

Industrial Cable Assemblies

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Industrial Cable Assembly Overview



Essex X-Ray is a world leader in the design and manufacture of Industrial Cable Assemblies, offering a complete range of High Voltage interconnect solutions for non-destructive testing, computed tomography and metrology.

Our assemblies are used throughout science and industry. Both straight and right angle terminations are available, offering an engineering solution when installing cables in areas of restricted space. Essex X-Ray are a trusted technical partner and supplier of leading Industrial X-Ray OEM's.

Essex X-Ray's Industrial Cable Assemblies are manufactured using high specification EPR X-Ray cable, renowned for its excellent high voltage characteristics. Standard cables rated from 75kVpc up to 320kVpc are available from stock. Our team designed many of the industry standard terminations used today and launched a NEW generation of springloaded connectors in 2016.

Spring-loaded connectors feature a mechanical spring built into the ferrule. The NEW design features compression rings as a visual aid for correct installation, reducing the risk of over-compression and the need for re-gapping during maintenance. Spring-loaded cable assemblies are proven to increase the service life of both the cable and tube.

Essex X-Ray also manufacture compatible receptacles, designed for X-Ray tube and HV generator sockets. A complete range of accessories and fittings are available to complete the installation, making us a one-stop shop for HV interconnection.

Please contact info@hvproducts.de for more information about our Industrial Cable Assembly range and High Voltage interconnection.



Industrial Cable Assembly Terminology



Cable Length The cable length refers to the specified length of a cable assembly. A guide to standard cable measurement can be found on page 47.

Cable Type Essex X-Ray use three main EPR X-Ray cables to manufacture Industrial Cable Assemblies; C2212 (S), C2042 (U) and C2236 (L). These cables are rated at 125kVDC, 230kVDC and 320kVDC.

Common Abbreviations

DC4 = Dow Corning 4 Installation Grease EPR = Ethylene-propylene Copolymer Rubber R/A = Right Angle SL = Spring-Loaded SS = Stainless Steel

Compression Ring Compression rings are a key feature of Essex X-Ray's NEW spring-loaded design. They provide a visual aid for compression during installation and maintenance.

Connector Type The connector type, also referred to as the plug is derived from industry standard terminology. Below is a list of historical connector types, along with their original voltage ratings for reference only;

R1 = 65kV Termination with standard Flange **R3** = 65kV Termination with extended Flange

R5/R27 = 100kV 3 Pin Termination

R10 = 100kV Philips

R12 = 160kV Philips Spring Loaded

R13 = 100kV Philips with extended Flange

R23 = 210kV Philips with Quick-Lock Flange

R24 = 160kV Euro **R28** = 225kV Philips

R30 = 210kV Seifert

Contact Tip The contact tip is a high temperature silver plated contact available in standard, wide band and solid form.

Ferrule A ferrule is the stainless steel body of a connector. Ferrules are available in both spring-loaded and solid form, with the clamping sleeve fitting onto the ferrule during installation.

Clamping Sleeve Also known as a clamping flange, the clamping sleeve is used to secure a connector in the mating socket during installation. Different types of clamping sleeve are available, including short & windowed versions compatible with our NEW spring-loaded connectors.

Part Number The standard part number format for Industrial Cable Assemblies. Is a 5-digit number preceded by the letter 'A', followed by a '/' and the meterage ie. A51001/05M. 'Dead Length' cables are denoted by the letter 'D' preceding the meterage ie. A51001/D05M.

Termination A termination is the methodology used to manufacture industrial plugs/connectors on to a length of EPR X-Ray cable.

Industrial Cable Assembly Terminology



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

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.

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.

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

Standard Industrial Cable Assembly Data



CABLE DATA

	C2212	C2042	C2236
Rated Voltage	125kVdc	230kVpc	320kVDC
Impedance	53Ω	59Ω	61Ω
Capacitance	131pF/m	115pF/m	102pF/m
Minimum Bend Radius	101mm	152mm	190mm
Minimum Ambient Temperature	-51°C	-51°C	-51°C
Maximum Conductor Temperature	121°C	121°C	121°C
Weight	0.49kg/m	1.07kg/m	1.63kg/m
Outer Diameter	19.9mm	31.1mm	38.2mm

CONNECTOR OVERVIEW

	R10	R10 SL	R10 RA	R10 SL R/A	R24	R24 SL	R24 R/A	R24 SL R/A
C2212	100kV	100kV	100kV	100kV	100kV	100kV	-	-
C2042	-	-	-	-	160-225kV	160-225kV	160-225kV	160-225kV
C2236	-	-	-	-	225kV	225kV	225kV	225kV

	R28	R28 SL	R28 SL	R28 SL R/A	R30	R30 SL	R30 R/A	R30 SL R/A
C2212	-	-	-	-	-	-	-	-
C2042	225kV	225kV	225kV	225kV	230kV	-	230kV	-
C2236	225kV	225kV	225kV	225kV	300kV	300kV	300kV	300kV

CLAMPING SLEEVES

Part Number	Description	Length	Thread
SK1328/A	R10 Short Small PCD	53mm	M32 x 1.5mm
SK1328/B	R10 Short Large PCD	53mm	M32 x 1.5mm
T20051/A	R10 Straight Small PCD	80mm	-
T20052	R10 Straight Large PCD	85mm	-
T20785/A	R10 Right Angle Small PCD	25mm	M48 x 1.5mm
T20785/B	R10 Right Angle Large PCD	25mm	M48 x 1.5mm
T20844	R24 Short	70mm	M45 x 1.5mm
T22752	R24 Short 'L' Cable	76mm	M56 x 1.5mm
T20131/A	R24 C/Sleeve	102mm	M45 x 1.5mm
T20697	R24 c/w Cut Outs	102mm	M45 x 1.5mm
T20045/F	R24 6-Hole	100mm	M45 x 1.5mm
T20697/A	R24 R/A c/w Cut Outs	87mm	M45 x 1.5mm
T22179	R24 Sprung	70mm	M45 x 1.5mm
T22813	R24 Windowed	102mm	M45 x 1.5mm
T22717	R28 Short	73mm	M56 x 1.5mm
T20289	R28 C/Sleeve	118mm	M56 x 1.5mm
T20405	R28 R/A	105mm	M56 x 1.5mm
T22182	R28 Sprung	104mm	M56 x 1.5mm
T20172/A	R30 C/Sleeve	110mm	M62 x 1.5mm
T22185	R30 Sprung	104mm	M62 x 1.5mm

SPRING LOADED CONNECTORS



- Spring loaded connectors have a mechanical spring built into the ferrule
- > The tension of a sprung termination creates constant pressure in the receptacle
- > Simple to install a tight, secure connection with lower maintenance costs
- > Eliminates over-gapping and the need for re-gapping
- > Features compression rings as a visual aid during installation and maintenance
- > Increases service life of cable and tube
- Compatible 'short' and 'windowed' clamping sleeves allow for compression ring viewing

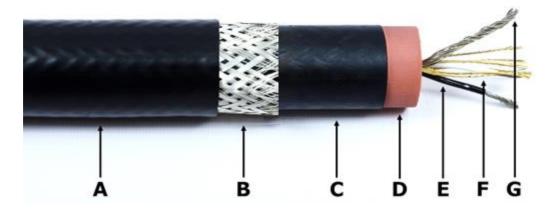
HOW TO ORDER

	Cable Type	Connector	Connector	Length
Cable Assembly*	C2042	R24 SL	R28 SL	5m
Clamping Sleeves	T20844 & T22717			-

^{*}Example R24 - R28 spring-loaded cable assembly with straight connectors



75kVDC - 320kVDC 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.

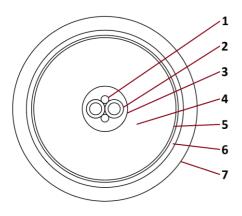
Specifications

- 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.



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 = 1kVbc		
3. Semi-con	Ø 4.8m EPR (Black) 0.25mr Min. Wa		
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	



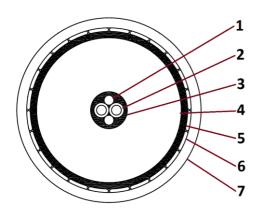
TECHNICAL DATA

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



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 = 5kVpc		
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	



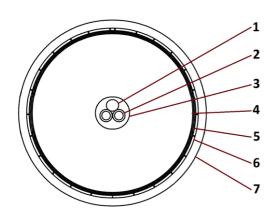
TECHNICAL DATA

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
	90kV RMS (60Hz) – 20 minutes
Production Test Voltage	Core Conductor to Bare Conductor 5kV RMS – 15 seconds



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

Standard Connector Overview



R10 Spring Loaded



C2212 Termination

Standard Connector Overview



R24 Spring Loaded



C2212 Termination



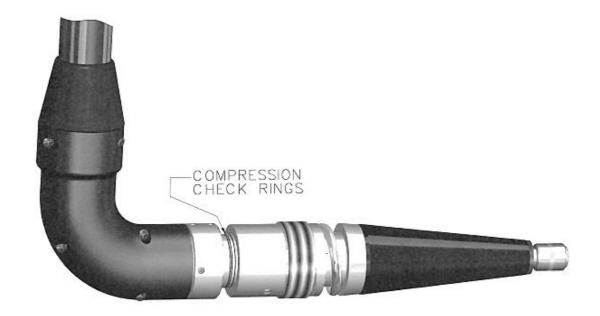
C2042 Termination



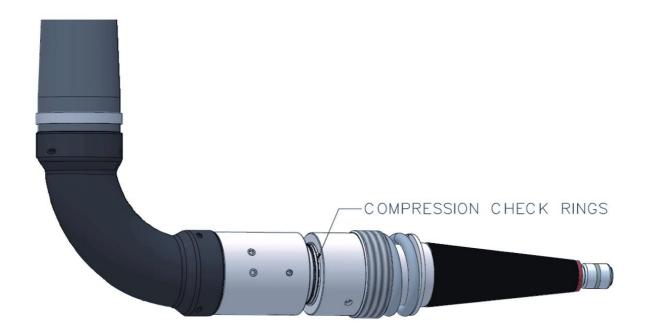
C2236 Termination



R24 Spring Loaded R/A



C2042 Termination



C2236 Termination

Standard Connector Overview



R28 Spring Loaded



C2042 Termination



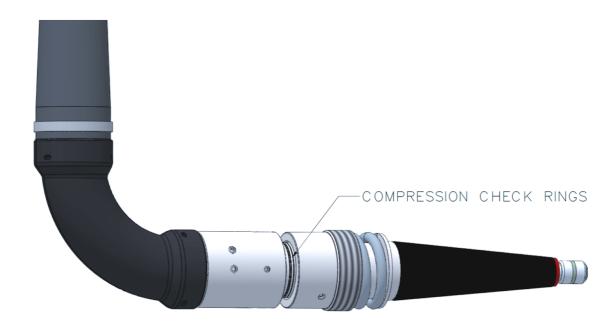
C2236 Termination



R28 Spring Loaded R/A



C2042 Termination

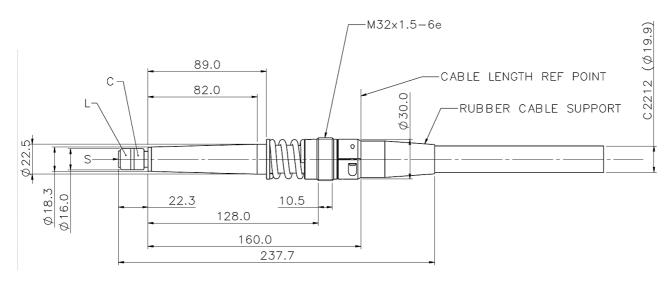


C2236 Termination



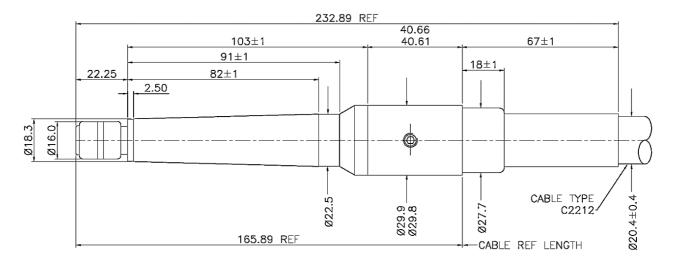
R10 Spring-Loaded Straight (100kV PHIL SL) on C2212

Standard Clamping Sleeve(s) - SK1368/A & SK1368/B



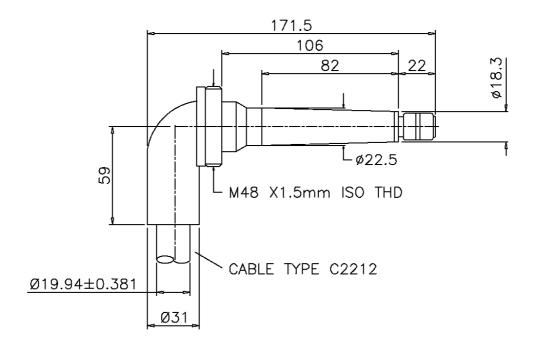
R10 Straight (100kV PHIL) on C2212

Standard Clamping Sleeve(s) - T20051/A & T20052





R10 Right Angle (100kV PHIL R/A) on C2212 Standard Clamping Sleeve(s) – T20785/A & T20785/B

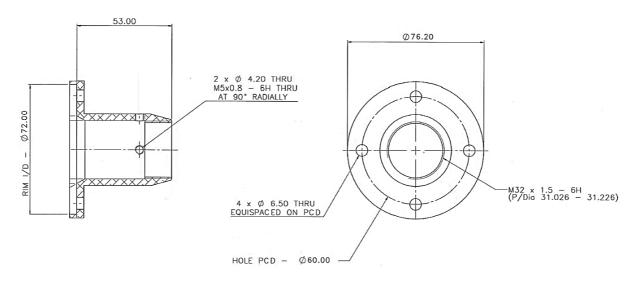


R10 Clamping Sleeves



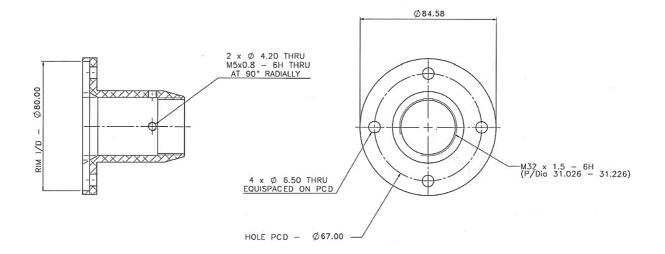
SK1328/A

R10 Short Small PCD



SK1328/B

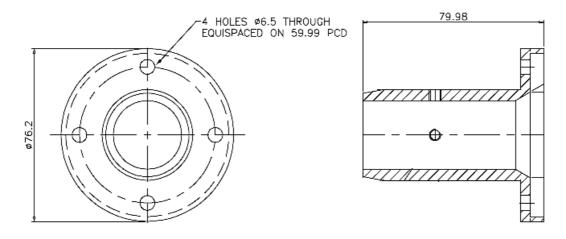
R10 Short Large PCD



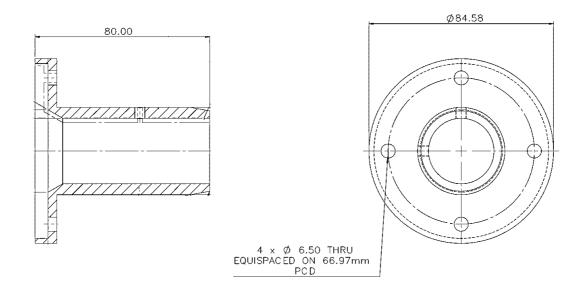
R10 Clamping Sleeves



T20051/A R10 Straight Small PCD



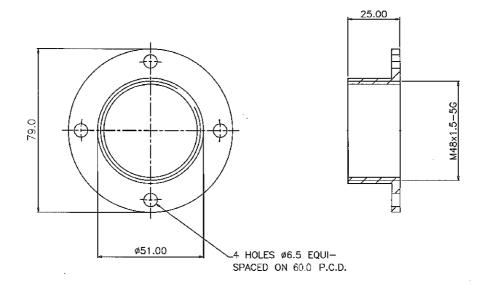
T20052 *R10 Straight Large PCD*



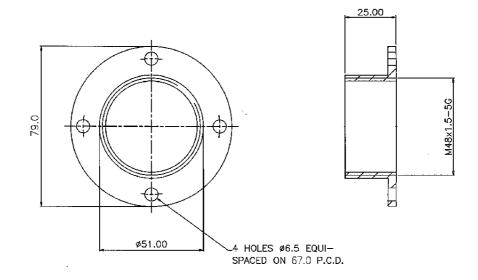
R10 Clamping Sleeves



T20785/A *R10 R/A Small PCD*



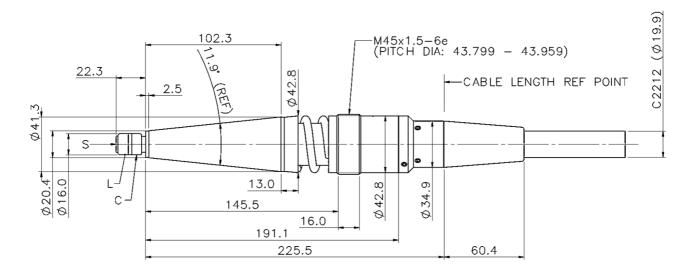
T20785/B *R10 R/A Large PCD*



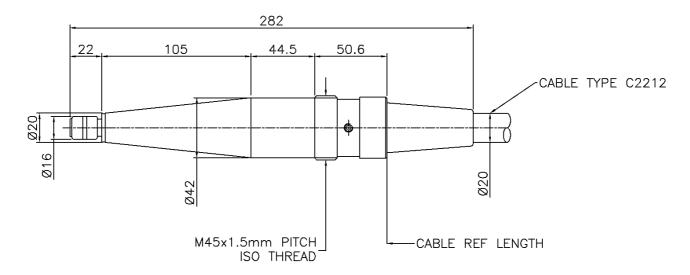


R24 Spring-Loaded Straight (160kV EURO SL) on C2212

Standard Clamping Sleeve - T20844



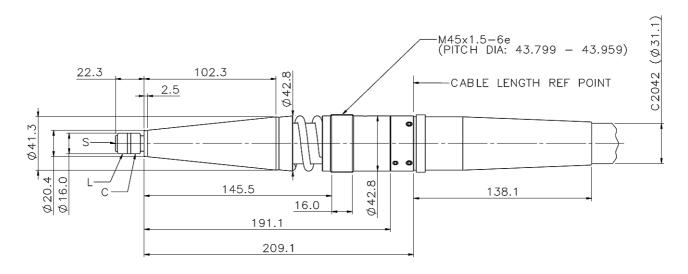
R24 Straight (160kV EURO) on C2212



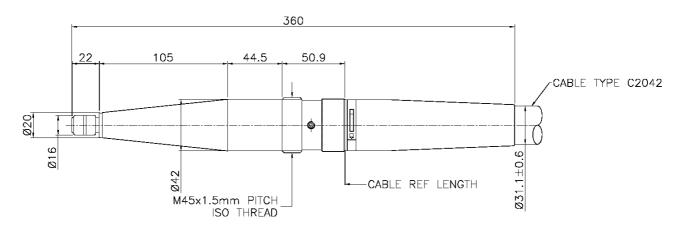


R24 Spring-Loaded Straight (160kV EURO SL) on C2042

Standard Clamping Sleeve - T20844



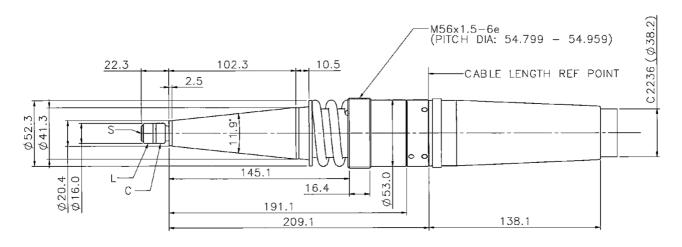
R24 Straight (160kV EURO) on C2042



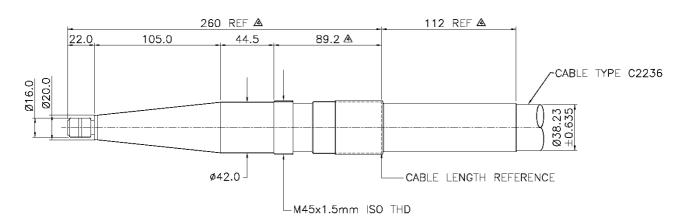


R24 Spring-Loaded Straight (160kV EURO SL) on C2236

Standard Clamping Sleeve - T22752



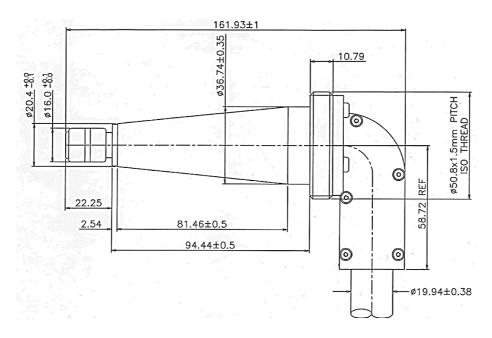
R24 Straight (160kV EURO) on C2236



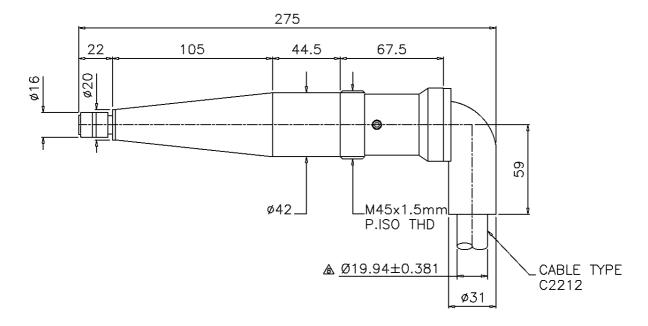


RTW Right Angle (160kV RTW R/A) on C2212

Standard Clamping Sleeve - T22559



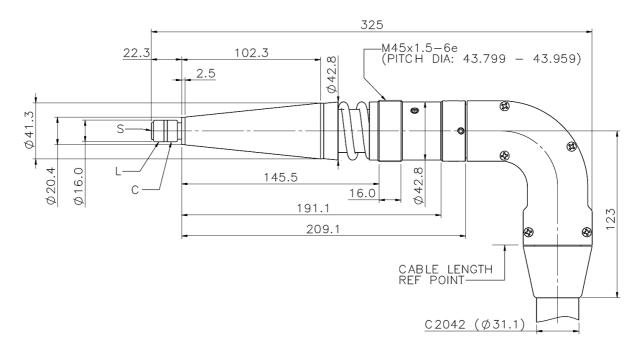
R24 Right Angle Small (160kV EURO R/A) on C2212



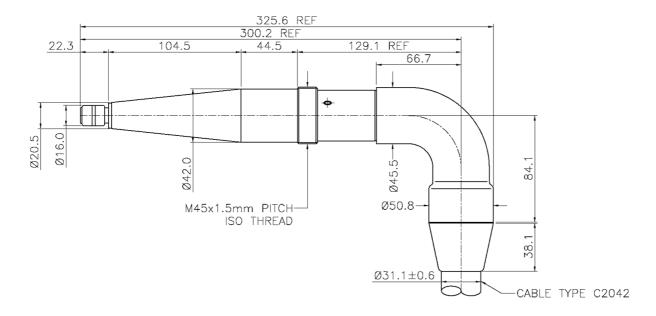


R24 Spring-Loaded Right Angle (160kV EURO SL R/A) on C2042

Standard Clamping Sleeve - T20844



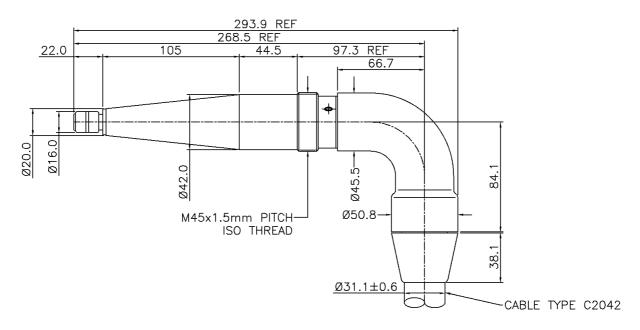
R24 Right Angle (160kV EURO R/A) on C2042



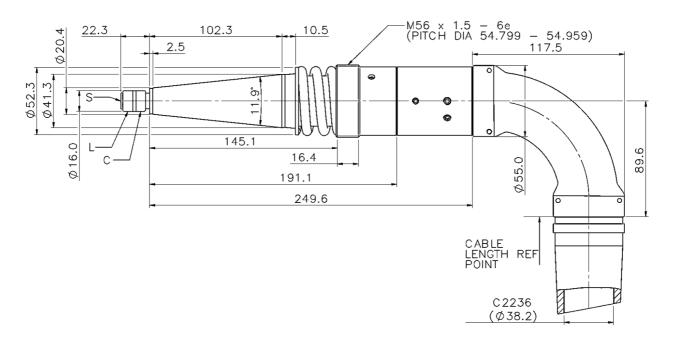


R24 Right Angle Short (160kV EURO R/A) on C2042

Standard Clamping Sleeve - T20844



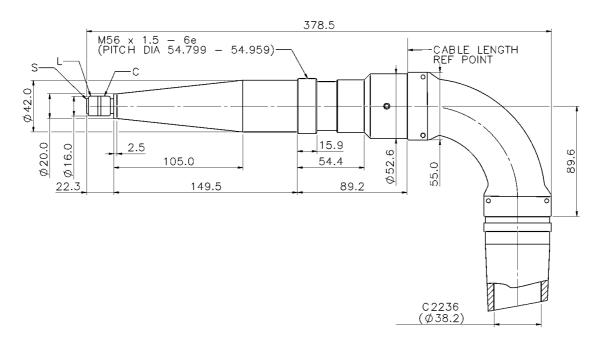
R24 Spring-Loaded Right Angle (160kV EURO SL R/A) on C2236



R24 Connectors

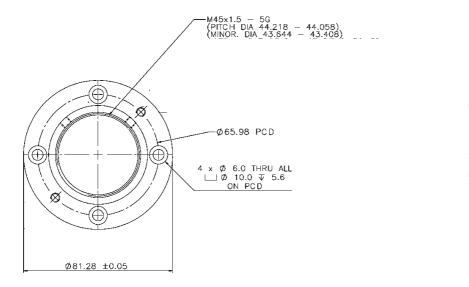


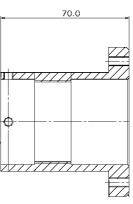
R24 Right Angle (160kV EURO R/A) on C2236 Standard Clamping Sleeve – T20844



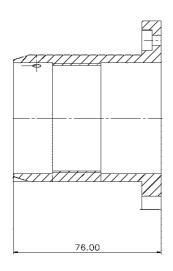


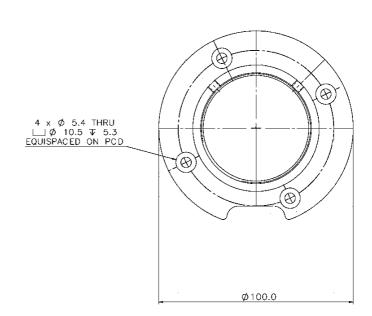
T20844 *R24 Short*





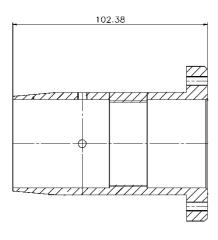
T22752 *R24 Short 'L' Cable*

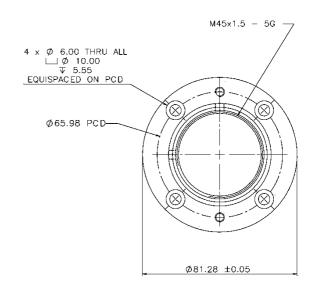




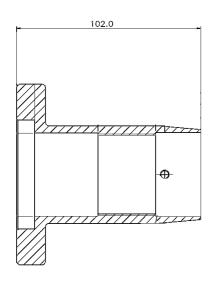


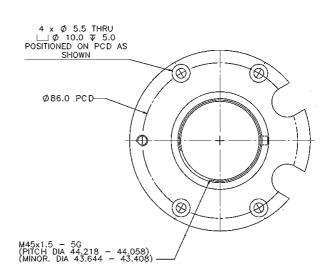
T20131/A *R24 C/Sleeve*





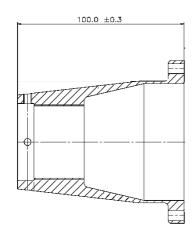
T20697 *R24 c/w Cut Outs*

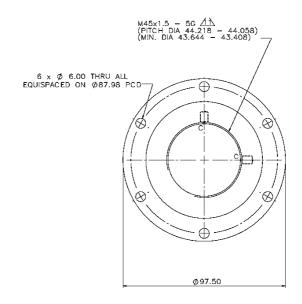




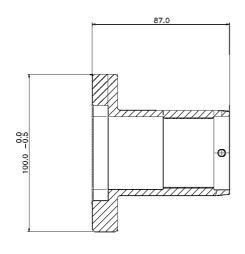


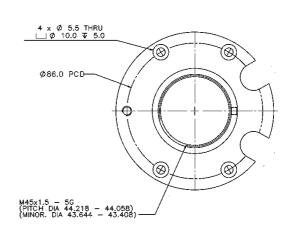
T20045/F *R24 6-Hole*





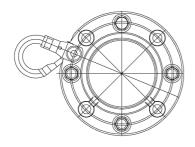
T20697/A *R24 R/A c/w Cut Outs*

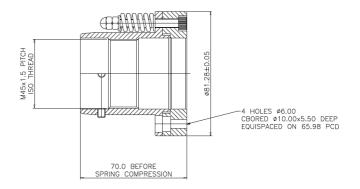




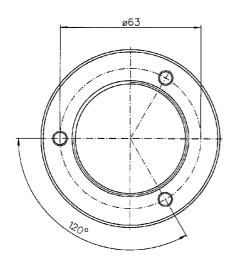


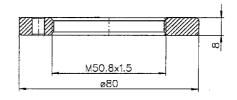
T22179 *R24 Sprung*





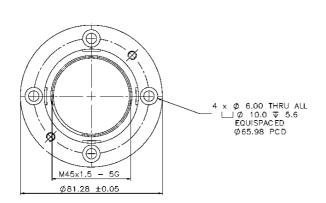
T22559 *RTW R/A*

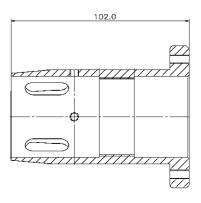






T22813 *R24 Windowed*

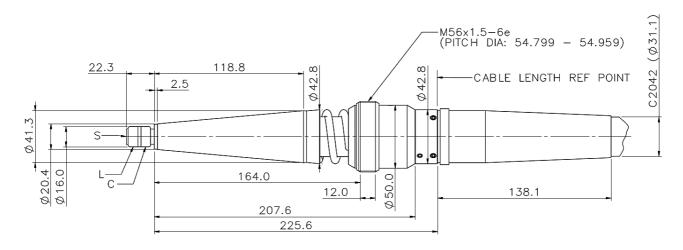




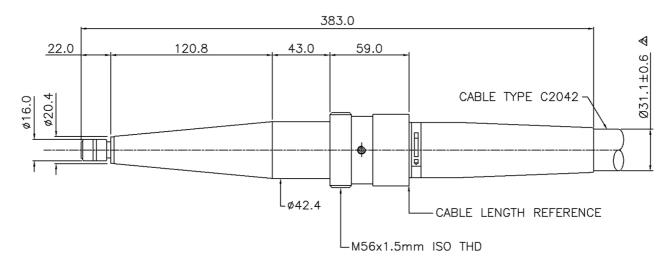


R28 Spring-Loaded Straight (225kV PHIL SL) on C2042

Standard Clamping Sleeve - T22717



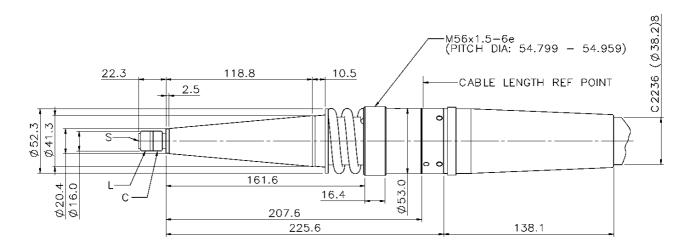
R28 Straight (225kV PHIL) on C2042



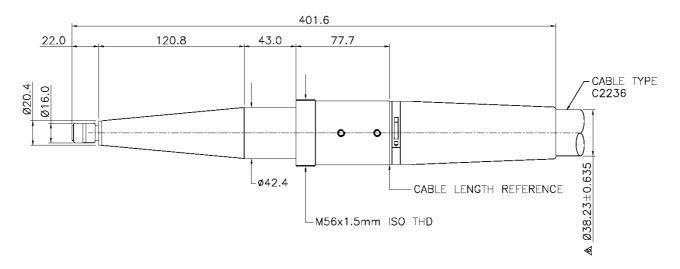


R28 Spring-Loaded Straight (225kV PHIL SL) on C2236

Standard Clamping Sleeve - T22717



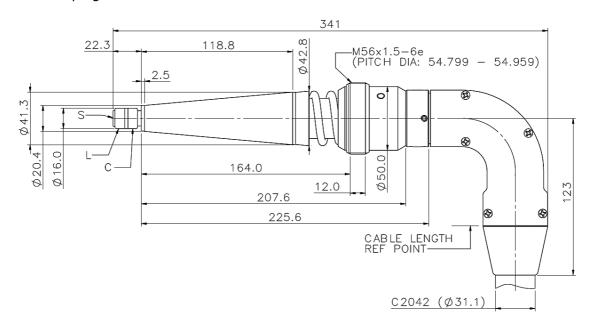
R28 Straight (225kV PHIL) on C2236



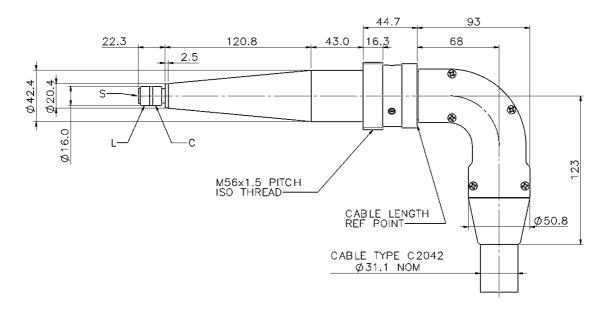


R28 Spring-Loaded Right Angle (225kV PHIL SL R/A) on C2042

Standard Clamping Sleeve - T22717



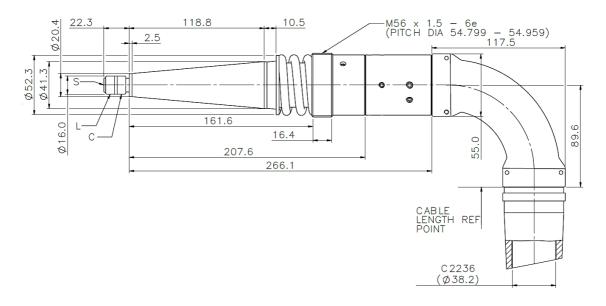
R28 Right Angle (225kV PHIL R/A) on C2042



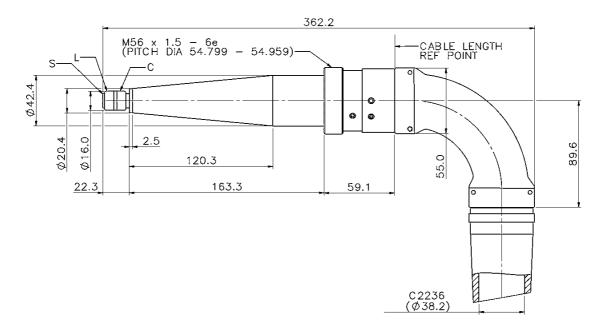


R28 Spring-Loaded Right Angle (225kV PHIL SL R/A) on C2236

Standard Clamping Sleeve - T22717



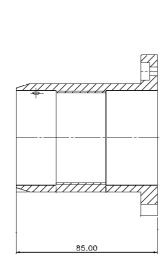
R28 Right Angle (225kV PHIL R/A) on C2236

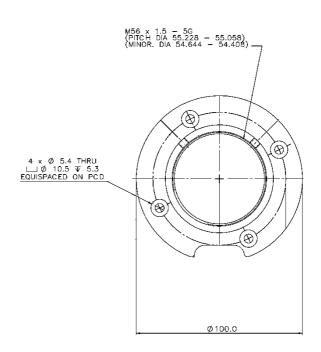


R28 Clamping Sleeves

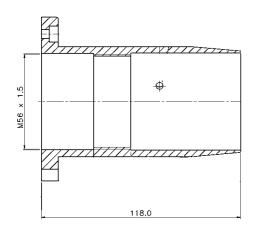


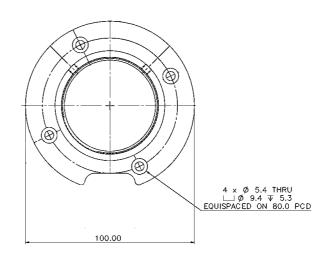
T22717 *R28 Short*





T20289 *R28 C/Sleeve*

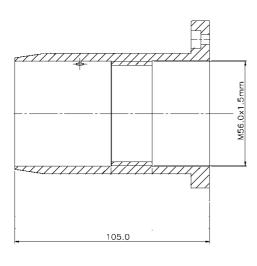


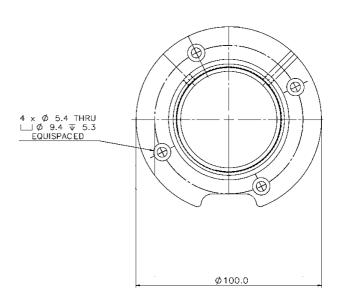


R28 Clamping Sleeves

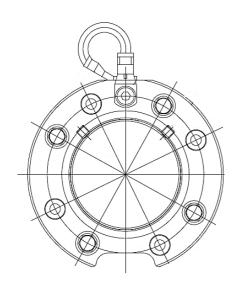


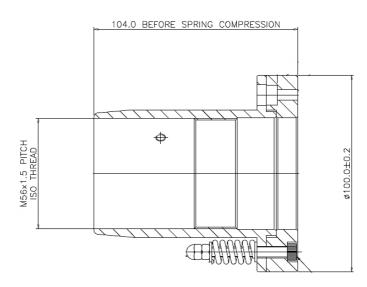
T20405 *R28 R/A*





T22182 *R28 Sprung*

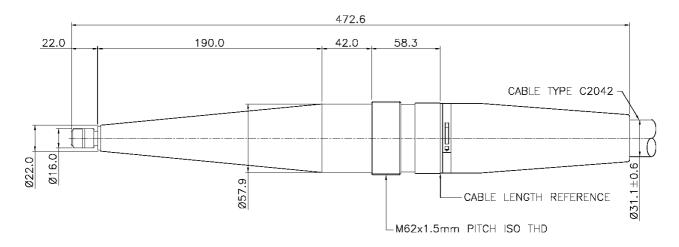






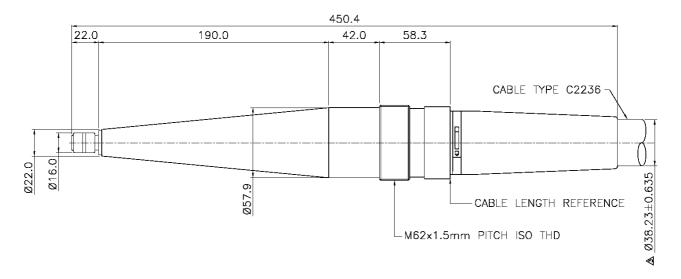
R30 Straight (210kV SEIF) on C2042

Standard Clamping Sleeve - T20172/A



R30 Straight (210kV SEIF) on C2236

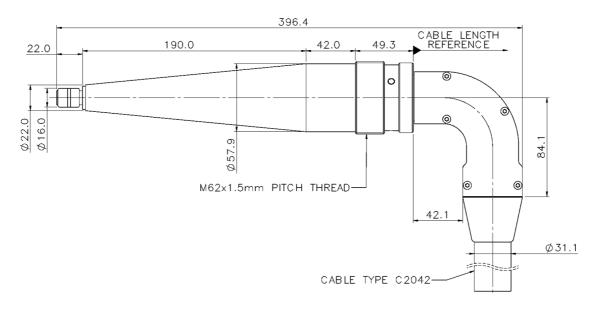
Standard Clamping Sleeve - T20172/A





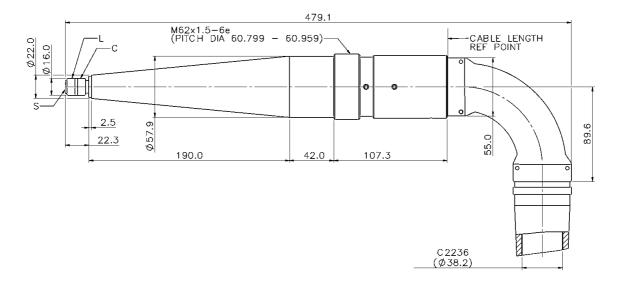
R30 Right Angle (210kV SEIF R/A) on C2042

Standard Clamping Sleeve - T20172/A



R30 Right Angle (210kV SEIF R/A) on C2236

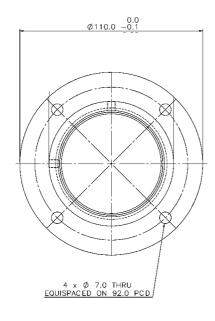
Standard Clamping Sleeve - T20172/A

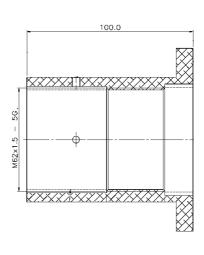


R30 Clamping Sleeves

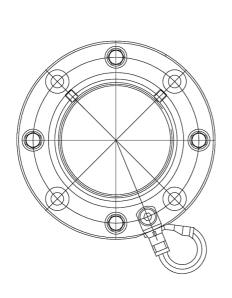


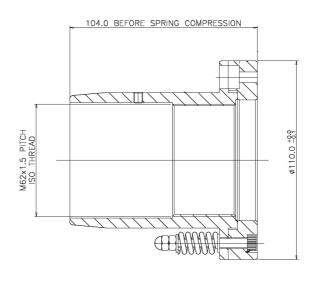
T20172/A *R30 C/Sleeve*





T22185 *R30 Sprung*



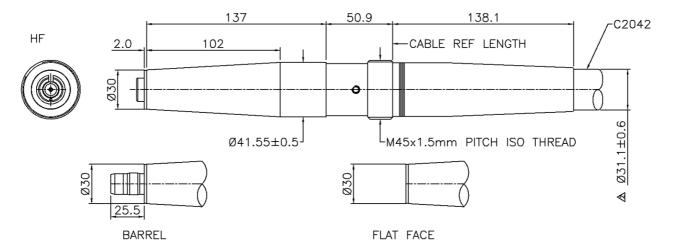


Pantak Connectors



Pantak Straight (PANTAK BARREL) on C2042

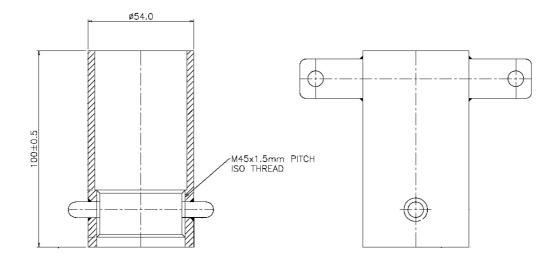
Standard Clamping Sleeve - T21417



Pantak Clamping Sleeves

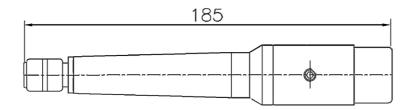


T21417 *Pantak C/Sleeve*

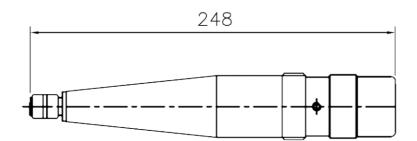




R10 (100kV PHIL) Part Number – A92001

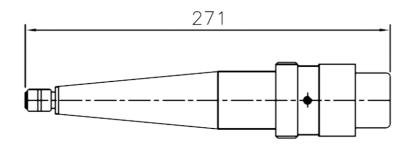


R24 (160kV EURO) Part Number – A92006

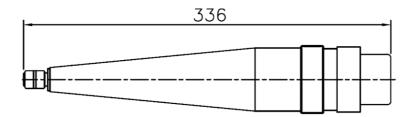




R28 (225kV PHIL) Part Number – A92020



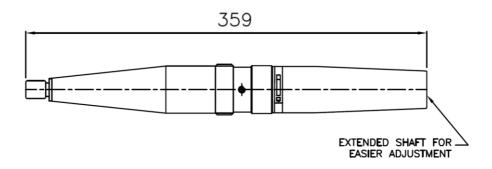
R30 (210kV SEIF) Part Number – A92011





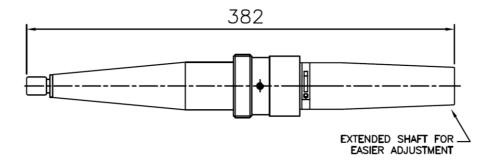
R24 Extended Shaft (160kV EURO)

Part Number - A92055



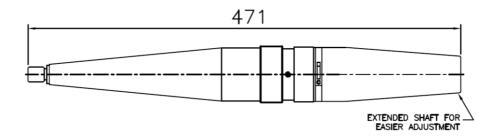
R28 Extended Shaft (225kV PHIL)

Part Number - A92054



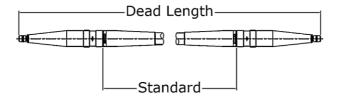


R30 Extended Shaft (210kV SEIF) Part Number – A92053

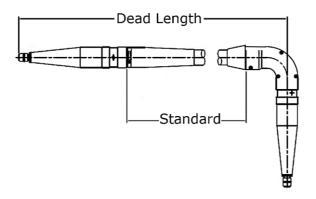


Standard Cable Measurement

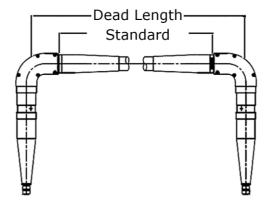
Straight to Straight Assembly



Straight to R/A Assembly



R/A to R/A Assembly



Installation Grease



P00075/C

DC4 Installation Grease



Trade Name	Dow Corning 4 Electrical Insulating Compound	
Appearance	Translucent White Inorganic Grease	
CAS#	Weight (%)	Component Name
68037-74-1	70.0 – 90.0	Dimethyl, methyl silicone resin
7631-86-9	7.0 - 13.0	Silica, amorphous
70131-67-8	5.0 - 10.0	Dimethyl siloxane, hydroxyl-terminated
Evaporation	30 hours/200°c max = 2.0%	
Service Temperature	-55°c to +200°c	
Relative Density	1.0g/ml at 25°c	
Dielectric Strength	1.27mm gap – 1.0kV/ml	
Permittivity	3.1 at 100Hz 3.1 at 100kHz	
Dissipation Factor	0.0025 at 100Hz	
Volume Resistivity	0.10 x 10 ¹⁵ Ohm/cm at 23°c	
Arc Resistance	120 seconds	

OVERVIEW

Dow Corning 4 (DC4) Electrical Insulating compound is a lubricating, grease like material used as a moisture proof seal for electrical assemblies and terminals. Used for cable connectors, battery terminals, switches and various other plastic on metal combinations.

FEATURES

- > High dielectric strength
- Low volatility
- Moisture resistant
- Good thermal oxidation and chemical stability
- ➤ Retains its grease like consistency from -55°c to +200°c
- Odourless
- Highly water repellent
- Adheres readily to dry metals, ceramics, rubber, plastics and insulating resins

HOW TO USE

DC4 compound can be applied by hand using suitable PPE, dispensing equipment, brushing or wiping. A thinner consistency can be achieved by dispersing in solvents such as xylene, mineral spirits and methyl ethyl ketone. Compound can then be applied by brushing, dipping or spraying. DC4 should not be applied to any surface which will be painted or finished.

Note: Please refer to our Installation Instructions for Industrial Cable Assemblies and the manufacturers product safety data sheet for full application and product safety instructions





