KINECTRICS NORTH AMERICA INC. TEST REPORT
FOR 774-kcmil 3M™ COMPOSITE CONDUCTOR

Test Name:	**TENSION TESTS ON FULL TENSION SPLICES FOR 774-kcmil 3M™ COMPOSITE CONDUCTOR AT ROOM TEMPERATURE**
Test Dates:	June 21, 2005 and September 13-14, 2005
Cable Supplier:	3M Company
Laboratory:	Kinectrics Inc. 800 Kipling Avenue Toronto, Ontario M8Z 6C4 CANADA
Standard:	Based on ANSI C119.4-2003, Paragraph 7.3.4
Kinectrics Staff:	Mr. Craig Pon Mr. Mike Kastelein Mr. Mike Colbert

OBJECTIVE

3M contracted with Kinectrics under PO # 1600000 to conduct tension tests on Class 1, full tension splices manufactured by ACA Conductor Accessories (formerly Alcoa-Fujikura Ltd.). The objective of the test was to verify the room temperature maximum load carrying capability of the splices for 774-kcmil 3M™ Composite Conductor. The ACA catalogue number of the splice is B9095-L (special design for 3M™ Composite Conductor). The rated tensile strength (RTS) of the conductor is 32,210 kgf (71,010 lbf). The specifications for the conductor are shown in Appendix A and an engineering drawing of the splice is shown in Appendix B. 3M own all data and copyright to this information.

TEST SAMPLES

Three (3) test samples were prepared by ACA Conductor Accessories at their facilities. Each sample comprised a full tension splice approximately 1.75 m (5.75 ft) in length installed between two(2) 774 kcmil conductors each approximately 6 m (20 ft) in length. The samples were shipped to Kinectrics where the two ends of each conductor sample were terminated with an epoxy-resin clamp.

TEST SET-UP

Each test sample was installed in a hydraulically-activated horizontal test machine. The distance between the inboard faces of the epoxy-resin clamps was about 14 m (46 ft). The set-up showing one of the samples installed in the test machine is shown in Figure 1.

INTRUMENTATION

The load cell (#17356-0) in the test machine (MTS 3156/MTS 493.01DC) that measured the the tension was last calibrated in May 2005 and is due for calibration in May 2006. The data logger (#CA1C1A) that recorded the load cell measurements was last calibrated in January 2005 and is due for calibration in January 2006. the measuring system has a load accuracy of ± 2%.

TEST PROCEDURE

The tension in the sample was increased at a rate of 6,442 kgf/min (14,202 lbf/min) until failure occurred. The ambient air temperature was approximately 22^{o}C during the test.

TEST RESULTS

Sample #1 was tested on June 21, 2005. The conductor failed inside one of the epoxy-resin clamps at 28,196 kgf (62,161 lbf) or 87.5% of the conductor RTS. The failure was attributed to a premature break inside the resin clamp due to an inadequately designed epoxy fitting. For purposes of qualifying the splices, the test result is not considered valid. The epoxy fitting was re-designed and successfully used in the tests below.

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Sample #2 was tested on September 13, 2005. The conductor failed at 32,284 kgf (71,173 lbf) or 100.2% of the conductor RTS. The failure occurred approximately 12-18 inches from the north epoxy-resin clamp. The full tension splice remained intact at the time of failure. A photograph of the failure location is shown in Figure 2.

Sample #3 was tested on September 14, 2005. The conductor failed at 32,452 kgf (71,544 lbf) or 100.8% of the conductor RTS. The failure occurred inside the north end of the full tension splice. A photograph of the failure location is shown in Figure 3.

ACCEPTANCE CRITERIA

ANSI C119.4 specifies that Class 1, full tension splices shall support greater than 95% of the conductor RTS in tension.

CONCLUSION

The ACA Conductor Accessories Class 1, full tension splices for 774-kcmil 3M™ Composite Conductor meet the tension requirements specified in ANSI C119.4.

ACKNOWLEDGEMENT

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DISCLAIMER

Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the Department of Energy.

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Date: September , 2005

Figure 1 Set-up for Test on ACA Conductor Accessories 774-kcmil 3M™ Composite Conductor Full Tension Splice (Looking South)

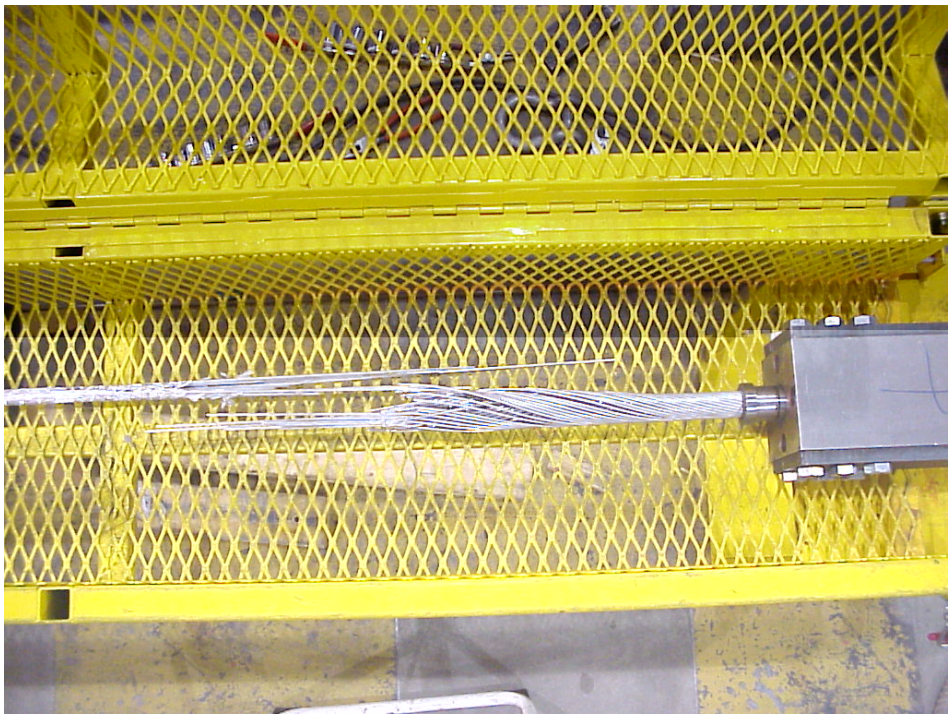

Figure 2 Sample #2 - Failure of 774-kcmil 3M™ Composite Conductor at 100.2% RTS. Failure occurred in the conductor ~12-18 inches outside of North Deadend Clamp.

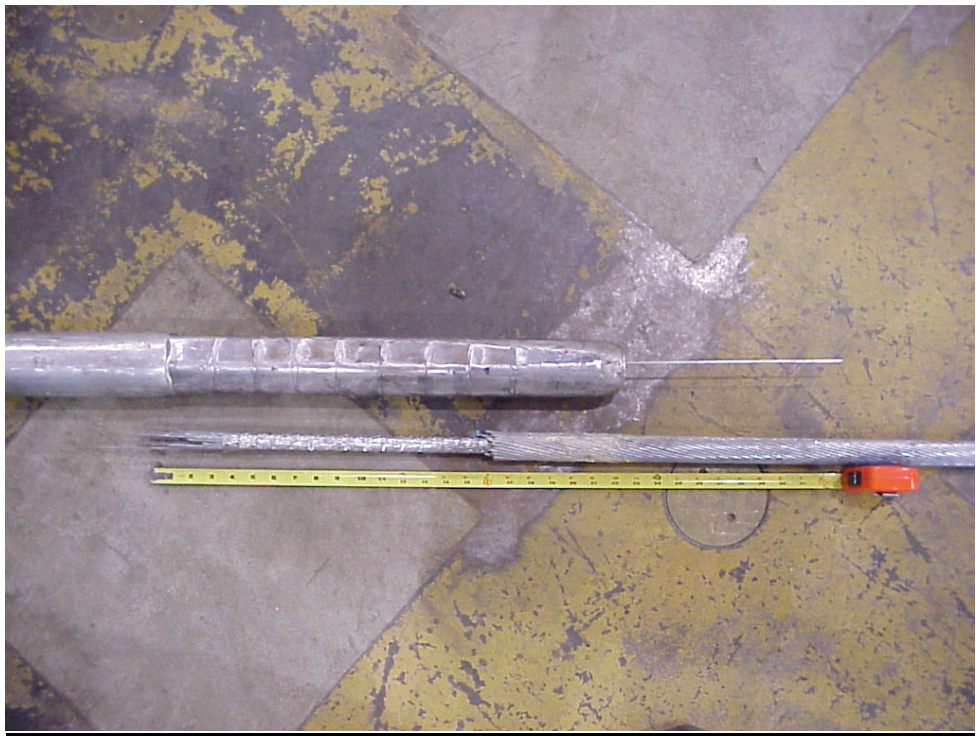

Figure 3 Sample #3 – Failure of the 774-kcmil 3M™ Composite Conductor at 100.8% RTS. Failure occurred in the conductor but within the North End of the ACA Conductor Accessories Full Tension Splice.

APPENDIX A

Specifications for 774-kcmil 3M™ Composite Conductor

Conductor Physical Properties

Designation		ACCR_774-T53
Stranding		46/37
kcmils	kcmil	774
Area Fraction Core	%	34.52%
Weight Core	lb/ft	0.48
Diameter		
indiv Core	in	0.10
indiv Al	in	0.13
Core	in	0.73
Total Diameter	in	1.25
Area		
Al	in^2	0.607
Total Area	in^2	0.9280
Weight	lbs/linear ft	1.202
Breaking Strength		
Core	lbs	57,885
Aluminum	lbs	13,125
Complete Cable	lbs	71,010
Modulus		
Core	msi	32.9
Aluminum	msi	8.8
Complete Cable	msi	17.1
Thermal Elongation		
Core	$10^{-6}/C^{o}$	6.35
Aluminum	$10^{-6}/C^{o}$	23.00
Complete Cable	$10^{-6}/C^{o}$	11.96
Heat Capacity		
Core	W-sec/ft-C	84
Aluminum	W-sec/ft-C	272

Conductor Electrical Properties

Resistance		
DC @ 20C	ohms/mile	0.0970
AC @ 25C	ohms/mile	0.0993
AC @ 50C	ohms/mile	0.1091
AC @ 75C	ohms/mile	0.1190
Geometric Mean Radius	ft	0.0366
Reactance (1 ft Spacing, 60hz)		
Inductive Xa	ohms/mile	0.4013
Capacitive X'a	ohms/mile	0.0876

APPENDIX B

Drawing for ACA Conductor Accessories full-tension splice, part number B9095-L, for 774-kcmil 3M™ Composite Conductor
(reproduced with permission from Conductor Accessories)

NOTES:

1. IDENTIFICATION SHALL CONSIST OF THE WORD 'ACA', CONDUCTOR SIZE, DIE SIZE, AND ASSEMBLY DRAWING & LETTER.
2. ALUMINUM SLEEVE SUB-ASY. (ITEM 1) SHALL CONSIST OF THE FOLLOWING ALUMINUM PARTS: TUBULAR SLEEVE, AND FILLER PLUG.
3. STEEL SLEEVE SUB-ASY. (ITEM 2) SHALL CONSIST OF A STEEL SLEEVE, AND (2) ALUMINUM INSERT SLEEVES.

BILL OF MATERIAL — B9095

ITEM	DESCRIPTION	MATERIAL	DETAIL DWG'S ITEM	QUAN.	REMARKS
1	ALUMINUM SLEEVE SUB-ASY.	NOTE 2	SEE TABLE	1	
2	STEEL SLEEVE SUB-ASY.	NOTE 3	SEE TABLE	1	

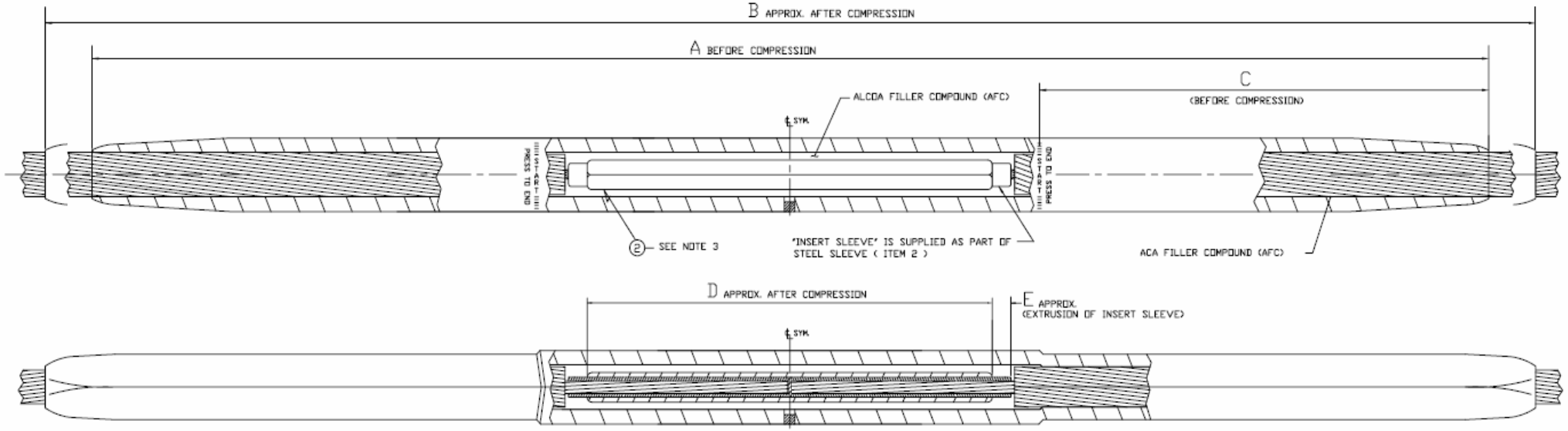

ILLUSTRATION AFTER COMPRESSION

ASY. LTR.	CONDUCTOR SIZE	CONDUCTOR DIA.	DIMENSIONS IN INCHES A	B	C	D	E	ITEMS PER BILL OF MATERIAL 1	2		DIE ALUM.	DIE STEEL	'AFCHT' COMPOUND LBS.	'AFCHT' COMPOUND APPROX. AMT. OF 1# TUBE	WEIGHT IN POUNDS ALUM.	WEIGHT IN POUNDS TOTAL
A	477M 26/7 ACCR	.858	38.00	41.75	12.00	11.00	.50	B9100-A	B9098-AA		10030AH	10014SH	1.0	1 TUBE	7.7	8.5
B	795M 26/19 ACCR	1.108	42.00	46.31	13.75	11.00	.62	B9100-B	B9098-AB		10040AH	10018SH-LG	1.5	1-1/2 TUBES	14.7	16.0
C	1272M 54/19 ACCR	1.381	48.26	53.50	16.88	11.25	.25	B9100-C	B9098-AC		10048AH	10020SH-LG	2.0	2 TUBES	24.6	26.4
D	477-T13 ACCR/TW	.860	38.00	41.75	12.00	11.00	.50	B9100-D	B9098-AA		10030AH	10014SH	1.0	1 TUBE	7.7	8.5
E	675-T11 ACCR/TW	.902	39.75	43.75	12.88	11.00	.50	B9100-E	B9098-AA		10034AH	10014SH	1.0	1 TUBE	10.3	11.1
F	954-T13 ACCR/TW	1.200						B9100-F								
G	1033-T13 ACCR/TW	1.240						B9100-G								
H	590-T13 ACCR/TW	.860	38.00	41.75	12.00	11.00	.50	B9100-H	B9098-AA		10030AH	10014SH	1.0	1 TUBE	7.7	8.5
K	1113-T13 ACCR/TW	1.290						B9100-K								
L	774-T53 ACCR	1.254			18.00			B9100-L	B9226-A		10050AH	10024SH-LG	6.0	6 TUBES		

ORDER INFORMATION

CUSTOMER TO ORDER BY ASSEMBLY DRAWING AND LETTER i.e. B9095-A

ACA04859

NO.	REVISION RECORD	BY	CK.	ZONE
10	GENERAL REVISIONS-ADDED DRAW-F,-G,-J TO BOM ITEMS	AA	VG	
9	REVISED ASY. K	VG		
8	REVISED SLEEVE	AA	VG	
7	ADDED COMPOUND AMT.	VG		
6	ADDED ASY. H	VG		
5	ADDED DWG. ACCR/TW	VG		
4	ASY. G REV. CONDUCTOR SIZE WAS 680M 26/7 ACCR/TW	VG		
3	ADDED ASY. E	VG		
2	ADDED ASY. C & D	VG		
1	ADDED REV. & TABULATED	VG		

SUPERCEDES — SUPERCEDED BY — REV. THIS NO.

AMERICA FUJIKURA TELECOMMUNICATIONS DIVISION || ACA

JOINT

FOR COMPOSITE CORE CONDUCTOR (ACCR)

ASSEMBLY

DESIGNED BY	DRAWN BY	CHECKED BY
	WLQ	
SCALE	DATE	APPROVED BY
N.T.S.	APRIL 6, 2002	

B9095

DISTRIBUTION

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