

J.O.No. 11700
O.F.E. No. 8700
C.O. No. 3468
Specification No. BVS-356
P.O.No. - BV-227

February 26, 1970
Revised November 6, 1970
Revised August 19, 1971
Revised February 24, 1972

Job Book Copy

301A P.D.

SPECIFICATION

FOR

5,000 V POWER CABLE

FOR

BEAVER VALLEY POWER STATION - UNIT NO. 1

DUQUESNE LIGHT COMPANY

SELLER: THE KERITE COMPANY

1 JOCK
1 A.P. F...
1 M...
1 H.C. L...
1 F...
1 C.A. C...
1 D. W...
1 C.K. S...
1 S...
1 S...

REVISIONS	REV. 0	REV. 1	REV. 2	REV. 3
Prepared By	LBB mjs	LBB mjs	LBB mjs	LBB mjs
Project Engineer Approval	dn	LBB for JHN	dn	dn
Quality Assurance Review	L.B.	L.B.	L.B.	L.B.
Equipment Specialist Review	Eful	Eful	Eful	Eful

STONE & WEBSTER ENGINEERING CORPORATION

78061806/11

79061806/11 XA

12pp

SECTION II :

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S P E C I F I C A T I O N

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FOR

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5,000 V POWER CABLE

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FOR

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BEAVER VALLEY POWER STATION - UNIT NO. 1

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DUQUESNE LIGHT COMPANY

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PITTSBURGH, PENNSYLVANIA

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-:-

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Stone & Webster Engineering Corp., Engrs.

Boston, Mass.

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February 26, 1970

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Revised November 6, 1970

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Revised August 19, 1971

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Revised February 24, 1972

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Information marked with asterisks (*) furnished by Seller. Data furnished by the Seller are included herein for Purchaser's information and use. The Seller is not relieved of responsibility for the correctness of design and details represented by the data. The Seller shall be responsible to advise the Engineers promptly in writing of any changes in the data required to describe accurately the characteristics of the equipment as it is to be shipped and erected.

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1. SCOPE

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This specification covers the furnishing of single conductor and three conductor armored 5,000 v power cable for use on 4,160 v a-c, three-phase, 60 Hz, grounded wye service in a nuclear power station. Single conductor cables shall be suitable for use in dry or wet locations, indoors or outdoors, in conduit or underground ducts. Three conductor armored cables shall be suitable for use in dry locations, indoors in trays, inside or outside the containment. Cables used inside the containment shall have copper conductors and galvanized steel armor. None of the cables are required to operate inside the containment with post accident conditions. Installation of the cables will be by others.

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well as manufacturer's identification and year of manufacture. 187
Markings shall be effected by indenting or surface printing. 188

On three-conductor cables, provision shall be made for 190
phase identification on individual conductors. 191

11. RADIATION RESISTANCE 194

Cables specified herein are for use inside and outside 196
the reactor containment of a nuclear power plant. They must be 199
capable of withstanding a total normal operating radiation dose
of 3 times 10^7 rads over the expected 40 yr life of the plant 200
without any significant change in physical and electrical 201
properties.

12. TESTS 204

All tests shall be made by the manufacturer, who shall 206
provide the Engineers with certified cable test reports. Each 209
length of cable shall be tested in accordance with the attached
Form QCD-101EF1, dated November 1970. Alternating current 211
dielectric tests shall be made between each conductor and ground 212
and between conductors of the completed cable.

Tests shall include dielectric and insulation resistance 214
tests of the insulation. Prior to the application of any outer 215
coverings, all insulated conductors shall be immersed in water 216
for 24 to 36 hr. After this period, and while still immersed, 217
60 Hz a-c test voltage shall be applied in accordance with 218
Table I. Insulation resistance tests are made at this time in 219
accordance with Table II.

Tests shall be made on the single conductor jacketed 221
cables. After submersion in water for 12 to 18 hr, while still 222
submerged, cables shall be tested at a-c and d-c values shown in 223
Table III.

Where personal inspection is called for, all tests shall 225
be witnessed by the Purchaser or his representative, who shall be 227
notified at least a week to 10 days prior to the time tests are
to be performed.

Prior to shipping any cable, the Seller must have 229
received a shipment release. This release will not be issued 231
until the certified test reports are received by the Purchaser 232
and checked.

13. INSPECTION AND REJECTION 235

The Purchaser shall be permitted at any reasonable time 237
to have his representative visit the manufacturer's plant for the 238
purpose of examining or ascertaining whether or not the materials 240

manufacture may be considered, provided that all applicable codes, standards and quality requirements are met and documented where required by Form QCD-101.

17. QUALITY ASSURANCE

Each bidder shall furnish with his proposal a detail description of his Test and Quality Assurance program covering tests and test procedures to be made in the event of an order.

18. DESIGN DATA BY SELLER (TO BE FURNISHED WITH PROPOSAL)

The physical and electrical characteristics of the cable covered by this specification are summarized below. All fill-in data are to be completed by the Seller. In addition to the tabulated data, each bidder shall submit supporting test data to substantiate claims that the cable (or alternates) meets requirements for radiation, flame, heat and moisture resistance of the insulation and jacket materials and the completed cables.

<u>Cable Characteristics</u>		<u>Guaranteed Data</u>
A. Voltage classification		5,000 v
B. Conductor	Aluminum	Copper
1. Strand hardness temper	ECH-19	Soft drawn
2. Conductivity, %	Not stated	
3. Strand shielding material	NA	NP
C. Insulation		
1. Basic insulation material		HT Kerite
2. Type		Rubber-like
3. Tensile strength, min psi		550
4. Elongation, min %		350
5. After 7 days in air oven at 150 C: Tensile strength, min % original Elongation, min % original		Not stated
6. After 40 hr at 80 psi, 150 C: Tensile strength, min % original Elongation, min % original		N.S. N.S. N.S.
7. Heat distortion, 150 C, max %		N.S.
8. Water absorption, 7 days, 75 C water, mg/in		N.S.
9. Max % change in SIC, 75 C water 1-14 days 7-14 days		N.S. N.S.
10. Insulation resistance constant, min (50 F)		see Table II
11. Test voltage, 5 min a-c, v/mil insulation		see Table I, II, III

12.	Corona level	<u>N.S.</u>	35
13.	Dielectric breakdown strength:		36
	Room temperature	<u>N.S.</u>	36
	Operating temperature	<u>N.S.</u>	36
14.	Crone resistance at		36
	0.0305 concentration - room temperature	<u>N.S.</u>	36
	0.0005% concentration - 125 F	<u>N.S.</u>	36
15.	Cold bend, -65 C	<u>N.S.</u>	36
16.	U-bend - 125 v/mil	<u>N.S.</u>	36
17.	Temperature rating, C		36
	Normal rating	<u>90</u>	36
	Emergency rating	<u>130</u>	36
	Short-circuit rating	<u>250</u>	36
18.	Radiation resistance		37
	Overall threshold of damage	<u>min. 1 x 10⁶ rad</u>	37
	Highest dose still serviceable	<u>min. 1 x 10⁶ rad</u>	37
19.	Flame resistance	<u>Passes</u>	37
D. Insulation Shielding			37
1.	Nonmetallic semiconducting material	<u>None</u>	38
2.	Nonmagnetic metallic tape material	<u>None</u>	38
3.	Metallic tape thickness, mils	<u>None</u>	38
4.	Metallic tape width, in.	<u>None</u>	38
5.	Metallic tape overlap, %	<u>None</u>	38
E. Jacket			38
1.	Type of compound	<u>NS Neoprene</u>	38
2.	Material characteristics	<u>N.S.</u>	38
3.	Corona level	<u>N.S.</u>	38
4.	Tensile strength, min psi	<u>N.S.</u>	38
5.	Elongation, min %	<u>N.S.</u>	38
6.	Tear strength, min lb/in	<u>N.S.</u>	38
7.	Flame resistance	<u>Passes</u>	38
8.	Radiation resistance		38
	Overall threshold	<u>1 x 10⁶ rad</u>	38
	Highest dose still serviceable	<u>1 x 10⁶ rad</u>	40
9.	Track resistance	<u>397</u>	40
10.	Surface resistivity	<u>N.S.</u>	40
F. Fillers			40
1.	Material type	<u>Asbestos</u>	40
2.	Flame resistance	<u>N.S.</u>	40
G. Binding Tape			41
1.	Material type	<u>N.S.</u>	41
2.	Flame resistance	<u>N.S.</u>	41

INSPECTION REPORT

QCD 101EFL 11/70

POWER CABLE - 5000 V

FINAL REPORT

STONE & WEBSTER ENGINEERING CORPORATION

TRIP REPORT NO _____

SHOP QUALITY CONTROL

SHEET 1 OF 1

CLIENT	Dunsmuir Light Company	AC NO	11700	MARK NO
PROJECT	Beaver Valley Power Station - Unit No. 1	ORDER NO	BV-227	ITEM NO
VENDOR	The Kerite Company	SHOP/ORDER NO		
SUBVENDOR		SHOP NO		
DESCRIPTION	5,000 Power Cable	VENDOR'S NO		
VENDOR'S DRAWING(S)		CODE		
TEST REPORT		REPORT PERIOD	FROM	TO

INSPECTION AND DOCUMENT RECORD	Req'd for P.O. Items	To Be Mit. By #	BY	DATE	DATE RECORD SENT	
					TO BOSTON	TO JOB BY BOSTON
1 *Conductor Tests	X	N				
2 Physical and Aging Tests on Insulation and Jacket						
3 *Ozone Resisting Test						
4 *Accelerated Water Absorption Tests						
5 *Thickness of Shielding Tapes						
6 *Voltage Tests on Completed Cable	X	N				
7 *Insulation Resistance Test	X	N				
8 Corona Level Test						
9 Visual Inspection and Verification of Dimensions	X	I				
10 Preparation for Shipment	X	N				
11 **Tests for Thermoplastic Jackets						
12 **Heat Distortion ALPI Cable	X	N				
13 **Dimensional Checks of Interlocked Armor	X	N				
14						
15 **Tests for Ozone and Discharge Resisting Jackets						
16						
17 Manufacturer's Statement of Compliance	X	N				
18						
19 Water Tank Test	X	I, E, C				
20						
21						
22						
23						
24						
25						

LIST ALL DEVIATIONS FROM SPECIFICATION OR DRAWINGS, NAME OF ENGINEER GIVING APPROVAL AND DATE

Number of certified test reports to be sent to Boston 8

R *Applicable to all cable

E **Applicable when particular construction is specified.

M ***The Kerite Company do not subscribe to IPCEA and take exception to these tests
A #1, Inspector; E, Engineer; C, Client; N, Not to be Witnessed

Engineers' inspectors will make certain test reports in accordance with the applicable standards are submitted to and approved by the Engineers prior to shipment.

OFFICE

REPORTED BY

(SIGNED IF FINAL)

DATE

United States Engineering & Construction Co.
 1000
 Boston, Massachusetts 02107

Certification:

This is to certify that all cable shipped on DV-227, Mark 2-53
 has been manufactured in strict compliance with the Kerite Quality
 Assurance Program and meet all applicable requirements.

01293

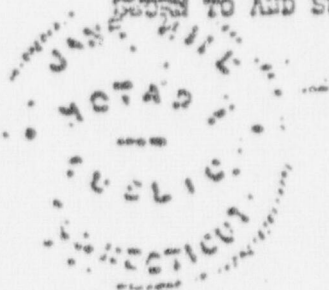


Certified by
 THE KERITE COMPANY

Richard A. B. [Signature]
 President & General Manager
 TEST & INSPECTION DEPARTMENT

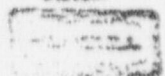
PER/

ISSUED TO AND SUBSCRIBED TO BEFORE ME THIS 1st DAY OF APRIL, 1973



James H. Hill Notary Public

My Commission
 Expires Dec. 31, 1973



a subsidiary of KODAK PAPER & FILM COMPANY

Manufacturing Corporation

ORDER

To: Beaver Valley Power Station
Unit 01
Duquesne Light
B59-10A Order No. BV-227

01076
Certification:

This is to certify that the cable shipped on this order has been manufactured in accordance with the requirements of S&W Specification BVS-356 and Purchase Order No. BV-227.



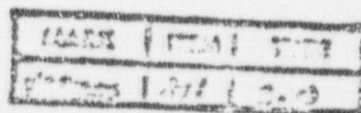
Certified by

THE KERITE COMPANY

Handwritten signature
HOWARD E. HICKMAN
QUALITY ASSURANCE MANAGER

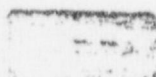
RECEIVED

SHOWN TO AND SUBSCRIBED TO BEFORE ME THIS 17 DAY OF DECEMBER, 1975

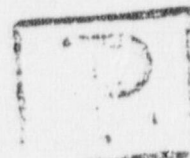


Handwritten signature

By *Handwritten signature*
Date: 12/21/75



100% C.O.





THE BELL COMPANY

November 25, 1970

Stone & Webster Engineering Corporation
P.O. Box 11225
Boston, Massachusetts 02107

Re: Beaver Valley Power Station
Unit #1

Gentlemen:

The Kerite cable listed below was tested and inspected with the following results and was found to conform to the order. These cables are custom designed and manufactured specifically in accordance with our understanding of the service intended and installation methods that will be used.

Order No. BV-227
Item No. 13 NFB-55 (Change #7)
Job No. 11700

Factory Order: B-59
Factory Item: 18A
Beaver Valley Unit #1
Duquesne Light Company

#1/0 AWG Strand 5KV 125 Mills HT Kerite and 95 Mills HT, NS Jacket.

PRELIMINARY TEST

The tests are made after the insulated conductors are immersed in water continuously for at least twenty four (24) hours.

Insulation resistance exceeds our guaranteed value of 4690 megohm/1000 feet at 60°F.

Voltage test 60 cycle AC, five (5) minutes	14.5 KV
Voltage test DC, five (5) minutes	43.5 KV



INTERMEDIATE VOLTAGE TEST

The tests are made after the jacketed conductors are immersed in water for at least sixteen (16) hours.

Voltage test 60 cycle AC, five (5) minutes	20.0 KV
Voltage test DC, five (5) minutes	60.0 KV

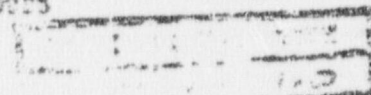
FINAL INSPECTION

Reel No.	SN No.	Length in feet
G-2819	#1	4019
G-2820	#2	4015
G-2821	#3	4051

Continuity Resistance at 65°F	
Max.	Min.
ohms/1000 ft	

.0057
.0093
.0025

12,000
A MEMBER OF THE BELL COMPANY



(12-10-70)

November 23, 1975

100-11A NTP-15 (Class 50)

Pool No.	Test No.	Conductor	Insulation		Jacket Thickness		Outside Dia.	
		O.D.	Min.	Max.	Min.	Max.	Min.	Jacket
C-2819	C0757	.363	.129	.140	.105	.119	.860	.880
C-2820	C0755	.363	.133	.145	.104	.123	.860	.870
C-2821	C0756	.363	.131	.141	.105	.125	.860	.850

50910



Certified by

THE MERITE COMPANY

Howard E. McGraw
 HOWARD E. MCGRAW
 QUALITY ASSURANCE MANAGER

HEWLETT

KNOWN TO AND SUBSCRIBED TO BEFORE ME THIS 24 DAY OF NOVEMBER, 1975

MARK	ITEM	TYPE
VER	13	1-0



Gene Hill FOR THE PUBLIC
 By Commission
 Expires March 31, 1979

PLURAL a subsidiary of HAWLEY HARRIS INCORPORATED

February 23, 1972

Summary Report - Tests at Kerite Plant on 2-2-72

By the time Mr. N. Giannattasio (S&W) and myself arrived at the Kerite Cable Plant in Seymour, Conn. on the morning of February 2, 1972, the scheduled voltage tests had been performed. Mr. G. Volpe, the S&W Q.A. Inspector, told us that we would be detained by the bad weather and had told Kerite to proceed with the testing. Mr. Volpe felt we could accept his word that the test was properly performed.

I stated that I personally wanted to witness the tests. Mr. McGrane, the Q.A. Manager for Kerite, was most accommodating and said that they would run what ever tests I desired.

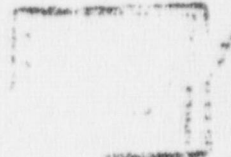
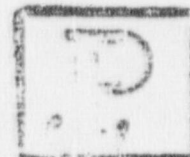
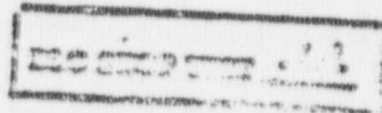
The cable reels had been immersed for approximately 24 hours prior to the test. The 500 MCM cables successfully passed a 66 KV P.C. withstand for 5 minutes and a 22 KV, 60 hertz, withstand for 5 minutes. The #1/0 cables successfully passed a 60 KV D.C. withstand for 5 minutes and a 20 KV, 60 hertz, withstand for 5 minutes.

The manufacturer has a good system for documentation of all the tests that are performed on the individual conductors and on the over-all cable assembly.

Their documentation provided for complete traceability of the individual cable manufacture and test. Mr. McGrane provided a copy of their Q.A. test procedure for our review.

The manufacturer had the latest copy of the specification as issued by S&W. Kerite has stated that they do not subscribe to the standards of IPCTA, IEEE, ASTM, or IEC. Also, Kerite had taken an exception in their bid to non-hydrocarbon fillers (see 8). These items are covered in letters but not in the final specification which is the document that the Q.A. Inspector uses for his checking.

DATE
1/13
TIME
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1/1



... a high voltage ...
... the ...
... voltage ...
... of ...
... minutes to ...

H. A. Val Mason
H. A. Val Mason

GA-7-2002

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