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

Test Name:	**SUSTAINED LOAD TEST ON COMPRESSION DEADEND FITTING FOR 774-KCMIL 3M™ COMPOSITE CONDUCTOR AT ROOM TEMPERATURE**
Test Date:	September 16-23, 2005
Cable Supplier:	3M Company
Laboratory:	Kinectrics Inc. 800 Kipling Avenue Toronto, Ontario M8Z 6C4 CANADA
Standard:	Based on ANSI C119.4-2003, Paragraph 7.3.3.1
Kinectrics Staff:	Mr. Craig Pon Mr. Michael Kastelein Mr. Mike Colbert

OBJECTIVE

3M contracted with Kinectrics under PO # 1600000 to conduct a room temperature sustained load test on a full tension, compression deadend clamp manufactured by ACA Conductor Accessories (formerly Alcoa-Fujikura Ltd.). The objective of the test was to verify the room temperature sustained load carrying capability of the compression deadend clamp on a 774-kcmil 3M™ Composite Conductor. The ACA catalogue number of the deadend is B9178-L (special design for 3M 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 dead-end assembly is shown in Appendix B. 3M owns all data and copyright to this information.

TEST SAMPLE

The test sample was prepared by ACA Conductor Accessories at their facilities. The sample

comprised a full tension compression deadend installed on one end of a 774-kcmil 3M™ Composite Conductor approximately 14 m (46 ft) in length. The sample was shipped to Kinectrics where the other end of the conductor was terminated with an epoxy-resin clamp.

TEST SET-UP

The test sample was installed in a hydraulically-activated horizontal test machine. The length of exposed conductor between the inboard face of the epoxy-resin clamp and the edge of the ACA Conductor Accessories compression deadend was about 12.5 m (41 ft). The set-up is shown in Figure 1.

INTRUMENTATION

The load cell (#17356-0) in the test machine (MTS 3156/MTS 493.01DC) that measured 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 load measuring system has an accuracy of ± 2%.

TEST PROCEDURE

A test machine having a load accuracy of ± 2% was used for this test. The conductor was preloaded to 1,000 lbf (454 kgf) or about 1.4% of the rated tensile strength (RTS) of the conductor (RTS = 71,010 lbf, 32,210 kgf). The tension in the sample was increased from preload to 54,678 lbf (24,802 kgf) or 77% of the conductor RBS in about ten(10) minutes. The tension was maintained at this level for 168 hours. The elongation of the conductor over an 8.06 m gauge length was also measured and recorded during the test using a pull wire potentiometer. The ambient temperature in the laboratory was approximately 22^{o}C during the test. On completion of the sustained load test, the tension in the sample was increased until failure.

TEST RESULTS

The conductor sample failed at 14,989 kgf (33,044 lbf), or 102.6% of the RTS of the conductor. The conductor failed at approximately the midpoint of the span. The failure is shown in Figures 1 and 2.

Figure 3 shows the conductor strain (%) and tension (kgf) plotted against elapsed time during the sustained load phase. Most of the strain (approximately 0.40%) of the conductor occurs during the initial tensioning of the conductor. Approximately 0.023% strain occurred during the remainder of the test.

ACCEPTANCE CRITERIA

To qualify under the ANSI standard, a connector must hold 77% of the conductor's rated tensile strength (RTS) for seven days (168 hours). At the end of the sustained load period, the residual strength must exceed 95% of the conductor RTS.

CONCLUSION

The 774-kcmil 3M™ Composite Conductor deadend clamp exceeded the 95% RTS strength criterion specified in ANSI C119.4-2003.

ACKNOWLEDGEMENT

This material is based upon work supported by the U.S. Department of Energy under Award No. DE-FC02-02CH11111.

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 26, 2005

Figure 1 Room Temperature Sustained Load Test sample (post-test) of an ACA Conductor Accessories Deadend attached to a 774-kcmil 3M™ Composite Conductor (Looking South). Conductor and Dead-end were stressed for 168 hours under the Sustained Load at Room Temperature and then tested to failure in tension. Failure was at the mid-span.

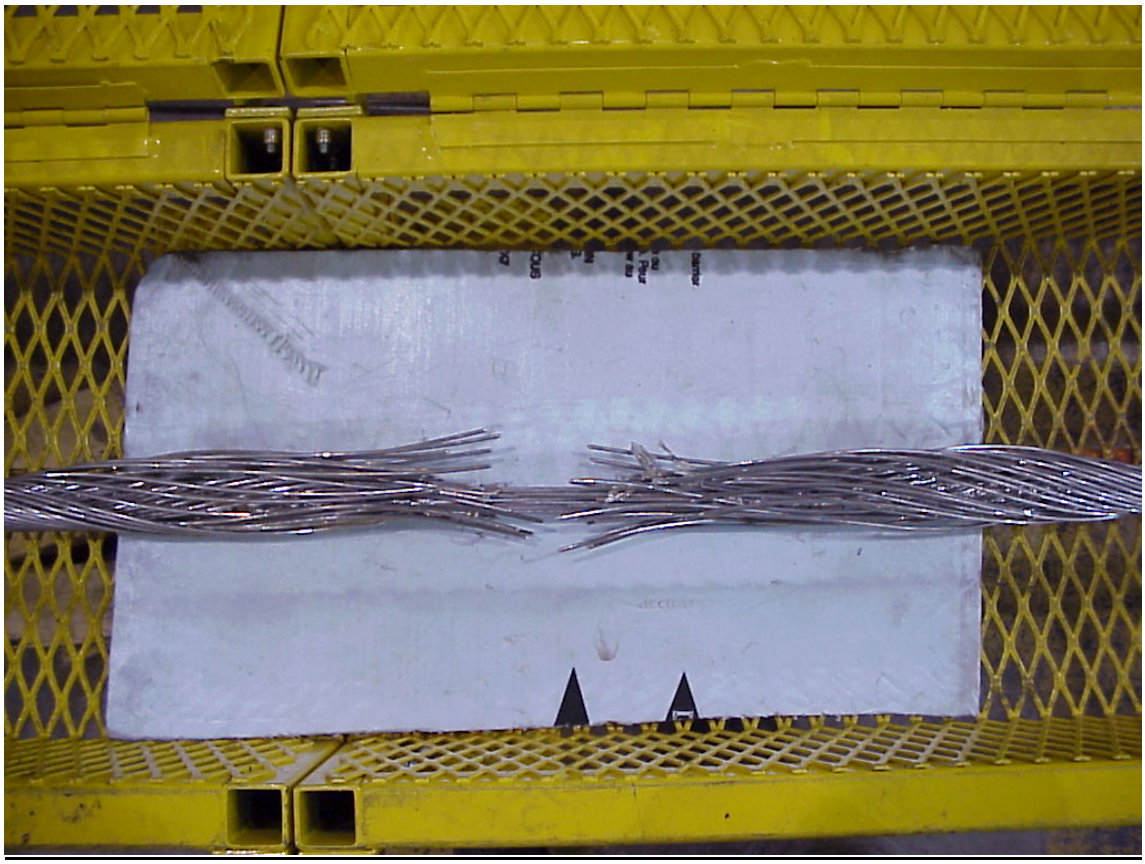

Figure 2 774-kcmil 3M™ Composite Conductor after the Tension Test to Failure. Conductor and dead-end were stressed for 168 hours under Sustained Load at Room Temperature (Close-Up view)

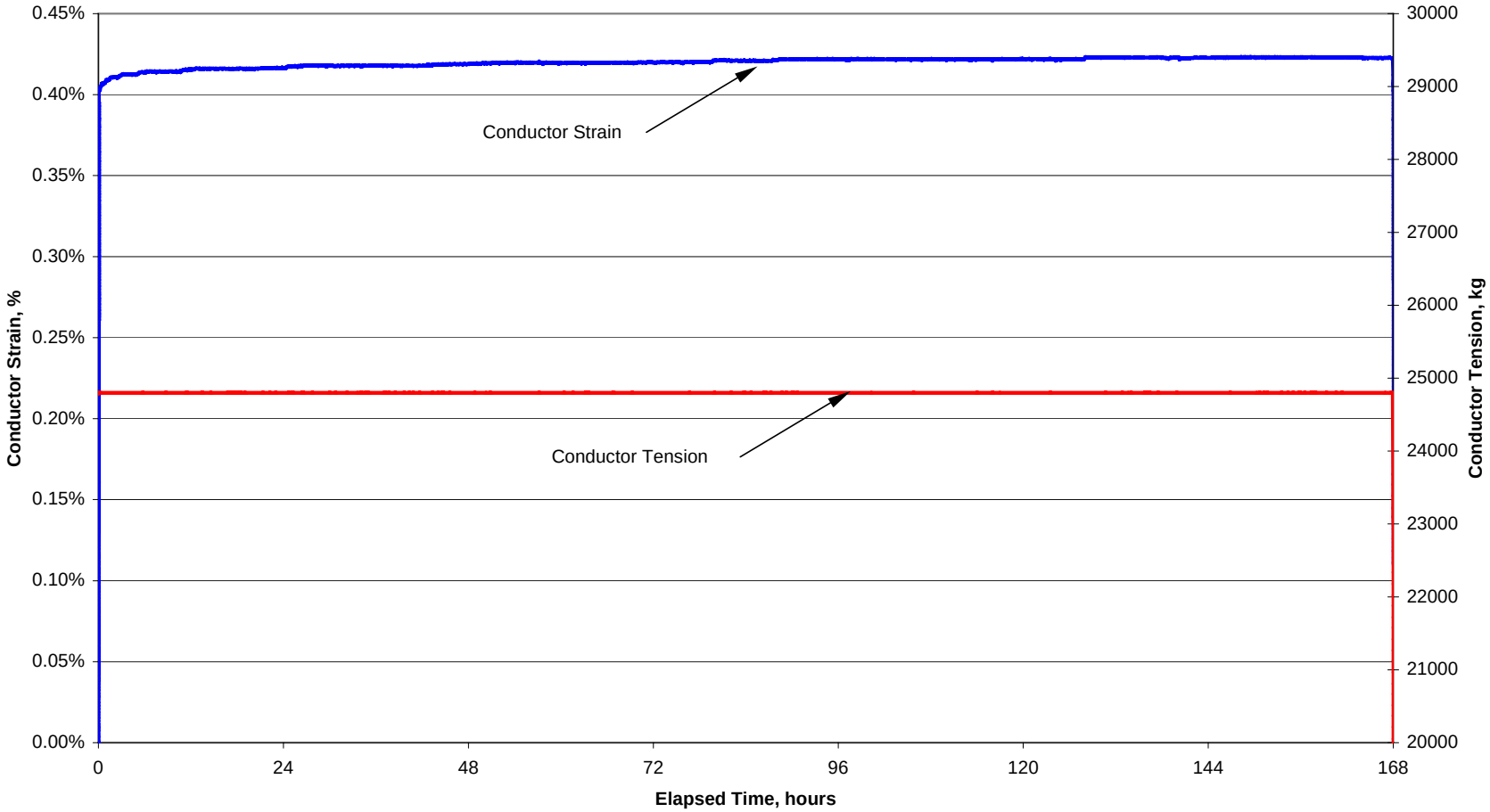

Figure 3 Conductor Strain and Tension vs. Elapsed Time for 774-kcmil 3M™ Composite Conductor Sustained Load Test at Room Temperature

APPENDIX A

Specifications for 774-kcmil 3M™ Composite Conductor

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	0.105
indiv Al	in	0.130
Core	in	0.735
Total Diameter	in	1.254
Area		
Al	in^2	0.6077
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 B9178-L, for 774-kcmil 3M™ Composite Conductor
(reproduced with permission from ACA Conductor Accessories)

B9178

BILL OF MATERIAL

ITEM	DESCRIPTION	MATERIAL	METAL AREA PER	REQ'D	REMARKS
1	EYE DEADEND SUB-ASY.	NOTE 2	SEE TABLE	1	
2	DEADEND BODY SUB-ASY.	ALUM.	SEE TABLE	1	
3	TERMINAL	ALUM	SEE TABLE	1	
4	CLEVIS DEAD END SUB-ASY	NOTE 2	SEE TABLE	1	
5	ADJ. EYE-DEAD END SUB-ASY	NOTE 2	SEE TABLE	1	

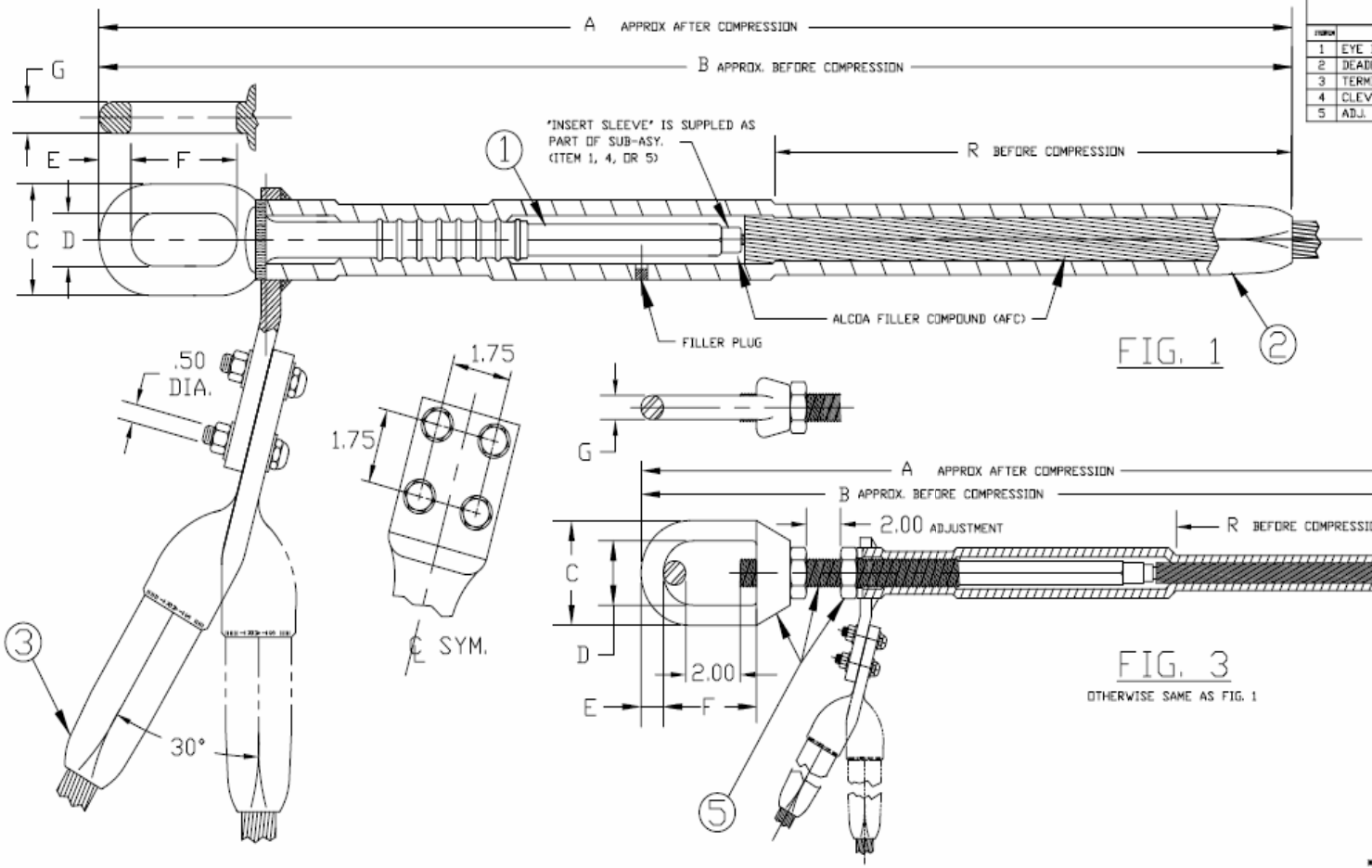

FIG. 1

FIG. 3

OTHERWISE SAME AS FIG. 1

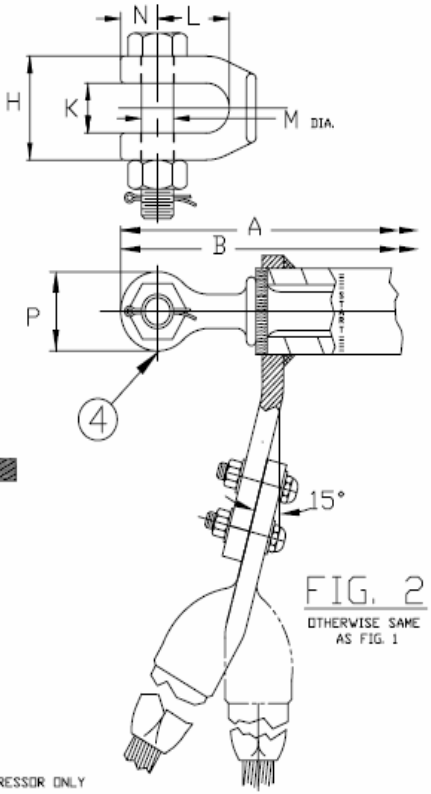

FIG. 2

OTHERWISE SAME AS FIG. 1

*USE 100A COMPRESSOR ONLY

ASY. LTR.	CONDUCTOR SIZE	CONDUCTOR DIA.	FIG.	DIMENSIONS IN INCHES A	B	C	D	E	F	G	H	K	L	M	N	P	R	ITEMS PER BILL OF MATERIAL 1	2	3	4	5	*DIE SIZE ALUM.	*DIE SIZE STEEL	'AFCHT' COMPOUND DEAD END LBS.	DEAD END APPROX. AMT. OF 1# TUBE	TERMINAL LBS.	TERMINAL APPROX. AMT. OF 1# TUBE	TOTAL LBS.	TOTAL APPROX. AMT. OF 1# TUBE	WEIGHT IN POUNDS ALUM.	WEIGHT IN POUNDS TOTAL
A	477M 26/7 ACCR	.858	1	31.56	29.06	2.62	1.25	.88	2.69	.75	—	—	—	—	—	—	12.00	B9098-A	B9099-A	B9102-A	—	—	10030AH	10014SH	.67	2/3 TUBE	.30	1/3 TUBE	1.0	1 TUBE	5.6	8.6
B	795M 26/19 ACCR	1.108	1	33.31	30.56	3.25	1.25	1.12	2.62	1.00	—	—	—	—	—	—	13.75	B9098-B	B9099-B	B9102-B	—	—	10040AH	10018SH-LG	1.0	1 TUBE	.54	1/2 TUBE	1.5	1-1/2 TUBES	10.5	16.5
C	1272M 54/19 ACCR	1.381	2	39.00	36.38	—	—	—	—	—	3.69	1.56	2.88	1.25	1.44	2.88	16.88	—	B9099-C	B9102-C	B9118-A	—	10048AH	10020SH-LG	1.3	1-1/3 TUBE	.66	2/3 TUBE	2.0	2 TUBES	15.4	27.7
D	477-T13 ACCR/TW	.860	1	31.56	29.06	2.62	1.25	.88	2.69	.75	—	—	—	—	—	—	12.00	B9098-A	B9099-D	B9102-D	—	—	10030AH	10014SH	.67	2/3 TUBE	.30	1/3 TUBE	1.0	1 TUBE	5.5	8.5
E	675-T11 ACCR/TW	.902	1	32.56	29.94	2.62	1.25	.88	2.69	.75	—	—	—	—	—	—	12.88	B9098-A	B9099-E	B9102-E	—	—	10034AH	10014SH	.67	2/3 TUBE	.30	1/3 TUBE	1.0	1 TUBE	7.3	10.3
F	954-T13 ACCR/TW	1.200	1																													
G	1033-T13 ACCR/TW	1.240	1																													
H	590-T13 ACCR/TW	.860	1	31.56	29.06	2.62	1.25	.88	2.69	.75	—	—	—	—	—	—	12.00	B9098-A	B9099-H	B9102-H	—	—	10030AH	10014SH	.67	2/3 TUBE	.30	1/3 TUBE	1.0	1 TUBE	5.5	8.5
K	1113-T13 ACCR/TW	1.290	1																													
L	774-T53 ACCR/TW	1.254	3	52.00	49.38	5.56	3.12	1.25	4.00	1.25	—	—	—	—	—	—	18.00	—	B9099-L	B9102-L	—	B9225-A	10050AH	10024SH-LG	4.0	4 TUBES	.76	3/4 TUBE	4.75	4-3/4 TUBES		

ORDERING INFORMATION

CUSTOMER TO ORDER BY ASSEMBLY DRAWING & LETTER. i.e. B9178-A

NOTES:

1. IDENTIFICATION SHALL CONSIST OF THE WORD 'ACA', CONDUCTOR SIZE, DIE SIZE, AND ASSEMBLY DRAWING AND LETTER.
2. EYE DEADEND (ITEM 1) SHALL CONSIST OF A STEEL EYE FORGING, FELT WASHER, AND ALUMINUM INSERT SLEEVE. CLEVIS DEADEND (ITEM 4) SHALL CONSIST OF STEEL CLEVIS FORGING, FELT WASHER AND ALUMINUM INSERT SLEEVE. ADJUSTABLE EYE DEAD END (ITEM 5) SHALL CONSIST OF A THREADED SHAFT, EYE NUT, JAM NUTS, FELT WASHER AND ALUMINUM INSERT SLEEVE.
3. DEADEND BODY (ITEM 2) SHALL CONSIST OF THE FOLLOWING ALUMINUM PARTS; BARREL, TONGUE, AND FILLER PLUG.

DATE	NO.	REVISION RECORD	BY	CK	ZONE
03/29/05	1	GENERAL REVISIONS ADDED FIGS 2 & 3 AND TABLE	AA	WG	

SUPERSEDES | SUPERSEDED BY | REV. DWG. NO.

AMERICA FUJIKURA TELECOMMUNICATIONS DIVISION || ACA

DEADEND

FOR 3M COMPOSITE CORE CONDUCTOR (ACCR)

ASSEMBLY

DESIGNED BY	DRAWN BY	CHECKED BY
	A. ALAIMO	W. QUESNEL

SCALE	DATE	APPROVED BY
N.T.S.	02-15-05	

B9178

DISTRIBUTION

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