Workshop Air Conditioner Heavily Modified (maybe not for the better)

By R. G. Sparber

Introduction

Unlike my other articles, I am writing this one because I don't know what to do next. I know my air conditioner is not operating efficiently but I also know that the modifications I have made so far don't help enough. Hopefully people will see what I'm doing wrong and suggest fixes.

Starting point

Due to powers beyond my control, I needed to install my through the wall air conditioner near the floor and in a recess. The unit is a Whirlpool ACU129PR rated at 11,600 BTUs. My shop is around 150 square feet. My external wall faces south and picks up a lot of heat in these Phoenix summers. We have hit 122° F in the shade. This means that the exterior wall can easily get to 160° F. Insulation essentially time shifts when this heat reaches the inside of the shop and maybe lowers the peak a bit. Without air conditioning, the shop is essentially unusable in the summer. I have 8" of fiberglass in the attic and 3 ½" of fiberglass in the interior wall. There are no windows but I do have two doors. The exterior door is steel clad with a core of insulation. The door from shop to garage is faced with 3" of ridged foam. Both doors are gasketed.

Early Problems

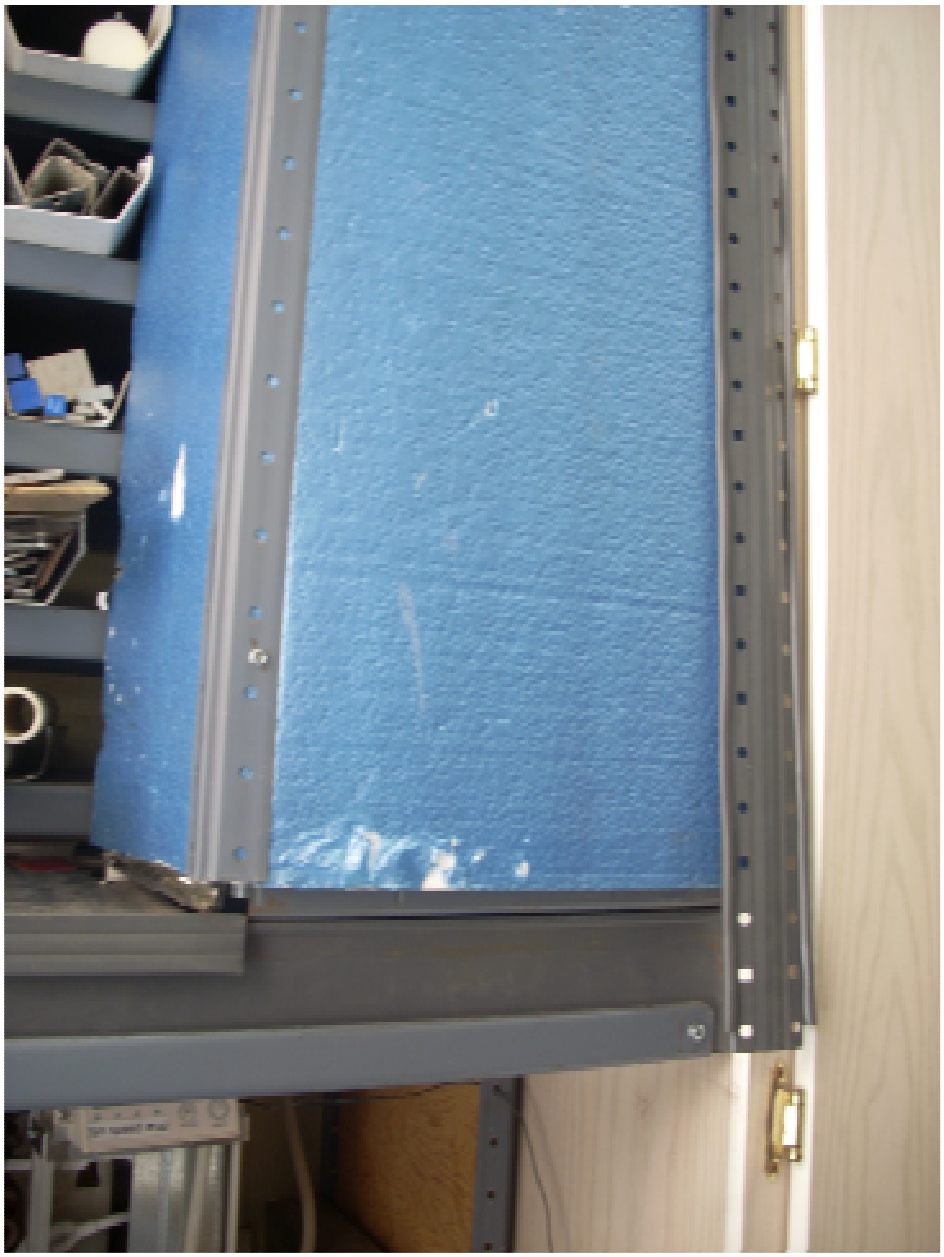
The first thing I noticed was that the area in front of the unit was very cold but the rest of the shop was hot. Apparently the air was blowing out of the unit and then sucked right back in before it could enter the room. My solution was to build a

plenum that would take the output to the far side of my shop. The narrow grill at the top of the unit is the output.

A tour of the System

After removing the top grill, I added a sheet metal box that channels the air to the vertical part of the plenum.

Note that I also moved the control panel down so I could access it easier.



Here is the connection between horizontal box and vertical plenum. Until recently I had insulation around this horizontal box.

When the vertical plenum reaches the ceiling, it connects to the horizontal plenum which goes about 8’.

I hung a small box fan on the end of the horizontal plenum as an experiment but originally it was just open.

Lots of Problems

The first problem I have is that the fan in the air conditioner was never meant to drive such a long plenum. Adding the box fan didn't seem to help much. As a test, I removed the plenum assembly and just left part of the horizontal box.

If you are very observant, you might have noticed a lot of frost on the coils in the first picture but much less here. I was running a swamp cooler as I worked on the unit and it sure throws off a lot of water. At the moment the humidity is 13% outside which means there should be no frost at all. I expect the little bit shown above will be gone soon. Along with low humidity, it is 100° outside right now and we are far from the heat of the day. It is expected to reach 110° tomorrow.

Data

With the box fan running, I measured 88° at the intake of the unit. Right at the output I saw 73°. I know I should be seen a differential of maybe 40° so I think this is related to the lack of air moving. The coil being frosted tells me it is plenty cold there but not enough of this cold is getting coupled to the air. At the bottom of the vertical plenum I read 74.4°. At the box fan I am at a pitiful 83.7°. Ambient in the room is 90°.

With the duct removed but a baffle left in place between intake and output, I measure a temperature at the fan output of 76°. At this time there was still a lot of frost on the coils. When I turned the unit off for a few seconds, the frost melted almost instantly. I then realized my mistake and turned off the swamp cooler. So I'm still not seeing a decent temperature differential.

The shop has been closed up with the unit running for about 1.5 hours. Ambient is 90° and the output of the unit is around 75°. There must still be a lot of moisture in the air because the coils had a lot of frost on them.

What's Next

If you need more data or pictures, please let me know. I sure want to get this system working!

Thanks,

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