

1.0 PURPOSE

This test procedure is used by the Electrical Safety Division to determine if representative samples of a methane-indicating detector or a multi-gas detector that has methane detection capability complies with the drop test requirements of 30 CFR 22.7(d) (3).

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. 30 CFR Section 22.7(d)(3) *Mechanical strength*. Detectors and indicating detectors shall be subjected to the following mechanical tests: Four of each of those parts or groups of assembled parts that are not normally strapped to the user shall be dropped 20 times on a wood floor from a height of 3 feet. Parts that are strapped to the user may be subjected to a jarring or bumping test to demonstrate adequate strength. The average number of times that any one of the detectors can be dropped before breakage or material distortion of essential parts shall be not less than 10.
- 3.2. ACRI2001 "Criteria for the Evaluation and Test of Intrinsically Safe Apparatus and Associated Apparatus".

4.0 DEFINITIONS

- 4.1. Methane detector - A device that may be used to detect the presence of methane in a gassy mine.
- 4.2. 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.
- 4.3. Multi-Gas Detector/Monitor - A device that may be used to detect the presence of methane and other gases in a gassy mine.
- 4.4. Essential part - A component or assembly of the detector that would render the detector unsafe, inaccurate, or unreadable as determined by these test procedures.

- 4.5. Clean air - Air that is free of combustible gases and contaminating substances.

5.0 TEST EQUIPMENT

- 5.1. Drop test apparatus or equivalent means to drop the detector. The floor of the drop test apparatus shall be level and constructed of oak planking no less than 1-inch thick. (Note: A guide that does not restrict the vertical free-fall of the detector may be used to assure the intended surface or corner of the detector impacts the floor first) (Mechanical Technology Inc. Model 5D 100S)
- 5.2. Certified gas mixtures or gas mixing and measuring equipment capable of providing 0.25 and 2.00 ($\pm .05$) percent (by volume) methane-air mixtures. (Matheson Model 8250 Dyna-Blender and Horiba Model VA-510 CH₄ Analyzer Unit)
- 5.3. A thermometer minimum precision: 0.1° Celsius (C); minimum accuracy: $\pm 1^\circ\text{C}$ (Fluke or Omega).

6.0 TEST SAMPLES

Four (4) representative production samples of the methane-indicating detector. If the detector is powered by more than one type of battery pack, the detector assembled with the heaviest pack should be tested. If the detector has optional components, such as a pump, drop tests shall be performed with and without the component attached.

7.0 PROCEDURES

- 7.1. Record the ambient temperature. (Note: The ambient temperature must be $25^\circ \pm 10^\circ\text{C}$)
- 7.2. Remove the detector from any removable case or holster.
- 7.3. Turn on the detector. Note: If specified by the manufacturer, the detector shall be left on until the minimum warm-up time has expired.
- 7.4. Inspect the detector. Photograph and note any damage to the detector before the drop test. If the damage is significant and it has been determined that the damage may affect the operation of the detector, notify the applicant and request a replacement.

- 7.5. Perform methane determinations of clean air, 0.25% and 2.0% methane-air gas mixtures using the detector. If any of readings are not within the minimum and maximum indications specified in Table 1 below, calibrate the detector per the manufacturer's calibration procedures. Analyze the manufacturer's calibration gas with the Horiba Model VA-510 CH₄ Analyzer Unit. Record the reading. If the reading is not within the manufacturer's calibration gas specifications, testing cannot be started. Notify the applicant.
- 7.6. Measure the distance from the arm of the drop test apparatus to the floor of the drop test apparatus. This distance shall be 3-feet (\pm 1-inch). If necessary, adjust the height of the arm of the drop test apparatus.
- 7.7. Place the detector on the arm of the drop test apparatus with any surface, edge or corner facing down.
- 7.8. Actuate the arm of the drop test apparatus to allow the detector to fall onto the drop test apparatus floor.
- 7.9. Identify and record each time the detector was dropped and the surface or corner of the detector that made initial contact with the drop test apparatus floor.
- 7.10. Inspect the detector. Photograph and note any damage to the detector.
Note: If the detector turns off when dropped, it may be turned back on and the test continued.
- 7.10.1. If there was any breakage or material distortion of essential parts of the detector, the detector fails and there will be no additional drop tests of that detector. Refer to Section 9 for examples of breakage or material distortion of essential parts.
- 7.11. Perform methane determinations of clean air, 0.25% and 2.0% methane-air gas mixtures using the detector.
- 7.11.1. If any of the methane readings are outside the minimum and maximum indications specified in Section 9.3, the detector fails and there will be no additional drop tests of that detector.

Note: Detectors are not to be re-calibrated.

7.12. Continue the procedure by repeating steps 7.7 through 7.11 until a total of twenty (20) valid drop tests have been performed on each detector or until the detector fails. Orient the axis of the detector for each test such that the detector will strike the floor or platform on each surface and each corner at least once during the twenty (20) drop tests. The particular surface or corner of the detector which strikes the floor or platform shall be arbitrarily selected for each test. After each of the drop tests, the detector is to be inspected and methane determinations are to be made as specified in 7.4 and 7.5. Record the number of times the detector has been drop tested, identify the surface or corner which made initial contact with the floor or platform and record the results of each drop test noting failures.

8.0 TEST DATA

- 8.1. The ambient temperature. Minimum precision: 0.1°C; minimum accuracy: ± 1°C.
- 8.2. A description of the methane detector including manufacturer, model, or type number and serial number.
- 8.3. The sample number.
- 8.4. An identification of the surface or corner of the detector which made initial contact with the floor or platform. A pictorial drawing of the detector may be helpful in this identification.
- 8.5. The results of the visual inspection for mechanical damage as determined in 7.4 and 7.10.
- 8.6. The number of times the drop test was performed on each detector.
- 8.7. The results of methane determinations as determined in 7.11. Record each required methane determination reading. Readings not within the limits or error specified are to be noted.
- 8.8. Test equipment with calibration due dates.
- 8.9. Reference to the manufacturer's calibration procedure (document number, section, revision date, etc.).

9.0 PASS/FAIL CRITERIA

- 9.1. 30 CFR 22.7(d)(3) states: "The average number of times that any one of the detectors can be dropped before breakage or material distortion of essential parts shall be not less than 10." The Approval and Certification Center (A&CC) recognizes the ambiguity of this requirement. Therefore, the average number of times each detector (four samples) can be dropped before breakage or material distortion of essential parts as specified in 9.2 or readings not within the limits of error as specified in 9.3 shall not be less than 10.
- 9.2. Material distortion or mechanical failure constitutes failure. Failures include, but are not limited to, the following:
- (1) breakage or distortion of the case assembly (including display windows) which would allow coal dust to enter the detector enclosure,
 - (2) physical damage which would make the display unreadable,
 - (3) physical damage which would turn the detector off permanently,
 - (4) breakage of the sensor enclosure which would expose the sensor element, (4) evidence of physical damage to the battery supply, the sensor, or any other component or assembly.
- 9.3. Methane determinations not within the limits of error specified as follows, constitutes failure:

Actual Percentage of Methane	Minimum Indication	Maximum Indication
0.00 (Fresh Air)	-0.1	0.1
0.25	0.1	0.4
2.00	1.8	2.2