Appendix I

Guidance on Lightning Rod Installation and Grounding

The diameter of the platform, the height of the fence, the height of the pedestal and the vertical beam width are all factors affecting the free sight. As a rule of thumb, use 1.5 times the lower limit of the vertical beam width (see Figure 6-7) - in this angle there must be free sight. In blanked sectors or directions of low practical importance this rule may be ignored. Normally, the height of the pedestal is chosen to achieve free sight.

The mounting flange needs to be installed level (horizontal) in both top and bottom planes (no tilt). The bolts need to be fastened properly to the mast/tower with the right torque. If wires are being used to stabilize the pedestal or it is supported by concrete, make sure they are done properly.

Five different types of antennas are supplied for this project which come with only two types of turning units:

1. 1.5KW Turning Unit (comes with all Compact antennas)
2. 4KW Turning Unit (comes with all other antennas; i.e. 21', 18' High Gain and 21' LA)

Identify which one is supplied for the subject site. Refer to Appendix C for the drawing of the mounting flange for 1.5 kW turning units and Appendix D for the drawing of the mounting flange for 4 kW turning units.

Also refer to the following documents for the mechanical drawings:

Antenna System, 21', HG, Installation Drawing

Antenna System, CO

6.7 BOOM FOR WIND/ICE SENSOR

Wind and Ice sensors can be mounted on a single boom structure off the tower as shown in Figure 6-8.

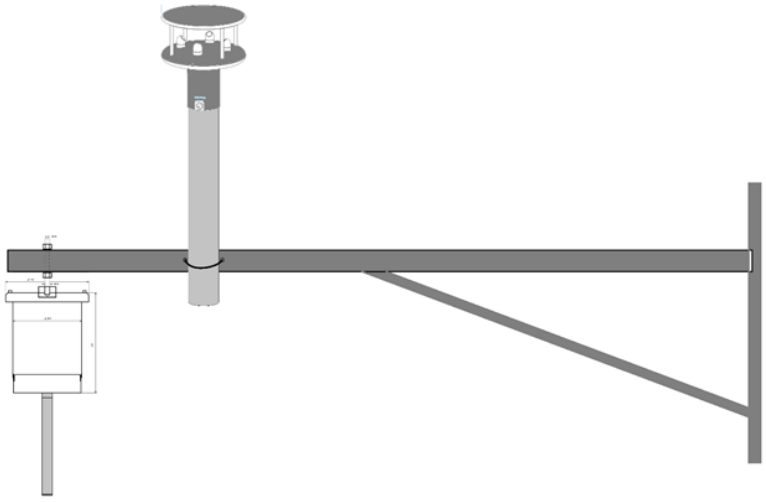

Figure 6-8 An example of the boom structure

Make the boom available and erect it considering the following criteria for a proper installation of the sensors:

a. Install the sensors in the blanked antenna sectors or directions of low practical importance.
b. Do not block the antenna rotating plane; a reasonable vertical separation is necessary.
c. If the sensor is to be mounted on a tower or mast, then the boom should be at least twice as long as the minimum diameter or diagonal of the tower. The boom should be positioned on the prevailing wind side of the tower.
d. Install the boom around the same side of the tower as the lightning rod is placed.
e. Ground the boom to the grounding reference.

Figure 6-9 shows an example of wind and ice sensors installation. To install the sensors on the boom, a set of mounting accessories are needed which are included in the equipment package. The installation of the sensors will be explained in the following chapters.

Figure 6-9 An example of wind and ice sensors installation

6.8 LIGHTNING PROTECTION

The antenna system and other equipment on tower top must be properly protected against lightning. Most of the time, damage caused by lightning occurs due to overvoltage induced on power supply line into the RADAR site and distributed to other parts of the system. To accommodate this problem, it is recommended to add surge arrestors to power supplies and galvanic connections going into the RADAR equipment room. The optimum solution is that the power supply is the only galvanic connection from the exterior and using fiber optic cables for all telecom connections.

The idea is to connect the system as effectively as possible to ensure that all components have the same potential if lightning strikes, to form a Faraday's cage around the equipment cabin.

Figure 6-10 shows the recommended solution for lightning protection and grounding.

In addition, a recommended precaution is to set up a lightning attractor rod. The lightning rod must be mounted just outside the circumference of the antenna, see Figure 6-11. The purpose of the lightning protection rod is to attract the lightning and, in this way, distract it from the antenna.

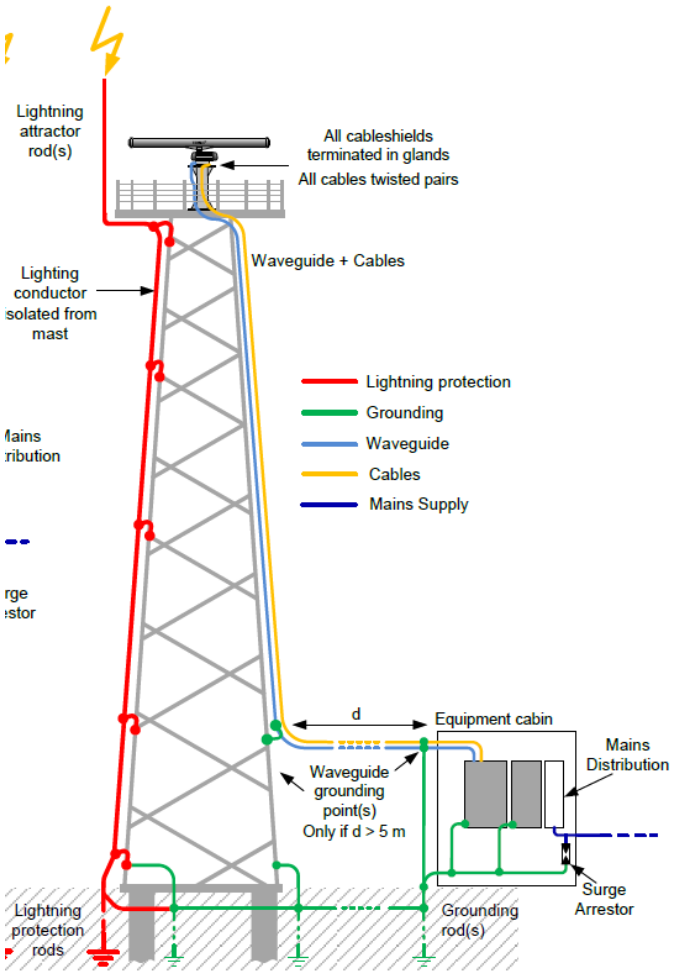

Figure 6-10 Lightning protection

The lightning attractor rod must be as thin as possible, diameter app. 60 mm, thereby reducing the influence on the antenna to a minimum. It should be placed in the direction of least interest, for example in a blanked sector.

The below shown example of lightning attractor rod design is based on experience.

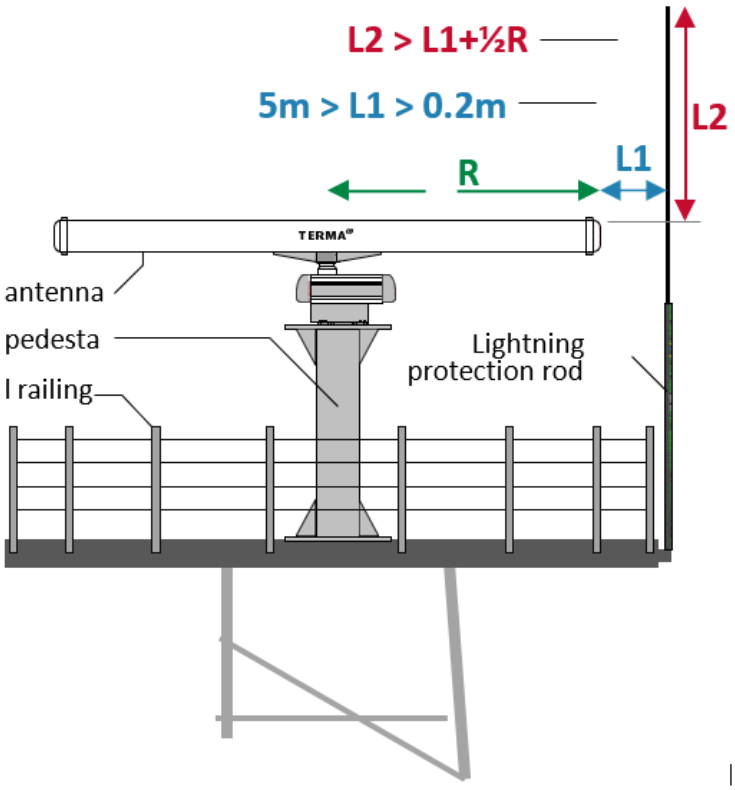

Figure 6-11 Position of a lightning rod

6.9 TRANSITION ABSORBERS

It is necessary to avoid surges induced to the radar site (from outside sources) through any galvanic connections; like mains power, possibly telecom links or etc. Therefore, all such galvanic connections must pass through transition absorber devices.

Also as explained in section 6.8, the equipment and antenna system must be properly protected against lightning by using a lightning rod and conductor. All cables need to be shielded and the signal cables need to be twisted pairs. The waveguide and all the cables running from the tower top to the radar equipment room need to be grounded properly. It is required to connect the groundings as effectively as possible to ensure that all components have the same potential in the event that lightning strikes.

It is desirable to run the shielded cables directly from the tower top to the radar equipment room and it is recommended not to cut their shield on the way. In case you prefer to use transition absorbers in between, the following guidelines should be considered to ensure correct operation:

- Only use metal boxes with cable feedthroughs, capable of screen connection.