holes can also allow ram air in flight to slightly expand the boots, which may appear as if they are inflated when they really aren't. On the ground, absent the ram air, they lay normally.

If a boot never inflates, the first thing to look for is a hole. Activate the system and liberally apply a 50% soap-and-water solution, which should quickly locate the problem. If the bubble routine doesn't work, you have a more serious problem and it's time to call your mechanic. The culprit could be dirty contacts preventing the flow valve from getting the go-ahead signal. More likely, it is a dirty valve, and removing, partially disassembling, cleaning, lubricating, and reassembling it will do the trick. Other possible problems include leaking or broken lines, timers, or relays.

Boots that only partially inflate probably indicate an incorrect pressure-regulator setting, but as the regulator is factory preset, it shouldn't be adjusted in the field. If that's not the problem, then the valves could be stuck in a less than full-open position, the lines could be clogged, or the pump could be simply going bad. The easy one is when boots inflate out of sequence; that's timer trouble. On the other hand, boots that inflate when the system is off require some thinking.

When in flight, the airflow over the wing causes a partial pressure around the boots. That is why a vacuum is applied to the boots when they aren't inflated—to prevent the boots from falsely inflating due to the external partial pressure. If there is a leak in the vacuum lines the ambient partial pressure will pull the boots away from the airfoil in a sort of false inflation. If they automatically inflate in flight with the system off, you have a potentially serious condition because even partially inflated boots can erode aerodynamic efficiency, making takeoffs and landings very dicey indeed.

Preventive Maintenance

Preventive maintenance of pneumatic de-icing systems will go a long way toward extending their life. Your mechanic can do a lot for holes and tears with a cold patch kit. If done properly, a patch will last the lifetime of the boot, but don't expect miracles. The process is similar to patching a tire, but you must use a patch kit designed for de-icing systems. The possibility of successfully patching a hole is determined by the size and location of the hole. For instance, according to the BFGoodrich *Installation, Maintenance and Repair Manual for Pneumatic De-icers*, the largest allowable patch repair is 5 inches by 10 inches. It also stipulates that a de-icer must be replaced if there are cuts, tears, or ruptures that cut the inflatable tube fabric, if there is broken stitch or thread, or if the damage that leaks air is larger than a 4-inch-by-9-inch area.

As boots accumulate small surface nicks and scuff damage, you may want to have the surface cover refurbished. This is a sort of "magical" cleaning up that actually will resurface the boot, provided the damage is not deeper than 0.010 inch and there is no air leakage when inflated. It is a protective coating that may be applied more than once; however, the manufacturer recommends not doing it more than twice. If the scuffing isn't too bad, it's an economical way of cleaning up the surface, and it has the added benefit of greatly improving the appearance.