High Voltage Products. High Voltage Experts.

EPR X-Ray Cable

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EPR X-Ray Cable Overview

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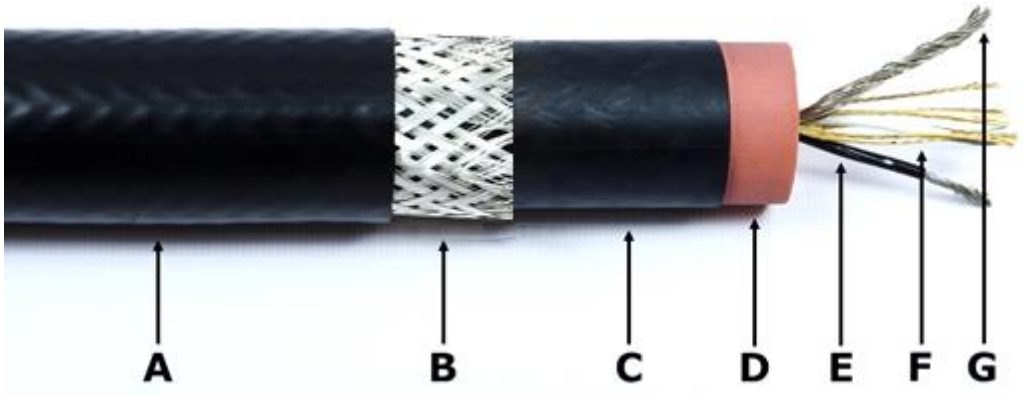
75kV$_{DC}$ – 320kV$_{DC}$ Rating
Single Core, 3 Core, 4 Core & 5 Core



A Jacket – Okoseal **B** Coated Copper Braid **C** Extruded Insulation Shield **D** Primary Insulation – Okoguard
E Extruded Semi-Conductive Layer **F** Polyester Insulation **G** Coated Stranded Copper Conductors

Product Features

- Low Noise - <10pC @ 200 Vac/mil of insulation to 42kV max
- Performance tested for long trouble free service
- Small diameter
- Flexible construction
- Excellent flexing endurance Mechanically rugged
- Resistant to most oils and chemicals
- Complies with NEMA Standard XR-7 where applicable

Installation

The minimum bend radius for permanent installation or flexing in service is four times the cable diameter.

Specifications

• **Cable Core:** Each Low Noise cable core contains two insulated filament conductor. In 65, 75 and 100kV cable filament conductors are #15 AWG (19x) [1.65mm²] tinned copper insulated with heat sealed colour coded polyester tape. In 230kV cables, the filament wires are #16 AWG (19x) [1.31mm²] tinned copper. The 320kV cable filaments are #14 AWG (19x) [2.08mm²] tinned copper. Both the 230kV and 320kV filament wires are insulated with an extrusion of ETFE. Four conductor cables include one #20 AWG (7x) [0.52mm²] copper weld conductor per ASTM B-45 insulated with heat sealed polyester and shielded with metalized red polyester. The tinned copper uninsulated conductor in 3/C 75, 125 and 230kV cables is segmented into two #18 AWG [0.83mm²] flex standard wires. The 4/C uninsulated conductor is segmented into three #18 AWG wires. A single #12 AWG (19x) wire is used in the 320kV cable.

• **Core Shield:** An extruded layer of semi-conducting compound encapsulates the composite core assembly.

• **High Voltage Insulation** Premium EPR (ethylene-propylene rubber) insulation. This o-zone resistant high voltage dielectric is extruded in tandem with the semiconducting layers which ensures an intimate and contaminate free interface between the layers.

• **Insulation Shield** A strippable extruded layer of semi-conducting EPR compound is applied directly over the insulation.

•**Shield** A braid of tinned copper wires is applied directly over the insulation shield. Minimum coverage as indicated in datasheet.

• **Jacket** A flexible Okoseal (specially compounded PVC) jacket is extruded over the shield to provide additional mechanical strength and resistance to most oils and chemicals.

Voltage The recommended maximum AC or DC voltage that may be continuously applied to a wire in conformance with its specifications. Some cables have been tested for operation above their rated voltage for a limited time period. For pulsed operation or insulating dielectric environments please contact us.

Impedance (OHMS) The average characteristic or surge impedance of a coaxial cable is determined by the ratio of the outer diameter of the inner conductor and by the dielectric constant of the insulating material between the conductors.

Capacitance The measurement of picofarads per metre, of the ability of a dielectric material to store electrical energy. Capacitance values for unshielded cables assume a uniform conductive surrounding.

Conductor Size AWG American Wire Gauge. The standard for copper wire sizes, specifying the diameter. The smaller the AWG number the larger the wire diameter.

Strands The first number signifies the number of wires in the conductor. The second number signifies the gauge size of the strand.
The letters following represent the type of plating on the copper conductor. **TC** – Tin Plated Copper, **SPC** – Silver Plated Copper, **NPC** – Nickel Plated Copper, **BC** – Bare Copper
Square mm: The metric measurement of copper in the conductor.

Diameter The outside diameter of the conductor in mm.

Semicon A semi-conducting material that has a resistance characteristic between that of insulators and conductors. When bonded between two elements of a cable, the adjacent surfaces of the two elements will maintain equal potential, providing uniform voltage stress, thus reducing internal corona. Semicon is used for both the inner conductor shielding and between the dielectric insulation and metallic shield.

Dielectric A non-conducting, insulating material with a dielectric constant, which is the ratio of capacitance of the material to the capacitance of air.

Material Specifies the type of compound used
EPR: Ethylene propylene diene monomer rubber
EPDM: Ethylene propylene diene monomer rubber
Hypalon: Chlorosulfonated polyethylene
LD: Low density
PVC: Polyvinyl chloride
PE: Polyethylene
TPR: Thermoplastic rubber

Diameter Outside dimension over dielectric in mm

Rated Voltage The maximum DC voltage that can be applied between the centre conductor and inner shield.

Inner Shield A conducting layer or sheath of material applied around an insulated conductor or conductors to prevent extraneous electrostatic fields between the enclosed conductors and the external environment. Typical shields are constructed of a copper braid, metal tapes or conductive rubbers. Shields can also be used to provide return current paths.

Inner Shield A conducting layer or sheath of material applied around an insulated conductor or conductors to prevent extraneous electrostatic fields between the enclosed conductors and the external environment. Typical shields are constructed of a copper braid, metal tapes or conductive rubbers. Shields can also be used to provide return current paths.

Construction The AWG size of the individual strand in the braid with designation of plating on the strand.

AWG Equivalent The conductor size equivalent of the braid wires.

% Coverage The physical area of the cable covered by the shielding.

Intershield Insulation Specifies the type and thickness of non-conductive insulating material between the two shields.

Rated Voltage The maximum DC voltage that can be applied between the inner and outer shields.

Outer Shield The outer shield provides additional electrostatic shielding for low noise applications.

Jacket Material An outer sheath or protective covering over a conductor or insulation mainly used for protection against the environment, but may also be used to provide additional insulation.

Outside Diameter The measurement in mm's of the finished cable.

Minimum Bend Radius The measurement of the flexibility of the finished cable determined by the strands in the conductor and the material used in the dielectric and jacket.

Part Number The four digit part number characterises the basic core of the cable and can be followed by a suffix indicating the insulation jacket material or type of construction.

Minimum Ambient Temperature The measurement in degrees Celsius of the safe environmental operating temperature of the finished cable determined by the size and types of material in the cable.

Maximum Conductor Temperature The maximum operating temperature in degrees Celsius of the finished cable, determined by the size and types of material in the cable.

Weight The weight in kilograms per metre of the finished cable**.**

Standard EPR X-Ray Cable Data

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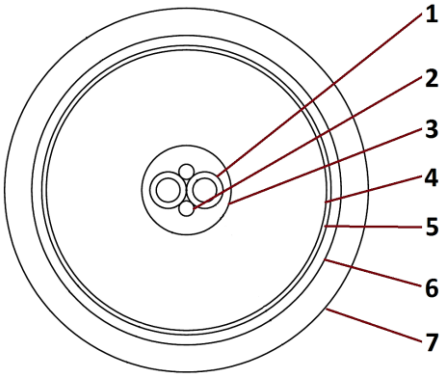
Rated Voltage		Part Number	Jacket Material	Outside Diameter (mm)	Impedance (Ω)	Capacitance (pf/m)	Min. Bend Radius (mm)	Min. Ambient Temp (°C)	Max Conductor Temp. (°C)	Weight (kg/m)
DC	AC									
75	25	C2214	PVC	16.5	46	154	76	-51	121	0.37
75	25	C2226	PVC	16.8	37	197	76	-51	121	0.39
100	30	C2213	PVC	21.5	44	161	102	-51	121	0.57
100	30	C2171	PVC	21.5	36	167	102	-51	121	0.58
125	30	C2212	PVC	19.9	53	131	102	-51	121	0.49
150	50	C2266	PVC	26.4	47	154	140	-51	121	0.89
230	75	C2042	PVC	31.1	48	115	165	-51	121	1.07
320	100	C2236	PVC	38.2	61	102	191	-51	121	1.64
320	115	C2338	PVC	38.2	61	102	191	-51	121	1.64

C2214

75kV 3 Core EPR Type P



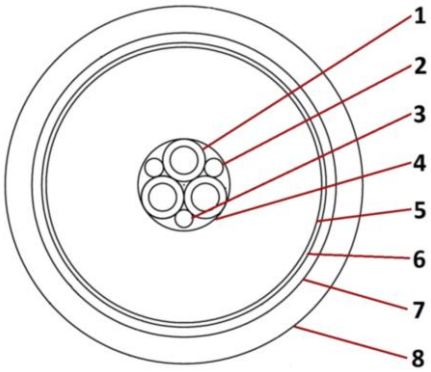
1. Conductor	2x #15AWG (19x0.3mm) Tin Plated Copper with Fusable Tape (One Black, One Yellow)	
2. Conductor	2x #18AWG (19x0.2mm) Tin Plated Copper Uninsulated	
3. Semi-con	EPR	Ø 4.8mm 0.51mm Min. Wall
4. Dielectric	Insulating EPR	Ø 13.0mm ± 0.25mm
5. Semi-con	EPR	Ø 14.1mm ± 0.25mm
6. Braided Shield	#34AWG Tin Plated Copper, 11 Ends, 24 Carrier (Coverage ≥ 95%)	Ø 14.7mm ± 0.25mm
7. Jacket	PVC (Grey)	Ø 16.5mm ± 0.38mm

TECHNICAL DATA

Operating Voltage	75kVDC/25kVAC
Impedance	46Ω
Capacitance	154pF/m
Corona Inspection Voltage	42kVrms @ 10PC
Minimum Bend Radius	76mm
Minimum Ambient Temperature	-51°c
Maximum Conductor Temperature	121°c
Weight	0.37kg/m

C2226

75kV 4 Core EPR



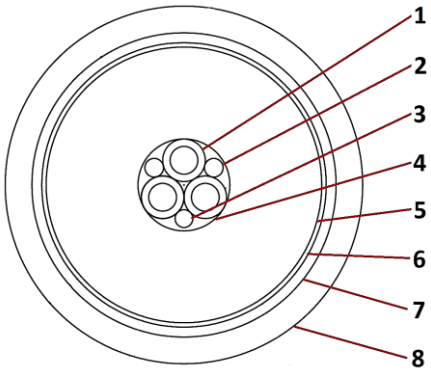
1. Conductor	3x #18AWG (19x0.2mm) Tin Plated Copper Uninsulated	
2. Conductor	2x #15AWG (19x0.2mm) Tin Plated Copper with 0.15mm Fusable Tape	
3. Conductor	1x #16AWG (19x0.3mm) Tin Plated Copper with 0.45mm Tefzell	
4. Semi-con	EPR	Ø 5.8mm 0.25mm Min. Wall
5. Dielectric	Insulating EPR	Ø 13.2mm ± 0.25mm
6. Semi-con	EPR	Ø 14.4mm ± 0.25mm
7. Braided Shield	0.16mm Tin Plated Copper Braid (Coverage ≥ 95%)	Ø 15.0mm ± 0.25mm
8. Jacket	PVC (Grey)	Ø 16.8mm ± 0.38mm

TECHNICAL DATA

Operating Voltage	75kV$_{DC}$/25kV$_{AC}$
Impedance	37Ω
Capacitance	197pF/m
Minimum Bend Radius	76mm
Minimum Ambient Temperature	-51°C
Maximum Conductor Temperature	121°C
Weight	0.39kg/m

C2213

100kV 4 Core EPR



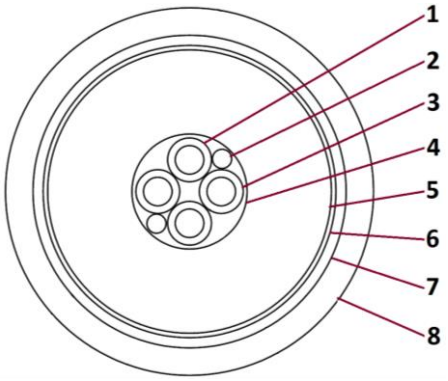
1. Conductor	3x #18AWG (19x0.2mm) Tin Plated Copper Uninsulated	
2. Conductor	2x #15AWG (19x0.3mm) Tin Plated Copper with 0.15mm Fusable Polyester Tape	
3. Conductor	1x #20AWG (7x0.3mm) Copper Weld with 0.61mm Fusable Mylar Metallised Mylar Tape	
4. Semi-con	EPR	Ø 6.1mm 0.25mm Min. Wall
5. Dielectric	Insulating EPR	Ø 16.8mm ± 0.25mm
6. Semi-con	EPR	Ø 17.9mm ± 0.25mm
7. Braided Shield	0.2mm Tin Plated Copper Braid (Coverage ≥ 80%)	Ø 18.7mm ± 0.25mm
8. Jacket	PVC (Grey)	Ø 21.5mm ± 0.38mm

TECHNICAL DATA

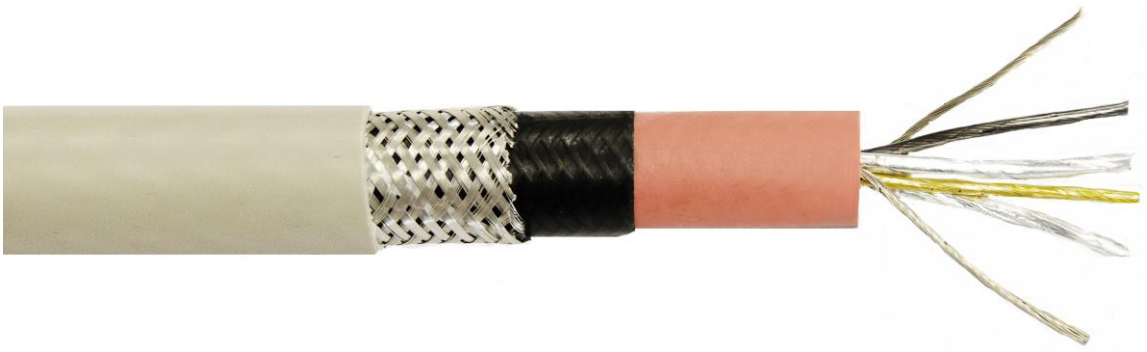
Operating Voltage	100kVDC/30kVAC
Impedance	44Ω
Capacitance	161pF/m
Minimum Bend Radius	102mm
Minimum Ambient Temperature	-51°C
Maximum Conductor Temperature	121°C
Weight	0.57kg/m

C2171

100kV 5 Core EPR



1. Conductor	2x #15AWG (19x0.3mm) Tin Plated Copper with 0.15mm Fusable Polyester Tape	
2. Conductor	2x #18AWG (19x0.2mm) Tin Plated Copper Unisulated	
3. Conductor	2x #20AWG (7x0.3mm) Copper Weld with 0.6mm Fusable Mylar 0.05mm Metallised Mylar Tape	
4. Semi-con	EPR	Ø 6.6mm 0.25mm Min. Wall
5. Dielectric	Insulating EPR	Ø 16.7mm ± 0.25mm
6. Semi-con	EPR	Ø 17.9mm ± 0.25mm
7. Braided Shield	0.16mm Tin Plated Copper (Coverage ≥ 80%)	Ø 18.7mm ± 0.25mm
8. Jacket	PVC (Grey)	Ø 21.5mm ± 0.38mm

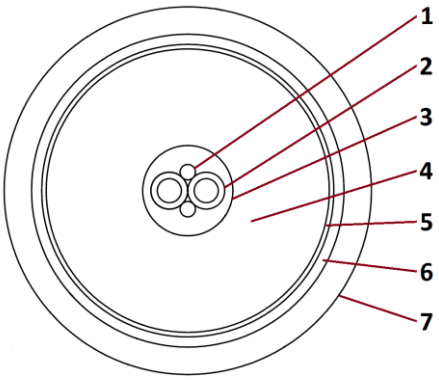


TECHNICAL DATA

Operating Voltage	100kVDC/30kVAC
Impedance	36Ω
Capacitance	167pF/m
Minimum Bend Radius	102mm
Minimum Ambient Temperature	-51°C
Maximum Conductor Temperature	121°C
Weight	0.58kg/m

C2212

125kV 3 Core EPR Type S



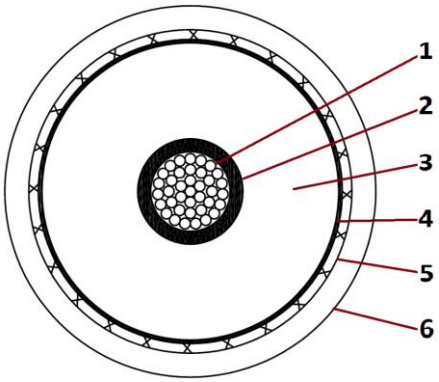
1. Conductor	2x AWG18 (19x0.2mm, Tin Plated Copper) Uninsulated	
2. Conductor	2x AWG15, (19x3.3mm, Tin Plated Copper), Polyester Tape Insulation, Rated Voltage = 1kVDC	
3. Semi-con	EPR (Black)	Ø 4.8mm 0.25mm Min. Wall
4. Dielectric	Insulating EPR	Ø 15.7mm ± 0.25mm
5. Semi-con	EPR (Black)	Ø 16.9mm ± 0.25mm
6. Braided Shield	Tin Plated Copper (Coverage ≥ 80%)	Ø 17.5mm ± 0.25mm
7. Jacket	PVC (Grey)	Ø 19.9mm ± 0.38mm

TECHNICAL DATA

Operating Voltage	125kVDC/30kVAC
Impedance	53Ω
Capacitance	131pF/m
Minimum Bend Radius	102mm
Minimum Ambient Temperature	-51°C
Maximum Conductor Temperature	121°C
Weight	0.49kg/m

C2243

125kV Single Core EPR



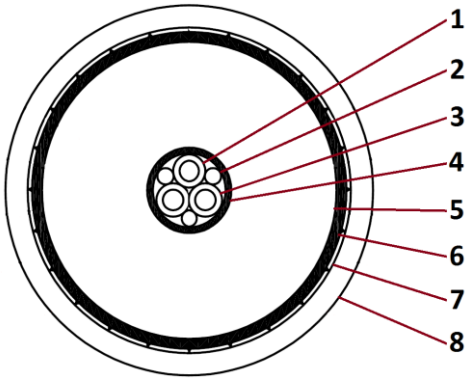
1. Conductor	#8AWG (49x) Tin Plated Copper	
2. Semi-con	EPR	Ø 5.6mm 0.51mm Min. Wall
3. Dielectric	Insulating EPR	Ø 15.8mm ± 0.25mm
4. Semi-con	Semi-Conductive Tape	Ø 16.1mm ± 0.25mm
5. Braided Shield	Shield 0.25mm Tin Plated Copper 7 Ends, 24 Carrier (Coverage ≥ 90%)	Ø 17.1mm ± 0.25mm
6. Jacket	PVC (Black) 1.27mm Wall	Ø 19.7mm ± 0.38mm

TECHNICAL DATA

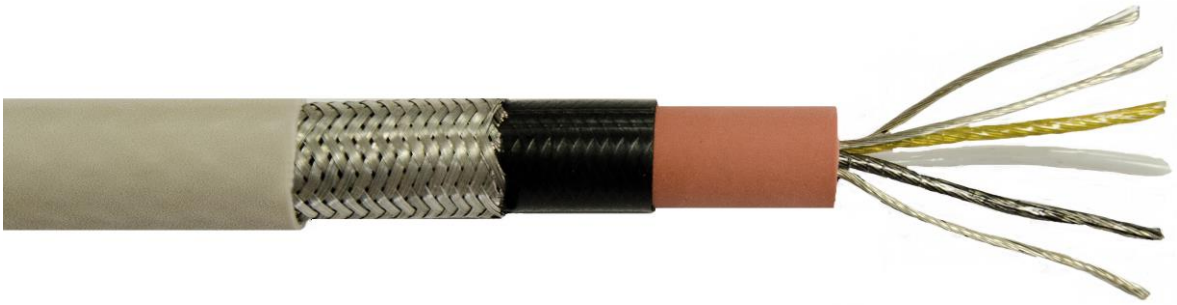
Operating Voltage	125kV$_{DC}$/45kV$_{AC}$
Impedance	40Ω
Capacitance	167pF/m
Minimum Bend Radius	127mm
Minimum Ambient Temperature	-51°C
Maximum Conductor Temperature	121°C
Weight	0.67kg/m

C2266

150kV 4 Core EPR



1. Conductor	2x #15AWG (19x0.3mm) Tin Plated Copper with 0.15m Thick Fusable Polyester Tape	
2. Conductor	3x #18AWG (19x0.23mm) Tin Plated Copper Uninsulated	
3. Conductor	1x #16AWG (19x0.3mm) Tin Plated Copper with 0.45mm Wall Tefzel	
4. Semi-con	EPR	Ø 6.09mm 0.25mm Min. Wall
5. Dielectric	Insulating EPR	Ø 21.2mm ± 0.38mm
6. Semi-con	EPR	Ø 22.6mm ± 0.38mm
7. Braided Shield	Tin Plated Copper (Coverage ≥ 90%)	Ø 23.2mm ± 0.38mm
8. Jacket	PVC (Grey)	Ø 26.4mm ± 0.63mm

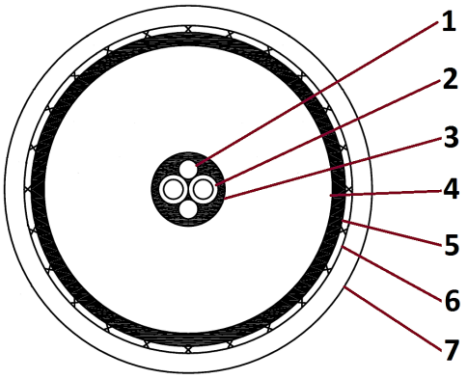


TECHNICAL DATA

Operating Voltage	150kVDC/50kVAC
Impedance	47Ω
Capacitance	154pF/m
Minimum Bend Radius	140mm
Minimum Ambient Temperature	-51°C
Maximum Conductor Temperature	121°C
Weight	0.89kg/m

C2042

230kV 3 Core EPR Type U



1. Conductor	2x #18AWG (19x0.2mm Tin Plated Copper) Uninsulated	
2. Conductor	2x #16AWG (19x3.3mm Tin Plated Copper), 0.5mm Tefzel Insulation (One Black, One White), Rated Voltage = 5kVDC	
3. Semi-con	Semi-Conductive EPR (Black)	Ø 6.1mm 0.25mm Min. Wall
4. Dielectric	EPR	Ø 24.9mm ± 0.51mm
5. Semi-con	Semi-Conductive EPR	Ø 26.2mm ± 0.51mm
6. Braided Shield	Tin Plated Copper (Coverage ≥ 80%)	Ø 26.8mm ± 0.51mm
7. Jacket	PVC (Black)	Ø 31.1mm ± 0.64mm

TECHNICAL DATA

Operating Voltage	230kVDC/75kVAC
Impedance	59Ω
Capacitance	115pF/m
Minimum Bend Radius	152mm
Minimum Ambient Temperature	-51°C
Maximum Conductor Temperature	121°C
Weight	1.07kg/m
Production Test Voltage	90kV RMS (60Hz) – 20 minutes
	Core Conductor to Bare Conductor 5kV RMS – 15 seconds

C2042

230kV 3 Core EPR Type U

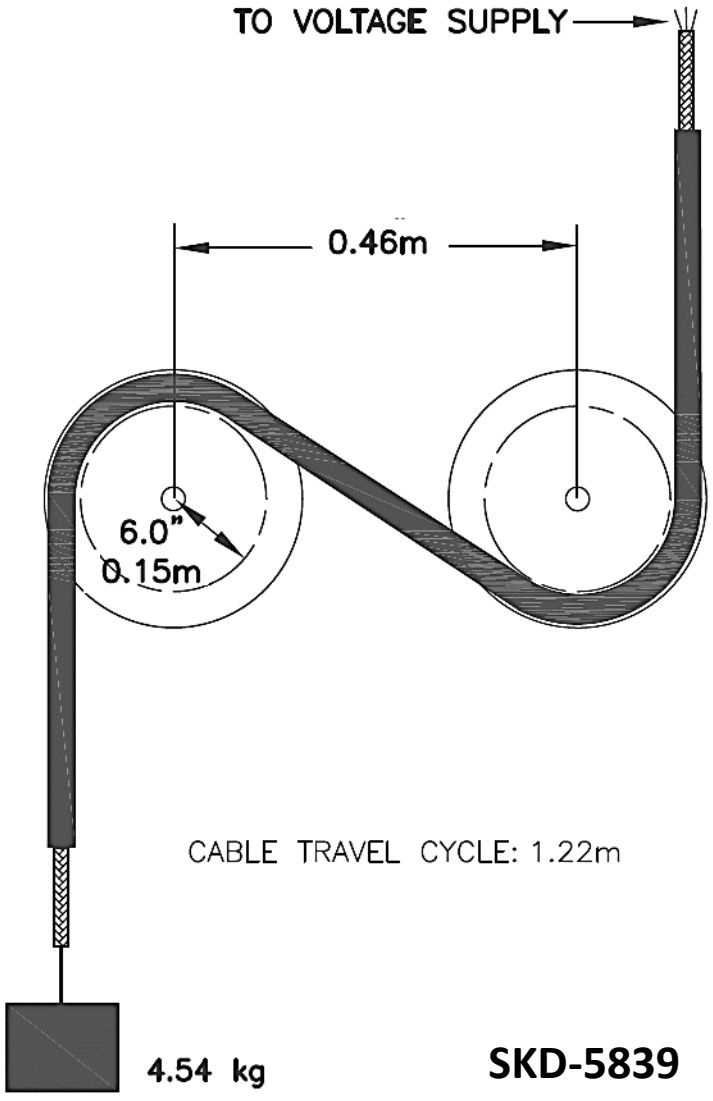
Mechanical Flex Endurance Qualification Test

PURPOSE: To determine if the X-Ray cable design can withstand repeated flexing while energised at a high ac test voltage.

REQUIREMENT: No dielectric breakdown of the insulation during the flex period.

PROCEDURE: A suitable length, nominally 15m shall be selected to properly terminate and install into the test rig. The cable shall be installed around two free turning sheaves as shown in SKD-5839. The sheaves shall be sized to be equal to or less than the recommended minimum bending radius of the cable.

A weight shown on SKD-5839 shall be applied to the lower end of the cable in order to keep the cable aligned and in place around the sheaves. An extension of the upper terminal is attached to a crank that turns approximately 8rpm, The transmitted motion provides a sinusoidal type linear velocity thru the sheave assembly.

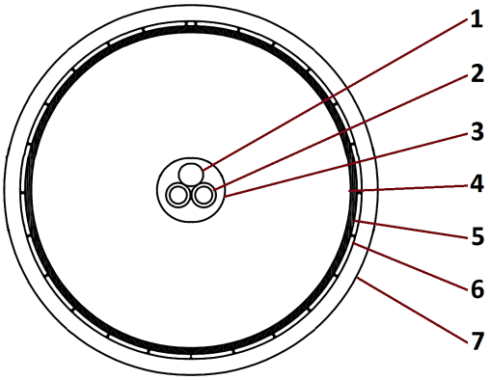


The high voltage shall be applied to the upper terminated end. For 230kV cable the test voltage shall be applied and the motor started. The test shall run for 77,800 cycles or until the cable fails, whichever occurs first. Provisions shall be provided to monitor the time. In the event of a failure, the clock shall stop so that the time to failure can be recorded. Should no failure occur during the 77,800 cycles, the best specimen shall be removed from the test apparatus and an ac step voltage withstand test to breakdown shall be performed for engineering information only. The filament conductors shall be withstand tested for one minute at 5000v, for engineering information only.

PERFORMANCE CRITERIA: The specimen shall have complied with this qualification test if no dielectric failure occurs during the 77,800 cycle flex endurance.

C2236

320kV 3 Core EPR Type L



1. Conductor	1x #12AWG (19x0.45mm) Tin Plated Copper Uninsulated	
2. Conductor	2x #14AWG (19x0.37mm) Tin Plated Copper with 0.38mm Tefzel (One Black, One White)	
3. Semi-con	EPR	Ø 6.6mm 0.25mm Min. Wall
4. Dielectric	Insulating EPR	Ø 32.5mm ± 0.51mm
5. Semi-con	EPR	Ø 33.8mm ± 0.51mm
6. Braided Shield	#34AWG Tin Plated Copper 9 Ends, 24 Carrier 80% Minimum Coverage	Ø 34.8mm ± 0.51mm
7. Jacket	PVC (Black)	Ø 38.2mm ± 0.64mm

TECHNICAL DATA

Operating Voltage	320kVDC/100kVAC
Impedance	61Ω
Capacitance	102pF/m
Minimum Bend Radius	191mm
Minimum Ambient Temperature	-51°C
Maximum Conductor Temperature	121°C
Weight	1.64kg/m

C2236

320kV 3 Core EPR Type L

Mechanical Flex Endurance Qualification Test

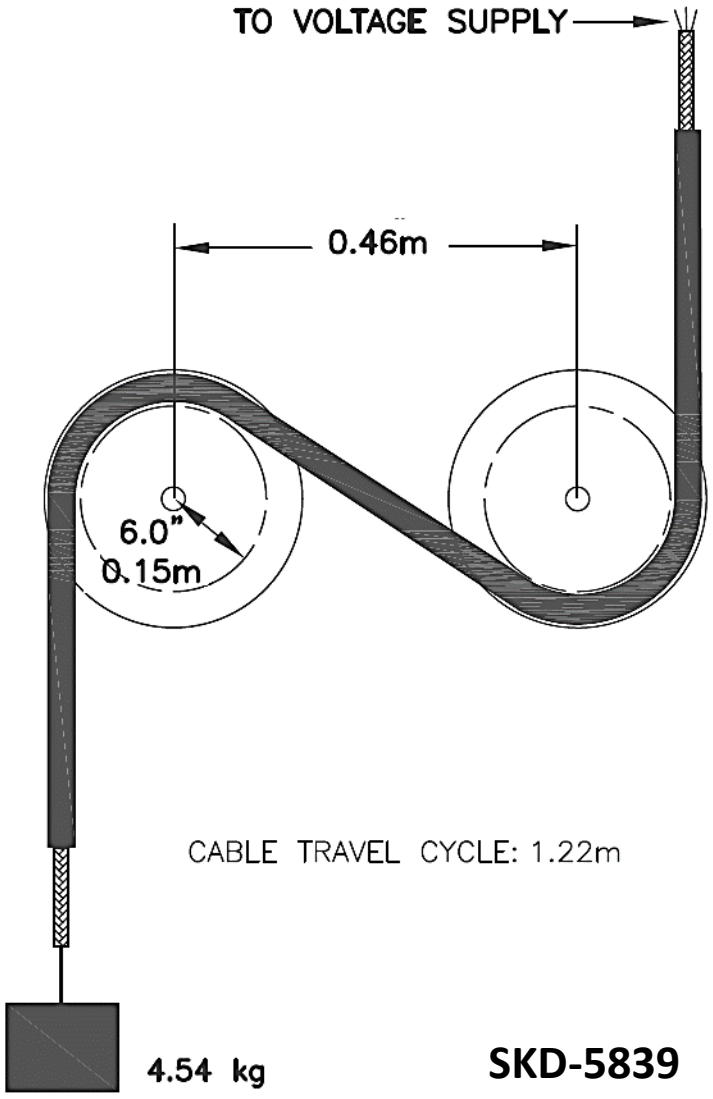
PURPOSE: To determine if the X-Ray cable design can withstand repeated flexing while energised at a high ac test voltage.

REQUIREMENT: No dielectric breakdown of the insulation during the flex period.

PROCEDURE: A suitable specimen shall be selected to properly terminate and install into the test rig. The cable shall be installed around two free turning sheaves as shown in SKD-5839. The inside diameter of each sheave is 420mm.

A weight shown on SKD-5839 shall be applied to the lower end of the cable in order to keep the cable aligned and in place around the sheaves. An extension of the upper terminal is attached to a crank that turns approximately 8rpm, The transmitted motion provides a sinusoidal type linear velocity thru the sheave assembly.

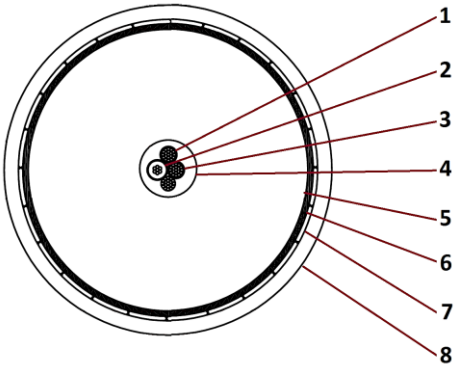
The high voltage shall be applied to the upper terminated end. For 320kV cable the normal ac test voltage shall be applied and the motor started. The test shall run for 78,000 cycles or 200 hours, whichever occurs first. Provisions shall be provided to monitor the time. In the event of a failure, the clock shall stop so that the time to failure can be recorded. The specimen is flexed at an approximate rate of 6.5 cycles per minute.



PERFORMANCE CRITERIA: The specimen shall maintain the test voltage for the entire flex duration without failure.

C2338

320kV 4 Core EPR



1. Conductor	2x #15AWG (19x0.33mm) Tin Plated Copper with 0.15mm Mylar Tape	
2. Conductor	1x #15AWG Tinned Copper Uninsulated	
3. Conductor	1x #20AWG (7x0.32mm) Copperweld with 0.61mm Fusable Mylar 0.05mm Metallised Mylar Tape	
4. Semi-con	EPR	Ø 6.6mm 0.25mm Min. Wall
5. Dielectric	Insulating EPR	Ø 32.5mm ± 0.51mm
6. Semi-con	EPR	Ø 33.8mm ± 0.51mm
7. Braided Shield	#34AWG Tin Plated Copper 9 Ends, 24 Carrier 80% Minimum Coverage	Ø 34.8mm ± 0.51mm
8. Jacket	PVC (Black)	Ø 38.2mm ± 0.64mm

TECHNICAL DATA

Operating Voltage	320kVDC/115kVAC
Impedance	61Ω
Capacitance	102pF/m
Minimum Bend Radius	191mm
Minimum Ambient Temperature	-51°C
Maximum Conductor Temperature	121°C
Weight	1.64kg/m

High Voltage Cable Enquiry Form

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CABLE SPECIFICATION	
Voltage DC or AC (Peak/RMS/Bipolar/Unipolar)	
Current (Average/Peak/RMS)	
Shielded or Unshielded	
Single-Core or Multi-Core	
Coaxial or Triaxial	
Impedance/Capacitance	
Any mechanical restrictions ie. Minimum Bend Radius	
Operating Temperature	
If Pulsed:	
Pulse Width (Length)	
Rise and Decay Times	
Repetition Rate/Duty Cycle/Frequency	
Does the current return on the shield? (Coaxial)	
APPLICATION DETAILS	
Type of application	
End user	
Total length required	
Dimensional restrictions	
How is the cable terminated?	
Any other information	

Can't find a suitable cable for your application? Essex X-Ray offer a wider range of customised HV cable solutions for scientific and industrial use. Please complete the above form and return it to info@hvproducts.de

HVP
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