LIGHTNING SYSTEM (ARRESTOR PROTECTION)

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Electrical engineer
Kurdistan engineers union

der Name : Awat ali Muhammad

d no : 1068 (1990)

Birthday 1968
Location rzgary sulaimany

Electrical Engineer with 29+ years of experience working with renowned companies in the electrical industry. Solutions-oriented and analytical with history of success contributing to reliable, best-in-class Integrated Circuit (IC) design, sensor production, and sound quality-control procedures.

PROFESSIONAL EXPERIENCE

<ABC> Organization
Electrical Supervisor March 1998 – Present

Ensured quality issue repair for proper historical documentation
Executed equipment maintenance strategies within budgets averaging…
Responsible for all aspects of underground work including, installing instruments, cable pulling & threaded rod; install CMS, trunking, tray, ladder rack, confine space entry, small power and lighting, terminating and gladding SWA
Trained and managed 16 employees
Diagnosed errors in the systems, equipment, and electrical parts, via using test equipment to identify the cause of breakdown; fix the problems and connect wires to circuit breakers, transformers and other components within designated schedules

<TYU> GROUP
Electrical Supervisor 1990 – 2019

Planned and executed maintenance of electrical instruments, facilities, equipment's and components and systems
Controlled computer-aided engineering and designed equipment to perform engineering tasks.
Examined installations to ensure conformance to design and equipment specifications, and provided technical assistance to field personnel in the areas of high voltage distribution equipment and high voltage motors/generators
Supervised a team of two electricians responsible for cable pulling, tray installation, high level wiring of lights, small power and lighting, making off circuits in dis boards; responded and provided technical assistance to electrical equipment problems within the company-owned facilities

METHOD OF LIGHTNING PROTECTION SYSTEM FOR BUILDING

omply with the General Conditions, Supplementary Conditions and the requirements in various Sections of the Electrical Specification. In addition read and conform to all Electrical Sections of these specifications. The installation shall comprise air networks connected to roof and down conductors and finally terminated in earth electrodes, via structural re-bars and suitable test points in accordance with the details included on the attached drawings or in the Specification Section.

Provide all labour, materials, products, equipment and services to supply and install the lightning protection systems as indicated on the drawings and specified in these specifications.

REFERENCE STANDARDS FOR LIGHTNING PROTECTION SYSTEM

Provide a lightning protection system in accordance with BS 6651 and IEC 61024 to protect the building structure and personnel from the risk of a lightning strike.

All electrical installations shall be carried out in accordance with the best International Standards and Codes of Practice specifically with the current issue of the IEE Regulations (BS 7671) and the requirements of the supply authority.

The entire installation shall be installed and tested in accordance with the relevant British and International Standards and any requirements of local authority.

COORDINATION FOR LIGHTNING PROTECTION SYSTEM

Contractor to allow for coordination with other contractors and employing a specialist supplier to ensure that a comprehensive lightning protection installation is provided.

Whilst other Divisions are providing (by nature of their work) components of the lightning protection system, the contractor is responsible for the overall system. This includes the supervision and testing the provision of

dedicated reinforcing bars and also the bonding of the building cladding system to the network of down tapes and equipotential conductors.

RESPONSIBILITIES TO LIGHTNING PROTECTION SYSTEM INSTALLATION

Where necessary, engage a specialist to undertake the design, installation, testing and commissioning of the lightning protection system.

MEP CONTRACTOR

The **MEP contractor** shall assume responsibility for the overall system including:

1. vertical and horizontal copper aluminum tape conductors as detailed in the specification and drawings.
2. Linking the conductor system to the structural steelwork and reinforcing bars.
3. testing the whole system in conjunction with the cladding and structural package contractors.
4. provision of test points and reference electrodes.
5. miscellaneous bonds to structural steelwork, lift guide rails, BMU track, grilles, spire structure, glazing mullions and any other exposed metallic conductive parts.
6. linking the substation earth bar network to the lightning protection system.

STRUCTURAL CONTRACTOR

The Structural Contractor is responsible for providing continuous structural steelwork and reinforcement bars which are electrically continuous and also shall be responsible for the verification of the testing of joints etc to the satisfaction of the appointed specialist sub-contractor prior to concrete pours.

PILING CONTRACTOR

The piling Contractor is responsible for ensuring the pile steelwork/reinforcement is electrically continuous and shall also be responsible for the verification of the testing of joints etc during construction of the cage mesh and prior to the concrete pour.

Ensure suitable tails are provided by the contractor at the pile cap/raft slab point for future connection/extension onto the steel reinforcing of the system by the other Contractors.

CLADDING CONTRACTOR

The cladding Contractor is responsible for providing and connecting earth tails on to the cladding primary support structure where necessary. The other end shall be connected on to the lightning protection system conductor tapes by the other Contractor.

SHOP DRAWINGS FOR LIGHTNING PROTECTION SYSTEM

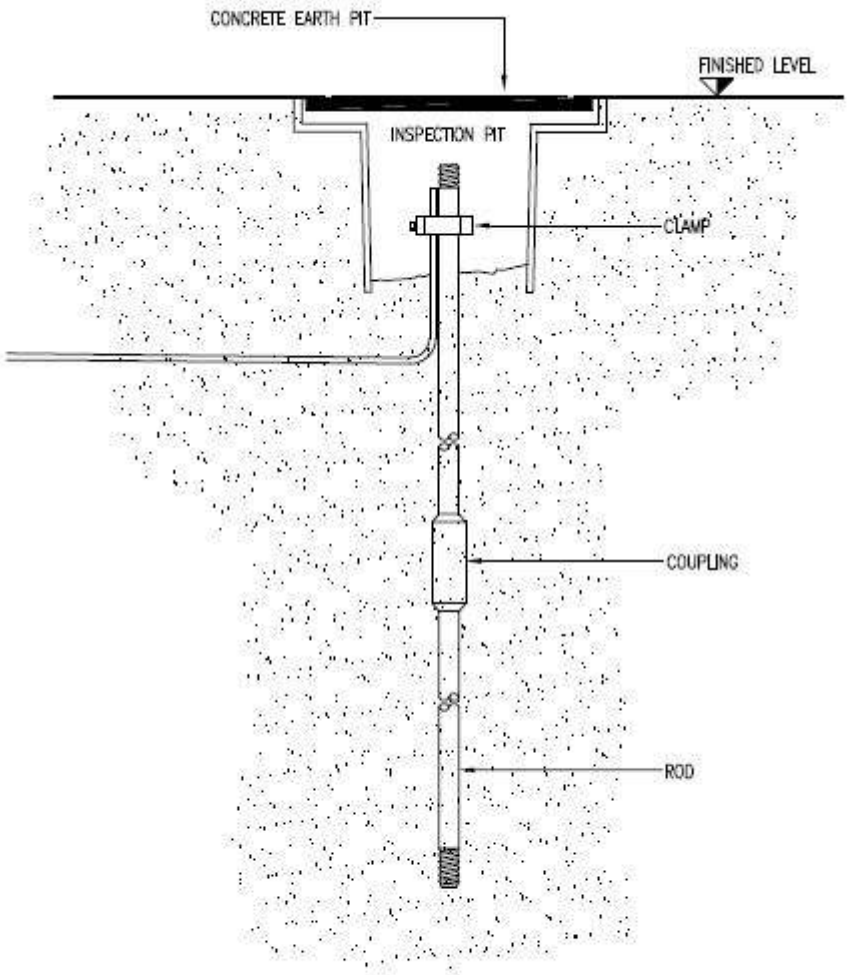
Provide complete shop drawings as produced in conjunction with the appointed specialist sub-contractor.

PRODUCTS FOR LIGHTNING PROTECTION SYSTEM

The Contract shall include for the supply and installation of all necessary components to provide a complete lightning protective system to the Tower structure as detailed in the following Specification Sections in order that the building(s) may be protected against the effects of a lightning discharge in accordance with British Standard BS.6651.

The installation shall comprise air networks connected to roof and down conductors and finally terminated in earth electrodes, via structural re-bars and suitable test points in accordance with the details included on the attached drawings or in the following Specification Section.

Each component shall be suitable for application and as specifically detailed in the following Specification Sections and/or drawings.



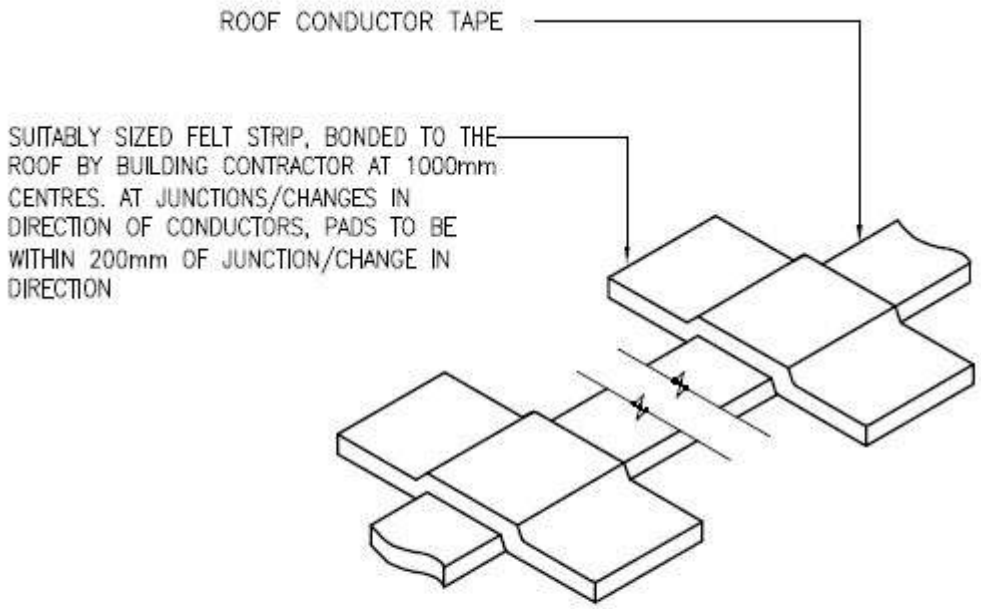
TYPICAL DETAIL OF EARTH ELECTRODE

N.T.S.

Conductor tape saddles shall be fixed to the walls by Round-head 37.5mm x No. 8 brass wood screws and rawlplugs, the saddles being spaced at not less than 1.00m intervals. As an alternative the Contractor may cast pockets into the structural wall and secure studs via vast resin adhesive once the form-work is removed.

Bi-metal connections shall be provided between aluminium and copper interfaces and elsewhere as necessary to avoid electrolytic action.

LIGHTNING PROTECTION ROOF CONDUCTORS

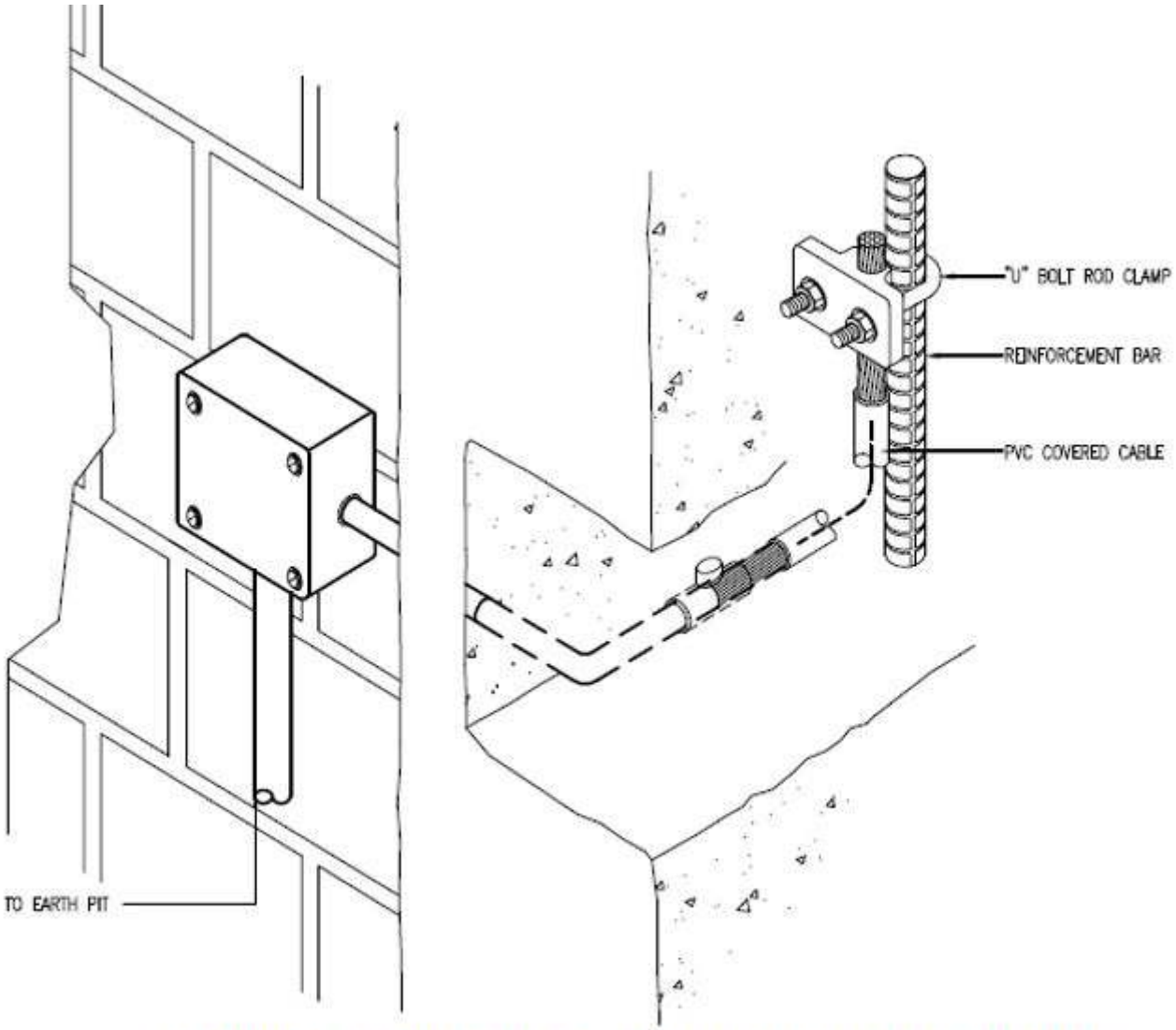


ROOF TAPE FIXING DETAIL

NTS

Air terminations shall be formed and be of the type shown on the drawings.

Provide a network of conductor tape around the roof area of the building. This shall be used to connect all down conductors, window cleaning track, cladding, spire, structural reinforcing and all other exposed conductive metal parts to a common potential.

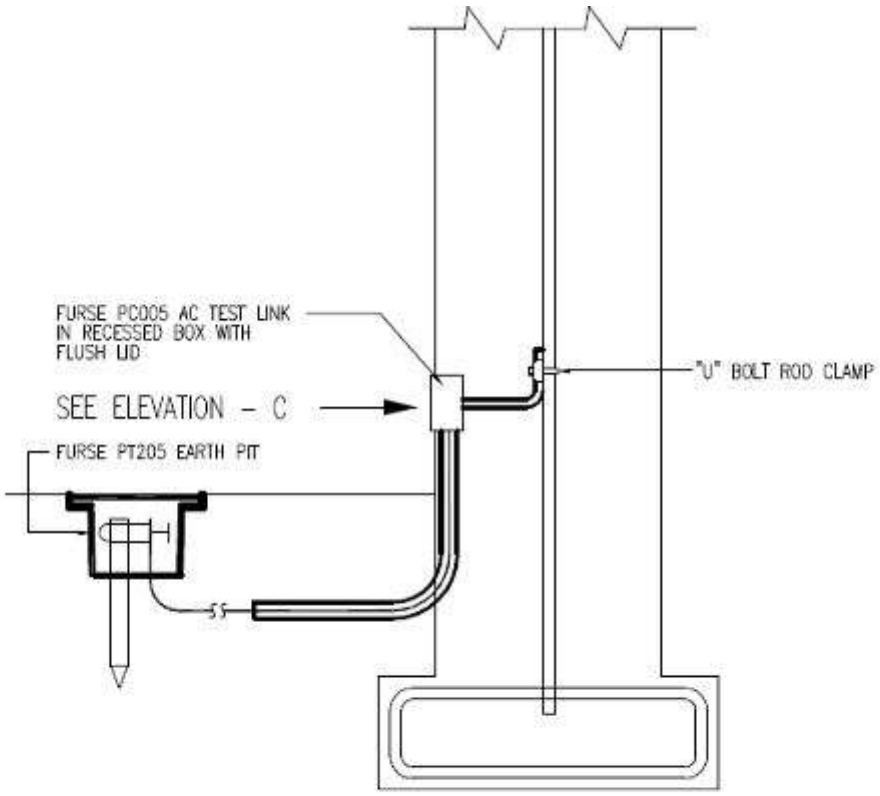


TYPICAL EARTH POINTS ARRANGEMENTS

NTS

The roof conductors shall be fixed to the roof surface by means suitable saddles, positioned at intervals not exceeding 1.00m by suitable means, care shall be taken to ensure that any holes formed in the cladding, are effectively sealed to prevent ingress of water. This shall be confirmed and agreed with the Contractor.

LIGHTNING PROTECTION DOWN CONDUCTORS



TYPICAL DOWN CONDUCTOR ARRANGEMENTS

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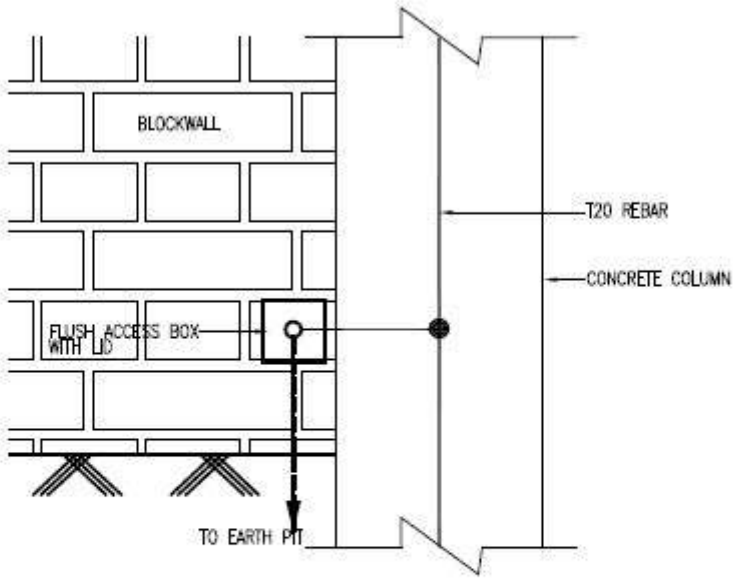


CONNECTION METHOD OF
DOWN CONDUCTOR AND EARTH PIT

ELEVATION - C

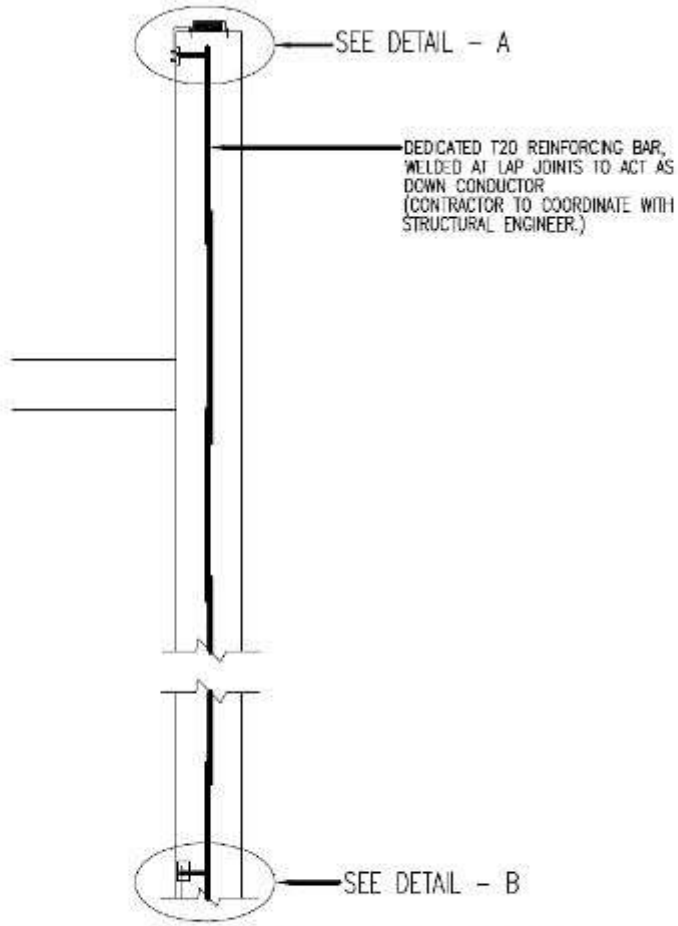
1. Provide down conductor tapes in locations as indicated on the drawings.

2. Down conductors shall be either: Installed surface on the structure concealed behind the cladding OR Reinforcing bars within the concrete structure.

1. Down conductor tapes shall terminate on to dedicated reinforcing bars which shall be utilised as the final connection to earth via the pile foundations. The Contractor shall include for supervising and testing the installation of the reinforcing bars including all joints prior to the concrete being poured.

2. Down conductors to be connected at roof level to a common loop tape.

3. Provide horizontally mounted conductor tapes at levels indicated on the drawings. These shall provide a common connection for all down conductors, structure, cladding, steelwork and exposed metalwork.



TYPICAL DOWN CONDUCTOR ARRANGEMENTS

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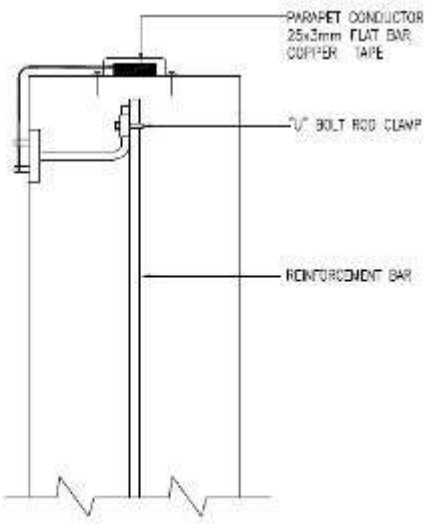
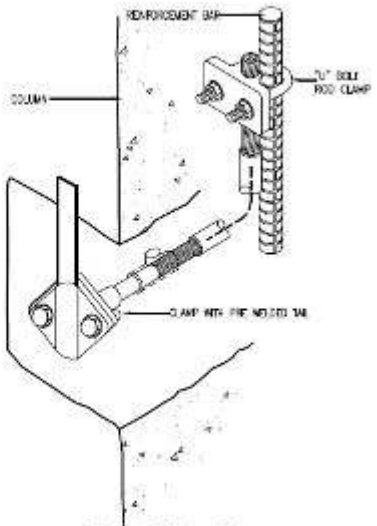
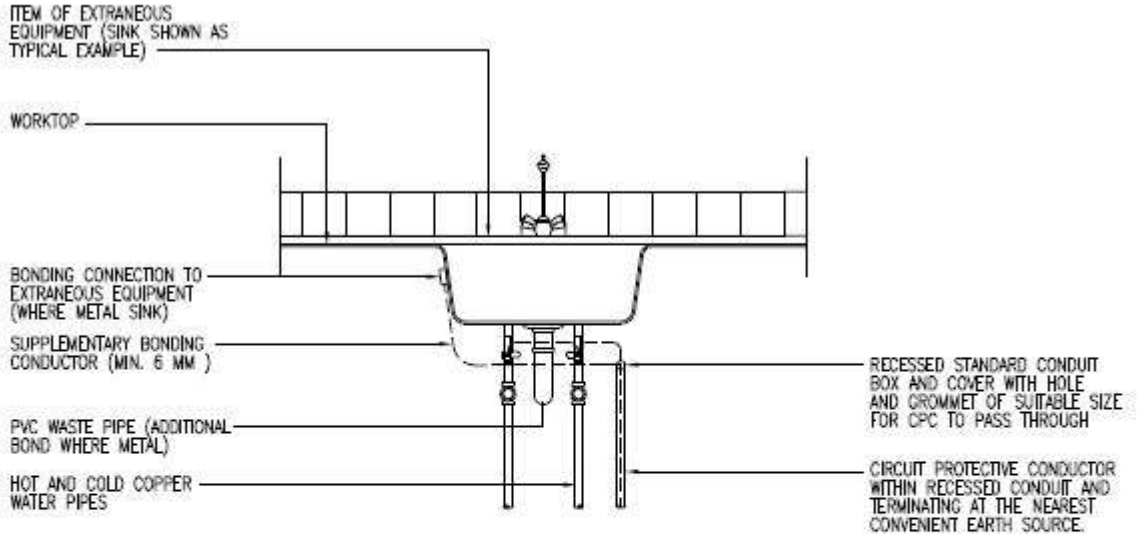


DETAIL - A



DETAIL - B



LOCAL SUPPLEMENTARY BONDING TO EXTRANEOUS EQUIPMENT

NTS

LIGHTNING PROTECTION TEST POINTS

Provide a joint for test purposes at approximately 1m from finished floor level in an accessible location, unless otherwise detailed, on every down conductor. The test link shall be of cast gun-metal and be proprietary manufactured to enable the electrode to be removed from the lightning protection system.

LIGHTNING PROTECTION EARTH REFERENCE PITS

1. Certain individual down conductors shall be effectively bonded to suitable 3.60m long by 16mm diameter earth rods manufactured from hard drawn copper rod in the form of 1.20m sections. Each section shall be complete with internal screws and socket. The earth reference electrode shall be installed not more than 1.00m away from the building with the earth reference electrode head located not less than 500mm below the ground level. Final connection of the down conductor to the earth reference electrode shall be made by means of a pressure type connector clamp.

2. The Contract shall include for the supply and delivery of inspection pits manufactured as detailed in the attached Specification Section and/or drawings, these to be handed over to the contractor for installation. An inspection pit shall be supplied for each earth termination. Heavy duty covers suitable to withstand vehicular traffic shall be provided for pits located in the roadway areas. The lid of each pit shall be lockable and jam free construction and supplied with the appropriate key.

1. Where electrode points are located internally within building floor slabs they shall comprise a suitable earth rod water seal installed in the base of a pocket formed in the slab, with the pocket and associated cover.

2. The body of each earth pit shall as a minimum comprise shatter-proof, lightweight, polymer material with a high resistance to chemical damage from such substances as petrol, oil, diesel, bitumen etc. Each unit shall include high ultra-violet stability, wide temperature application and earth bar facility (where necessary) to permit multiple earth tape connections to be made. Where these are not suitable concrete pits shall be provided.

MANUFACTURERS OF LIGHTNING PROTECTION MATERIALS

As Furse or Erico or equal and approved.

SITE EXECUTION OF LIGHTNING PROTECTION SYSTEM

1. All metallic projections, ducts, vent pipes, gutters, radio and television aerials, fan housings, window cleaning equipment and tracks etc, on or above the main surface of the roof structure shall be bonded to and form part of the air termination network.

2. No joints in either the down conductor or roof conductors shall be allowed other than at air terminal, earth electrodes and terminal or test block positions.

3. Where it is found that the resistance to earth at any test point is in excess of 10 ohms, the length and number of earth electrodes shall be increased to the instructions of the MEP Consultant, in order to comply with the requirements of the British Standard. The resistance of each metallic conducting path, including all joints, shall not exceed 6% of the calculated resistance of the copper tape itself. In addition, the resistance from the earth electrode to the nearest test clamp shall not exceed 0.2 ohms.

4. The Contractor shall include ensure that at the completion of the installation to resistance to earth from each testing point does not exceed 10 ohms, the tests being carried out in accordance with BS 7430. The Contract shall include for the performance of these tests and submitting the results to the MEP Consultant.

5. Connections to the earth electrodes shall not be covered over with top soil without the permission of the MEP Consultant.

6. Upon completion of the works, submit a certificate of installation to the MEP Consultant for review and approval.

7. The operating and Maintenance manuals shall be compete with system records to BS 6651 that includes the following items as a minimum:

    1. As installed drawings

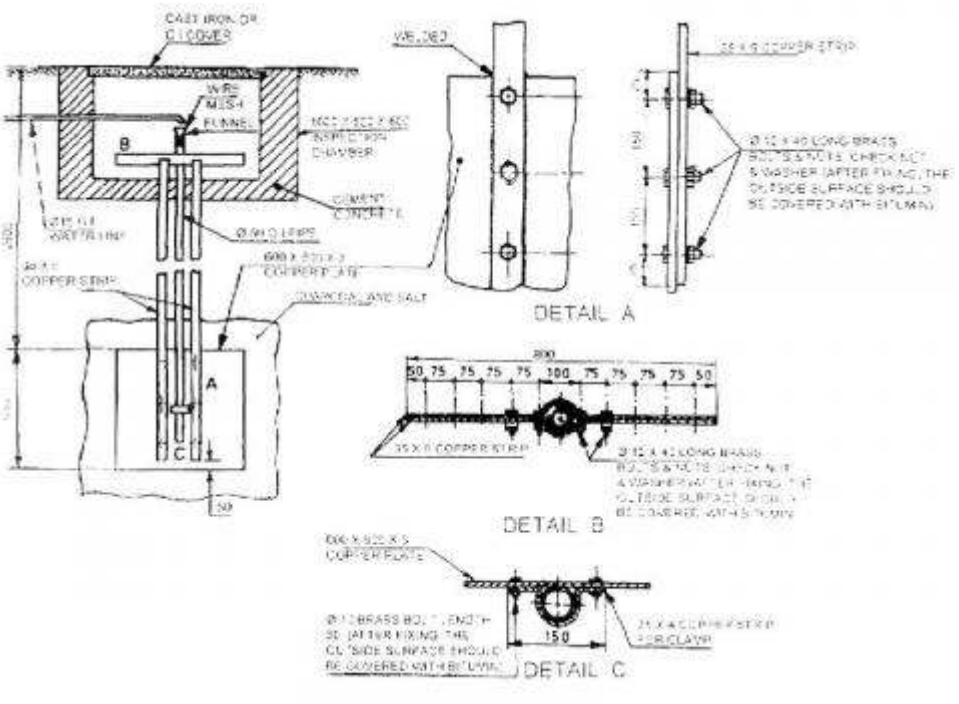
    2. Nature of soil

    3. Earth resistivity measurement.

    4. Earth electrode resistance.

    5. Details of earth electrode types and locations Include a copy of the certificate in the O&M manuals.

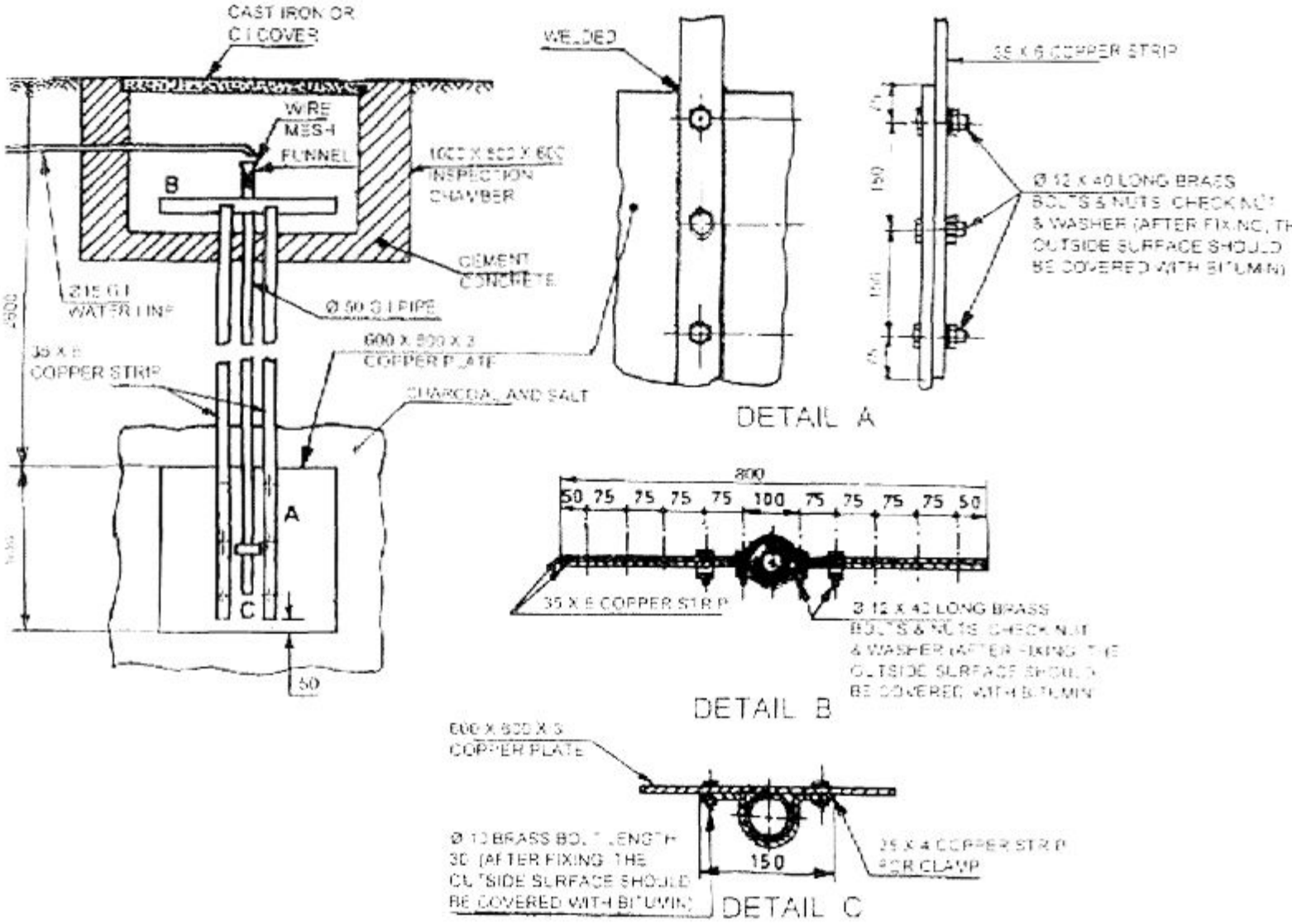
The scope of this specification covers the supply, installation and testing and earthing system of the entire installation and for lightning protection.



APPLICABLE STANDARDS

The following standards shall be applicable, however, contractor shall comply with the latest or superseded versions of IS/BIS to be used for the complete work:

- IS 3043 1966: Code of practice of earthing.
- IS 2309 1969: Code of practice for the protection of building and allied structures against lightning.



EARTHING SYSTEM

1. The earthing system shall comprise of earth electrodes at substation and other convenient places, with an interconnecting earth grid.

2. The earth electrodes shall be in conformity with IS 3043 of plates or pipes of GI with test links, internal connecting leads, earthing mixture of salt, charcoal, etc. The number of each electrodes shall be determined from measurement of the earth resistance which finally should not exceed 1 ohms.

1. The earth conductors shall be of GI of minimum cross section as 200 sq. mm. As far as possible, all earth electrodes shall be interconnected to form an earthing grid, by means of earth conductors. All joints in the grid shall be welded or riveted. Connections of the grid for the equipment shall be of GI or copper wires and all such terminations of wires be with soldered cable lugs.

2. All cables and conduits shall have continuously run earth wires of specified gauges, securely fastened to the main earthing grid. The hardware used shall be galvanized steel or brass.

3. Earth conductors on wall, structures shall be installed with proper clamps and saddles. Earth conductors when crossing through walls shall be passed through GI pipes.

4. The layout of the earth electrodes and earthing conductors shall be first approved by the Authorities before commencing the work.

5. Large Motors, Switchboards - HT & LT, Transformers, DG Sets, etc. shall have earthing GI strips of appropriate cross-section to carry the full short circuit current. Similar motors, DBs wiring conduits shall have earthing GI wires of appropriate cross section.

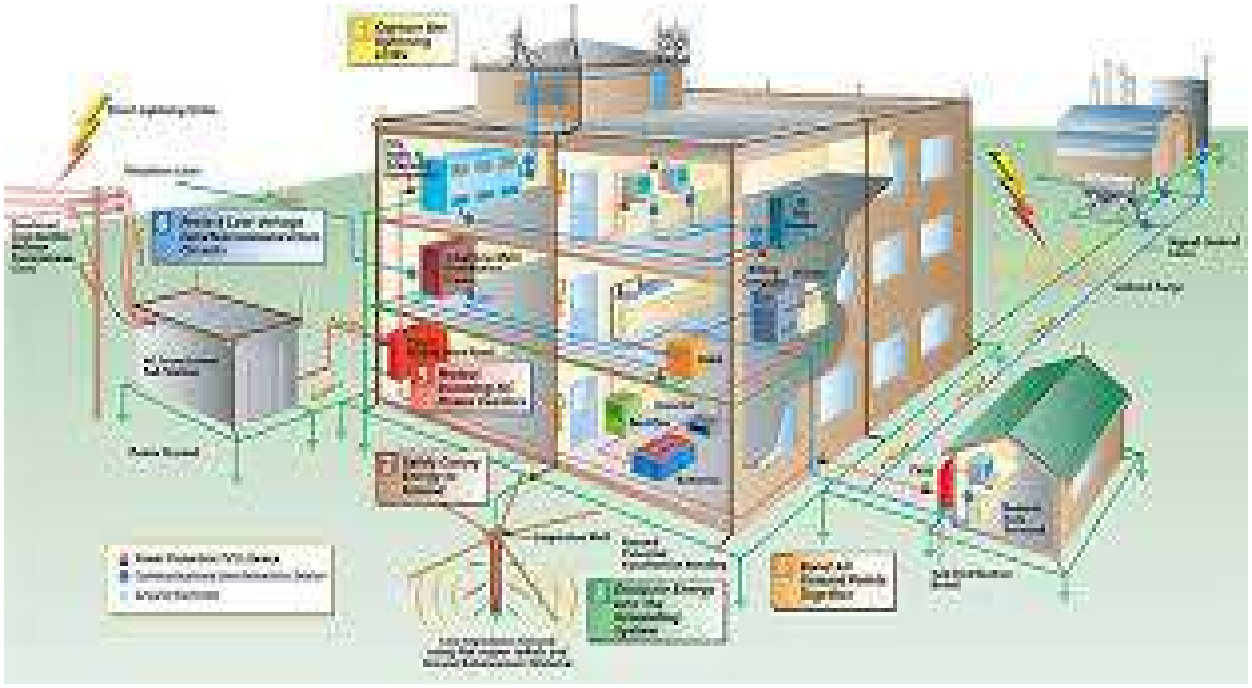
LIGHTNING PROTECTION

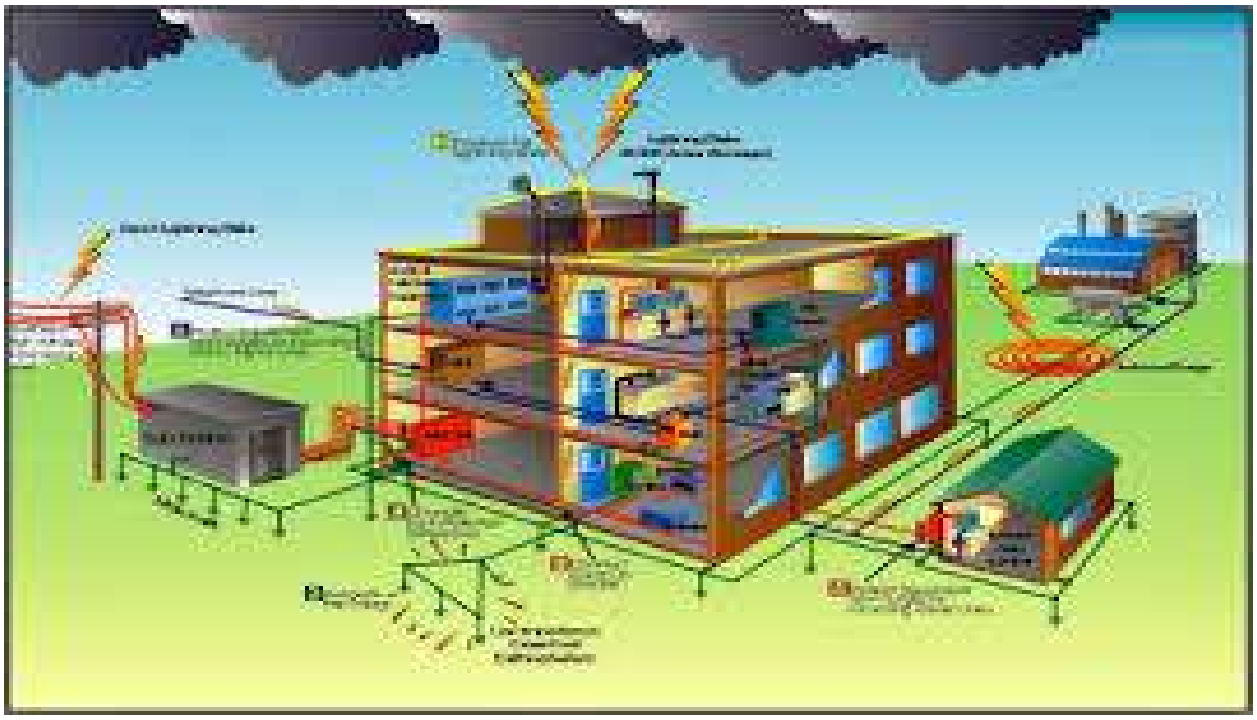
1. The lightning protection system shall comprise of lightning earthing terminals, roof conductors, down conductors, test links and earth electrodes.

2. Each down conductor shall have a separate earth electrode of GI pipe as per IS 2309.

3. The number of down conductors and earth terminals shall be determined from the Risk index as per IS 2309.

4. All terminals and roof conductors shall be interconnected by welding or revetting to form a continuous grid. Water, steam and other service pipes shall not be used for interconnections.





The three parts of a lightning protection system

Posted on August 12, 2015 by height in Blog Entry

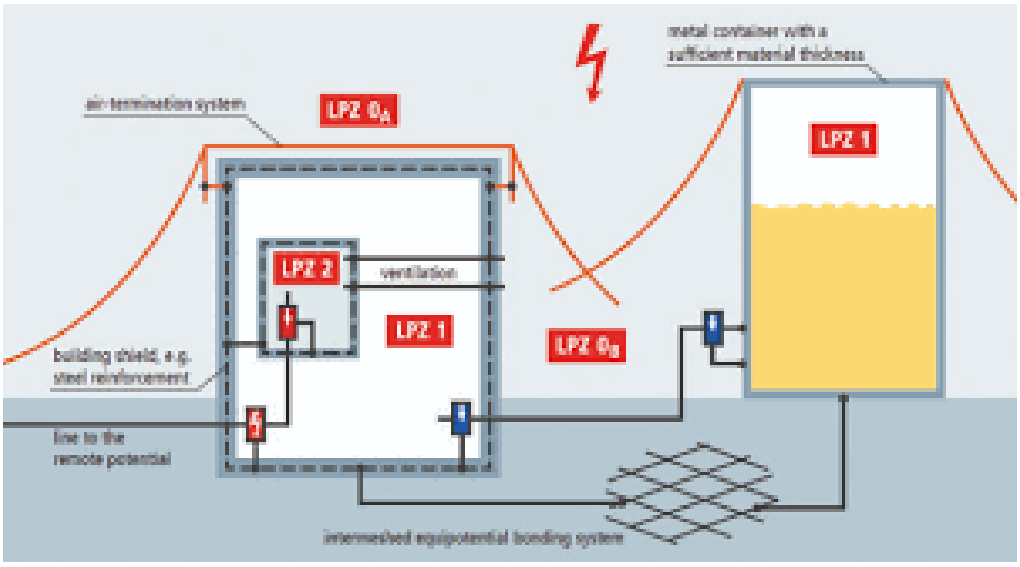
Lightning protection systems are designed to create a path for huge currents to pass safely away from a property, rather than striking it directly. If a structure doesn't have a system in place, the current could flow into all kinds of conductors including phone lines, cabling or metallic utility pipes as it seeks a route to the ground. Steel framed buildings are at increased risk because the current could flow through the structure itself.
Having a protection system in place will not prevent lightning from striking a property, as this is physically impossible. The only way to protect the structure is to create a system to redirect the current as safely as possible and reduce the possibility that it will take different paths to ground.

Air terminals (lightning rods) need to be positioned on specific parts of the roof, particularly on the highest points such as the chimney and the ridge. They come in many different forms but are usually made from highly conductive metal. They can be topped with a tall, needle point or a smooth, highly polished sphere.

The terminals will connect to conductor cables that run along the top and edges of the roof. These will then extend down the side of the property to the ground. This creates a very easy path free from obstacles for current to flow through.

Once they reach ground, the conductor cables will be connected to grounding rods. Each rod is a long sturdy piece of metal that is driven deep into the earth. This means that when electricity flows down the cables it will dissipate harmlessly into the ground. The rods need to be buried deep enough to ensure that the current won't reach buried cables and utilities.

Lightning protection systems don't necessarily need to have air terminals to function. The idea is that current is more likely to strike the highest point. By having rods extending up from the property, you have greater control over where the current will go if lightning does occur. If you have good cable coverage and grounding you may not need to install terminals.



What is a Lightning Protection System?

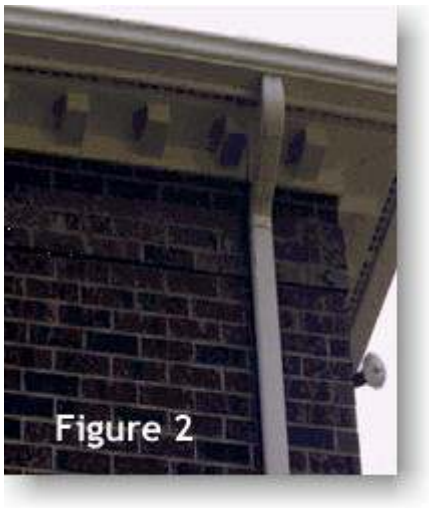
A lightning protection system is a passive means of preventing property damage from the effects of a lightning strike. **It works by providing the electric charge produced by the clouds a path of least resistance to the ground.** There are four main parts of a properly installed lightning protection system: copper air terminals, copper cable, copper clad ground rods, surge suppressors.

The air terminals and cable are typically copper, but sometimes they can (or must) be aluminum. All of the air terminals are connected via the cable which has a minimum of two ground rods buried 10 feet below grade. This system is then grounded to both the water pipes and existing ground of the

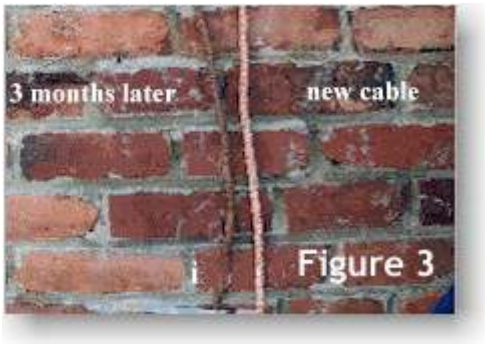
circuit box. The surge suppressor can be connected to the breaker box to cover the entire electric system or they can be placed at individual appliances or electronics.

When most people hear the term lightning rod, they picture large ornate rods with heavy cable draped on the roof and down the sides of old homes (see fig. 1). LSV tries to make the lightning protection system as inconspicuous as possible.

Typically, the only things visible on a lightning protection system are the air terminals, 10"-12" copper rods, on the chimney and roof ridges. If the system is to be installed on an existing building, every effort is made to conceal the copper cable (see fig. 2).



If the copper cable cannot be concealed, the cable will be less noticeable as it weathers and changes from shiny orange to dull patina (see fig.3). Whether a lightning protection system is concealed during construction of a new building or exposed on an existing structure, the materials used are identical.



Lightning protection systems can be installed on a variety of structures including homes, businesses, farm buildings, boats, and trees to protect them from damage. There are several independent organizations that have issued standards on the installation and design of lightning protection systems. The three most recognized are Underwriters Laboratory (UL), Lightning Protection Institute (LPI), and National Fire Protection Association (NFPA). Fore more detailed information on the standards you can and ask for a copy of UL96A, LPI-175, or NFPA-780, respectively.

Who Needs Lightning Protection?

Lightning can strike anywhere and do millions of dollars worth of damage. Lightning is to blame for more deaths and property loss than tornadoes, hurricanes, and floods combined. And although we cannot yet predict where lightning will strike, there are some factors that increase the risk of a lightning strike. **If your home or business meets 5 or more of the following criteria, you are in a high risk group.**

- has had previous lightning damage
- is located in an isolated, open area
- is located on a hill
- located near a large body of water
- is located in an area that has a high number of thunderstorms
- has tall trees overhanging the roof
- has metal, brick or stone chimney brick
- has metal ridge vent
- has aluminum siding
- has no surge protection

As homes and businesses use more sensitive electronic equipment, it might be a smart idea if every building has a lightning protection system. This would prevent millions of dollars spent in replacing or repairing damaged equipment

Personal Lightning Safety

If you are outside and you notice a storm brewing, do you know what to do? Here are a few safety tips…

- Keep an eye on the sky, watch for well-defined darkening cumulus clouds, and listen for thunder.
- If you see a flash in the sky, start counting "one one thousand, two one thousand, three one thousand", and so on until you hear thunder. Take that number and divide it by 5. This will let you know how many miles away the approaching storm is. For every five seconds the storm is 1 mile away.
- If the storm approaches, seek shelter in a building (preferably with lightning protection) or car.
- Once inside, turn off all appliances, stay off the phone, and avoid taking a shower or running the water. A lightning surge can enter the house through all of these.

- If you are not able to get indoors, go to a low-lying open area away from trees, poles, and anything metal.
- Assume the safety position. Make yourself a small target. Squat low to the ground, place your hands on your knees and put your head down low. Do not lie flat on the ground.
- If you are trapped in the woods, take shelter under the shortest trees in the area.
- If you are boating or swimming, get out of the water immediately and seek shelter.

- If you are trapped in a boat, seek the lowest area away form anything metal, and assume the safety position.
- If someone has been struck, administer first aid immediately and call for help. Do not be afraid to handle the person, they carry no electrical char

Lightning Protection Specifications

- General
- Materials
- Installation
- Inspection & Certification

General: Provide and install a complete lightning protection system in compliance with the specifications and standards of the most current editions of the National Fire Protection Association's Lightning Protection Code NFPA-780 and Underwriters Laboratories Lightning Protection Code UL96-A. the system shall be installed by a lightning protection contractor who is listed by Underwriters Laboratories, Inc.

Materials: All lightning protection materials and components shall comply in weight, size and composition with UL96-A and NFPA-780 lightning protection material code requirements for this type of structure.

All materials shall be copper, bronze, or stainless steel. Aluminum components shall be used in locations where system components are mounted to aluminum surfaces to avoid galvanic corrosion of dissimilar metals. Class I materials shall be used on structures not more than 75 feet in height. Class II materials shall be used on structures over 75 feet in height.

Installation:

Air terminals may be of copper or aluminum and shall project a minimum of 10 inches above the object to be protected. Air terminals

shall be placed at an interval not exceeding 20 feet along ridges and around perimeters and not more than 24 inches from ridge ends, roof edges and the outside of corners of protected structures. On mid-roof sections, additional air terminals shall be located at intervals not exceeding 50 feet. Prominent non-metallic objects or metal objects having a thickness of less than 3/16 inch require the installation of air terminals and conductors as required.

Copper or aluminum conductors or the size required by UL-96A and NFPA-780 code requirements shall interconnect all air terminals and provide a two way path to the ground form all air terminals and provide a two-way path to the ground from each air terminal. Conductors shall

maintain a horizontal and/or downward path to the ground and shall be free of excessive splices and sharp bends. No bend shall form an included angle of more than 90 degrees or have a radius of less than 8 inches. Fasteners shall be placed on each run of exposed conductor at intervals not exceeding 3 feet. Down conductors shall be spaced at intervals averaging not more than 100 feet around the perimeter of the structure. A structure shall never have fewer than 2 down conductors. In the case of structural steel frame buildings, cable down conductors may be omitted. Roof conductors shall be instead connected to the structure's steel frame at intervals averaging not more than 100 feet around the perimeter. Connection to the steel frame will be made with bonding plates which provide a minimum of 8 square inches of contact.

Roof penetration is required for down conductors or for connection to structural steel framework shall be made using thru-roof assemblies with solid bars and appropriate roof flashings. Conductors shall not pass directly through the roof. Roof flashings compatible with the roofing system shall be furnished and installed by the roofing contractor per roofing manufacturer's specifications.

All cable connections shall beet specifications for Class I and Class II systems with bolt pressure fittings preferred. All fasteners used in these connectors shall be comprised of stainless steel.

Common grounding of all grounding mediums within the building shall be ensured by interconnecting with main size conductors and fittings. All other metal bodies shall be bonded as required by NFPA-780 and UL96A.

Ground Terminations: Each downlead shall terminate in a ground connection below finished grade. Ground terminations shall consist of 5/8 inch x 10 foot (minimum) copper-clad steel ground rods. The down conductor shall be connected to the ground rod using a bronze ground clamp having at least 1-1/2 inches of contact between the rod and the conductor. The rods shall be located a minimum of 1 foot below grade, a minimum of 2 feet from the foundation and extend a minimum of 10 feet vertically into the earth. In instances where structural steel framework is utilized as down conductors, the perimeter columns shall be grounded at intervals averaging not more than 60 feet. Columns shall be bonded using bonding plates with 8 square inches of surface contact. Conductor from ground connections to the ground terminations shall be Class II copper lightning conductor.

Lightning Protection Systems for Towers, Antennas and Structures

LBA Technology™ and its technology partners have many years of experience providing grounding and lightning protection services. We offer a complete, integrated capability to provide lightning protection solutions for towers, antennas, and other structures.

We offer lightning protection services and products for broadcasting, wireless communications, utilities, fuels, and military assets, to name a few. Our products can protect structures such as antenna towers, windmills and wind farms, tanks, drill rigs, field camps, monitoring installations and many more.

Our systems and equipment comply with appropriate aspects of UL, ANSI, NFPA, and relevant military/industry standards.

LBA expertise goes beyond lightning protection to all forms of protection from electromagnetic effects, including radio frequency interference, HEMP (high altitude electromagnetic pulse), and static discharges. Because of this wide

ranging capability set, LBA can often integrate all electromagnetic protection requirements in a project for the most cost efficient solution. Check out our industry leading capabilities in electromagnetic shielding!

LBA furnishes its products and services solely for professional and technical applications. It does not deal with residential uses.

Lightning Mast Protection Systems

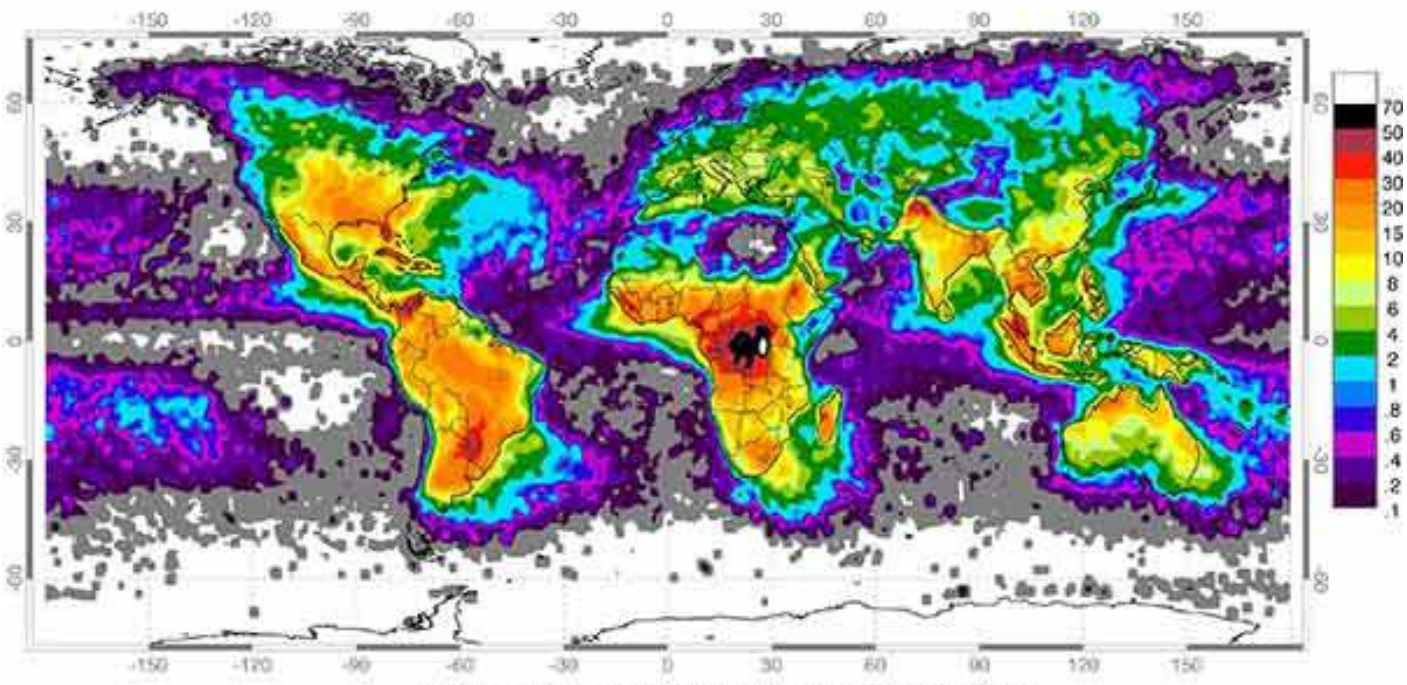
Tower & Antenna Protectors

Copper Grounding Products

Where Is Lightning Protection Required?

Almost everywhere! Virtually all populated regions have varying incidences of lightning strikes. There is meaningful risk worldwide over the lifetime of typical tower and antenna systems. Facilities outside of "lightning belts" should at least be minimally protected while critical infrastructure and flammable/explosive risks must be protected wherever they are. Extreme protection measures are mandatory in areas of intense lightning risk!

Global Distribution of Lightning



Low Resolution Full Climatology Annual Flash Rate

Global distribution of lightning April 1995-February 2003 from the combined observations of the NASA OTD (4/95-3/00) and LIS (1/98-2/03) instruments.

Who Needs Lightning Protection?

The largest class of technical structures needing lightning protection in the world today is towers and their antennas, particularly for wireless communications and broadcasting.

In less than 30 years, cellular mobile towers and antenna structures have proliferated on every continent, and are perfect lightning targets! To a lesser extent, AM, FM, and TV towers have also sprouted, sometimes sharing with cell systems. Not only are the towers at lightning risk, but also the cellular, public safety, broadcast, and communications antennas mounted on them. At risk too, are the attached cell site equipment, radio transmitters, coaxial cables, and tower light systems.

Related to communications towers are other vertical technical structures such as drilling rigs, flare towers, wind turbines, tanks, environmental monitor masts, and industrial structures.

At the same time, portable and temporary high value assets have flourished. From satellite antennas to mobile command posts, work camps to mobile power systems, important assets and their personnel are being put in harm's way from lightning discharges.

LBA specializes in the lightning protection of these technical assets. With 50 years' experience worldwide in electromagnetic protection, broadcasting and wireless communications, we have the expertise to provide the best protection for these systems.

Lightning Mast Protection Systems
Area protection for fixed and portable assets

LBA Technology™ offers the PLP family of fixed and portable lightning protection masts and kits. Based on a light weight, rugged aluminum mast; various mounting styles, grounding systems, and UL – Listed air terminals are offered. PLP lightning mast components are under 7 feet (2.13 m) long for easy surface or air transport and rapid field installation.

Typical applications include:

- Camps, portable buildings or vehicles
- Petroleum, water pumping and utilities
- Emergency NGO or military command posts
- Solar cell and satellite dish installations
- Environmental monitoring facilities
- Rooftop installations not readily protected by conventional terminals

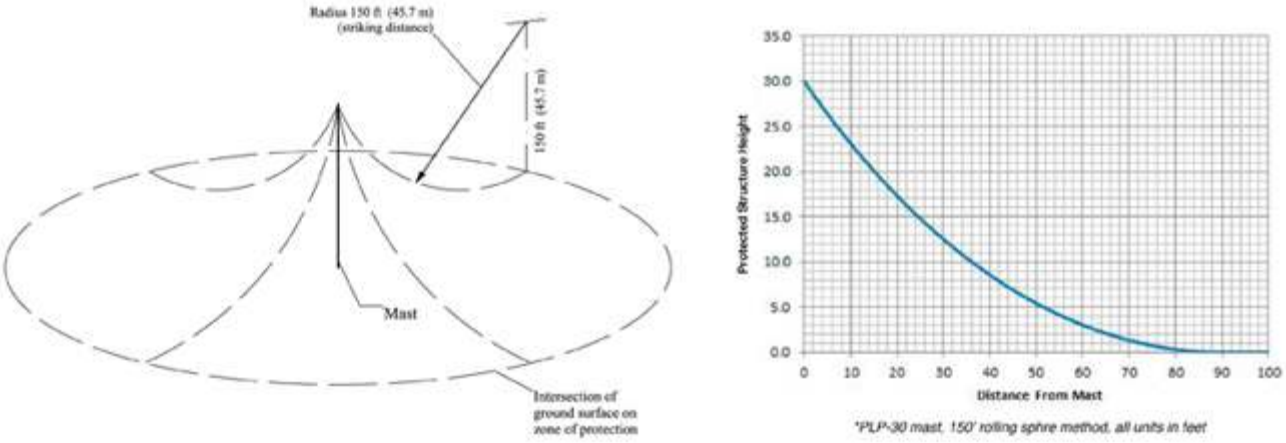
* *Patents pending on this unique lightning mast*

Typical of the Series – The PLP-32

PLP- 32 Lightning Masts are recommended for a wide range of lightning protection applications where it is impossible or undesirable to attach conventional lightning terminals. Other models in the series share the same attributes and differ only in height and weight.

PLP-32 Lightning Masts provide a cone of protection within which lightning charges are diverted to the mast and grounded instead of to the protected object. Multiple PLP-32 masts may be used to protect extended areas. Protected areas may be determined by use of the widely accepted “rolling sphere” concept. For example, a single PLP-32 mast will protect 9 foot (2.14 m) high portable buildings wholly within a 40 foot (12.19 m) radius. An array of five PLP-32 masts will protect a camp of portable buildings within a 25,000 square foot (2323 m2) area. Consult LBA Technology™ for specific layouts you wish to protect.

PLP-32 Zone of Protection



**PLP-30 mast, 150' rolling sphere method, all units in feet*

The PLP-32 Lightning Mast is furnished with a UL-Listed streamer retarding air terminal. Streamer retarding (static dissipation) terminals have been shown to reduce the probability of lightning strikes, as well as divert them to ground, should they occur. Static dissipation systems work by dissipating static charge. Static dissipation arrays provide, in

effect, a "low resistance" route for static ground charge to reach the atmosphere preventing a buildup of the ground charge to the value necessary to trigger a strike.

The PLP-32 mast includes a universal base section, four screw-together mast sections, and a screw-in air terminal. The screw couplings are of a special proprietary design for maximum current contact area and high mechanical strength. The assembled weight is only 45 pounds (20.5kg).

The PLP-32 is rated to survive 120 mph (193 kph) hurricane winds, when the base is appropriately ballasted or tied down. The PLP-32 utilizes the same construction system as LBA's "Power-Topper" antenna top loading systems which have served for over 30 years in many parts of the world.

PLP-32 Deployment Options: The PLP-32 and its options are all designed for convenient, fast deployment with minimum resources. Assembly and disassembly of the PLP-32 mast is a simple one person procedure, using only common hand tools, and typically requires under an hour. Once assembled, the PLP-32 mast may be readily mated with an appropriate support system. The universal base section of the mast is designed to interface with an optional fixed base (FB-1), portable base (PB-1), or customer supplied base. The base section is provided with attachments for grounding conductors.

PLP-32PK Portable Kitted System: All necessary components for rapid shipping and field deployment of the PLP-32 are available in a kit. The PLP-32 PK kit includes a PLP-32 Lightning Mast, a PB-1 Portable Mount System rope guy kit, a dissipater tip protector, six HDS-18" hold-down stakes, three GR-4 four foot (1.22 m) ground rods and bimetal grounding attachments, three GC-4 #4 copper ground cables, and a heavy duty ripstop nylon transport carrier. Packed length is under 90" (2.29 m) and weight under 100# (45.4 kg), allowing for easy handling and air/surface express shipment. NOTE: PLP-(*) versions are also available in similar kit systems. The PLP-32PK and PLP-38PK include the PLP-PBHD base. Weights will vary.

PLP-CAT Fast Deployment Catenary Lightning Protection System

PLP-CAT Fast Deployment Catenary Lightning Protection Systems are designed to protect large objects or buildings in a broad area by utilizing an appropriate number of special PLP-series masts and catenary wires between mast pairs. PLP-CAT systems are ideal for protecting fuel or explosive storage facilities, temporary encampments, vehicle parks, and other facilities not amenable to stand alone lightning mast deployments.

PLP-CAT systems use streamer discharge dissipation technology to reduce the probability of lightning strikes, but are also NFPA70 compliant for lightning strike termination. As an example, under NFPA's 100' (30.5m) rolling ball method of hazardous material protection prediction, a PLP-CAT-35(480) lightning protection system with four catenary conductors 80' (24.3m) long on 35' (10.7m) masts will protect an area approximately 12,000 ft2 (1115m2) to a height of 18' (5.5m).

In most cases, PLP-CAT systems can be set up by four persons using hand tools in just a few hours. The patent-protected systems are reusable, light weight and easily transported. They are supplied complete in man-carry cases. The systems are suitable for temporary or permanent installation, with non-penetrating base systems for roof mounting available. All systems are customized to your needs by LBA experts.

PLP-38 MOB Roll-away, Fold-over Lightning Protection Masts

Based upon the established PLP-series, this patent-protected lightning protection system is designed for quick installation as a reusable fold-over mobile platform. It provides the same level of protection as a PLP-38 standard system.

PLP-38-MOB systems include streamer discharge dissipation technology to reduce the probability of lightning strikes, but are also fully compliant to NFPA70 requirements for lightning strike termination.

Fully integrated, the system breaks down for compact storage and transportation in provided man-carry cases. All fasteners and installation hardware are captive for fast installation and to avoid loose parts that could cause foreign object damage at sensitive sites. No tools are required for installation. Installation time is under one hour for two personnel. The base utilizes water-ballast and is suitable for non-penetrating application on rooftops and other critical surfaces.

Replace lightning rods on towers and structures

LBA offers a wide variety of lightning air terminals in the form of lightning dissipaters. Sometimes called a static dissipater, or static dissipation array, this relatively new and advanced air terminal replaces conventional lightning rods in most applications. It functions as a streamer retarding air terminal.

Static dissipation array generically describes a system using point discharge phenomenon to protect towers and antennas and the area around them from a lightning strike. Static dissipation arrays function, as the name implies, by dissipating static electrical charge. Among design factors, the radius of the dissipater electrode cross-section is critical because the process which enables dissipation of static ground charge to the atmosphere is related to electric field intensity (and flux density) surrounding the lightning dissipater. Static dissipation arrays provide, in effect, a "low resistance" route for static ground charge to reach the atmosphere, thus preventing a buildup of the ground charge to the value necessary to trigger a strike on the protected object.

Since a static dissipation system must provide a low resistance path to the atmosphere, it seems logical to provide as many discharge points as reasonably possible. By using a large number of air terminal points one can compensate for any loss of efficiency from a theoretical maximum, and spread the dissipater elements over more of the cross-section area of the tower or antenna structure.

All objects have natural dissipation points. On a tower structure, charge tends to gather at, and dissipate from the tower top, antennas and antenna mounts, and from corners. The most effective way to mount a dissipater in terms of structure, weight, wind loading, cost and aesthetics is to enhance this natural dissipation by supporting the dissipater from the structure itself at these natural dissipation points. Since most antenna and tower structures are steel, direct attachment provides excellent conductivity. As a practical matter, the dissipater configuration should be tailored to the structure, not vice versa.

Our lightning dissipaters are available in configurations which can protect the entire tower structure, or just individual cellular antennas. To accomplish this, dissipaters are available in linear, spot, and candelabra styles. From our proprietary products to those of LBA partner suppliers, our products meet highest quality and reliability standards, certified by standards organizations as required. Consult with LBA for the exact mix of products to most effectively protect your antenna or tower system.

Read more about: How to Select Lightning Dissipation Systems

Tower and Structure Linear Dissipater Arrays

Description:
The Linear Dissipater Array (LDA) is designed to retard streamer formation and to enhance the natural dissipation characteristic of the structure, consistent with aesthetic considerations. A linear dissipater element consists of a central cable with dissipation electrodes inserted continuously within the wind of the cable. Each element is two feet long. The configuration of LDA elements and supporting structure is dependent upon the specifics of the tower top or other structure being protected. Each array is custom designed and quoted.

Application:
Linear Dissipation Arrays are suited to large exposed structures where a high level of static charge dissipation is required. Such structures include broadcast and communications towers, large light structures, bridge spans, flare pipes, oil rigs, and industrial process equipment.

Candelabra Dissipater Arrays

Description:
Candelabra Dissipater Arrays (CDA) typically include four individual brush-style dissipater elements on brackets around the top of a 1/2" x 13 threaded supporting rod. Versions are available on 18", 24" and 48" stainless rods. All CDA's are Underwriter Laboratories listed as "air terminals" and may be used as part of a "Master Label" system. These CDA's are patent protected.

Application:
A CDA is appropriate for use wherever an air terminal (lightning rod) is appropriate and static dissipating qualities are desired. The addition of the streamer retarding CDA secures the benefits of the latest technology in static dissipation while retaining the proven protection of the conventional air terminal. It is particularly suited to protecting aviation warning lights atop power transmission towers and other structures because its thin support rod places the dissipaters above the beacon without occulting its warning beam. The CDA is also ideal for protecting structures like smaller towers, light poles, and satellite dishes.

Spot Dissipater Elements Description:
Spot dissipater elements (SDE) are patent protected brush-style dissipaters. They consist of a multiplicity of thin stainless steel wires that are mounted in a stainless tube. The tube is provided with convenient mounting holes. The stainless construction makes the spot dissipaters highly corrosion resistant. The basic SDE consists of a "brush" of stainless wires 4" long in a 3" long tube, for a total length of 7". With appropriate fittings, several variants are available. Typical are:

SDE-1	SDE with 3" (76.2 mm) tube mount and ¼" (6.35 mm) mounting hole
SDE-2	SDE-1 with dual ¼" (6.35 mm) mounting holes
SDE-22A	Dual SDE dissipater, includes hardware set for 1" (25.4 mm) pole attachment
SDE-22B	Dual SDE dissipater, includes hardware set for pipe to 2 ½" (63.5 mm)

Application:
Spot dissipaters are multipurpose devices. Their lightweight and convenient mounting facilitate protection of structural features and devices that do not require the larger LDA and CDA dissipaters. For instance, handrails, lighting fixtures, small antennas, poles, storage tanks, shelters, pumps, and many more devices may be protected. More than one SDE may be attached along the perimeter of tanks or similar assets. For that use, a spacing of 10 to 20 feet is typical. The SDE-22A is specifically designed to mount to the tips of DC grounded radio antennas. The SDE-22B is intended to attach to the top of lightning protection poles and flagpoles.


SDE-1


SDE-2


SDE-22A


SDE-22B

Air Terminals

Description:
These Air Terminals incorporate the “brush” of an SDE in the end of a conventional air terminal rod. These units are made solid copper or aluminum and include a standard ½” screw thread on the base to fit most lightning system bases and grounding fixtures. These terminals are Underwriter Laboratories listed. Typical variants are:

DAT-118C	Air terminal with 18” (457 mm) solid copper rod, ½” (12.7 mm) x 13 threads
DAT-118A	Air terminal with 18” (457 mm) solid aluminum rod, ½” (12.7 mm) x 13 threads
DAT-124SS	Air terminal with 24" (609.6 mm) solid stainless steel rod, 5/8" (15.9 mm) x 13 threads
DAT-160SS	Air terminal with 60” (1,524 mm) solid stainless steel rod, 5/8” (15.9 mm) x 13 threads

Application:
Typical applications are on building structures and equipment. These can be used in place of a standard air terminal in a lightning protection system built to UL-96A and NFPA 780 specifications.

Air Terminal Extensions

Use the LRE-series of lightning air terminal extenders to facilitate protection of sensitive electronic, communication, and mechanical assets. The LRE-series of extenders adds a critical step in the quest to put lightning where it belongs, the ground.

Conventional practice has been to place lightning rods or air terminals directly on the structure of outdoor air handling units, stacks, control boxes, and antenna, CCTV, and lighting masts. This type of arrangement permits

lightning strike charges to flow not only through the mast or structure, but through the attached sensitive equipment as well.

LRE extenders solve the problem by keeping the air terminal well above and independently attached below the protected equipment. This more effectively controls the lighting path. Charges are routed directly to ground, bypassing exposed equipment or cable routings.

Select Models LRE-8 and LRE-14 to elevate air terminals eight feet and fourteen feet, respectively. The extenders are constructed of heavy-duty aluminum and meet NFPA requirements. They can be used with most UL-listed air terminals. LRE-series extenders are designed for installation with an assortment of mounting options, including a non-penetrating roof mount.

LRE-8	Air Terminal Extender, 8' x 1' (244 cm x 30.5 cm) aluminum base, for ½"(12.7 mm) x 13 air terminals
LRE-14	Air Terminal Extender, 14' x 1 ¼" (4.27 m x 31.8) aluminum base, for ½" (12.7 mm) x 13 air terminals

(Shipped as two pieces, max length 96")

LRE lightning protection hardware is particularly effective when coupled with the LBA series of field dissipater air terminals and candelabra dissipaters. Unlike conventional air terminals, these charge dissipation air terminals bleed off accumulating electrostatic energy, reducing the potential for actual lightning strikes. Consult LBA for recommendations on appropriate selections.

The order numbers shown represent our most popular items. Additional types and custom configurations are available. To quote your specific requirements, or to order, please consult Mike Senn, or 252-757-0279.

Technical Note

LBA does not claim that these products are 100% effective in preventing lightning strikes. At the present collective level of understanding of the lightning phenomenon, the behavior of lightning events is to some degree unpredictable. These products, however, ***do influence the course of lightning strikes*** *and thereby are believed to reduce the incidence of direct strikes.*

Proper grounding of the PLP family and all lightning protective devices is very important. LBA grounding notes and accessories are offered for user convenience only. It is the user's sole responsibility to determine and apply installation and grounding practices appropriate to their application. The standards of the Underwriter's Laboratories (UL), National Fire Prevention Association (NFPA), and appropriate other standards groups should be carefully followed.

Copper Ground System Materials

LBA offers a complete selection of copper bare wire and strap of various widths and gauges for grounding system construction. Our offerings include prefabricated copper ground wire terminations, Copperweld™ ground rods, chemical ground rods, earthing mesh, and exothermic welding materials, as well as UL and NFPA compliant lightning system cable and accessories.

HOW TO PROPERLY GROUND A TV ANTENNA

In this article I want to go over the importance of why you should always ground your outdoor TV antenna. Not only will we cover, **why**, but we'll also cover **how** to properly ground a TV antenna.

Full Disclaimer! Whenever performing electrical work it is always advised you contact a licensed professional in your area. This article serves only as a reference and is not intended, nor does it constitute, any professional direction or advice.

Warning

Governments and ISPs across the world monitor their users' online activities. If found streaming copyright content, you could get into serious legal trouble. Currently, your IP **74.103.176.54** is visible to everyone. I strongly recommend that you get the best VPN for streaming and hide your identity so that your entertainment doesn't take a turn for the worst.

Here are the reasons why you must use a VPN all the time.

I personally use and recommend you use one of **PureVPN**, **IPVanish** or **ExpressVPN**. They are the fastest and most secure VPNs in the industry.

The National Electrical Code (NEC) and the Canadian Electrical Code (CEC) requires that every television antenna installation must be grounded. These are the national codes, so be sure to check with your local State or Province for any regional type codes that must be adhered to for your specific location.

Before we get started let's take a look at a few different concepts that are important when we say that we are going to "ground" something or "bond" something. Specifically let's look at grounding and why we ground metal objects. Let's also look at bonding, and what it means to bond metal objects. These two concepts serve two different roles and are often confused.

What Does It Mean To "Ground" Something?

Grounding and bonding are probably the least understood and improperly implemented part of an electrical system. Before we get into what grounding is and how to properly ground a TV Antenna, let's debunk two myths right away:

Myth #1:

Electricity is trying to get to the earth...WRONG! Electricity is trying to get back to the source of it's creation and it will use the earth as a PATH if needed.

Myth #2:

Electricity takes the path of least resistance...WRONG!!! Electricity takes all available paths proportional to the resistance and the source of its creation.

"Grounding of metal parts" of electrical equipment is the intentional connection of the equipment to the earth. Failure to properly ground metal parts to the earth could result in high voltage being applied to metal parts if lightning strikes.

"Effectively grounded" if metal object are intentionally connected to the earth via a low impedance (resistance) path.

"System grounding" to the earth is for lightning and Line Surge issues. It will NEVER aid in the clearing of a breaker or fuse in your actual house.

What Does It Mean To "Bond" Something?

"Bond, bonded or bonding" means the permanent joining of metallic parts to form an electrically conductive path which provides the capacity to conduct safely any current likely to be imposed on it.

What is important to understand with bonding is that proper bonding of your TV Antenna, Mounting Pole and/or conduit offers a low resistance path to the earth via your **equipment grounding conductor** in the event of a lightning strike. Without this PATH lightning will find another way to get to the earth, that could be through your antenna cable and/or even worse, your HOUSE!

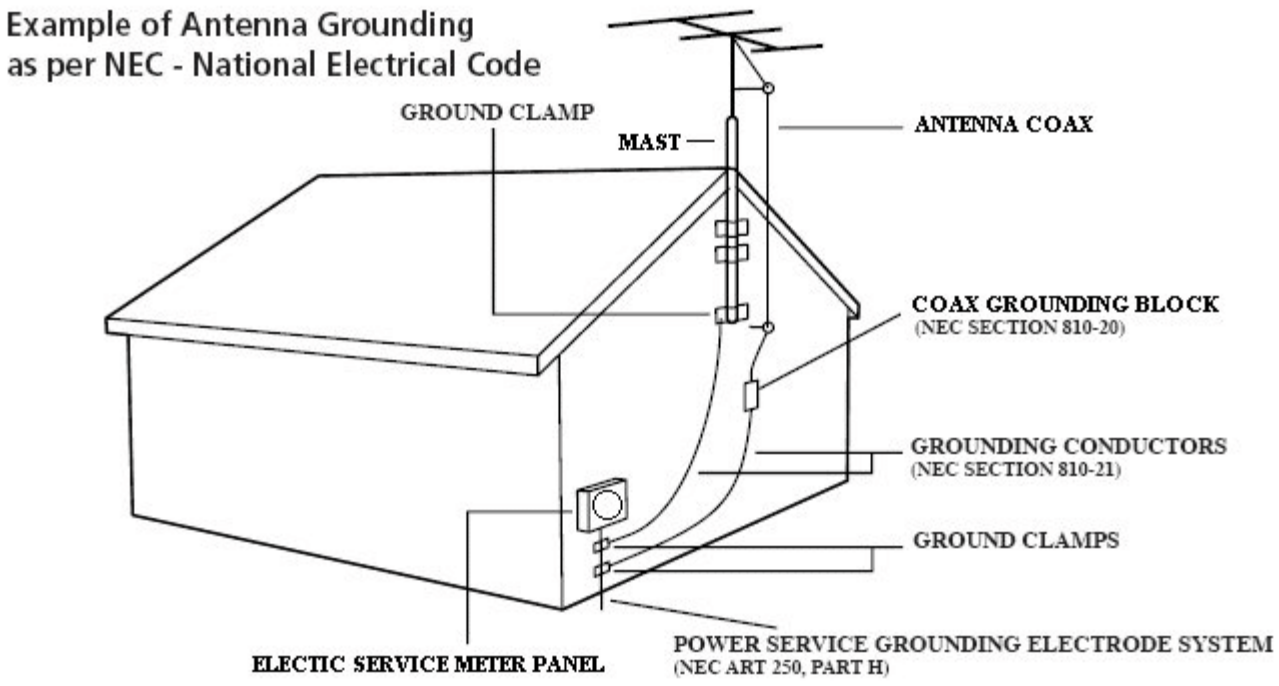
Therefore, it is extremely important that all the metal parts of your TV Antenna hardware are bonded together and that a grounding conductor (wire) is installed to connect your TV antenna to your grounding rod or ground plate.

How To Properly Ground A TV Antenna

The NEC requires that the antenna mast be grounded directly. If you look at the image below, you'll want to use a #6 AWG or #8 AWG Solid Copper ground wire for all of your grounding runs and suitable Ground Clamps. Below is an image taken form the NEC code book that shows how to properly ground a TV antenna. Depending on your geographic region this could vary slightly, however, the basic installation remains largely unchanged.

While grounding your TV antenna is not a difficult job, it certainly won't cost you too much, and may even provide you with a little piece of mind, to have a licensed professional either perform the installation, or at the very least, verify your installation meets the applicable codes for your area.

Either way, I think this image will serve as a very useful tool to help visualize the basic connections needed to properly ground an outdoor TV antenna.



Step #1 – Mount Your TV Antenna

Determine where you will mount your antenna – mount your TV antenna in a location that will provide you with good structural support. Whatever location you choose, be sure to also consider the direction of your transmission broadcast towers so that you have the clearest line of sight possible.

Securely mount your antenna – using the provided mounting hardware, mount your TV antenna to your rooftop or to the side of your house as illustrated in the picture above. Be sure to follow all mounting instructions that accompanied your antenna for safe and secure installation. Note, if you are mounting to your rooftop, be sure to use a roof sealant to cover up the screws to prevent any chance of water getting through.

Step #2 – Locate Your House's Service Grounding Conductor (Wire)

If you go down to your basement and locate your electrical panel, you should see a solid copper wire that goes from your electrical panel through your wall to the outside. This wire will connect to a grounding electrode (ground rod) or a grounding plate.

In the illustration above, the is shown as the "Power Service Grounding Electrode System". Locate this system grounding conductor and place a ground clamp on it. Amazon has many different styles and varieties of Ground Clamps and they're fairly inexpensive. The size of the clamp is usually based on the size of the wire that your are clamping to.

Depending on where your live and the size of your service, your houses service grounding conductor could be anywhere from a #2 AWG to a #6 AWG.

Remember, the NEC requires a minimum #10 AWG grounding wire for your antenna. I recommend a #6 AWG or #8 AWG Solid Copper ground wire from Amazon. Using solid wire is preferred over stranded because stranded wire can become brittle over time when exposed to the elements.

Step #3 – How To Properly Ground a TV Antenna Mast

Using an Antenna Mast Ground Clamp, run the other end of the ground wire you connected in Step #2 to your antenna mast and secure it tightly. Again the clamp you will need will depend on the diameter of your antenna mast.

Step #4 – How To Ground Your Coax Cable

Now it's time to ground your TV antenna's coax cable. The coax cable itself can build up a static electric charge and in order to properly dissipate that charge an antenna discharge unit or grounding block can be used (again check you local code rules).

Again these types of Coax Ground Blocks can be found right on Amazon and are fairly inexpensive. Although not shown in this picture, I do recommend also using Coax Surge Protectors that are rated up to at least 1500 MHz to provide another layer of protection.

That's it! You now know how to properly ground a TV antenna!

A couple of small tips before I let you go.

Antenna masts that are painted, badly rusted, or have some kind of coating on them, be sure to scrape the areas where the metal parts meet to ensure good bonding. After the antenna mast hardware and mount are securely connected, there is no issue in repainting afterwards.
Securely fasten the grounding wire to the side of your house using staples or other zip-screw type wire clamp suitable for the job.
Try to keep your ground wire runs as short as possible and avoid making 90 degree turns or bends. If you need to bend the ground wire, make the bends as gradual and as smooth as

possible. The reason is lightning doesn't like to turn corners, and what you don't want is for a lightning strike to discharge into your house.

What If Lightning Does Strike!

In the unlikely event that lightning does strike your TV antenna, even if you've done all the proper grounding to it, there is no guarantee that damage won't be caused.

The simple truth is, when lightning strikes, it's going to do whatever it's going to do, and the best we can do is provide a low impedance (resistance) path to get that energy back to the earth as quickly and as safely as possible. The good news is lightning strikes are extremely rare!

If your still worried about damage being caused to your equipment or your television set in the event of a lightning strike, you can always disconnect the coax cable from your devices when you know a storm is coming.

Conclusion

Well I hope this article has given you a good idea how to properly ground a TV antenna. Again, this article should only be used as a reference. It is always a good idea to consult you local licensed electrician or antenna installer to ensure that you meet all the requirements and applicable electrical codes for your country or region.

Intelligent

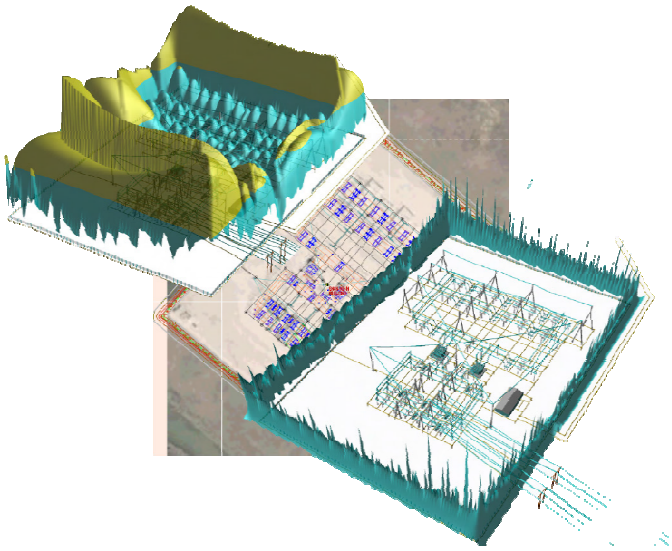
Identifiesandremovesbackgroundnoise, EMIandstraycurrentsfromtestresults.

Informative

Multipleanalysisoptions: Compliance withIEEEand/orIECsafetystandards,andLi ghtningShieldingandTransientAnalysis.

Convenient

Idealforenergizedsystems,siteswithlimited



real estate,andotheruniquesituations.

Reliable

Quantifiedconfidencelevels,automaticerror correctionandin-fieldcalibration.Smart GroundisEPRIapproved.

TheSmartGroundAdvantage

Utilitiesandindustrial facilitieshavestruggled foryearswithunreliablegrounding measurementsproducedbytheFall-of-Potential(FOP)method anditsinherentlimitations.

UnliketheoutdatedFOPtest,SmartGroundanalyzesthein-situgroundingenvironmentandcompares actualmeasurementstoanelectro- geometriccomputermodel ofthesystem being tested.Theresultsarehighly-accuratemeasurementsandpracticalrecommendationstohelpyoumakeinformeddecisions.

Whattoexpect

TheSmartGroundtestisperformedon-site byourexpertengineerandtechniciansincooperationwithyour staff.Ourexperience

ensurestestingiscompletedsafely,quickly,andwithminimalimpacttooperations.

The Report

ThestandardSmartGround reportcoversall aspectsoftestingincluding:

1. Resultsfromalltestareas,withmulti- layersoilresistivity,groundsystemimpedance,andpoint-to-pointcontinuitymeasurements.
2. Safetyassessmentsofworst-casestep,touch,and transfervoltagesaccordingtoIEEEstandard 80 and/or IEC standard 479-1.
3. Visualrepresentationsofthefacilitydetailinglocationsof measurements,observations,andrecommendations.
4. Expertrecommendationstailoredforyoursite,basedontestfindings,safetystandards,andyourspecificneeds.
5. Ageneralbillofmaterialsandasafetyassessmentofexpectedresultspost implementation ofrecommendations, ifrequired.

SmartGroundTestingService

ComprehensiveAnalysis

SmartGroundgeneratesanelectro-geometricmodelofthesite'sphysicalandelectricalcharacteristics,whichiscompared withmeasurementstoidentifydeteriorationanddeficiencies.Usesfrequencyrangesup to1000Hztoanalyzeimpedance.

BroadApplications

SmartGroundreturnsaccurateresultsonenergized andconnectedgroundgrids, usingsophisticated softwaretofilteroutelectricalnoise.

ConfidentResults

SmartGroundcollectsthousandsofdatasampleswithahighsignal-to-noiseratiotocalculatemeasurementsandverifyresultswithquantifiedconfidence levels.

Practical& Convenient

SmartGroundisaccurateeven whenthe distancetothe currentprobe isonly 2times thediagonal distanceofthegrid.Theshorterdistancesavesworkwithoutcompromisingaccuracy.

Fall-of-Potential(FOP)

LimitedCapabilities

Foreachmeasurement,FOPtestersarecapable ofonlyonereadingatasinglefrequency,withnovalidationoftheresults.Allanalysismustbeperfo rmedmanually,increasingriskforerror.

NarrowApplications

FOPcan'tdistinguishbackground noisefromtestcurrent,thusmakingitinappropriateforenergizedsystems.

QuestionableResults

Noerrorcheckingorconfidencelevels.Not sensitiveenoughtoaccuratelymeasurelow-

resistancegroundslikethoseat largeplantsorsubstations.

Difficultto Deploy

ExcessiveleadlengthmakesFOPimpractical in urban ordeveloped areas. Distance to thecurrent probe must be at least5 times the diagonal distance of thegridand upto 16timestorealizethesameaccuracyasSmartGround.

Risks ofInefficientGrounding

When properlydesignedandmaintained, agrounding system establishes electrical connectionswiththeearth,providesacommongroundreference,andminimizesgroundp otentialrise. Thisreductioninground potentialrisepreventsmanyelectrical anomalieswhichcanaffect:

- General personnel safety
- Lightningandsurgeprotection systems
- Clearinggroundfaultsquickly
- Protectingcriticalelectronicsystems

Yetmanyfacilitiesnevermakeneededrepairsbecauseburiedgroundingsystemsaredifficul t toinspectandtest.TheSmartGround

servicesimplifiestestingandprovides practical recommendationssoyou canfinallyhaveconfidenceinyourgrounding system.

LIGHTNING ELIMINATORS
WWW.LIGHTNINGPROTECTION.COM

GAF®

GroundingAugmentationFill™

LowResistanceBackfillforBetterGrounding

Propergrounding iscritical topersonnelsafetyanduninterruptedoperations,but localsoil conditionsoftenmakeitdifficulttoachievetargetresistance.

Grounding Augmentation Fill (GAF) fromLightning Eliminators is specially formulated tohelpcreatealowresistanceearthinterface,makingit**easierandlessexpensive**tomeet yourgroundingrequirements.

ReducingGroundResistance

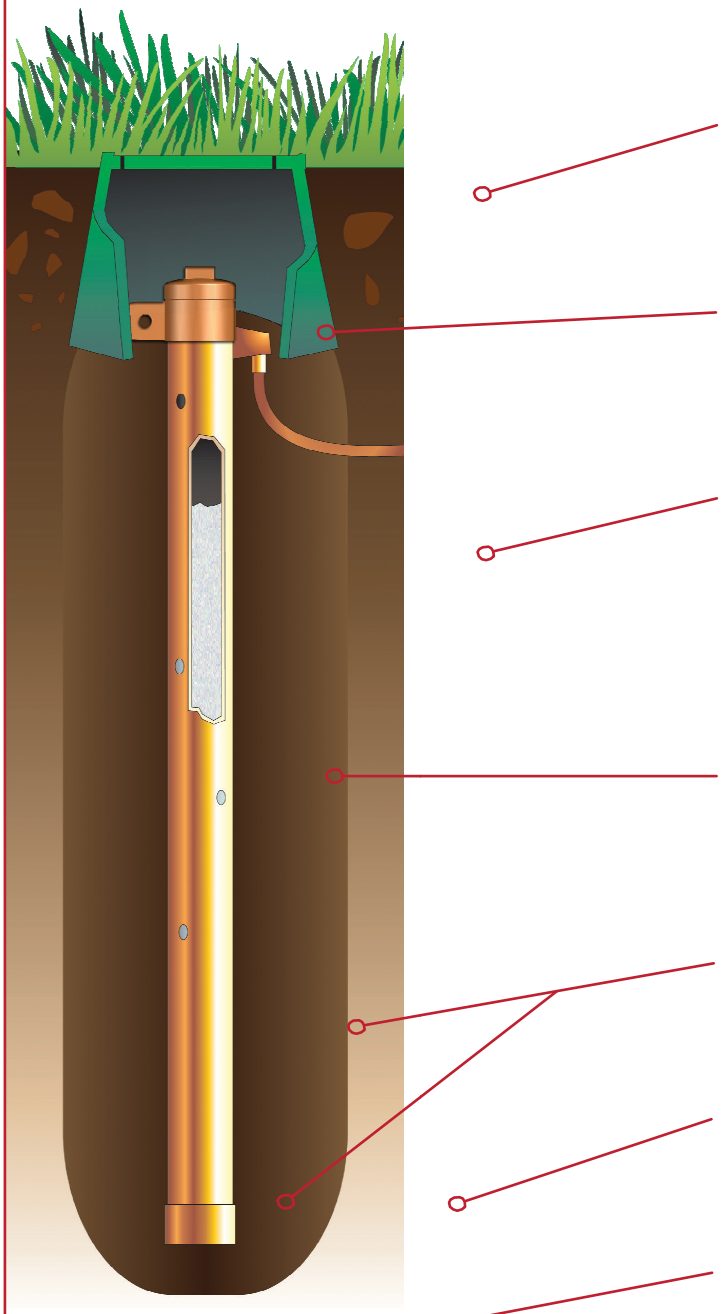
Ninety-fivepercentof theresistanceofagroundingelectrodeisestablishedby thesoilwithinanareawhoseradiusis1.1timestheelectrode'slength,calledtheinterfacing hemisphere.Asshowninthetable below, augmentinglocalsoilwithGAFconductivebackfill facilitatesalowresistancegroundconnection.Thegreaterthepercentageof soilreplaced,thelower theultimategroundingresistance.

HoleDiameter	BagsofGAF	Reductionin Resistance
6"(15cm)	2	34%
12"(30cm)	6	45%
24"(61cm)	23	56%
36"(91cm)	50	63%

Withjust1/3the resistivityofbentonite,GAFhasalower freezingpointandexpansionfactor,andretainsmoisturebetterthanlocalsoil.**UsingGAFcontr ibutestooverallsafety**inapplicationssuchas electricalsubstationsbyreducingstepandtransfervoltages,evenin

GAFSpecifications

6. Resistivityof0.5ohm/meter
7. Availablein50pound(22.6kg)bags
8. 1.5cubicfeet(0.0425cubicmeters)perbag



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Calculate Lightning Protection for Building / Structure

Example: Calculate Whether Lightning Protection is required or not for following Building. Calculate No of Down Conductor for Lightning Protection

Area of Building / Structure:

- Length of Building (L) = 60 Meter.
- Width of Building (W) = 28 Meter.
- Height of Building (H) = 23 Meter.

Lightning Stock Flushing Density

- Number of Thunderstorm (N)= 80.00 Days/Year
- Lightning Flash Density (Ng)=69 km2/Year
- Application of Structure (A)= Houses & Buildings
- Type of Constructions (B)= Steel framed encased without Metal Roof
- Contests or Consequential Effects (C)= Domestic / Office Buildings
- Degree of Isolation (D)= Structure in a large area having greater height
- Type of Country (E)= Flat country at any level
- Maximum Acceptable Overall Risk Factor =0.00000001

Reference Table As per IS:2309

Thunder Storm Days / Year	**Lightning Flash Density** (Flashes to Ground /km^2/year)
5	0.2
10	0.5
20	1.1
30	1.9
40	2.8
50	3.7
60	4.7
80	6.9
100	9.2

Application of Structure	**Factor**
Houses & Buildings	0.3
Houses & Buildings with outside aerial	0.7

Factories / workshop/ Laboratories	1
Office blocks / Hotel	1.2
Block of Flats / Residences Building	1.2
Churches/ Hall / Theaters / Museums, Exhibitions	1.3
Departmental stores / Post Offices	1.3
Stations / Airports / Stadium	1.3
Schools / Hospitals / Children's Home	1.7
Others	1.2
Type of Constructions	**Factor**
Steel framed encased without Metal Roof	0.2
Reinforced concrete without Metal Roof	0.4
Steel framed encased with Metal Roof	0.8
Reinforced concrete with Metal Roof	1
Brick / Plain concrete or masonry without Metal Roof	1.4
Timber framed or clad without Metal Roof	1.7
Brick / Plain concrete or masonry with Metal Roof	2
Timber framed or clad with Metal Roof	
Contests or Consequential Effects	**Factor**
Domestic / Office Buildings	0.3
Factories / Workshop	0.3

Industrial & Agricultural Buildings	0.8
Power stations / Gas works	1
Telephone exchange / Radio Station	1
Industrial key plants, Ancient monuments	1.3
Historic Buildings / Museums / Art Galleries	1.3
Schools / hospitals / Children Homes	1.7

Degree of Isolation	**Factor**
Structure in a large area having greater height	0.4
Structure located in a area of the same height	1
Structure completely Isolated	2

Calculation:

Collection Area (Ac)=(L x W) + 2 (L x H) + 2(W x H) +(3.14 x H2)

- Collection Area (Ac) = (60×28)+2x(60×23)+2x(28×23)+(3.14x23x23)
- Collection Area (Ac) =7389 Meter2

Probable No of Strikes to Building / Structure (P)= Ac x Ng x 10^{-6} No's / Year

- Probable No of Strikes to Building / Structure (P)= 7389x69x10^{-6} No's / Year
- Probable No of Strikes to Building / Structure (P)= 05098 No's / Year

Overall Multiplying Factor (M) =A x B x C x D x E

- Application of Structure (A)= Houses & Buildings as per Table Multiplying Factor = 0.3
- Type of Constructions (B)= Steel framed encased without Metal Roof as per Table Multiplying Factor =0.2
- Contests or Consequential Effects (C)= Domestic / Office Buildings as per Table Multiplying Factor =0.3
- Degree of Isolation (D)= Structure in a large area having greater height as per Table Multiplying Factor =0.4
- Type of Country (E)= Flat country at any level so as per Table Multiplying Factor =0.3
- Overall Multiplying Factor (M) =0.3×0.2×0.3×0.4×0.3
- Overall Multiplying Factor (M) =0.00216

Overall Risk Factor Calculated (xc)= M x P

- Overall Risk Factor Calculated (xc)= 0.00216 x0.05098
- Overall Risk Factor Calculated (xc)= 000110127

Base Area of Structure (Ab) = (LxW)

- Base Area of Structure (Ab)=60×28
- Base Area of Structure (Ab)=1680 Meter2

Perimeter of Structure (P) =2x (L+W)

- Perimeter of Structure (P)=2x(60+28)
- Perimeter of Structure (P)=176 Meter

Lightning Protection Required or Not

- **If Calculated Overall Risk Factor Calculated > Maximum Acceptable Overall Risk Factor than only Lighting Protection Required**
- Here Calculated Overall Risk Factor is 0.000110127 > Max Acceptable Overall Risk Factor is 00000001
- **Lightning Protection is Required**

No of Down Conductor

- **Down Conductors As per Base Area of Structure (s) =1+(Ab-100)/300**
- Down Conductors As per Base Area of Structure (s) =1+(1680-100)/300
- Down Conductors As per Base Area of Structure (s) =6 No's
- **Down Conductors As per Perimeter of Structure (t)= P/30**
- Down Conductors As per Perimeter of Structure (t)= 176/30
- Down Conductors As per Perimeter of Structure (t)= 6 No's
- **Minimum No of Down Conductor is 6 No's**

Results:

- **Lightning Protection is Required**
- **Down Conductors As per Base Area of Structure (s) =6 No's**
- **Down Conductors As per Perimeter of Structure (t)= 6 No's**
- **Minimum No of Down Conductor is 6 No's**