

TERMS TO KNOW:

Air Terminal. A device of Copper or Aluminum generally that is a receptor or contact point that either draws to itself a lightning charge or flash to be carried along the conductor path to a grounding device.

Approved. Simply means acceptable to the ruling authority of any given jurisdiction.

Conductor Cable or Cable. Generally a copper or aluminum conductor formed out of an acceptable number of wires stranded and or weaved together which carries the lightning strike or flash to the ground.

Main Conductor. The conductor which is intended to carry lightning currents from the strike point safely to the ground rods and ground.

Ground or Grounded. To be connected to earth or to a conductive entity that is connected to the earth itself. Ground rods must be at least ½ inch in diameter and 8 feet long. They are to be free of paint or any other covering and must be buried 10 feet deep. In areas where depth becomes a problem, you may use grounding plates. Every structure needs to have at least 2 ground rods and should be placed as far apart as possible and diagonally from each other if possible.

Lightning Protection System. This is the complete system starting with the lightning strike point or strike determination including the earth, connections, *surge equipment*, fittings, ground terminals (rods).

Loop style method or loop conductor. This is the conductor (copper or aluminum conductor cable), which covers or runs a path around the diameter or perimeter of a structure and is used to interconnect the ground terminals (rods or plates), main conductors or other grounding bodies.

Strike Termination Equipment. This can be several devices however the most common items are the following and concentrated upon in this general application. The equipment may be *air terminals (lightning rods, points, etc)* Metal TV antennas or masts such as on a sailboat, permanent metal beams of a building and overhead ground wires known as the catenary lightning protection. *These items of a lightning protection system are used to intercept lightning flashes or strikes and carries the strike to the along the conductor path to the ground.*

Surge Arrestors or Protectors. A device which takes the high surge and voltage of electricity or lightning and renders it harmless by discharging it. Lightning can strike blocks away and travel through the electrical system, phone system, cable TV and these surge protectors and arrestors can stop the damage done. *No structure is completely safe from lightning if there is not a HULK (whole house arrestor) installed on the electrical service for non-structure lightning hits.*

Zone of Protection. The area around and within a specific distance of a lightning protection system that is safe from direct lightning strikes. In simpler terms, there is an area around a lightning rod (air terminal) that is protected from lightning strikes because the lightning is drawn away from it and drawn to the lightning rod itself so it may safely carry the lightning strike away and to the ground. This is why you need 1 air terminal at each point and why they must not be spaced any further away from each other than 20 feet. Each terminal has a zone of protection and together in the system will cover a radius around your house or structure.

Mixing Metals. For all general purposes, copper shall not come in contact with aluminum or other metals where they will be able to corrode, especially in damp or wet areas. This same rule applies to aluminum. If using an aluminum system, you will need to convert the conductor cable to copper just before the ground rod by using a bimetal connector. Bimetallic connectors shall be installed not less than 18 inches above earth level. Areas that the two opposing metals may come in contact you may protect them from each other by using for example a rubber hose, length of garden hose, PVC pipe. This example is generally for covering a section of the conductor cable.

Aluminum. Aluminum materials shall not come into direct contact of the earth. Aluminum equipment shall not be installed on copper roofing materials or other copper surfaces where they can become exposed to runoff from those copper items. Aluminum cable shall not be attached or connected to any surface that has an alkaline-base paint. Also, aluminum shall not be laid and buried in wet concrete or installed somewhere where there is a lot of moisture.

Placement of Air Terminals. Placement of the air terminals on ridge roofs or pitched roofs shall be at or within 24 inches of ridge ends. If you are doing flat or gently sloping roof lines, the air terminals shall be placed at edges or outside corners and not exceeding a space of 20 feet from one another. If you are using air terminals of 24 inches of height or more above the area to be protected you may place those terminals no further than 25 feet apart.

Dormers. On rooflines with dormers as high or higher than the main roofline itself shall have as many air terminals as described and used in any other circumstance. If the dormers are below the main ridgeline they will only need protection in the areas that fall outside the zone of protection.

Surge Suppression. The devices that are available being, HULK (whole house arrester), the SE1K (for coax TV cable) and the DTK1P (phone arrestors) *are required by code to be installed* as well as protection on radio and television lead-ins. *Lightning can enter the structure through the electrical service from blocks away* and just the standard grounding that everyone is familiar with on the electrical service is *not at all* protection from lightning strikes entering the house or building.

Using other metals. Such metal parts of a building such as rain gutters, eave troughs, chutes, etc shall not be used in place of the main lightning rod or air terminal. Any metal

that is less than 3/16 inch thick shall be protected and not used as a conductor. Metal, which is thicker than this, can be bonded to the system.

Direction of conductors. The conductor cable must run horizontally or downward and not be formed into a “V” or “U” pocket. These sometimes can occur at areas such as dormers or chimneys. You must put a down conductor at the base of that particular pocket to make it up to code. No conductor may be bent in which it forms less than a 90 degree angle known as an included angle, and if it bends, the radius must be at least 8 inches. All conductors shall be securely fastened to the structure by some means of a clip or clamp and not more than every 3 feet.

Splices and connections. When having to use a cable splice known as an “end to end” or straight, or using a “tee” or “twin”, there are 2 types available and this is a crimp fitting or bolt tension. We suggest the bolt tension when available because all connections must be able to withstand a pull test of 200 pounds.

Concealed systems. A complete concealed protection system is available and is run the same way as the conventional method. Some people have fear of the conductor cable getting hot from the lightning strike and are afraid to attach the cable to the 2 x 4's or other beams in the house. *The cable does not get hot when struck by lightning providing you are using what we sell, and that is Class One conductor cable.* The reason why the cable does not get hot is because there is no resistance in a proper thickness of copper cable, with no resistance, you have no heat.

FIGURE 3.1.2(a) Roof types: protection methods (drawings are top and end views of each roof type).

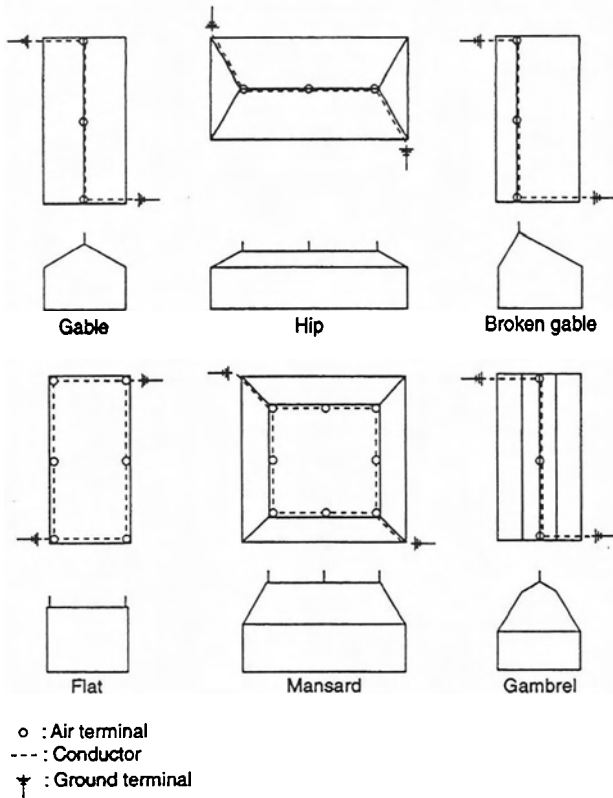
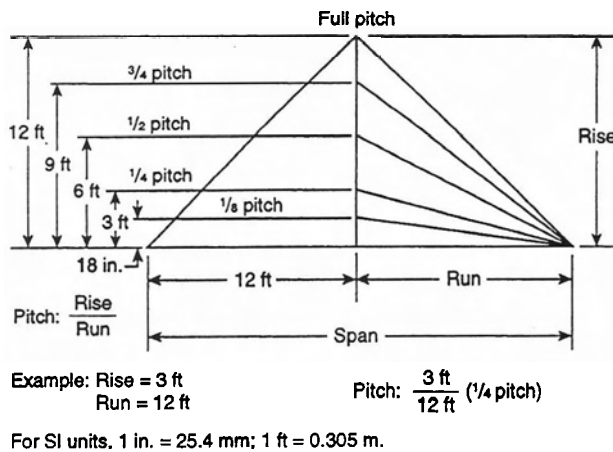


FIGURE 3.1.2(b) Roof pitch.



3.4 Mechanical Damage or Displacement. Any part of a lightning protection system that is subject to mechanical damage or displacement shall be protected with a protective molding or covering. Where metal pipe or tubing is used around the conductor, the conductor shall be electrically connected to the pipe or tubing at both ends.

3.5 Use of Aluminum. Aluminum systems shall be installed in accordance with other applicable sections and with the following.

3.5.1 Aluminum lightning protection equipment shall not be installed on copper roofing materials or other copper surfaces, or where exposed to runoff from copper surfaces.

3.5.2 Aluminum materials shall not be used where they come into direct contact with earth. Fittings used for the connection of aluminum down conductors to copper or copper-clad grounding equipment shall be of the bimetallic type. Bimetallic connectors shall be installed not less than 18 in. (457 mm) above earth level.

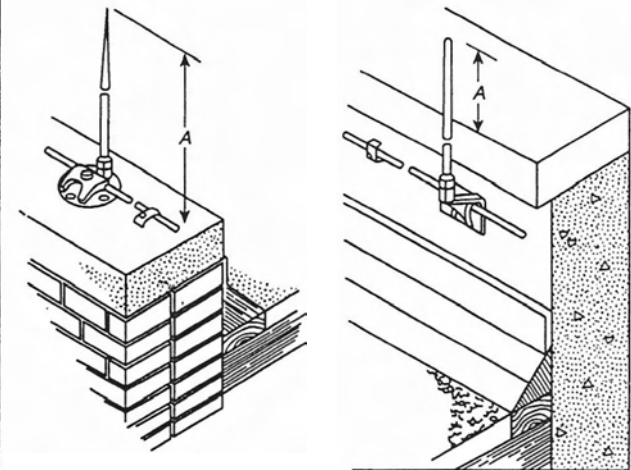
3.5.3 Connectors and fittings shall be suitable for use with the conductor and the surfaces on which they are installed. Bimetallic connectors and fittings shall be used for splicing or bonding dissimilar metals.

3.5.4 An aluminum conductor shall not be attached to a surface coated with alkaline-base paint, embedded in concrete or masonry, or installed in a location subject to excessive moisture.

3.6 Strike Termination Devices. Strike termination devices shall be provided where required by other sections of this standard. Metal parts of a structure that are exposed to direct lightning flashes and that have a metal thickness of $\frac{3}{16}$ in. (4.8 mm) or greater shall require only connection to the lightning protection system. Such connections shall provide a minimum of two paths to ground. Strike termination devices shall not be required for those parts of a structure located within a zone of protection.

3.6.1* Air Terminal Height. The tip of an air terminal shall be not less than 10 in. (254 mm) above the object or area it is to protect, as shown in Figure 3.6.1.

FIGURE 3.6.1 Air terminal height.



A: 10 in. (254 mm)
 Note: Air terminal tip configurations can be sharp or blunt.

3.6.2 Air Terminal Support. Air terminals shall be secured against overturning by one of the following methods:

- (1) Attachment to the object to be protected
- (2) Braces that are permanently and rigidly attached to the building

Figure 7.1
Ridge conductor drops from higher to lower roof levels

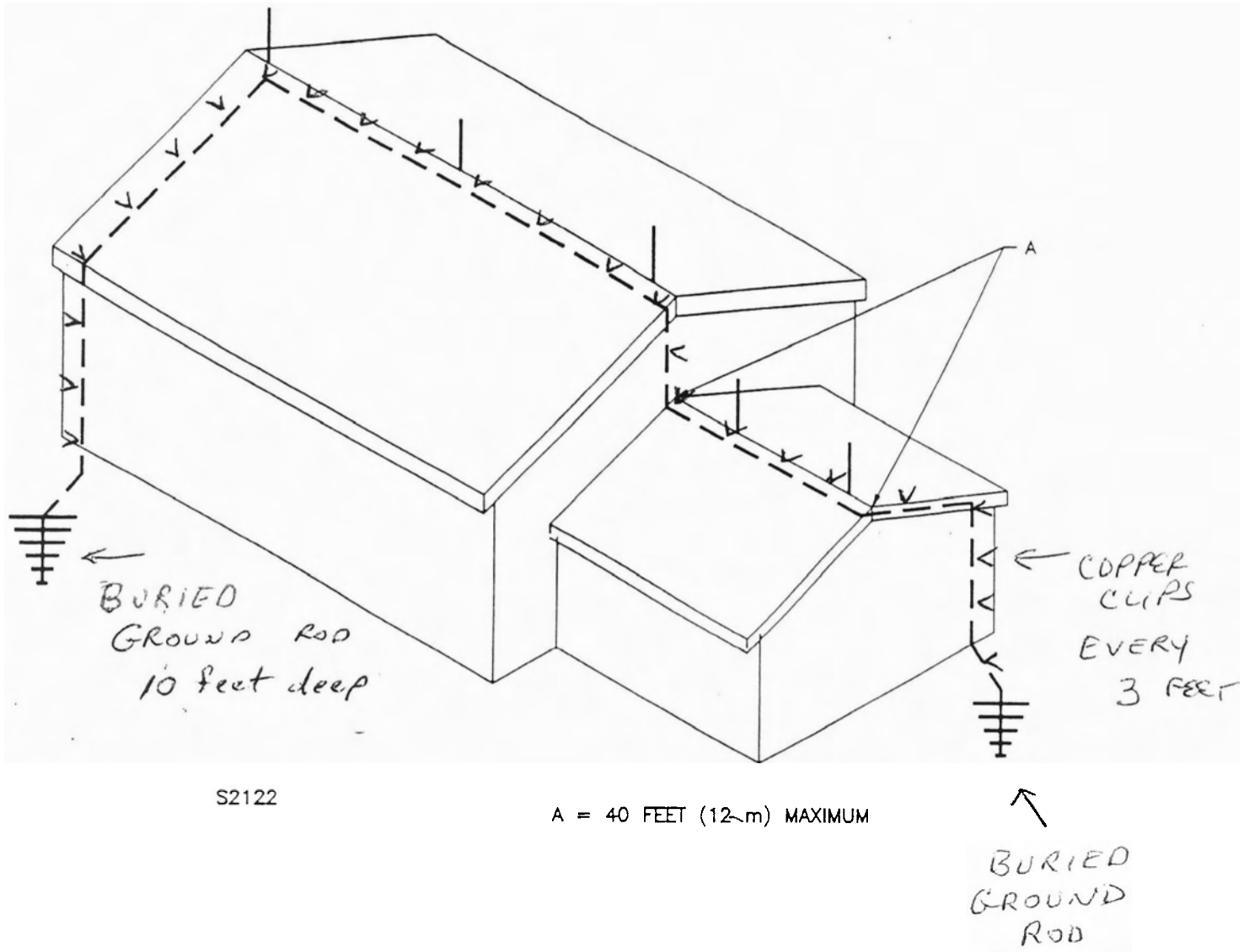
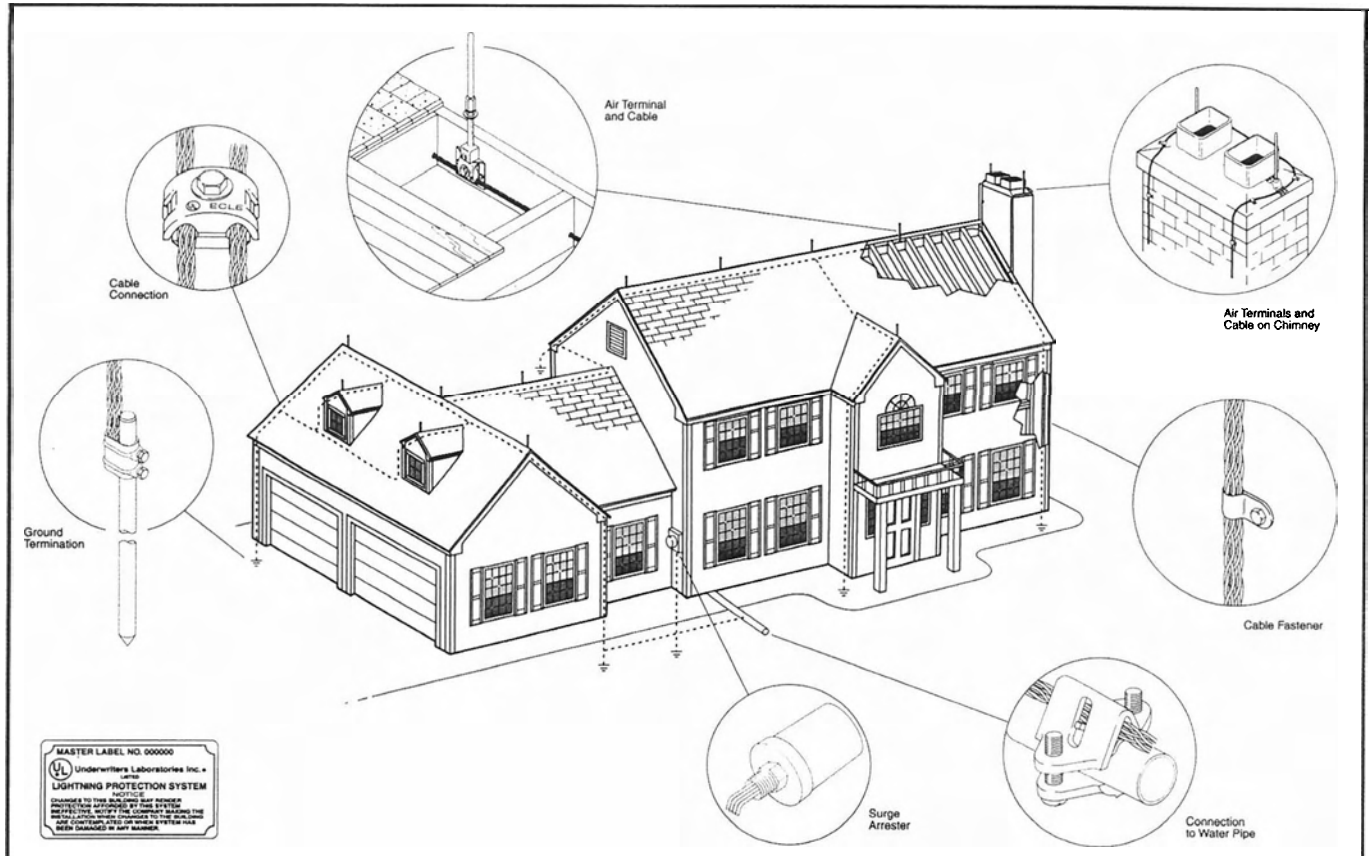


Figure 7.1 revised July 8, 1998

There's Nothing Magical About Good Lightning Protection.



The System

A lightning protection system performs a simple task. It provides a specified path on which lightning can travel. When a home is equipped with a lightning protection system, the destructive power of the lightning strike is directed safely into the ground, leaving the home, family members and personal belongings unharmed.

The Primary Components

A lightning protection system should include all of the following elements, which work together to prevent lightning damage.

- air terminals (rods)
- conductor (cable)
- bonds with metallic bodies

- ground terminations
- surge arresters

Electronic Protection

Modern homes are especially vulnerable to the havoc that lightning can wreak on sensitive electronic equipment. To assure the highest level of protection, UL-listed lightning surge arresters are installed on electrical service panels and other incoming lines. Arresters are the first line of defense against harmful electrical surges that can enter a structure through power lines. For additional protection, UL-listed transient voltage surge suppressors can be installed to protect specific electronic components. A qualified lightning protection

specialist can make recommendations for surge protection that is tailored to your specific needs.

Quality Counts

It is essential that lightning protection systems are installed by trained, qualified lightning protection specialists. For quality assurance all materials and methods should comply with nationally recognized safety standards as established by Underwriters Laboratories and the National Fire Protection Association.



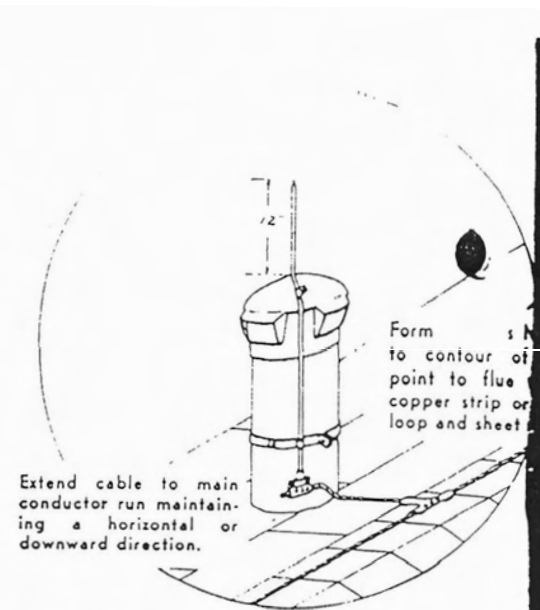
Lightning Protection
Standard UL 96A



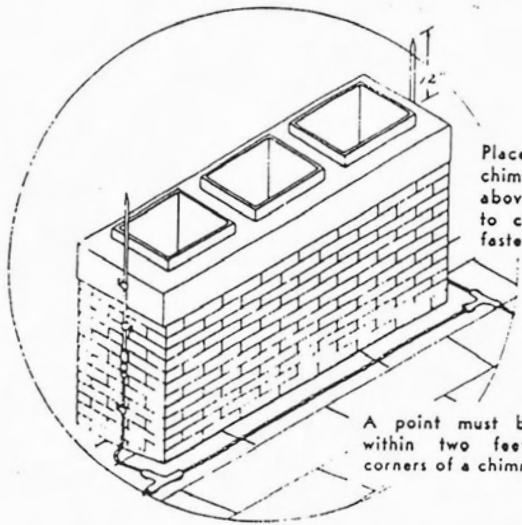
Lightning Protection
Standard NFPA 780

Typical House Lightning Protection Installation Procedure

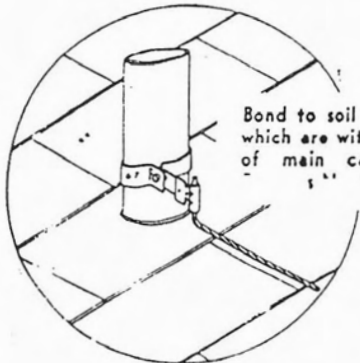
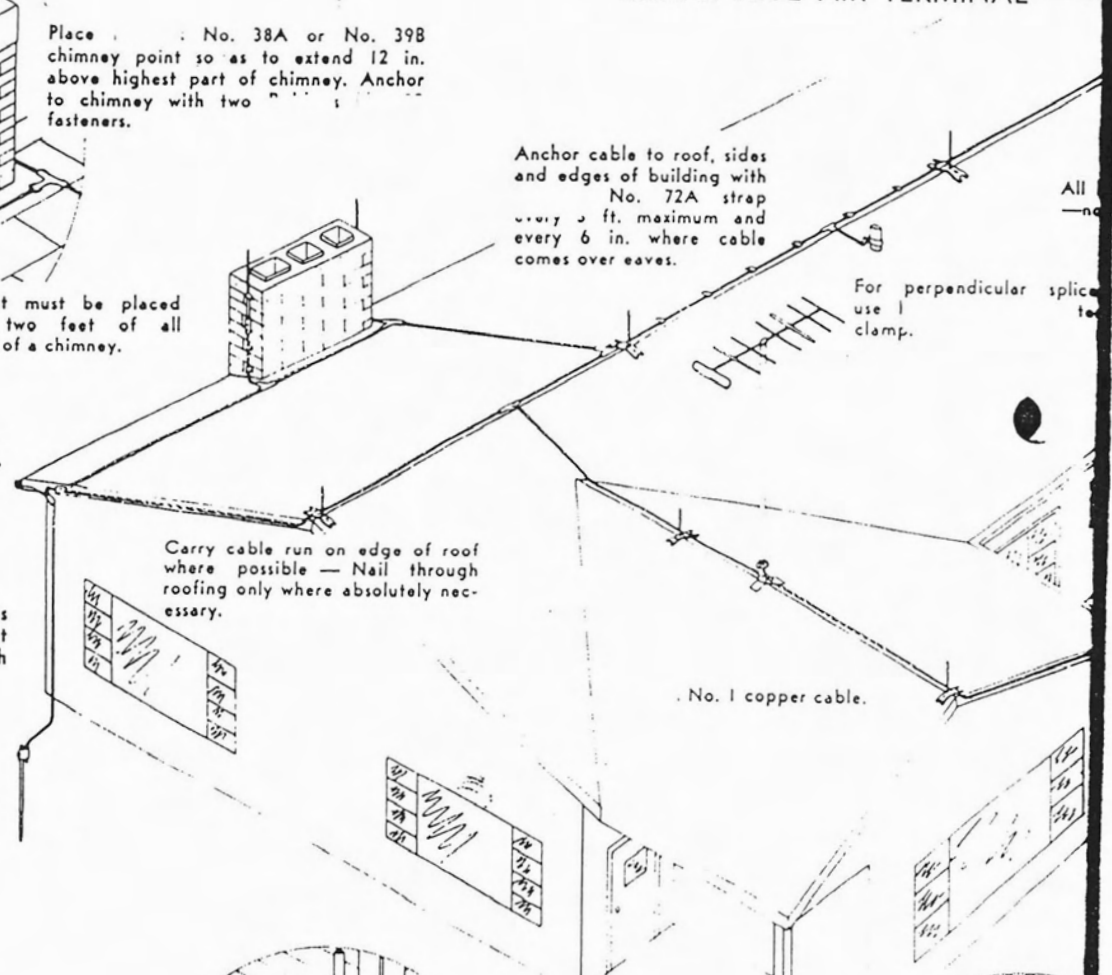
"Designs incorporated in this drawing meet the requirements of Underwriters' Laboratories for a Master Labeled Lightning Protection System."



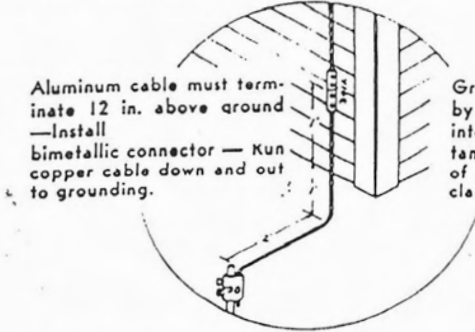
METAL FLUE AIR TERMINAL



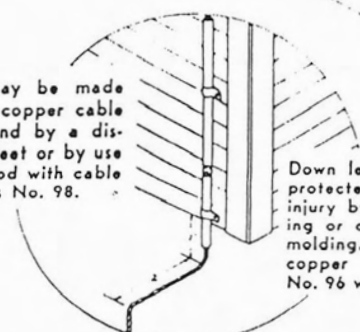
CHIMNEY AIR TERMINAL



ROOF VENT BONDING

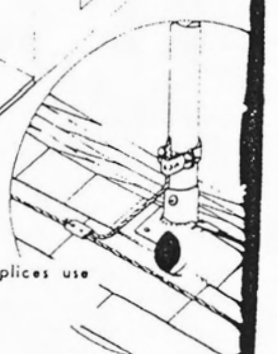


ALUMINUM SYSTEM GROUNDING and GROUND ROD



DOWNLEAD and GROUNDING

Down lead cables shall be protected from mechanical injury by enclosing in tubing or covering with wood molding. Use No. 93 copper tube or No. 96 wood molding.



ANTENNA GR

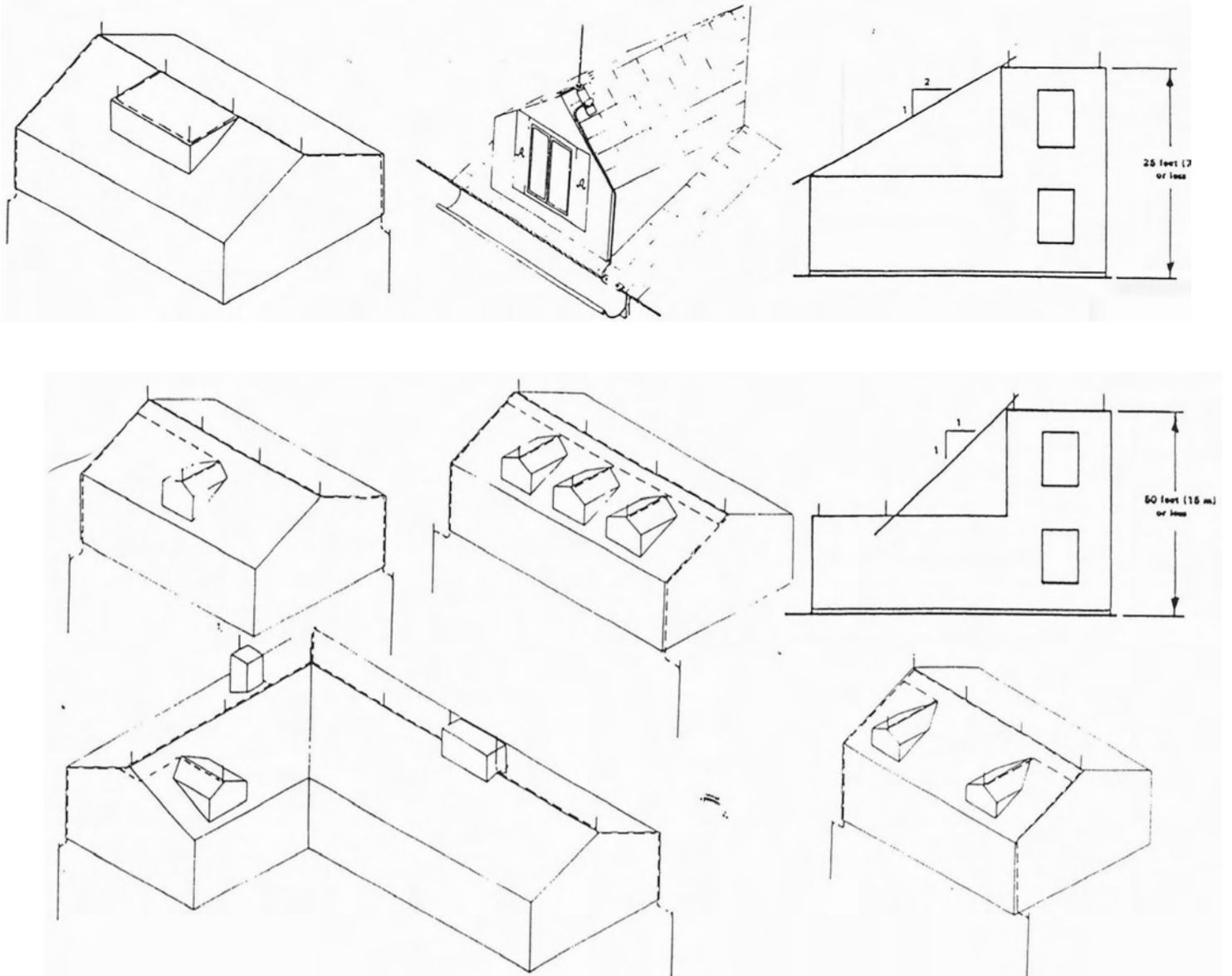
DORMERS

Prominent dormers are determined by the following rule. Measure the height from the finished grade level to the main ridge. From a position at grade level, directly below the main ridge, measure out horizontally two times this height. At this point, sight to the main ridge. If the entire dormer is under the line of sight, the dormer is not prominent. If any part of the dormer extends above the line of sight, it is considered prominent and shall be protected. If uneven terrain

surrounds the structure, scale drawings shall be made to assist in this determination.

This rule shall also apply to dormers located near other higher parts of the structure such as chimneys, side gables, and towers. In these cases, measure the distance from grade level to the top of such projections and proceed as outlined.

Dormers whether ridge, round or flat roof use the same rule.



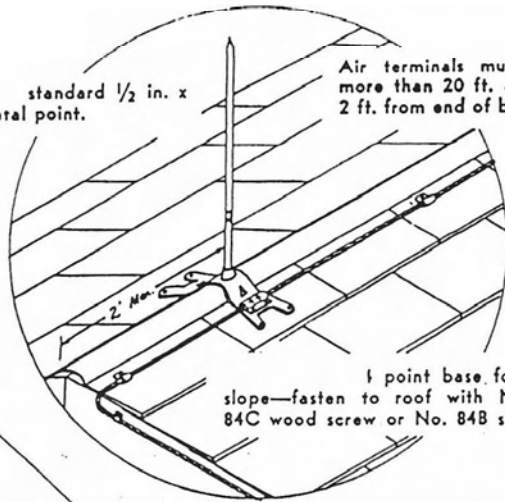
Dead Ends mean air terminals with only one path to ground. Air terminals may be "dead ended" on dormers and chimneys provided the conductor run from the air terminal to the main roof conductor is not more than sixteen (16) feet long and maintains a horizontal or downward coursing. "Dead ends" on main ridges or wings off main ridges are not acceptable.

Small dormers that are located near the lower edge of the roof can be protected in a neat manner by running the cable underneath the corner board next to the sheathing, then over to the main downlead under the edge of the shingles at the gutter. Do not anchor cable to gutter since the holes will cause damaging leaks.

chimney point
metal flue—Anchored
with
sheet metal screw.

standard 1/2 in. x
solid metal point.

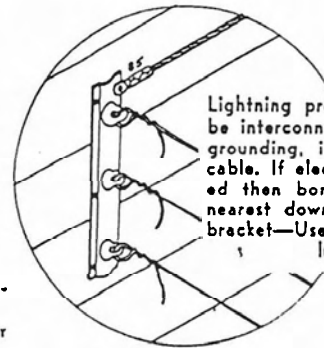
Air terminals must not be spaced
more than 20 ft. apart or more than
2 ft. from end of building.



Point base formed to fit roof
slope—fasten to roof with No. 84 nail, No.
84C wood screw or No. 84B sheet metal screw.

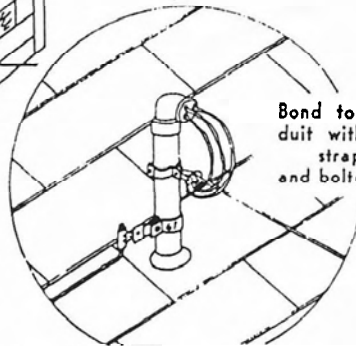
AIR TERMINAL ASSEMBLY

Curves in cable shall be gradual
less than 8 in. radius.



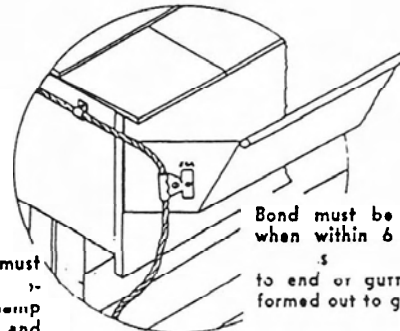
Lightning protection grounding must
be interconnected to electric service
grounding, if present, with full size
cable. If electric service not ground-
ed then bond must be made from
nearest downlead cable to entrance
bracket—Use full size cable and
lug.

ELECTRIC SERVICE BOND



Bond to entrance con-
duit with
strap drawn tight
and bolted.

ELECTRIC SERVICE BOND



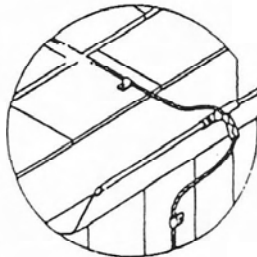
Bond must be made to metal gutter
when within 6 ft. of main cable—Use
bonding plate bolted
to end of gutters where cable can be
formed out to gutter gradually.

GUTTER BONDING



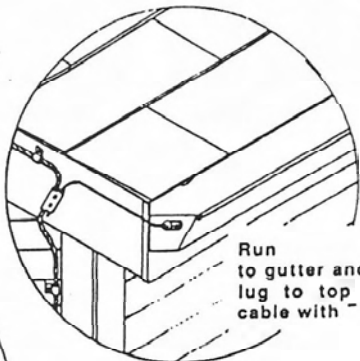
Connection must be made from one
download cable to water service line
by use of
clamp and full size cable.

WATER PIPE BONDING



Where main cable run must
come over gutter—Use
cable trough clamp
crimped over gutter edge and
crimped to cable—Use grad-
ual bend to cable.

GUTTER BONDING



Run
to gutter and bolt
lug to top edge. Splice wire to
cable with
clamp.

GUTTER BONDING

General Design Rules

All buildings must have two groundings as widely separated as possible, preferably at diagonally opposite corners if perimeter, distance around, is 250 feet or less.

If building perimeter is between 250 feet and 350 feet, then three groundings are required. If between 350 feet and 450 feet, then four groundings, etc.

Lightning Protection Systems shall be applied to metal covered buildings in like manner as on buildings without metal coverings.

Cables shall be free of sharp turns and "u" or "v" pockets. Cables shall maintain a horizontal or downward course.

This drawing shows the use of copper materials—equivalent materials in aluminum may be used.

Base of metal antenna
with

Typical Commercial Lightning Protection System

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