

nVent ERICO Early Streamer Emission System 1000

Installation, Operation and Maintenance Manual



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Introduction

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 of this manual.

During thunderstorm conditions, when the lightning down leader is approaching ground level, an upward leader may be created by any surface. In the case of a passive lightning rod, the upward leader propagates only after a long period of charge reorganization. In the case of the ESE i-Series, the initiation time of an upward leader is significantly reduced. The ESE i-Series generates controlled magnitude and frequency pulses at the tip of the ESE terminal during high static fields prior to a lightning discharge. This enables creation of an upward leader from the ESE air terminal that propagates toward the thundercloud downward leader.

PURCHASER ACKNOWLEDGES THAT LIGHTENING IS A NATURAL EVENT WITH STATISTICAL VARIATION IN BEHAVIOR AND 100% PROTECTION IS NOT OFFERED AND CANNOT BE PROVIDED.

The design methods for the placement of nVent ERICO System 1000 ESE air terminals on structures are based on the calculations using formulas published in the Standard NF C 17-102. The French standard NF C 17-102 is the guiding document for ESE lightning protection systems. The NF C 17-102 standard and this manual shall be used as the main references for the System 1000 installation. Please note that the French Standard NF C 17-102 is used in other countries under different names of the local standard. Some examples include: Argentina IRAM 2426, Spain UNE 21186, Macedonia MKS N.B4 810, Portugal NP 4426, Romania I-20, Slovakia STN 34 1391.

IN ALL CASES THE INSTALLER AND THE AUTHORITY HAVING JURISDICTION OVER THE SITE ARE RESPONSIBLE FOR THE INSTALLATION OF THE ERICO SYSTEM 1000 ESE AS WELL AS ENSURING THAT THE INSTALLATION COMPLIES TO THE LATEST NF C 17-102 AND IEC EN 62651-2 STANDARDS. 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. NVENT EXCLUDES ALL OTHER LIABILITY EXCEPT SUCH LIABILITY THAT IS DIRECTLY ATTRIBUTABLE TO THE GROSS NEGLIGENCE OF NVENTS EMPLOYEES. SHOULD NVENT BE FOUND LIABLE BY A COURT OF COMPETENT JURISDICTION ITS LIABILITY SHALL IN NO EVENT EXCEED THE TOTAL PURCHASE PRICE PAID UNDER THE CONTRACT. NVENT SHALL IN NO EVENT BE RESPONSIBLE FOR ANY LOSS OF BUSINESS OR PROFITS, DOWNTIME OR DELAY, LABOR, REPAIR OR MATERIAL COSTS OR ANY SIMILAR OR DISSIMILAR CONSEQUENTIAL LOSS OR DAMAGE INCURRED BY PURCHASER. ALL OTHER TERMS AND CONDITIONS FOR THIS PRODUCT ARE AS SET OUT IN NVENT ERICOS QUOTATION DOCUMENTS AND TERMS AND CONDITIONS OF SALE.

Operation

The ESE air terminal contains a passive charging circuit that operates automatically. The air terminal becomes active only during thunderstorms. It does not require external power or component replacement during normal operation.

Warning: Do not attempt to install the nVent ERICO System 1000 during periods of lightning activity.

This Installation, Operation and Maintenance Manual assumes that in all cases, the System 1000 is designed by nVent ERICO Engineering or other qualified representative with specific experience in Standard NF C 17-102. It is understood that a design is formulated using data provided by the customer as to site layout and measurements and in accordance with all relevant standards.

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REPRESENTATIVE. THIS MANUAL IS NOT INTENDED AND SHOULD NOT BE USED AS A DESIGN GUIDE. ANY DESIGN OR STANDARD INFORMATION BELOW IS INTENDED FOR REFERENCE ONLY AS SITE CONDITIONS WILL VARY.

For a successful installation, the system design shall assure that:

1. The grounding system's configurations should be designed as a result of soil resistivity analysis. The required grounding system resistance shall be less than 10 Ω .
2. Downconductors shall comply with IEC EN 62651-2 and the path to ground should be as short as possible.
3. Downconductor shall be secured using three fixings, at minimum, per meter (approximately every one foot).
4. The design practices are outlined in the Standard NF C 17-102 and determine air terminal placement, mast height and protection level calculations.
5. It is essential to adhere to local standards and regulations for relevant local down conductor and grounding requirements.

nVent ERICO System 1000: NFC 17-102 Standard Principles

nVent ERICO System 1000 components are intended for use in ESE-type lightning protection systems that comply with the NFC 17-102 standard.

“This standard is applicable to Early Streamer Emission lightning protection systems provided to protect facilities and open areas against direct lightning impact. This ESE System shall be tested, selected and installed according to the latest revision of the standard.”

Radius of protection: Standard formulas

According to NFC 17-102:2011, the standard protection radius (R_p) of the ESE i-Series is linked to ΔT (below), the protection levels I, II, III or IV (as calculated in EN 62305-2) and the height (h) of the ESE i-Series above the structure or feature to be protected (defined by NFC 17-102 as a **minimum 2 m**).

Where $2\text{ m} \leq h \leq 5\text{ m}$, then R_p can be calculated from

$$R_p(h) = \frac{h \times R_p(5)}{5}$$

Where $h \geq 5\text{ m}$, then R_p can be calculated from

$$R_p(h) = \sqrt{2rh - h^2 + \Delta(2r + \Delta)}$$

$R_p(h)$ in meters, is the protection radius at a given height h

h in meters is the height of the ESEAT tip over the horizontal plane through the furthest point of the object to be protected

r in meters is:

- 20 m for protection level I
- 30 m for protection level II
- 45 m for protection level III
- 60 m for protection level IV

$\Delta(m)$ $\Delta = \Delta T (\mu s) \times 10^6$

Field experience has proved that Δ is equal to the efficiency obtained during the ESEAT evaluation tests

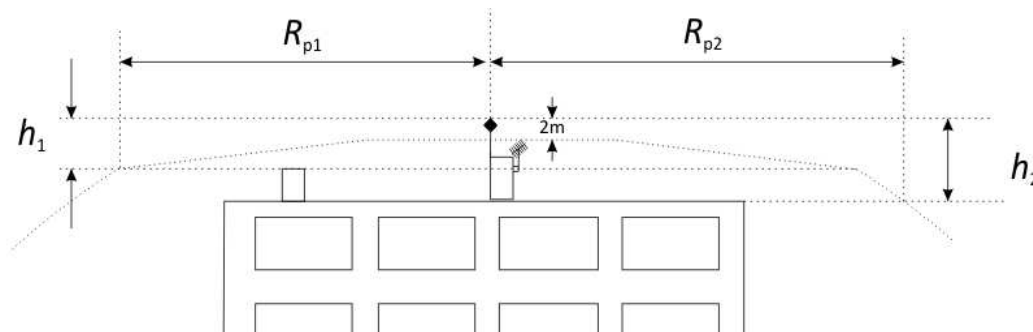


Figure 1

Radius of protection:

h (m)	LEVEL I Rp for 99%, D = 20 m				LEVEL II Rp for 97%, D = 30 m				LEVEL III Rp for 91%, D = 45 m)				LEVEL IV Rp for 84%, D = 60 m			
	SI25i	SI40i	SI45i	SI60i	SI25i	SI40i	SI45i	SI60i	SI25i	SI40i	SI45i	SI60i	SI25i	SI40i	SI45i	SI60i
2	17.0	23.2	25.3	31.4	19.6	26.2	28.3	34.6	23.0	30.0	32.2	38.8	25.9	33.4	35.8	42.7
3	25.5	34.9	37.9	47.1	29.4	39.2	42.4	51.9	34.5	45.0	48.4	58.2	38.9	50.1	53.7	64.0
4	33.9	46.5	50.6	62.9	39.2	52.3	56.6	69.2	46.0	60.0	64.5	77.7	51.8	66.8	71.6	85.3
5	42.4	58.1	63.2	78.6	49.0	65.4	70.7	86.5	57.4	75.0	80.6	97.1	64.8	83.5	89.4	106.7
10	43.9	59.2	64.3	79.4	51.3	67.2	72.4	87.8	60.8	77.6	83.0	99.1	68.9	86.7	92.5	109.2
15	44.7	59.8	64.8	79.9	53.0	68.4	73.5	88.8	63.4	79.6	84.9	100.7	72.3	89.4	95.0	111.3
20	45.0	60.0	65.0	80.0	54.1	69.3	74.4	89.5	65.5	81.3	86.5	102.0	75.1	91.8	97.2	113.2
30	43.8	59.1	64.2	79.3	55.0	70.0	75.0	90.0	68.4	83.7	88.8	104.0	79.6	95.5	100.7	116.3
40	40.2	56.5	61.8	77.4	54.0	69.2	74.3	89.4	69.8	84.9	89.9	104.9	82.7	98.0	103.1	118.4
50	33.3	51.8	57.5	74.1	51.1	67.0	72.2	87.7	69.8	84.8	89.8	104.9	84.4	99.5	104.5	119.6
60	20.1	44.5	51.0	69.1	45.9	63.1	68.6	84.8	68.3	83.6	88.7	103.9	85.0	100.0	105.0	120.0

Note: Values in meters. 5 m of the terminal is the referenced radius of protection.
The level of protection should be determined by IEC EN 62305-2 Risk Assessment

Table 1

Separation distance

The separation distance must be calculated using IEC EN 62305-3 in order to avoid a dangerous spark. It may be necessary to add extra downconductors or use an insulated downconductor.

nVent ERICO System 1000 Installation

Safety Instructions:

1. 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, fall protection harness and gloves as appropriate to the application.
2. The System 1000 products are manufactured by nVent ERICO. 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 the manufacturer's instructions.

Warning:

1. nVent ERICO products shall be installed and used only as indicated in nVent ERICO product instruction sheets and this manual. Instruction sheets are available at www.nVent.com and from your nVent ERICO customer service representative.
2. nVent 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.

Installation Configurations Recommended by nVent ERICO

1. nVent ERICO does not warranty the installation of the nVent ERICO System 1000, only the components.
2. Recommendations from nVent ERICO Engineering are listed in nVent ERICO Lightning Protection Mast Wind Ratings manuals, one for North America and one for Worldwide use.
3. Mast installations that do not meet the installation prints included in the nVent ERICO Mast Wind Loading Ratings manuals shall automatically void the product warranty.
4. Based on these guides, nVent ERICO Engineering can provide forces exerted on the brackets and guy wires, by certain maximum wind speeds. These recommendations help the structural engineer to select the proper hardware to support the installation.
5. nVent ERICO documented wind load ratings are available upon request. If the lower section of the mast is conductive, it must be electrically bonded to the nearest conductive structural point.

Recommended Order of Installation

1. Complete installation of a grounding system.
2. Complete installation of downconductor(s).
3. Termination of the downconductor(s) to the grounding system.
4. Terminate the top of the downconductor(s) to the nVent ERICO Early Streamer Terminal.
5. Verify the ESE terminal and attach the terminal to the top of the mast.
6. Raise the mast into position and secure.
7. The nVent ERICO System 1000 must be at least two meters higher than any point or object on the structure it is intended to protect.
8. The resistance of the lightning protection grounding system must be less than 10 ohms. This should be measured without downconductor(s) connected and without interconnection to other grounding systems.

ESE Air Terminals

nVent ERICO ESE air terminals are rated for ΔT 25 μ s, 40 μ s, 45 μ s and 60 μ s triggering time. The function of the rings at the top of the terminals is to easily distinguish the rated efficiency. No ring corresponds to ΔT 25 μ s, two rings to ΔT 40 μ s or 45 μ s and four rings to ΔT 60 μ s. Do not install nVent ERICO ESE air terminals without checking the correct trigger rating based on the lightning protection system design.

304L series

Part Number	Triggered Advance, ΔT	Stainless Steel Material	UL certification file
SI25i	25 μ s	304L (EN 1.4306)	UL E507847
SI40i	40 μ s	304L (EN 1.4306)	
SI45i	45 μ s	304L (EN 1.4306)	
SI60i	60 μ s	304L (EN 1.4306)	UL E507847

Note: UL (NF C17-102) OVHC.E507847

Table 2



316L series

Part Number	Triggered Advance, ΔT	Stainless Steel Material
SI60i316	60 μ s	316L (EN 1.4404)

Table 3

316L RT series (for remote tester)

Part Number	Triggered Advance, ΔT	Stainless Steel Material	Accessories included
SI60i316RT	60 μ s	316L (EN 1.4404)	Base connector
SI60i316RT-KIT	60 μ s	316L (EN 1.4404)	SIREMOTETESTER

Table 4

Raising of Masts

Ensure that:

1. There are no overhead AC power lines.
2. There is nothing overhead that will obstruct the lift.
3. There is enough manpower available to conduct the lift safely.
4. There is only ONE person in control of the lift.
5. Everyone involved in the lift knows what has been planned and how the lift is to be performed.
6. The mast is securely footed and cannot move out of control during the lift.
7. Any guying has been properly secured at the mast anchor points.
8. The downconductor has been correctly terminated and the structure bonding cable has been attached to the termination.
9. The downconductor cannot be damaged at the base of the mast while lifting; maintain a minimum bending radius of 20 cm (8 in.).
10. The mast can be easily and safely secured at the base and guying points immediately after it has been lifted into position.
11. Any extra rigging that is required for the lift is removed only 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 5 m (20 feet) in height or is being lifted from a sloped surface. A typical arrangement is shown in Figure 2. When using a crane to lift the mast into position, ensure that:
 - a. The crane has enough weight and height capacity to perform the job safely.
 - b. There is nothing overhead that will obstruct the lift.
 - c. Any guying has been properly secured at the mast anchor points.
 - d. The nVent ERICO SI ESE air terminal is NOT used as a slinging point.
 - e. When slinging the mast, ensure that the slings or harnesses cannot foul or bend the mast and / or the nVent ERICO ESE air terminal.
 - f. The downconductor cannot be damaged as a result of dragging over rough or sharp surfaces during the lift.

When ready to raise the guyed mast, check the following:

1. Guys to the mast anchor points are properly secured.
2. Ensure the guys are not twisted, kinked or damaged in any way.
3. Ensure that each guy can be easily secured at the anchors when the mast has been raised.
4. 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.
5. If using turnbuckles, ensure that they are wired securely with nichrome wire. Remember to always consistently plan the lift before attempting it.
6. If the mast is to be raised by hand, ensure that it can be safely and easily managed manually. It is recommended that a crane or other suitable equipment be used for anything over 6 m (20 feet) in height, to minimize the possibility of the mast becoming bent or damaged.
7. It is very important to keep the mast straight during the lift.

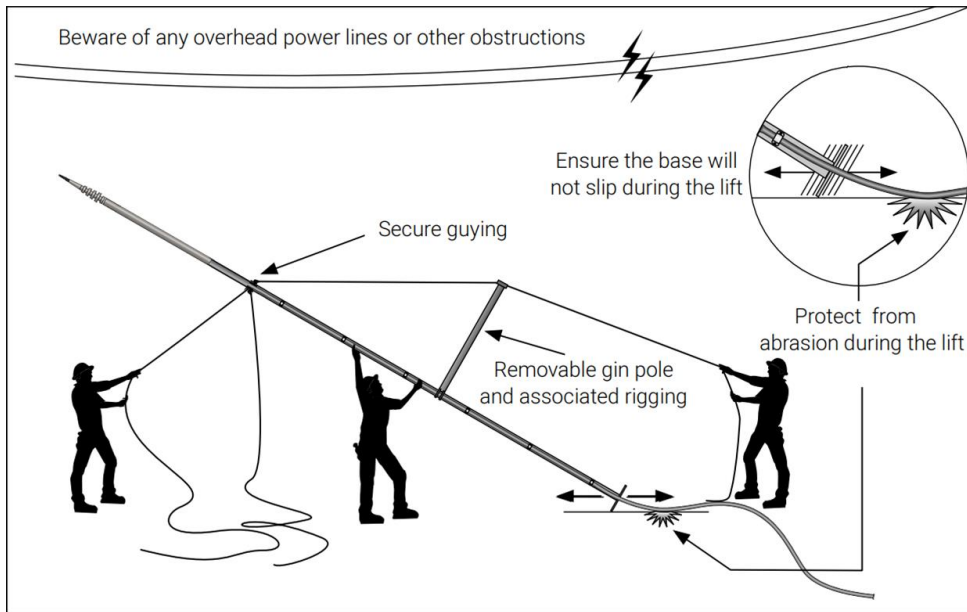


Figure 2

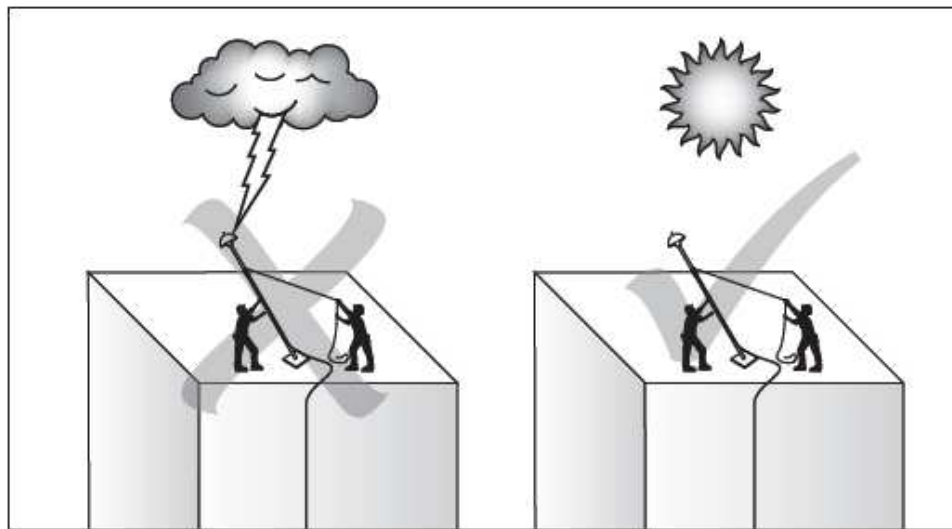


Figure 3

Guying System

4 & 7 Meters and Custom (X length) Guy Kits

The guying material is a lightweight plastic coated fiberglass rope, which is non-conductive and must be used with any section of FRP insulated mast material.

Guy Kit Specifications:

Part Numbers	Mast elevation at 45°	Guy Diameter	Guy Length	Guy Tensile Strength
GUYKIT4MGRIP (701305)	4m (13 ½ft.)	4mm (5/32 in.)	6 m (20 ½ft.)	430 Kg (946 lb.)
GUYKIT7MGRIP (701315)	7m (24 ½ft.)	5mm (3/16 in.)	10 m (34 ft.)	560 Kg (1232 lb.)

Table 5

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

IMPORTANT RECOMMENDATIONS:

- When guying any mast, it is advised that the guying angle be no greater than 60° from horizontal.
- For SIM mast, we recommend to use GUYRING28. Guy wire thimbles will be secured to the guy ring.
- It is recommended that 8mm (5/16 in.) diameter stainless steel guying saddles are used for the base guy anchors.
- If these are to be anchored to a concrete surface, then 6mm (¼ in.) diameter x 40mm (1½ in.) depth (minimum) masonry anchors or similar should be used.
- 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.
- When using shackles (5mm (3/16 in.) minimum), ensure that the shackle pins are secured with nichrome wire to stop any chance of them loosening.

When securing the fiberglass guys, use the guying grips supplied in the Guying Kit, carefully following the following instructions:

When securing guys, ensure that:

- Minimum of 3 grips are used per guy end.
- Grips spaced at a minimum of 30mm (1½ in.) on guys.
- 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 60cN.m (5 lbf.in.) of torque is applied to the grips.

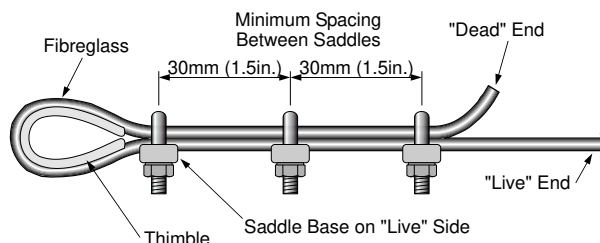


Figure 3

Mast: Bases & Assemblies

The selection of the mast configuration is a mandatory requirement:

1. Elevate the terminal to the required height as determined by the design process, minimum height of 2 m (6.6 feet) above the highest point or object on the structure.
2. The mast should be securely attached to the selected mounting point(s).
3. The mast should be guyed if applicable.
4. The hereafter assemblies are for common cases. For fastening the mast assembly to the structure it is advisable that guidance from a local structural engineer that will follow the specific installation and local regulations.

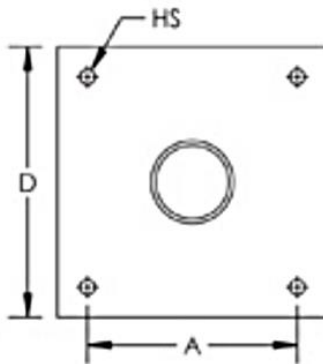
The ESE air terminal can be mounted with a cantilever or guyed mast assembly. nVent ERICO has instruction prints detailing pre-configured mast assemblies that achieve terminal heights between 2m (6.6 feet) and 8m (26.0 feet) above roof level. Wind loading calculations are available for each configuration upon request. Note: It is the responsibility of the installation contractor to ensure the mast assembly is installed in a way that is structurally sound. This requires a specific review of the installation and the site, which might include additional considerations such as wind loading, ice loading, and/or vibration. It is the responsibility of the installer to have the design reviewed by a registered professional engineer before being installed.

The below tables show installation print numbers for the desired mast series and terminal height. These detailed installation sheets can be found at www.nVent.com. The pre-configured assemblies defined in these installation prints are available for reference when designing and/or installing a lightning protection system. However, they are not to be used in place of a completed lightning protection system design by qualified engineer.

Mast Bases

nVent ERICO supplies several types of bases to suit:

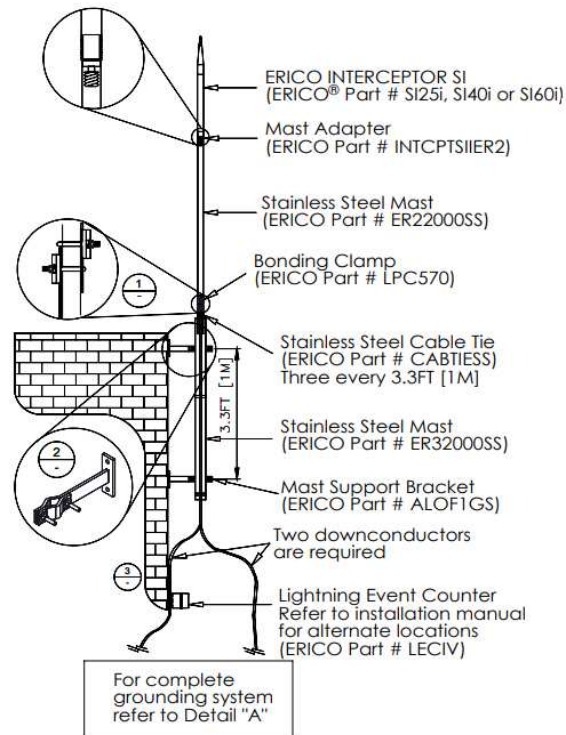
1. nVent ERICO brand of aluminum base with internal mast spigots.
2. Aluminum masts welded directly onto the required length of mast.
3. Stainless steel base with the mast spigots.



PN	D	A	HS	WEIGHT
MBMAST3M (502040)	US all models 9.0" (228.6 mm)	US all models 7.0" (177.8 mm)	US all models 0.5" (12.7 mm)	8.6 Kg 19.0 lb
MBMAST4M (701340)	Europe all models 230.0 mm (9.05")	Europe all models 180.0 mm (7.09")	Europe all models 13 mm (0.51")	10.7 Kg 23.5 lb
MBMAST5M (701350)				13.6 Kg 30.0 lb
MBMAST6M (701360)				15.2 Kg 33.5 lb
SIMBASE2840	200 mm (7.87")	170.0 mm (6.7")	11.0 mm (0.43")	1.23 Kg 2.71 lb
SIMBASE2840316				1.23 Kg 2.71 lb
ER2BASESS	9" (228.6 mm)	7" (177.8 mm)	1/2" (12.7 mm)	5.2 Kg 11.5 lb
ER3BASESS				5.6 Kg 12.4 lb

Table 6

ER 304 Series Preconfigured Mast Assemblies



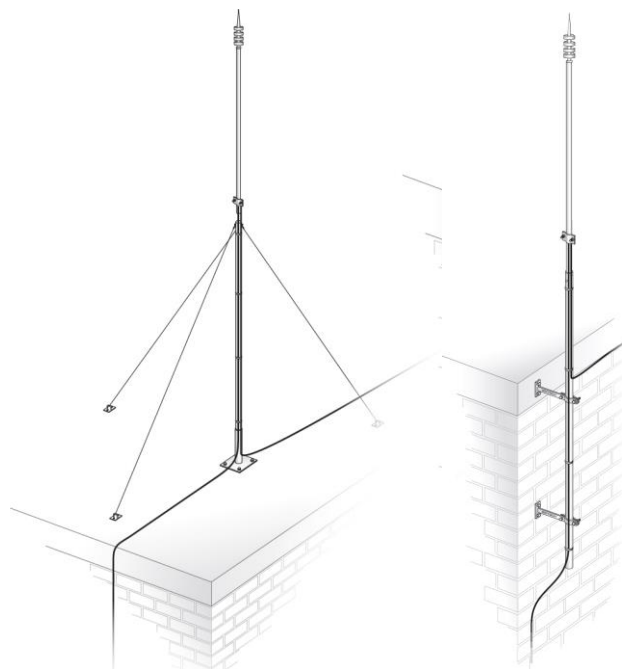
Example Mast Assembly: ER Cantilever 4m
Figure 4

ER Guyed Mast							
Instruction IP	IP79116	IP79117	IP79118	IP79119	IP79120	IP79121	IP79122
Mast Height (m)	2m	3m	4m	5m	6m	7m	8m
INTCPTSIIER1						1	1
INTCPTSIIER2	1	1	1	1	1		
ER11000SS						1	
ER12000SS							1
ER22000SS	1		1	1			
ER23000SS		1			1	1	1
ER32000SS			1				
ER33000SS				1	1	1	1
ER2BASESS	1	1					
ER3BASESS			1	1	1	1	1
GUYKIT4MGRIP		1	1			1	1
GUYKIT7MGRIP				1	1	1	1
CABTISS	4	6	8	10	12	14	16

ER Cantilever Mast				
Instruction	IP79106	IP79107	IP79108	IP79109
Mast Height	3m	4m	6m	7m
H Above Roof	2m	3m	4m	5m
INTCPTSIER1				1
INTCPTSIER2	1	1	1	
ER11000SS				1
ER22000SS		1		
ER23000SS	1		1	1
ER32000SS		1		
ER33000SS			1	1
CABTISS	6	8	10	14
ALOF1GS	2	2	3	3

Table 7

SIM 304L Series Preconfigured Mast Assemblies



Example Mast Assembly: SIM Guyed & Cantilever

Figure 5

SIM Guyed Mast in SS 304L						
Instruction	IP8528 p1	IP8528 p2	IP8528 p3	IP8528 p4	IP8528 p5	IP8528 p6
Mast Height (m)	2m	4m	5m	6m	7m	8m
GUYKIT28		1	1	1	1	1
SIM28A2	1	1	1	1	1	1
SIM33B2		1		1		
SIM33B3			1		1	1
SIM40C2				1	1	
SIM40C3						1
SIMBASE2840	1	1	1	1	1	1
GUYKIT4MGRIP		1	1	1		
GUYKIT7MGRIP					1	1
CABTISS	7	12	15	18	21	24
BASEADAPTER40		1	1			
TMCSS	2	2	2	2	2	2

SIM Cantilever Mast in SS 304L					
Instruction	IP8504	IP8504 p1	IP8504 p2	IP8504 p3	IP8504 p4
Mast Height	2m	5m	5m	7m	8m
H above roof	2m	3m	4m	5m	6m
SIM28A2	1	1	1	1	1
SIM33B2		1	1		
SIM33B3				1	1
SIM40C2			1	1	
SIM40C3					1
CABTISS	6	9	12	14	17
TMCSS	2	2	2	2	2
ALOF1GS	2	2	2	3	3

Table 8

SIM 316L Series Preconfigured Mast Assemblies

SIM Guyed Mast in SS 316L				
Instruction	IP8528 p1	IP8528 p4	IP8528 p5	IP8528 p6
Mast Height (m)	2m	6m	7m	8m
GUYKIT28		1	1	1
SIM28A2316	1	1	1	1
SIM33B2316		1		
SIM33B3316			1	1
SIM40C2316		1	1	
SIM40C3316				1
SIMBASE2840316	1	1	1	1
GUYKIT4MGRIP		1		
GUYKIT7MGRIP			1	1
CABTISS	7	18	21	24
TMCSS316	1	1	1	1

SIM Cantilever Mast in SS 316L					
Instruction	IP8504	IP8504 p1	IP8504 p2	IP8504 p3	IP8504 p4
Mast Height	2m	5m	5m	7m	8m
H above roof	2m	3m	4m	5m	6m
SIM28A2316	1	1	1	1	1
SIM33B2316		1	1		
SIM33B3316				1	1
SIM40C2316			1	1	
SIM40C3316					1
CABTISS	6	9	12	14	17
ALOF1GS	2	2	2	3	3
TMCSS316	1	1	1	1	1

Table 9

FRP and Aluminum Series Preconfigured Mast Assemblies

ERICORE Guyed Mast in fiber				
Instruction	IP8588 p1	IP8588 p2	IP8588 p3	IP8588 p4
Mast Height (m)	5m	6m	7m	8m
INTCPTSIERICOR	1	1	1	1
INTCPTADBUTTSII	1	1	1	1
FRP2MBLACK	1	1	1	1
ERICORETRMOS	1	1	1	1
ERICORE/LTKIT/A	1	1	1	1
ILCOUPL	1	1	1	1
MBMAST3M	1			
MBMAST4M		1		
MBMAST5M			1	
MBMAST6M				1
GUYKIT4MGRIP	1	1		
GUYKIT7MGRIP			1	1
CABTISS	9	12	15	18
CONSADE25	3 per meter of ERICORE			
CONSADFX	2 per CONSADE25			

ERICORE Cantilever Mast in fiber			
Instruction	IP8590 p1	IP8590 p2	IP8590 p3
Mast Height	5m	6m	8m
H above roof	4m	5m	6m
INTCPTSIERICOR	1	1	1
INTCPTADBUTTSII	1	1	1
FRP2MBLACK	1	1	1
ERICORETRMOS	1	1	1
ERICORE/LTKIT/A	1	1	1
ILCOUPL	1	1	1
ALUM3M	1		
ALUM4M		1	
ALUM6M			1
7000250S4	2	2	3
CABTISS	9	12	18
CONSADE25	3 per meter of ERICORE		
CONSADFX	2 per CONSADE25		

Note: These mast configurations are only intended for use with nVent ERICO Ericore Conductor.

Table 10

Free Standing Masts

nVent ERICO System 1000 can be adapted to free standing masts using guidance from a structural engineer. Two examples are depicted in in Figures 6 and 7.

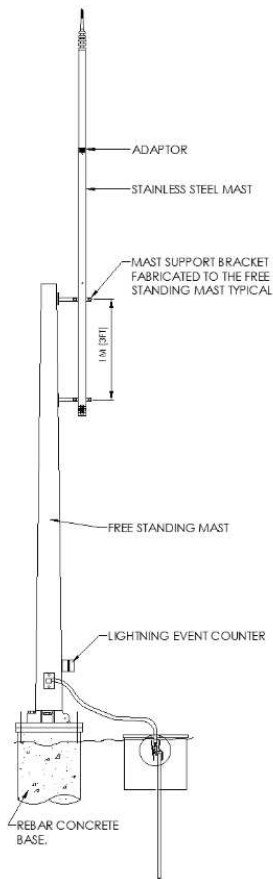


Figure 6

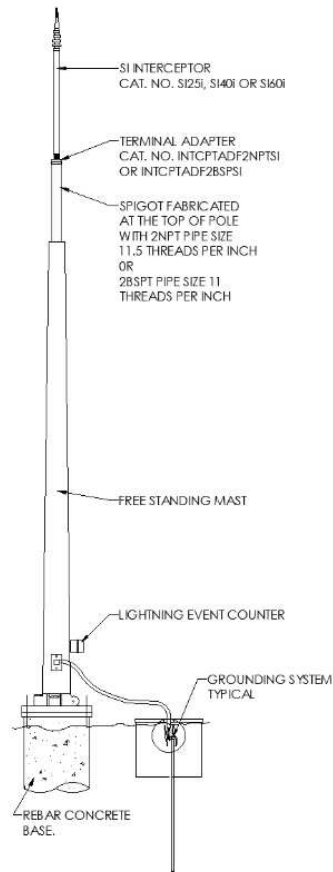


Figure 7

ISOnV Preconfigured Mast Assemblies

Mast in Stand, 2 Blocks

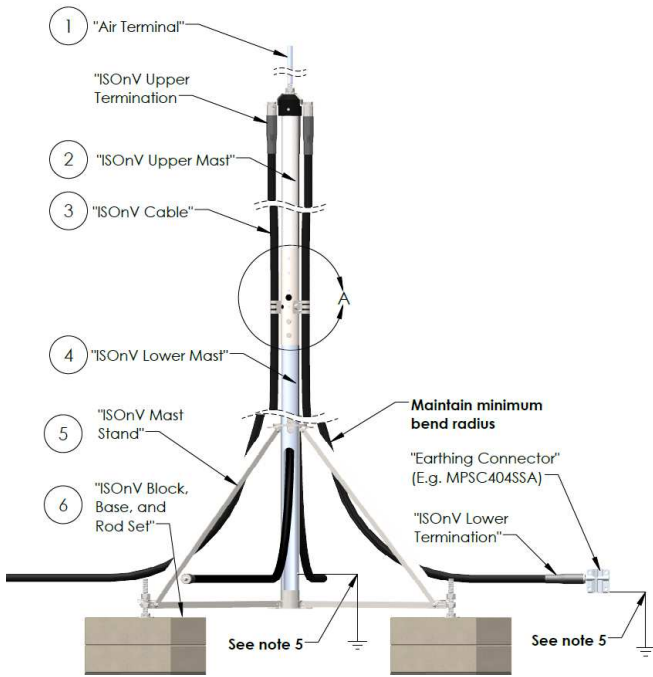


Figure 8

Cantilever Mast, 2 Fixture

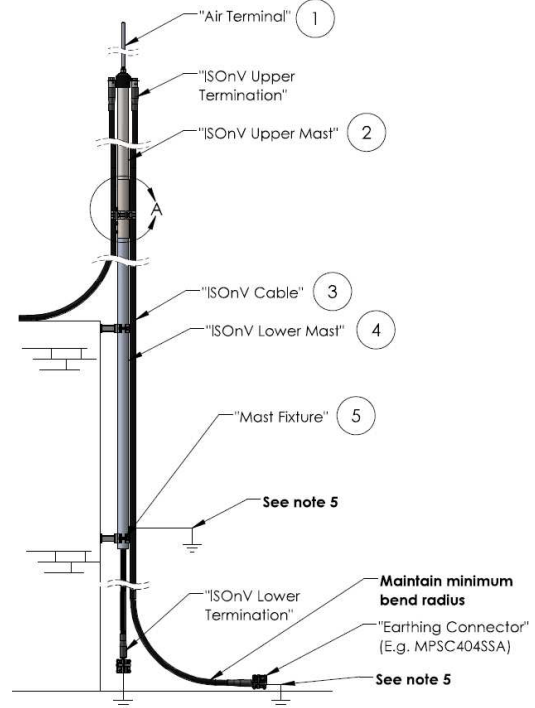


Figure 9

ISOnV STAND Mast in fiber						
Instruction	IP852 9	IP853 1	IP853 5	IP853 0	IP853 4	IP853 6
Terminal Height	4.3m	4.5m	5.9m	6.9m	7.1m	7.2m
ISONVESE	1	1	1	1	1	1
ISOMASTASSY	1	1	1	1	1	1
ISONVMASTA11	1	1				
ISONVMASTA24			1			
ISONVMASTA37				1	1	1
ISONVSTAND10	1	1		1		
ISONVSTAND15			1			1
ISONVSTAND25					1	
ISONVBLOCKSE T2	4			4		
ISONVBLOCKSE T4		4			4	
ISONVBLOCKSE T5			4			4
LPTIESS25	4	4	8	12	12	12

Table 10

ISOnV Cantilever Mast in fiber				
Instruction	IP853 8	IP854 0	IP854 7	IP855 1
Terminal Height	4.1m	5.4m	5.4m	6.7m
H above roof	3.5m	4.6m	4.5m	5.5m
ISONVESE	1	1	1	1
ISOMASTASSY	1	1	1	1
ISONVMAST 11	1			
ISONVMAST 24		1	1	
ISONVMAST 37				1
ISONVBKT15	2	2	3	3
LPTIESS25	4	8	8	12

IMPORTANT:

- These tables are only indicative per one downconductor. For a correct design, the maximum length of downconductor(s) must be calculated according to the separation distance. The system can accept maximum of five downconductors per one terminal.
- ISONV-type fixings and connections are not included and must meet nVent ERICO installations recommendations. The most configurations identified in this section are compatible with all nVent ERICO ESE air terminals.
- For isolated ISONV Systems, please ask nVent ERICO for a design.

Downconductors

Below table shows the minimum requirements for the downconductors in a qualified LP system.

Commonly used downconductors include:

Tapes	: tinned copper 30x2 and bare red copper 25x3
Insulated cables	: cables ISONV and ERICORE
Round copper, stranded	: stranded smooth weave LPC126R or stranded copper
Round conductors, Ø8mm	: solid copper or solid aluminum

For specific part numbers and attributes please refer to www.nvent.com.

EXTRACT of IEC EN 62561-2:2018 Ed. 2, Table 1

Material, configuration and cross-sectional area of air-termination conductors, air-termination rods, earth lead-in rods^g and down-conductors

Material	Configuration	Cross-sectional area ^a mm ²	Recommended Dimensions
Copper, Tin plated copper ^b	Solid tape	≥ 50	2 mm thickness
	Solid round ^d	≥ 50	8 mm diameter
	Stranded ^f	≥ 50	1,14 mm up to 1,7 mm strand diameter
	Rod solid round ^h	≥ 176	15 mm diameter
Aluminum	Solid tape	≥ 70	3 mm thickness
	Solid round	≥ 50	8 mm diameter
	Stranded ^f	≥ 50	1,63 mm strand diameter
Copper coated aluminum alloy ^e	Solid round	≥ 50	8 mm diameter
Aluminum alloy	Solid tape	≥ 50	2,5 mm thickness
	Solid round	≥ 50	8 mm diameter
	Stranded ^f	≥ 50	1,7 mm strand diameter
	Rod solid round ^h	≥ 176	15 mm diameter
Hot dipped galvanized steel	Solid tape	≥ 50	2,5 mm thickness
	Solid round	≥ 50	8 mm diameter
	Stranded ^f	≥ 50	1,7 mm strand diameter
	Rod solid round ^h	≥ 176	15 mm diameter
Copper coated steel ^e	Solid round	≥ 50	8 mm diameter
	Solid tape	≥ 50	2,5 mm thickness
Stainless steel ^c	Solid tape ⁱ	≥ 50	2 mm thickness
	Solid round ⁱ	≥ 50	8 mm diameter
	Stranded ^f	≥ 70	1,7 mm strand diameter
	Rod Solid round ^h	≥ 176	15 mm diameter

NOTE For the application of the conductors, see IEC 62305-3.

a. Manufacturing tolerance: -3 %.

b. Hot dipped or electroplated; minimum thickness coating of 1 µm. There is no requirement to measure the tin plated copper because it is for aesthetic reasons only.

c. Chromium □ 16 %; nickel □ 8 %; carbon ≤ 0,08 %.

d. 50 mm² (8 mm in diameter) may be reduced to 28 mm² (6 mm in diameter) in certain applications where mechanical strength is not an essential requirement. Consideration should, in this case, be given to reducing the spacing between the fasteners.

e. Minimum 70 µm radial copper coating of 99,9 % copper content.

f. The cross-sectional area of stranded conductors is determined by the resistance of the conductor according to IEC 60228.

g. If the earth lead-in rod is partially installed in soil it has to fulfill the requirements of Table 2 and Table 3.

h. Applicable for air-termination rods and earth lead-in rods. For air-termination rods where mechanical stress such as wind loading is not critical, a 9,5-mm diameter, 1-m long rod may be used.

i. If thermal and mechanical considerations are important, then these values should be increased to 75 mm².

Table 11 (Note: Table 1 from standard)

Resistance of natural downconductors

Externally interconnected steel frames (metal structures) may be used as downconductors if they are conductive and their resistance is 0.1 Ω or lower.

This can be reached in combination with nVent ERICO Earthbridges that are in accordance with IEC EN 62561-1.

Number of downconductors.

For non-isolated ESE systems, each ESE Air Terminal (ESEAT) shall be connected to at least two downconductors. For better current distribution, the two paths to ground should be situated on two different facades (unless there are no other options).

- To comply with IEC EN 62561-2, at least one of the downconductors must be a specific downconductor and a conductive structure can represent the natural downconductor.
- When many ESEAT's are located on the same building, it is required that at least the same number of specific downconductors are installed.
- The calculated separation distance for the whole lightning protection system might allow a higher or lower number of downconductors.
- The separation distance dictates the number of downconductors needed. In some cases one of the downconductors can be shared by two ESEAT's.
- In the case of an isolated ESE System, at least one downconductor is needed for each ESEAT.

Lightning Event Counters

A lightning event counter should be installed on the system to record the number of lightning events. It should be placed on the most direct (short) down-conductor and is preferably located just above the control joint.

Types of Lightning Event Counters

LECIV	Mechanical display
LECIVR	Mechanical display with wired Remote Monitoring
LECV	Digital display

Table 12



Figure 10

Grounding System

NF C 17-102 and IEC 62305-3 General Grounding Recommendations.

For grounding, the Standard NF C 17-102 refers to Standard IEC 62305-3. From the viewpoint of lightning protection, a single integrated structure earth-termination system is preferable and is suitable for all purposes (i.e. lightning protection, power systems and telecommunication systems). For earth-termination systems, two basic types of earth electrode arrangements apply, namely system A and B.

The type of arrangement A comprises of horizontal or vertical earth electrodes installed outside the structure to be protected, they are connected to each down-conductor or foundation earth electrodes not forming a closed loop. In type A arrangements, the total number of earth electrodes shall be not less than two. When the above-mentioned requirements cannot be met, a type B earth arrangement shall be used.

Type B arrangement. This type of arrangement comprises of either a ring conductor external to the structure to be protected, in contact with the soil for at least 80 % of its total length, or a foundation earth electrode forming a closed loop. Such earth electrodes may also be meshed. Reduction of earthing resistance by the extension of earth electrodes is practically convenient up to 60 m. In soil with resistivity higher than 3,000 Ωm , the use of type B earth electrodes or earthing enhancing compounds is recommended.

Following are general grounding recommendations by nVent ERICO.

Prior to the installation of the 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. Care must be taken to follow the ground survey design. Ensure the correct materials have been provided and are used to achieve the required ground resistance < 10 Ω . The grounding system is critical to integrity of any lightning protection installation and should include considerations of the latest revisions of relevant grounding standards.

Other Grounding Considerations

1. Available space for a grounding system installation.
2. Natural soil conditions including resistivity, moisture, temperature, and chemical content.
3. Location of underground services - Power, Communications, Fuel, Gas, Water, etc.
4. Use of suitable ground rods, such as nVent ERICO copper bonded rods.
5. Contact nVent ERICO customer service, or distributor, if you require additional assistance.

Figures x and xx represent examples of recommended standalone grounding systems, or minimum grounding system requirements for each downconductor. Figure x represents the minimum grounding system requirement for each 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. 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 that can be disconnected for future testing.

When driving ground rods, it is advisable to use nVent ERICO ground rod drivers and 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:

1. 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 cables, bars, rods, tapes, structural steel work, reinforcing steel and pipes.
2. Supplied ground rod clamps should be used to terminate downconductors directly to ground rods. This allows later disconnection for maintenance requirements.

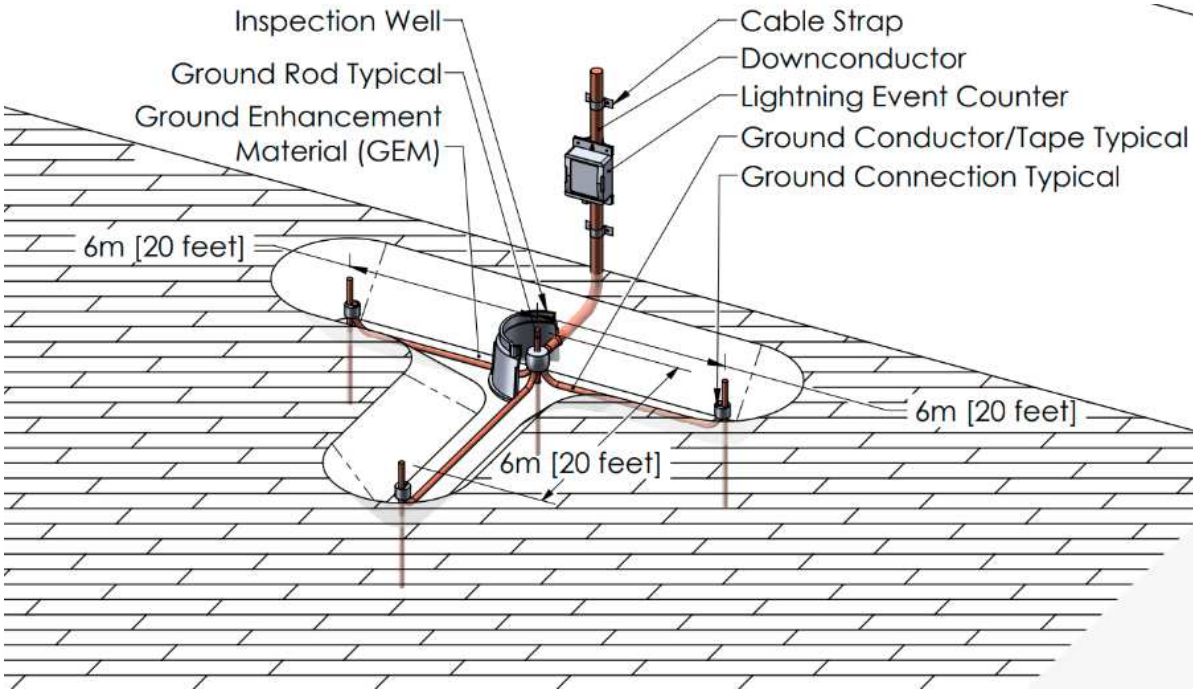


Figure 11

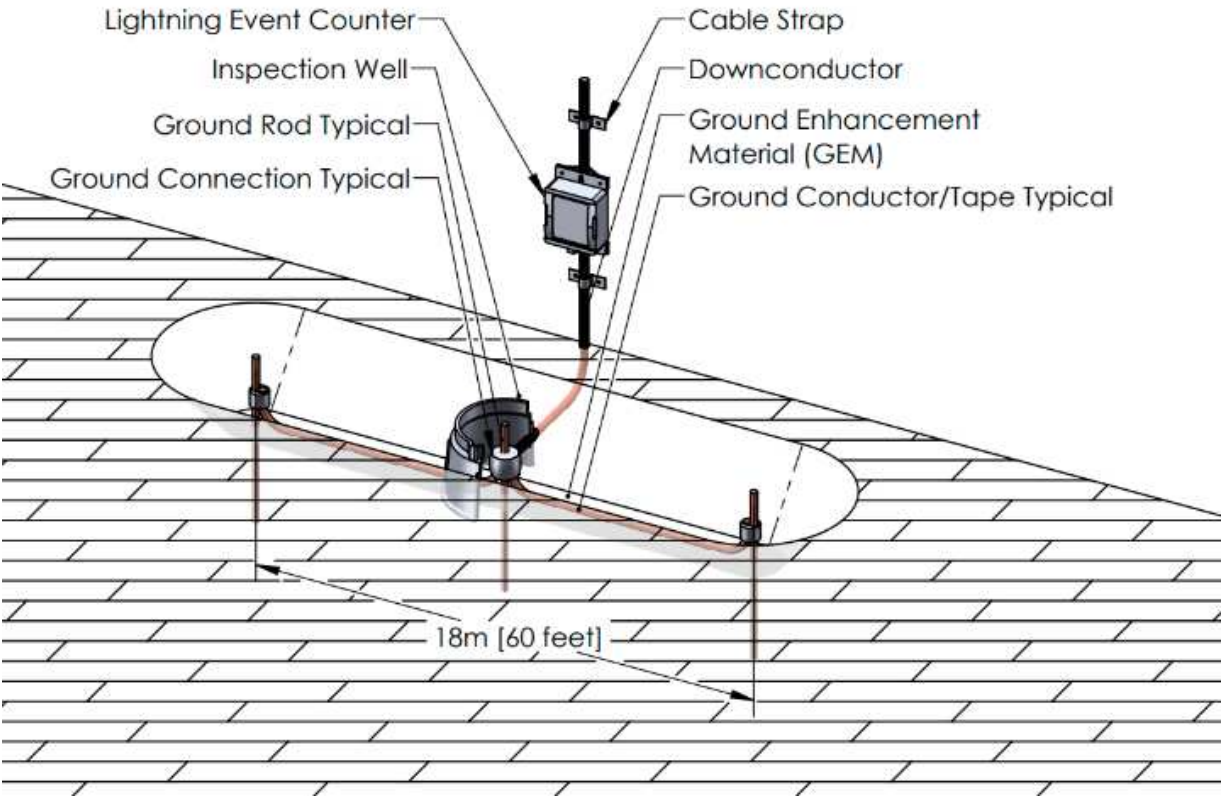


Figure 12

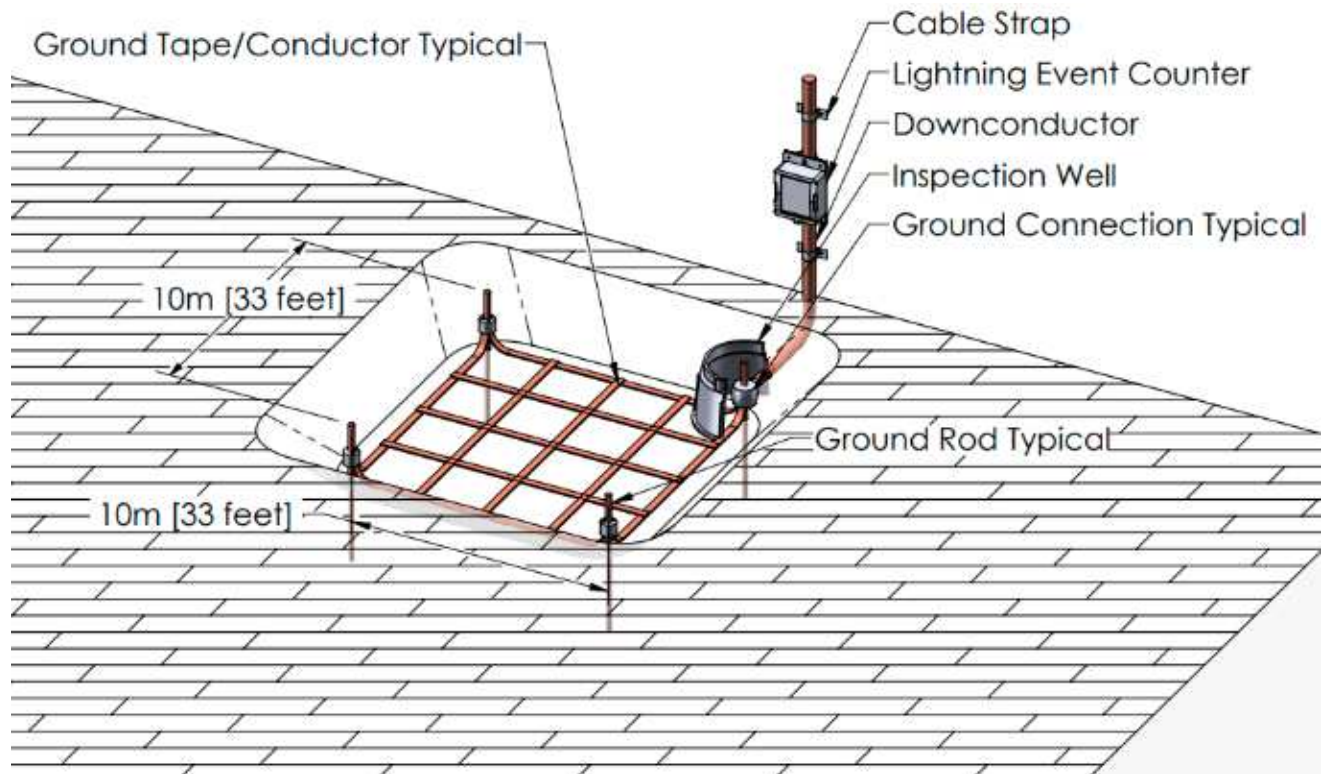


Figure 13

Lowering Ground Resistance

1. nVent ERICO Ground Enhancement Material (GEM) PN GEM25A, is recommended and supplied when the existing soil mass has a high resistivity.
2. GEM enhances the overall grounding system by creating a larger and more conductive volume adjacent to the ground rod, providing multiple paths of dissipation, which increases the uniform distribution of energy. GEM also decreases the voltage gradient quicker and more effectively than could be achieved by the native earth.
3. GEM requires water and a mixing container. Follow the installation instructions printed on the bag or bucket.

Insulation of Grounding Systems

In some installations, it may be necessary to insulate part of the ground system from 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 x).

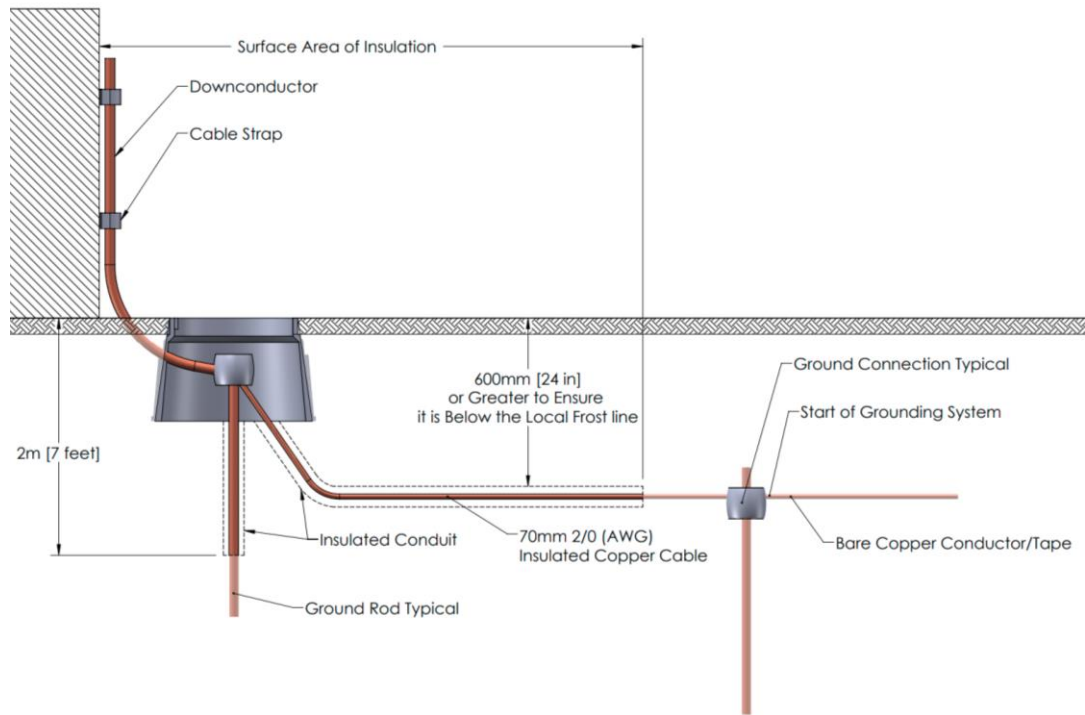


Figure 14

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 integrated grounding system. This will eliminate the possibility of ground loops and potential differences that arise under transient conditions.

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 it should be at least 70 mm² (2/0 AWG) or larger. In some circumstances, it may be necessary to use a Potential Equalization Clamp (PEC100), which insulate the grounds under steady state conditions and 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 downconductor(s) 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 downconductors for long horizontal lengths at the ground level to reach a designated earth point is not recommended. Instead, termination should be made to a ground rod upon reaching the ground level. Then a separate length of grounding conductor should be connected from the ground rod to other earthing points as required.

Labeling

The labeling of Inspection Wells or grounding systems to local requirements is the responsibility of the installer.

Special Applications

Hazardous Applications - ATEX

Standard NF C 17-102 section 3.52 addresses structures with risk of explosion, mainly structures containing solid explosive materials or hazardous zones as defined in accordance with IEC 60079-10. In addition;

1. It is recommended to perform a risk analysis study of the area and the facility within IEC EN 62305-2, or to a local relevant standard and mainly following local regulations.
2. The nVent recommendation is to design to the highest protection level of 99%. You can follow IEC EN 62305-2 and/or local regulations.
3. ESE terminals should be located a minimum of 1m outside of the hazardous zones.
4. nVent ERICO recommends using insulated downconductors like ISONV or Ericore. IEC EN 62305-3 accepts not insulated DC with conditions. Please refer to the local regulations. 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.
5. 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.
6. 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 the 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.

Protection of buildings for levels of protection I+ and I++

Level of protection I+ : The ESE System at level of protection 1 is additionally connected to the metal structure or reinforced bars of the buildings, used as natural downconductor. In addition to the dedicated downconductor included in the ESE System. Connection to the natural downconductors shall be made at roof level and at the ground level. When the downconductors are not interconnected at roof level, a ring conductor located above the roof can be used to achieve these requirements. The downconductors shall be interconnected at ground level either by the earthing loop or by a dedicated conductor. If there are no natural downconductors or if one of the above requirements cannot be fulfilled, level I+ cannot be achieved.

Level of protection I++ : The roof is protected at level I+ with an ESEAT having a radius of protection **reduced by 40%** compared to values in the above table to achieve a complete protection of equipment on the roof against direct lightning strikes.

Tall Buildings

Protection of high-rise buildings (height greater than 60 m)

Additional protection against direct lightning strike for the highest 20% of the structure height for buildings greater than 60 m or any point above 120 m, using ESEAT or any other means must be implemented at each facade wall according to a valid standard. Furthermore, a minimum of 4 downconductors, interconnected by a ring conductor when applicable, shall be used, distributed along the perimeter and, if possible, at each angle of the building.

NOTE: In general the risk due to the lateral flashes is low, because only a few percent of all flashes to tall structures will be to the side. Their intensities are a lot lower than those of flashes to the top of structures.

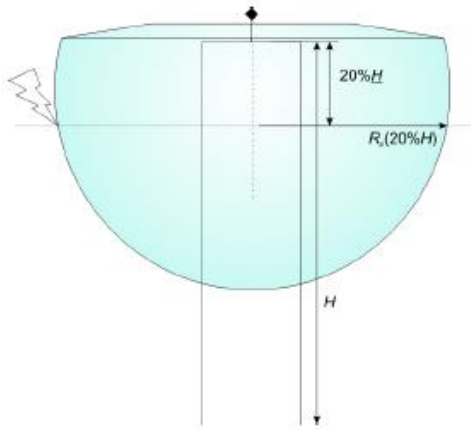


Figure 15

Protection of Substations

In most Lightning Protection applications the protection levels are selected by the owner of the property. The protection levels in lightning protection (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. nVent ERICO System 1000 can be mounted directly on the structure, or on a freestanding mast that would be supplied by the customer.

Maintenance Disclaimer

Warning: Do not attempt maintenance during potential lightning activity.

The maintenance should be undertaken as follows:

1. It is essential and usually mandatory following local regulations that the nVent ERICO System 1000 Lightning Protection System should be subjected to verification:
 - a. Initially, once the nVent ERICO System 1000 installation is completed.
 - b. Whenever the protected structure is modified, repaired or when the structure has been struck by lightning.
 - c. Periodicity table for inspections, following point 8 of standard NFC 17-102 and Table E2 of standard IEC 62305-3, installation must be regularly inspected to assure that installation is fully operative.

TABLE 7 NFC 17-102 Protection level	Visual inspection	Complete inspection	Critical systems complete inspection	In case of structures with a risk of explosion	Inspection after a lightning event in the structure
I and II	1 year	2 years	1 year	6 months	Complete
III and IV	2 years	4 years	1 year	N/A	Visual

Note: please adapt to the local regulations if more restrictive.

Electrical testing of the installation should be performed once a year

Table 13

2. Documentation must be created after installation:
 - a. Required protection Level: *Risk Assessment report as per IEC EN 62305-2*
 - b. Justification of the protection: *Design report with a drawing of the installation.*
 - c. Type and characteristics of ESE AIR TERMINAL: *List of Air Terminals models with their datasheet.*

- d. ESE Air Terminal Test procedure: *see documents: SI-TESTER IP8564 or SIREMOTETESTER IP9021*
 - e. Number and localization of down-conductors: *can be included on Design Report or make an specific table.*
 - f. Existence and localization of lightning event counter: *can be included on Design Report or drawing.*
 - g. Justification of electrical insulation: *Separation distance calculation or Insulated cable calculation.*
 - h. Justification of lightning equipotential bonding including SPDs: *Design and drawing for bonding and SPDs.*
 - i. Type and value of earth terminations systems: *can be included on Design Report or drawing.*
 - j. Justification of earth terminations systems dimensions if the value is higher than 10 Ω. *Report of measure or calculation as per IEC EN 62305-3.*
3. Maintenance should be undertaken as defined in NFC 17-102 Table 7 below and after a lightning event. Initial and regular reports of maintenance must be saved. Any faults found in the nVent ERICO System 1000 during an inspection should be corrected as soon as possible in order to maintain its optimal effectiveness.
 4. Maintenance of components and protections system has to be conducted according to nVent ERICO System 1000 documentation at the time of installation and assumes the structure has not been changed.
 5. Check that the building is the same physical shape and that no additional structures such as antennae, advertising signs, satellite dishes, building maintenance units or similar have been installed 2 m (80 in) below the nVent ERICO System 1000. A new design can be necessary in this case.
 6. Inspect the ERICO System 1000 terminal to ensure that they are not physically damaged . Also, verifying it remains operational using SI-TESTER or SIREMOTETESTER.
 7. Inspect the tip on top of the ESE Air Terminal to ensure it is not excessively burnt, deformed or missing.
 8. Check that:
 - a. The mast is securely attached to the structure.
 - b. Check that the guys are secure and undamaged. (Replace if necessary).
 - c. Check that all fastenings are secure and tight.
 9. Look for signs of damage to the downconductors (whether by lightning, careless handling, vandalism or other causes).
 10. Check that the Lightning Event Counter is secured and if the display is registering a reading, record the reading and date.
 11. Ensure the grounding resistance is less than 10 ohms.
 12. Check the continuity of all bonding conductors.
 13. Remove and replace any damaged or missing parts.

nVent ERICO ESE Air Terminal Testing Procedure

nVent ERICO proposes two ways for testing of the nVent ERICO Interceptor SI25i, SI40i, SI45i, SI60i, SI60i316 & SI60i316RT air terminals using commonly available test equipment.

ESE Air Terminal Testers

SI-TESTER	Manual tester for all SI ESE models
SI-TESTER-POLE	Telescopic Pole (up to 10m) for SI-TESTER
SIREMOTETESTER	Remote tester to be installed with a SI RT ESE model

Table 14

Manual tester SI-TESTER and pole SITESTERPOLE

Easily test on-site the state of an nVent ERICO System 1000 Early Streamer Emission Terminal, SIXXi models.



Figure 16

The test result is displayed in summary with a display of the <OK> (green led) or <Default> (red led). This tester allows verification of an installation for the whole ESE range, up to 10m accessibility using SITESTERPOLE.

For more information, download IP8564 Manual Tester instructions at www.nvent.com.

Remote Tester SIREMOTETESTER

The tester mounted on SI60i316RT air terminals, working in autonomously without any external power, allowing daily verification when the ESE Air Terminal is not accessible, up to 100m distance.

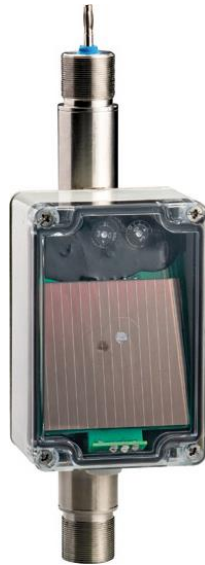


Figure 17

Remote detection of the operation status for ESE RT models by LED's.

Easily test the state of an nVent ERICO System 1000 Early Streamer Emission Terminal, SIXXi RT models while on-site.

For more information, download IP9021 Remote Tester instructions at www.nvent.com.

In case you have further questions related to the nVent ERICO ESE S1000 system or components please contact to nVent ERICO Engineering.