Slot Antenna Radomes

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Slot Antenna Radomes

For popular UHF and Highband VHF slot antennas there are three types of radome systems. These radomes systems are:

Slot Cover – a plastic cover shaped like the slots of the antenna is mounted directly over the slot. Each slot has it's own cover

Sheathed or Wrapped Radome – a radome is formed with sheets of a low dielectric UV stabilized plastic, or pre formed UV stabilized fiberglass sections.

Pressurized Radome – a pressurized radome is formed from sealed and gasketed pre formed fiberglass tubes,. The radome is a single or multiple section system.

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Slot Cover Radomes

A slot cover radome consists of small plastic covers that fit into the individual antenna slots. One cover is needed for each slot. The remaining antenna surfaces are not covered.

The slot covers are the most simple radome system and offer the lowest wind loads of the three radome types. They are also the lightest mechanical system of the three radome types.

The drawbacks to this radome system are the possibility of the slot covers melting when pollutants begin to cover and bond to the slot cover. Since the slot cover provide minimal clearance from the antenna couplers, the sensitivity to ice build up is the greatest.

On the plus side, they are the least expensive radome design, and covers can be individually replaced with the antenna in place.

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Sheathed Radomes

Sheathed radomes are made from sheets of UV stabilized material like Polyethylene or formed sections of fiberglass. The sections of radome material are layered over each other to prevent direct moisture ingress. Condensation that forms under the radome is removed by weep holes at the bottom of the antenna.

The radome may be wrapped 360 degrees around the antenna, form a U shaped slot cover, or span over the forward parastitics of the antenna.

On the top of the antenna the radome is inserted under the lip of a top plate to prevent moisture ingress. The radome sections may be sealed on the vertical edges for use in areas with high wind driven rains.

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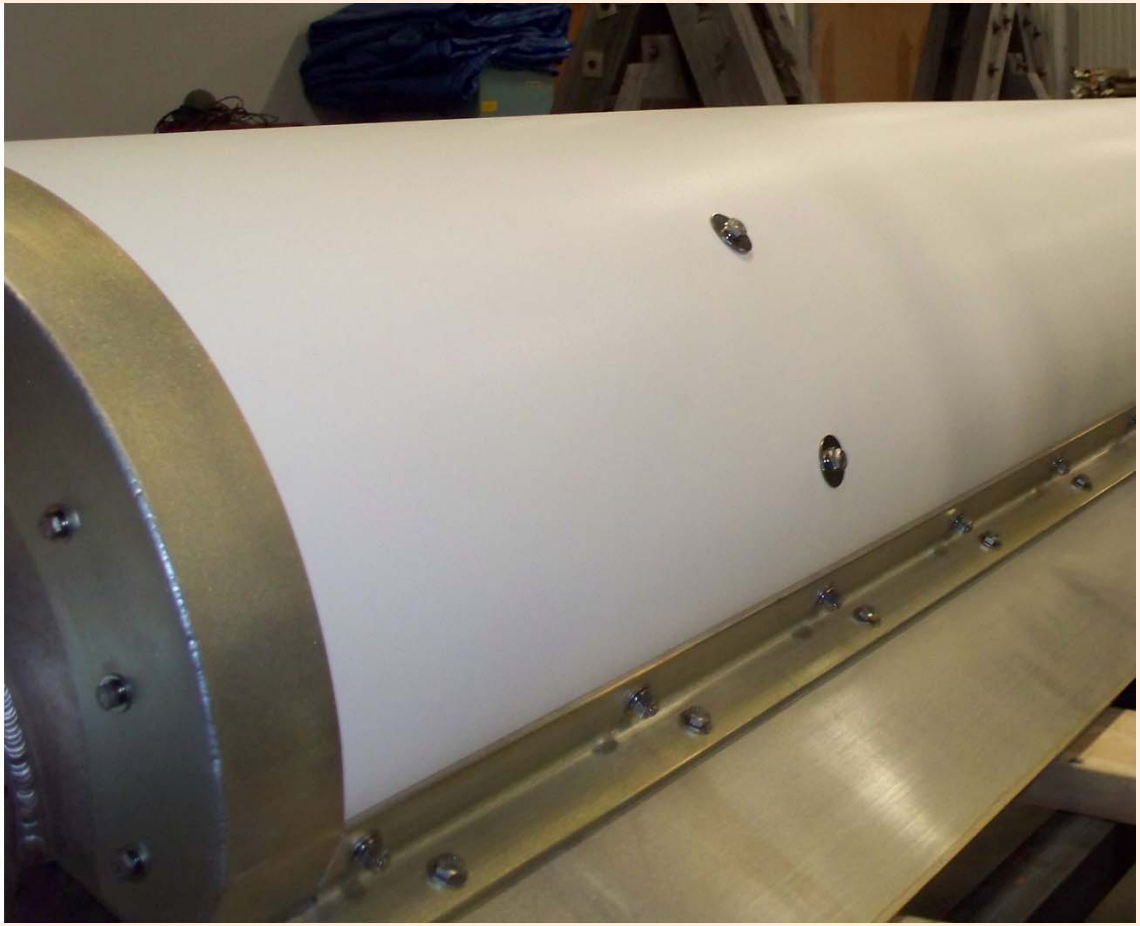

Channel 13 side mounted Elliptically polarized antenna. Wide Cardioid azimuth pattern.

This is the top of a sheathed radome VHF side mount antenna. The radome fits under the metal lip on the left side of the picture. To the right of the radome are two bolts. They hold the radome tight to Teflon standoffs. The ends of the radome are held down and sealed with a aluminum strip.

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Sheathed Radomes

The sheathed radome offers the most flexibility in radome designs. The entire antenna can be covered, including parastitics and polarizers, or just part of the antenna can be covered. With a sheathed radome, the slot to radome clearance can easily be increased in high environment conditions or for E/P and C/P antennas that have external polarizers.

The sheathed radome has a higher wind load than slot covers, and adds a small amount of weight to the antenna. The UV stabilized material we use on antennas has good resistance to ice build up and is very rugged.

If a section is damaged, in many cases it can be replaced while the antenna is still mounted. The sheathed radome provides a dry environment for the antenna at the same relative humidity as outside air.

Sheathed radomes cost more than slot covers, but less than pressurized radomes.

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This is an Omni-directional UHF slot antenna that uses a sheathed radome 360 degrees around the pylon. The top of the antenna is to the left and has a lipped cap that the radome fits under. The bolts along the antenna go into Teflon radome stops. Just to the center of the picture a smaller section of radome material is used to cover the gap between the two radome sections. The material used on this antenna is a UV stabilized Polyethylene. White, Gray and International Orange colors are available. The radome in this picture is 12 inches in diameter.

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This is a 8 bay center fed low RFR UHF slot antenna going through final test. It has a medium cardioid azimuth pattern. This antenna needed to be painted to match the color of the building it is mounted on (Empire State Building). The custom formed fiberglass radomes cover the front half of the antenna and are tied down along the edges of the parasitic wings.

Fiberglass versus Polyethylene were used to allow the radome to be painted. The metal surfaces of the pylon are passivated and can be painted. The bottom of the antenna has not been capped and sealed yet.

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Pressurized Radomes

Pressurized radomes are made from flanged tubular sections of cast fiberglass. The ends of the flanged sections are gasketed to form an air tight seal to the outside world. A dehydrator or gas bottle is used to delivery a very small positive pressure inside the transmission line and antenna. The antenna is kept completely dry.

The pressurized radome system is the most expensive of the three systems as it uses custom formed tubes and gasket sealing components. It is the heaviest of the three systems and has some drawbacks to consider.

On larger antenna arrays the metal pylon will expand and contract at a different rate than the radome. A flexible gasketing system must be designed to allow for the expansion and contraction. The flange areas of the radome need to be thickened with extra layers to prevent cracking. Glued radome flanges should be avoided at all costs.

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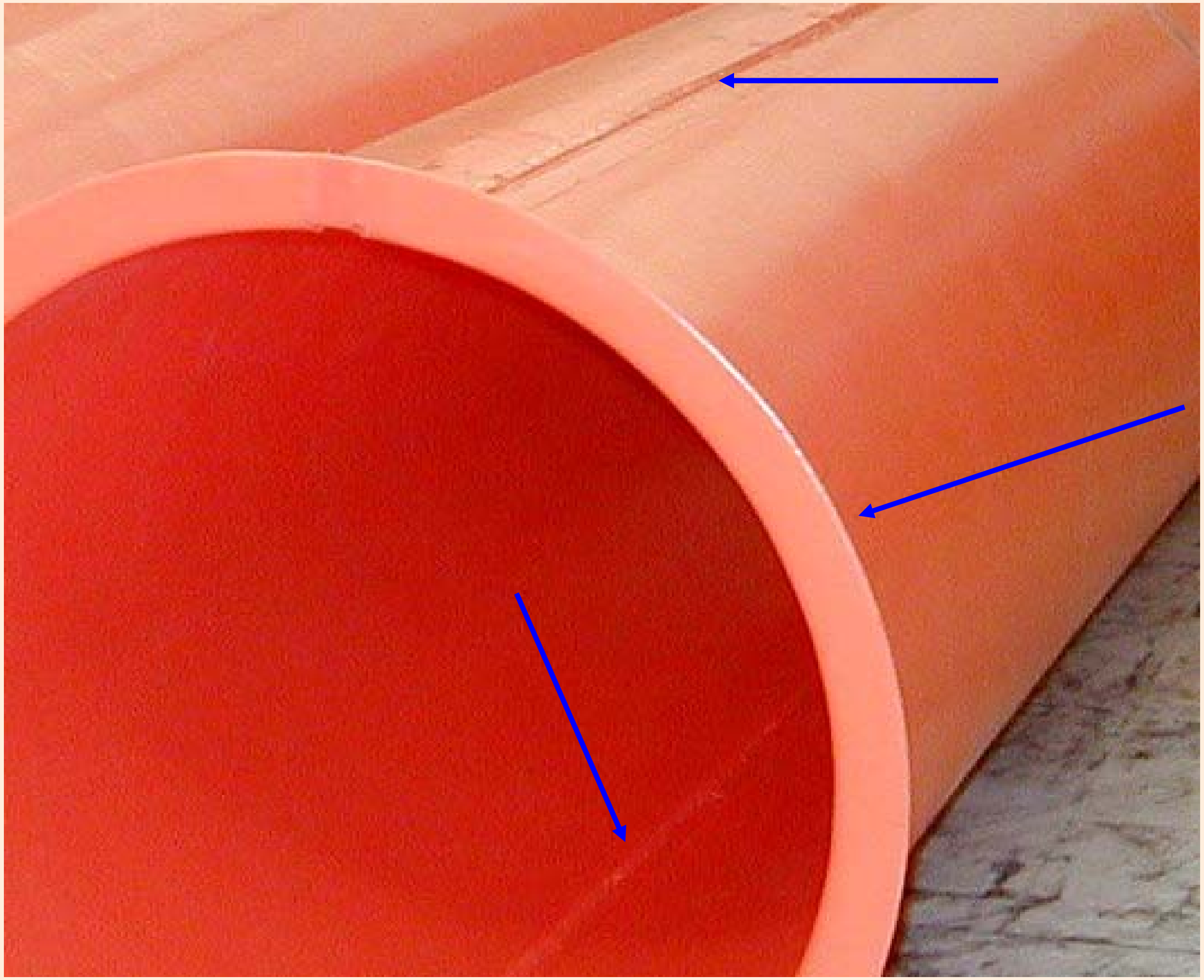

Example of a glued pressurized radome system. You can see the that two 180 degree sections were glued together with no reinforcement. The flanges are not built up or strengthened, This radome design can easily crack under windy or very cold conditions.

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Since the aluminum pylon has a higher expansion/contraction rate over a range of temperature than the fiberglass radome, an expansion assembly is used to keep stress off the radome system

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Pressurized Radomes

An accurate pressure gauge and over pressure relief valve should be used at all times on a transmission system that uses sealed or pressurized radomes. If the pressurization equipment fails, and the pressure inside the antenna builds, the radome can crack, the gasketing seals can be ruptured or the radome can explode.

The pressurized radomes have a higher chance for failure over the long term from ice damage, and the seals drying out. In most cases the antenna would need to be removed from the tower to repair the radome.

Here is a close up of the radome flange area. The fiberglass near the flanges has been thickened with extra layers of material to prevent cracking. The flanges are also thicker than the main body of the radome. An aluminum radome stop between the flanges is part of the support system of the antenna.

Pressurized Radomes

The user of the antenna needs to be careful that the radome is not over pressurized, or it can fail or explode. A accurate pressure gauge and pressure relief valve need to be installed and maintained at all times.

Pressurized radomes do have a shorted operational life than sheathed radomes, due to the gaskets drying out over time (15 to 20 years), and delamination of the radome (20 years +). Side mounted antennas used in icy conditions are at a higher risk of damage from falling ice. An ice bridge should be used in those areas.

Most pressurized antenna systems require the removal of the antenna from the tower to repair or replace the radome system. On some top mounted designs, the sections can be removed and replaced. If a climbing ladder is used, the radome system can not be used to support the ladder. A system of radome stops mounted to the antenna pylon are needed.

This is a 3 bay low RFR channel 8 antenna with elliptical polarization. The radome is a single section of formed fiberglass. At the top and bottom ends of the radome (see black arrows on picture) extra layers of fiberglass are applied to increase the thickness on the ends of the radome tube, and on the flanges to prevent cracking. Inside the radome are Teflon radome stops that provide lateral support to the radome. This keeps the radome from flexing during high wind conditions (up to 200 K.P.H at this site).

A flexible gasketing system is used to allow for difference in the expansion rate between the steel pylon and radome system.

If you look at the bottom of the antenna, you will see the pylon is offset in the radome. This was done to allow more clearance for the vertical polarizer elements on the front of the pylon.

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Thank You !

Questions ?

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