °F in increments of 5 °F. [Tenney Model TH27 3 Environmental Chamber].

5.4. 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 [Horiba Model VIA-510].

5.5. Gas mixing equipment to supply methane-in-air mixtures of 0.25 to 5.00 (±0.05) percent by volume at the calculated flow rate [Matheson Dynablender Model 8250].

5.6. A five-foot (minimum) length of coiled copper tubing. The test gas flows through this tube to condition the test gas to stabilize at the temperature inside the environmental chamber.

5.7. A flow meter for measuring the test gas flow rate entering the test box, and the flow rate of the detector's built in sampling pump or optional sampling pump. [Gilian "Gilibrator"]

5.8. A thermometer with a range of at least 0 - 70 °F, a resolution of at least 0.2 °F, and an accuracy of at least 1 °F for determining the interior temperature of the environmental chamber [Fluke 2170A].

5.9. Certified gas measuring equipment (Horiba Model VA 510 CH4 Analyzer Unit)

6.0 TEST SAMPLES

6.1. Four representative production samples of the portable methane indicating detector. 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, calibration procedures, probes, sampling lines, extra batteries, and battery chargers (if rechargeable).

7.0 PROCEDURES

7.1. Calibrate the Horiba VIA-510 gas analyzer using the 8.5xx% methane with nitrogen balance calibration gas cylinder.

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

7.3. Calibrate the detectors (using manufacturer's calibration kit) according to the manufacturer's instructions. If more than one calibration procedure is included in the manufacturer's instructions, each specified procedure must e used on at least one test sample. Analyze the calibration gas with the gas analyzer. Record the reading. Note: Do not recalibrate the detectors during the test.

7.4. 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.

7.5. Calculate and record the free space volume of the test box.

7.6. Measure and record the inner dimensions of the test box, and calculate and record its volume.

7.7. Measure and record the outer dimensions of each detector or other device to be placed into the test box. Calculate and record the total volume that all devices within the test box will occupy.

7.8. Subtract the volume of the detectors from the volume of the test box.

7.9. Measure and record the length and inside diameter of any sampling tubes.

7.10. Calculate and record the test gas flow rate necessary to maintain a replacement ratio between 0.5 to 0.8 exchanges per minute in the test box. If the detectors have sampling pumps, increase the calculated test gas flow rate

to compensate for the flow drawn by the pump(s) as specified by the applicant.

7.11. For diffusion type detectors, place the detectors into the test box and place the test box into the environmental chamber. Arrange the detectors such that they do not obstruct the inlet and outlet ports of the test box. Position the sensor head of each detector away from any inlet port.

7.12. For pump or aspirated type detectors, connect the sampling tube to the test box through a gas port located near the center of the side of the test box. Place the test box and detectors into the environmental chamber. If a probe is specified for use on the sampling tube, mount the probe such that the test gas is drawn from the middle of the test box through the probe.

7.13. Connect tubing from the gas mixing apparatus to the coiled copper tubing in the environmental chamber. Connect tubing from the outlet of the copper tubing to an inlet port on the test box located near the bottom of the test box.

7.14. Connect an exhaust tube to an outlet port near the top of the test box so that the test gas exhausts outside of the building. DO NOT USE A FAN TO EXHAUST.

7.15. Connect the gas sampling tube from the gas analyzer to an outlet port at the same level as the sensor heads (diffusion type detectors) or at the same level as the outlet port to pump or aspirated type detectors.

7.16. Set the environmental chamber to (70 ±1) °F. Allow the test chamber to stabilize at that temperature for one hour.

7.17. Check and adjust, if necessary, the zero and span readings of the gas analyzer.

7.18. Set the gas mixing apparatus to flow only air at the flow rate calculated in 7.6. Record the readings of the detectors.

7.19. Introduce the test gas into the test chamber at the flow rate calculated, starting at 0.25%.

7.20. Once the concentration within the test box reaches the set test gas concentration that is displayed on the Horiba Model 510 gas analyzer, wait for at least two minutes. Record the test gas concentration reading, and each of the readings displayed on the test samples. Note: If the concentration

within the test box does not reach the test gas concentration, check the test box or connection lines for leaks, verify proper operation of the gas measuring equipment and repeat this step.

7.21. With the environmental chamber set to (70 ±1) °F, repeat steps 7.15 and 7.16 setting the gas mixing apparatus, in this order, to 0.5%, 1.0%, 2.0%, 3.0%, 4.0%, 5.0%, 5.0%, 4.0%, 3.0%, 2.0%, 1.0%, 0.5%, 0.25%, and 0.0% volume methane-in-air.

7.22. Set the environmental chamber to (65 ±1) °F. Allow the test chamber to stabilize at that temperature for one hour.

7.23. Repeat steps 7.15 thru 7.17 four more times, reducing the temperature in the environmental chamber from 65 °F to 50 °F in 5 degree increments. Take fresh air readings before the start of each series.

8.0 TEST DATA

8.1. The analyzed value of the 8.5xx% methane in nitrogen balance calibration gas.

8.2. Readings of the instruments when the calibration gas is applied.

8.3. The manufacturer, model number, and serial number of each detector, and part number of the pump, if it is an optional type and not internal to the instrument

8.4. Reference the manufacturer's calibration procedure filed in the correspondence folder of the investigation.

8.5. Specified flow rate of any sampling pump.

8.6. Length and inside diameter of any sampling tubes

8.7. Calculation of the test gas flow rate

8.8. Manufacturer, model number, serial number, and calibration due date for all test equipment

8.9. Internal temperature of the environmental chamber, test gas concentration from the gas analyzing equipment, and gas concentration as displayed on each detector under test.

9.0 PASS/FAIL CRITERIA

The detector fails if the average of the ten readings (two readings for each percentage at five different temperatures), or more than two readings for each percentage of any of the four samples exceed the limits of error given below.

Methane-in-air mixtures	Minimum indication	Maximum indication
0.00	-0.10	0.10
0.25	0.10	0.40
0.50	0.35	0.65
1.00	0.80	1.20
2.00	1.80	2.20
3.00	2.70	3.30
4.00	3.70	4.30
5.00	Manufacturer's specifications	Manufacturer's specifications