IEEE 1580 Type P
Polyrad® XT-125 Single Conductor

Specification BR-781
Polyrad® XT-125 Flexible Marine Type P
Irradiated Cross-linked Polyolefin Single Conductor
Rated for 600/1000 Volts or 2000/1000 Volts (AC or DC)
For Use on Oil Rig-Shipboard-Apparatus

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I. Scope
This specification covers single conductor wire and cable rated at 600/1000 volts or 2000/1000 volts, AC or DC, insulated with General Cable’s Polyrad XT-125 Type P Marine insulation, a thermosetting irradiation cross-linked polyolefin which is flame retardant, moisture- and oil-resistant, and mechanically tough. Armor of aluminum or bronze and an arctic-grade overall sheath in accordance with IEEE Standard 45/IEEE Standard 1580-2010 is available at the option of the purchaser.

IEEE 1580 Type P cables should be designed, engineered and produced by cable manufacturers that have manufactured these specific cables for a minimum of 15 years. These manufacturers should be actively involved in the standards organizations that support the continued development, safety and quality of IEEE 1580 Type P cables.

II. Applicable Documents
The wire and cable manufactured under this specification shall be tested and inspected in accordance with the latest issues of the following standards, as applicable or as modified herein:

- ASTM B33: Tinned Soft or Annealed Copper Wire
- ASTM D149: Test for Dielectric Breakdown Voltage and Dielectric Strength of Electrical Insulation Materials at Commercial Power Frequencies
- CSA C22.2 No. 245/UL 1309: Marine Shipboard Cable
- IEEE Std 45: IEEE Recommended Practice for Electrical Installation on Shipboard
- IEEE Std 1580: IEEE Recommended Practice for use on Shipboard and Marine Fixed or Floating Platforms
- IEEE Std 383: Type Test of Class 1E Electrical Cable, Field Splices & Connectors for Nuclear Power Generating Stations
- IEEE Std 1202: Standard for Flame Testing of Cables for use in Cable Tray in Industrial and Commercial Occupancies
- IEC-92-3: Electrical Installations in Ships, Part 3; Cables (Construction, Testing and Installation)
- IEC 60332-2A: Tests on Electric Cables Under Fire Conditions
- UL 44: Standard for Rubber Insulated Wire & Cable
- UL (UBVZ): Shipboard Cable, Marine
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III. Conductor
Conductors shall be of soft annealed tinned copper per ASTM B33 and shall conform to requirements as listed in the Dimensional Data section of the Type P data sheets.

IV. Separator
A suitable separator may be used if deemed necessary by the manufacturer.

V. Insulation
The insulation shall be Polyrad XT-125 Type P Marine, an irradiated cross-linked polyolefin, with a minimum average thickness as listed in the Dimensional Data section of the Type P data sheets. The insulated conductor shall meet the following requirements:

A. Physical Properties

Unaged Requirement
- Tensile Strength, Min. PSI 2000 Min.
- Elongation at rupture, Min. % 250 Min.

Aged Requirements
- After air oven 7 days @ 158°C ± 2°C
  - Tensile Strength (% of original) 90 Min.
  - Elongation (% of original) 55 Min.
- After air oven 7 days @ 121°C ± 2°C
  - Tensile Strength (% of original) 90 Min.
  - Elongation (% of original) 90 Min.
- Oxygen Bomb 7 days @ 80°C @ 300 PSI
  - Tensile Strength (% of original) 90 Min.
  - Elongation (% of original) 90 Min.
- Air Bomb 42 hours @ 127°C 80 PSI
  - Tensile Strength (% of original) 90 Min.
  - Elongation (% of original) 90 Min.
- Heat Distortion, 1 hour @ 200°C
  - Clause 4.3.6.1 CSA Std. C22.2 No. 0.3 20% Max.
- Cold Bend, 120 hours @ -55°C 6 kV - 5 Min.
IEEE 1580 Type P Polyrad® XT-125 Single Conductor

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B. Electrical Properties
Dielectric Strength per ASTM D-149 > 700 V/Mil
Insulation Resistance > 5000 Megohms/M' = 20,000
Insulation Resistance K
Accelerated Water Absorption
Gravimetric 7 days @ 70°C 5 MG/in²
Electrical SIC 24 hours @ 75°C 6.0
Increase in Capacitance
1 - 14 Days 3.0
7 - 14 Days 1.5
Stability Factor after 14 Days .5

C. Qualification Testing
1. Tension Set
   Gauge marks are 4” apart. 10% Max.

2. Ozone Resistance
   After 24 hours exposure to an ozone concentration of 0.03% by volume at 90°C ± 2°C, there shall be no insulation cracks.

3. Flammability Requirements
   Insulated conductors shall pass the flame test described in ICEA S-19-81 and the VW-1 vertical flame test described in UL Subject 44.
   Insulated conductors shall also pass the flammability requirements described in IEEE Std. 45, IEEE Std. 1580, IEEE 1202 and IEC 60332-3A for flame tests.

4. Corrosion Tests
   a) Copper Mirror: (Ref. ASTM 2671) A 0.4 gram sample of insulation is placed in the bottom of a 2 inch x 12 inch test tube. A copper coated glass mirror shall be suspended 6 inches over the sample by a thin copper wire. The lower two inches of the test tube shall be heated to 175°C for 16 hours.
      Requirement: Remove less than 5% of the copper film.

   b) Acid Gas Detection: A 1.0 mg sample shall be heated to combustion in a closed quartz tube. The resulting gases are drawn through a detector tube (MSA #91636) using a special air sampling pump manufactured by Mine Safety Apparatus Company. The amount of acid gas is determined by measuring the length of the color change in the detector tube.
      Requirement: 220 PPM/MG typical.
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5. Oil Resistance
   Hot Oil Swell Tests - Insulated wires are premeasured and immersed in a hot oil bath. After the required exposure
time, they are removed and measured for the amount of swell.
   
   Requirement:
   A. IRM 902 Oil 100 hours @ 150°C Max. Max. % Swell 40
   B. Diesel Oil 100 hours @ 60°C Max. Max. % Swell 60

   Note: When tested in accordance with AAR 589 (IRM 902 oil at 121°C for 18 hours), the retention of tensile and
   elongation shall be:
   Tensile - 70% Minimum   Elongation - 90% Minimum

6. Smoke Emission
   The test shall be performed in an N.B.S. Smoke Chamber using #12 AWG wire insulated with 45 mils of Polyrad XT
   Type P Marine. The procedures are per NFPA Standard 258 in the flaming (F) and non-flaming (N) modes.

   (F) Flaming plus Radiant Furnace
   Dm  T16  T.9Dm
   485  1.20  7.15

   (N) Non-flaming Radiant Furnace
   203  10.3  25.7

   Dm = Max. Specified Optical Density
   T16 = Time to reach critical Ds (Specified Optical Density)
   T.9 Dm = Time to reach 90% of Dm

7. Abrasion Resistance
   Rotating Scrap abrader (Ref. MIL-C-915) - A 24 inch specimen is draped over an 8 inch rotating drum with two (2) 90° vee
   edge abrating tools 180° apart. Failure is detected by electrical contact between abrading tool and conductor. The cable
   is weighted with a 450 gram weight.
   
   Requirement: 2500 cycles minimum

8. Crush Resistance
   A wire sample is placed between two (2) parallel flat plates and compressed until electrical contact is detected across
   conductor to the plate.
   
   Requirement: 7500 lbs. minimum
VI. Arctic-Grade Jacket (Optional)

The optional arctic-grade jacket, when required, shall meet NEK 606 ester-based mud oil resistant requirements and be black irradiated cross-linked Chlorosulfonated Polyethylene meeting the following requirements when tested in accordance with IEEE Standard 1580-2010.

<table>
<thead>
<tr>
<th>Jacket &amp; Overall Sheath</th>
<th>Requirements Per IEEE 1580-2010 Table 16</th>
<th>General Cable Type CP Jacket</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical Properties</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Material (Arctic-Grade Chlorosulfonated Polyethylene)</td>
<td>Thermosetting Chlorosulfonated Polyethylene</td>
<td>Thermosetting Chlorosulfonated Polyethylene</td>
</tr>
<tr>
<td>Physical Requirements</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unaged:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tensile Strength, min. psi</td>
<td>1800</td>
<td>2200</td>
</tr>
<tr>
<td>Elongation at rupture, min. percent</td>
<td>300</td>
<td>350</td>
</tr>
<tr>
<td>Set, max. percent</td>
<td>30</td>
<td>12</td>
</tr>
<tr>
<td>Aging Requirements</td>
<td></td>
<td></td>
</tr>
<tr>
<td>After air oven at °C</td>
<td>121 ± 1</td>
<td>121 ± 1</td>
</tr>
<tr>
<td>Hours</td>
<td>168</td>
<td>168</td>
</tr>
<tr>
<td>Tensile Strength percent of unaged, min.</td>
<td>85</td>
<td>100</td>
</tr>
<tr>
<td>Elongation at rupture, percent of unaged, min.</td>
<td>65</td>
<td>90</td>
</tr>
<tr>
<td>After oil immersion at °C</td>
<td>121 ± 1</td>
<td>121 ± 1</td>
</tr>
<tr>
<td>Hours</td>
<td>18</td>
<td>18</td>
</tr>
<tr>
<td>Tensile Strength percent of unaged, min.</td>
<td>60</td>
<td>90</td>
</tr>
<tr>
<td>Elongation at rupture, percent of unaged, min.</td>
<td>60</td>
<td>90</td>
</tr>
<tr>
<td>Cold Bend, no cracks, °C (Note 1)</td>
<td>-40</td>
<td>-55</td>
</tr>
<tr>
<td>Cold Impact, °C (Note 1)</td>
<td>-40</td>
<td>-40</td>
</tr>
<tr>
<td>Mechanical water absorption, mg/in²</td>
<td>100</td>
<td>87</td>
</tr>
</tbody>
</table>

NOTE: (1) For test procedures refer to CSA Standard C22.2, No. 38, Clause 6.4.7. The insulation system used for this test shall be representative of the final product. Cable intended for arctic or severe cold application should be capable of passing both cold bend at -40°C and cold impact at -40°C.
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MOR™ Polyrad® XT-125, Unarmored

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VII. Cable Identification
The surface of the cable shall be printed with the following minimum information at intervals not greater than two feet.

“POLYRAD® XT-125 (UL) E85994 BR781 110C 1/C XXAWG 2000V or (CSA) 245/1309 FT4 –40C IEC 1KV 60332.3A IEEE 1580 TYPE P OR (ETL) 109229 YEAR OF MFG SEQUENTIAL FOOTAGE MARK”

VIII. Reel Markings
Each reel to be shipped shall be marked to include the following minimum information in addition to any other information specified by the purchaser:

General Cable
Polyrad XT-125 Type P Marine
Voltage Rating
Conductor Size & No. of Conductors
Footage on Reel
Month/Year of Manufacture