

“SHROUD SIZING”

Teacher Name _____

Date: _____ MM/DD
M T W R F

Summary

The “fan shroud” that goes around the front of the box fan is an important element of optimizing the particle filtration efficiency of a box fan filter. Jim Rosenthal, co-inventor of the Corsi-Rosenthal cube, says a 15” diameter circle is best. Is it?

Begin by establishing the necessity of the shroud by observing flow IN to the fan at the corners of an unshrouded fan. The little fan inside the anemometer will spin one way near the center of the fan, and at some point as you move toward the corner, it will stop and reverse direction (move slowly to give it time to respond).

[skip if using paper strips] Now estimate the flow rate of air through the fan by sampling the air speed at many points, taking an average, and multiplying by the area of the fan’s opening.

Add duct tape to the perimeter of the fan in a roughly circular pattern, checking with the anemometer after each layer to see if the in-flow has been stopped. When it has, measure the diameter of the opening and estimate the flow rate again.

Connection(s)

Previous Learning:

Calculating areas of circles and polygons, calculating averages.

Future Learning:

By adding a particle counter, you could measure the filtration efficiency and quantify the effect the shroud vs. no shroud has on efficiency.

Instructional Plan

(Note: WC...whole class; CL...cooperative learning structure; PR...cooperative learning pair; IND...individual work)

- Demonstration of flow into the fan at the corners _____ WC CL PR IND
- Discuss the impact that would have on filtration efficiency _____ WC CL PR IND
- Measure flow for unshrouded fan _____ WC CL PR IND
- Increase the size of the shroud until in-flow stops _____ WC CL PR IND
- Re-measure flow rate _____ WC CL PR IND
- Reflection questions _____ WC CL PR IND
- _____ WC CL PR IND

Reflection...

Instructional Resource(s)

-  Box fan filter _____
-  Anemometer (a strip of paper could also work) _____
-  Duct tape _____
-  Ruler or tape measure _____

A powerful purifier has a high flow rate. The flow should be lower after the shroud was added. Does that mean the purifier got worse? (clean air delivery rate = flow x filtration efficiency)

Would the optimum shroud size be the same for every Corsi-Rosenthal box (different filters, different fans,...)?