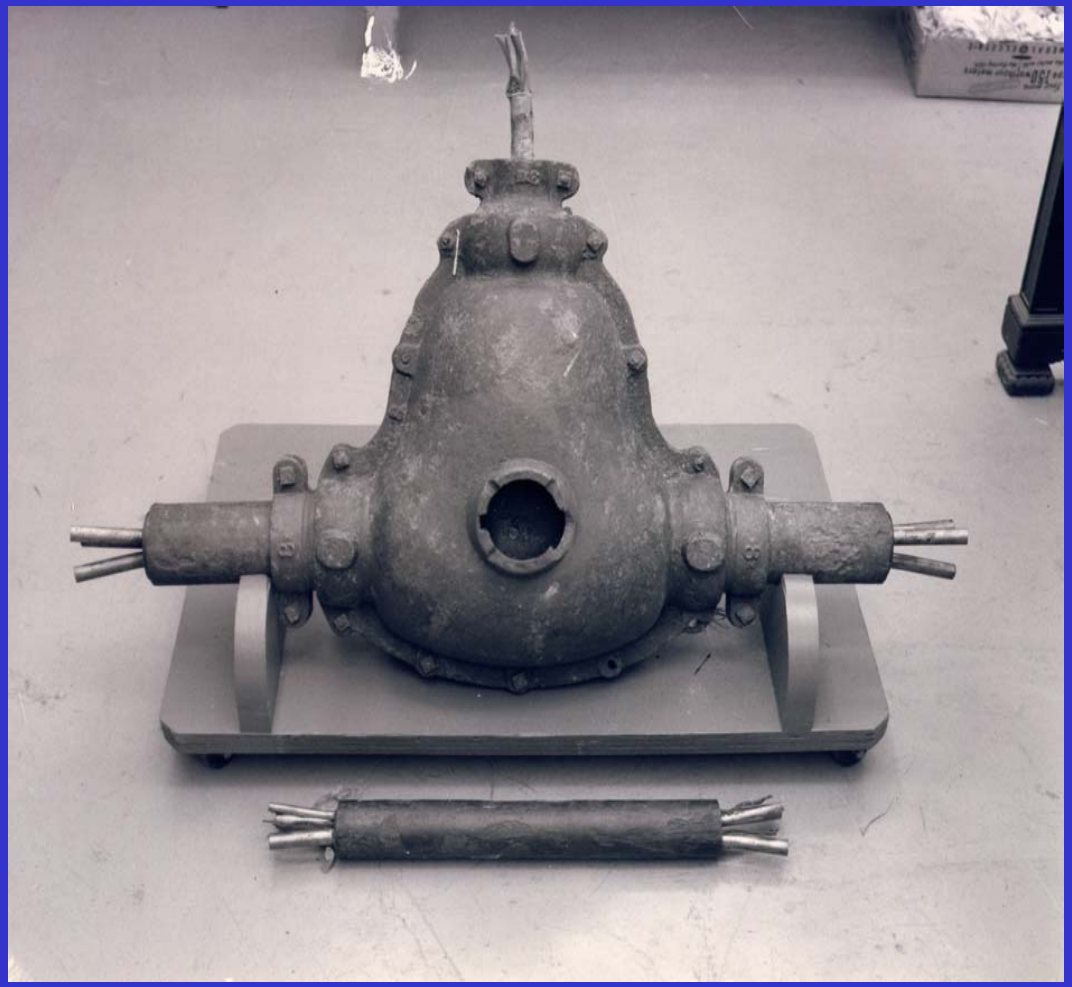
PILC OPERATING EXPERIENCES & PRACTICES

STAN HEYER
PECO ENERGY CO.
APRIL 30, 2003

Wooden Duct

Secondary Tap of "Edison Tube" Conductor



OXFORD 63

FROM MH #	TO MH#	LENGTH	CONDUCTOR	SUPPLIER	INSTALL DATE
90743	7918	22	3x115	SUC	10/1/00
7918	6995	40	3x115	SUC	10/1/00
6995	90742	84	3x115	SUC	12--99
90742	32870	52	3x115	SUC	12--99
32870	7919	54	3x115	SUC	12--99
7919	32871	89	3x115	SUC	12--99
32871	7920	132	3x115	SUC	12--99
7920	5387	35	3x115	SUC	10/1/00
5387	32872	88	3x115	SUC	10/1/00
32872	7921	106	3x115		10/1/00
7921	89593	40	3-1x250	Roeb.	8/1/50
89593	7921	40	3-1x250	Roeb.	8/1/50
7921	32878	93	3x115		10/1/00
32878	7922	124	3x115	ASW	10/1/00
7922	7923	79	3x250	Okon.	06/06/29
7923	5390	200	3x250	ASW	12/01/04

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Affect of Overloads on PILC Cable Performance

- 12 year study of 3 conductor sector cable performance (1930-1941)
- 13 kV belted cable design
- 6 generating station tie lines included in study
- 22 miles of cable in study

Conductor Temperatures

- AEIC Normal Operating Conductor Temperature - of 80°C (calculated to be 77°C)
- Overload Conductor Temperature – calculated to be 109°C

13 kV 3-Conductor Belted Cable Overload Test Data

	Test Group	Entire System
6 Years Operation at AEIC Rating	18.1	6
2 Years Overload of Test Group	67.8	9
4 Years Operation at AEIC Rating Subsequent to Overload	43.8	7.3

Failures per 100 miles of cable per year

Causes of Failure Data During Two Years of Overload

	Test Group	Entire System
Lead Sheath Cracks	52	3.4
Insulation Breakdown	4.5	0.6
Electrolysis & Corrosion	4.5	3.6
Miscellaneous	6.8	1.4
Total	67.8	9.0

Failures per 100 miles of cable per year

Causes of Failure During Four Years Subsequent to Overload

	Test Group	Entire System
Lead Sheath Cracks	31.7	2.4
Insulation Breakdown	5.4	0.7
Electrolysis & Corrosion	4.5	2.5
Miscellaneous	2.2	1.7
Total	43.8	7.3

Failures per 100 miles of cable per year

Major PILC Design Change

- Increasing failure rates due to longitudinal movement of 3 conductor cable.
- Added a 500 kcmil single conductor triplexed cable in 1946.
- Triplexed cable reduced longitudinal cable movement during load cycling between 1/5 and 1/12 from 3 conductor cables.

3-Conductor versus 1-Conductor Triplexed Cable Failure Rates

- Industry Average - 9.5
- PECO 3- Conductor Cable - 8.6
- PECO Triplexed Cable - 6.2

Failures per 100 miles of cable per year

Industry Average Data from Joint EEI-AEIC Cable Operating Report 1960-63

Single Phase Splice

3 Phase Splice

Close Up 3 Phase Splice

Completed Insulated 3 Phase Splice

Four Way Splice

Single Phase Live End Seal

3 Phase Test Cap

Seven Way Splice

Close up of 7 Way Splice

PRODUCTS NEEDED TO TRANSITION FROM PILC TO EXTRUDED CABLES

- REPLACEMENT FOR SECTOR CABLE
- REPLACEMENT FOR 1 PHASE CABLE
- TRIFURCATING TRANSITION SPLICE
- TRANSITION SPLICE FOR SINGLE PHASE
- WYE SPLICE

LIMITATIONS OF THE NEW EXTRUDED CABLE SYSTEM

- SPLICES ARE LARGER
- TAPS CANNOT BE MADE IN TRANSITON MANHOLES DUE TO MH SIZE LIMITATIONS
- REPAIRS SOMETIMES REQUIRE PULLING AN EXTRA STRETCH OF CABLE DUE TO INADEQUATE SPACE TO SLIDE TUBES FOR COLD OR HEAT SHRINK PRODUCTS

BENEFITS OF EXTRUDED CABLE SYSTEM OVER PILC

- LESS SKILL REQUIRED FOR INSTALLATION
- CABLE IS LESS EXPENSIVE
- FASTER INSTALLATION OF SPLICES

TRANSITION MILESTONES

- FIRST EPR FLAT STRAP INSTALLATION AUGUST 2000
- JANUARY TO DECEMBER 2001 – LESS THAN 500 FEET OF PILC CABLE INSTALLED (REDUCED FROM AN ANNUAL USAGE OF 12000 FEET)
- JANUARY 2002 ELIMINATED ALL USE OF PILC CABLE