

1.0 PURPOSE

This document establishes MSHA's Standard Flame Test Procedure (STP) for Hose, and Other Materials: Title 30, Code of Federal Regulations, Part 18, Section 8.65.

2.0 SCOPE

2.1. The Quality Assurance and Materials Testing Division, Approval and Certification Center conducts the flame test that is outlined in 30 CFR, Part 18, Section 18.65. The following products are required by 30 CFR to be fire resistant or flame resistant:

- a. Hose conduit,
- b. Fire hose liner,
- c. Fire suppression hose cover,
- d. Cable reel insulation,
- e. Insulation for battery box covers,
- f. Packing gland material.

2.2. This flame test is also used for the evaluation of other products not covered by mandatory regulations but issued acceptance for underground use under the "Standard Application Procedures for Acceptance of Flame-Resistant Solid Products Taken into Mines" (ASAP5001). Some of these products are belt skirting, chute liner, cover of hydraulic hose, rock dusting hose and dust collecting hose.

3.0 REFERENCES

3.1. 30 CFR, Part 18, Section 18.65.

4.0 DEFINITIONS

4.1. Afterflame - means the continuation of visible flaming of the specimen under the specified test conditions after the applied flame is removed.

- 4.2. Afterglow - means the continuation of visible glowing of a specimen after flaming has ceased.
- 4.3. Sample - means at least four specimens from a given lot.
- 4.4. Specimen - means a piece of the material that is six (6) inches long by ½ inch wide by the thickness of the material.
- 4.5. Applicant - is defined in 30 CFR, Part 18, Section 18.2 as “an individual, partnership, company, corporation, organization, or association that designs, manufacturers, assembles or controls the assembly of an electrical machine or accessory and seeks approval, certification, or permit, or MSHA acceptance for listing of flame-resistant cable or hose.”
- 4.6. Acceptance is defined in 30 CFR, Part 18, Section 18.2 as “written notification by MSHA that a cable or hose has met the applicable requirements of this part and will be listed by MSHA as acceptable flame-resistant auxiliary equipment.”

5.0 TEST EQUIPMENT

- 5.1. A schematic of the flame test apparatus is shown in the Appendix (Drawing B-1281 and B-1282). The principal parts of the test apparatus are a cabinet with a transparent access door, air flow nozzle, fume exhaust system, specimen holder, Pittsburgh-Universal Bunsen burner, burner placement guide and a mirror.
 - 5.1.1. Test Cabinet - The test chamber is a 21 - inch cubical chamber constructed of 16 gage metal. A close-fitting transparent door located on the front side of the cabinet is used for viewing the specimen during testing and for access to the interior of the cabinet. An 8-1/2 inch diameter hole is made in one side of the cabinet to accommodate the air flow nozzle. An exhaust port is located on the opposite side of the cabinet. The top of the test cabinet is removable for periodic cleaning and contains a ½-inch diameter hole with a removable cover cap for inserting a probe to measure air flow.
 - 5.1.2. Air Flow Nozzle - An ASME flow nozzle with a 16 to 8 ½ -inch reduction is mounted on one side of the cabinet. The nozzle directs the air flow over the specimen.

- 5.1.3. Exhaust System - An electrically driven exhaust fan, controlled by a variable autotransformer is connected at the exhaust side of the cabinet (opposite from the air flow nozzle) to produce the air flow over the specimen. The fan must be equipped with an "on/off" switch. If the exhaust system is equipped with a damper, it must not be used to turn the air flow on and off. Independent studies by MSHA and NIST have both shown that afterflame times are directly dependent on the acceleration or time to go from zero to 300 ft. /min. air flow. The "on/off" switch must be used for starting the motor used to produce the air flow. The airflow must go from zero to 300 ft. /min. in 8.5 seconds \pm 1.0 seconds.
- 5.1.4. Specimen holder - A metal support stand with an adjustable clamp is used to hold the specimen. Twenty mesh wire gauze, five inches square, is fastened on the ring clamp and positioned approximately $\frac{1}{4}$ - inch below the specimen.
- 5.1.5. Burner - A Pittsburgh-Universal Bunsen-type burner with inside diameter of 11 mm and a variable orifice, controlled by a needle valve, is used as an ignition source. The fuel is natural gas with a heat content of 890 to 900 BTU/ft³. The BTU is calculated at 60°F, 30 inches of Mercury (net) dry basis.
- 5.1.6. Burner Placement Guide - A metal guide, set on the floor of the cabinet, is used to position the burner directly beneath the test specimen. The guide should have a stop bar to insure that the burner is positioned in the same place for each specimen during application of the ignition flame. Positioning and retracting of the burner is accomplished by means of a metal rod ($\frac{3}{32}$ " diameter) connected to the burner and passing through a small hole in the front side of the cabinet.
- 5.1.7. Mirror - A mirror is placed inside the back wall of the test cabinet to permit a rear view of the specimen during the test. An outside mirror focused on the intake air nozzle is also used to view the specimen during the test.

6.0 TEST SAMPLES

- 6.1. The size of the test specimens is to be six (6) inches long by ½-inch wide by the thickness of the material. A minimum of four (4) specimens from the same lot is required as follows:
 - 6.1.1. Hose conduit; full thickness (complete wall) of the hose cut longitudinally.
 - 6.1.2. Fire hose; the liner (inner tube) cut longitudinally.
 - 6.1.3. Fire suppression hose; the cover of the hose cut longitudinally.
 - 6.1.4. Cable reel insulation; normal thickness of the material without the backing.
 - 6.1.5. Insulation for battery box covers; normal thickness of the material without backing.
 - 6.1.6. Packing Gland material; diameters being requested.
- 6.2. Prior to testing, the specimens should be conditioned for a minimum of 24 hours at an ambient temperature of $73 \pm 5^{\circ}\text{F}$ and a maximum relative humidity of 55%.

7.0 PROCEDURES

- 7.1. Place a specimen in the sample holder with its longitudinal axis and its transverse axis inclined at 45° to the horizontal. Angle the top of the specimen toward the viewing mirror at the back of the cabinet and the bottom toward the viewing door at the front. A half inch of the specimen should extend beyond the 20-mesh wire gauze and be centered one-inch above the top of the burner.
- 7.2. Materials which are too thin to be self supporting in the horizontal position are held in position by means of a No. 12 copper wire through the specimen.
- 7.3. With the exhaust fan turned off and the cabinet door closed adjust the air and gas supply to give an overall blue flame three (3) inches in height with no distinct inner cone or persistence of yellow coloration. It is helpful to adjust the flame and conduct the test in subdued room lighting.
- 7.4. Keep the cabinet door closed throughout the test.

- 7.5. Use a stop watch or timer to measure the duration of the applied flame, afterflame and afterglow.
- 7.6. Slide the burner under the specimen to the stop position and immediately start the stopwatch.
- 7.7. After one minute, fully retract the burner from beneath the specimen and simultaneously turn on the exhaust fan by means of the "on/off" switch. The gas to the burner may be shut off.
- 7.8. Beginning with the removal of the burner, determine and record the total duration of afterglow even if it exceeds 60 seconds, as the exact time will be needed for averaging four specimens. After the test specimen ceases to flame, it shall remain in the air flow for a least 3 minutes longer to determine the presence and duration of afterglow. If a glowing specimen exhibits flame within the 3 minutes, this flame time shall be added to the first flame time. Measure and record the total duration of afterglow even it exceeds 3 minutes, as the exact time will be needed to determine the average of the four specimens.
- 7.9. After the completion of the test, leave the fan on until the products of combustion are exhausted.
- 7.10. Repeat the procedure for a total of four specimens.

8.0 TEST DATA

- 8.1. The test results are compiled for the four test specimens and listed on a test report.

9.0 PASS/FAIL CRITERIA

- 9.1. The average results of the four (4) test specimens must not exceed one (1) minute duration of afterflame or three (3) minutes afterglow.



