ERITECH®

Grounding, Lightning Protection and Surge Protection

For Telecommunications

ERICO®

Indoor Bonding Layout

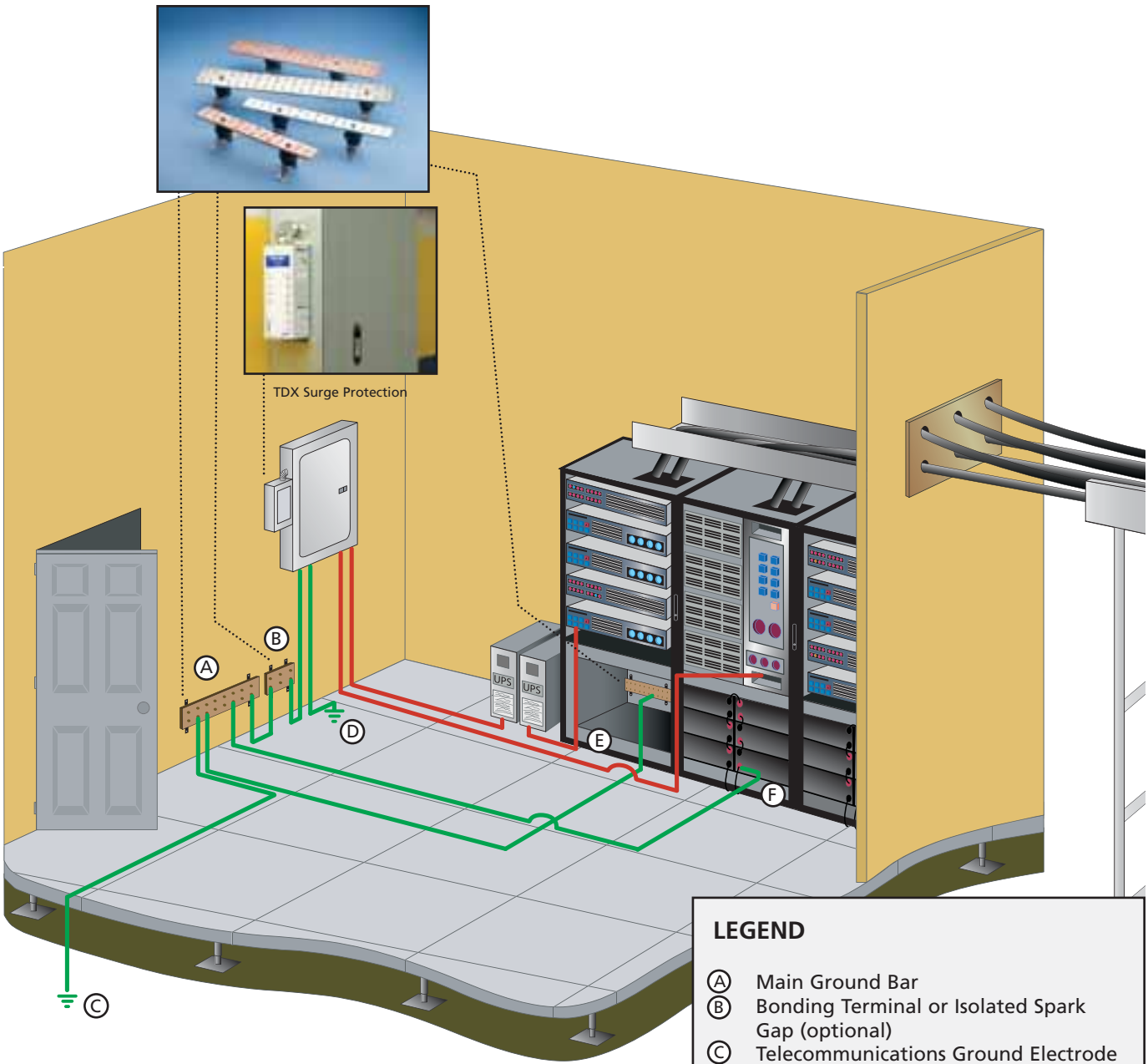
Grounding/earthing, lightning protection and surge protection are critical parts of a telecommunications facility installation. ERICO® has complete telecommunications applications solutions to help protect the facility against electrical noise, lightning induced surges and transients caused by switching components in the power systems.

ERICO solutions include ERITECH® ground rods, ground mats, ground enhancing material (GEM), ground bars, CADWELD® connections, ERITECH lightning protection systems and CRITEC® MDF, co-axial and power surge protectors.

To make the application of these products simpler, the grounding, lightning protection and surge protection system at a telecommunications facility is divided into 5 components.

1. Indoor Bonding Arrangement
2. Outdoor Grounding Arrangement
3. Surge Protection for Power Lines
4. Surge Protection for Telephone Lines
5. Direct Strike Lightning Protection

ERITECH ground bars can be used to achieve the ideal indoor grounding arrangement as required at the telecommunications facility.



LEGEND

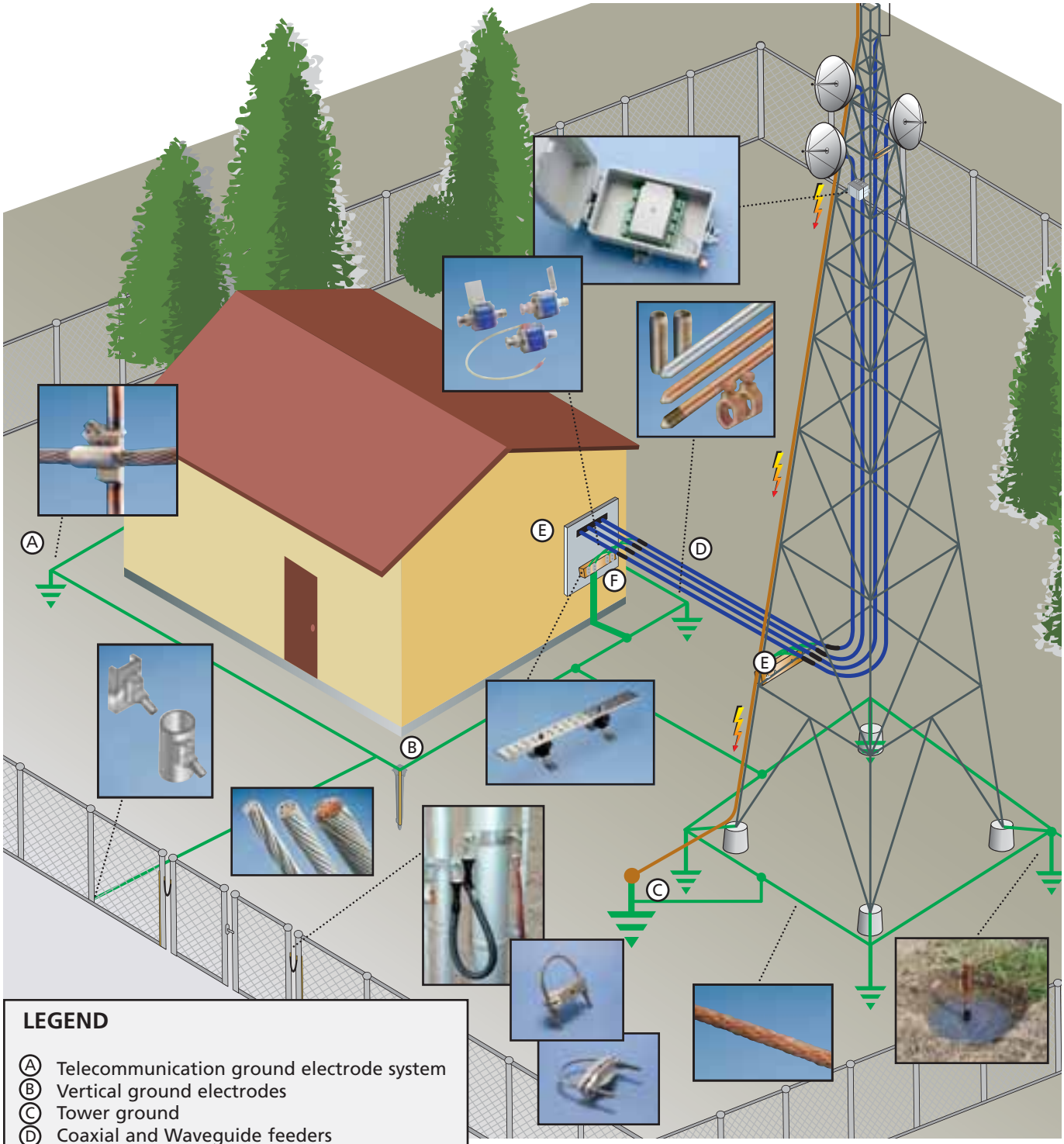
- Ⓐ Main Ground Bar
- Ⓑ Bonding Terminal or Isolated Spark Gap (optional)
- Ⓒ Telecommunications Ground Electrode
- Ⓓ AC Ground Electrode
- Ⓔ Communications Ground Bar
- Ⓕ Battery Ground

Outdoor Grounding / Earthing Layout

The outdoor arrangement of a grounding system at a telecommunications facility is depicted here. This arrangement is not always possible due to certain constraints at the site. Where the telecommunication equipment is installed in a large multi functional building or several floors above the ground floor this layout may not be possible.

Alternative outdoor ground electrode system needs to be considered on a case by case basis if the suggested layout below is not possible to implement.

ERICO® offers a full range of products to form the outdoor grounding system at a telecommunications facility.



LEGEND

- Ⓐ Telecommunication ground electrode system
- Ⓑ Vertical ground electrodes
- Ⓒ Tower ground
- Ⓓ Coaxial and Waveguide feeders
- Ⓔ Coaxial surge protectors or ground kit
- Ⓕ RF Ground Bar

Ground Rods, Connections and Accessories

Ground Rods

ERICO® offers a range of ground rods for telecommunications applications to suit the needs and preferences of the carriers. The most common of these are copper bonded steel ground rods, due to their versatility in varied soil conditions and compatibility with various common metals used underground.

The copper-bonded ground rod has an electrolytic coating of copper deposited over a layer of nickel. This process helps ensure a long lasting, molecular bond between the copper layer and the steel core. ERICO recommends copper-bonded ground rods because the copper coating will not slip or tear when driven, nor will it crack if the rod is bent. The tough, carbon steel core has good characteristics for deep driving. Copper-bonded ground rods have a high resistance to corrosion and provide a low resistance path to ground.

It is important to note that certain soils and landfill areas may not be compatible with copper. In these situations, stainless steel is a better choice. Stainless steel may also be an alternative, when structures or components, such as steel towers, poles or lead sheathed cables are in close proximity to an array of ground electrodes. In these circumstances, consideration must be given to the consequence of galvanic corrosion.

Grounding Connections

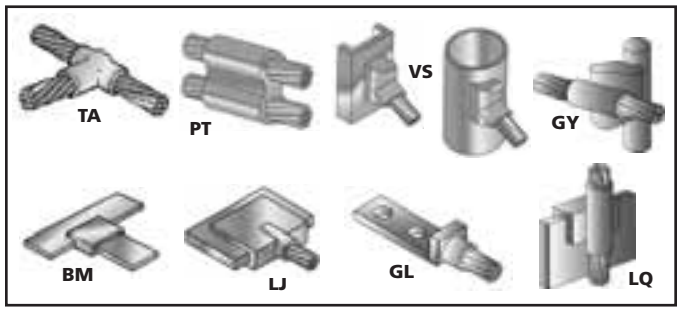
Grounding connections are vital to the proper operation and integrity of the electrical system. ERICO offers a range of mechanical grounding connections including clamps, jumpers, fence connections, U-Bolts and other clamps.

However, the CADWELD® welded electrical connection is our recommended method of making grounding connections. The principle technology consists of bringing together a welding material and ignition agent in a suitable graphite mold. The reduction of copper oxide by aluminum produces molten copper and aluminum oxide slag at extremely high temperatures. The shape of the mold, its dimensions, and the size of welding material, are all dependent on the items to be welded.

The key benefits of CADWELD are:

- Connections are permanent and will not loosen or corrode.
- Connections are made with inexpensive, lightweight equipment.
- Connections can be made without the need for any special skills.

The CADWELD connection is essentially a fusing through of the grounding conductor, whereby there is greater amount of metal across the cross section of the connection than that across the conductor. It can be intuitively seen that the connection is as good as the conductor, if not better, which is a unique feature of CADWELD. Independent scientific tests have been done to CADWELD using the most stringent standards associated with high voltage electrical installations.



Typical CADWELD Connections used in telecommunications grounding and bonding

Ground Bar

Ground Clamp

Ground Clamp

Ground Tester

Grounding Conductors and Accessories

The two most common grounding conductors used in telecommunications are round cables or flat tape. Flat tape conductors have a lower inductance and provide a higher capacitive coupling to the ground, which results in a lower impedance earth system, especially at high frequencies associated with lightning and telecommunications noise. ERICO offers a range of conductors including bare or tinned copper tape, bare copper cables and smooth weave cable conductors.

In situations where ground conditions make it difficult to achieve the required resistance, ERICO offers Ground Enhancement Material (GEM). GEM is a low-resistance, non-corrosive, carbon dust based material that improves grounding effectiveness, especially in areas of poor conductivity. GEM contains cement, which hardens when set to provide a permanent, maintenance-free, low-resistant grounding system that will not leach or wash away.

ERICO also provides a range of coaxial surge protectors that are suitable for use up to a frequency of 3 GHz. It is strongly recommended that feeders not fitted with coaxial surge protectors be grounded via appropriate grounding kits.

The ERITECH EST series of earth testers are available for testing of soil resistivity and ground resistance of electrodes.

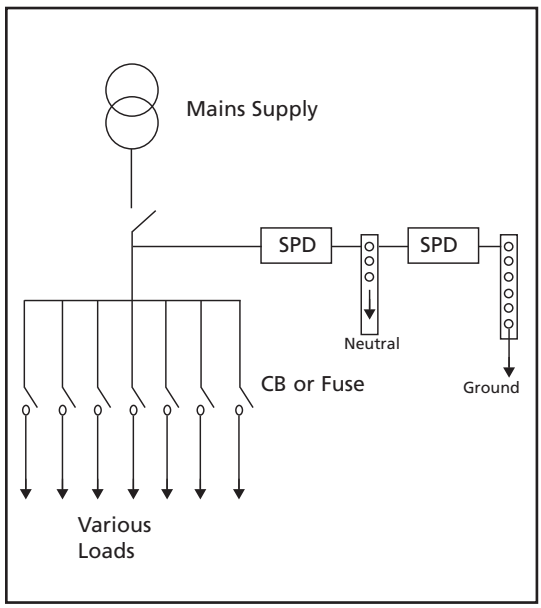
Surge Protection for Power and Telephone Lines

A telecommunications site needs reliable grounding for the purpose of good reference ground, noise control and dissipation of any lightning energy. Surges in the power and copper based telephone lines can also originate from lightning strikes that have struck objects some distance from the actual site, in many cases, even miles away. Having a good ground alone is not enough to minimize damage due to these surges caused by distant strikes. Surges can also occur in power lines due to switching of circuit breakers in the power systems under fault conditions. It is important to have adequate surge protection on the AC mains and on telephone lines.

The best starting point in the selection of surge protection devices is to look at the following 5 ratings as defined by IEC® standards and choose suitable levels for the application.

- Maximum Discharge Current, or Imax. This is the single shot rating of the SPD.
- Nominal Discharge Current or In. This is the 15 shot rating of the SPD.
- Voltage Protection Level, or Up. This is the voltage to which surges tested to IEC standards are limited to. Normally this test is done at In. Sometimes this test is done at 3kA 8/20us. The lower the Up the better the SPD is as a protection device.
- Maximum Continuous Operating Voltage, or Uc. SPD's can experience damage if the supply voltage exceeds their clamp voltage for a prolonged duration. A high Uc will mean that the product is rugged against over-voltage events.

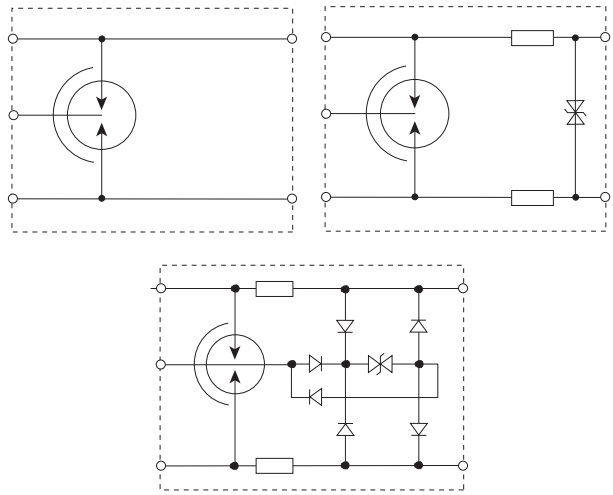
Typical Wiring of a SPD at a Main Switch Board



The SPD arrangement shown left is called shunt surge protection whereby the SPD is connected in parallel with the load. The limitation of this type of protection is that while the surge voltage is controlled to a manageable level, these devices do not lower the voltage rise time of the incoming surges. It is widely acknowledged that both the voltage level as well as the rise time of power surges can cause damage to sensitive electronics. In applications where a higher level of protection is deemed necessary due to the critical nature of the telecommunications network element, surge reduction filters can be used to effectively reduce the voltage levels and rise times.

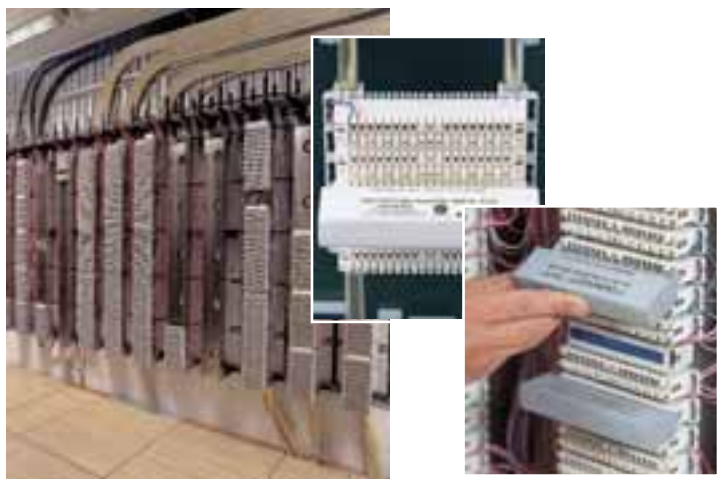
Surge Protection for Telephone Lines

Lightning surges can get coupled into telephone lines, in a very similar manner that they couple into power lines.



Topologies for Telephone Line Protection

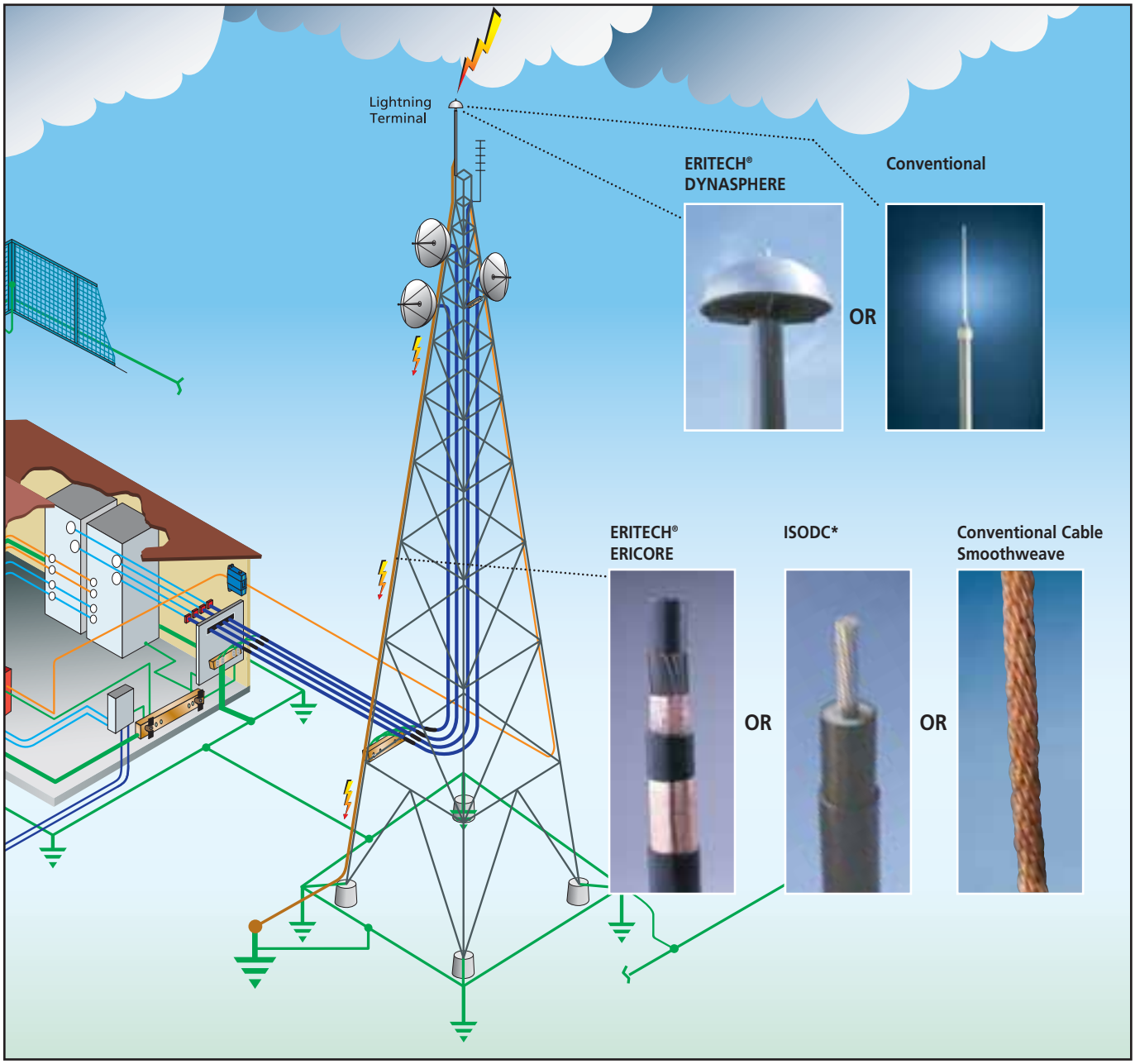
A single stage gas arrestor installed at the main distribution frame helps ensure that both of the lines are shorted to ground momentarily to take bulk of the energy down to ground when a surge occurs. However, because it is not possible to short out the two lines at exactly the same moment, a differential mode transient develops which is very damaging to the end equipment. Hence in critical applications, the use of single stage gas arrester modules at main distribution frame is not adequate. Surge protective devices with secondary clamping stages provide a better protection.



Lightning Protection for Telecommunications Towers

Direct lightning strikes to telecommunications towers are a reasonably regular occurrence, more so on mountain tops and in certain parts of the world. The traditional approach to lightning protection on towers is to have a lightning rod on the top of the tower and a dedicated down conductor comprised of bare cable or tape that is installed on the tower to connect the lightning rod to the ground.

A modern method is to use an optimal air terminal design, the ERITECH® DYNASPHERE mounted on top of the telecommunications mast on a 3-4 metres long fibreglass reinforced pole, FRP. The FRP provides isolation between the air terminal and the tower and helps ensure that the lightning does not flash over and electrify the mast or the antenna. A special purpose downconductor, called the ERITECH® ERICORE is routed in the core of the FRP and connects to the bottom of the ERITECH® DYNASPHERE via a high voltage, impulse rated termination. The ERITECH® ERICORE runs along a leg of the tower away from the routes of feeders, down to the tower grounding system. ERITECH® ERICORE cable is designed to minimize the voltage between itself and the tower so that the bulk of the lightning energy is contained within the cable, thereby protecting the tower and feeders from conducted lightning currents and having much less reliance on bonding practices which sometimes are overlooked or completed incorrectly.



* ISODC - is an isolated lightning protection cable system based around IEC62305. It is designed to isolate the lightning current from sensitive equipment, eliminating the need for separation distances required with conventional cable. Contact ERICO® for further information.

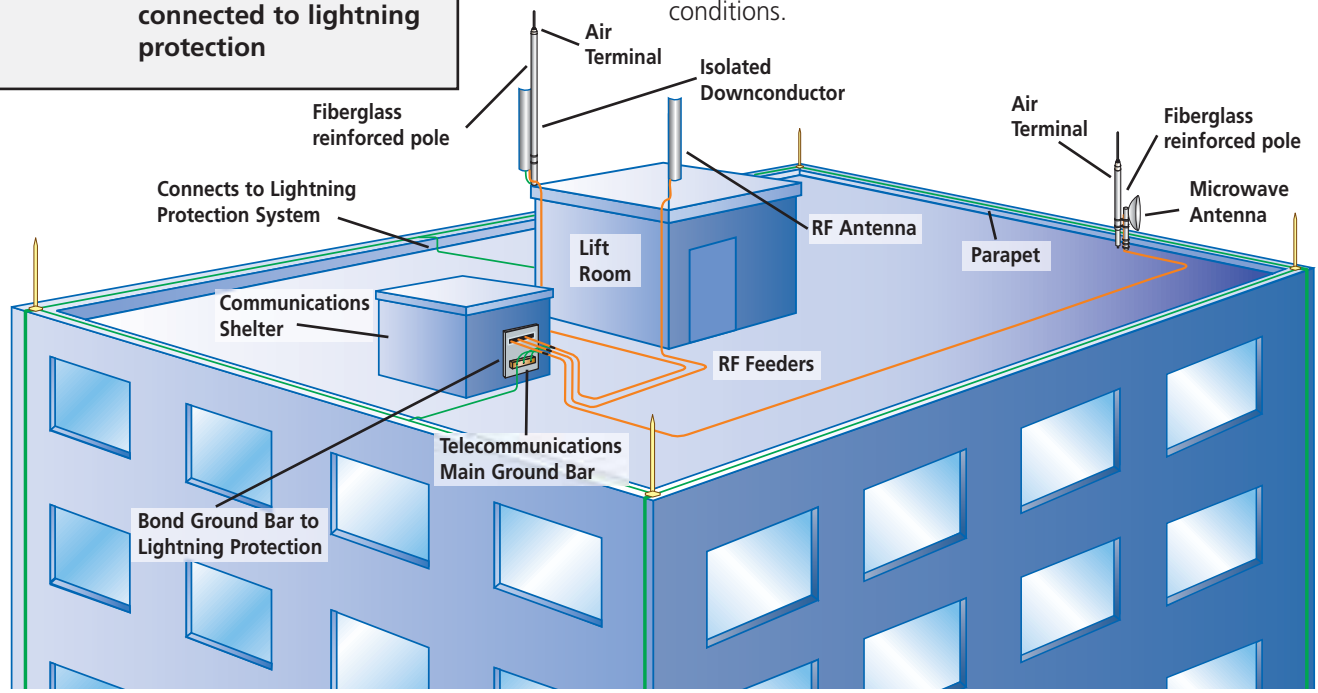
Lightning Protection for Roof Mounted Installations

Traditionally, some rooftop installation have been protected by the use of air terminals (Franklin Lightning Rods), often connected to the building lightning protection system. However, the traditional building lightning protection techniques are not well suited to protect these roof top installations. Hence many telecommunications companies have opted not to provide any form of air terminal. Instead they do extensive bonding of all their roof mounted equipment.

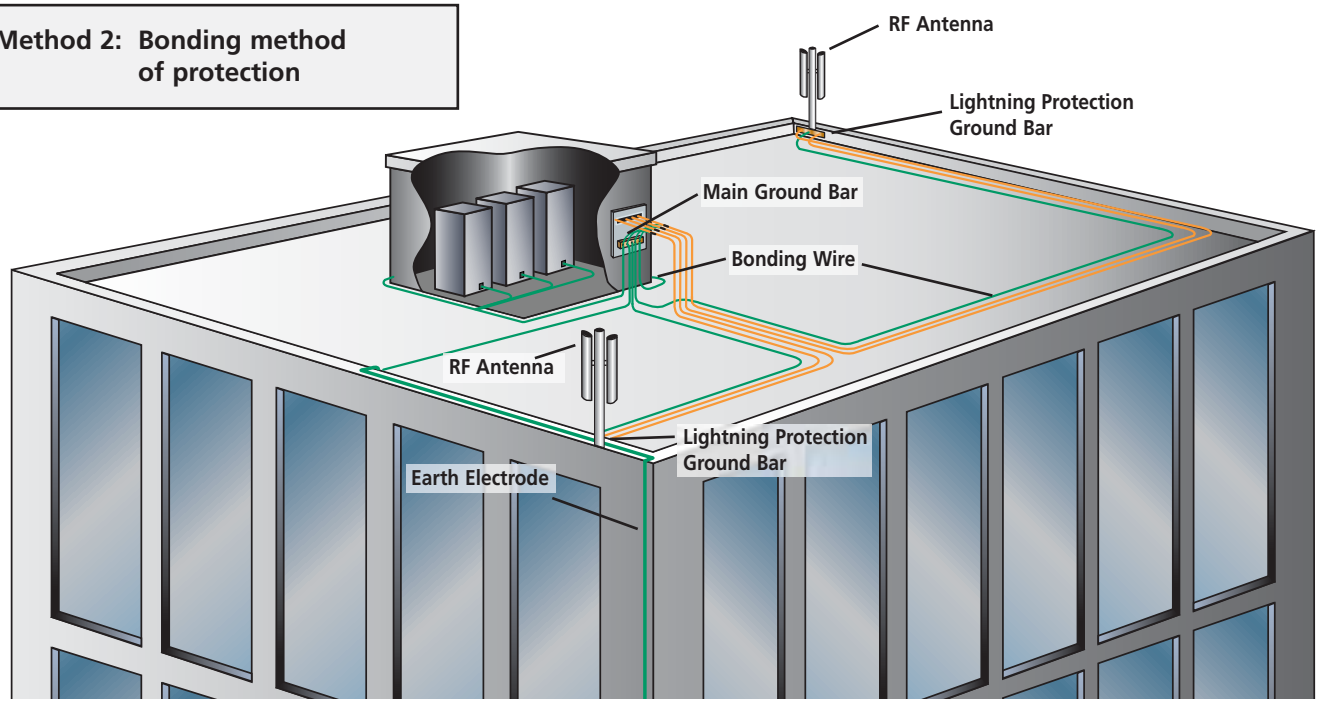
The Isolated Downconductor System provides a modern approach to lightning protection for rooftop installations. The ERITECH brand of isolated systems provide a traditional air terminal fitted to an isolated fiberglass reinforced plastic (FRP) mast. The isolated downconductor internally connects to the air terminal inside the FRP. The FRP mast has natural isolation properties, high strength for windy sites and low weight to minimize mast loading.

The advantage is that this downconductor can be mounted directly on the mast or structure to be protected – without electrification of mounted equipment under lightning conditions.

Method 1: Isolated downconductor connected to lightning protection



Method 2: Bonding method of protection



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