**Pete Gavin's Aeronca Stuff**

*Old Winter Air Restriction Plates*

*St. Croix River southbound returning to Airlake from EAA Ch 272 breakfast at Bong Airport, Superior WI Oct 18, '03*

### Winter Gear for the Chief---Lower cowl cooling air restriction plate---Warning: NOT FOR USE ABOVE 39 Deg F

**The winter gear for my 65 hp Chief consists of fleece covers (one for the oil tank and four more for the intake pipes), the carb air filter baffle plate (Continental Service Bulletin M64-6), the winter cover over the oil cooling hole just below the spinner (part 3-640), and until recently, the cooling air restriction plates on either side of the spinner shown in the photo above. The air restriction plates had been with the Chief for many years, and they worked fairly well. But when I heard the only approved method was to restrict the cooling air at the lower cowl exit, I decided to try it.**

**In my search for the lower cowl restriction plate, I visited Safe-Air at Albert Lea, MN. Joe at Safe-Air did not have the plate (part 4-687), but he copied the following page for me from his manuals.**

10-10. ENGINE COOLING WINTERFRONT AND BAFFLE.

10-11. DESCRIPTION.

10-12. The installation, designed to provide satisfactory engine temperatures when aircraft are operated at low outside temperatures, involves the attachment of the winterfront, part No. 3-640, which covers the oil cooling air opening in the cowling nose bowl (see figure 10-6) and the restriction plate, part No. 4-687, which is located in the cooling air exhaust opening in the lower cowl and is attached to the cowl lip.

10-13. INSTALLATION.

a. Check all standard cowling and baffles, including inter-cylinder baffles, for proper fit. Repair or replace any faulty installation.

b. Install winterfront in nose-bowl oil cooling opening, turning down screws until a snug fit is obtained between the plate and nose-bowl.

c. Assemble brackets, part No. 1-3518, to plate, part No. 4-687, using attaching parts provided. The brackets should be sufficiently loose to permit adjustment along the slot in plate, part No. 4-687.

d. Drill four 3/16 inch (.188) holes in the lower cowl lip locating holes, as shown in figure 10-7, matching with the holes in the flange of the plate and brackets. The center hole in the plate is not required for plate support.

e. Install the plate with attaching flange "UP" so that cut-out in the plate is below fuel strainer drain.

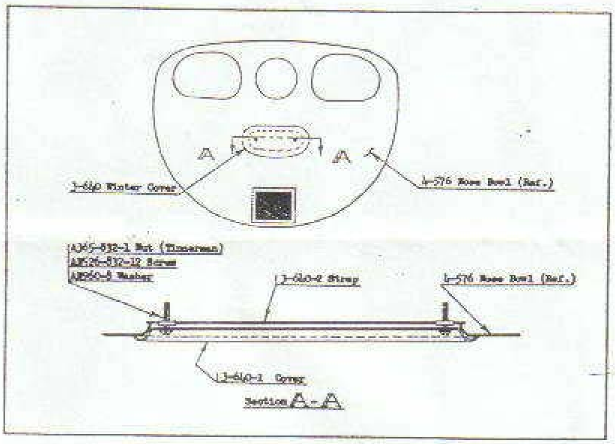



Figure 10-6 - Installation of Winter Cover

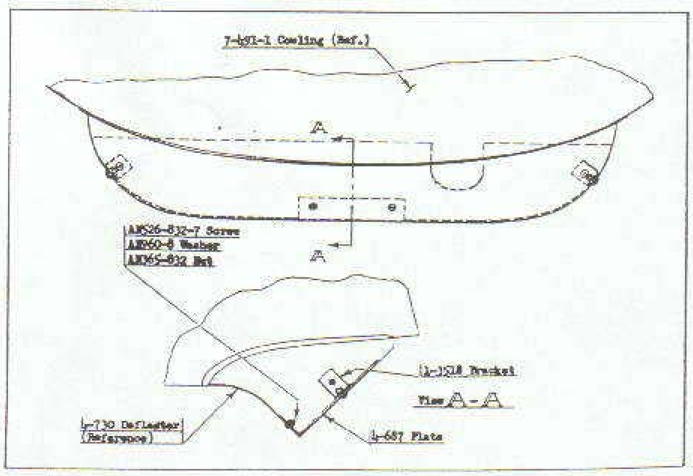
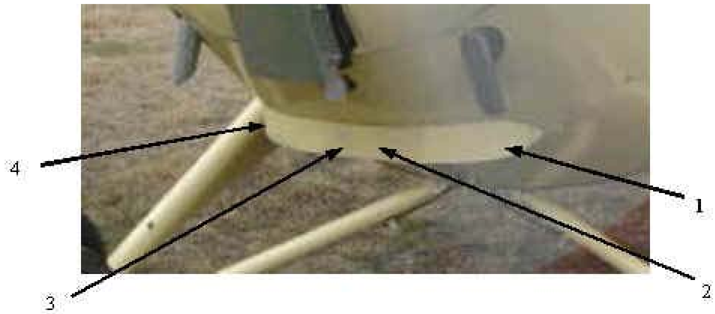


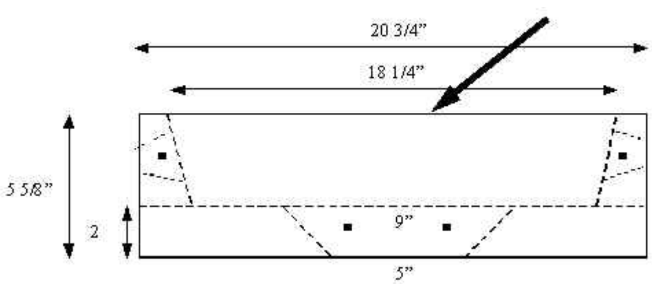

Figure 10-7 - Installation - Cooling Air Restriction

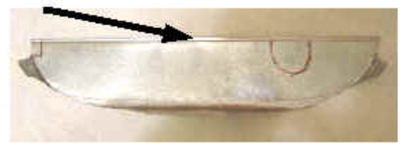


**Figure 10-7 at the bottom of the page above shows the restriction plate. It is a little confusing, but in the top half of the figure, imagine that you are standing in front of the Chief, looking down through a transparent cowl and and deflector. The restriction plate is outlined with a dotted line, and it attaches at four points to the lower cowl deflector. See the picture to the left below. The arrows point to where four holes will be drilled to attach the restriction plate to the deflector. The photo to the right shows the lower cowl with the new plate installed.**




Before making up the plate, I had to decide how much of the lower cowl exit to block. Since I was having fair luck with the restriction plates on the front, I started by measuring how much of the air they were blocking. With all of the irregular holes this was not easy, but I estimated that the front plates were blocking about 25 of 40 square inches on each side of the spinner. Measuring the lower cowl opening, I estimated the cross-section area to be about 86 square inches. To allow the same amount of air to pass, I would need to block about 56 square inches of the lower cowl opening, leaving about 30 square inches open. The width of the opening near the firewall was about 18 and 1/2", so the gap between the lip of the firewall and the back edge of the plate would need to be about 1 and 2/3". I heard from a couple people who suggested a narrower gap, so I decided to make up the plate to leave a gap of 1 and 1/2" from the rear edge of the plate to the lip of the firewall. This would leave about 28 square inches of opening. In the diagram from Safe-Air, they show a cutout for the gascolator. But I decided that if I left a gap of 1 and 1/2", that would leave enough room to drain fuel. (In the picture to the right below, you can see the mark where the cutout for the gascolator would have gone if needed.)



**CUTTING OUT THE PLATE**

I started with a 2' length of standard gauge galvanized steel stovepipe (6" diameter) and rolled it out flat. Note the four black arrows in the graphics above. The lengthwise edge of the stovepipe which is folded back on itself is blunt and should be used for the rear edge of the plate. The other edge is too sharp and will cut you when you need to reach through the opening in the lower cowl. The arrows show this same edge on the other graphics. My lower cowl opening is 5 1/8" from the deflector to the lip of the firewall, so to leave 1 1/2" open, my plate would need to be 3 5/8" from front to back. I decided to leave a generous 2" for the flange at the front, so I cut an oblong 5 5/8" x 20 3/4". I then marked off the front flange (5" across at top, 9" across at bottom), trimmed away the metal on either side to the 2" line, and bent the flange at the 2" line to stand at 90 degrees from the plate. I then placed the plate under the cowl as it would be installed with the front flange tight against the inside of the deflector. I then marked the plate where it contacted the curved bottom edge of the deflector.

At this point, I also decided to leave flanges on either side of the plate instead of making up separate brackets as called for in the Aeronca manual. I decided that brackets would be needed only if one were making up the plate to be adjustable to fit a variety of aircraft. In my case, I could cut the flanges to fit my deflector.

Once the plate is cut out and the flanges bent to meet the inside of the deflector, the next step is to hold the plate in position and drill the four holes (3/16") through the deflector and the plate. I positioned all four holes 7/8" above the bottom edge of the deflector. #10 x 24 sheet metal screws 5/8" in length hold the plate, with #4 speed nuts used to secure the screws tightly. (See screws with washers and speed nuts at above left).

The picture at left shows the compete installation from below. The 1 and 1/2" clearance at the back gives you enough room to hold the speed nuts while you tighten the screws.

**HOW WELL DOES IT WORK?** **Warning: NOT FOR USE ABOVE 39 Deg F**

The new lower cowl plate works perfectly on my 65 hp Chief at 30 deg F. By that I mean that at 30 deg ambient, the plate brings my oil temp up to its normal summer reading in a reasonable time. In addition, because the lower plate keeps all of that warm engine air inside the cowling, it really helps to warm up the cabin. In fact, flying at 30 deg F, I was comfortable even without turning on the cabin heat.

What do I mean by the normal summer reading? This is the oil temp reading the engine stabilizes at on day after day of summer flying. In exceptional conditions it will run maybe 10 deg warmer, but it takes 90 deg F ambient and a full load to do that. My normal summer reading is 175. How accurate is that reading? I don't know, but the engine has performed flawlessly at that reading for many years.

The big drawback with air restriction plates is that they make engine temperatures less stable and much more dependent on ambient air temperature. For example, I have heard many people say that without restriction, their engine runs 100 deg over ambient (Fahrenheit), and their restriction plate adds 20 deg. Well, in the summer, my Chief with its A65-8F engine stabilizes at 175 in a wide range of ambient temps. With restriction, at 18 deg ambient I get a spread of 137 for a stabilized oil temp of 155. At 30 ambient, I get a spread of 145 for a stabilized oil temp of 175. At 39 ambient, I get a spread of 158 for a stabilized oil temp of 197, more than 20 deg over normal summer temp. I have not tested the lower cowl plate above 39 deg F, but based on results so far, I would guess that flying with the plate at 50 deg F ambient would push the oil temp over redline.

This illustrates the major problem with air restriction plates. A plate that gets good results at 30 deg comes close to overheating the engine at 39 deg, yet leaves the engine and cabin colder than I would like at 18 deg.

Here is data from 3 flights that show how the lower cowl plate performed. Note that I only reached max oil temp away from the pattern after a period of cruise, and that landing or a touch and go normally reduced oil temp. Note also that I wanted to gather data starting with everything at ambient temperature, so I did not preheat the engine for these tests.

**FLIGHT 1 Airlake to Fleming (17 nm each way) with touch and goes 1.1 tach hours**

**Summary: Air temp: 30 deg F, Max oil temp: 175, spread=145**

I tested the new plate on a sunny day with the air temperature at 30 degrees F. I ran the engine at 1200 rpm for 15 minutes or so until the oil temp climbed to 125 deg F. I then took the Chief up in the pattern for 4 touch and goes, where the oil temp climbed to 150 def F. I then departed the pattern at Airlake and cruised over to Fleming, an airfield 17 nm away. About halfway there, the oil temp stabilized at just under 175 deg F. This is just below my normal summer oil temp in cruise. I did a touch and go at Fleming, where the oil temp dropped somewhat in the pattern, and headed back to Airlake. The oil temp quickly stabilized again at just under 175, and stayed there until I cut power back at Airlake. I had put a total of 1.1 hours on the tach and never exceeded 175 deg F on the oil temp.

**FLIGHT 2 Airlake to Owatonna (30 nm) with landing 1.5 tach hours**

**Summary: Air temp 39 deg F, Max oil temp: 197, spread=158**

Started engine cold at 1152, takeoff at 1205, depart pattern at 1208

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Time: | 1152 | 1205 | 1208 | 1211 | 1214 | 1216 | 1219 | 1222 until cutting power | On base | 1242 |
| Oil temp F: | 39 | 105 | 125 | 150 | 170 | 175 | 180 | 190 (stabilized) | 175 | 175 at shutdown OWA |

Added 13 gallons of fuel before taking off from Owatonna at 1305.

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Time: | 1305 | 1310 | 1315 | 1318 | 1321 | 1325 | 1335 | Clear of runway | 1345 |
| Oil temp F: | takeoff | 150 | 175 | 180 | 190 | 195 | 197 (stabilized) | 185 | 175 at shutdown Airlake |

Note: The increase of 7 deg in oil temp on the return leg may have been due to the weight of fuel added (91 lbs) at OWA

**FLIGHT 3 Airlake to Owatonna (30nm) without landing Jan 3, 2004 1.3 tach hours total**

**Summary: Air temp 18 deg F, Max oil temp: 155, spread=137**

Air temp 18 deg F Started engine cold at 1450, takeoff at 1507, cruise to Owatonna, circle and return

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|---|---|---|---|---|---|---|
| Time: | 1450 | 1507 | 1512 | 1521 | 1530 | 1613 |
| Oil temp F: | 18 | 100 | 125 | 150 | 155 (stabilized) | 155 at shutdown Airlake |

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**HOW DOES IT COMPARE TO THE NOSE BOWL PLATES?**

The nose bowl plates gave very similar performance on oil temps, although the lower cowl plate keeps the oil temp about 5 deg warmer than the particular nose bowl plates I was using. This makes sense in that they provide a lower cross-sectional area for air to pass than did the nose bowl plates, and they also keep some back pressure on escaping air. The big difference is in cabin heat. The cabin is much colder with the nose bowl plates, because they let all of the warm engine air escape at the lower cowling exit. The lower cowl plate creates back pressure that keeps the warm air inside the cowling and pushes it back into the cabin.

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**Questions, comments, or suggestions? Email petegavin@comcast.net**