

# LISTING REPORT

## INTERTEK TESTING SERVICES NA INC.

Job No. 3054228-001

3933 US Route 11

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Cortland, NY 13045

Issued: June 2, 2004  
Revised: October 22, 2004

REPORT NO. 3054228-001

INSPECTION, TESTS AND EVALUATION  
OF A  
SHIPBOARD MULTICORE CABLES FOR CONTROL CIRCUITS

RENDERED TO

DRAKA NORSK KABEL  
LOESMOEN, NORWAY

**GENERAL:** This Report gives the results of the inspection, tests and evaluation of Shipboard power cables with applicable requirements of IEC 60092-353, Second Edition, 1995-01, Electrical Installations in Ships – Part 353: Single and multicore non-radial filed power cables with extruded solid insulation for rated voltages 1 kV and 3 kV; IEC 60092-351, First Edition, 1983, Electrical Installations in Ships – Part 351: Insulating materials for shipboard power cables with Amendment 1, 1992-12 & Amendment 2, 1997-06; and IEC 60092-359, Edition 1.2, 1999-08, Electrical Installations in Ships – Part 359: Sheathing materials for shipboard power and telecommunications cables.

The investigation began on January 22, 2004 and was completed on May 18, 2004 at Intertek's Cortland, NY facility. With the exception of IEC 60331 & IEC 60332-3 Flame Tests, all testing was performed by Draka USA at their North Dighton Facility under the Supervised Applicant Testing (SAT) program.

**Applicant:** Draka Norsk Kabel  
3301 Hokksunb  
Loesmoen  
Norway

**Manufacturer:** Draka Norsk Kabel  
3301 Hokksunb  
Loesmoen  
Norway

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Draka Norsk Kabel

Intertek Testing Services NA Inc.  
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Issued: 06/02/04  
Revised: 10/22/04

<u>Report Composition:</u>	<u>Numbering</u>
Cover	1
Revisions	2
Main Report	3-12
Illustrations	N/A
Markings	7
Components Requiring Yearly Testing	N/A
Total Number of Pages	12

Note: When additional pages have been added after issuing, such as "A" or "-1" pages, they should be noted in the table above.

For example: main report 1-5, 5A, 5B, 6-10, 10-1, 11-15.

REVISION SUMMARY - The following changes have been made to this Report:

<u>Date</u>	<u>Project #</u>	<u>Project Handler</u>	<u>Page</u>	<u>Item</u>	<u>Description of Change</u>
10/22/04	N/A	C. Barlow	1 & 9	Applicant	Changed applicant to "D raka Norsk Kabel, 3301 Hokksunb, Loesmoen, Norway
10/22/04	N/A	C. Barlow	all	Header	Changed "Draka USA" to "Draka Norsk Kabel"

**PRODUCT DESCRIPTION**

**PRODUCT COVERED**

Shipboard power cables

**PRODUCT DESCRIPTION**

0.6/1 kV 1 to 37 conductor, with and without circuit integrity.

**MODEL SIMILARITY**

None

**ELECTRICAL RATINGS**

<u>Product</u>	<u>Voltage</u>
Shipboard multicore cables for control circuits	0.6/1 kV

### TEST PERFORMANCE

A representative sample of the product was tested in accordance with the following Standards:

IEC 60092-353, Second Edition, 1995-01, Electrical Installations in Ships – Part 353: Single and multicore non-radial power cables with extruded solid insulation for rated voltages 1 kV and 3 kV.

IEC 60092-351, First Edition, 1983, Electrical Installations in Ships – Part 351: Insulating materials for shipboard power cables with Amendment 1, 1992-12 & Amendment 2, 1997-06.

IEC 60092-359, Edition 1.2, 1999-08, Electrical Installations in Ships – Part 359: Sheathing materials for shipboard power and telecommunications cables.

The following tests were performed:

<u>Test Description</u>	<u>Standard</u>
<u>Tests performed on Type EPR insulation</u>	
Insulation Resistance Constant at room temperature	IEC 60092-351, Table 2
Insulation Resistance Constant at 90°C	IEC 60092-351, Table 2
Increase in AC Capacitance	IEC 60092-351, Table 2
Mechanical Characteristics without aging	IEC 60092-351, Table 3
Mechanical Characteristics after aging in air oven	IEC 60092-351, Table 3
Mechanical Characteristics after aging in air bomb	IEC 60092-351, Table 3
Hot Set	IEC 60092-351, Table 4
Ozone Resistance	IEC 60092-351, Table 4
<u>Tests performed on Type SHF-2 jacket</u>	
Mechanical Characteristics without aging	IEC 60092-359, Table II
Mechanical Characteristics after aging in air oven	IEC 60092-359, Table II
Mechanical Characteristics after immersion in hot oil	IEC 60092-359, Table II
Hot Set	IEC 60092-359, Table II
Elongation Test	IEC 60092-359, Table II
Determination of the amount of halogen acid gas	IEC 60092-359, Table II
Ozone Resistance Test	IEC 60092-359, Table II
<u>Complete Cable Tests</u>	
High Voltage Test	IEC 60092-353, Paragraph 4.2.1 b
Electrical Resistance of Conductors	IEC 60092-353, Paragraph 4.2.1 a
Flame Retardance Test (IEC 60332-3)	IEC 60092-353, Paragraph 4.2.4 f
Insulation Resistance	IEC 60092-353, Paragraph 4.2.1 c
Fire Resistance Test (IEC 60331-21)	IEC 60331-21

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

**CONCLUSION**

A representative sample of the product covered by this report has been evaluated to and found to comply with the applicable requirements of IEC 60092-353, Second Edition, 1995-01, Electrical Installations in Ships – Part 353: Single and multicore non-radial power cables with extruded solid insulation for rated voltages 1 kV and 3 kV.

Report prepared by:



Chuck Barlow  
Associate Engineer- Cabling Products

Report reviewed/approved by:



Jim Anastasi  
Engineering Reviewer

Report revised by:



Chuck Barlow  
Associate Engineer- Cabling Products

Revision reviewed/approved by:



Jim Anastasi  
Engineering Reviewer

### GENERAL INFORMATION

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

### COMPONENTS

Components used shall be those itemized in this Intertek report covering the product, including any amendments and/or revisions.

### LISTING MARK

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

### 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 Intertek. 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 Certification 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 Intertek 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 Mark from non-conforming product.
3. Contact the issuing product safety evaluation center for instructions.

### GENERAL REQUIREMENTS AND DEFINITIONS

**Recognized Component** – A component part, which has been previously evaluated by an accredited certification body with restrictions and must be evaluated as part of the basic product considering the restrictions as specified by the Conditions of Acceptability.

**Listed Component** – A component part, which has been previously Listed or Certified by an accredited Certification Organization with no restrictions and is used in the intended application within its ratings.

**Unlisted Component** – A part that has not been previously evaluated to the appropriate designated component standard. It may also be a listed or recognized component that is being used outside of its evaluated listing or component recognition.

**Critical Component** – An essential part, material, subassembly, system, software, or accessory of a product that has a direct bearing on the product's conformance to applicable requirements of the product standard.

**Construction Details** – For specific construction details, reference should be made to the following photographs and 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 apply.

1. **Markings** – The product is marked on a component labeling system as follows (modify as required per requirements in standard):

**Cable Markings:** The following information is ink, indented or embossed printed on the surface of the cable's outer jacket at 40-inch maximum intervals.

- 1) Cable description
- 2) Cable manufacturer/company name or trade name
- 3) Conductor size ("AWG" is optional)
- 4) (ETL)us logo or "ETL Classified"
- 5) ETL Control Number
- 6) Voltage rating
- 7) Insulation Level
- 8) Date of manufacture (optional)
- 9) Length markings (optional)

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

- 1) Cable description
- 2) Cable manufacturer/company name or trade name
- 3) Conductor size ("AWG" is optional)
- 4) (ETL)us logo or "ETL Classified"
- 5) ETL Control Number
- 6) Voltage rating
- 7) Insulation Level
- 8) Date of manufacture (optional)
- 9) Length of cable in container or on reel

### **MANUFACTURING AND PRODUCTION TESTS**

The manufacturer agrees to conduct the following Manufacturing and Production Tests on each unit as specified in IEC 60092-353, Second Edition, 1995-01, Electrical Installations in Ships – Part 353: Single and multicore non-radial power cables with extruded solid insulation for rated voltages 1 kV and 3 kV.

#### **ELECTRICAL RESISTANCE OF CONDUCTORS (IEC 60092-353, Paragraph 4.2.1 a / IEC 60092-350, Paragraph 9.2):**

##### **TEST OBJECTIVE/PROCEDURE:**

The complete cable length, or sample therefrom, shall be maintained at room temperature for a period of at least 12 hours before testing. The measured value shall be corrected to a temperature of 20°C and a length of 1 km in accordance with the factors given in clause 5 of IEC 228. The d.c. resistance of each conductor at 20°C shall not exceed the appropriate maximum values specified in IEC 228.

#### **HIGH VOLTAGE (IEC 60092-353, Paragraph 4.2.1 b / IEC 60092-350, Paragraph 9.3):**

##### **TEST OBJECTIVE/PROCEDURE:**

The test is to be carried out at ambient temperature, using either alternating voltage at power frequency or direct voltage, at the manufacturers option.

The test voltage shall be applied for 5 minutes between the conductor(s) and metallic screen. The conductors may be suitably connected for successive application of the test voltage to limit the total testing time, provided that the sequence of connections ensures that the voltage is applied for at least 5 minutes without interruption between each conductor and each other conductor and between each conductor and the metallic coverings.

The test voltage shall be 1.5 kV a.c. or 3.6 kV d.c. for cables of rated voltages up to and including 0.15/0.25 kV, and 3.5 kV a.c. or 8.4 kV d.c. for cables of rated voltages up to and including 0.6/1.0 kV. The test voltage shall be increased gradually to the specified value.

The samples shall not exhibit any evidence of dielectric breakdown of the insulation.

### **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.

**CORRELATION PAGE FOR MULTIPLE LISTINGS**

**MULTIPLE LISTING**

The following products which are identical to those identified in the index except for model number and participant name are authorized to bear the ETL label under provisions of the Intertek Multiple Listing Program

**MULTIPLE LISTEE**

None

**BASIC LISTEE**

Draka Norsk Kabel  
3301 Hokksunb  
Loesmoen  
Norway

**MANUFACTURER**

Draka Norsk Kabel  
3301 Hokksunb  
Loesmoen  
Norway

**PRODUCT**

Shipboard power cables  
0.6/1 kV 1 to 37 conductor, with and without circuit integrity.

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**MULTIPLE  
LISTEE  
MODEL NO.**  
None

**BASIC LISTEE  
MODEL NO.**  
None

**BASIC  
LISTEE  
ORDER NO.**  
3054228

**Construction Detail**

**Section 1**

**Product Covered:** Shipboard power cables. Type RFOU 0.6/1kV

**Product Description:** 0.6/1 kV 1 to 37 conductor, without circuit integrity.

**Conductor:** Circular, tinned, stranded copper

**Insulation:** Thermosetting Ethylene Propylene Rubber (EPR)

- minimum average thickness: in accordance with Table 1 of IEC 60092-353
- minimum thickness at any point: not less than 0.1 mm + 10% less than that specified in Table 1 of IEC 60092-353
- the thickness of any separator on the conductor over the insulation shall not be included in the thickness of the insulation.

**Bedding:** Flame retardant halogen-free thermoset compound and PETP-tape.

**Armour:** Tinned copper wire braid covered with PETP-tape.

**Outer Sheath:** Flame retardant halogen-free thermoset compound, SHF-2.

- Thickness is in accordance with Paragraph 3.7.3 a of IEC 60092-353.

**Construction Detail (continued)**

**Section 2**

**Product Covered:** Shipboard power cables. Type BFOU 0.6/1kV

**Product Description:** 0.6/1 kV 1 to 37 conductor, with circuit integrity.

**Conductor:** Circular, tinned, stranded copper

**Insulation:** Thermosetting Ethylene Propylene Rubber (EPR)

- minimum average thickness: in accordance with Table 1 of IEC 60092-353
- minimum thickness at any point: not less than 0.1 mm + 10% less than that specified in Table 1 of IEC 60092-353
- the thickness of any separator on the conductor over the insulation shall not be included in the thickness of the insulation.

**Bedding:** Flame retardant halogen-free thermoset compound and PETP-tape.

**Armour:** Tinned copper wire braid covered with PETP-tape.

**Outer Sheath:** Flame retardant halogen-free thermoset compound, SHF-2.

- Thickness is in accordance with Paragraph 3.7.3 a of IEC 60092-353.

**FOLLOW-UP SERVICE SAMPLE(S)**

In accordance with ETL Follow-up Services, one sample of Type BFOU cable shall be submitted on a frequency of one sample per twelve (12) months of Follow-up Service. The submitted cable sample will be subjected to IEC 60331 testing.

Also one sample of Type RFOU cable shall also be submitted on a frequency of one sample per twelve (12) months of Follow-up Services. The submitted cable will be subjected to IEC 60332-3, Cat. A

The selected samples shall be marked by the ETL inspector as a selected test sample and submitted to Intertek Testing Services - Cortland, attention to the person who prepared this report and referencing Listing Report No. 3054228-001.

If 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, Intertek 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 Intertek 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, Intertek 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, Intertek 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, Intertek 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