1.0 PURPOSE

This test procedure is used by the Electrical Safety Division to determine if a portable methane detector/multi-gas detector, that is strapped to the user, meets the requirements of 30 CFR 22.7(d)(3).

2.0 SCOPE

This STP applies to methane detectors/multi-gas detectors that are intended to be strapped to the user.

3.0 REFERENCES

30 CFR Part 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.

4.0 DEFINITIONS

4.1. Methane detector - a portable hand-held instrument capable of indicating the percentage of methane in the ambient atmosphere.

4.2. Multi-gas detector - a portable hand-held instrument fitted with multiple sensors (at least one combustible sensor indicating the percentage of methane) capable of detecting more than one type of gas in the ambient atmosphere.

4.3. Essential Part - A component or assembly of the detector that would render the detector unsafe, inaccurate, or unreadable as determined by this test procedure.

4.4. Fresh/Clean air – Air that is free of combustible gases and contaminating substances.

4.5. 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. A shock test apparatus in accordance with IEC Standard 60068-2-27, 4th edition. This test apparatus shall be provided with a means of mounting the methane detector to the table of the shock test apparatus. The shock test apparatus shall be adjusted to deliver a peak acceleration of 50 g for a duration of 11 milliseconds (ms) using a half sine wave pulse.

5.2. Certified gas mixtures or gas mixing and measuring equipment capable of providing both 0.25 - 0.27 and 2.00 - 2.05 percent (by volume) methane-air mixtures (Matheson Model 8250 Dyna-Blender and Horiba Model VA-510 CH4 Analyzer Unit).

5.3. Hose(s) and connectors, as needed.

5.4. Digital Thermometer. Minimum resolution of 0.20 degree Celsius (C) and minimum range from 0 to 40 degrees C. (Fluke 2170A).

6.0 TEST SAMPLES

6.1. Four representative samples of the portable methane 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 the maximum length and maximum inside diameter specified for use with the detector.

6.3. The manufacturer's calibration kit (including calibration adapter, calibration procedures, instruction manual, probes, and sampling lines).

7.0 PROCEDURES

7.1. Conduct the test in an ambient temperature of 25 (±10) °C. Record the ambient temperature on the test sheet.

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

7.3. Calibrate the instruments according to the manufacturer's instructions. Note: Do not recalibrate the detectors during the test.

7.4. Perform methane accuracy determinations of clean air (0.00%), 0.25% and 2.0% methane–in-air of the sample detector using the manufacturer's calibration kit gas cylinder.

Note: If any of the clean air and methane readings is outside the minimum and maximum indications specified in Section 9.3, the detector fails and there will be no additional testing or re-calibration of that sample.

7.5. Place the detector/pump assembly in the case that will be used to strap the detector to the user.

7.6. Position the detector/pump assembly on the shock test apparatus with a surface perpendicular to the intended shock direction. Record the position of the detector.

7.7. Activate the shock test apparatus.

7.8. Inspect the detector for damage. Photograph and describe any damage to the detector. Note: If the detector turns off during the test, it may be turned back on and the test continued.

If there was any breakage or material distortion of essential parts of the detector, the detector fails and there will be no additional testing of that sample. Refer to Section 9.2 for examples of breakage or distortion of essential parts.

7.9. Perform methane accuracy determinations of clean air (0.00%), 0.25% and 2.0% methane–in-air of the sample detector and record the final reading and alarm(s) status.

If any of the clean air and methane readings is not within the limits of error specified in Section 9.3, the detector fails and there will be no additional testing or re-calibration of that sample.

7.10. Repeat Steps 7.6 through 7.9 two additional times with the detector/pump assembly mounted in the same direction.

7.11 Reposition the detector/pump assembly so that a different surface is perpendicular to the intended direction of the shock. Repeat 7.6 through 7.10.

7.12 Repeat 7.6 through 7.10 for each of the remaining 4 surfaces of the detector/pump assembly for a total of 18 shock tests per sample.

7.13 Repeat 7.5 through 7.12 on the remaining three samples of the detector/pump assembly.

8.0 TEST DATA

8.1. Final reading of the detector after each concentration of test gas and fresh air was applied.

8.2. The manufacturer, model number, sample number, and serial number of each detector.

8.3. Model/part number and flow rate of the pump, if applicable.

8.4. Length and inside diameter of sampling tubing, if applicable.

8.5. Alarm(s) status

8.6. Ambient temperature.

8.7. Test equipment identification (e.g. model number, part number, serial number(s) and calibration due dates).

8.8. Flow rate applied to the calibration adapter during testing.

8.9. Total number of times the shock test was performed on each sample. Identify each surface that was shock tested.

8.10. Photographs and results of the inspection for mechanical damage as determined in Section 7.8.

9.0 PASS/FAIL CRITERIA

9.1. The average number of times that the four detectors can be shock tested 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) Breakage of the sensor enclosure which would expose the sensor element: and,

(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