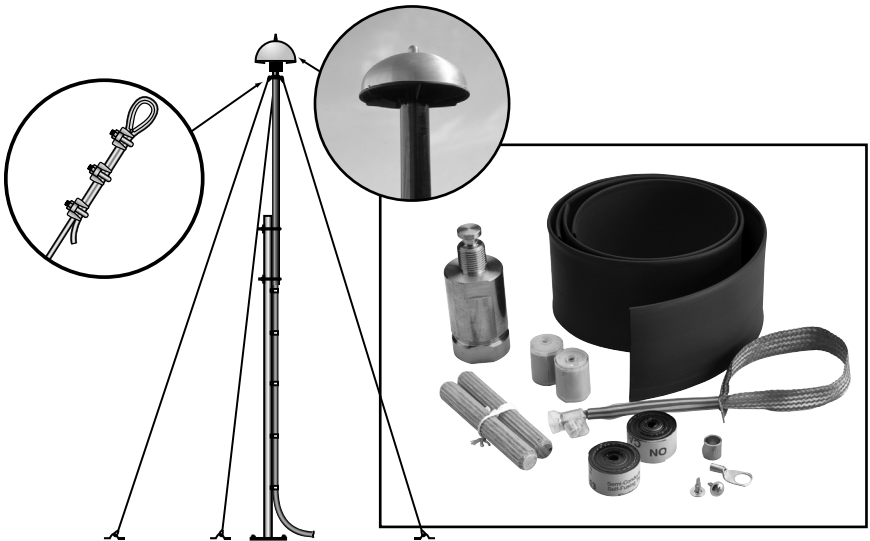




ERICO

nVent ERICO System 3000

Installation, Operation and Maintenance Manual



nVent ERICO System 3000 Installation, Operation and Maintenance Manual

EDITION 15

Due to ongoing research into the phenomena of lightning and lightning protection technology and product improvement, nVent ERICO reserves the right to alter any information and specifications contained herein at any time without notice. Installers of System 3000 should check that they have the latest edition. System 3000 is manufactured by nVent.



International patents on the System 3000 are existing and pending. System 3000 (or any other lightning protection system) does NOT offer 100% protection against all lightning events. However, correct installation is essential for the maximum level of safety.

Details of the System 3000 Lightning Protection System

System Owner: _____

Location: _____

Date Installed: _____

Installation Contractor: _____

Purchased From: _____

Signature of Installation Contractor: _____

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nVent ERICO System 3000

INSTALLATION, OPERATION AND MAINTENANCE MANUAL

Due to ongoing research into the phenomena of lightning and lightning protection technology and product improvement, nVent ERICO reserves the right to alter any information and specifications contained herein at any time without notice. Users should check with nVent ERICO to ensure they have the latest edition.

Lightning protection standards outline design or calculating methods, to place air terminals on structures. i.e. they calculate the attractive or protection radius of a particular air terminal in accordance with each particular design method, so that the air terminals can be manually positioned on structures to provide the best coverage. The common design methods for each of these standards are based on the Electro-Geometric Model.

The design method employed to position the System 3000 air terminals on the structure, the Collection Volume Method (CVM), is based on an improved Electro-Geometric Model. Similar to the rolling sphere or striking distance formulae used generally in lightning protection standards, the CVM employs additional lightning parameters in its striking distance formulae, namely electric field intensification factor, and structure height and physical shape. The formula in the CVM also takes into account such parameters as the velocity ratio of the lightning down-leader to up-leader streamers, humidity and the height above sea level.

As a system, the combination of the products and the placement method used in the design and installation of the nVent ERICO System 3000 does not comply with any particular standard. However, the actual components of the System 3000 are in full compliance with certain standards (in terms of lightning current handling ability, material of construction, etc). The Dynasphere air terminal is UL listed and complies with standard UL96, emphasizing the compliance to accept lightning current exposure.

Since system 3000 does not comply with any particular standard, it is important to follow the instructions published in the nVent ERICO System 3000 Installation, Operation and Maintenance Manual. nVent ERICO offers inspection services for system 3000 installations and can issue a Certificate of Installation Compliance for qualifying installations.

Warning and Safety Instructions

WARNING:

1. nVent ERICO products shall be installed and used only as indicated in nVent ERICO product instruction sheets and training materials. Instruction sheets are available at www.erico.com and from your nVent ERICO customer service representative.
2. nVent ERICO products must never be used for a purpose other than 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 nVent 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.

The nVent ERICO System 3000 is manufactured by nVent.

International patents on the nVent ERICO System 3000 are existing.

Local distributors should be the user's first point of contact with supply, delivery, installation, limited warranty and checking of the system for compliance with manufacturer's instructions.

Pre-Installation Requirements

This manual is a guide to the installation, operation and maintenance of the nVent ERICO System 3000 Lightning Protection System.

It assumes that the system to be installed has been designed by an authorized nVent ERICO representative. The system design will include:

- Grounding system designed as a result of soil resistivity analysis.
- Downconductor routes chosen to avoid other services, maintain minimum bending radii and minimize downconductor run length.
- Downconductor securing requirements..
- Terminal types – operating environment.
- CAD software design report which determines terminal placement, mast & height requirements as well as protection level calculations.

All of the above are recommendations for a successful installation. If there is any doubt about any of the points mentioned, please contact nVent ERICO or your nearest distributor for clarification.

CHECKING LIGHTNING PROTECTION COMPONENTS PRIOR TO INSTALLATION

Before installation, perform following inspection:

Terminal(s)

- nVent ERICO Dynasphere terminals have not been dented.
- The correct finial tip has been installed, based on the overall height of the air terminal above grade.

nVent ERICO Ericore downconductor(s)

- The cable drum (if supplied) is in a serviceable condition.
- Correct length(s).
- That there is no obvious damage to the cable.
- Make sure that the end of cable is properly sealed to prevent moisture migrating into cable strands.
- Is terminated as required. If the downconductor has been preterminated before shipment, check that the termination is still intact and in good order. See note on Page 14 on removing protective covers.
- If the Upper Termination Kit has been supplied separately, check that the cold-shrink tube in the kit is in good order, has no tears or cuts and has not collapsed.
- Applications engineering does not recommend field installations of upper terminations unless the operators are trained by nVent Applications Engineering.

This information along with downconductor lengths and quantities (if more than one length on the one drum), will be printed on a label on the side of the cable drum(s).

nVent ERICO System 3000 Installation

During the installation of the System 3000, all site restrictions and safety requirements must be followed.

The recommended order of installation is as follows:

1. Full installation of the grounding system
2. Full installation of the downconductor
3. Termination of the downconductor to the grounding system
4. Construction of the mast, insertion of the upper termination into the FRP mast and connection to the nVent ERICO Dynasphere air terminal
5. Termination of bonding cable from upper termination to structure is required to be grounded (refer to Downconductors section of the manual on page 13)
6. Raise mast into position and secure

GROUNDING SYSTEMS

Pre-Installation



Prior to the installation of the lightning protection grounding systems, it is important to refer to site drawings of all underground services to ensure that these are avoided and not interrupted during trenching, excavation, boring or driving ground rods, (see Figures 1, 2, 3 and 4).

Care must be taken to follow the ground survey design. Ensure the correct materials have been provided and are used to achieve an acceptable Ground DC resistance (typically $<10\Omega$).

The grounding system is critical to the integrity of any lightning protection installation and should include consideration of:

- Latest Revisions of Standards compliance: (IEC 62305-1, BS EN 61068-1, SAA AS/NZS 1768, NFPA® 780, CSA C22.1, NEC® etc.) and also any local standards and Codes in accordance with authorities having jurisdiction.
- Available space / location.
- Natural soil conditions including resistivity, moisture, temperature, and chemical content.
- Location of underground services - Power, Communications, Fuel, Gas, Water, etc.
- Use of suitable grounding rods such as nVent ERICO rods.

Contact nVent ERICO customer service, or Distributor, if you require additional assistance.

Figures 1 and 2 represent examples of recommended stand alone grounding systems, or minimum grounding system requirements for each ERICORE down-conductor. It is required to have minimum of two down conductors, when conventional conductors are used. Figure 3 represents the

minimum grounding system requirement or each conventional downconductor.

Where other grounding systems are present, a minimum of one copper-bonded ground rod (3/4 in diameter x 10 ft length) bonded to the existing system is required.

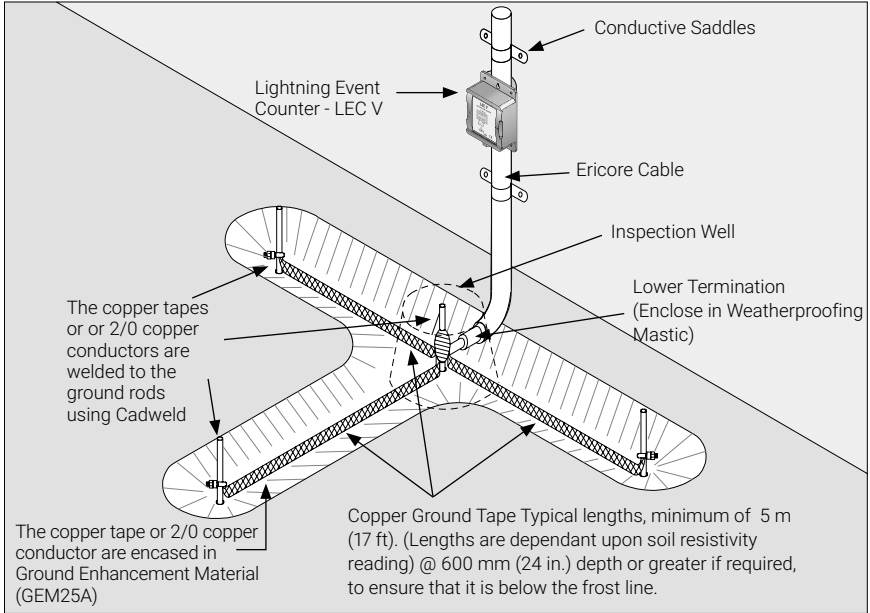


Figure 1: Radial ground

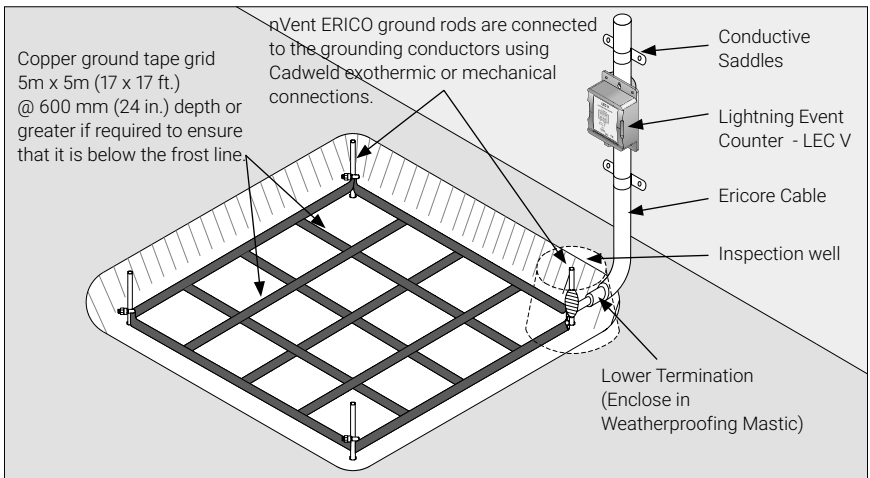


Figure 2: Grid ground

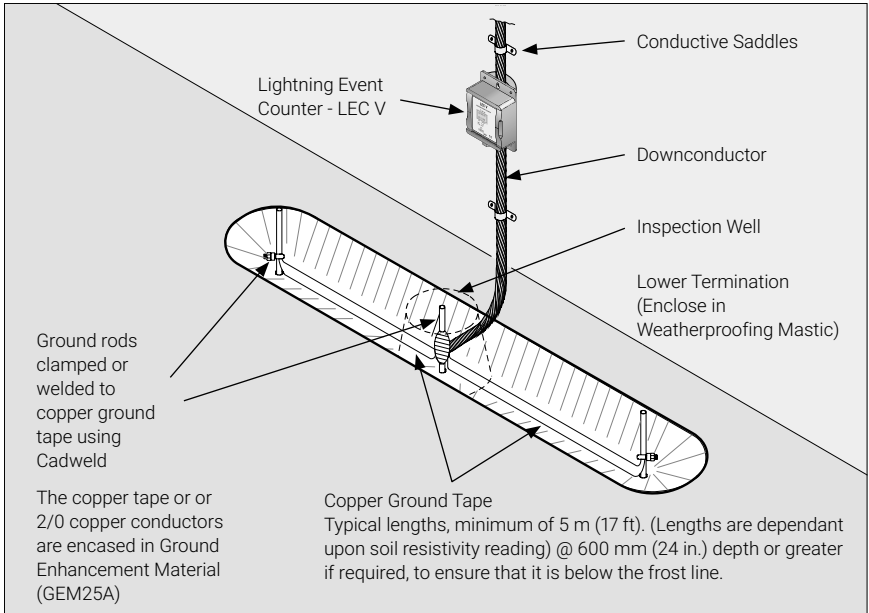


Figure 3: Radial ground

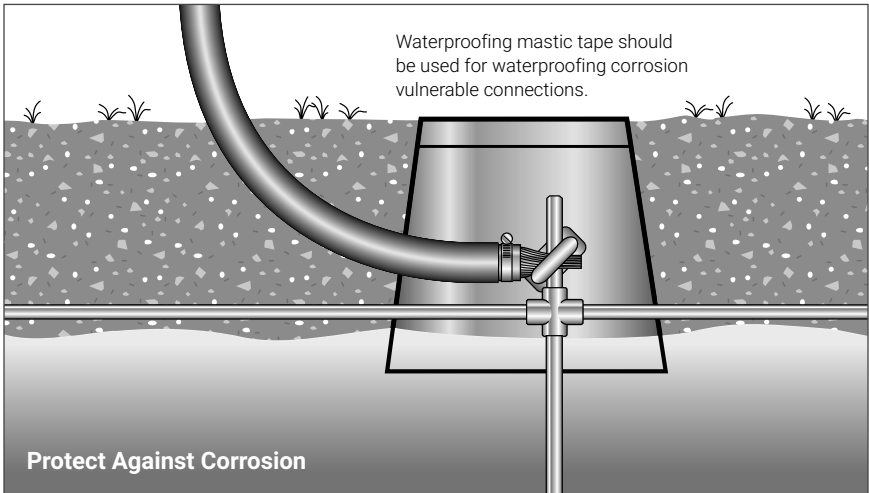


Figure 4: Precautions required for Inspection Well excavation and lower termination corrosion protection

It is advised that an Inspection Well is installed where the end of the downconductor terminates to the grounding system.

This provides a convenient access point for disconnection and future testing.

When driving ground rods it is advisable to use nVent ERICO ground rod drivers or drive sleeves to prevent mushrooming on the top of the rod. When coupling rods, use compression type ground rod couplers.

When bonding the grounding system components, use the recommended methods suggested below:

- nVent ERICO Cadweld connections should be used for all below grade connections. Cadweld connections provide permanent electrical bonding, corrosion resistance and mechanical strength between conductors, including most types of copper cable, bar, rod, tape, structural steel work, reinforcing steel and pipe.
- Supplied ground rod clamps should be used for termination of Ericore downconductors directly to ground rods. This allows later disconnection for maintenance requirements.
- Use of aluminum lugs or couplings is prohibited.
- Supplied waterproofing mastic tape should be used for waterproofing corrosion vulnerable connections and must be used in all Ericore to ground rod connections.

Ground Resistance Lowering Compounds

Ground enhancement material, nVent ERICO PN GEM25A, is recommended and supplied when the existing soil mass has a high resistivity.

GEM25A can be used to increase the total surface area of grounding conductors, thereby reducing the ground resistance / impedance.

GEM25A requires water and a mixing container. Follow the installation instructions printed on the bag or bucket provided.

Insulation of Grounding Systems

In some installations, it may be necessary to insulate part of the ground system from an area of the surface, for the purposes of safety or isolation (pedestrian walkways, proximity to other services, etc.). In this situation, it is recommended that a minimum of 70 mm² (2/0 AWG), insulated copper cable is run in PVC conduit to the connection point (start) of the intended ground system. This conduit should be at a depth of at least 600 mm (24 in.), or greater if required, to ensure that it is below the frost line to the start of the intended ground system (see Figure 5).

Bonding the Lightning Protection Ground to Other Service Grounds

Where separate grounds exist and the structures have mutual electrical connections e.g.: Structure, Power, Signal, Communications and Lightning Protection, they should be bonded together to form an equipotential ground plane. This will eliminate the possibility of ground loops and potential differences that arise under transient conditions.

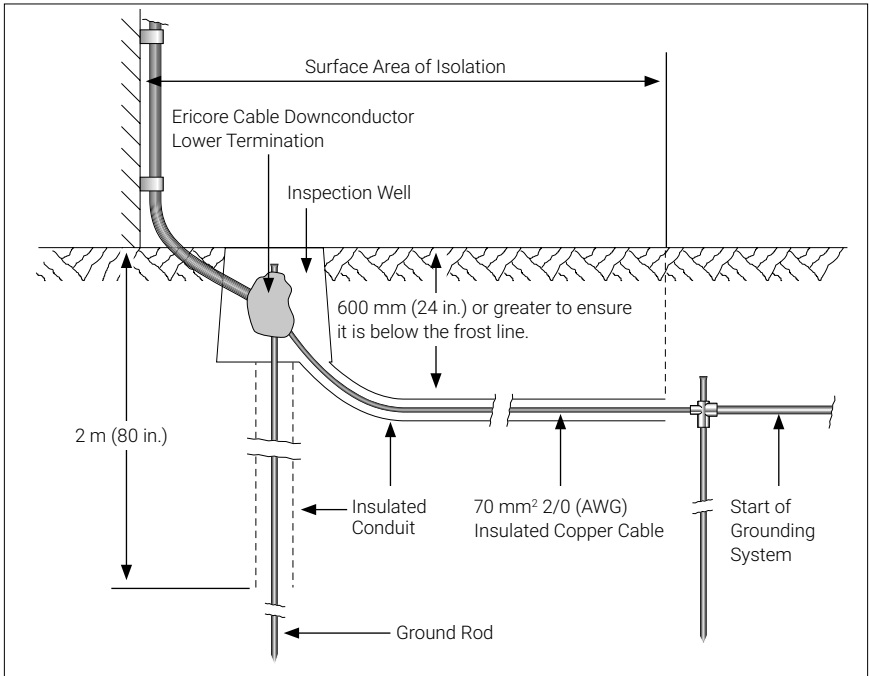


Figure 5: Various methods of isolating the ground system

Authorization may be required by the particular service providers before bonding of these grounds takes place. The size of the bonding cable depends on local standards, but should be at least 70 mm^2 (2/0 AWG) or larger.

In some circumstances, it may be necessary to use a Potential Equalization Clamp (PEC100) which effectively bonds all grounds to the same potential under transient conditions, to satisfy service providers.

Conductor to Grounding System Connection

When determining the length of nVent ERICO Ericore conductor required in a particular situation it is prudent to make the

connection to the grounding system at the first available opportunity. The practice of running nVent ERICO Ericore downconductor for long horizontal lengths at the ground level to reach a designated earth point is discouraged. Instead, a lower termination should be made to a ground rod upon reaching the ground level. Then a separate length of conventional grounding conductor should be connected from the ground rod to other earthing points as required.

Labelling

The labelling of Inspection Wells or grounding systems to local requirements is the responsibility of the customer / installer.

ERICORE DOWNCONDUCTOR



The nVent ERICO Ericore downconductor or other recommended downconductor, route, length and any pre-terminations should have been selected during the design stage.



Depending on site requirements, the downconductor(s) may have their upper terminations completed at a pre-specified end of the cable by nVent ERICO before shipment. These terminations will be protected by a short length of flexible PVC tube.

It is VERY IMPORTANT that when removing these tubes, they are not removed with a knife or cut in any way as this will damage the outer layer of the termination. e.g. It is suggested that the tape and cover are best removed by hand. (See Figure 6)

All nVent ERICO Ericore purpose-designed downconductors have a semi-conductive outer sheath which is approximately 2 mm (0.08 in.) thick. Rough or careless handling of the downconductor can damage this sheath and compromise its performance.

Downconductor Hauling

Locate the downconductor cable drum at the appropriate location (refer to Figure 6).

When hauling the downconductor, use the following guide points:

- Ensure that the cable drum, if supplied, is in a serviceable condition.
- If the downconductor has been upper terminated on the outside of the drum, then the downconductor must be hauled off the drum from the ground.
- If the downconductor has been upper terminated on the inside of the drum, then the drum must be at or near the top of the structure, so that the downconductor can be unwound from the drum towards the grade (see Figure 6).
- When using slings or ropes to haul downconductors, use MULTIPLE hitches around the cable.
- DO NOT sling from the termination coupling or cold-shrink section of the terminated downconductor.
- DO NOT use cable stockings over terminated downconductor ends.
- Protect the downconductor from abrasion and tearing when hauling over rough surfaces, at all times, especially around corners or through penetrations.

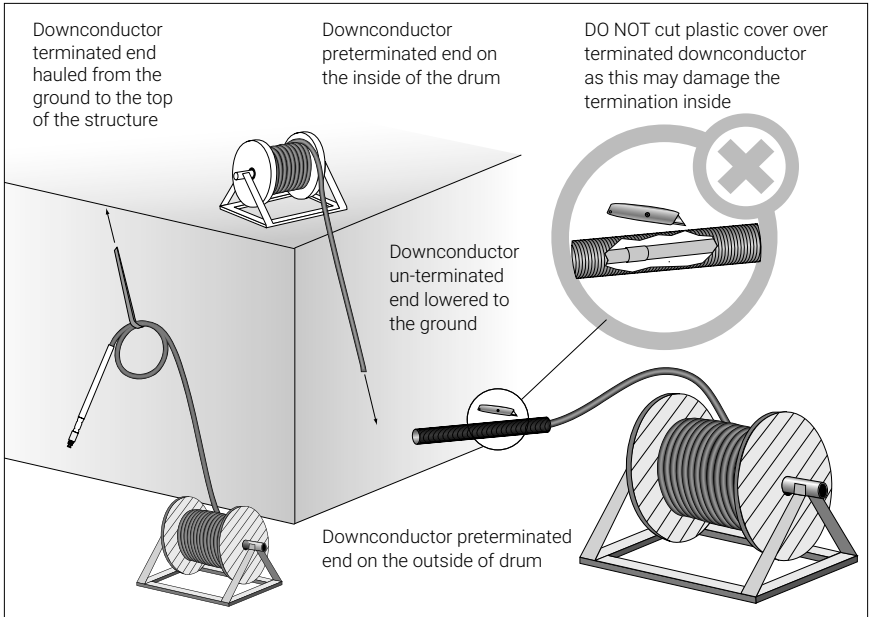


Figure 6: Cable pre-termination and drum locations

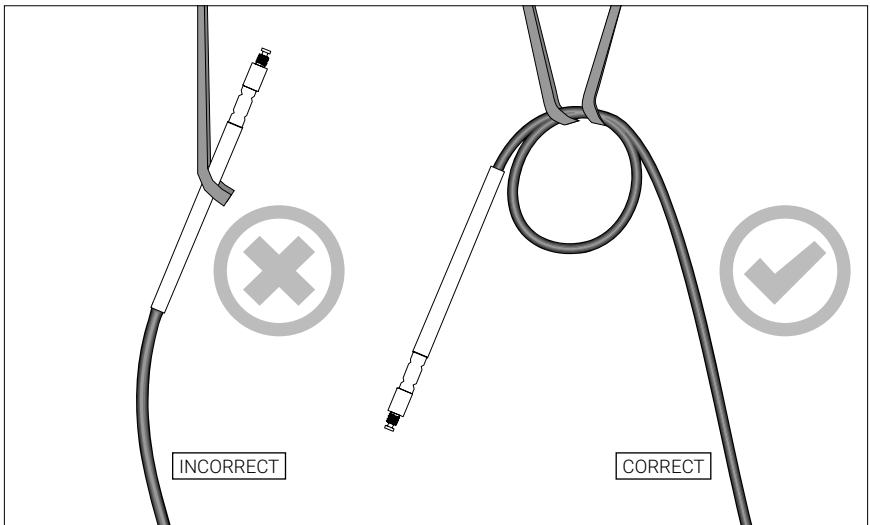


Figure 7: Incorrect and correct cable hoisting methods

Penetrations

Before routing the downconductor through any penetrations, ensure that:

- If un-terminated, the hole is a minimum of 50 mm (2 in.) in diameter.
- If terminated, the hole is a minimum of 60 mm (2 3/8 in) in diameter.
- The hole must be smooth and without sharp edges.
- A max of 2 m (6 ft) of non-conductive conduit can be used, to protect the Ericore cable from damage, when routed through concrete or masonry opening.
- A max of 1 m (3 ft) of non-conductive conduit can be used over any part of the top 10% of the cable length.
- **Ferro-magnetic conduit is never used.**

If either side of the penetration requires environmental protection i.e.: waterproofing, air-con pressure seal etc., use a standard professional method of protection.

Routing



The route taken by the downconductor is very important and must follow these rules:

- Carefully survey the intended route of the downconductor immediately prior to the installation to check for any alterations that may effect the original design, i.e.: structural changes, new antenna or mast installations, air conditioning towers or ducting, etc.
- Use the most direct route practical to minimize the downconductor length.
- To minimize the risk of side-flash, DO NOT route the downconductor back beside itself after change of direction, i.e.: 180°.
- Minimize the number of bends.
- Minimize the strain on the downconductor during installation.
- The Ericore cable must be installed in a downward fashion.

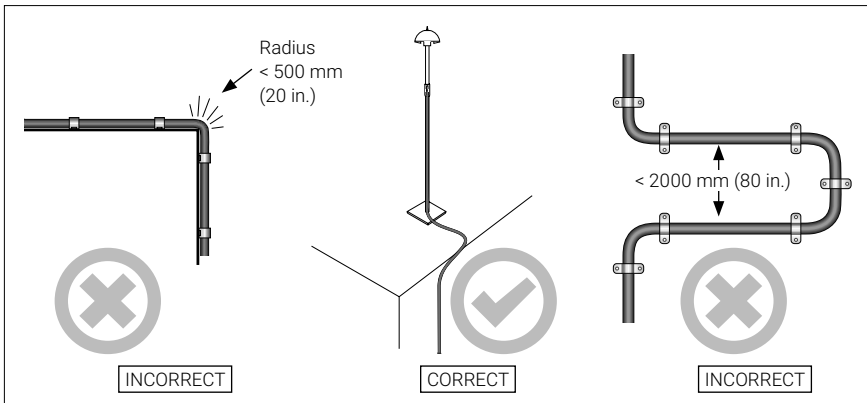


Figure 8: Correct & incorrect cable routing methods

- Ensure that a minimum bend radius of >500 mm (20 in.) is maintained.
 - Parallel routing with other services - Minimum separation = 2 m (80 in.). Try to isolate as much as possible from other services.
 - If the downconductor must cross other services, ensure that it crosses at right angles to minimize any inductive effect.
 - The lower end of the Ericore cable must terminate to a grounding system.
 - Allow 500 mm (20 in.) of slack in the length of downconductor at the upper end of the cable to facilitate mast erection and correct seating of the nVent ERICO Dynasphere terminal in the top of the FRP mast.
- Where isolation of the downconductor is required (for physical or proximity safety reasons) install the cable in a suitable insulating conduit with a minimum wall thickness of 3 mm ($\frac{1}{8}$ in.).
- NOTE: This is the only time that the downconductor should be isolated from the structure and generally only for 2 m (6 ft.) maximum.

DO NOT route the entire length of downconductor in insulated conduit. Conduit made from ferro-magnetic material must not be used.

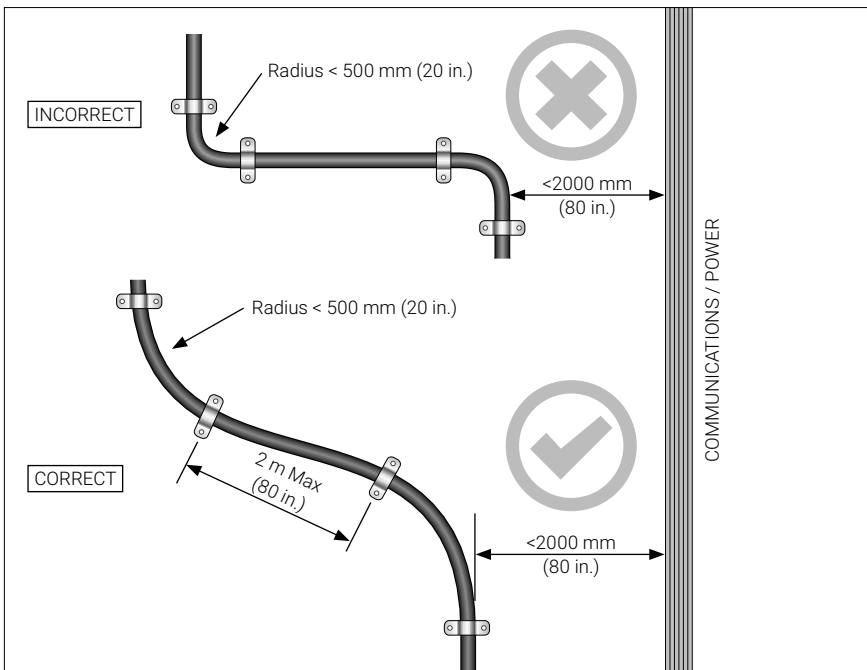




Figure 9: Correct & incorrect cable routing

- To seat the terminal correctly in the top of the FRP mast, any cable slack will have to be removed from the mast while also minimizing any stress on the upper termination sheds (flanges) by twisting the FRP mast against the terminal for at least one turn.


 If the downconductor is damaged during installation, it is no longer usable and must be replaced.


Securing the Downconductor

 Securing of the downconductor not only provides a mechanical attachment to the structure, but also an electro-static connection to the structure via the semiconductive outer sheath of the downconductor cable.

It is important that the downconductor is both physically and electrically secured to the entire length of the structure to relieve both physical and electrical stresses along the downconductors' length.

The electrical bonding of the downconductor is especially important for at least the first 10% of the downconductor route from the upper termination, and for this reason the downconductor must be secured at least every 1 m (40 in.). Roof penetrations are acceptable within the first 10% of the downconductor route.

 nVent ERICO brand of saddles and conductive clamps are recommended for the purpose of securing the downconductor. These have been specifically designed and manufactured to mechanically secure and electrically bond the nVent ERICO Ericore to the structure, while minimizing stress points on the cable.

 Only use nVent ERICO provided clamps. Use of an alternative brand of saddle can compromise the outer sheath, creating high stress points which can lead to flashover (see Figure 10).

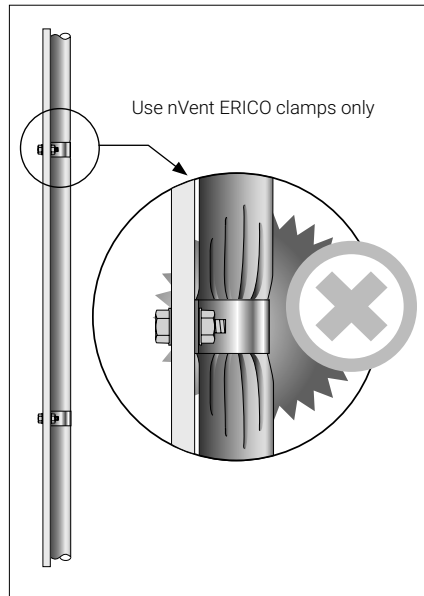


Figure 10: Detail shows the need to use nVent ERICO clamps

- For brick and concrete walls or roofs, use the nVent ERICO brand of stainless steel saddles. These have two 6 mm (¼ in.) diameter holes on either side and are suitable for use with masonry anchors. These saddles can also be used with other suitable fastenings against wood, fiberglass and metallic surfaces.
- When securing externally to round section structures such as pipes, tower legs, masts etc. stainless steel cable ties are recommended. Ensure that these are firmly secured.
- For securing to other structures such as angle iron i.e.: radio towers, structural beams etc., use nVent CADDY brand of beam clamps and suitable cable clamps from nVent ERICO.
- If the downconductor is to be routed above a false ceiling, ensure that it is fixed to the underside of the concrete floor slab using stainless steel saddles.
- Use of exothermic fastening methods on nVent ERICO brand of saddles is NOT recommended.
- Use of nVent CADDY ERISTRUT (or other similar strut system) is recommended where suitable (see Figure 11).

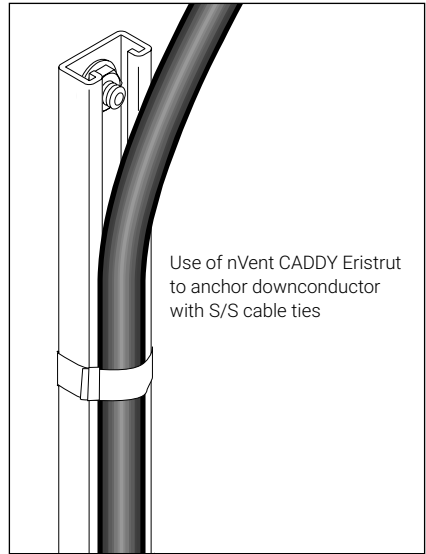


Figure 11: Downconductor anchored to strut

Do not use strap that will damage the semiconductive jacket of the cable.

Labelling

VITAL WARNING LABELS must be located at eye level and on at least one of these locations:

- Where there is the possibility of personnel being in close proximity to the cable
- Where the downconductor terminates to the grounding system
- At the mast base

There is a VITAL WARNING LABEL supplied in each of the upper and lower termination kits.

If more labels are required, contact your nearest nVent ERICO Distributor.

Structure Bonding Braid

To ensure that the upper end of the downconductor can be adequately electrically bonded to the structure, a Structure Bonding Braid has been provided at the base of the upper termination of the downconductor. This braid is a 75 mm (3 in.) tail which exits from under the termination heatshrink and is supplied with a connector to allow connection to a 6 mm² (8 AWG) copper cable (as mentioned in the following text). This must be connected to a conductive structural point to relieve the electrical stresses on the downconductor and masonry surfaces.



The use of the Structure Bonding Braid is NOT optional, and MUST always be used.

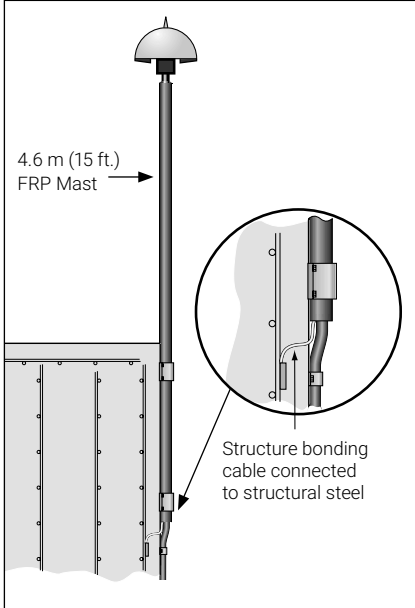


Figure 12(a): Cantilevered FRP section on building

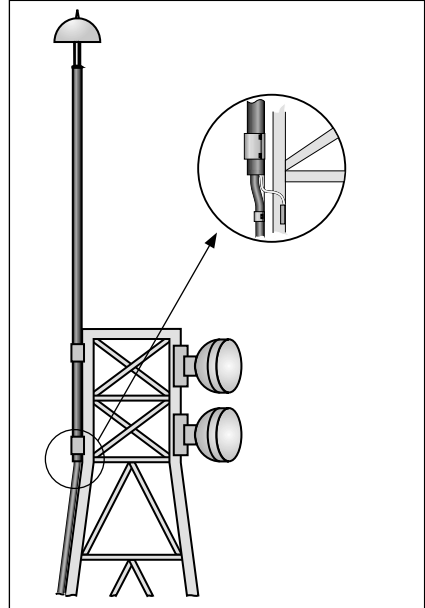


Figure 12(b): Cantilevered FRP section on radio tower



After routing the downconductor, it must be kept in constant physical contact with the structure via conductive fixings as follows:

For the top 10% of the downconductor:

- The downconductor from the terminal must be secured at least every 1 m (40 in.). This includes metallic mast sections.
- Installing the downconductor through ferromagnetic raceways, pipes, and conduits is not recommended.

For the lower 90% of the downconductor:

- The downconductor must be secured at least every 2 m (80 in.). This includes routing inside any type of pipe or conduit.
- The length of the downconductor through non-ferromagnetic raceways, pipes, and conduits should not exceed 2 m (80 in).
- Installing the downconductor through ferromagnetic raceways, pipes, and conduits is not recommended.



When using metallic lower sections of mast (i.e.: aluminum), then the downconductor **MUST** be secured with nVent ERICO brand of saddles to the mast at 1 m (40 in.) intervals (max.). The mast in turn must be electrically bonded to the nearest conductive structural point. In this case, the structure bonding braid must connect to the inline coupling (see Fig. 13).

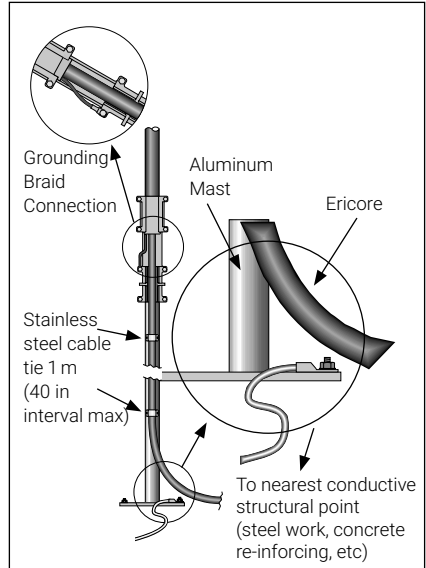


Figure 13: Connection of structure bonding braid in FRP and metallic masts

The 6 mm² (8 AWG) copper cable used to connect the structure bonding braid to the structure must be one continuous length. Joints in this cable would represent a potential maintenance issue.

Any metallic surfaces that the downconductor may be secured to, if possible, should be electrically connected to the structural steel work.

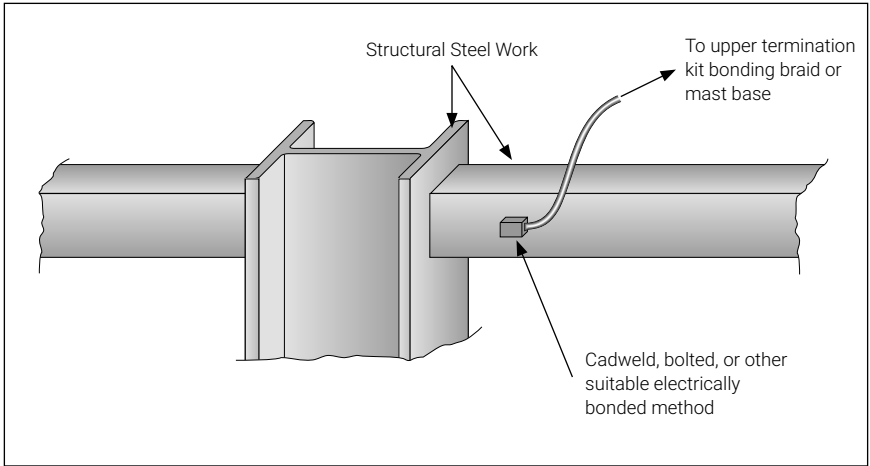


Figure 14: Connection of bonding cable to structural steel work

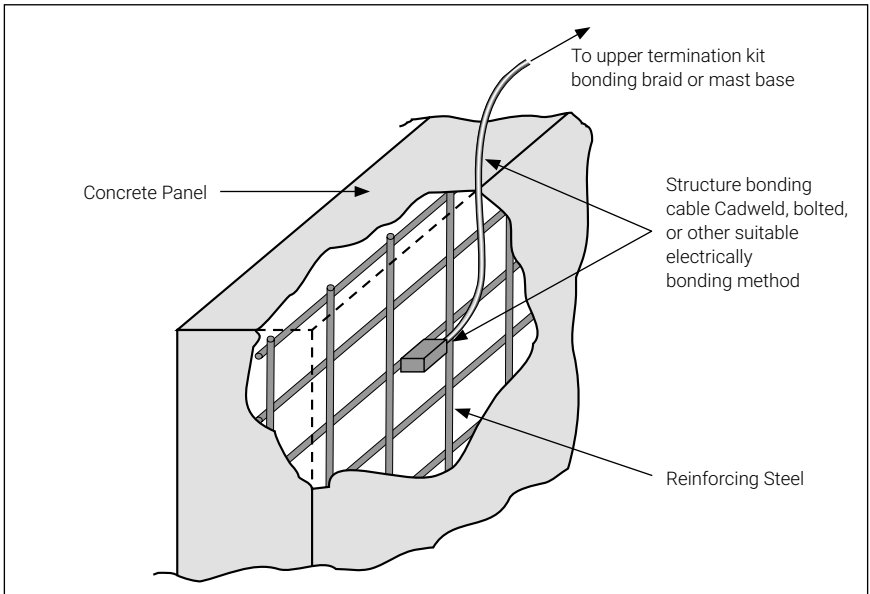


Figure 15: Connection of bonding cable to concrete reinforcing

TERMINALS AND MASTS

nVent ERICO Dynasphere Terminal

The nVent ERICO Dynasphere is the air terminal of the nVent ERICO System 3000.

Suitable for use in:

- General purpose applications
- Temperatures of up to 100°C (212°F)
- Corrosive environments (salt or acid atmosphere)

Warning – Do not install the nVent ERICO Dynasphere without installing the correct finial tip.

Ensure the air terminal is supplied with the finial tip secured in place. There are three different finial tip configurations (two separate, and one secured in place), similar to that shown in Figure 16. It is important that the correct finial tip is installed, specific to the application height. Figure 17 shows the three different finial tip sizes, ranging from sharp to blunt in dimension. The sharp tip (middle), medium tip (left) and rounded tip (right). The application of each of these tips is detailed below:

- Sharp Tip – Terminal heights less than 20 m (65 ft.)
- Medium Tip – Terminal heights less than 50 m (165 ft.), greater than 20 m (65 ft.)
- Rounded Tip – Terminal heights greater than 50 m (165 ft.)

Note: heights listed refer to the actual terminal height above ground level

If required, replace the finial tip supplied with the appropriate tip for the application, and tighten firmly.

Once the terminal has been checked and found to be in an acceptable condition



Figure 16 – nVent ERICO Dynasphere with two spare finial tips.



Figure 17 – Three (3) nVent ERICO Dynasphere finial tip sizes.

for installation, it can be attached to the terminated downconductor as shown in the Upper Termination instructions (IP8519 found at www.ericom.com).

Please note and record, the serial number of each unit. The serial number is required for any certificate of compliance upon request.

Masts

The selected mast configuration chosen must:

- Elevate the terminal to the required height as determined by the design process (minimum height of 3 m (10 ft.) above the highest point of the structure)
- Include a minimum of 2 m (80 in.) of insulated mast material (FRP) immediately below the air terminal
- Be suitably rated for local weather conditions. It is advisable that guidance from a local civil engineer be sought
- Be securely attached to the selected mounting point(s)
- Be guyed if applicable

Mast Wind Loading

- nVent ERICO does not warrant the installation of the nVent ERICO System 3000, only the components.
- All installations approved by nVent ERICO Engineering are listed in nVent ERICO Lightning Protection Mast Wind Ratings Manuals, one for North America and one for worldwide use.
- Mast installations that do not meet the installation prints included in the nVent ERICO Mast Wind Loading Ratings Manual, automatically voids the product warranty.
- Based on these manuals, nVent ERICO Engineering can provide forces exerted on the brackets and guy wires, by certain maximum wind speeds. This information helps the structural engineer to select the proper hardware to support the installation.
- nVent ERICO documented wind load ratings are available upon request



If the lower section of the mast is conductive, i.e. aluminum or galvanized iron, then:

- It must be electrically bonded to the nearest conductive structural point. This may be either structural steel work or concrete reinforcing. Refer to page 20 for details.
- The downconductor must be secured to the mast at 1 m (40 in.) intervals (max.).

Three basic types of mast configuration include:

Guyed

Single length guyed - one section of FRP (Fiberglass Reinforced Plastic) mast material guyed at the top.

Cantilevered

Used in situations where it is more practical to mount without a base, eg: radio towers or the sides of buildings.

One third of the lower mast should be secured against the structure. Detailed installation sheets are available at www.ericom.com

nVent ERICO offers a custom steel mast where guying is not possible

Freestanding

Often used where the terminal, downconductor and grounding system are isolated from volatile areas by installing the nVent ERICO System 3000 at least 5 m (17 ft.) away from those areas.

The free standing mast requirements for foundations and erections are generally handled by the mast manufacturers .

Mast Bases

nVent ERICO supplies two types of aluminum bases to suit:

- nVent ERICO brand of FRP masts (aluminum base with an internal mast spigot)
- Aluminum masts (welded directly onto the required length of mast)

Both base types have downconductor exit holes in the base, required if the downconductor is to be routed inside of the mast. They also have identical mounting hole dimensions which are shown (Figure 18).

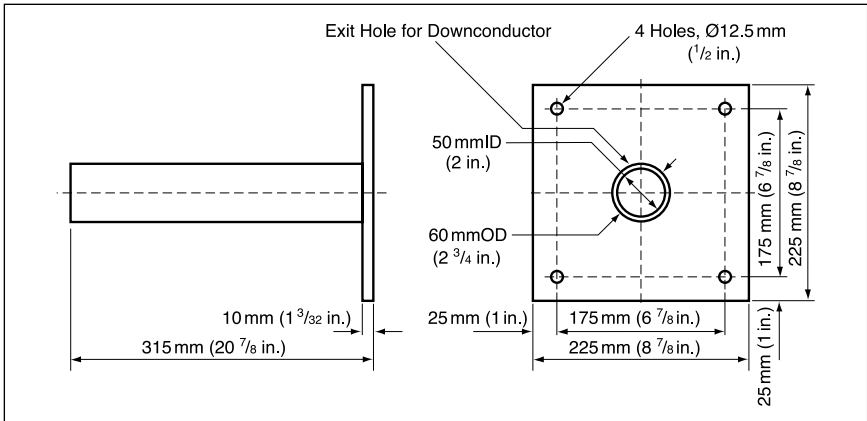





Figure 18: Base and mounting dimensions

 If an aluminum mast and base are used and can not be directly attached to the structural steel work, or are anchored to a concrete roof, then they need to be directly electrically bonded to the closest structural steel work or conductive structural point. Refer to page 20.

Mast Couplings and Guying Points

The inline coupling is designed to fit between upper portion of the aluminum mast and lower portion of the FRP mast. It provides three guying anchor points and a downconductor exit point. The maximum mast diameter that the inline coupling is able to clamp onto is 70 mm (2 7/8 in.) OD.

 On both U-bolt connectors and in line couplers, the maximum torque is 55 kg-cm (45 in-lb.).

 **IMPORTANT** – To maintain the necessary clearance between the nVent ERICO Dynasphere air terminal and the top of the mast, the FRP mast must protrude at least 1400 mm above the top of the structure. The following shows the required positioning dimensions for the two available FRP mast sizes.

2 meter FRP Mast

Overlap with structure = 600 mm (24 in.)
 Protrusion above structure = 1400 mm (55 in.)

4.6 meter FRP Mast

Overlap with structure = 1.5 m (59 in.)
 Protrusion above structure = 3.1 m (122 in.)

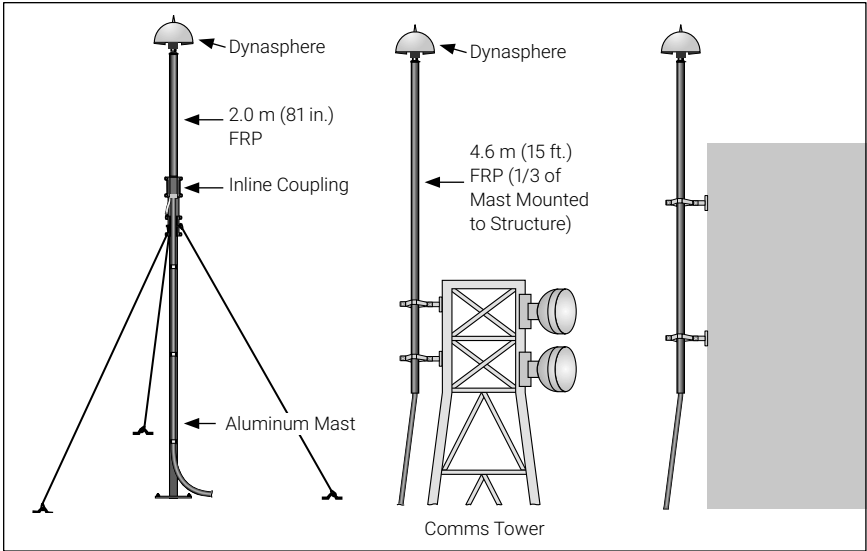


Figure 19: Guyed and cantilevered mast examples

Guying

nVent ERICO has standard 4 m (13 ½ ft.) and 7 m (24 ½ ft.) guying kits. If the guying of a fiberglass mast is required, then the appropriate guying kit should be selected to suit the application. The guying material is made up of light weight plastic coated fiberglass, which is non-conductive.

If a customized guy kit has been supplied, then the actual guy length can be determined from the following:

$$\text{Guy Length} = 1.41 X$$

Where X = the vertical height between the upper and lower guying points and the assumed angle from horizontal is 45°.

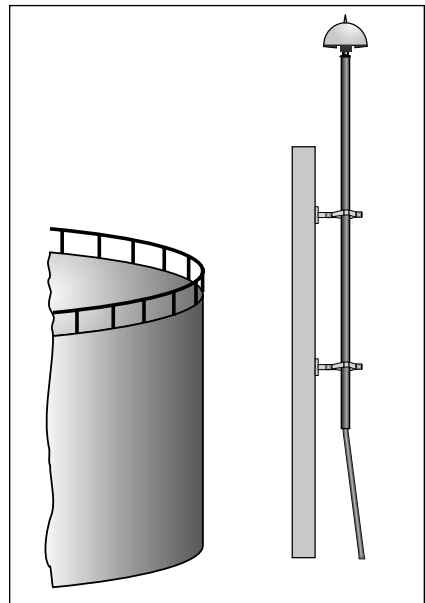


Figure 20: Single structure cantilevered mast example



Important recommendations:

- When guying any mast, it is advisable that the guying angle be no greater than 60° from horizontal.
- It is recommended that 8 mm (5/16 in.) diameter stainless steel guying saddles are used for the base guy anchor points. If these are to be anchored to a concrete surface, then 6 mm (1/4 in.) diameter x 40 mm (1 5/8 in.) depth (minimum) masonry anchors or similar should be used.
- nVent ERICO can provide wind load ratings per mast type to the structural engineer.
- Each of the guying kits comes with six stainless steel thimbles to relieve stress on the guys at the anchor points. These thimbles **MUST** be used when guying, (see Figure 21).
- When using shackles (5 mm (3/16 in.) minimum), ensure that the shackle pins are secured with nichrome wire.

When securing the fiberglass guys, use the guying grips supplied in the guying kit, carefully following the instructions provided. Use of alternative wire rope grips is acceptable but ensure that:

- Grips are made of a suitable material to PREVENT corrosion.
- There are a minimum of 3 grips per guy end.
- Grips are spaced at a minimum of 30 mm (1 1/4 in.) on guys (or 6 x guy diameter).
- Grips are correctly orientated - grip base (saddle) on the 'live' side of the guy and 'U-bolt' over the 'dead' side or tail of the guy.
- No more than 60 cN-m (5 lbf-in.) of torque is applied to the grip.

The above recommendations should also be used for any other guying, i.e.: stainless steel, when used on any mast.

Guy Kit Specifications

Guying Kit	Guy Diameter	Actual Guy Length	Guy Tensile Strength
4 m Guy Kit	4 mm - 5/32 in.	6 m - 20 1/2 ft.	430 Kg - 946 lb
7 m Guy Kit	5 mm - 3/16 in.	10 m - 34 ft.	560 Kg - 1232 lb

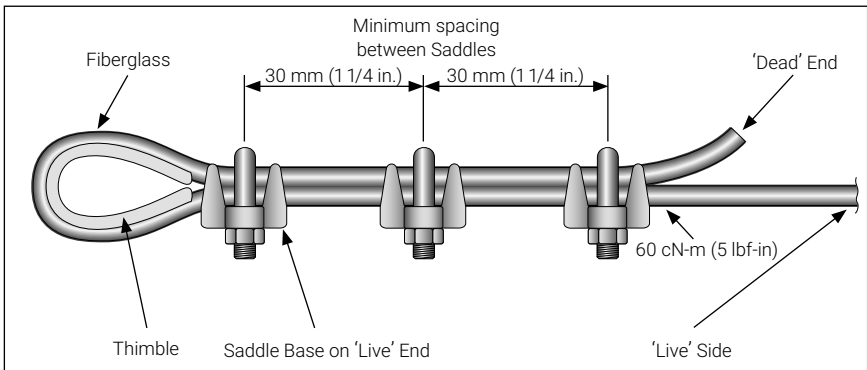


Figure 21: Correct methods of guying

Raising of Mast

When ready to raise the mast, check the following:

- Guys to the inline coupling, guying ring or other mast anchor points are properly secured.
- Ensure the guys are not twisted, kinked or damaged in any way.
- Ensure that each guy can be easily secured at the anchors when the mast has been raised.

Turnbuckles or rigging screws are recommended at the base anchor points of the guys to enable easy vertical alignment of the mast and correct tensioning of the guys. If using turn-buckles, ensure that they are wired securely with nichrome wire.

Using conductive guying, such as stainless steel, is acceptable as long as it is NOT used for guying to the top of sections of insulated FRP mast. Guying to the top of an aluminum section of mast is acceptable.


Remember to always plan the lift before attempting it.

If the mast is to be raised by hand, ensure that it can be safely and easily managed manually.

It is recommended that the use of a crane or other suitable equipment be used for anything over 6 m (20 ft.) in height, or for hazardous area installations such as high elevations (towers).

To minimize the possibility of the mast becoming bent or damaged, it is very important to keep the mast straight during the lift.

Ensure that:

-  There are no overhead AC power lines.
- There is nothing overhead that will obstruct the lift.
- There is enough man-power available to safely conduct the lift.
- There is only ONE person in control of the lift.
- Everyone involved in the lift knows what has been planned and how the lift is to be performed.
- The mast is securely footed and cannot move out of control during the lift.
- Any guying has been properly secured at the mast anchor points.
- The downconductor has been correctly terminated and the structure bonding cable has been attached to the termination.

- The downconductor can not be damaged at the base of the mast while lifting, i.e.: if the cable exits from the mast base it must be protected and not used as the pivot point for the mast. Maintain a minimum bending radius of 500 mm (20 in.).
- The mast can be easily and safely secured at the base and guying points immediately after it has been lifted into position.
- Any extra rigging that is required for the lift only, can be removed after the mast is in place.

It may be necessary to use a gin pole arrangement to assist when lifting the mast, especially if the mast is over 6 m (20 ft.) in height or it is being lifted from a sloping surface (typical arrangement shown below).

When using a crane to lift the mast into position, ensure that:

- The crane has enough weight and height capacity to safely do the job.
- There is nothing overhead that will obstruct the lift.

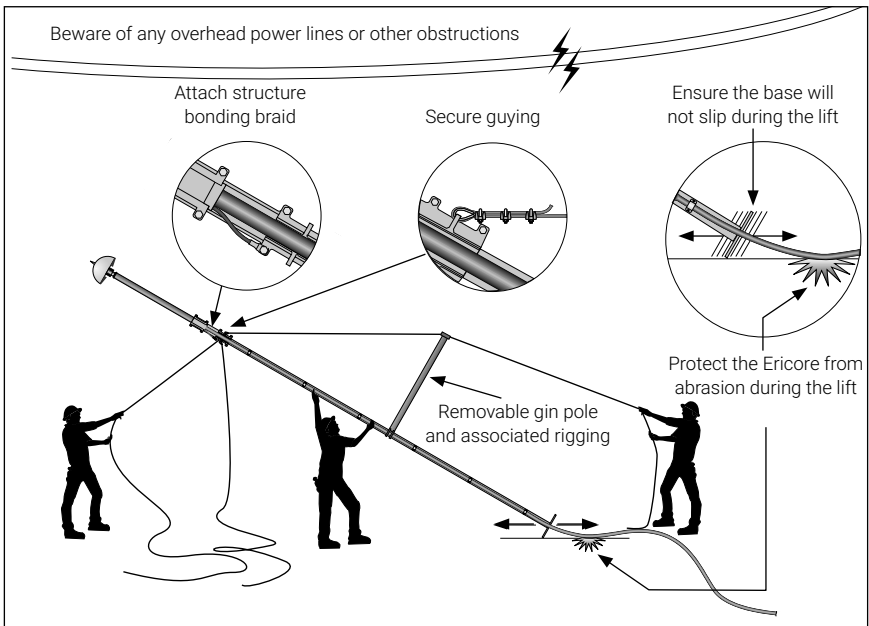


Figure 22: Removable gin pole to assist raising the mast

- Any guying has been properly secured at the mast anchor points.
- The downconductor has been correctly terminated and the structure bonding cable has been attached correctly.
- The nVent ERICO Dynasphere terminal is NOT used as a slinging point.
- When slinging the mast, ensure that the slings or ropes can not foul the nVent ERICO Dynasphere terminal.
- When lifting the mast, the downconductor is tied off to the mast as well to remove any strain on the downconductors termination to the nVent ERICO Dynasphere terminal.
- The downconductor can not be damaged at the base of the mast while lifting (maintain a minimum bending radius of 500 mm (20 in.)) or can not be damaged as a result of dragging over rough or sharp surfaces during the lift.
- Any extra rigging that is required for the lift only, can be removed after the mast is in place.
- The mast can be easily and safely secured at its base and guying points when it is lifted into position.

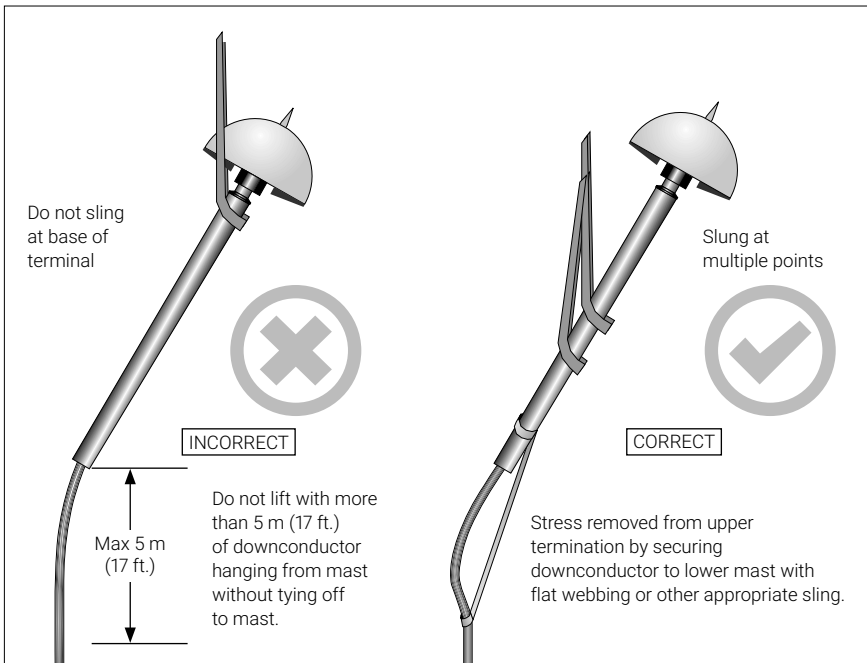


Figure 23: Incorrect and correct hauling methods

LIGHTNING EVENT COUNTER

The Lightning Event Counter is a device for registering and recording the number of strikes that the nVent ERICO System 3000 has intercepted. The nVent ERICO LECV is the latest event counter model and features a digital display. nVent also accepts use of the LECIV and LECIVR for System 3000 installations.

The following should be considered prior to installation of the Lightning Event Counter:

- It is advisable to locate the LECV in a secure area that is not prone to contact with moving objects, theft or vandalism.
- If the LECV is to be encased in an additional enclosure, ensure that it is mounted to enable easy access to the display (see Figure 24 below).

The LECV can be mounted at any point on the downconductor or at the injection point

of the grounding system.

Refer to the instructions supplied with the LECV when installing the unit.

When mounting the LECV, ensure that:

- It is mounted in a secure area that is not prone to contact with moving objects, theft or vandalism.
- It is not mounted in an area that is prone to flooding.
- The display can be easily viewed if the LECV is mounted vertically and is encased in a separate enclosure.
- For conventional cable applications the LECV should be mounted at the location, before the lightning current can split to multiple conducting paths. If the current splits, the counter might not iterate.

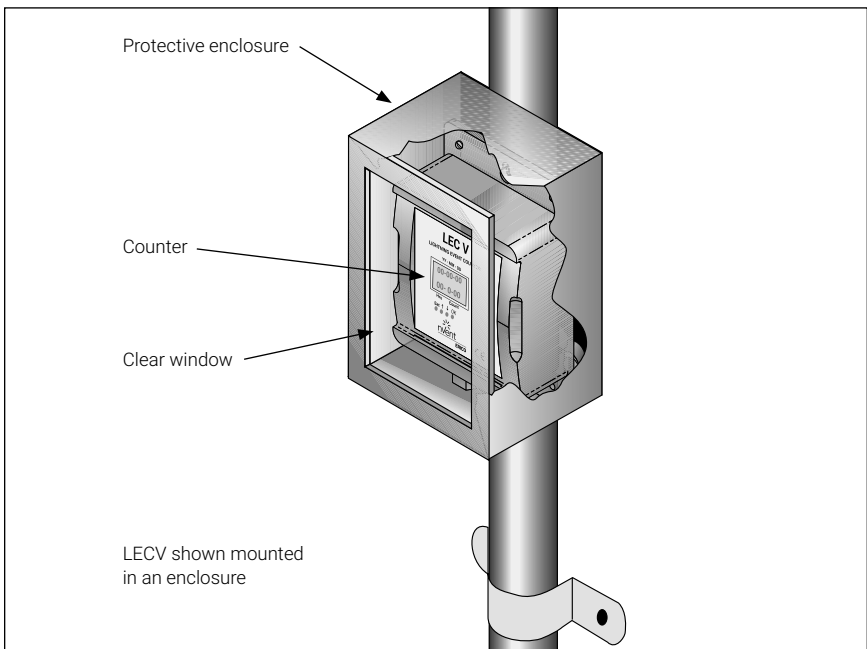


Figure 24: LECV in protective enclosure with clear viewing window, for easy counter reading

SPECIAL APPLICATIONS

Hazardous Applications

- If a System 3000 solution is proposed, the design and report must be completed by a member of the nVent ERICO Applications Engineering team and must be presented to the customer in its entirety.
- It is recommended to perform a risk analysis study of the area and the facility to a local relevant standard.
- The system shall be designed to the highest protection level of 99%.
- The mast assembly cannot be directly mounted to hazardous structures. They must be installed on free standing poles as an isolated system.
- Ericore cable must be used. Conventional conductor is not allowed.
- Air terminals at facilities with potentially explosive atmospheres, where combustible fumes are emitted from a vent or stack must be placed in non-hazardous areas where a combustible mixture of fuel and oxygen will never occur under worst case conditions.
- The grounding and bonding system must be designed in compliance with the latest revisions of relevant national or international standards that specifically address the topic of grounding and bonding in explosive or flammable facilities.
- If a site does not have a proper grounding and bonding system, the earth potential rise caused by a lightning strike may cause arcing and side flashing between metallic objects on the site. If grounding and/or bonding system is neglected or poorly implemented, the pipes, tanks, scaffolds and catwalks may develop dangerous potential differences and generate sparks, which can cause explosions.

Conventional Cable as the Downconductor

- nVent ERICO manufactures components allowing connection of the conventional conductor with the Dynasphere terminal.
- A FRP mast shall not be used with conventional conductor. An aluminum mast may be used.
- In some short-run installations, conventional cable can be used. These installations must incorporate 2 conventional downconductors and comply with applicable national and international standards. Splice the conventional lightning cable after it exits the mast. In these cases, a Terminal Lug Coupling Adaptor will be supplied with a Cadweld mold (LAC8D002) and weld metal (90PLUSF20) to connect LPC126RL250 cable to the base of the Dynasphere (see Figure 25).
- Each Dynasphere air terminal requires at least two downconductors that should be routed to ground on opposite sides of the building. They should each have a separate grounding system or bond into the buildings existing counterpoise grounding.
- There is no limitation on length of the conventional conductor. Since nVent ERICO is supplying the conductor, the conductor should be Class II PN LPC126 or equal and LPA105 or equal where Standard NFPA 780 is used and minimum of 50 mm² (98.7 kcmil) conductor in other regions where IEC standards is applicable.
- Since the conductor is exposed, the bonding principles should comply with the latest revisions of the local or international standards.

- It is important to consider dissimilar metals. For example, do not install copper cable on zinc-plated roof.
- The conventional conductor shall not lie in the standing water.
- The conductor has to follow the path to ground in a downward fashion. For example the conductor cannot go from the roof level over the parapet wall up the hill. A hole should be drilled through the parapet wall. If that is not possible the conductor may go over the parapet wall in the maximum slope of 0.305 m (1 in.) over 0.915 m (3 in.) of distance.
- IEC standards do allow use of composite conductors. nVent ERICO does not offer products that connect the Dynasphere to composite conductors, and is not presently recommended.
- The NFPA 780 standard allows the use of copper or aluminum conductors only. Composite conductors may not be used in applications compliant to NFPA 780.

Using the Mast as a Downconductor

- A stainless steel mast system is the preferred method recommended by nVent ERICO for installation of the System 3000 with conventional conductor.
- nVent ERICO offers two types of stainless steel masts in both cantilevered and guyed configurations. The SIM and ER series of masts vary in mast height from 4 m (157 in.) to 8 m (315 in.). Each mast configuration is comprised of multiple mast sections, accessories, and adaptors to attain the designed overall height. Special adaptor part numbers may be ordered to connect the Dynasphere to the different mast sections.
- nVent ERICO also allows the use of a water pipe with UNC or British threads, using special couplers manufactured by nVent ERICO to support the Dynasphere. The downconductor is connected to the pipe using a Cadweld exothermic connection. These applications are used

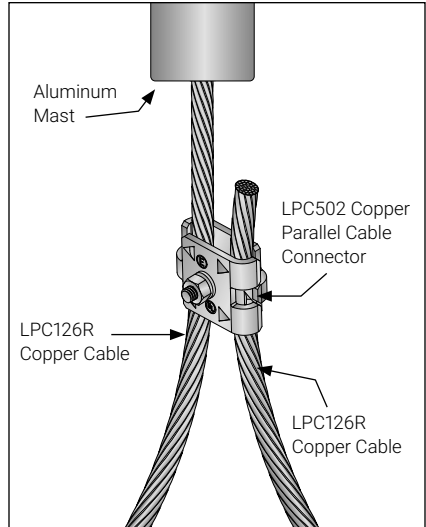
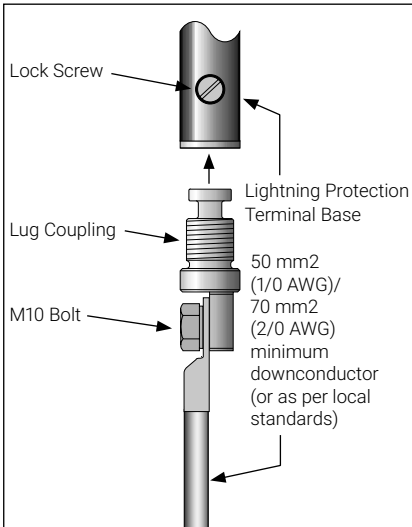


Figure 25: Lug coupling for non-Ericore downconductors

with utility poles and other shorter free standing masts. For these applications, single conductor may be used

- nVent ERICO offers a custom design of heavy steel, freestanding masts made to order, namely standard duty and heavy duty. There are two different heights available. Each mast has a distinctly different base.
- Both masts are designed from the 1026 steel drawn over mandrel (DOM) tube, using low yield stress of material at 60 ksi. This meets ASTM A513 type 5 specification.
- The standard duty mast was designed for 145 km/hour (90 miles/hour) wind. The seismic design is for 154% gravity. This design should satisfy wind condition in most global locations.
- The heavy duty mast is designed for 241 km/hour (150 miles/hour) wind. The seismic design is for 330% gravity.
- Refer to standard installation sheets for exact mast configurations and installation details available on www.erico.com. Wind loading information is available upon request for only mast configurations described in the standard installation sheets. Contact your nVent ERICO representative for mast availability in your region.

Hybrid System Applications

There are two types of hybrid systems:

1. Combination of conventional and System 3000. For applications that require both a common design method and a collection volume method (CVM) for the placement of air terminals. These hybrid systems are typically not recommended by nVent ERICO, but they can be used in special cases, for example, in substations. This

system can be considered only if it is designed by nVent ERICO Application Engineers and all components are manufactured and supplied by nVent ERICO. The system must comply to the latest revision of the nVent ERICO System 3000 Installation, Operation and Maintenance Manual.

2. **Combination of nVent ERICO Ericore Cable with conventional conductor or structural steel as a downconductor.**

nVent ERICO recommends using Ericore cable in majority of the installations, but there are exceptions. nVent ERICO has designed hybrid systems in instances where concealed downconductor is already installed. For example, a pool area on top of a roof that has to be bypassed using nVent Ericore cable to minimize possibility of cross flashes. The complete System 3000 would be installed up to the existing grounding point. At the grounding point there should be a nonconductive junction box (rated for outdoor applications), with a ground bar where the lower termination of the nVent ERICO ERICORE Cable will be connected with the grounding point. The existing grounding system consisting of conventional conductor, structural steel or rebar must comply to the latest revisions of Standards IEC62305 indicating that the resistance of the existing grounding system does not exceed 0.2Ω .

nVent ERICO does not assume any responsibility for the grounding system and attachment of the nVent ERICO System 3000 to the structure. nVent ERICO manufactures components to assemble this type of system.

Protection of Tall Structures

The statistical probability of a lightning strike to the side of the structure is 1% or 2%, depending on the height of the structure. This should be discussed with the architect or the owner, since there is a balance between the risk factor and aesthetic appearance. Most skyscrapers are built in highly developed areas, which decreases the probability of a lightning strike to the side of the structure. Only the portion of the structure that extends above the surrounding structures would be subject of concern. In most instances, additional air termination is not implemented.

Protection of Substations

In most Lightning Protection applications the protection levels are selected by the owner of the property. The protection levels in LP of substations are dictated by the Basic Insulation Level (BIL) of the equipment being protected. Standard IEEE 998 includes a table that correlates the protection levels with BIL. Obtain the information on BIL from the utility company, prior to designing the system. In LP protection of substations, all terminal placement methods mentioned in IEEE 998 are applicable including the Collection Volume method. nVent ERICO System 3000 can be mounted directly on the structure, or on freestanding mast that would be supplied by the customer.

Long Lengths of Ericore Downconductor

Most installations can be conducted with a single Ericore cable as described earlier in this manual. However, where the installation involves a long single length of Ericore cable, additional measures may be needed to ensure that the voltage build up will not exceed the voltage withstand rating of the cable during a lightning strike.

Where the length of the Ericore cable between the terminal and the grounding system exceeds 70 m (230 ft.) follow the chart in Figure 33 of the manual.

However, if the result indicates that additional measures are required, then a single uninterrupted length of Ericore cable cannot be run.

Practical Examples for Long Lengths of Ericore Downconductor

When to use a twin Ericore arrangement or a series connected arrangement depends on the particular circumstance. The following examples give typical guidance.

TELECOM TOWERS

Most towers would be less than 70 m (230 ft.), or so, in height so that a single Ericore downconductor would suffice. However, where the tower is over the maximum single length but less than twice the maximum single length (typically 70 m (230 ft.) to 140 m (460 ft.) in height), it is preferable to run twin Ericore downconductors. These conductors should ideally run down opposite legs of the tower and each connect into the ring earth at the base of the tower.

Alternatively, and less preferably, a single upper section of typical length 70 m (230 ft.) could be run from the top of the tower to a point lower down on the tower, then bonded to the tower using a waterproofed lower termination. A conventional lightning downconductor could be run from this point down to the base of the tower. This arrangement helps ensure that the lightning current bypasses the sensitive electronics mounted in the antennas on the top half of the tower.

BUILDINGS

Buildings less than 70 m (230 ft.), or so, in height are served by a single Ericore downconductor.

Buildings of height over the maximum single length but less than twice the maximum single length (typically 70 m (230 ft.) to 140 m (460 ft.) in height) may be installed with either twin Ericore downconductors, or

a series connection in the service shaft.

Buildings of height greater than twice the maximum single length (typically greater than 140 m (460 ft.) in height) need to use the series connection method. The nVent ERICO application engineering group will determine the allowable lengths of the lower cable sections, which may be able to be longer than the upper length, and in some cases, the lower sections may be conventional downconductor.

PROPOSED ERICORE LENGTHS

Although the flowchart in Figure 26 allows lengths of up to 87 m (285 ft.), ideally lengths should be limited to 70 m (230 ft.) to avoid any likelihood of lightning energy cross-flashing to the structure.

In the case of installations exceeding the maximum single Ericore cable length, the advice of the nVent ERICO application engineering group should be sought. The following information on the techniques used is intended as a guide for installers and to provide background information.

Note: If the number of thunderdays for the proposed installation site is not known, but the ground flash density is known, this value can be converted to thunderdays using the following table. This resulting value can then be used in Figure 26 located on the following page.

Ground flash density (strikes / km ² / year)	Lightning activity (thunderdays / year)
Up to 2.7	20
2.8 to 3.9	30
4.0 to 5.2	40
5.3 to 6.6	50
6.7 to 9.5	60
9.6 to 12.5	80
12.6 or more	100

PROPOSED ERICORE LENGTH

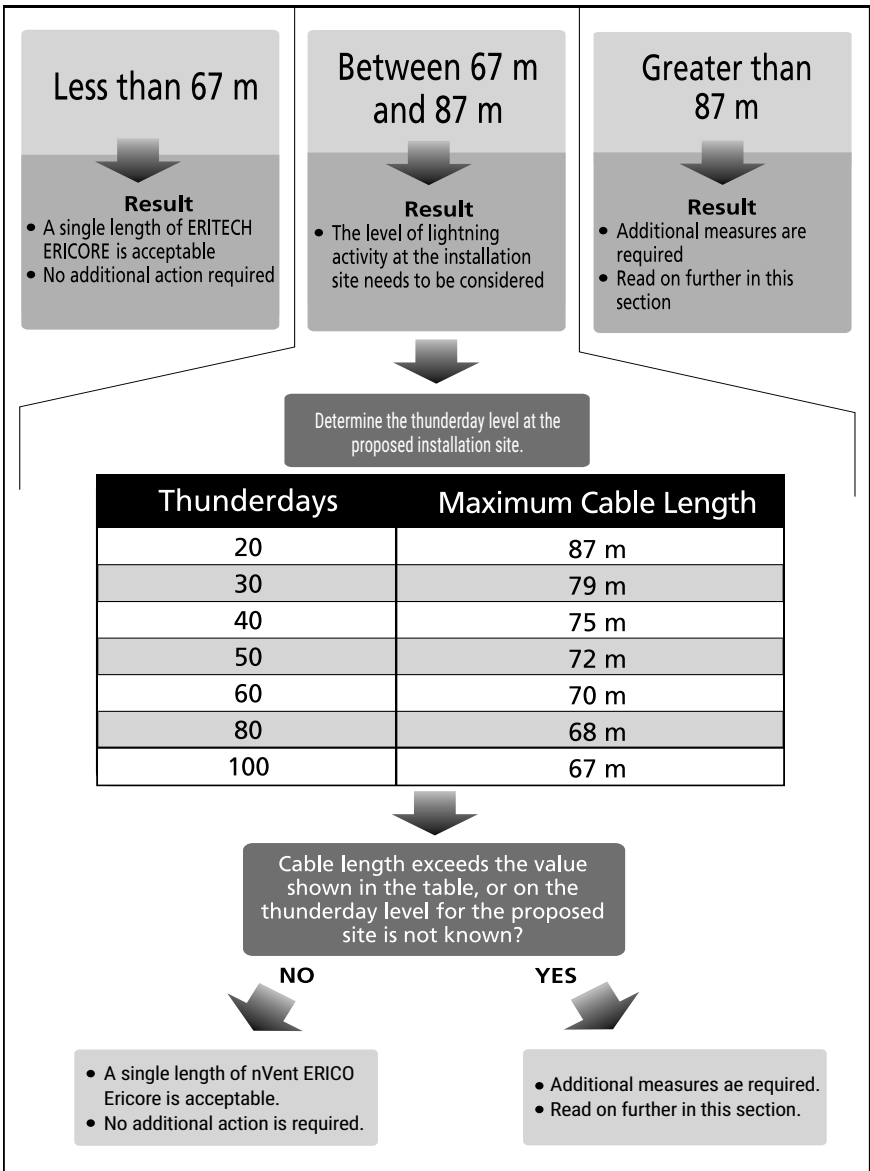


Figure 26: Determination of maximum single Ericore length

ERICORE MAXIMUM LENGTHS

The construction of the nVent ERICO Ericore cable has been carefully designed and tested to withstand a 250kV potential difference under lightning conditions. When compared to a conventional bare copper conductor, the Ericore cable has relatively low characteristic impedance. This lowers the induced voltage on the Ericore cable for much longer lengths. The maximum length of single Ericore cable is limited by its rated voltage. While longer lengths of Ericore cable can be used, the risk of damaging the Ericore cable increases when approaching the maximum length.

The risk can be determined by considering the statistical nature of lightning. The percentage of lightning strikes that are severe enough to damage the Ericore cable at a given length are based on the known parameters of the Ericore cable. A cable that is "X" meters long will withstand "Y" percent of lightning strikes as follows:

- 69 m (226 ft.) of Ericore handles 95% of lightning strikes (i.e. one strike in twenty will damage the cable)
- 87 m (285 ft.) of Ericore cable handles 80% of lightning strikes (i.e. one strike in five will damage the cable)
- 94 m (308 ft.) of Ericore handles 75% of lightning strikes (i.e. one strike in four will damage the cable)

INSTALLATION METHODS FOR ERICORE EXCEEDING 70 M

There are two methods to extend the length of Ericore

1. Parallel splicing - use two Ericore cables in parallel with the Dual Terminal Adaptor kit that allows you to install two Ericore cables at the top of the mast (See Figure 34), or

2. Series splicing - Connect two or more Ericore cables in series between the air terminal and the first grounding point. Terminate each section to a busbar that is electrically connected to the structure (see Figure 35).

Parallel Splicing

By installing two Ericore cables, the current from the lightning strike will split into each cable. It is recommended that at the base of the supporting mast, the Ericore cables are routed down opposite sides of the building for better distribution of the lightning energy. Running the Ericore cables close together is not recommended. If the paths taken by each cable are similar in length, then each cable length can be up to two times the maximum single length of Ericore cable. If the lengths of each Ericore cable are different, then the maximum length of shorter Ericore cable must comply with the below equations:

For $a > 1$ and $L_1 = aL_M$,

$$L_2 \leq bL_M \text{ where } b = \frac{1}{1 - \frac{1}{a}}$$

Key

L_1 Length of the shorter Ericore cable

L_2 Length of the longer Ericore cable

L_{max} Maximum length of the shorter Ericore cable

L_M Maximum length of a single run of Ericore cable

Parallel splicing of Ericore cable should only be used for structures whose height is less than or equal two times the maximum length of a single run of Ericore cable. For taller structures, series splicing must be used.

The twin Ericore conductors are run in a parallel manner down to the base before they split to the opposite side of the structure (see Figure 27). The usual conductive saddle spacing applies.

At the point of connection to the grounding system, each nVent ERICO Ericore cable is fitted with an nVent ERICO Ericore lower termination kit, and attached to the grounding system.

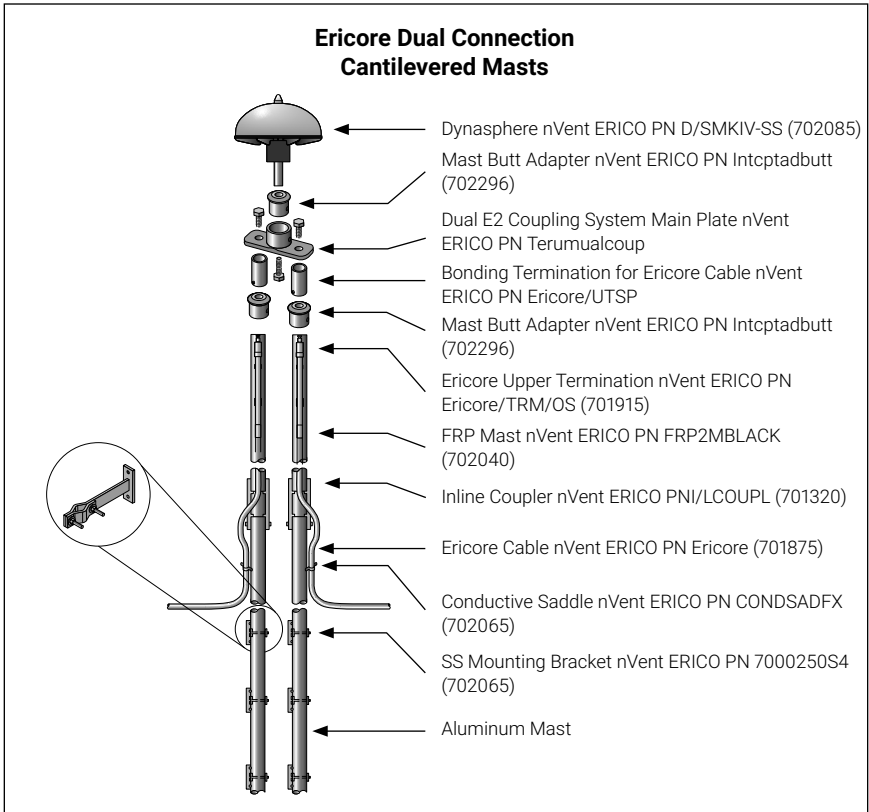


Figure 27: Exploded view of the Dual Coupling Termination

A typical mast arrangement is shown in Figure 27. Two mast assemblies comprised of an aluminum lower mast section, an inline coupler, and upper FRP mast must be independently supported. Each upper termination must be connected to the Dual Coupler assembly (TERMDUALCOUP) and secured by the provided couplers (Ericore/UTSP) and bolts provided. The spacing of the two mast assemblies is 140 mm (5.5 in.)

which is determined by the dimensions of the dual coupler assembly. The nVent ERICO Dynasphere (D/SMKIV-SS) shall be installed in the center hole with the butt adapter and tightened with the provided bolt. Each Ericore cable shall exit their respective inline couplers and be affixed to the mast assembly by stainless steel straps at the normal interval of at least every 1 m (40 in.).

Series Splicing

As an alternative to running twin Ericore cables, a single Ericore cable can be run, but it is separated into several sections, none of which exceeds the cable breakdown voltage. This is done by periodically connecting the cable to a conductive structural point.

The lower end of the upper cable section is fitted with a lower termination, and the upper end of the lower cable section is fitted with an upper termination. The lower termination inherently has a lug termination, but the upper termination needs to be fitted with a bonding termination (Ericore/UTSP) and lug (TERMLUGCOUPL) to allow it to be lugged. Each of these two lugged terminations must be electrically bolted together and to a suitable conductive structural point (see Figure 29).

In some installations, both lugs can be directly connected to a suitable conductive structural point, but in some installations it will be more convenient to connect both lugs to a small busbar, and have this busbar connected to a suitable nearby conductive structural point. Note that the conductor used in this case must be a minimum of 16 mm² (4 AWG) and should not exceed 5 m (200 in.) in length. A suitable conductive structural point may be either structural steel work or conductive properties within concrete panels or slabs.

These joints should not be exposed to the weather and are usually located in a service shaft. Very tall buildings will have a number of connection points depending on their height.

Details of where to provide the joint will be provided by the nVent ERICO application engineers, after consideration of the building details.

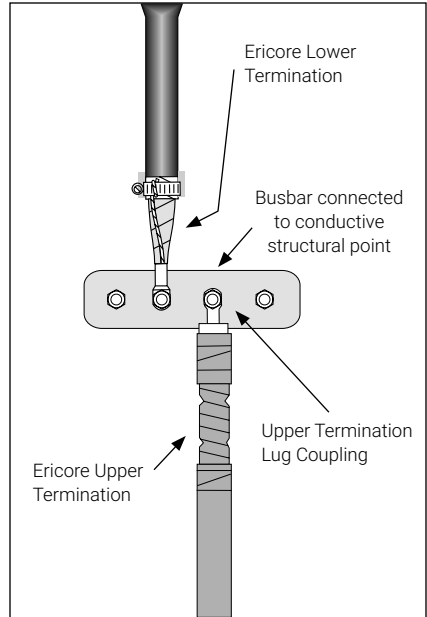


Figure 28: Upper and lower terminations to splice the Ericore by using ground bar connected to the rebar or the structural steel

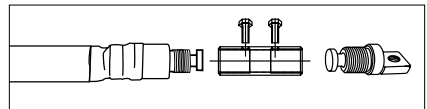


Figure 29: If an upper termination lug coupling is not available, a (TERMLUGCOUPL) may be used in conjunction with a coupling tube (part: Ericore/UTSP) as shown here

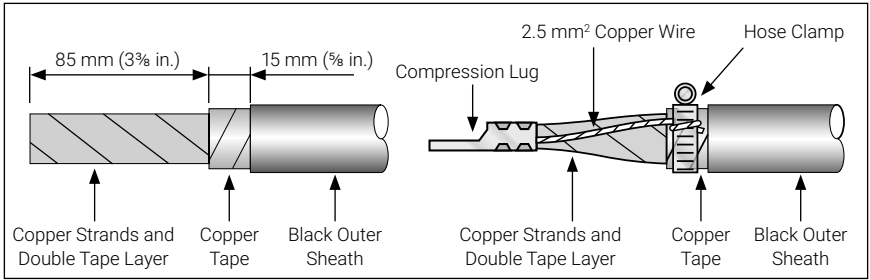


Figure 30: Stripping lengths lower termination

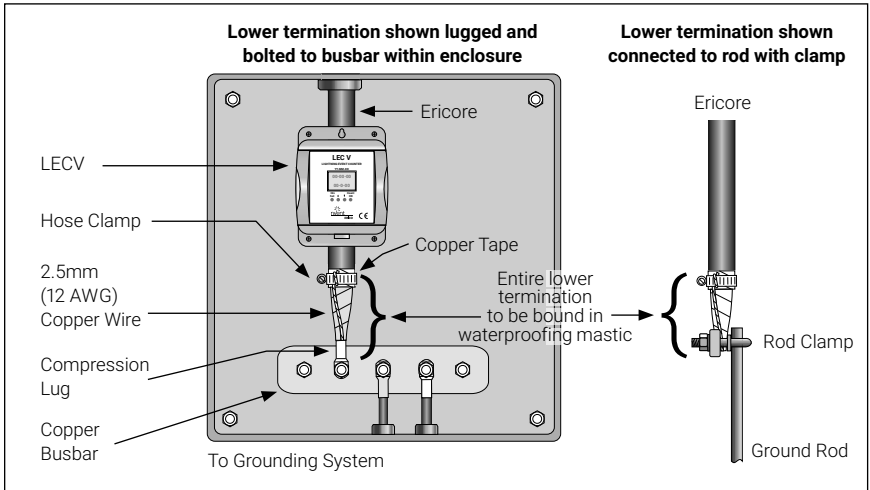


Figure 31: Termination to busbar and ground rod

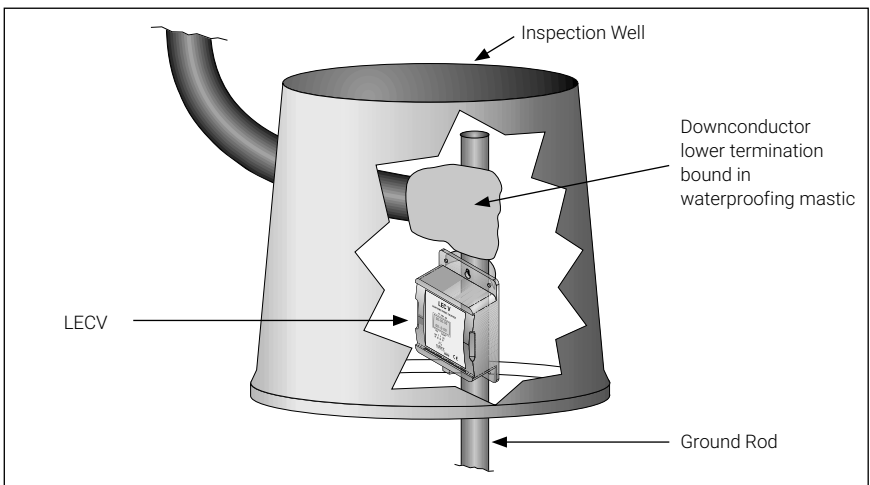


Figure 32: Completed termination for downconductor

Lower Termination of Ericore Downconductor

The lower termination is a vital part of the Ericore cable assembly. The lower termination is designed for maximum electrical stress relief of the Ericore cable, before it is connected to the grounding system. The ultimate goal is to contain the lightning energy in the cable before it is safely dissipated into the grounding system.

Refer to the lower termination installation manual for more details. The lower termination consists of many intricate steps that have to be followed precisely to assemble lower termination correctly.

If the instructions are not followed correctly, or if any of the insulation layers or the copper foil are incorrectly cut, then the integrity of the whole lightning protection is affected.

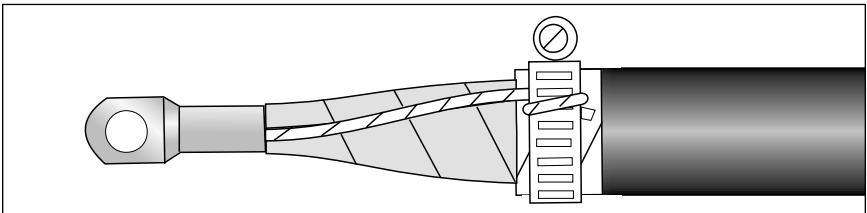


Figure 33: Grounding option using the 70 mm (2.75 in.) lug

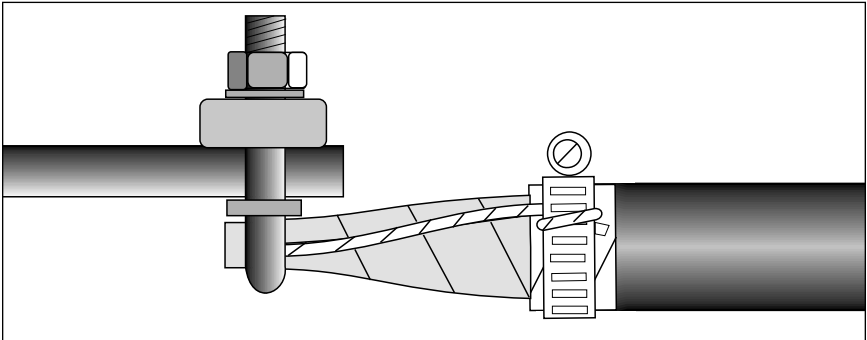


Figure 34: Grounding option for connection to a ground rod

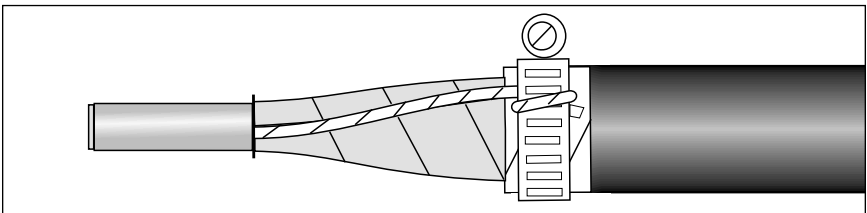


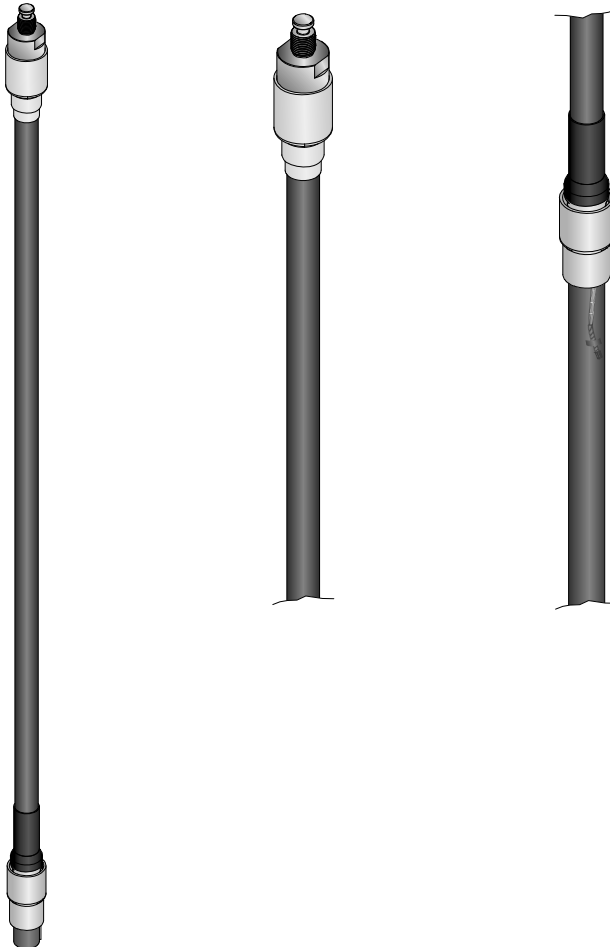
Figure 35: Grounding option for exothermic connection

Upper Termination of Ericore Downconductor

The upper termination is a vital part of the Ericore cable assembly. The upper termination is designed for maximum electrical stress relief of the Ericore cable, before it is connected to the Dynasphere terminal. The ultimate goal is to contain the lightning energy in the cable and bring it safely to the grounding system.

Refer to the upper termination installation manual for more details. The upper termination consists of many intricate steps that have to be followed precisely to assemble upper termination correctly.

If the instructions are not followed correctly, or if any of the insulation layers or the copper foil are incorrectly cut, then the integrity of the whole lightning protection is affected.



Operation and Maintenance

The nVent ERICO System 3000 lightning protection system requires no user operation and is completely automatic in operation.

- The nVent ERICO Dynasphere becomes active only during storm activity.
- The system does not require any external power requirements or replacement components for normal operation.
- It is essential that the nVent ERICO System 3000 be regularly maintained.

Maintenance should be undertaken:

- After each known strike to the nVent ERICO Dynasphere
- At least once per year
- If any changes have been made to the structure, whether they be structural, antennae or building maintenance unit additions, etc.

Use the maintenance record table below to record the relevant details. These records and manual should be kept in a safe place near the installation.

Maintenance should be undertaken as follows:



Do not attempt maintenance during potential lightning periods.

1. Check that the building is in the same physical shape and that no additional structures such as antennae, advertising signs, satellite dishes, building maintenance units or similar have been installed within 3 m (121 in.) height of the nVent ERICO Dynasphere.
2. Inspect the nVent ERICO Dynasphere to ensure that it is not dented or physically damaged in any way.
3. Inspect the finial tip on top of the nVent ERICO Dynasphere to ensure that it is not excessively burnt, deformed or missing. A finial tip must be replaced if more than 6 mm (¼ in.) of the tip is missing.
4. Check that the FRP mast and lower mast assembly is securely attached to the structure and is placed in a vertical position. Check that the guys are secure and undamaged. Replace if necessary. Check that all fastenings are secure and tight.
5. If connected, check the structure bonding cable from the upper termination or mast base is securely connected to the structural steel work.
6. Look for signs of damage to the nVent ERICO Ericore downconductor (whether by lightning, careless handling, vandalism or other causes). Check that the downconductor is inaccessible to people and machinery.
7. Check that all labels and signs are still attached and clearly legible. These labels **MUST** be in place. Refer to the section on Labelling.
8. Check that the nVent ERICO Lightning Event Counter (LEC) is secure, and that the display is registering a reading, then record the reading.
9. Record resistance and continuity measurements using Figures 36 through 43.

The following steps should be taken to measure the performance of your system after a known strike to the terminal has occurred:

- A. Remove the waterproofing mastic from the lower termination to expose the connection.
- B. Disconnect the downconductor from the grounding system.
- C. If possible, disconnect the structure ground bonding cable from the grounding system.
- D. Measure the ground resistance of the lightning protection grounding system and record in column 1 of ground resistance readings.
- E. Measure the ground resistance of the structure and record in column 2 of ground resistance readings.
- F. Reconnect the structure ground bonding cable to the lightning protection ground system, then measure & record in column 3 of ground resistance readings.
- G. At the lower termination of the downconductor, disconnect the 2.5 mm² (12 AWG) bonding wire from under the hose clamp.

- H. With a multimeter, measure the continuity between the center conductor and the copper screen of the downconductor. (this should be greater than 1,000 ohms).
- I. If possible, measure the continuity between the center conductor at the lower and upper end of the downconductor (this should be low ohms).
- J. Reconnect the 2.5 mm² (12 AWG) bonding wire to the hose clamp.
- K. Reconnect the downconductor lower termination and structure ground bonding cable to the lightning protection grounding system.
- L. Reseal the lower termination and grounding connection in waterproofing mastic and ensure that the whole connection is made waterproof.
- M. Report any problems, defects of inconsistencies to your nearest nVent ERICO Distributor.

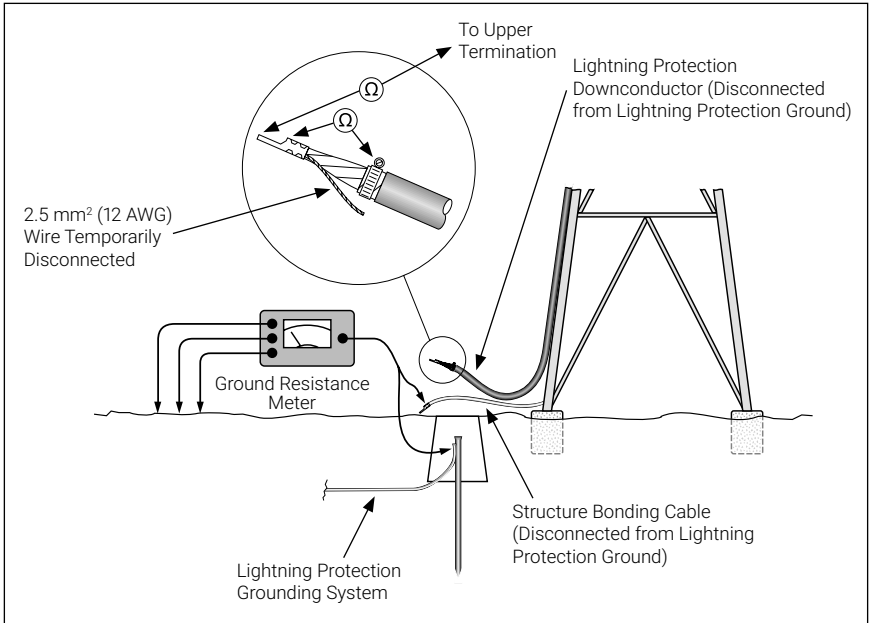


Figure 36: Grounding and downconductor continuity testing

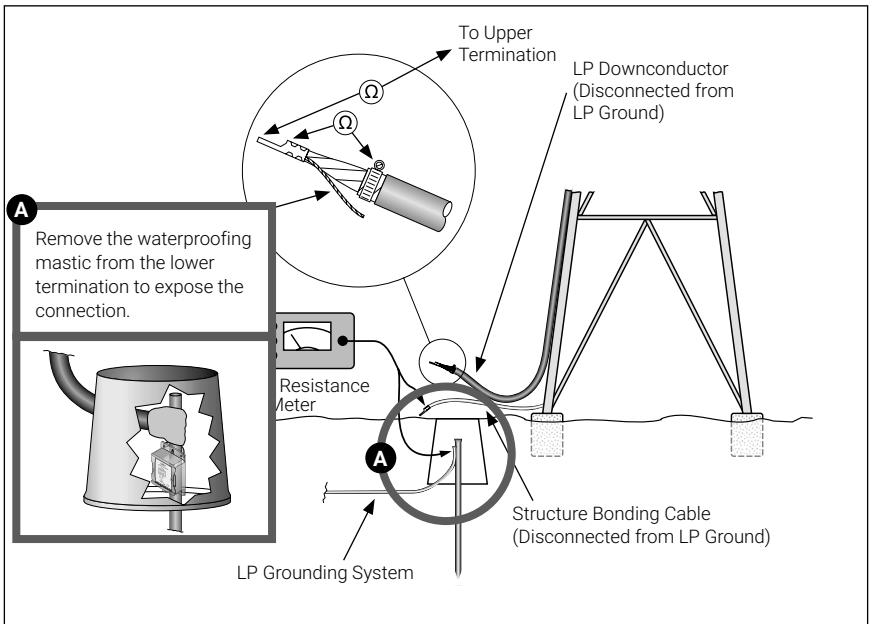


Figure 37: Grounding and downconductor continuity testing

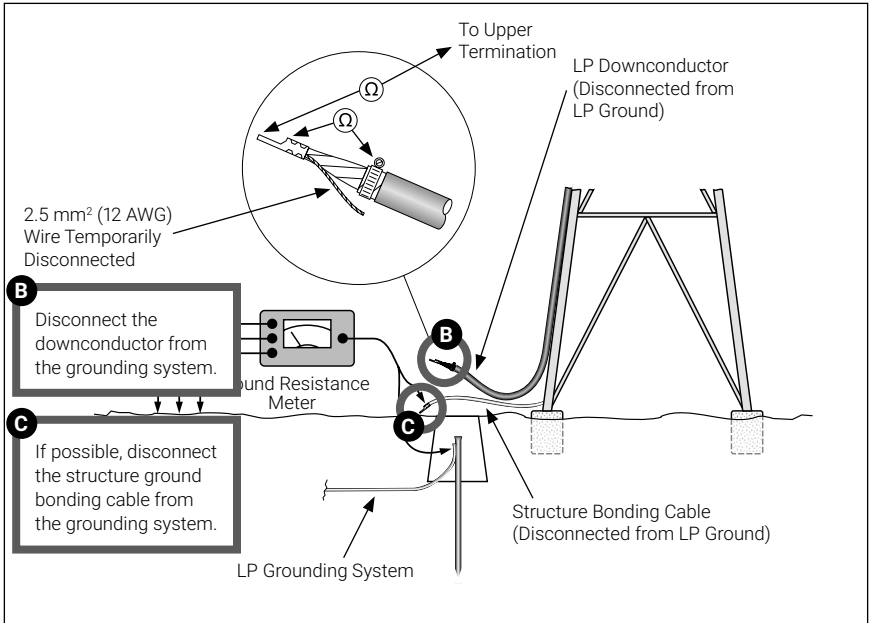


Figure 38: Grounding and downconductor continuity testing

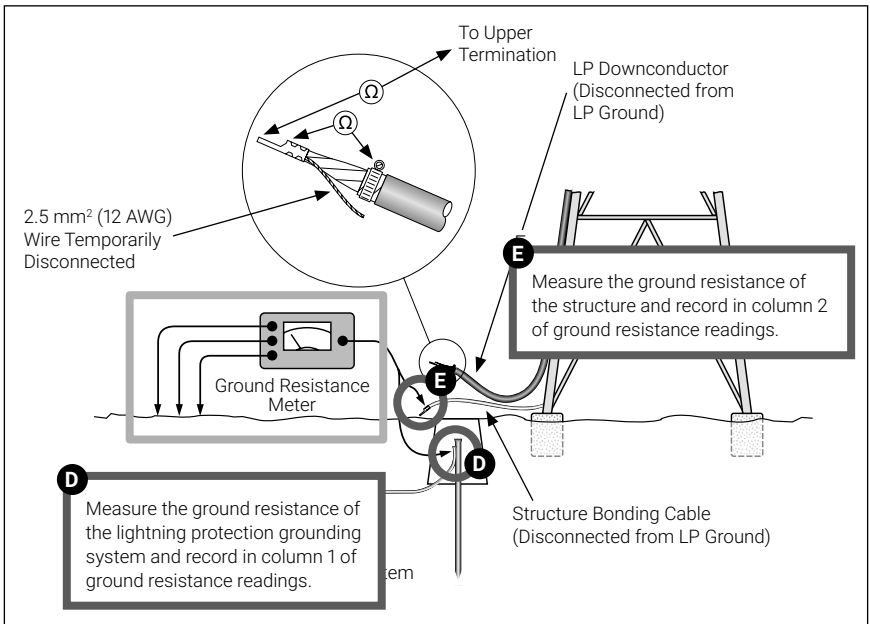


Figure 39: Grounding and downconductor continuity testing

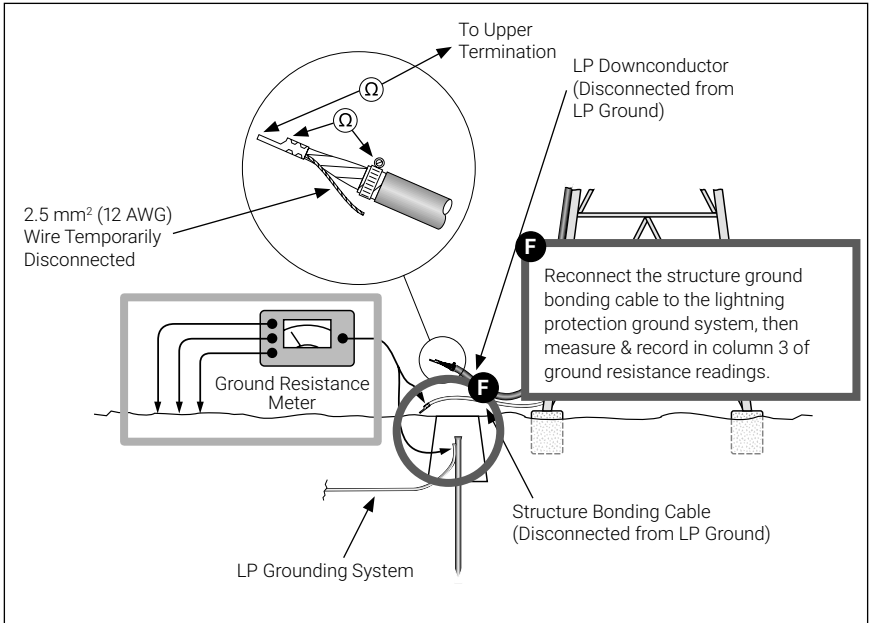


Figure 40: Grounding and downconductor continuity testing

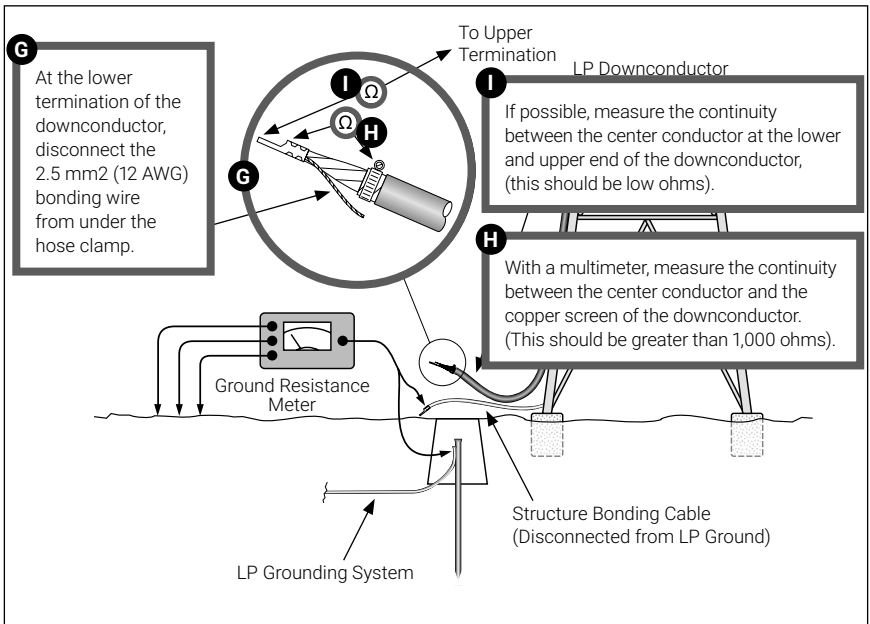


Figure 41: Grounding and downconductor continuity testing

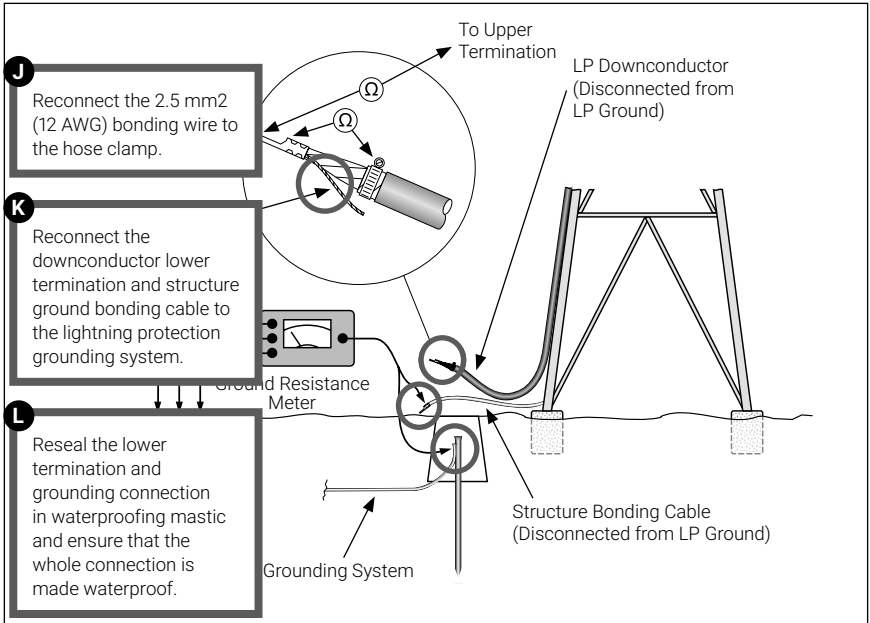


Figure 42: Grounding and downconductor continuity testing

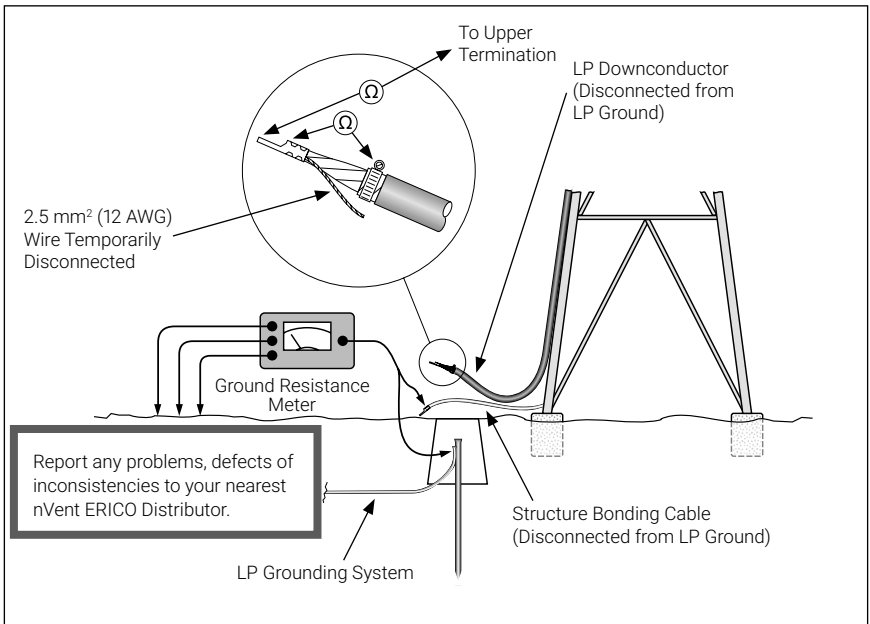


Figure 43: Grounding and downconductor continuity testing



EST4620

- Measures ground resistance (2- and 3-Point) Fall-of-Potential method and soil resistivity (4-Point)



EST4630

- Measures ground resistance (2- and 3-Point) Fall-of-Potential method and soil resistivity (4-Point)



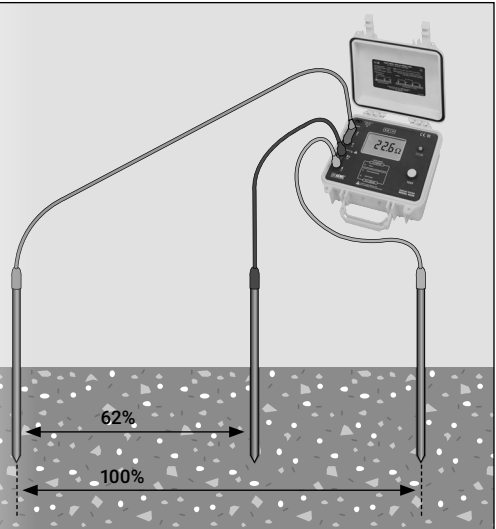
EST6472

- Measures Ground Impedance at frequencies up to 5kHz to test lightning strike protection
- Ground Resistance testing using the 2 clamp method (no auxiliary rods needed) using optional current probes
- Includes DataView® software for data storage, real-time display, analysis, report generation and system configuration
- 3-Point Fall-of-Potential measurement with manual or automatic frequency selection

Depth of the ground electrode	Distance to the inner stake	Distance to the outer stake
2 m	15 m	25 m
3 m	20 m	30 m
6 m	25 m	40 m
10 m	30 m	50 m

Note the 62% factor to be used, as approximated in the table above.

The earth electrode of interest must be disconnected from its connection to the site.



When performing a 3–pole ground resistance test, it is essential that the probe is placed outside the sphere of influence of the ground electrode under test.

To test the accuracy of the results and to ensure that the ground stakes are outside the spheres of influence, reposition the inner stake (probe) 1 meter in either direction and take a fresh measurement.

If there is a significant change in the reading (30%), you need to increase the distance between the ground rod under test, the inner stake (probe) and the outer stake (auxiliary ground) until the measured values remain fairly constant when repositioning the inner stake (probe).

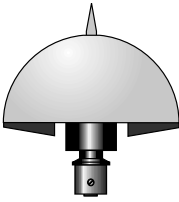
NOTICE

Users are advised that the nVent ERICO System 3000 Lightning Protection System may not function to its full efficiency under ice or snow conditions or on chimneys or stacks emitting gasses or pollutants. For advice on temperature or corrosion concerns, please contact your local nVent ERICO Distributor.

MAINTENANCE RECORD

Date of Inspection	Lightning Event Counter Reading	Ground Resistance Readings			Check of Maintenance Points 1 to 11	Comments	Inspected by
		1	2	3			

Specifications



nVent ERICO Dynasphere Enhanced Terminal

Capture point of the nVent ERICO System 3000. Initiates an upward leader during storm conditions to attract lightning discharges over a greater radius than conventional protection.

Height: 140 mm (5 ½ in.)
 Diameter: 255 mm (10 in.)
 Weight: 2.8 kg (6 lbs.)
 Color/Finish: Brushed Stainless Steel



nVent ERICO Ericore downconductor

Purpose designed cables, using a copper 50 mm² (1/0 AWG) main conductor to safely convey the lightning energy to ground, while minimizing side flashing.

Diameter: 36 mm (1 7/16 in.)
 Weight: 1.2 kg / m
 13 oz / ft.



FRP Mast

Purpose designed Fiberglass Reinforced Plastic, manufactured from non-hyrosopic epoxy and glass laminate, provides an insulated mast for mounting the Dynasphere.

Lengths: 2 m (81 ½ in.) & 4.6 m (187 ¾ in.)
 Inside Diameter: 60 mm (2 ¾ in.)
 Outside Diameter: 68 mm (2 11/16 in.)
 Weight: 2 m = 3.3 kg (7 ¼ lbs.)
 4.6 m = 7.6 kg (16 ¾ lbs.)
 Color/Finish: Black

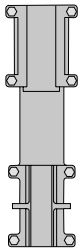


Aluminum Mast

Lightweight lower mast material.

Lengths: 3, 4, 5 & 6 m
 (122 ½, 163 ¼, 204 & 245 in.)
 Inside diameter: 61.9 mm (2 7/16 in.)
 Outside diameter: 69.9 mm (2 ¾ in.)
 Weight: 2.4 kg / meter

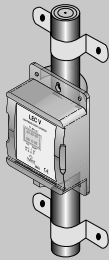
Available with or without mast base plate.



Inline Coupling

Purpose designed coupling to clamp FRP to aluminum lower mast, providing 3 guy anchoring points and downconductor exit point.

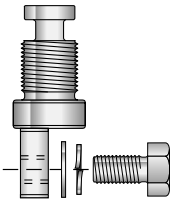
Max. Clamping diameter: 70 mm (2 7/8 in.)
 Max. Clamping torque: 55 kg/cm (45 in.lb)
 Weight: 2.4 kg (5 1/4 lbs.)
 Height added to mast: 200 mm (7 7/8 in.)



Lightning Event Counter (LECV)

Purpose designed lightning event counter.

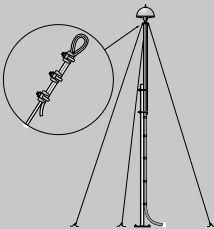
I.P. Rating: IP65, NEMA 4
 Operating Temp. Range: -40°C to +80°C (-40°F to 176°F)
 Dimensions: 141 mm(h) x 91 mm(w) x 42 mm(d),
 5.55 in(h) x 3.582 in(w) x 1.653 in(d)
 Weight: 0.36 kg, 0.794 lb



Terminal Lug Coupling

The terminal lug coupling allows for connection of a conventional downconductor such as 25 mm x 3 mm copper tape / bar to the Dynasphere. See Upper Termination Instructions for fixing of coupling to Dynasphere.

Material: Brass Alloy 384D
 Length: 68.75 mm (2 1/16 in.)
 Weight: 181 grams (6.38 oz.)
 Diameter: 25.4 mm (1 in.)



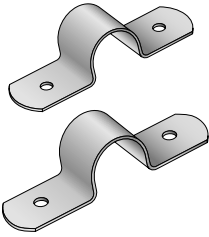
Guy Kit

Purpose designed guying kits for anchoring from a guy ring or inline coupling. Each kit comes complete with six stainless steel thimbles, plus 18 guying grips per kit. Refer to pages 44 and 45 for more detail.

4 m Guy Kit

7 m Guy Kit

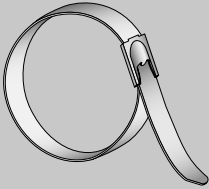
Guy Diameter:	4 mm (5/32 in.)	5 mm (3/16 in.)
Actual Guy Length:	6 m (20 1/2 ft.)	10 m (34 ft.)
Guy Tensile Strength:	430 kg (946 lb.)	560 kg (1232 lb.)



Ericore downconductor Saddles

Purpose designed saddles for securing of downconductor to structure.

Material:	Stainless Steel 316
Length:	114.5 mm (4 ½ in.)
Thickness:	1.2 mm (1/16 in.)
Fixing Hole Diameter:	6 mm (¼ in.)
Width:	25.5 mm (1 in.)



Stainless Steel Cable Tie

Purpose designed cable ties for securing of Ericore downconductor to the mast.

Length:	521 mm (20 ½ in.)
Width:	7.9 mm (5/16 in.)
Material:	Stainless Steel
Maximum Bundle Diameter:	152 mm (6 in.)
Minimum Loop Tensile Strength:	250 lbs.

Glossary for terms used in this text

Securing

Saddles, cable hangers or clamps used to mechanically and electrostatically secure the downconductor to the structure.

Bond

Electrical connection between the outer semi-conductive sheath of the downconductor and other electrically conductive materials.

Clamp

Electrically conductive, mechanical anchoring of the downconductor to the structure.

Conductive Structural Point

Any point of the structure that is electrically conductive and is either connected to the structure earth or has a substantial metallic mass.

Fastenings

Bolts, screws, masonry anchors or other hardware used to secure anchors to the structure.

FRP

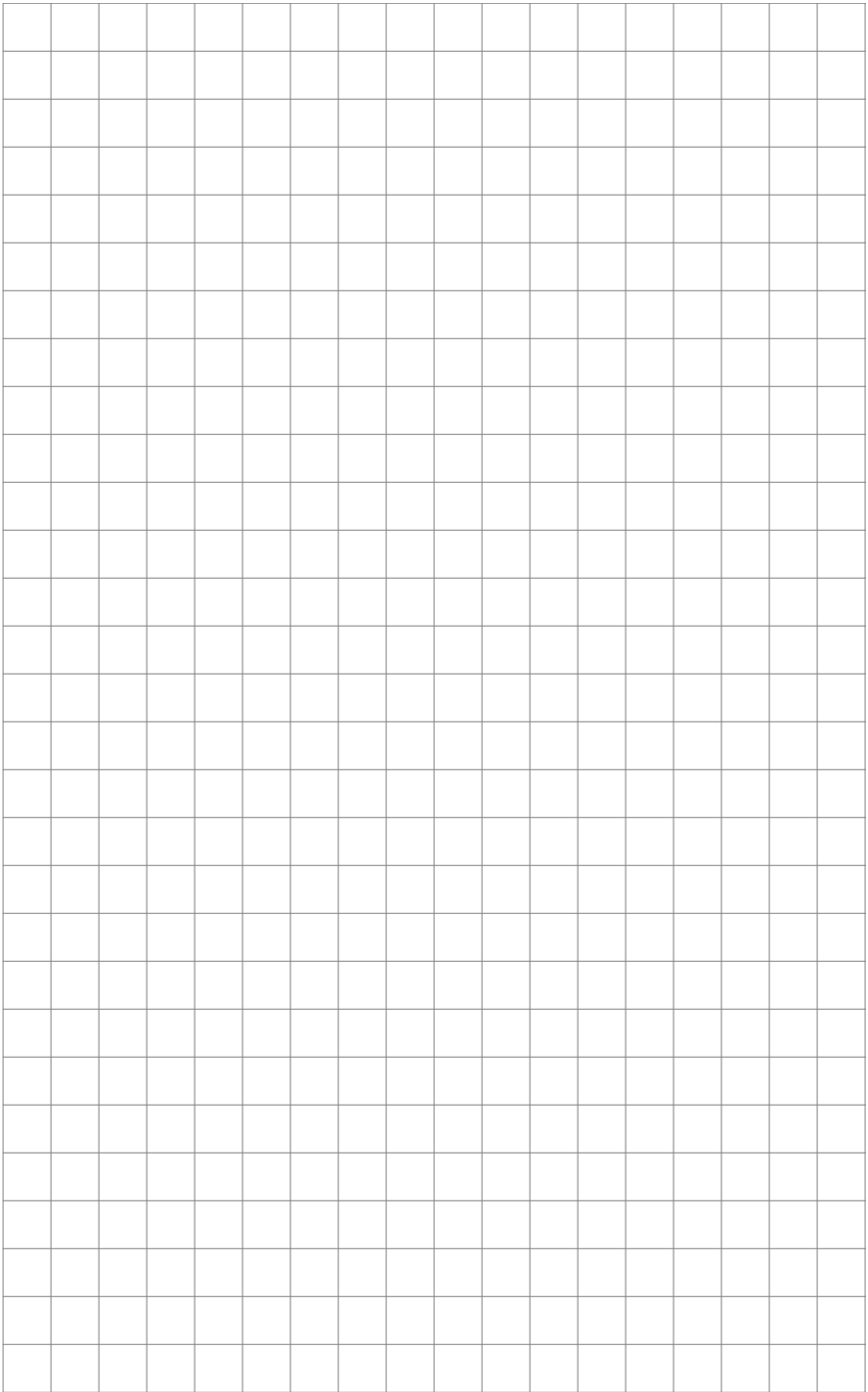
Fiberglass Reinforced Plastic. Insulated mast for mounting Dynasphere.

Metallic Mast Section

Any type of electrically conductive mast section, ie: aluminum masts, galvanized free standing mast, etc.

Structure Bonding Braid

Conductive lead at the base of the upper termination used to electrostatically bond the downconductors' outer sheath to a conductive structural point if the downconductor cannot be clamped to a conductive structural point within 5 m (17 ft.) of the upper termination.





[nVent.com/ERICO](https://www.nVent.com/ERICO)