1.0 PURPOSE

1.1. This test procedure is used by the Electrical Safety Division (ESD) to determine if representative samples of an optical isolator comply with the requirements of ACRI2001 "Criteria for the Evaluation and Test of Intrinsically Safe Apparatus and Associated Apparatus", Section 9.12.

1.2. 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.

2.0 SCOPE

This Standard Test Procedure (STP) applies to optical isolators submitted for test as a protective component for use in intrinsically safe apparatus and associated apparatus evaluated, approved, or certified per 30 CFR Parts 18, 22, 23, and 27.

3.0 REFERENCES

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

3.2. 30 CFR Part 18 "Electric Motor-Driven Mine Equipment and Accessories"

3.3. 30 CFR Part 22 "Portable Methane Detectors"

3.4. 30 CFR Part 23 "Telephones and Signaling Devices"

3.5. 30 CFR Part 27 "Methane-Monitoring Systems"

4.0 DEFINITIONS

4.1. IS Side - The side of the optical isolator connected to the intrinsically safe circuit of the associated apparatus.

4.2. Non-IS Side - The side of the optical isolator connected to the non-intrinsically safe circuit of the associated apparatus.

4.3. Maximum Fault Voltage - The highest voltage that can be applied across the IS side of the optical isolator under worst-case, two-fault conditions.

4.4. Maximum Safe-Area Voltage - The highest voltage that can be applied to the Non-IS side of the optical isolator under normal and fault conditions.

5.0 TEST EQUIPMENT

5.1. A variable power source having sufficient voltage and current to simulate the maximum safe-area voltage source.

5.2. A variable power source having sufficient voltage and current to simulate the maximum fault voltage to the IS side of the optical isolator.

5.3. A withstand/insulation tester (Kikusui Model 8850 or equivalent).

5.4. A stopwatch if the withstand/insulation tester does not have a built-in timer.

6.0 TEST SAMPLES

Nine (9) samples of each type optical isolator.

7.0 PROCEDURES

7.1. Conduct the test at an ambient temperature of 25 (± 10)°C.

7.2. Set the withstand/insulation tester breakdown or cutoff current to 5 milliamperes, if equipped.

7.3. Each optical isolator shall be tested. The dielectric withstand voltage shall be 2500 volts or four times the maximum safe-area voltage, whichever is greater. Record the dielectric withstand voltage.

7.3.1. Short-circuit all leads (pins) from the Non-IS side of the optical isolator. Short-circuit all leads (pins) from the IS side of the optical isolator.

WARNING: HIGH VOLTAGE!
DO NOT CONTACT LIVE CONDUCTORS.
TEST COMPONENT IN A SUITABLE ENCLOSURE.
COMPONENT UNDER TEST MAY BURST INTO FRAGMENTS OR FLAME DURING THE TEST.

7.3.2. Apply the test voltage between the Non-IS and IS sides of the optical isolator. The test voltage shall be increased from zero to the dielectric withstand voltage in approximately ten seconds. Maintain the test voltage at the dielectric withstand voltage (-0, +10%) for 60 (-0, +2) seconds.

7.3.3. Record the test voltage and whether or not the optical isolator passed the dielectric withstand test.

7.3.4. Disconnect the short-circuit from all leads (pins).

7.4. Samples of the optical isolator shall be tested to determine if the optical isolator will continue to provide adequate isolation between the IS side and the Non-IS side after the maximum safe-area voltage is suddenly applied across the Non-IS side leads (pins).

7.4.1. Select three of the nine samples of the optical isolator for test.

WARNING: HIGH VOLTAGE!
DO NOT CONTACT LIVE CONDUCTORS.
TEST COMPONENT IN A SUITABLE ENCLOSURE.
COMPONENT UNDER TEST MAY BURST INTO FRAGMENTS OR FLAME DURING THE TEST.

7.4.2. Apply the maximum safe-area voltage to the Non-IS side of the optical isolator for 60 (-0, +2) seconds. Record the maximum safe-area voltage and a narrative description of any damage to the optical isolator. Photographs showing damage to the optical isolator may be attached to the test sheet.

7.4.3. After testing the three samples, determine if each optical isolator continues to withstand the dielectric test voltage when tested per Section 7.1.

7.5. Samples of the optical isolator shall be tested to determine if the optical isolator will continue to provide adequate isolation between the IS side and the Non-IS side after the maximum safe-area voltage is gradually applied across the Non-IS side leads (pins).

7.5.1. Select three of the remaining six samples of the optical isolator for test.

7.5.2. Connect and power the optical isolator such that it will be conducting (turned on) during the test. Provide a schematic diagram or a verbal description of the test circuit to document how the optical isolator was tested.

WARNING: HIGH VOLTAGE!
DO NOT CONTACT LIVE CONDUCTORS.
TEST COMPONENT IN A SUITABLE ENCLOSURE.
COMPONENT UNDER TEST MAY BURST INTO FRAGMENTS OR FLAME DURING THE TEST.

7.5.3. Connect the appropriate variable DC or AC power source across the Non-IS side of the optical isolator. Increase the voltage across the Non-IS side of the optical isolator in five percent maximum steps from zero to the maximum safe-area voltage in a ten (-0, +1) minute period. Record the maximum safe-area voltage, the voltage at which the component failed, if applicable, and a narrative description of any damage to the optical isolator. Photographs showing damage to the optical isolator may be attached to the test sheet.

7.5.4. After testing the three samples, determine if each optical isolator continues to withstand the dielectric test voltage when tested per Section 7.1.

7.6. Samples of the optical isolator shall be tested to determine if the optical isolator will continue to provide adequate isolation between the IS side and the Non-IS side after the maximum fault voltage is gradually applied across the IS side leads (pins).

7.6.1. The three remaining samples of optical isolators shall be used in this test.

7.6.2. Connect and power the optical isolator such that it will be conducting (turned on) during the test. Provide a schematic diagram or a verbal description of the test circuit to document how the optical isolator was tested.

WARNING: HIGH VOLTAGE!
DO NOT CONTACT LIVE CONDUCTORS.
TEST COMPONENT IN A SUITABLE ENCLOSURE.
COMPONENT UNDER TEST MAY BURST INTO FRAGMENTS OR FLAME DURING THE TEST.

7.6.3. Connect the appropriate variable DC or AC power source across the IS side of the optical isolator. Increase the voltage across the IS side of the optical isolator in five percent maximum steps from zero to the maximum fault voltage in a ten (-0, +1) minute period. Record the maximum fault voltage, the voltage at which the component failed, if applicable, and a narrative description of any damage to the optical isolator. Photographs showing damage to the optical isolator may be attached to the test sheet.

7.6.4. After testing the three samples, determine if the optical isolator continues to withstand the dielectric test voltage when tested per Section 7.1.

8.0 TEST DATA

8.1. The manufacturer and manufacturer's model or part number for the optical isolator.

8.2. A schematic diagram of the optical isolator identifying the IS and Non-IS terminals and describing how the optical isolator was connected in the test circuit.

8.3. Manufacturer's specified minimum dielectric withstand voltage between the input and output, and the internal creepage and clearance distances, if specified, for the optical isolator.

8.4. The maximum safe-area voltage.

8.5. The maximum fault voltage and current that could be applied to the IS side of the optical isolator.

8.6. The dielectric withstand voltage for each test and whether or not the optical isolator passed the test.

8.7. A narrative description of any damage to the optical isolator during test.

8.8. Equipment used for testing on the test sheet. This should include: manufacturer, model number, serial number, and calibration due date for each piece of equipment.

9.0 PASS/FAIL CRITERIA

Each optical isolator must pass the dielectric withstand test described in Section 7.3 after testing per Sections 7.4 through 7.6.