

**ERITECH<sup>®</sup>**

# Instruction Manual

Isolated Downconductor System

Model ISODC & Accessories

For Isolated Lightning Protection using

IEC 62305 Separation Distances



**ERICO<sup>®</sup>**

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**WARNING:**

Due to ongoing research into the phenomena of lightning, lightning protection technology and product improvement, ERICO® reserves the right to alter any information and specifications contained herein at any time without notice.

The ERITECH® Isolated Downconductor is a specialized lightning protection downconductor, that during operation may be subjected to impulse currents of over 100,000 Amps and voltage of up to 700,000 V may be developed.

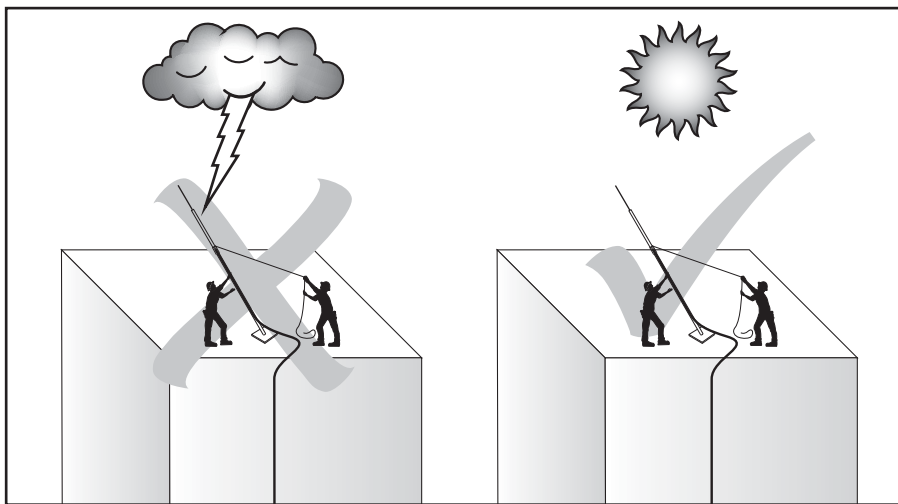
Reliable operation is dependent upon correct design and installation in accordance with IEC 62305 series and ERICO instructions. The Isolated Downconductor must not be damaged in handling, installation or service. The downconductor sheath is a specialized semi-conductive material requiring electrical bonding to the structure. This sheath is fragile and damage to the sheath may require replacement of the cable.

Fully refer to installation instructions prior to handling and installation. Do not assume that traditional lightning protection or HV cable practices apply.

These products should be installed as part of a IEC 62305 series integrated lightning protection system.

No lightning protection system offers 100% protection against all lightning events. However, correct installation is essential for the maximum level of safety.

Only install system during storm-free periods. Do not install in close proximity to overhead power lines. Do not expose personnel to electromagnetic radiation sources such as live transmission equipment during installation.



1. ERICO products shall be installed and used only as indicated in ERICO product instruction sheets and training materials. Instruction sheets are available at [www.erico.com](http://www.erico.com) and from your ERICO customer service representative.
2. ERICO products must never be used for a purpose other than the purpose for which they were designed or in a manner that exceeds specified load ratings.
3. All instructions must be completely followed to ensure proper and safe installation and performance.
4. Improper installation, misuse, misapplication or other failure to completely follow ERICO's instructions and warnings may cause product malfunction, property damage, serious bodily injury and death.

**SAFETY INSTRUCTIONS:** All governing codes and regulations and those required by the job site must be observed. Always use appropriate safety equipment such as eye protection, hard hat, and gloves as appropriate to the application.

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# 1. DESIGN

Design requirements of the ERITECH® Isolated Downconductor system is based on two sections of the IEC 62305-3 standard "Protection Against Lightning – Part 3: Physical damage to structures and life hazard". For correct installation the system must be designed and installed in accordance with these requirements.

- Step 1.** Determine the required height of the air terminal to provide protection according to IEC 62305 Protection Angle Method (PAM)
- Step 2.** Determine the length of Isolated Downconductor so separation distance (IEC 62305-3 section 6.3) does not exceed 1000 mm
- Step 3.** Meet ERICO's mounting and installation requirements and interconnect to a standard compliant grounding or lightning protection system

## IEC 62035 Protection Angle Method

An air terminal is assigned a protective angle where any equipment fully located within the protected volume is deemed to be protected. The protection angle provides a cone volume of protection with the angle determined by the height of the air terminal above the object and the Lightning Protection Level (LPL).

Determine the required minimum height of the air terminal tip above the top of mast/items to be protected. It is recommended that highest LPL be used (i.e. LPL I). Alternatively the required Lightning Protection Level can be determined by IEC 62305-2 risk assessment.

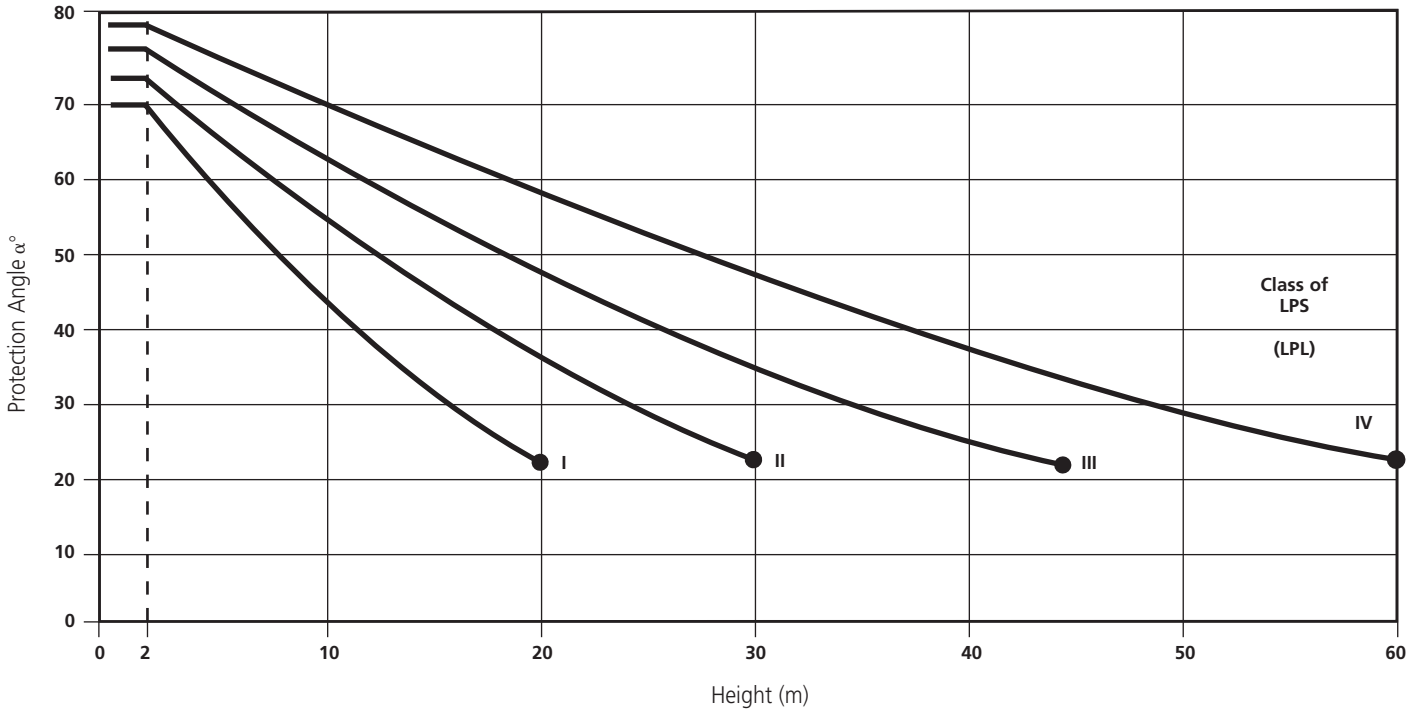


Figure 1. IEC 62305 Part 3, Table 2 details the protection angle.

# 1. DESIGN (continued)

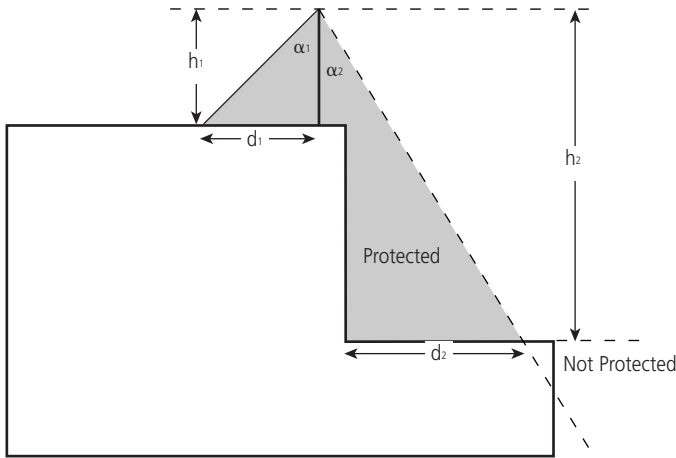
**Table 1.** Height versus horizontal distance using protection angle method.

Height h of air-termination (m)	Distance d (m) and protection angle $\alpha^\circ$ (rounded down to nearest degree)							
	LPL I		LPL II		LPL III		LPL IV	
	Distance	Angle	Distance	Angle	Distance	Angle	Distance	Angle
1	2.75	70	3.27	73	4.01	76	4.70	78
2	5.49	70	6.54	73	8.02	76	9.41	78
3	7.07	67	8.71	71	10.46	74	12.99	77
4	7.52	62	9.42	67	12.31	72	13.95	74
5	8.32	59	10.25	64	14.52	71	16.35	73
6	8.57	55	10.82	61	14.14	67	17.43	71
7	9.29	53	11.65	59	15.72	66	18.24	69
8	9.53	50	12.32	57	16.40	64	18.85	67
9	9.65	47	12.85	55	16.93	62	20.21	66
10	10.00	45	13.27	53	17.32	60	20.50	64
11	9.90	42	14.08	52	19.05	60	19.84	61
12	10.07	40	14.30	50	19.20	58	20.78	60
13	10.16	38	14.44	48	19.27	56	21.64	59
14	9.80	35	14.50	46	19.27	54	22.40	58
15	9.74	33	15.00	45	19.91	53	23.10	57
16	9.61	31	14.92	43	20.48	52	22.85	55
17	9.04	28	15.31	42	20.99	51	23.40	54
18	8.78	26	15.65	41	21.45	50	23.89	53
19	8.86	25	15.94	40	21.86	49	25.21	53
20	7.68	21	15.07	37	21.45	47	25.60	52
21			14.70	35	21.75	46	25.93	51
22			14.84	34	22.00	45	26.22	50
23			14.94	33	22.21	44	27.41	50
24			14.42	31	22.38	43	26.65	48
25			14.43	30	22.51	42	26.81	47
26			13.82	28	21.82	40	27.88	47
27			13.17	26	22.66	40	27.96	46
28			13.06	25	21.88	38	28.00	45
29			12.91	24	21.85	37	28.00	44
30			12.73	23	21.80	36	28.97	44
31					21.71	35	28.91	43
32					21.58	34	28.81	42
33					21.43	33	28.69	41
34					21.25	32	28.53	40
35					21.03	31	28.34	39
36					20.78	30	29.15	39
37					20.51	29	28.91	38
38					20.20	28	28.64	37
39					19.87	27	29.39	37
40					19.51	26	29.06	36

# 1. DESIGN (continued)

**Table 1.** Height versus horizontal distance using protection angle method. (continued)

Height $h$ of air-termination (m)	Distance $d$ (m) and protection angle $\alpha^\circ$ (rounded down to nearest degree)							
	LPL I		LPL II		LPL III		LPL IV	
	Distance	Angle	Distance	Angle	Distance	Angle	Distance	Angle
41					19.12	25	29.79	36
42					18.70	24	30.51	36
43					18.25	23	30.11	35
44					18.68	23	28.57	33
45					18.18	22	29.22	33
46							28.74	32
47							28.24	31
48							27.71	30
49							28.29	30
50							28.87	30
51							28.27	29
52							28.82	29
53							29.38	29
54							28.71	28
55							28.02	27
56							27.31	26
57							26.58	25
58							25.82	24
59							25.04	23
60							25.47	23

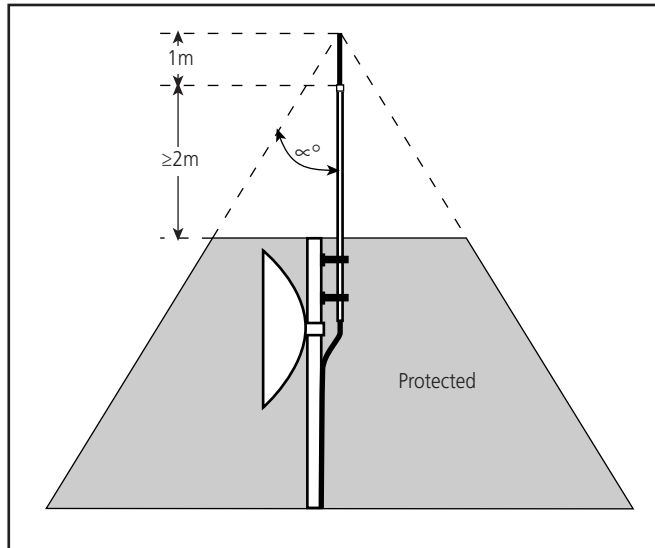


**Table 2.** Lightning Protection Levels

Lightning Protection Level (Class of LPS)	Peak current (10/350 $\mu$ s)	Probability of exceedance
I	200 kA	$\leq 1 \%$
II	150 kA	$\leq 3 \%$
III	100 kA	$\leq 9 \%$
IV	100 kA	$\leq 16 \%$

# 1. DESIGN (continued)

As shown in **Figure 2**, the ERITECH® Isolated Downconductor system requires two meters of clearance between the top of the isolated mast and mounting brackets/protected equipment. This two meter clearance is sufficient to prevent a flash-over between non-isolated air terminal and mast/object being protected.



**Figure 2.** Protection angle and two meter minimum Isolated Mast height.

## IEC 62305 Electrical Insulation & Separation Distance

Equipment and structures can be protected by isolation, provided that the distance between the air terminal (or downconductor) and items to be protected are separated by a separation distance greater than:

$$S = k_i \frac{k_c}{k_m} l \quad (\text{IEC 62305-3 section 6.3, equation 4})$$

**Where:**

**S** separation distance, in meters

**k<sub>i</sub>** depends upon the selected class of LPS

**k<sub>c</sub>** depends upon the lightning current flowing on the downconductors ( $k_c = 1$  for a single downconductor, 0.5 for two downconductors)

**k<sub>m</sub>** depends upon the electrical insulation material ( $k_m = 1$  for air)

**l** is the length, in meters, along the downconductor (from nearest equipotential bonding point, i.e. normally from lower termination), to the point where the separation distance is being considered.

**Table 3.**  $k_i$  versus Class of LPS.

$k_i =$	Class of LPS (Lightning Protection Level)
0.08	I
0.06	II
0.04	III
0.04	IV

# 1. DESIGN (continued)

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The ISODC Isolated Downconductor has an equivalent separation distance of 1000 mm of air. Therefore simplifying the equation in **Table 3, Table 4** provides the maximum length for a single downconductor where the lower termination is equipotentially bonded to the structure. If it is not possible to adhere to the distance limitations, then refer to **Annex A** for information on the ISODUAL dual coupling.

**Table 4.** Maximum Isolated Downconductor length for single equipotential bonded cable.

Class of LPS (Lightning Protection Level)	Maximum Isolated Downconductor length
I	12.5 m
II	16.6 m
III & IV	25 m

Where the lower termination is not equipotentially bonded to the structure, such as when connected to an isolated ring system, then distance must be measured to the nearest LPS-structural equipotential point. Contact ERICO® for advice.

## 2. GENERAL ASSEMBLY PROCEDURE

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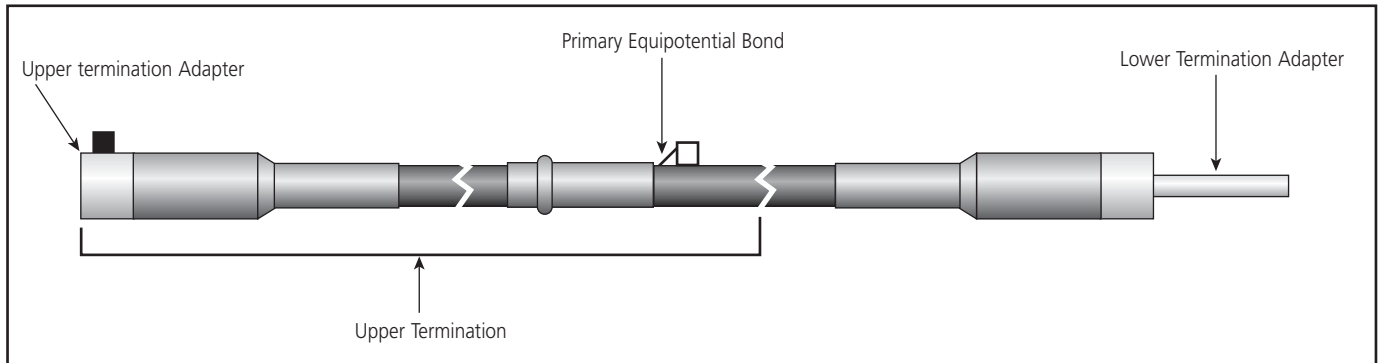
Follow procedures appropriate for the site. However, it is generally recommended to:

1. Check sufficient Isolated Downconductor length is available for planned route.
2. Assemble the Isolated Mast, air terminal and Isolated Downconductor together, before mounting the arrangement to the structure.
3. Attach the mast mounting brackets to the structure.
4. Hoist and attach assembled mast/air terminal/downconductor arrangement to the structure.
5. Connect ISODC primary equipotential bond conductor to support mast.
6. Route and secure the Isolated Downconductor.
7. Cut bottom of Isolated Downconductor to final length, install lower termination and connect to grounding/lightning protection system.

### 3. ASSEMBLY OF ISOLATED MAST

Use appropriate tools to securely assemble upper mast arrangement:

- Step 1.** Connect the 6 mm<sup>2</sup> equipotential bonding conductor to the ISODC primary equipotential bond connector.
- Step 2.** Feed the upper termination end of the ISODC Downconductor through the Isolated Mast. Make sure the ISODC primary equipotential bond conductor is accessible from the bottom of the mast.



**Figure 3.** Upper & lower termination adapter and ISODC primary equipotential bond connector.

- Step 3.** Loosely fit the 8 mm set screw into the hole on the side of the upper termination adapter (4 mm hex Allen key supplied). Do not insert to depth where set screw enters into threaded hole for air terminal.
- Step 4.** Insert the air terminal thread through pressure washer, ISOCAP50 body and fully screw into upper termination adapter. Refer to **Figure 4**. Ensure that hole for upper termination adapter-air terminal lock nut is aligned with access hole in ISOCAP50 body, tighten air terminal to 4 Nm.
- Step 5.** Tighten air terminal lock nut against pressure washer (4 Nm).
- Step 6.** Apply LOCTITE® to the 8 mm set screw and tighten it into place against the air terminal with a torque of 8 Nm.
- Step 7.** Fit ISOCAP50 body into Isolated Mast.

### 3. ASSEMBLY OF ISOLATED MAST (continued)

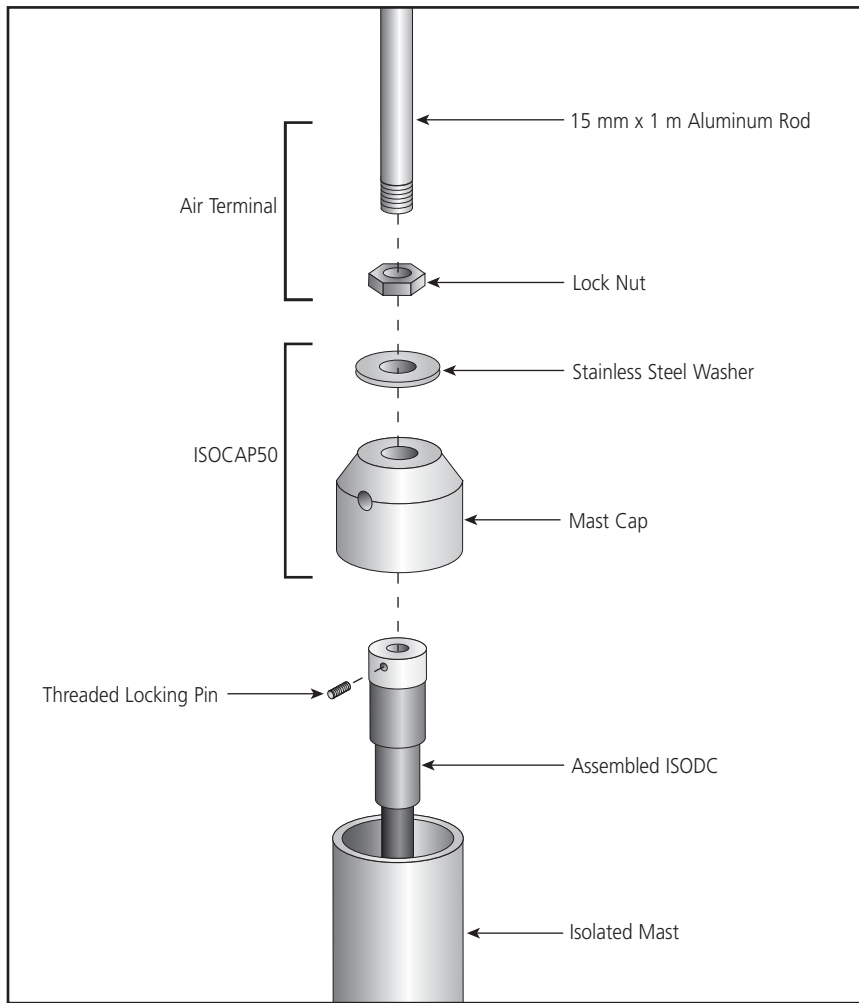


Figure 4. Upper mast arrangement.

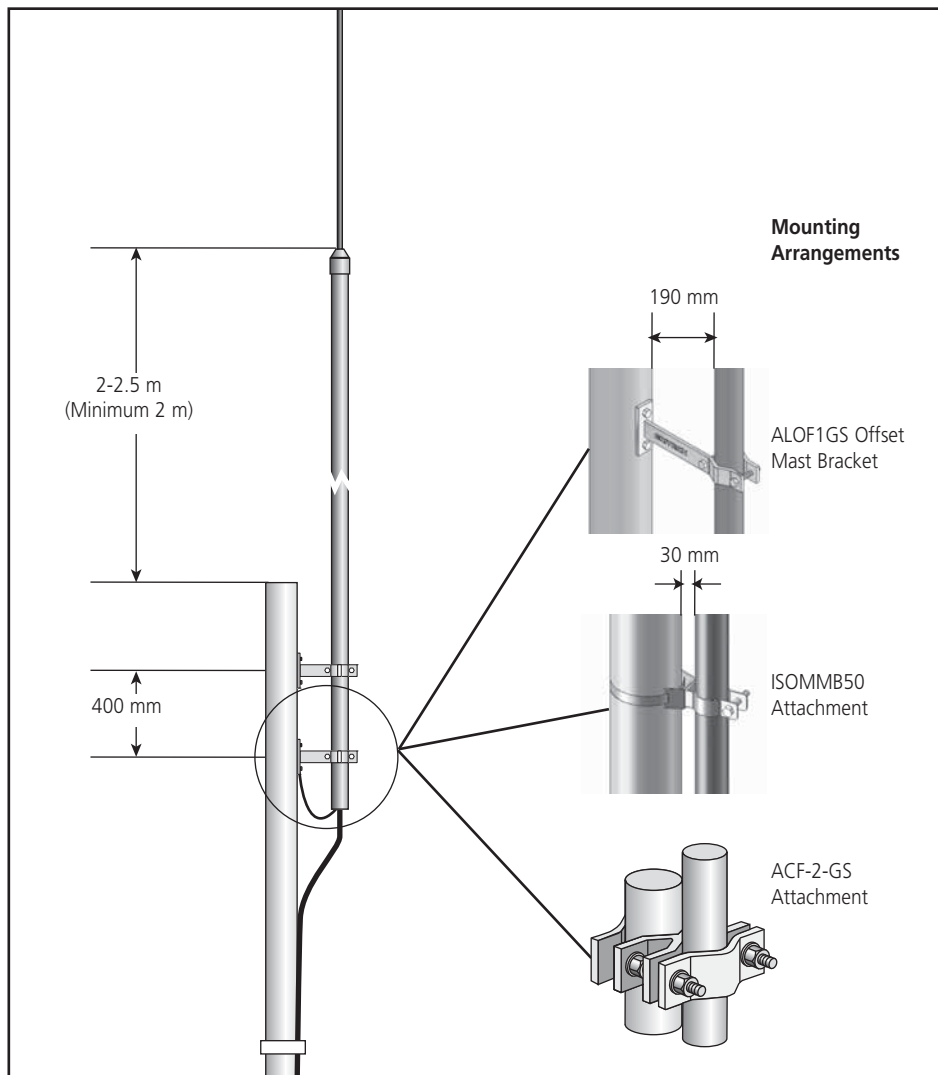
## 4. FIXING ISOLATED MAST TO THE STRUCTURE

The engineer responsible for the structure should first ensure that the mounting of the lightning protection system will not exceed the design parameters for the structure (e.g. wind and weight loading), nor exceed aviation or similar height limitations for the site. Galvanic suitability and mounting methods should be considered. The installation should be planned with appropriate access and safety equipment such as scaffolding, rigging and safety barriers etc. Appropriate precautions should be taken with regard to any potentially hazardous site conditions such as overhead or exposed power circuits or sources of electromagnetic radiation.

The Isolated Mast must be installed at a height where the angle-of-protection offered by the air terminal tip is sufficient to protect desired equipment. Additionally the minimum requirement of 2 m clearance must be maintained between the top of the Isolated Mast and structure/object to be protected (refer to **Figure 2**).

**Table 5.** Mast & mounting bracket requirements.

Mast height above structure	Mounting requirements	Mast
2 - 2.5 m	2 brackets at least 400 mm apart	ISOFRP3M Isolated 3 m mast
For taller mounting requirements ISOCAP68 and ERITECH® SYSTEM 3000 components can be used. Refer to <b>Annex B</b>		

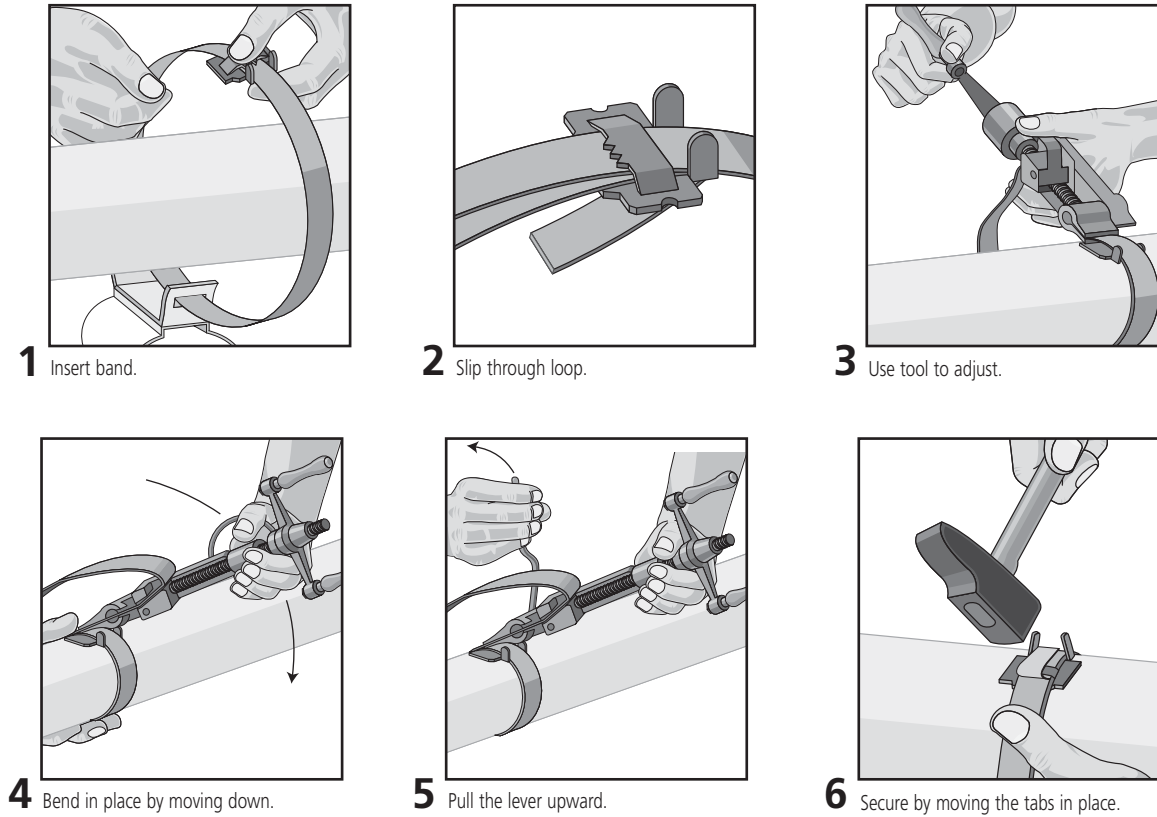


**Figure 5.** Mast height and mounting arrangement.

## 4. FIXING ISOLATED MAST TO THE STRUCTURE (continued)

The following illustrations show the mounting bracket fixing procedure.

Figure 6. ISOMMB mounting brackets fixing procedure.



Do not use FIXOBAND for strapping Isolated Downconductor to the structure.

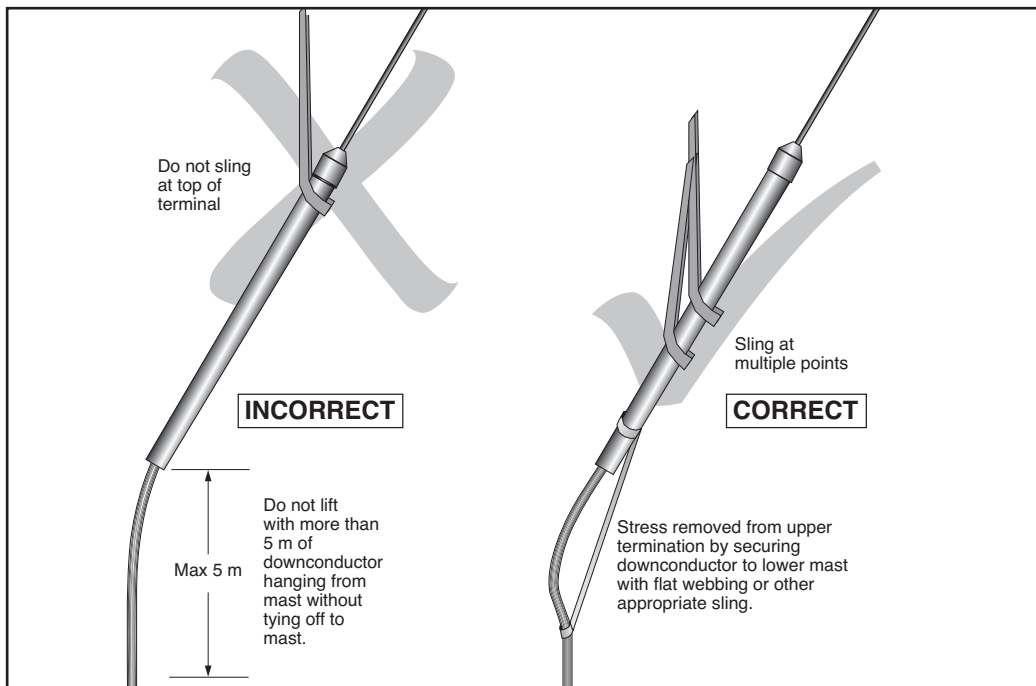


Figure 7. Incorrect and correct hauling methods.

## 5. SECURING THE ISOLATED DOWNCONDUCTOR

- It is not possible to join the Isolated Downconductor, so before installing, ensure sufficient length is available to route the Isolated Downconductor using the most direct route possible with minimum of bends (do not exceed minimum bending radii specification of 450 mm).
- Fix the Isolated Downconductor to the structure using metallic fixings – these provide mechanical and electrostatic connection of the Isolated Downconductor sheath to the structure. Do not use insulated fixings.
- Do not damage the Isolated Downconductor by over tightening straps or using non ERICO® approved fasteners.

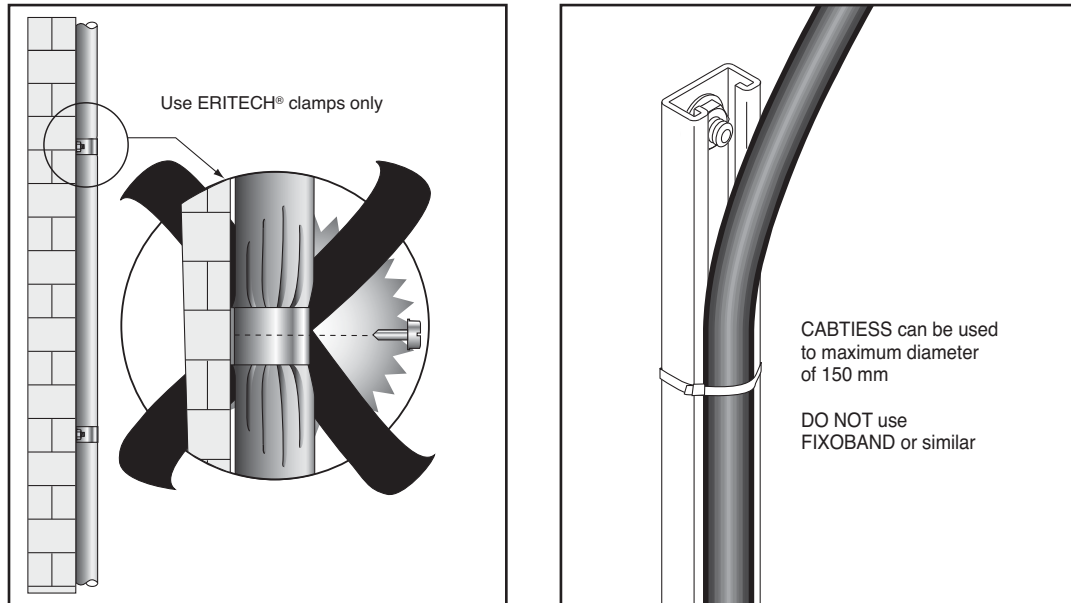


Figure 8. Isolated Downconductor fixing examples.

- Do not install the Isolated Downconductor within metallic or insulated pipes.
- Secure the Isolated Downconductor at 1 m intervals.
- Only cut the lower Isolated Downconductor section to length once Isolated Downconductor is fixed in position and required length is confirmed.
- The black sheath of the Isolated Downconductor must not be damaged. The sheath is fragile and care must be exercised in handling and installation. It should not be installed in water or ground.

## 6. FITTING LOWER TERMINATION ADAPTER

The Isolated Downconductor is supplied with the upper termination factory assembled. After the Isolated Downconductor is installed the lower end can be cut to desired length and lower termination adapter installed.

Tools required:

- Sharp knife
- Cable stripper (INT-BZ IMS II #17230, or similar)
- Hacksaw or cable cutter
- Pliers
- File

1. Strip back 25 mm of insulation exposing central conductors using cable stripper\*.
2. Strip back 44 mm of cable sheath measured from cable end.
3. Apply oxide inhibiting compound to aluminum conductor.
4. Fit stainless steel lower termination adapter and tighten 2 x set screws (4 Nm). A 4 mm hex key is provided for this purpose.
5. Apply protective wrapping to limit water penetration into adapter.

\* The insulation material of the downconductor can be difficult to remove without professional cable strippers designed to shave off insulation. Care is required. If cable strippers are not available, it is recommended to:

- a. First remove 44 mm of the outer layer.
- b. 25 mm from the cable end use a tube cutter to cut around the central white layer to a maximum depth of 6 mm.
- c. Carefully cut to a depth of 7 mm along the length of the insulation to be removed.
- d. Use pliers to carefully remove the insulation layer without disturbing the conductor.
- e. Ensure that all aluminum strands and layers of the conductor are smooth and cylindrical to fit into the termination adapter. Compact and file off sharp edges if necessary.

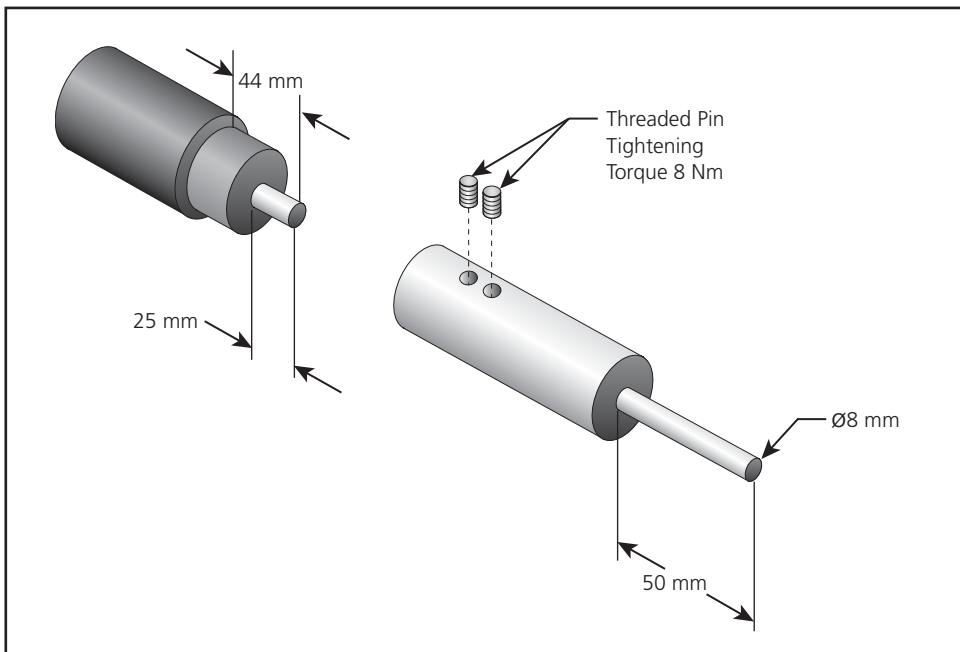


Figure 9. Lower termination adapter.

## 7. CONNECTION OF LOWER TERMINATION ADAPTER

The lower termination of the system should be connected to building lightning protection system (isolated or bonded system) or standard compliant lightning protection earth termination.

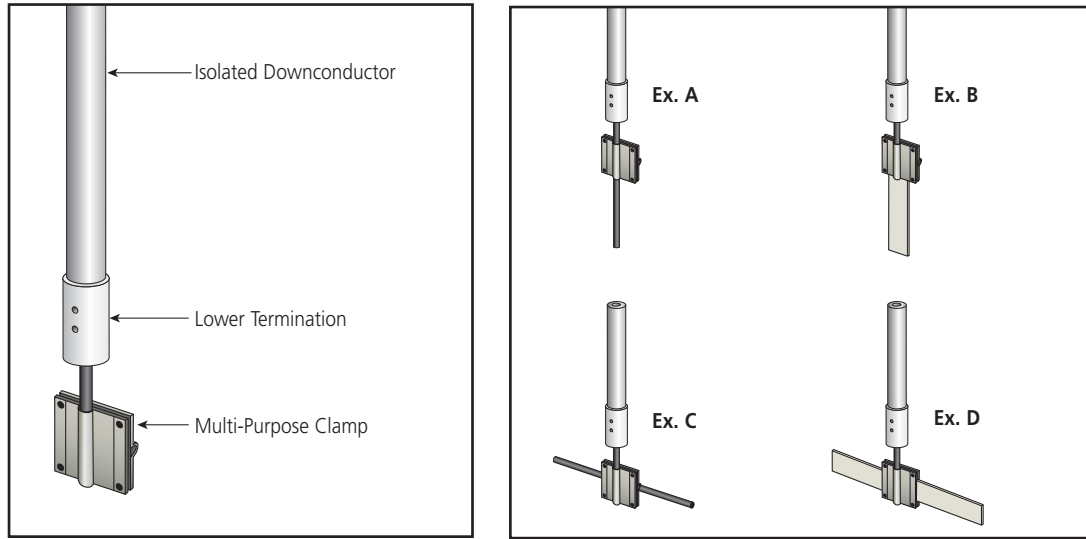


Figure 10. Examples of lower termination connections using multipurpose clamp.

## 8. ISODC PRIMARY EQUIPOTENTIAL BOND

The ISODC primary equipotential bond is an electrical connection to the ISODC sheath approximately 2.25 m from the upper termination adapter. This bonding connection is normally provided as part of the factory supplied upper termination of the ISODC. A 4.5 meter length of 6 mm<sup>2</sup> PVC covered conductor is supplied that should be connected to the screw terminal of the primary bond and routed out the bottom of the Isolated Mast, connecting to the nearest grounded metallic structural point. This conductor should be cut to length before terminating to the structure.

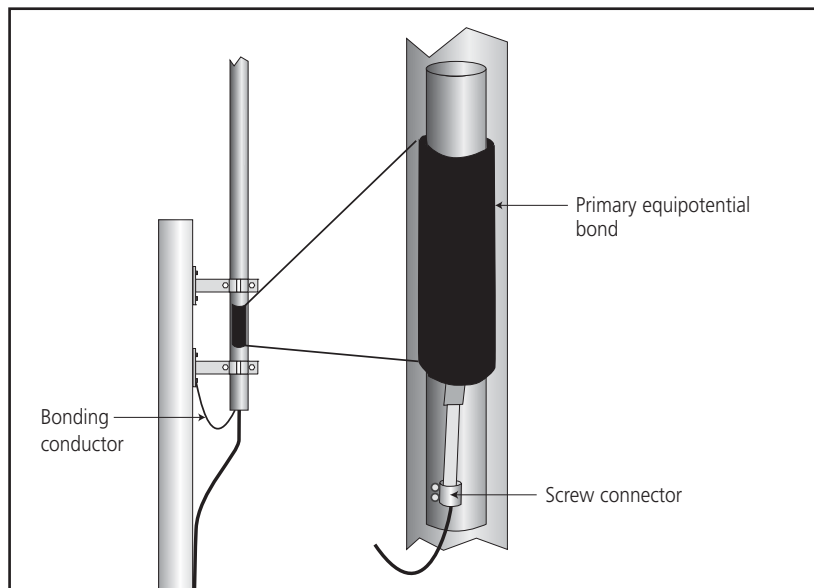


Figure 11. ISODC primary equipotential bond.

The primary equipotential bond is required to maintain the performance of the upper termination. Under lightning conditions the bond carries a small portion of the discharge current, however this minor current is small enough not to cause damage to the structure. The ISODC primary equipotential bond conductor should not be directly connected to the lightning carrying circuit (i.e. not to an isolated LP ring).

## 9. LIGHTNING EVENT COUNTER

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The Lightning Event Counter (LEC) is a device for registering and recording the number of strikes intercepted. The LEC should be mounted in a secure area that is not prone to contact by moving items, theft or vandalism. However, it should be mounted in a location that allows safe access to inspect the display. Refer to instructions supplied with the LEC.

The LEC is fixed to the Isolated Downconductor, and does not require additional fixing to the structure. Additional downconductor fixings should be installed directly above and below the LEC counter.

## 10. TESTING AND MAINTENANCE

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Ice loading, wind and other vibration sources can loosen mechanical and electrical connections over time. Atmospheric pollution can accelerate corrosion. Therefore, the Isolated Downconductor system should be visually inspected by a lightning protection specialist annually. Electrical tests should be conducted every 2 years.

Visual inspection should ascertain that:

- System conforms to the design standard (IEC 62305) and requirements of this instruction.
- Structure or equipment changes have not affected the design.
- All components are secure and in good condition.

Special attention should be given to:

- Mast mounting brackets.
- Isolated Downconductor sheath to ensure it has not suffered inadvertent mechanical damage.
- ISODC primary equipotential bond connection is securely connected to structure.

Electrical testing should include:

- Continuity test of the complete system.
- Earth resistance measurement.
- The upper and lower cable termination integrity can be tested by temporarily isolating the lower termination adapter from ground/structure. Using an Ohm meter measure between the lower termination adapter and ground/structure. Resistance should be between 700 and 2000 Ohms.

## 11. UPPER TERMINATION PROCEDURE

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The ISODC upper termination is normally preinstalled by the factory. If however, this needs to be field fitted then follow the procedure supplied with the termination kit. Note that this termination procedure is different to that of the lower termination adapter.

## 12. GENERAL SPECIFICATIONS

<b>Isolated Downconductor</b>	ISODC (#701130)
Description	XLPE/PE Isolated Cable
Equivalent separation distance	1000 mm of air
Material	Multi-strand aluminum (19 x 1.87 mm dia.). Total cross sectional area 50 mm <sup>2</sup>
Color	Black
Outer diameter	27 mm
Minimum bending radius	450 mm
Weight	0.58 kg/m
Installation temperature	> 0 deg C
Operating temperature	-40 deg C to 70 deg C
Termination Adapters	Stainless steel 304. Lower adapter provides 8 mm diameter, 50 mm stud
Standards	IEC 62305-3 EN 50164-2 UL® 96A

<b>Air Terminal</b>	AAR1015 (#711070) 1.0 m or AAR0515 (#711020) 0.5 m
Description	Aluminum air terminal, safety tipped
Dimension	16 mm thread, 0.5 or 1.0 m length
Standards	IEC 62305-3, EN 50164-2, UL 96A

<b>Isolated Mast</b>	ISOFRP3M (#701140)
Description	Fiberglass-reinforced thermoset polyester tube (UV stable)
Color	Grey
Diameter	50 mm
Weight	4.2 kg

<b>System</b>	
Worst case total system weight	< 16 kg (Based on 3 m Isolated Mast, air terminal, 10 m of Isolated Downconductor and 2 x ALOF1GS mounting brackets).
Wind loading	ISOFRP mast withstand speed > 195 km/h. Wind loading on support mast under such conditions 120 kg

## ANNEX A: ISODUAL DUAL COUPLING

If the maximum cable limitations in **Table 4** can not be adhered to, then it is possible to use two parallel downconductors. The ISODUAL adapter allows a second isolated downconductor to be connected to the air terminal. The second ISODC Downconductor is mounted externally to the Isolated Mast and fixed with UV stable non conductive cable ties.

If the routes are symmetrical, are on opposing sides of the structure and connect to a common equipotential grounding system (e.g. counterpoise ring), then a  $k_C$  factor of 0.5 can be used, effectively doubling the permitted length compared to single conductor. Contact ERICO® for advice when this is not possible.

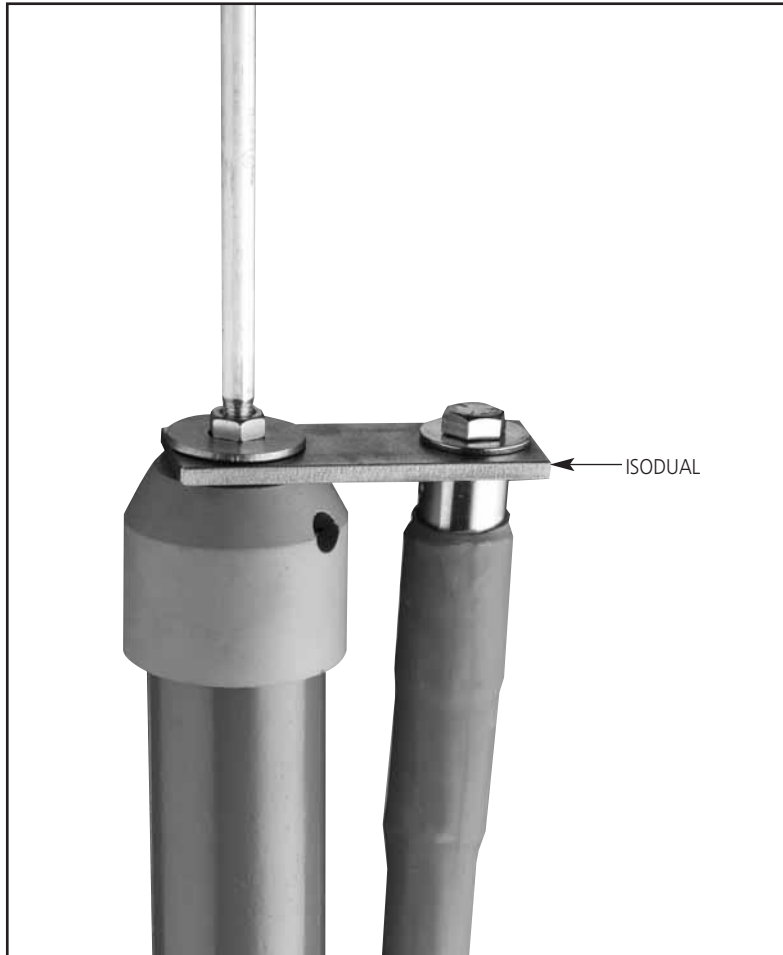


Figure 12. ISODUAL Dual Coupling.

# ANNEX B: ERITECH® SYSTEM 3000 MAST AND SUPPORT HARDWARE

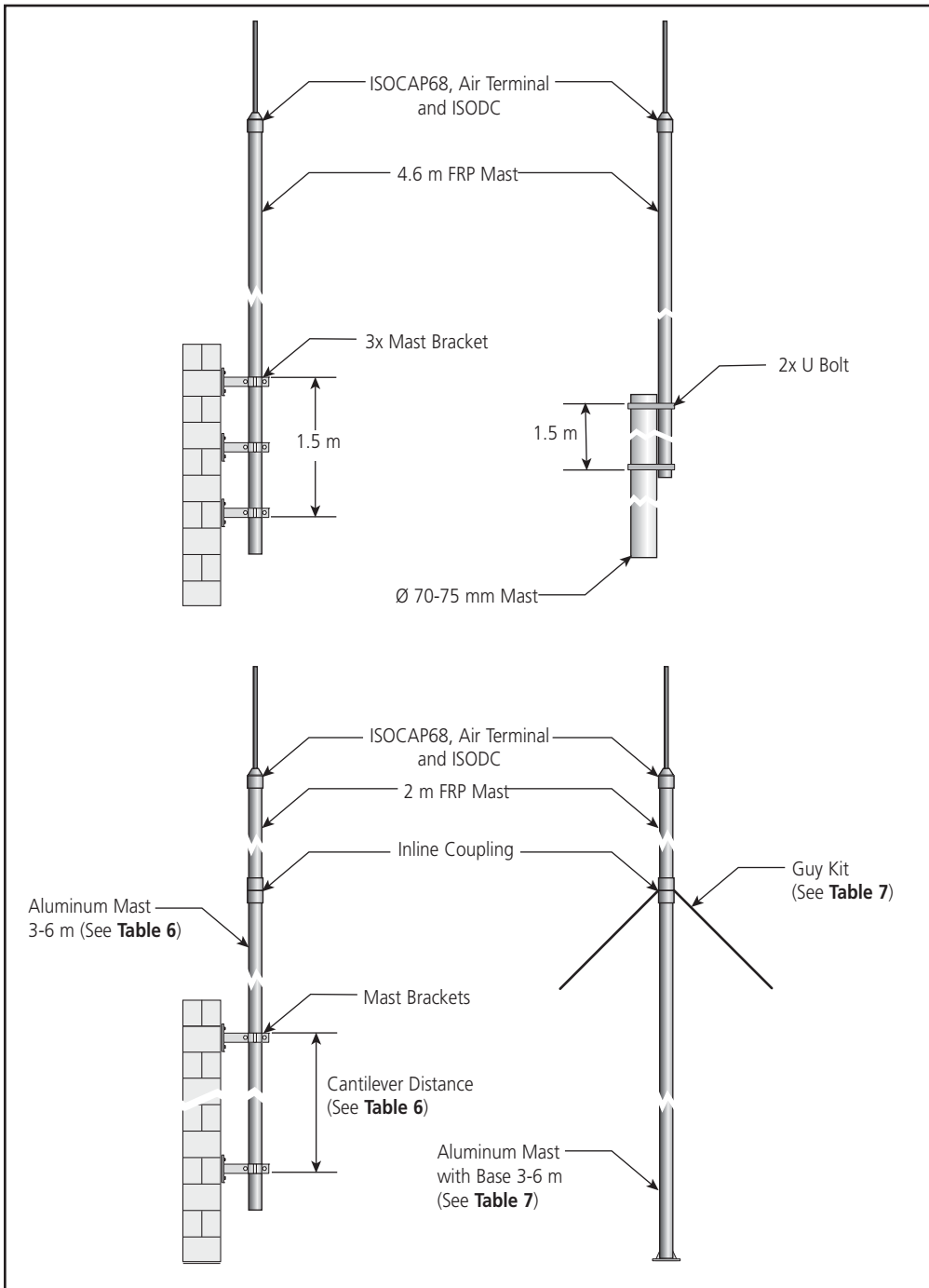


Figure 13. ISOCAP68.

Table 6. Cantilever Distance.

MAST	Cantilever Distance	# Mast Brackets
ALUM3M (3m)	1 m	3
ALUM4M (4m)	1 m	3
ALUM5M (5m)	1.5 m	3
ALUM6M (6m)	2 m	5

Table 7. Guy Kit.

MAST	Guy Kit
MBMAST3M (3m)	GUYKIT4MGRIP
MBMAST4M (4m)	GUYKIT4MGRIP
MBMAST5M (5m)	GUYKIT7MGRIP
MBMAST6M (6m)	GUYKIT7MGRIP

# ERICO®



[www.erico.com](http://www.erico.com)



## AUSTRALIA

6 Chilvers Road  
P.O. Box 148  
Thornleigh (Sydney) NSW 2120  
Australia  
Phone 61-2-9479-8500  
Fax 61-2-9484-9188



## GERMANY

Postfach 1147  
67709 Waldfishbach-Burgalben  
Germany  
Phone 0-800-189-0272  
Fax 0-800-189-0274



## POLAND

ul. Krzemieniecka 17  
54-613 Wrocław  
Poland  
Phone 48-71-374-40-22  
Fax 48-71-374-40-43



## BELGIUM

Postbus 33  
3110 Rotselaar  
Belgium  
Phone 32-14-69-96-88  
Fax 32-14-69-96-90



## HONG KONG

Unit 1, 2nd Floor, Block A  
Po Yip Building  
62-70 Texaco Road  
Tsuen Wan, New Territories  
Hong Kong  
Phone 852-2764-8808  
Fax 852-2764-4486



## SINGAPORE

Jurong Industrial Estate  
16 Wan Lee Road  
Singapore 627 946  
Phone 65-6-268-3433  
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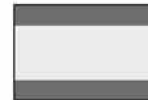
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R. Dom Pedro Henrique de Orleans  
E Braganca, 276  
Vila Jaguara  
São Paulo CEP 05117-000  
Brazil  
Phone 55-11-3621-4111  
Fax 55-11-3621-4066



## HUNGARY

P.f. 184  
1476 Budapest  
Hungary  
Phone 31-13-58-34-547  
Fax 31-13-58-35-499



## SPAIN

C/Provenza 288, Pral.  
08008 Barcelona  
Spain  
Phone 34-93-467-7726  
Fax 34-93-467-7725



## CANADA

P.O. Box 170  
Mississauga, Ontario  
Canada L5M 2B8  
Phone 1-800-677-9089  
Fax 1-800-677-8131



## INDONESIA

Sampoerna Strategic Square,  
Tower B 19th Fl.  
Jalan Jend. Sudirman Kav. 45-46  
Jakarta 12930  
Indonesia  
Phone 62-21-575-0941  
Fax 62-21-575-0942



## SWEDEN

Box 211  
201 22 Malmö  
Sweden  
Phone 46-40-611-13-60  
Fax 46-40-611-94-15



## CHILE

Alcantara 200, piso 6 Of. 17  
Las Condes, Santiago  
Chile  
Phone 56-2-370-2908  
Fax 56-2-370-2914



## ITALY

A&B Business Center  
Via Vallia 16, nr. 17  
20141 Milano  
Italy  
Phone 39-02-8474-2250  
Fax 39-02-8474-2251



## SWITZERLAND

Postfach 54  
3280 Murten  
Switzerland  
Phone 00-800-5000-1090  
Fax 00-800-6000-1090



## CHINA

Room 1204  
Tomson Commercial Building  
No. 710 Dongfang Road  
Pudong, Shanghai  
P.R. China 200122  
Phone 86-21-5081-3900  
Fax 86-21-5831-8177



## MEXICO

Melchor Ocampo 193  
Torre A piso 13  
Col. Veronica Anzures  
11300 Mexico D.F.  
Mexico  
Phone 52-55-5260-5991  
Fax 52-55-5260-3310



## THAILAND

No. 92/52 Sathorn Thani Tower 2  
18th Floor, Room #1804  
North Sathorn Road  
Silom, Bangkok, Bangkok 10500  
Thailand  
Phone 66-2-267-5776, 5777  
Fax 66-2-636-6988



## DENMARK

Box 211  
201 22 Malmö  
Sweden  
Phone 46-40-611-13-60  
Fax 46-40-611-94-15



## NETHERLANDS

Jules Verneweg 75  
5015 BG Tilburg  
Netherlands  
Phone 31-13-58-35-400  
Fax 31-13-58-35-499



## UNITED KINGDOM

52 Milford Road  
Reading, Berkshire RG1 8LJ  
United Kingdom  
Phone 44-118-955-0900  
Fax 44-118-955-0925



## FRANCE

rue Charles Dallière, BP 31  
42161 Andrezieux Bouthéon Cedex  
France  
Phone 33-4-77-36-54-32  
Fax 33-4-77-55-20-10



## NORWAY

Postboks 148  
1366 Lysaker  
Norway  
Phone 47-67-53-12-00  
Fax 47-67-12-42-68



## UNITED STATES

34600 Solon Road  
Solon, Ohio 44139  
U.S.A.  
Phone 1-440-248-0100  
Fax 1-440-248-0723