

# Analysis of Antenna Climbing Equipment

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**Abstract**—Antenna climbing systems are compared. Dedicated, separate climbing ladders are found to have superior safety and reliability characteristics.

**Index Terms**—Antenna Arrays, Climbing Equipment

## I. INTRODUCTION

Top mounted broadcast antenna equipment must include a climbing facility [1]. It is necessary to perform regular maintenance to the beacon atop the antenna as well as access any antenna equipment stacked above. Though the climbing equipment is often ignored, human safety and product reliability are important factors.

## II. ATTACHMENT TO THE ANTENNA STRUCTURE

Some climbing schemes differ in the method of attachment of the climbing pegs. Pegs may be attached to the radiating equipment or incorporated into a separate, dedicated climbing system. The two methods are shown in Figure 1.

Attaching pegs to the radiating portion of the antenna, shown as a slot in Figure 1, penetrates the protective radome cover. This reduces the integrity of the seal and encourages the ingress of water and other contaminants into the antenna equipment. Increasing the amount of contamination and ingress leads to lifetime reliability problems of key components like power dividing feed-points and radiating elements. It also provides a place for increased ice formation very near radiating elements, increasing the possibility of altering the radiation pattern and VSWR of the antenna.

Differential thermal expansion tends to make these problems even worse. With the steel mast expanding and contracting much more slowly than the radome, gaps around the climbing pegs are forced to form. The daily periodic cycling of thermal expansion causes stress on the radome material and the fasteners, eventually leading to failure of the radome.

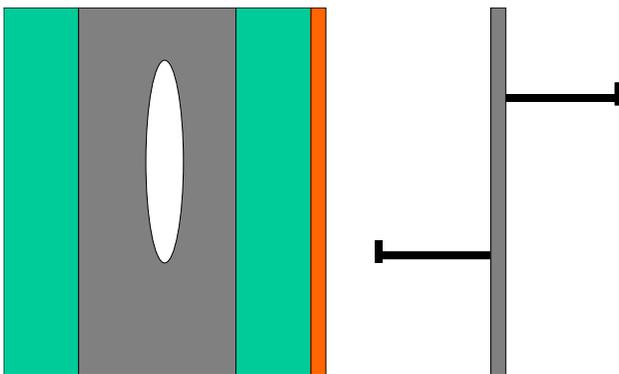


Figure 1a: Dedicated Climbing System

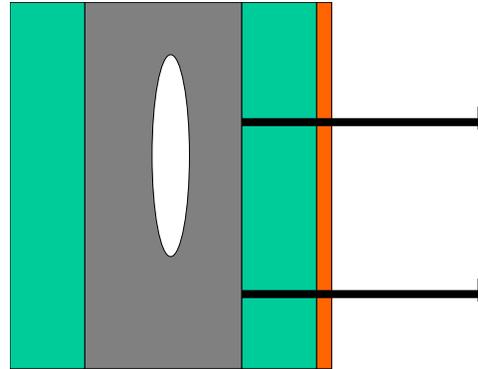


Figure 1b: Climbing Pegs Crossing Radome Surface

In a dedicated climbing system (Fig. 1a), the pegs are attached to a separate ladder. The ladder system is attached directly to the antenna mast at the base of the antenna, outside of radiating elements and the protective radome. This preserves the complete protection of the radome, allowing no ingress or contamination. With the attachment of the ladder visible to the climber, complete confidence may be placed in the climbing device, and there is never any doubt that the equipment is faulty or unsafe. The load of the ladder and climber is completely born by the main antenna mast, and lateral braces further reinforce the climbing system through the antenna aperture. Differential thermal expansion is not an issue with a dedicated climbing system because the radome material is never perforated by the climbing pegs or supports.

## III. SAFETY ISSUES

Antennas with dedicated climbing systems leave no doubts about climber safety. Every peg, support component, weld joint, nut and bolt is clearly visible to the climber. When pegs are attached along the antenna mast, the weld or joint integrity remains hidden behind the antenna radome.

Further complicating the direct attachment to the radiating portion antenna may require that some pegs have unequal spacing. The radiating elements are not equally spaced along the antenna mast, which introduces a compromise of peg spacing and RF loading of each radiator. If the pegs are spaced equally, each radiator may present each slot with different parasitic loading. If the pegs are not spaced equally, an extreme safety hazard is created in the climbing equipment.

Incorporating the climbing pegs into a separate ladder allows the regular, safe spacing of pegs and the elimination of the RF loading effects of the pegs. This also provides the climber with the additional safety of the rigid vertical mast of the ladder, around which safety straps may be placed. Also, Safety-Climb systems [1] are easily integrated into the separate ladders

and present RF power handling and RF loading concerns when positioned near the antenna.

#### IV. CONCLUSIONS

Antennas equipped with dedicated ladder climbing systems have superior reliability and safety characteristics when compared with antennas with climbing pegs attached directly to the antenna mast. Dedicated climbing systems allow no contaminant or water ingress into the antenna equipment because the radome is not compromised by climbing pegs. They also provide a climber with visual indications of the safety of the climbing equipment.

#### REFERENCES

- [1] Wittaker, Jerry, ed., *NAB Engineering Handbook, 9<sup>th</sup> Edition*, Washington, DC, 1999

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