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TR #18-0001-01

Coil Flex Test Report

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1. Introduction

This test report focuses on the destructive forces induced on a coil cord exposed to continuous extension and contraction over a period of time. Coil cords have been around for some time, however coiled data cables are a fairly new product. The goal of this test is to determine a "breaking point", where after some number of cycles the cables don't meet the electrical performance or are mechanically compromised. In order to perform this test we made a few small modifications to our rolling bend flex test machine to design an extension and contraction test for the coil cords.

2. Testing Equipment

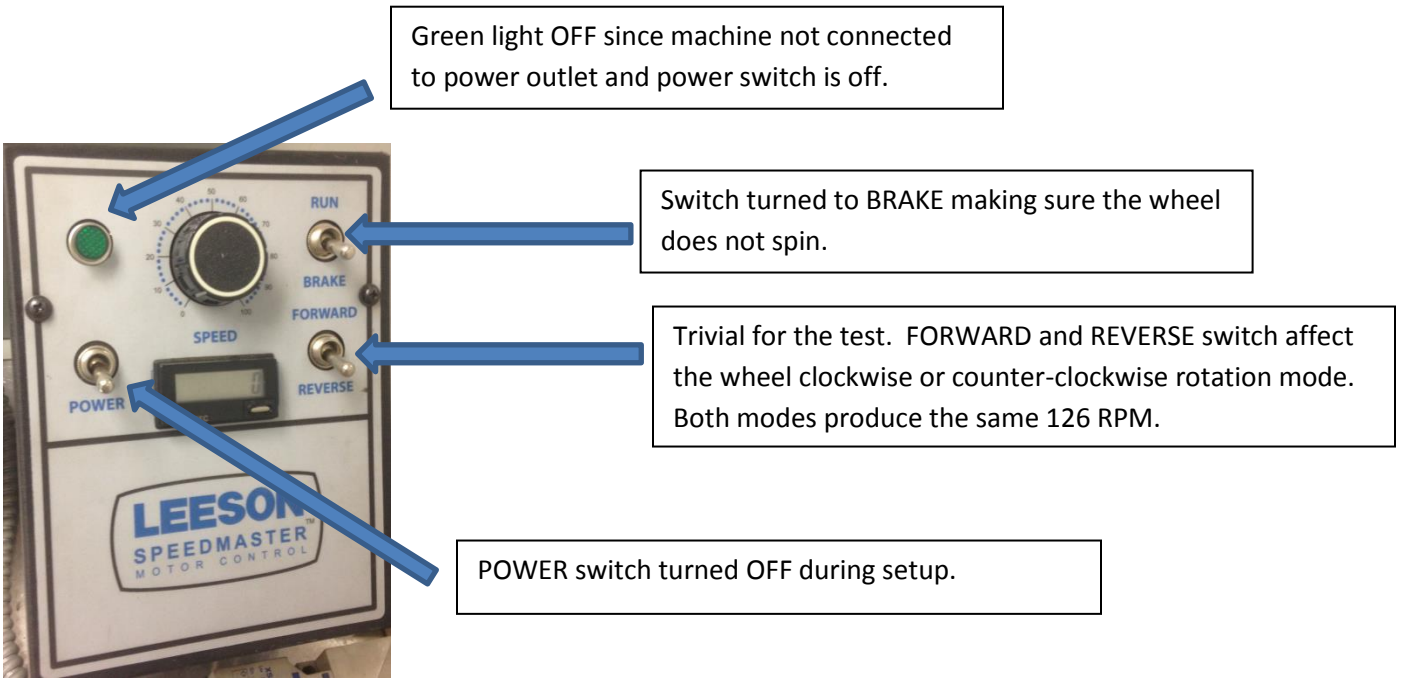
- WireXpert Portable tester
- Quabbin flex testing machine

3. Resources

Flex testing was done on the following Quabbin cables: R&D0606, R&D0618. Additional cables will be added to this report as they complete testing.

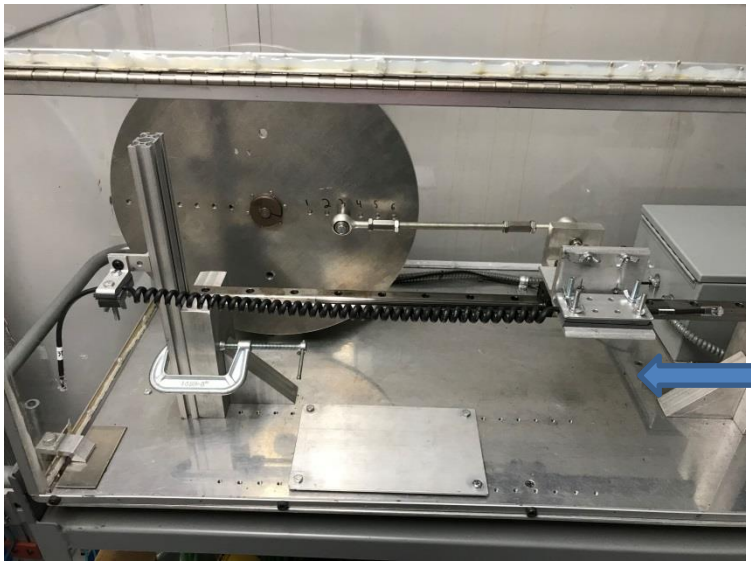
4. Setup

For initial setup, it is important to consider safety. Flex machine should remain OFF before testing can begin by making sure the power cord is NOT connected to the outlet. The access door can be unlocked and opened. The following picture indicates how the machine should appear before testing.

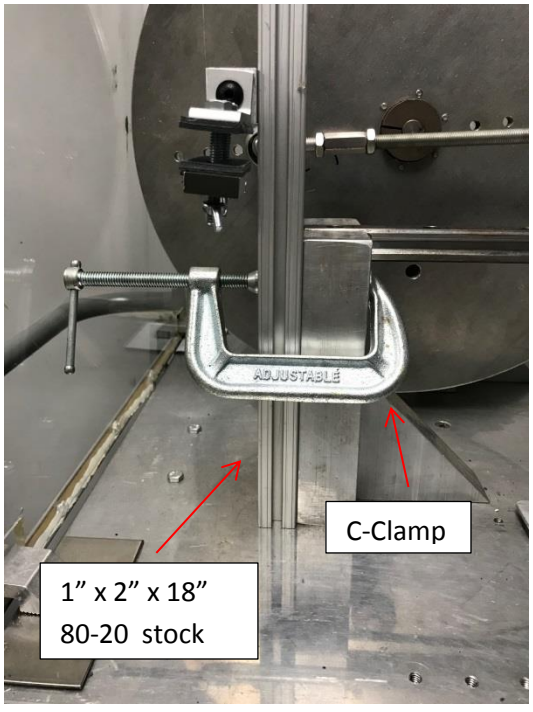


When machine is securely OFF, the cable setup can begin. The machine is capable of testing one or two cables at once. If 2 cables have a similar O.D., then it is possible to test them together. Prior to setting up the cables in the flex machine, pins and loads must be installed on both ends of the cables. The testing of the cable follows Quabbin standard procedures. Inserting the cable into the flex machine can begin once the cables are pinned or connectorized.

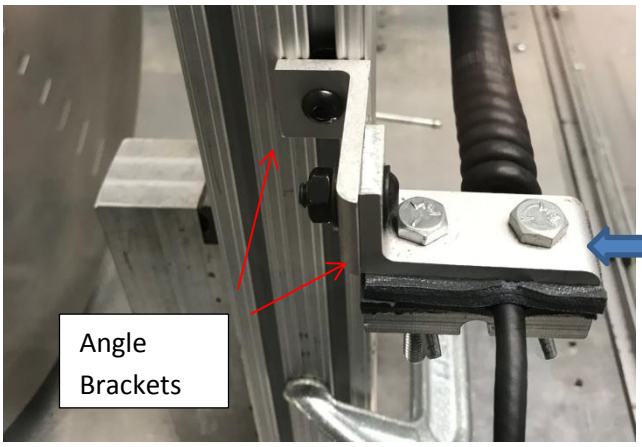
A. Cable setup:



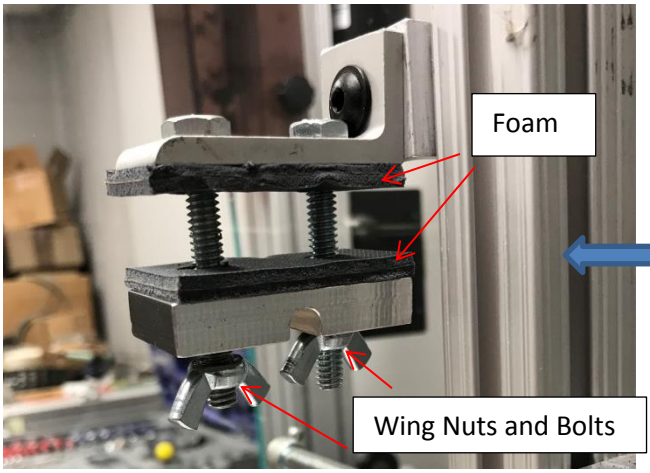
1. An overall view of the test setup can be seen to the left. The cable will be secured at either end, and positioned such that the coil will go from no extension to an extension of about 2x the static length.



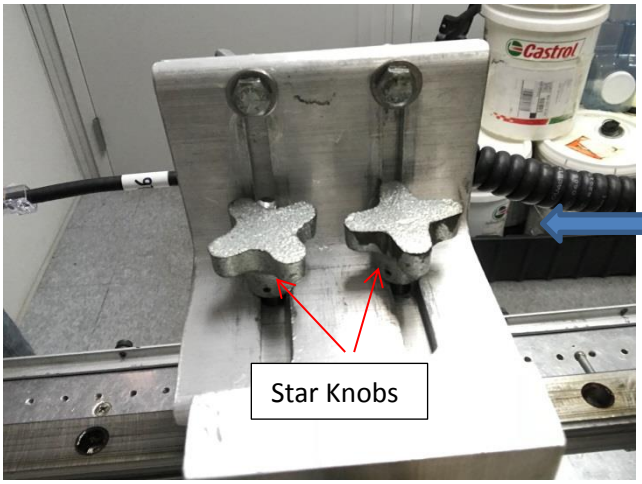
2. A c-clamp was used to secure a piece of 1" x 2" x 18" 80-20 stock. Ensure that the position of the c-clamp doesn't interfere with the motion of the flex tester.



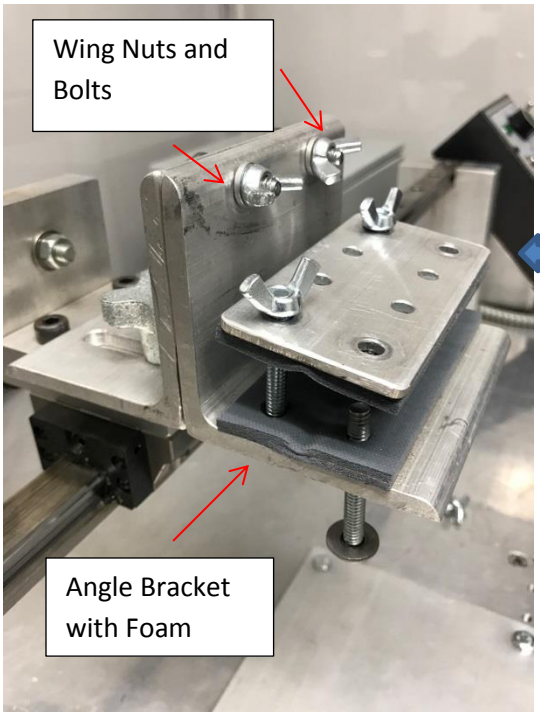
3. A slide nut is used to attach a small angle bracket to the 80-20 stock. The height should be adjusted to match the mount height at the other end of the track. A second angle bracket is attached to this bracket.



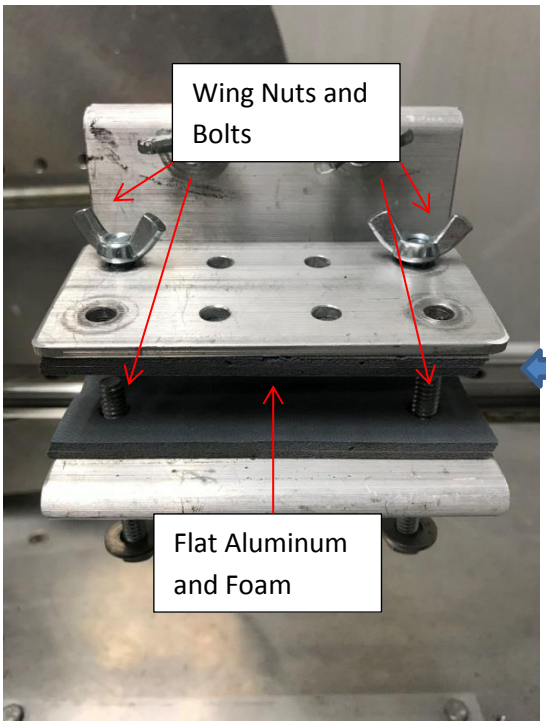
4. A small piece of adhesive backed foam is used to protect the cable on the lower angle bracket. A straight piece of aluminum is attached to the 2nd angle bracket using bolts and wingnuts, again adhesive backed foam is used to protect the cable. The wing nuts should be tightened enough to secure the cable but not overtightened.



5. Star knobs are used to secure a larger angle bracket to the flex tester base. The position of this bracket can be adjusted to keep it in line with the other end of the test fixture.



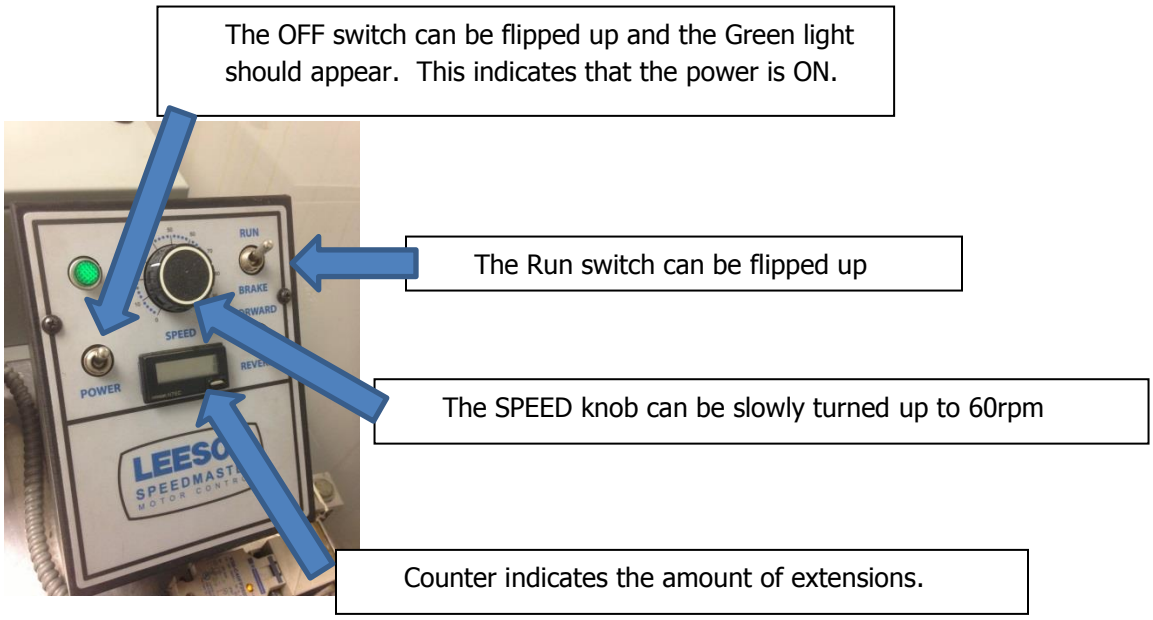
6. A second large angle bracket is mounted back to back with the one from above, two bolts and wing nuts can be used to attach the brackets. A piece of adhesive backed foam is attached to the flat part of the bracket.



7. A flat piece of aluminum is attached to the angle bracket using 4 bolts and wing nuts. A piece of adhesive backed foam is used to protect the cable. Route the cable through the center of the bracket. Tighten the wing nuts just enough to hold the cable but not so tight that the cable is deformed or damaged.

After the cable or cables are fully secure in the machine, electrical testing can begin. Ensure the cables pass the appropriate electrical test prior to beginning the coil flex test. Since the cables we used are ~9ft in length we conducted a TIA CAT5e – 3m Patch Cord test. It is important to first electrically test the cable or cables before the flex testing is done.

Ensure the power cord is plugged in prior to completing the following steps.



When the machine begins to run and cycle the coil cord, the access door is to be shut and locked for safety.

5. Test Description

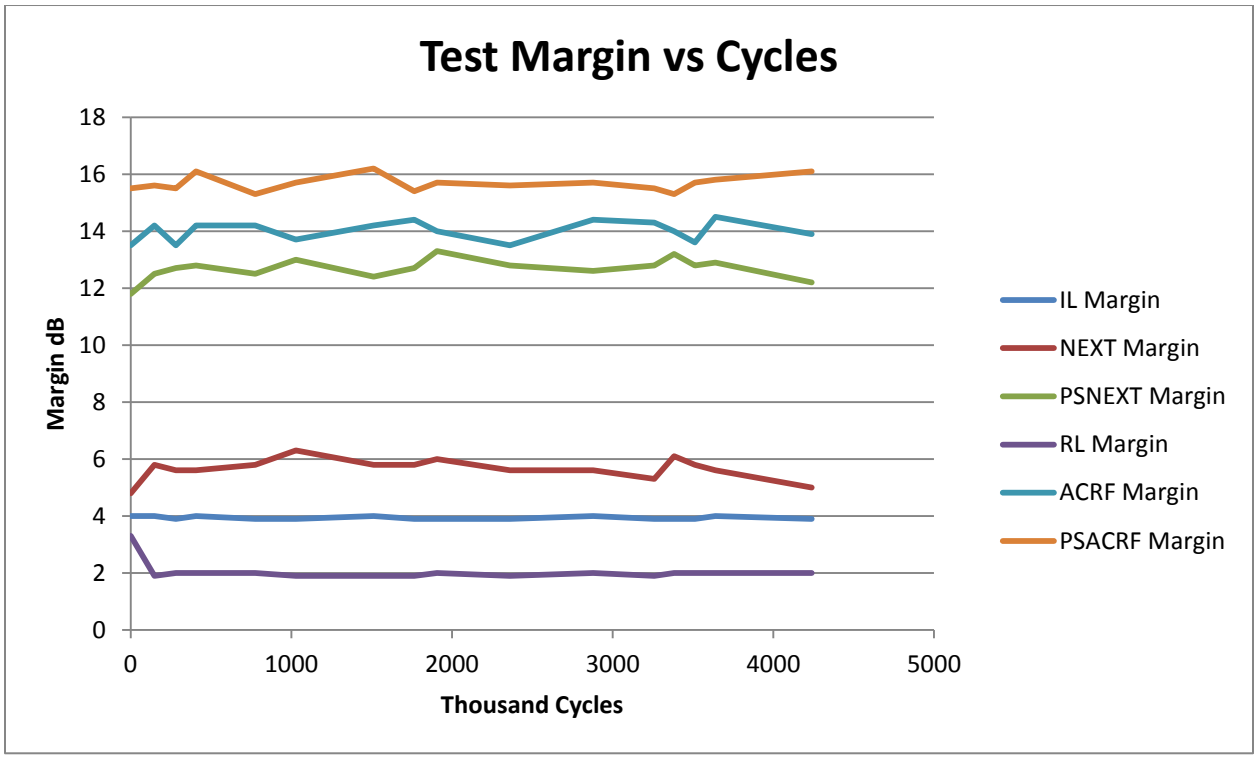
In order to ensure that the cables are able to withstand continuous cycling, data is recorded daily (or after a weekend). The same electrical test is performed daily and any notes about the condition of the cables are recorded. The electrical test is to be performed when the cable is in the fully extended position. Pictures may be taken to show cable wear if necessary.

6. Test Results:

R&D0606 Coil Cord Flex Test:

4PR, 26AWG 7/34, TPU jacket

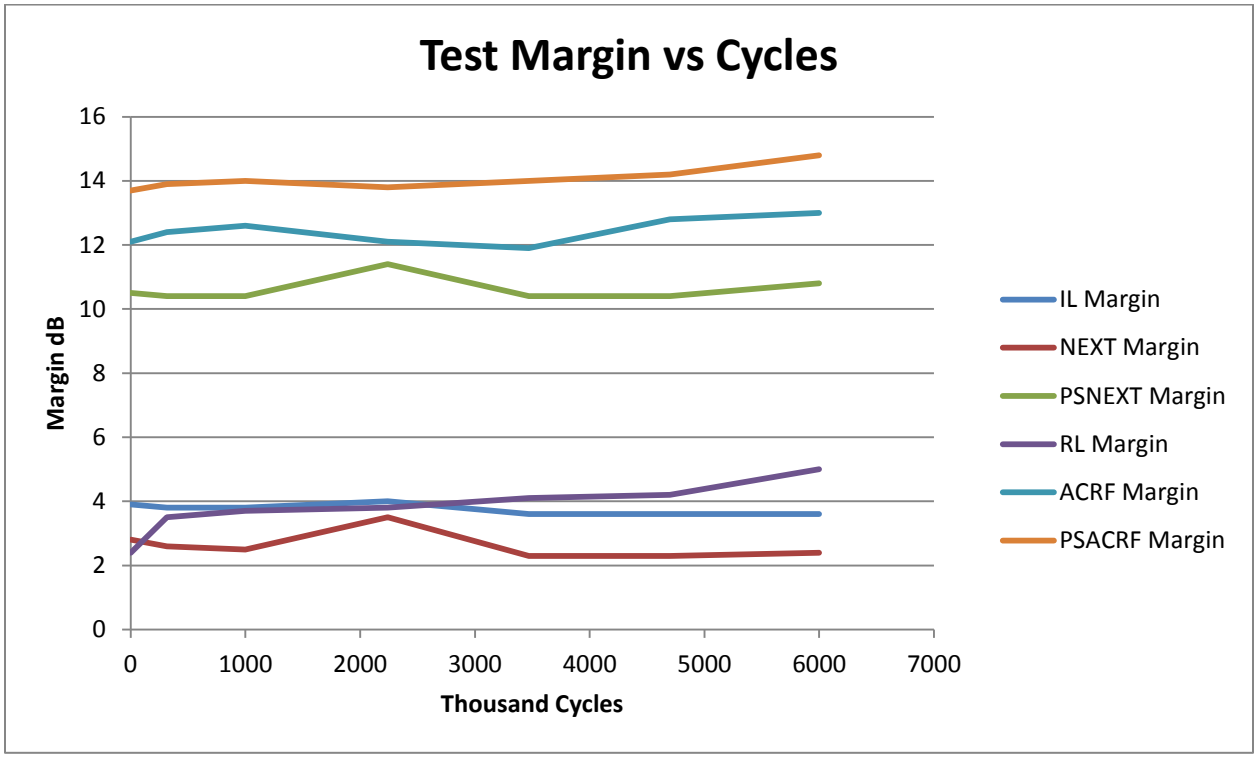
	0.5 million cycles	4 million cycles
Jacket wear	None	None
Conductor Failure	None	None
Electrical Testing	Pass	Pass



R&D0618 Coil Cord Flex Test:

4PR, 26AWG 7/34, Shielded, ZHAL TPU Jacket

	0.5 million cycles	6 million cycles	7.2 million cycles
Jacket wear	None	None	Yes
Conductor Failure	None	None	Yes
Electrical Testing	Pass	Pass	Fail



The jacket of the cable and the braid split at the beginning of the tangent, it appears as though the stress of the flex was concentrated in that area. The jacket cracked, and the braid and tape were also damaged. The cable failed electricals at this point. See the photo below:

A cable dissection indicated that the brown pair was almost completely severed, and the other pairs showed some small signs of wear.

7. Conclusion

Our unshielded TPU jacketed cable passed electricals out to 4 million cycles and can likely handle more flexing. While our shielded ZHAL TPU jacketed cable passed electricals out to 6 million cycles, before the jacket cracked and the primes were damaged. The cables also had little to no deformation or sagging of coils after the flex testing. Care must be taken when installing these types of cords to minimize stress concentration areas, as these can lead to electrical and mechanical failures.