774-kcmil, Type 53, 3M Brand Composite Conductor

Tensile Tests for Compression Dead End Fittings

3M Company
Purchase Order 0001325106

NEETRAC Project Number: 04-107b

July, 2005

A Research Center of
The Georgia Institute of Technology

Requested by: Mr. Colin McCullough
3M

Principal Investigator:
Paul Springer III, P.E.

Reviewed by:
Dale Callaway

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SUMMARY:

3M contracted with NEETRAC for mechanical testing for 774 ACCR 3M Brand Composite Conductor. Tests reported here are tensile strength for compression dead end fittings provided by Alcoa Conductor Accessories (ACA). The fittings meet the strength requirements stipulated in ANSI C119.4 for full-tension connectors.

SAMPLES:

1) Two (2) ACA dead end (part # B9178-L) fittings compressed on 3M ACCR 774-T53 Conductor (design drawing in Appendix A)

REFERENCES:

1) "Proprietary Information Agreement …." Dated 3/27/01
2) 3M Purchase Order 0001325106
3) 3M data file "3M ACCR 774-T53 River-X Cable Spec.xls", dated May 18, 2004, containing conductor technical specifications (Appendix B)
4) PRJ 04-107, NEETRAC Project Plan

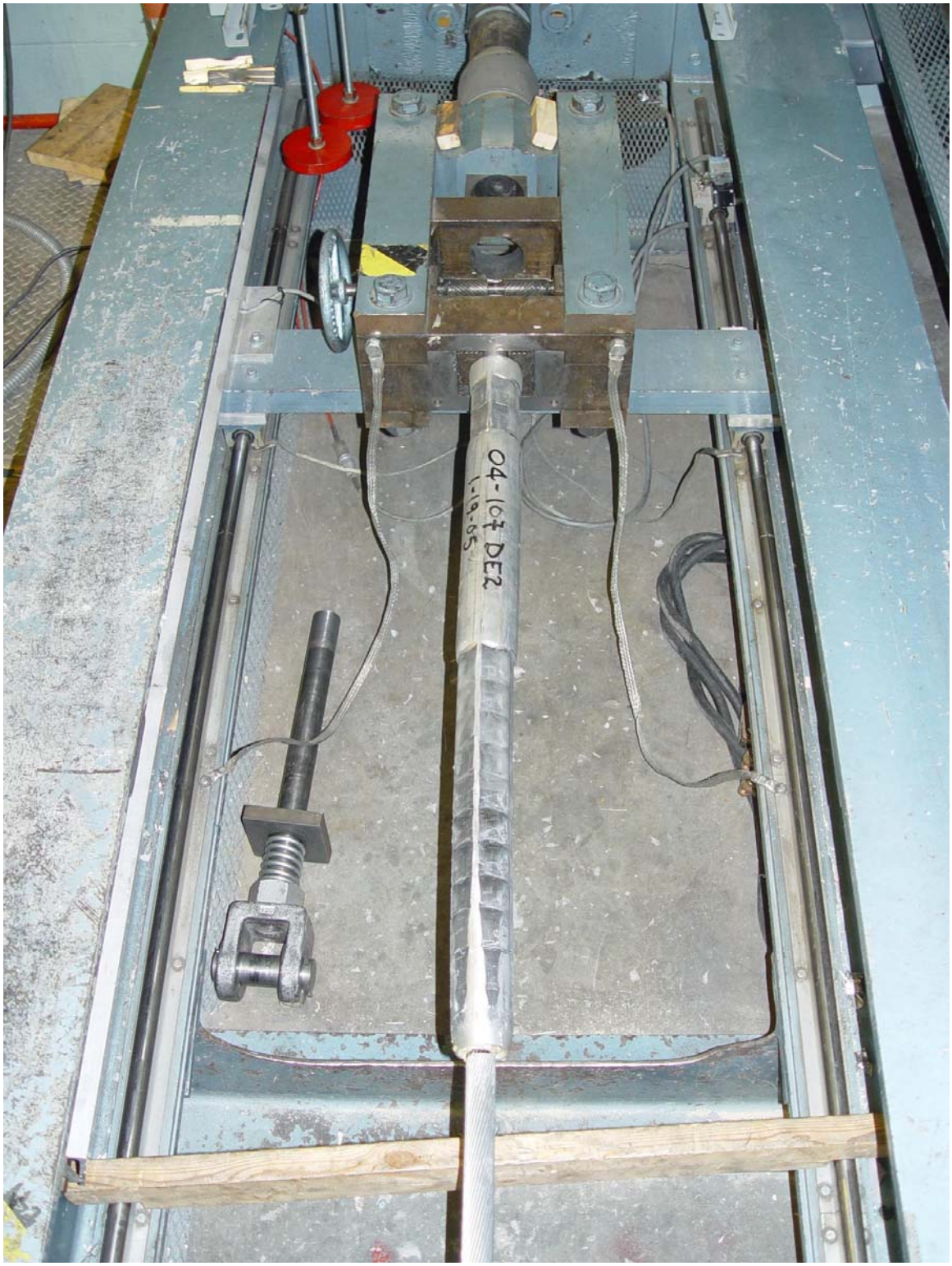
PROCEDURE AND RESULTS:

The conductor free end opposite the dead end fitting was terminated using cast-resin terminations. The cast-resin holds each strand independently, and therefore distributes the load in the short test section in a manner similar to loading of the same conductor in a long span. After the resin cured, the samples were pulled to destruction at a loading rate of 35,000 lb/min (50% of RBS per minute). A full-tension connector is required to hold 95% of the conductor's rated breaking strength (RBS). RBS for 3M ACCR 774-T53 is 71,010 lb.

Sample	Max load (lbs)	% RBS	Failure mode
1	69810	98	All strands failed at resin plug
2	72340	102	All strands failed at resin plug

EQUIPMENT USED:

1) MTS Servo-hydraulic tensile machine, Control # CQ 0195 (load and crosshead data)



Photograph 1, compression dead end fitting. Threaded shank held using vee-wedge grips

Acknowledgement

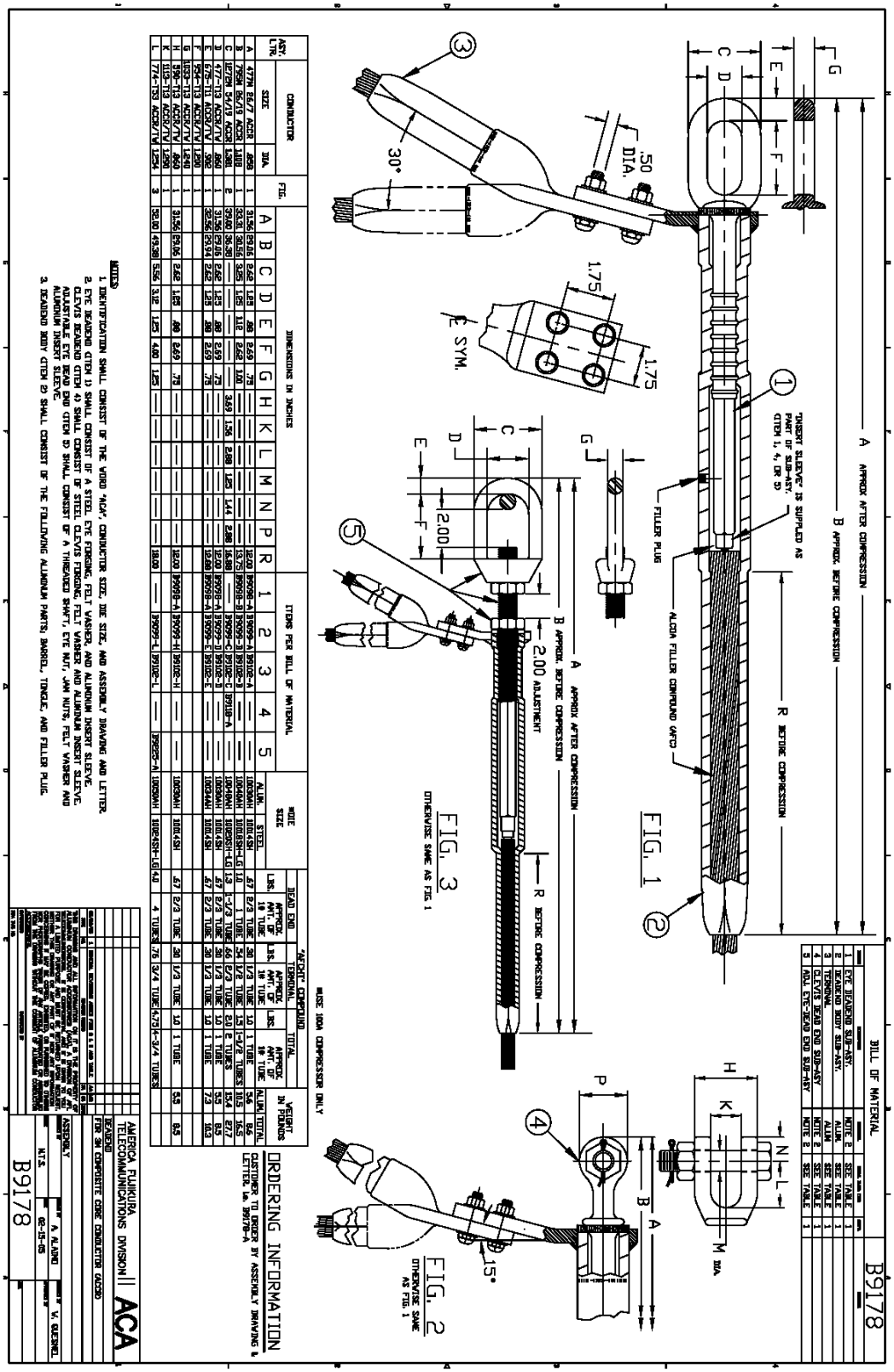
This material is based upon work supported by the U.S. Department of Energy under Award No. DE-FC02-02CH11111.

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.

Appendix A: Alcoa Conductor Accessories Dead-End B9178-L

(drawing is reproduced with permission from ACA)



Appendix B: 774-kcmil, Type 53, 3M Composite Conductor Specification

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