SCTE · ISBE

STANDARDS

Interface Practices Subcommittee

AMERICAN NATIONAL STANDARD

ANSI/SCTE 166 2020

Flexure Method for Drop Cable Conditioning

NOTICE

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1. Introduction

1.1. Executive Summary

This test procedure applies to flexible, braided, coaxial cables, where the need exists to analyze and compare performance before and after cable flexure and resultant fatigue.

1.2. Scope

This test procedure provides a method of flex fatigue for accelerating the degradation of coaxial drop cable in the laboratory environment. The degradation observed, as measured by various performance criteria (shield effectiveness, DC resistance, etc.), is not intended to predict life expectancy of the cable under test (CUT). The test data obtained is for relative comparison purposes only.

1.3. Intended Audience

Coaxial cable manufacturers, test laboratories, and end-users.

2. Normative References

The following documents contain provisions, which, through reference in this text, constitute provisions of this document. At the time of Subcommittee approval, the editions indicated were valid. All documents are subject to revision; and while parties to any agreement based on this document are encouraged to investigate the possibility of applying the most recent editions of the documents listed below, they are reminded that newer editions of those documents might not be compatible with the referenced version.

2.1. SCTE References

- No normative references are applicable.

2.2. Standards from Other Organizations

European Norms document, EN 50289-3-9: 2001, Communication Cables - Specifications for Test Methods - Mechanical Test Methods - Bending Tests

2.3. Published Materials

- No normative references are applicable.

3. Informative References

The following documents might provide valuable information to the reader but are not required when complying with this document.

3.1. SCTE References

- No informative references are applicable.

3.2. Standards from Other Organizations

- No informative references are applicable.

3.3. Published Materials

- No informative references are applicable.

4. Compliance Notation

shall	This word or the adjective "***required***" means that the item is an absolute requirement of this document.
shall not	This phrase means that the item is an absolute prohibition of this document.
forbidden	This word means the value specified shall never be used.
should	This word or the adjective "*recommended*" means that there may exist valid reasons in particular circumstances to ignore this item, but the full implications should be understood, and the case carefully weighted before choosing a different course.
should not	This phrase means that there may exist valid reasons in particular circumstances when the listed behavior is acceptable or even useful, but the full implications should be understood, and the case carefully weighed before implementing any behavior described with this label.
may	This word or the adjective "*optional*" means that this item is truly optional. One vendor may choose to include the item because a particular marketplace requires it or because it enhances the product, for example; another vendor may omit the same item.
deprecated	Use is permissible for legacy purposes only. Deprecated features may be removed from future versions of this document. Implementations should avoid use of deprecated features.

5. Abbreviations and Definitions

5.1. Abbreviations

CUT	cable under test
DC	direct-current
DCR	direct-current resistance
EN	European Norms
HDPE	high density polyethylene
JOD	jacket outer diameter
SCTE	Society of Cable Telecommunications Engineers
SDR	standard dimension ratio

5.2. Definitions

No definitions required.

6. Test Method A – Cable Outer Diameter ≤ 0.300"

For coaxial cables whose outer jacket sheath diameter is less than or equal to 0.300" (7.62mm), the procedure in this section ***shall*** be followed. See Figure 1 through Figure 7 for guidance.

6.1. Equipment

6.1.1. Coaxial Cable Flex Tester

The coaxial cable flex tester ***shall*** consist of a means to drive or rotate the cables under test and count the number of rotations or flex cycles the CUT is exposed. The device ***shall*** be capable of rotating samples under test at a rate of 500 ± 50 rpm.

6.1.2. Test Fixtures

The fixture ***shall*** contain 3/4" HDPE SDR11 conduit with a 0.840 ± 0.0156" (21.34mm ± 0.40mm) inner diameter. The conduit shall be of a smooth inner wall with a low coefficient of friction.

The conduit ***shall*** be fabricated with 40-inch radius, to simulate aerial cable flexural fatigue. {This bend radius is meant to simulate a 3.5% - 4.0% installed sag value}. See Figure 1.

6.1.3. Appropriate Tools

Tools *should* include, at a minimum:

- Cable Preparation Tool
- Crimp Tool / Compression Tool
- Cable Cutters

6.2. Sample Preparation

1. Obtain the necessary drop cable samples as required.
2. If connectors are not installed on samples prior to flexure, prepare one end of the sample using a drop cable stripping tool. Perform connector installation per manufacturer's instructions.
3. Install adapters necessary to connect the sample to the drop cable flex-tester.

6.3. Test Procedure

1. For comparison purposes, conduct a base-line test (shield effectiveness, DC resistance, etc.) on a control sample of appropriate length necessary for test fixture.
2. Insert CUT into the conduit and connect to the motor shaft adapter. Connect opposite end of CUT to spindle, plug, or another device to maintain sample center during flexure.
3. Cooling of the CUT during the flexure is permissible via forced or compressed air injected into the conduit(s). When cooling is utilized, it ***shall*** be noted on the data collection form and reporting.
4. Adjust the preset counter to the desired number of flexures. Typically, samples are conditioned for 5,000 flexures minimum in increments of 5,000 cycles.
5. Energize the motor and control panel for the drop cable flex tester.
6. Using a built in or handheld tachometer, stopwatch, or a clock; adjust the speed of rotation for 500 ± 50 rpm.
7. Remove the coaxial cable sample from the flexure tester after completing the desired flexure. The CUT ***shall*** include the center section of the flexed cable specimen.
8. Conduct the appropriate test of interest (shielding effectiveness, direct-current resistance (DCR), etc.) on the flexed cable sample.
9. Record both the pre and post conditioning test results. Since this test is a relative test comparison, both sets of data from the control sample and CUT ***shall*** be compared for analysis. The test

results ***shall*** include the centering method used while flexing, and if alternative cooling is utilized to condition the CUT.

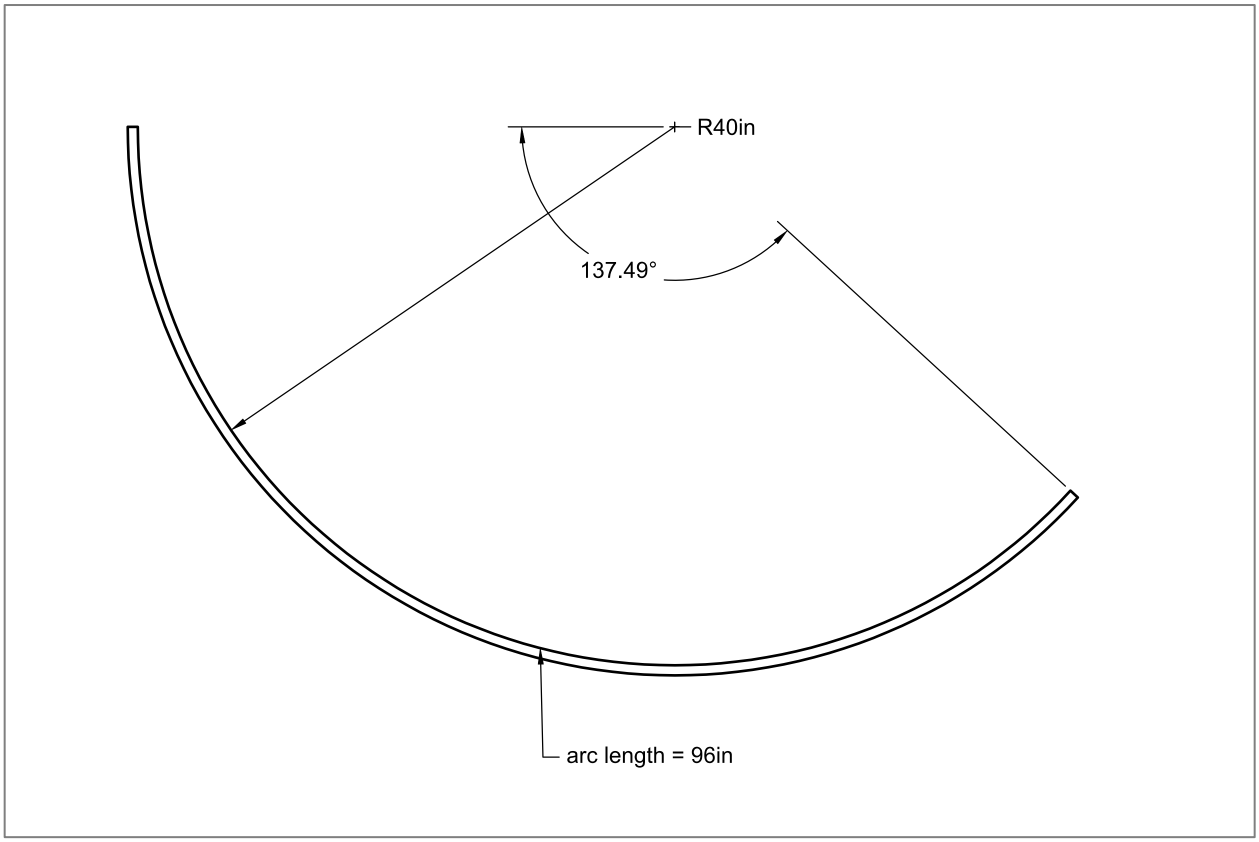

Figure 1 - Test Method A, Sweep Angle

Figure 2 - Test Method A – multiple sample condiioner

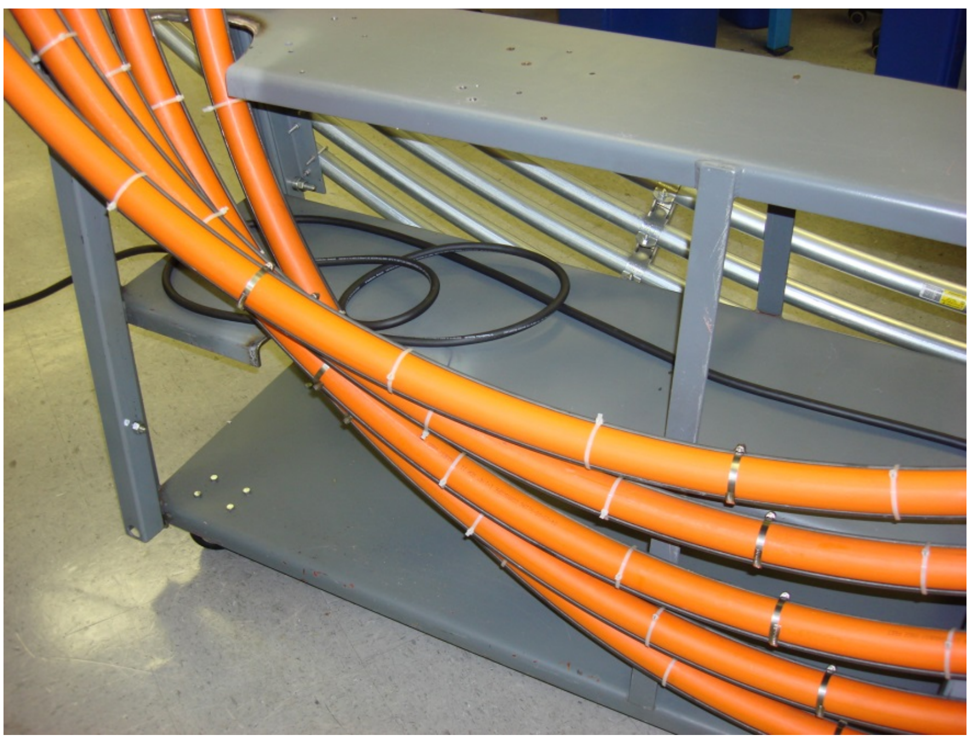

Figure 3 - Test Method A – multiple sample condiioner

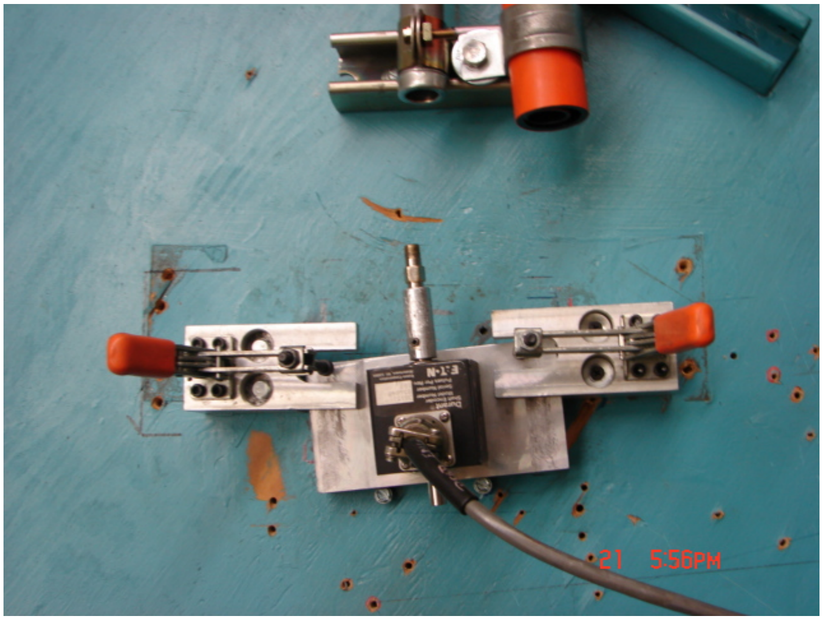

Figure 4 - Example of encoder for cycle count

Figure 5 - Example of drive portion of Test Method A equipment

Figure 6 - Example low-coefficient of friction plug

Figure 7 - Example low-coefficient of friction plug

7. Test Method B – Cable Outer Diameter > 0.300”

For coaxial cables whose outer jacket sheath diameter is greater than 0.300” (7.62mm), the procedure in this section ***shall*** be followed.

7.1. Equipment

The coaxial cable ***shall*** be flexed or fatigued per the requirements of European Norms document, EN 50289-3-9: 2001, Section 6, Flexing, as described in this document as “Test Method B.” Where there is any conflict between this document and EN 50289-3-9: 2001, this document ***shall*** take precedent.

7.2. Sample Preparation

1. Obtain the necessary drop cable samples as required per EN 50289-3-9: 2001
2. Sample length ***shall*** be between 4.1 ft. ~ 6.6 ft. (1.25m ~ 2.01m). This length is dependent upon the design of the flexing apparatus and the post-flexure tests conducted.
3. The cable under test (CUT) may be affixed to the weights with an extended length of stranded-steel cable to ensure the coaxial cable, remains inside of the outer pullies as referenced in EN 50289-3-9: 2001, Section 6, Flexing. See Figure 8.
4. If connectors are not installed on samples prior to flexure, prepare one end of the sample using a drop cable stripping tool. Perform connector installation per manufacturer's instructions.
5. Install adapters necessary to connect the sample to the drop cable flexing tester.

7.3. Test Procedure

1. For comparison purposes, conduct a base-line test (shield effectiveness, DC resistance, etc.) on a control sample of appropriate length necessary for test fixture. Excursion length in each direction ***shall*** be approximately 39.4 in. (1 m)
2. Ensure the proper pulleys are installed for the CUT. The inner pulley is to be semi-circular or grooved, with root diameter to be 20X the CUT outer jacket diameter. Example for a Series 11 coax with a jacket outer diameter (JOD) of 0.400 in. (10.2mm), the following parameters are provided as an example for the pulleys A & B design. See Figure 8. The angle between pulley A and pulley B, ***shall*** be 45 degrees See Figure 11.

Table 1- Pulley Dimensional Parameters

	Outer Diameter	Root Diameter	Width	Root Fillet / Radius
inch	9.00	8.00	1.26	0.50
mm	229	203	32.0	12.7

3. Insert CUT onto as instructed per EN 50289-3-9:2001, as referenced in section 7.1, above.
4. Adjust the preset counter to the desired number of flexures. Typically, samples are conditioned for 25 cycles flexures minimum in increments of 5 cycles. The rate of travel for the carriage assembly / cycle, is ≤ 0.5 cycles per second. A cycle is defined as a forward and reverse motion along the carriage assembly, returning to the original position.
5. Tension Weight - A weight or ballast ***shall*** be used to provide adequate tension on each end of the CUT, via a steel cable, or other suitable means. The tension weight-masses in Table 2 are recommended for the three main, drop coaxial cables. Higher weight-masses are permissible to achieve proper CUT tension, as long as the CUT performance properties are not compromised. The weight-masses in Table 2 are adequate for coaxial cables which utilize a PVC outer jacket. An example of the tension weight is shown in Figure 10.

Table 2 - Tension Weight-Mass

	Series 59	Series 6	Series 11
lbs	~ 2.50	~ 3.00	~ 8.00
kg	~ 1.13	~ 1.36	~ 3.63

6. Remove the coaxial cable sample from the flexure tester after completing the desired flexure. The CUT ***shall*** include the center section of the flexed cable specimen.

7. Conduct the appropriate test of interest (shielding effectiveness, DCR, etc.) on the flexed cable sample.
8. Record both the pre and post flexure test results. Since this test is a relative test comparison, both sets of data from the control sample and CUT ***shall*** be compared for analysis.

a) diameter of pulleys A and B;
b) mass of weights;
c) number of cycles;
d) test temperature;
e) pass/fail criteria.

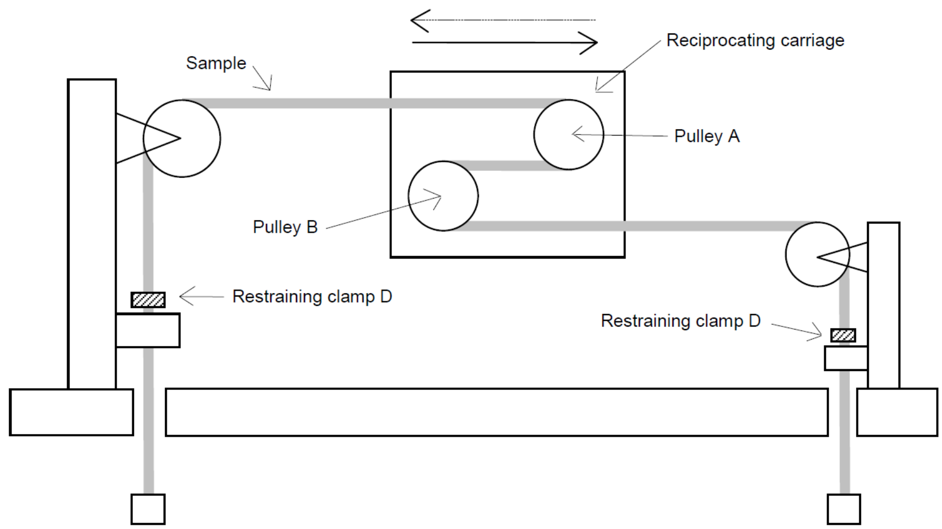

Figure 8 - Example of Test Method B equipment and set-up

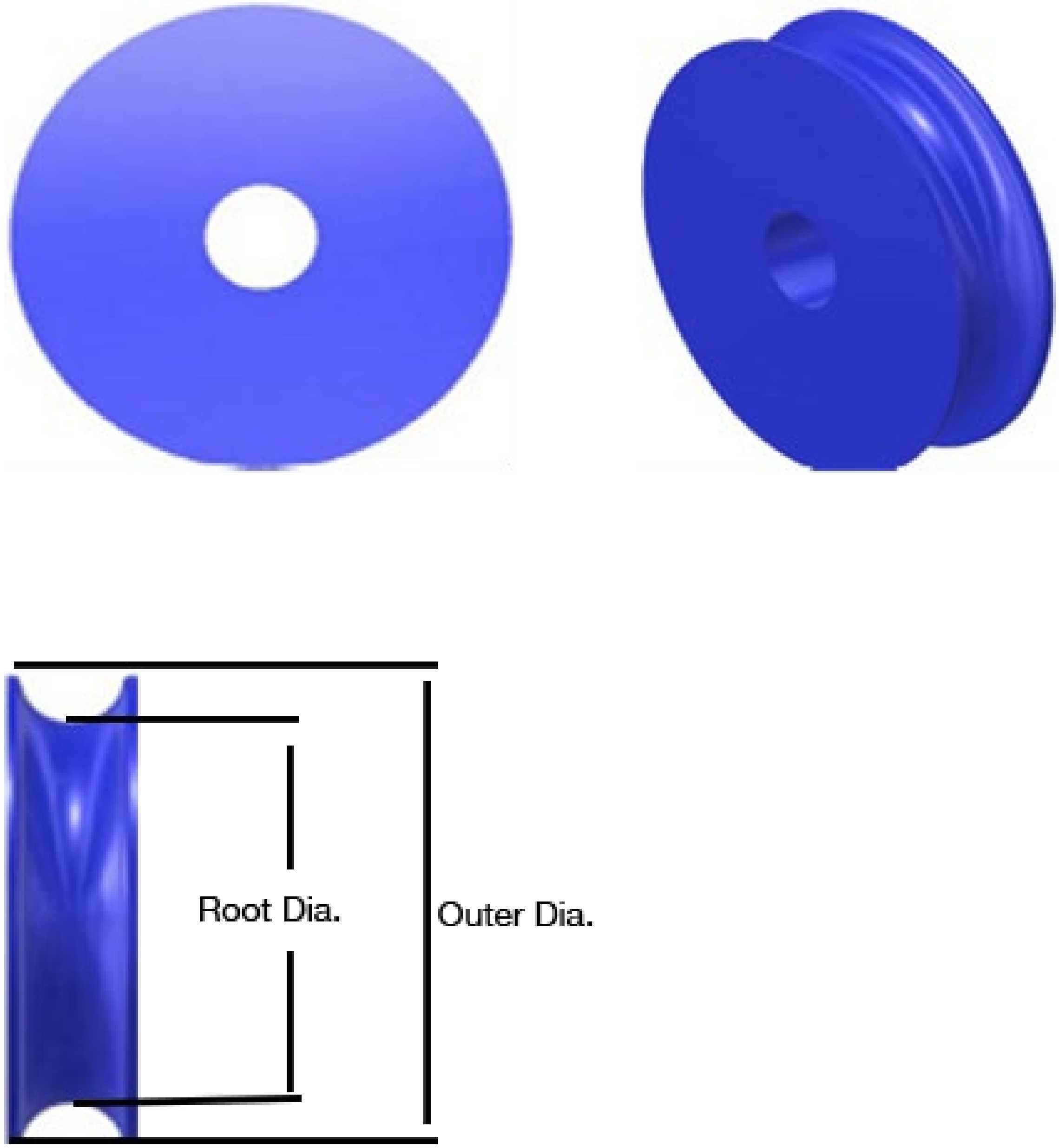

Figure 9 – Example of pulleys used for Test Method B

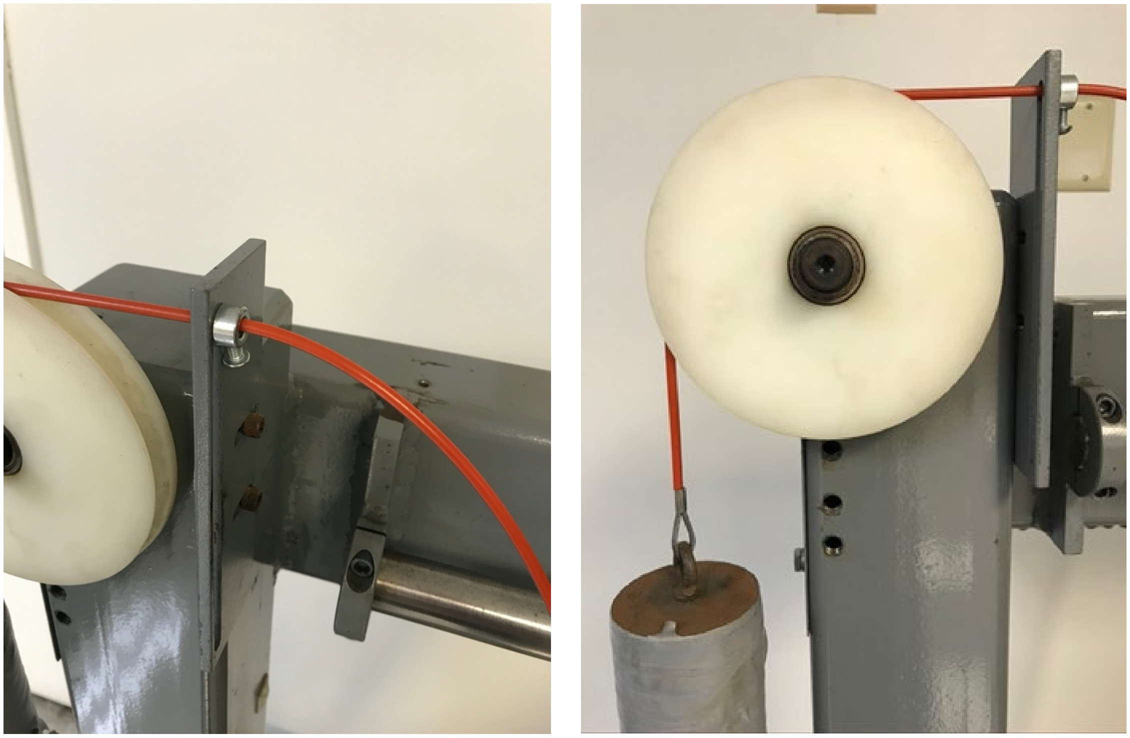

Figure 10 - Clamp Examples

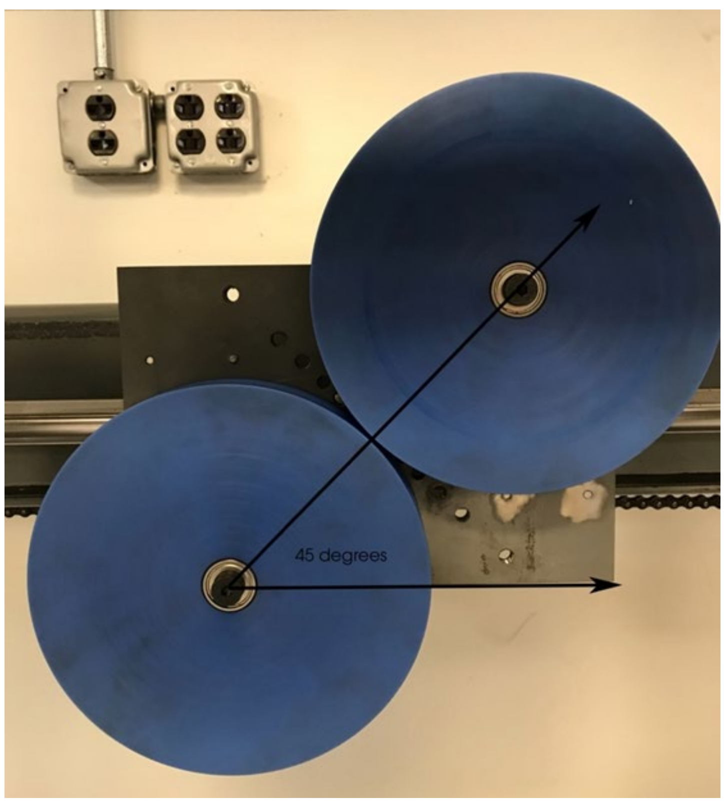

Figure 11 - Pulley Angle Example

8. Data Recording & Analysis

Flexure Method for Drop Cable Conditioning

Tester:		Date:
Cable Manufacturer:		
Cable Type/Size:		
Sample No.:		
Test Method:	Method A: ☐	Method B: ☐
Conduit Type & Diameter: SDR & inch (mm)		
No. Flexure Cycles:		
RPM:		
Cooled (yes / no):		
Pulley Diameter (Root); inch (mm)		
Weight Mass: lbs (kg)		
Centering Method:	Plugs: ☐	Encoder: ☐
Comments:		