

DEICE BOOT MAINTENANCE 101: THE WHY AND HOW OF PNEUMATIC DEICE BOOT CARE AND REPAIR

By Jerry Hansard and Ken Heath

While maintaining a plane's airworthiness involves complex electronic and mechanical systems, it also requires attention to seemingly simple inspection and maintenance routines. One of the systems requiring vigilance is the pneumatic deice boots found on a wide variety of general aviation and business aircraft and regional carrier turboprops.

rubber boot material) to crack along exposed or stretched surfaces. A plane doesn't have to be in the sky to be exposed to ozone; ozone is everywhere. Even "normal" air can have up to 0.01 ppm of ozone, but the presence of electrical equipment or lighting, both of which abound at airports and in hangars, can increase ozone exposure.

In addition to ozone, deice boots are subject to in-flight risks like storm damage and contact with debris or birds, plus on-the-ground accidental damage due to bumps and pokes by people, objects, and even other planes. Taken together, it's easy to see why maintenance technicians at service centers and FBOs need to pay careful attention to boot inspection and preventive maintenance, along with repairs or replacement as needed.

Invented by B.F. Goodrich more than 80 years ago, pneumatic deice boots and their method of operation haven't changed significantly, but their performance and longevity have been gradually enhanced through the use of newly engineered materials and manufacturing methods. While a high percentage of today's deice boots are still made from the familiar black neoprene, boots are also available in an engineered polymer called Estane®, and in a silver-colored urethane material that offers better aesthetics and durability. Regardless of brand or materials, pneumatic boots continue to be popular for small- and medium-sized aircraft due to their low cost of ownership, low weight, low energy burden, and dependable performance.

When properly installed, maintained, and operated, the function of deice boots is to help maintain control of an aircraft under icing conditions. A critical factor in maintaining this performance is a regular schedule of inspection, repair, and/or replacement. Although typical neoprene boots last from three years to even a decade or more with



JUST PRIOR to installation, connect the air/vacuum supply to the deicer; apply vacuum while installing deicer.

Unlike engines and other mechanical systems — where maintenance is often scheduled based on flight hours — deice boots can be subject to wear or damage whether an aircraft is in the air, on the tarmac, or even in a hangar. This means the boots used in pneumatic deicing systems require ongoing attention and care.

The most constant threat to the boots is ozone, which can cause neoprene (a popular synthetic

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proper care, the best time to detect problems with deice boots is on the ground.

INSPECTION

Deice boot inspections should be performed before and after every flight. As a first step after landing, wash the boots with mild soap and warm water to remove insects and other debris before it dries. After boots are cleaned and dried, perform a visual inspection for damage of any kind. It is relatively easy to detect even minor surface imperfections by looking along the length of the boot's leading edge under a good reflecting light source.

While pilots or aircraft owners may perform visual inspections, it is common and often prudent to have deice boots inspected by an FAA-certified technician who holds an Airframe and/or Powerplant (A&P) certificate — especially if remedial action, such as corrosion repair, is needed. Following are types of deice boot wear and tear often encountered during inspections.

Abrasions or erosion: Abrasions can occur from accidental damage during storage or maintenance, in prop-wash areas, or during high-speed flight in dust-prone regions. Mild abrasions or erosion can be treated to restore boots to a serviceable condition, but surface damage that exposes stitch-line threads or allows excessive air leakage will require removing and replacing the entire deice boot.

Cracking: Contrary to popular belief, cracking is not caused by UV light but by ozone. As already mentioned, cracks



PROPER DEICER installations require the use of rollers, following the manufacturer's instructions.

CESSNA MUSTANG with Goodrich deice boots is shown at right.



in neoprene rubber are generally caused by an accumulation of ozone damage over time. Boots without proper surface conditioning treatments can crack even if hangared. Excessive cracking mandates removing and replacing deice boots. Also, don't confuse surface cosmetic treatments with conditioning treatments, as they may not provide any protection from ozone damage. Aside from neglecting proper maintenance, using unauthorized sol-

vents, adhesives, waxes, or polishes can also cause an entirely different type of surface damage. For instance, waxes and polishes not endorsed by the manufacturer can themselves crack due to the typical harsh conditions to which aircraft are exposed. This type of surface crack-

ing, no matter how minimal, may actually increase ice accretion, as the cracks create anchor points for ice to bond to. The best advice is to follow the manufacturer's recommendations and maintenance manuals.

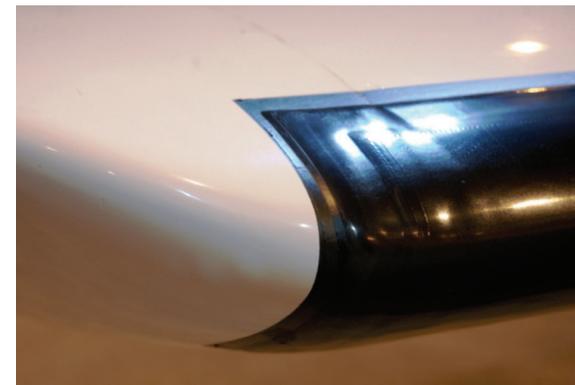
Pinholes: Generally defined as holes 1/16 inch or less in diameter, pinholes can be common occurrences on deice boots. The holes are not caused by physical damage, but by the discharge of static electricity that builds up on the boot's leading edge during flight. If pinholes have occurred but are not too numerous, the holes can be repaired. Goodrich's pinhole repair kit (P/N 74-451-AE) consists of a two-part adhesive; the application of the adhesive results in a controlled amount of material that repairs the displacement of the static discharge and is aesthetically pleasing. Installing a boot with a conductive edge sealer that properly grounds the

and the rubber boot layers. Alternatively, raised areas may indicate the boot has debonded from the wing's surface due to adhesive failure (due to unapproved thinning or improper application) or improper installation. Both delamination and debonding can be caused by water or fuel getting trapped between the boot and the wing, leading to corrosion of the aircraft's metal skin. Debonding can also occur if boots are installed over a faulty fuel-tank seam in wet-wing applications. If delamination or debonding are found, the deice boot must be removed, the underlying corrosion repaired, and a new boot installed.

Air leaks: Whatever their cause, air leaks prevent deice boots from operating at optimum efficiency, which can in turn damage the entire deicing system. Because the boots operate under

most age-related deterioration affecting longevity or reducing deicing performance can be forestalled by proper preventive maintenance. In addition to frequent cleaning and inspection, regular preventive maintenance consists largely of using manufacturer-approved care products and boot treatments. These treatments protect the neoprene from ozone damage, reduce cosmetic UV fading on both neoprene and Estane boots, or even enhance the release of ice from the boot during operation.

Approved cleaning agents: Among the approved cleaning agents for all types of deice boots are mild soap and water, a mixture of one part 5 percent vinegar to one part water, a mixture of one part household ammonia to one part water, or a proprietary cleaning agent such as Goodrich Aerospace Cleaner™



LEFT: PHOTO shows a completed deicer installation with Conductive Edge Sealer P/N 74-451-11 applied.

RIGHT: PHOTO shows deice boot with cosmetic treatment applied.

Deice Boots Inspection/Maintenance Schedule		
ACTION	CRITERIA	FREQUENCY
Visual inspection	Look for cuts, pinholes, cracking, etc.	Before and after every flight
Washing deice boots	Use approved materials	Very frequently, especially after flight
Rubber preservative for neoprene deicers	Use approved materials	Every six months
Cosmetic treatments	Use approved materials	As needed, 2-3 times/year
Ice adhesion inhibitor	Use approved materials	Every 50 flight-hours during icing season



MAINTAIN AND extend deice boot life and performance by using specified care products.

boot to the metallic wing can reduce or eliminate pinholes.

Cuts and tears: Usually caused by foreign object debris (FOD), cuts and tears can be repaired if they are small and widely dispersed. There is an upper limit to both the size of a repair patch, and the number of repairs that can be made in a given area. Damage that exceeds these limits requires boot replacement. Also, if boot damage results in a cut or broken stitch line, then the boot must be replaced.

Delamination and debonding: Raised or swollen areas of a boot may indicate delamination between the internal fabric

a vacuum when in normal flight, leaks allow moisture to be drawn into the boot and potentially into the system's control valves, creating a risk of system operation damage. Before inspecting for leaks, boots should be inflated to operating pressure. It is often possible to hear or feel the air leaks during inspection, but a tried-and-true technique is to simply brush a mixture of mild soapy water over the inflated boot and look for bubbles.

PREVENTIVE MAINTENANCE

While physical damage to pneumatic deice boots can happen at any time,

(P/N 74-451-238) or equivalent.

Neoprene rubber preservative: When applied every six months, a rubber preservative offers good protection from weathering, ozone, and UV rays, which helps extend the useful life and performance of the deice boot. Rubber preservatives soak into the rubber, rather than coating the boot surface, and are not to be confused with a cosmetic or UV treatment. Wipe on a manufacturer-recommended preservative such as Goodrich AgeMaster® No. 1 (P/N 74-451-127) after masking off the boot to prevent staining adjacent surfaces.

GENERAL AVIATION

High-luster cosmetic treatment: To maintain a like-new appearance, coat deice boots with the solution recommended by the boots manufacturer two or three times per year. Before recoating, be sure to remove any residual treatments with the recommended cleaner.

UV and dust protectant: When applied as needed, a water-based cosmetic coating such as Goodrich Aerospace Protectant™ (P/N 74-451-237) or an equivalent recommended by the boot manufacturer can make the deice boot resistant to dust, soiling, and staining, and also help minimize UV-caused slow fade.

Ice adhesion inhibitor: This coating enhances performance by lowering the adhesion strength between ice and the surface of deice boots. Wipe on a thin coat of the manufacturer-recommended ice adhesion inhibitor every 50 flight-hours during the icing season.

CONCLUSION

A program of frequent inspections and regular maintenance is critical to the proper performance of pneumatic deice boots and their contribution to overall flight safety. By identifying

problems early and effecting immediate repairs or boot replacement, the airworthiness of the aircraft can be assured. Always follow boot manufacturer's recommendations in terms of procedures and products. And be sure to maintain careful records of inspections, maintenance, and repairs in accordance with FAA regulations. **AMT**



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