

## **1.0 PURPOSE**

- 1.1. This document establishes MSHA's Standard Test Procedure (STP) for Measurement of Wall thickness of Hose Conduit, 30 CFR Part 18. Information regarding the test instrument was extracted from ASTM D374-79 and the RMA ISO DP4671 for the technical aspects of making hose thickness measurements.
- 1.2. The purpose of the test is to describe the test procedures used to take wall thickness measurements of hose conduit used in underground mines.

## **2.0 SCOPE**

The Quality Assurance and Materials Testing Division, Approval and Certification Center conduct the Hose Conduit Wall Thickness Measurement Test.

## **3.0 REFERENCES**

- 3.1. 30 CFR, Part 18, Section 18.39.
- 3.2. ISO 4671 Rubber and plastics hoses and hose assemblies — Methods of measurement of the dimensions of hoses and the lengths of hose assemblies
- 3.3. ASTM D374-79 - Standard Test Methods for Thickness of Solid Electrical Insulation.

## **4.0 DEFINITIONS**

Hose conduit – A hollow cylindrical product made from rigid material used to protect hoses and cables.

## **5.0 TEST EQUIPMENT**

A micrometer as indicated in Section 4, ASTM D374-79 (Standard Test Methods for Thickness of Solid Electrical Insulation) and having a ball attachment. A Vernier caliper may also be used. The precision should be to 0.001 inches or 0.01 mm.

A saw capable of cutting the hose conduit.

Microsoft Excel or another program capable of calculating averages and standard deviations of measurements at scale.

## **6.0 TEST SAMPLES**

A 3 ft. (92 cm) sample of the hose conduit (submitted by the applicant) should be used for wall thickness measurement.

## **7.0 PROCEDURES**

### **7.1. Sample Preparation**

7.1.1. Cut the three-foot sample into two 1.5 ft. (46 cm) sections and wipe it free of loose particles and burrs.

### **7.2. Sample Measurement: (See: Appendix A for schematic)**

7.2.1 Using the micrometer, keep the ball attachment on the inside of the hose to measure the curved surface accurately. Similarly, when using Vernier calipers, use the sharp ends to most accurately measure the curved surface.

7.2.2 Measure the sample at three locations (see Appendix A for a schematic):

7.2.2.1 Measure at each end of the hose conduit prior to cutting, at locations A and B in the schematic. Take 8-16 evenly spaced readings depending on the diameter of the conduit.

7.2.2.2 After cutting the sample in half, measure on either side of the cut for location C. Take 8-16 evenly spaced readings depending on the diameter of the conduit.

7.2.2.3 For small diameter hose, it may be necessary to split the sample to insert the micrometer jaws.

7.2.3 Record each reading on the Measurement of Hose Conduit Wall Thickness Data Sheet (See Appendix B). Record the readings to three places beyond the decimal (two places for millimeter measurements).

### **7.3 Data Analysis**

7.3.1 Use of Microsoft Excel or a similar program is suggested for this portion. You can make a template based on Appendix B to analyze measurements at scale.

7.3.2 Subtract the thickness of the ball attachment from the measurements, if not already done.

7.3.3 Calculate the average and first standard deviation of the sample or measurements from each location. Multiply the standard deviation by two to get numbers that represent 95 % of the distribution.

7.3.4 Subtract the 2x the standard deviation from the average to find the lower bound of the distribution. This number must be greater than 0.180 inches or 4.57 mm to pass.

**7.4 Test Modifications**

- 7.4.1 Since we cannot foresee all possible materials/products, compositions, physical properties, and applicable methods, MSHA reserves the right to modify the above test procedures.
- 7.4.2 Record any alterations to the procedure or unique observations made while following it in the comments section of the datasheet.

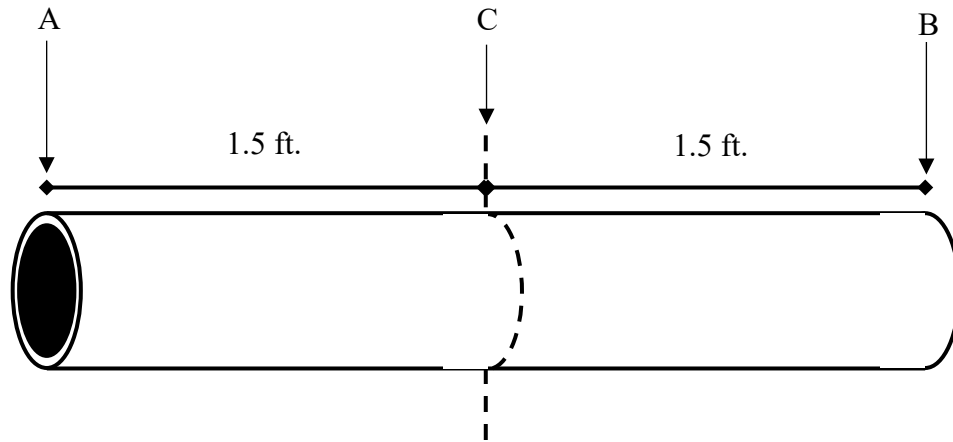
**8.0 TEST DATA**

Record photograph(s) of the conduit sample showing measurement locations A, B, and C. Save the information present on the datasheet using either the datasheet itself or a document generated during data analysis.

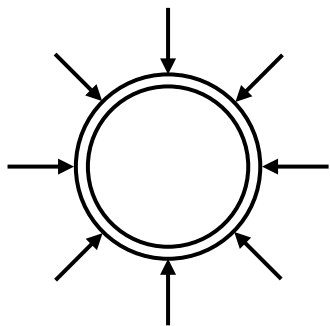
**9.0 PASS/FAIL CRITERIA**

The requirement for wall thickness criteria of hose conduit is a minimum 3/16 of an inch, as found in CFR 30, Part 18, Section 18.39. We round the exact fraction down from 0.1875 in. to 0.180 in. to account for process uncertainty. The sample of measurements to two standard deviations must fall entirely above the 0.180 in. minimum to be compliant.

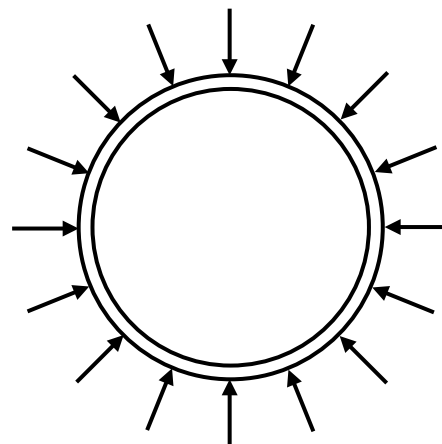
### Appendix A. Schematic of Sample Measurement



A, B, and C are measurement locations. Cut on the dotted line.



Conduit less than 1.5 inches in diameter



Conduit 1.5 inches or greater in diameter

Take 8 or 16 readings evenly spaced at each location, as visualized above.

## Appendix B.

### Measurement of Hose Conduit Wall Thickness Data Sheet

Tool used (circle one):      calipers              micrometer with ball attachment  
 Measurement unit:            inches              millimeters  
 Calibration ID#: \_\_\_\_\_ Calibration Date: \_\_\_\_\_  
 Investigator: \_\_\_\_\_ PAR: \_\_\_\_\_ Date: \_\_\_\_\_  
 Product: \_\_\_\_\_  
 Manufacturer: \_\_\_\_\_  
 Color: \_\_\_\_\_ Listed wall thickness: \_\_\_\_\_

Record picture(s) of the sample.

Measurement Location	A	B	C
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			
16			
<b>Average*</b>			
<b>Sample Standard Deviation x2 (2SD)</b>			
<b>Average minus 2SD</b>			

\*Subtract the height of the ball attachment if you used that method.

To pass: Subtract two times the standard deviation from the average. The value must be above 0.180 in. or 4.57 mm in each location.

Pass or Fail: \_\_\_\_\_

Comments: \_\_\_\_\_

\_\_\_\_\_

Signature: \_\_\_\_\_