

**LISTING REPORT
INTERTEK TESTING SERVICES NA INC.**

3933 U.S. Rt. 11

CORTLAND, NY 13045

Job No. J97007096

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Issued: 05/25/97

Revised: 09/12/03

REPORT NO. J97007096-001

INSPECTION, TESTS AND EVALUATION
OF MARINE SHIPBOARD CABLE

RENDERED TO
GENERAL CABLE
WILLIMANTIC, CT

GENERAL: This Report gives the results of the inspection, tests and evaluation of Marine Shipboard Cable for compliance with applicable requirements of the Standard for Electrical Installations on Ships, IEEE Std. 45, September 16, 1998 & Recommended Practice for Marine Cable for Use on Shipboard and Fixed or Floating Marine Platforms, IEEE 1580, June 14, 2001. Mr. Ed Aberbach authorized this investigation. The investigation was begun on 04/23/97 and completed on 05/25/97. Production-line samples, described below, in good condition was provided by the client and tested at ITS's Cortland, NY, facility.

Samples:

- Power and Distribution Cables:
3C#6, Type P, Unarmored; Armored; Armored and Sheathed
- Control Cables:
7C #14, Type P, Unarmored; Armored; Armored and Sheathed
- Signal Cables:
7P #18, Type P, Unarmored; Armored; Armored and Sheathed

Applicant: General Cable
1600 West Main Street
Willimantic, CT 06226

Contact: Mr. Ed Aberbach, phone: 860-456-8000

Manufacturer: Same as Applicant

Contact: Same as Applicant

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BICC General

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Issued: 05/25/97
Revised: 08/22/00

The following changes have been made to this Report:

Date	Order #	Approval	Page	Item	Description
08/22/00	N/A	C. Barlow	ALL	ALL	Report converted to new format and updated to show latest IEEE 45 revision.
09/12/03	3048320	C. Barlow	1 & 5	Standard	Added reference to IEEE 1580.
09/12/03	3048320	C. Barlow	4	Tests	Added statement that testing meets the requirements of IEEE 1580
09/12/03	3048320	C. Barlow	7	Markings	Added "IEEE 1580-2001"

Signatures not required until revisions are performed.

Revised By:



Chuck Barlow
Associate Engineer

Approved by:



Jim Anastasi
Engineering Reviewer

PRODUCT DESCRIPTION

PRODUCT COVERED:

The product covered by this report is Marine Shipboard Cable:
600 and 2000 Volt Single Conductor Distribution Polyrad XT.
600 and 2000 Volt Multiconductor Distribution Polyrad XT.
600 Volt Multiconductor Control Polyrad XT.
600 Volt Shielded Signal Polyrad XT.

PRODUCT DESCRIPTION:

The following is a list of cables covered by this listing report. The jacket material is type "CP" Thermosetting Chlorosulfonated Polyethylene. The insulation material is type "P" Polyolefin. All cables are constructed of the same jacket and insulation materials. The cables are rated at 100⁰C (212⁰F) in accordance with the standard.

Power and Distribution Cables:

600 and 2000 Volt Single Conductor Distribution Polyrad XT Type P Marine Shipboard Cable
An optional bronze basket weave armor or an armor and overall sheath may be included.
Construction and Assembly is in accordance with sections 8-15 through 8-33 of IEEE Std 45-1998 and BICC Brand-Rex, Co. Product Standard (BR-781).

600 and 2000 Volt Multiconductor Distribution Polyrad XT Type P Marine Shipboard Cable
An optional bronze basket weave armor or an armor and overall sheath may be included.
Construction and Assembly is in accordance with sections 8-15 through 8-33 of IEEE Std 45-1998 and BICC Brand-Rex, Co. Product Standard (BR-782).

Control Cables:

600 Volt Multiconductor Distribution Polyrad XT Type P Marine Shipboard Cable
An optional bronze basket weave armor or an armor and overall sheath may be included.
Construction and Assembly is in accordance with the standard and BICC Brand-Rex, Co. Product Standard (BR-782).

Signal Cables:

600 Volt Shielded Signal Polyrad XT Type P Marine Shipboard Cable
An optional bronze basket weave armor or an armor and overall sheath may be included.
Construction and Assembly is in accordance with the standard and BICC Brand-Rex, Co. Product Standard (BR-782).

TEST PERFORMANCE

Representative samples of the product was tested in accordance with the Standard, Institute of Electrical and Electronics Engineers (IEEE) Std 45, 1998, Recommended Practice For Electric Installations On Shipboard. See Appendix A for Summary of Test Results.

The following tests were performed for this listing evaluation:

<u>Test</u>	<u>Section</u>
<u>Tests conducted on the finished cable</u>	
Dimensional Tolerance	8.12
High Voltage	8.13.1
Conductor Resistance	8.13.2
Insulation Resistance	8.13.3
Flammability	8.13.4
Ease of Stripping	8.13.5
Salt Water Immersion	8.13.6
Oil Immersion	8.13.7
Pull-Through Metal Plates	8.13.8
Bending Endurance	8.13.9
<u>Tests conducted on the insulation material</u>	
Insulation Resistance	Table 8-5
Accelerated Water Absorption (Electrical Method)	Table 8-5
Accelerated Water Absorption (Gravimetric Method)	Table 8-5
Physical Requirements (Unaged and Air Oven Aged)	Table 8-5
Heat Distortion	Table 8-5
Cold Bend	Table 8-5
Cold Impact	Table 8-5
Ozone	Table 8-5
Tension Set	Table 8-5
Corrosivity	Table 8-5
Hot Oil Resistance	Table 8-5
Hot Creep Test	Table 8-5
Flammability (VW-1)	Table 8-5
<u>Tests conducted on the jacket material</u>	
Physical Requirements (Unaged, Air Oven Aged, and Oil Aged)	Table 8-9
Heat Distortion	Table 8-9
Heat Shock	Table 8-9
Cold Bend	Table 8-9
Cold Impact	Table 8-9
Mechanical Water Absorption	Table 8-9
Weatherometer Test	Table 8-9
Tear Test	Table 8-9

Results of the tests indicate the specimens conform to applicable test criteria.

These cables also meet the applicable requirements of IEEE 1580

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CONCLUSION

A representative sample of the product covered by this report has been evaluated and found to comply with the applicable requirements of the standard, Institute of Electrical and Electronics Engineers (IEEE) 45, September 16, 1998, Recommended Practice for Electric Installations On Shipboard. The cables also meet the requirements of IEEE 1580, June 14, 2001, Recommended Practice for Marine Cable for Use on Shipboard and Fixed or Floating Marine Platforms.

In Charge of Testing:



Chuck Barlow
Associate engineer

Report Approved by:

Signature on File

Brian Ensign
Engineering Reviewer

GENERAL INFORMATION

The Applicant and Manufacturer have agreed to produce, test and label ETL Listed products in accordance with the requirements of this Report. The Manufacturer has also agreed to notify ITS and to request authorization prior to using alternate parts, components or materials.

COMPONENTS:

Components used shall be those listed in the ITS report covering the products specified in the index including any amendments and/or revisions.

LISTING MARK:

The ETL listing mark applied to the products shall either be separable in form, such as labels purchased from ITS, or on a product nameplate or other media only as specifically authorized by ITS. Use of the listing mark is subject to the control of ITS.

MANUFACTURING AND PRODUCTION TESTS:

Manufacturing and Production Tests shall be performed as required in this Report.

FOLLOW-UP SERVICE:

Periodic unannounced audits of the manufacturing facility shall be scheduled by ITS. An audit report shall be issued after each visit. Special attention will be given to the following:

1. Conformance of the manufactured product to the descriptions in this Report.
2. Conformance of the use of the ETL mark with the requirements of this Report and the Listing, Labeling, and Follow-up Service Agreement.
3. In-plant quality control procedures and personnel.
4. Manufacturing changes.
5. Performance of specified Manufacturing and Production Tests.

In the event that the ITS representative identifies non-conformance(s) to any provision of this Report, the Applicant shall take one or more of the following actions:

1. Correct the non-conformance.
2. Remove the ETL Listing Mark from non-conforming product.
3. Contact the issuing product safety evaluation center for instructions.

GENERAL REQUIREMENTS AND DEFINITIONS

Recognized - Identifies any component, part or subassembly covered under the recognition service of an NRTL (US) or a CO (Canada) and intended for use in ETL Listed, ETL Classified, or ETL Recognized products.

Listed - Identifies any product covered under the Listing or Certification service of an NRTL (US) or a CO (Canada).

Construction Details - For specific construction details, reference should be made to the descriptions. All dimensions are approximate unless specified as exact or within a tolerance. In addition to the specific construction details described in this Report, the following general requirements also apply.

Markings - The unit is marked with the following information. *Products for end-use in Canada may be required to have markings in both French and English. It is the responsibility of the Applicant to determine any such requirement and provide bilingual markings, where applicable, in accordance with the Provincial Regulatory Authorities.*

Cable Jacket Markings: The following information is ink printed on the surface of the cables outer jacket at 24-inch maximum intervals:

1. Cable description
2. Cable manufacturer / Company name (optional is control number is printed)
3. "IEEE Std 45-1998" or "IEEE 1580-2001"
4. Cable type designation per IEEE 45
5. Conductor size
6. Voltage rating
7. "(ETLus)"
8. ETL Control Number (optional if cable manufacturer or name is printed)
9. Date of manufacture (optional)
10. Length markings (optional)

Label or Shipping Tag Markings: The following information appears on the label or shipping tag:

1. "ETL Listed"
2. "IEEE Std 45-1998" or "IEEE 1580-2001"
3. ETLus Logo
4. ETL Control Number (optional if cable manufacturer or name is printed)
5. Date of manufacture (Month and Year)
6. Conductor size
7. Number of conductors or pairs
8. Length of cable in container

Installation, Operating and Safety Instructions - Instructions for the proper installation and safe use of this product are provided by the manufacturer.

MANUFACTURING AND PRODUCTION TESTS

The manufacturer agrees to conduct the following Routine Tests (RT) on each unit as specified in Section 8.13 of IEEE Std 45-1998.

HIGH VOLTAGE:

TEST OBJECTIVE/PROCEDURE:

Each finished reel of cable shall be tested and successfully withstand for a period of five minutes the high-voltage ac test potential given in the table #1. The ac potential shall be applied between the conductors and ground for five minutes. Dielectric breakdown shall be detected by measuring the current leakage through the insulation.

Table #1
AC Test Potentials

Conductor Size AWG or Circular Mils	AC Test Potential (kV) 600 Volt Cables	AC Test Potential (kV) 0 – 2000 Volt
18 to 16	1.5	
14 to 9	3.5	5.5
8 to 2	5.5	7.0
1 to 4/0	7.0	8.0
250 000 to 525 000	8.0	9.5
525 000 and over	10.0	11.5

CONDUCTOR RESISTANCE:

TEST OBJECTIVE/PROCEDURE:

Measurements shall be made on either a sample at least 12 inches (305 mm) long or on the entire length of the completed cable. When the nominal resistance is less than 1 ohm, the measurement shall be made with a Kelvin-type bridge or a potentiometer. When the nominal resistance is greater than or equal to 1 ohm, the measurement shall be made using a Kelvin-type bridge, or a Wheatstone bridge, or a potentiometer. The measured resistance shall be corrected to 25 °C and to ohms per 1000 feet. The maximum nominal conductor resistance is given in table 2-4, page #6 in ICEA S-66-524.

Manufacturing and Production Tests (continued)

**INSULATION RESISTANCE:
TEST OBJECTIVE/PROCEDURE:**

Each reel of the finished cable shall be tested and have an insulation resistance measured between each conductor and ground, of not less than that given in table #2 below. The current is to be measured after a one-minute electrification with a continuous direct-current potential of not less than 100V nor more than 500V.

Table #2
Minimum Insulation Resistance

Conductor Size AWG or Circular Mils	Type 0 – 600 Volt
20 - 16	3000
14 - 9	1600
8 - 2	1200
1 - 4/0	800
250 – 525 000	650
525 – 1 000 000	550

Manufacturing and Production Tests (continued)

The manufacturer agrees to conduct the following Production Sample Tests (PST) as specified in Section 8.13 of IEEE Std 45-1998, at a frequency as specified in Section 6 of the applicable NEMA specification.

<u>Test</u>	<u>Section</u>
Insulation	Tables 8-3, 8-4, and 8-5
Jacket	Tables 8-9 and 8-10
Dimensional Tolerance	8.12
High Voltage	8.13.1
Flammability	8.13.4
Ease of Stripping	8.13.5

Test Equipment

All equipment used for production line testing must be calibrated annually, and the calibration must be traceable to NIST or the applicable national organization relevant to the country where the inspection is conducted.

FOLLOW-UP SERVICES TESTS

In accordance with Follow-up Services, a minimum length of 300 feet of the above referenced item shall be submitted on a frequency of one sample per year of Follow Up Service. The submitted cable sample will be subjected to one flame test in accordance with Section 8.13.4 of IEEE Std. 45-1998. Every three-(3) years, the submitted sample will also be subject to the accelerated water absorption (electrical method) test in accordance with Table 8-5 of IEEE Std. 45-1998.

If a compliance is documented, the ETL Listing services remain in place. In the event the submitted sample fails to comply with the requirements, the participant will be required to submit a letter of correction and another length of cable will be selected and tested.

If the submitted sample complies with the requirements, the ETL Listing services will remain intact. In the event another non-compliance is documented, ITS will issue documentation instructing the participant to place the production on hold. The participant will not be allowed to apply the ETL mark to continue production of the effected construction until the problem has been evaluated and corrected. An ITS inspector will then return to the manufacturing location to select two more samples for testing. Each of the samples will be from two different and consecutive production lots.

If both cable samples comply with the requirements, ITS will notify the participant and production and labeling will be allowed to continue as normal. If one sample complies with the requirements, and the other does not, ITS will contact the participant in writing and the lot from which the nonconforming sample was taken will be segregated and held in order to remove the ETL marks from the production run. The participant must also continue to evaluate the problem. If both samples do not comply with the requirements, ITS will notify the participant in writing to place the production on hold and remove the ETL marks.

The fee for the service is above and beyond the Follow-up Service fees. The fee will be based on the current price for one fire test burn at the time of sample selection. The amount of the fee will be forwarded at that time. The selected sample shall be marked by the ITS inspector as a selected test sample and submitted to Intertek Testing Services - Cortland, attention to the person who prepared this report and reference Listing Report No. J97007096-001.

CORRELATION PAGE FOR MULTIPLE LISTINGS

The following products, which are identical to those identified in the Product Description except for model number and Listee name, are authorized to bear the ETL label under provisions of the ITS Multiple Listing Program.

MULTIPLE LISTEE: None

BASIC LISTEE: General Cable
 1600 West Main Street
 Willimantic, CT 06226

MANUFACTURER: Same as Basic Listee

PRODUCT: Marine Shipboard Cable

MULTIPLE LISTEE
MODEL NUMBER
None

BASIC LISTEE
MODEL NUMBER
600 and 2000 Volt Single Conductor Distribution Polyrad XT.
600 and 2000 Volt Multiconductor Distribution Polyrad XT.
600 Volt Multiconductor Control Polyrad XT.
600 Volt Shielded Signal Polyrad XT.