



TENSILE TEST SUMMARY- DRAKE ACCC/TW

MECHANICAL STRENGTH TESTING

ABSTRACT

In order to demonstrate the tension fittings (Deadends) will maintain the required strength of 95% conductor RBS (per referenced ANSI specification listed below), samples were tensile loaded until breakage occurred.

SAMPLE INFORMATION

Each test sample assembly consisted of a length of Drake ACCC/TW conductor terminated on one end with a deadend (AFL design B11381-A-ACCC) and the other end with a "Lab Grip" (Samples 1, 2, 3 Lab Grip was constructed of 1/2 Joint AFL design B11385-A-ACCC, reversed compressed on conductor. Samples 4, 5, 6 Lab Grip was constructed of Deadend AFL design B11381-A-ACCC, reversed compressed on conductor). The length of conductor between the installed deadend fittings was approximately 13 feet.

REFERENCE DRAWING NUMBERS, SPECIFICATIONS AND CURRENT REVISION:

- B11381, Rev. 7 - Deadend for Composite Core Conductor ACCC/TW – Assembly
- B11385, Rev. 8 - Joint for Composite Core Conductor for ACCC/TW – Assembly
- ANSI C119.4-2011 - Section 4.6 "Tensile Strength and Related Conductor Strength"

CONDUCTOR INFORMATION:

1020 kcmil / Drake

Cable Designation	Conductor Design Information				
	Conductor OD (In.)	No. of Alum. Strands	Core OD (In.)	Core Rated Breaking Strength in Lbs (RBS)	Conductor Breaking Strength in Lbs (RBS)
Drake ACCC/TW	1.108	22	0.375	34,570	41,100

PROCEDURE

1. Install the test assembly into the tensile load machine with the “Lab Grip” attached at the fixed end and the “Test Deadend” eye attached to the pulling end.
2. Gradually apply a longitudinal load to the assembly until failure occurs.

ACCEPTANCE CRITERIA

The “Test Deadend” must obtain tensile loads equal to or greater than 95% Conductors rated breaking strength.
(Target Load: 41,000 Lbs. x .95 = 39,045 Lbs.)

EQUIPMENT INFORMATION

- Horizontal Tensile Bed, serial number 12150, Calibrated 8/19/14 according to ASTM E4 for force verification to an accuracy within 1%.

RESULTS (SAMPLE SET 1,2,3)

Sample No.	Conductor RBS	Target Load RBS	Load Achieved RBS	% Conductor RBS	Failure Mode and Location
1			31,900 Lbs.	78%	Lab Grip
2	41,100 Lbs.	39,045 Lbs.	42,100 Lbs.	102%	Conductor Break @ Deadend
3			41,300 Lbs.	100%	Conductor Break @ Deadend

CONCLUSION

Sample 1: Lab Grip failure prematurely ends the test at 78%. Test deadend remained in good shape with no slip indicated.

Sample 2 & 3: Assembly held in excess of the rated strength of the conductor.

AFL will manufacture and test 3 additional samples to meet the “Sample set” (3 passing samples) requirements of ANSI C119.4.



RESULTS (SAMPLE SET 4,5,6)

Sample No.	Conductor RBS	Target Load RBS	Load Achieved RBS	% Conductor RBS	Failure Mode and Location
4	41,100 Lbs.	39,045 Lbs.	44,988 Lbs.	109%	Conductor Break @ Lab Grip
5			43,907 Lbs.	107%	Mid-Span Conductor Break
6			42,425 Lbs.	103%	Mid-Span Conductor Break

TEST DATA (SAMPLE SET 4,5,6)

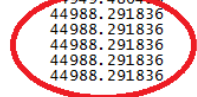
Wire Test Station

Date: 8/25/2015 8:59 AM

Operator G. HOARD
Project Name CTC DRAKE RETEST
Data Filename 20150825-CTC DRAKE RETEST-4
Sample Type DRAKE CTC
Target strength 39000.000000 (95% conductor RBS)
Sample Description overload capacity = 10%



Time	Target	Description	Load (lb)	Position (in)	Strain (%)	Unfiltered Load (lb)	Unfiltered Position (in)	Pe
09:04:37		Start Ramp to Initial Load	800.190849	-7.940561	-1.588112	821.546898	-7.940561	842.081561
09:04:37		Ramping to Initial Load	803.065702	-7.940553	-1.588111	821.546898	-7.940553	842.081561
09:04:42		Ramping to Initial Load	764.460536	-7.940863	-1.588173	764.049842	-7.940863	842.081561
09:04:45		Initial Load Met	801.833622	-7.941416	-1.588283	821.546898	-7.941416	842.081561
09:04:49		Starting Ramp Phase	1032.643231	-7.944558	-0.000361	1047.428189	-7.944558	1047.428189
09:04:49		Ramping to Break	1032.643231	-7.944558	-0.000361	1047.428189	-7.944558	1047.428189
09:04:49		Ramping to Break	1042.499869	-7.944705	-0.000391	1055.642054	-7.944705	1055.642054
09:04:50		Ramping to Break	1048.660268	-7.944827	-0.000415	1059.748986	-7.944827	1059.748986
09:04:50		Ramping to Break	1054.615320	-7.944965	-0.000443	1063.855919	-7.944965	1063.855919
09:04:50		Ramping to Break	1060.159679	-7.945047	-0.000459	1067.962851	-7.945047	1067.962851
09:09:56		Ramping to Break	44516.040905	-14.764661	-1.364382	44611.267318	-14.764661	44611.267318
09:09:56		Ramping to Break	44556.330780	-14.764734	-1.364397	44620.970155	-14.764734	44622.818314
09:09:56		Ramping to Break	44600.363178	-14.760241	-1.363498	44688.890013	-14.760241	44688.890013
09:09:57		Ramping to Break	44642.593620	-14.763676	-1.364185	44705.985487	-14.763676	44705.985487
09:09:57		Ramping to Break	44674.820900	-14.772296	-1.365909	44734.631958	-14.772296	44734.631958
09:09:57		Ramping to Break	44712.985391	-14.776049	-1.366660	44783.608182	-14.776049	44783.608182
09:09:57		Ramping to Break	44745.443691	-14.771409	-1.365732	44820.571370	-14.771409	44820.571370
09:09:58		Ramping to Break	44779.588436	-14.768796	-1.365209	44874.630033	-14.768796	44874.630033
09:09:58		Ramping to Break	44822.142306	-14.770009	-1.365452	44914.365460	-14.770009	44914.365460
09:09:58		Ramping to Break	44865.273726	-14.767087	-1.364867	44949.480489	-14.767087	44949.480489
09:09:58		Ramping to Break	44912.216975	-14.765898	-1.364629	44988.291836	-14.765898	44988.291836
09:09:59		Ramping to Break	44945.137314	-14.773395	-1.366129	44983.209398	-14.773395	44988.291836
09:09:59		Ramping to Break	44849.887799	-14.786257	-1.368701	44721.232803	-14.786257	44988.291836
09:09:59		Ramping to Break	44807.079807	-14.804133	-1.372276	44629.286872	-14.804133	44988.291836
09:10:00		Ramping to Break	38099.897844	-14.123623	-1.236174	714.766652	-14.123623	44988.291836





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Duncan, SC 29334 USA
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Wire Test Station

Date: 8/25/2015 9:21 AM

Operator G. HOARD
Project Name CTC DRAKE RETEST
Data Filename 20150825-CTC DRAKE RETEST-5 ←
Sample Type DRAKE CTC
Target Strength 39000.000000 (95% conductor RBS)
Sample Description overload Capacity = 10%

Time	Target	Description	Load (lb)	Position (in)	Strain (%)	unfiltered Load (lb)	unfiltered Position (in)	
09:21:14		Start Ramp to Initial Load	897.114457	-7.942263	-1.588449	895.471684	-7.942263	1904.908899
09:21:14		Ramping to Initial Load	897.730497	-7.942246	-1.588449	932.434077	-7.942246	1904.908899
09:21:18		Initial Load Met	866.723156	-7.942833	-1.588567	870.830089	-7.942833	1904.908899
09:21:29		Starting Ramp Phase	1072.275130	-7.945698	-0.000068	1080.283649	-7.945698	1080.283649
09:21:29		Ramping to Break	1072.275130	-7.945698	-0.000068	1080.283649	-7.945698	1080.283649
09:21:29		Ramping to Break	1074.533943	-7.945731	-0.000075	1076.176716	-7.945731	1080.283649
09:21:29		Ramping to Break	1075.766023	-7.945763	-0.000081	1076.176716	-7.945763	1080.283649
09:21:29		Ramping to Break	1075.560677	-7.945812	-0.000091	1072.069784	-7.945812	1080.283649
09:26:43		Ramping to Break	1856.873654	-7.965804	-0.004090	1937.713456	-7.965804	43907.118586
09:26:43		Ramping to Break	1921.311177	-7.971275	-0.005184	1940.056639	-7.971275	43907.118586
09:26:43		Ramping to Break	1943.571413	-7.977095	-0.006348	1970.518013	-7.977095	43907.118586
09:26:43		Ramping to Break	1959.622214	-7.982671	-0.007463	1996.293022	-7.982671	43907.118586
09:26:44		Ramping to Break	1970.752331	-7.985536	-0.008036	1998.636205	-7.985536	43907.118586
09:26:44		Ramping to Break	1978.133357	-7.987311	-0.008391	2015.038484	-7.987311	43907.118586
09:26:44		Ramping to Break	1987.623247	-7.989281	-0.008785	2008.008936	-7.989281	43907.118586
09:26:44		Ramping to Break	1995.238590	-7.990819	-0.009093	2031.440762	-7.990819	43907.118586
09:26:45		Ramping to Break	2004.025525	-7.992635	-0.009456	1993.949840	-7.992635	43907.118586
09:26:45		Ramping to Break	2010.117800	-7.994067	-0.009742	2038.470310	-7.994067	43907.118586
09:26:45		Ramping to Break	2016.795871	-7.995354	-0.010000	2008.008936	-7.995354	43907.118586
09:26:45		Ramping to Break	2022.770986	-7.996640	-0.010257	2050.186223	-7.996640	43907.118586
09:26:46		Ramping to Break	2030.386330	-7.998064	-0.010542	2029.097580	-7.998064	43907.118586
09:26:46		Ramping to Break	2036.244287	-7.999481	-0.010825	2059.558954	-7.999481	43907.118586

Wire Test Station

Date: 8/25/2015 9:33 AM

Operator G. HOARD
Project Name CTC DRAKE RETEST
Data Filename 20150825-CTC DRAKE RETEST-6 ←
Sample Type DRAKE CTC
Target Strength 39000.000000 (95% conductor RBS)
Sample Description overload Capacity = 10%

Time	Target	Description	Load (lb)	Position (in)	Strain (%)	unfiltered Load (lb)	unfiltered Position (in)	
09:33:52		Start Ramp to Initial Load	1143.119717	-7.946382	-1.589276	1113.139109	-7.946382	2050.18223
09:33:52		Ramping to Initial Load	1145.378530	-7.946390	-1.589278	1154.208435	-7.946390	2050.186223
09:33:56		Initial Load Met	1121.558321	-7.946813	-1.589363	1125.459907	-7.946813	2050.186223
09:34:09		Starting Ramp Phase	985.413507	-7.944656	-0.000007	985.824200	-7.944656	985.824200
09:34:09		Ramping to Break	985.413507	-7.944656	-0.000007	985.824200	-7.944656	985.824200
09:34:09		Ramping to Break	986.440240	-7.944689	-0.000013	989.931133	-7.944689	989.931133
09:34:10		Ramping to Break	987.672320	-7.944746	-0.000024	989.931133	-7.944746	989.931133
09:34:10		Ramping to Break	988.288360	-7.944803	-0.000036	989.931133	-7.944803	989.931133
09:34:10		Ramping to Break	988.699053	-7.944851	-0.000046	985.824200	-7.944851	989.931133
09:34:10		Ramping to Break	989.109746	-7.944843	-0.000044	989.931133	-7.944843	994.038065
09:34:11		Ramping to Break	990.136479	-7.944819	-0.000039	994.038065	-7.944819	994.038065
09:34:11		Ramping to Break	991.368559	-7.944811	-0.000037	994.038065	-7.944811	994.038065
09:34:11		Ramping to Break	993.011332	-7.944851	-0.000046	994.038065	-7.944851	994.038065
09:39:12		Ramping to Break	1670.004837	-7.983119	-0.007699	1576.863327	-7.983119	42425.818824
09:39:12		Ramping to Break	1621.383797	-7.970656	-0.005207	1574.520144	-7.970656	42425.818824
09:39:12		Ramping to Break	1471.160310	-7.954571	-0.001989	1121.352975	-7.954571	42425.818824
09:39:13		Ramping to Break	1378.248141	-7.952707	-0.001617	1191.170828	-7.952707	42425.818824
09:39:13		Ramping to Break	1278.772516	-7.950533	-0.001182	1174.743098	-7.950533	42425.818824
09:39:13		Ramping to Break	1181.708198	-7.949532	-0.000982	1207.598558	-7.949532	42425.818824
09:39:13		Ramping to Break	1186.858549	-7.948221	-0.000720	1236.347086	-7.948221	42425.818824
09:39:14		Ramping to Break	1192.813601	-7.947131	-0.000501	1211.705491	-7.947131	42425.818824
09:39:14		Ramping to Break	1190.965481	-7.947302	-0.000536	1150.101502	-7.947302	42425.818824
09:39:14		Ramping to Break	981.717268	-7.945291	-0.000134	193.186217	-7.945291	42425.818824
09:39:14		Ramping to Break	727.087449	-7.942841	0.000357	184.972352	-7.942841	42425.818824
09:39:15		Ramping to Break	421.326321	-7.939861	0.000952	180.865420	-7.939861	42425.818824
09:39:15		Ramping to Break	177.169180	-7.937379	0.001449	209.613947	-7.937379	42425.818824
09:39:15		Ramping to Break	182.302846	-7.934920	0.001941	189.079285	-7.934920	42425.818824

CONCLUSION

The Drake ACCC/TW Deadend design exceeds the minimum 'Ultimate Load' requirement of 95% conductor RBS.

The ANSI Ultimate Load requirement of passing (3) sample has been met.

RELATED TESTING

In order to optimize the core tension fittings (Forging/Insert Sleeve) for achieving maximum “Ultimate Load” (on the core) the following tests were conducted.

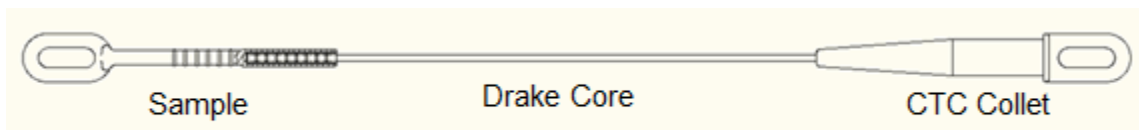
Various “Area Reductions” with various “Insert Sleeve” designs were tested. The following represents the final design and the results of extensive testing.



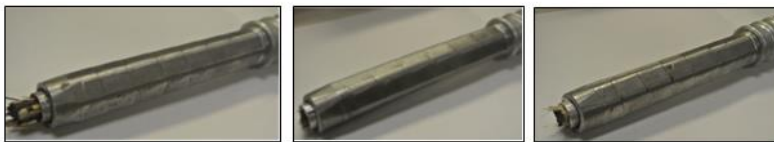
↗ Solid Insert

(Insert Sleeve with best results)

Test arrangement:



Test arrangement



Sample #1

Sample #2

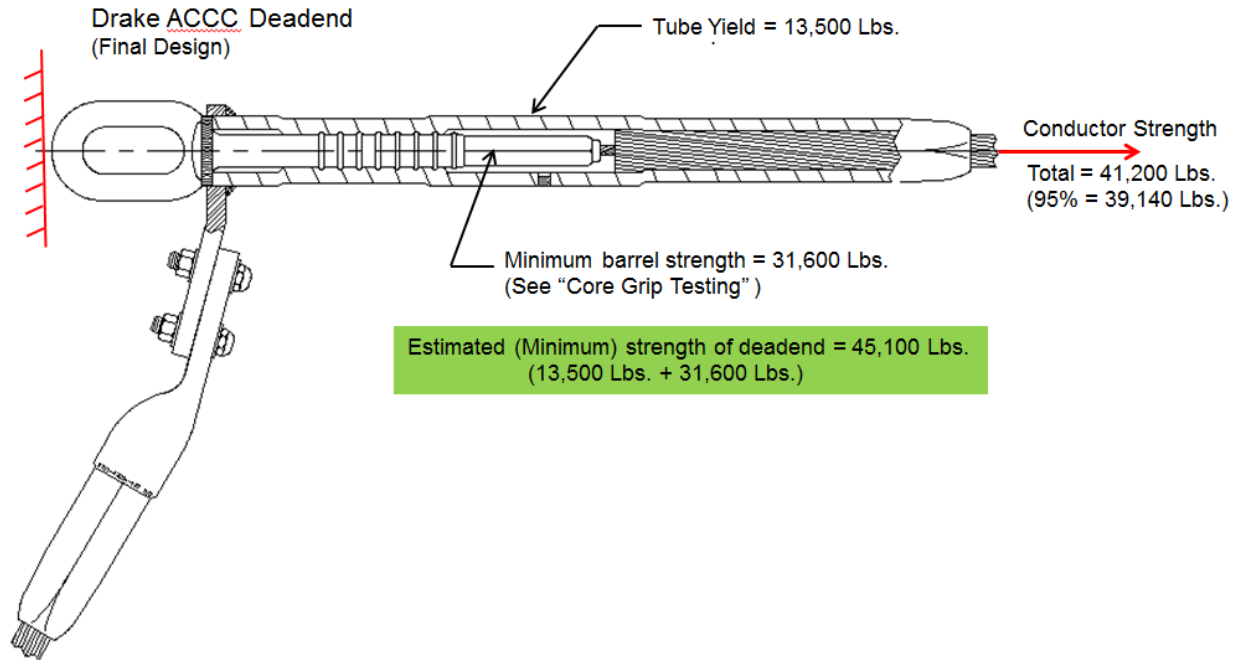
Sample #3



Tested samples
 (Forgings with “Solid” Insert Sleeves)

Sample	Core Strength (Lbs)	Ultimate Load achieved	% of Core strength
# 1	34,570	32,540	94.1%
# 2	34,570	31,931	92.3%
# 3	34,570	31,637	91.7%

- Failure Mode was Core break (in span) all failures were typical in nature
- No slip of Core (Note: slip line is visible at end of Insert Sleeves)



TEST PERSONNEL

Gerald Hoard - Technician
Wayne Quesnel – Design Engineer

TEST LOCATION AND REFERENCE INFORMATION

Tests were conducted at AFL's Hidden Lake Facility in Duncan, SC on September 17th, 2014.

Report Date: July 15, 2015

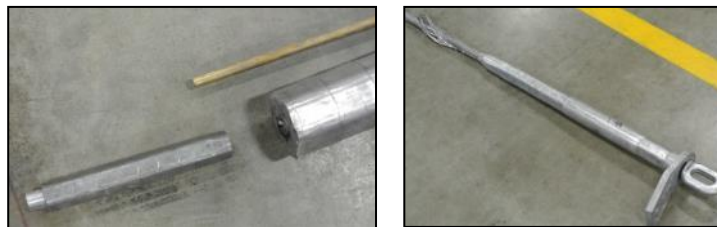
Test Reference Number: RLT00023 (PA2013-2199)

APPENDIX A – PICTURES



Figure 1 – Sample manufacture

Special care is necessary to ensure aluminum strands are not loose
(Conductor is supported in a channel and Lab Grip is reverse compressed)



“Lab Grip” failure

Deadend – Sample #1

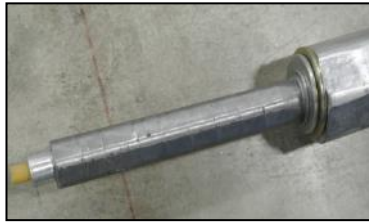
Figure 2 – Sample #1



“Lab Grip”

Deadend – Sample #2

Figure 3 – Sample #2



“Lab Grip”



Deadend – Sample #3

Figure 4 – Sample #3



Figure 5 – Test arrangement



Deadend



Lab Grip



Figure 6 – Sample #4 (Test Deadend after test)



Break at mouth of "Lab grip" Deadend



Figure 7 – Sample #5 (Test Deadend after test)



Conductor break at Mid-Span



Figure 8 – Sample #6 (Test Deadend after test)



Conductor break at Mid-Span