

Report Title: Evaluation of the Corsi-Rosenthal Box for Fire Safety

Research Team:

Lieutenant/Deputy Fire Marshal Daniel Volovski, MPA, BS, CFEI
University of Connecticut Fire Department – Fire Marshal Unit

Sharmin Akter, Graduate Researcher, Environmental Engineering, University of Connecticut

Britney Russell, Graduate Researcher, Chemical Engineering, University of Connecticut

Abstract

In September 2023, the University of Connecticut Fire Department was approached by a collaborative team of researchers at UConn Health and the UConn School of Engineering to assist in evaluating the fire safety of a form of DIY air cleaner, also known as a Corsi-Rosenthal Box. The goal of this evaluation was to determine whether the aftermarket modifications to the fan, by way of adding filters to form an air-filtering cube, would result in any electrical resistance heating or other fire safety concerns during use.

A previous evaluation of this was conducted by the Chemical Insights Institution, a division of Underwriters Laboratories, including resources from the UL Fire Science Research Institute, using a timed experiment in a 68-degree Fahrenheit room. This evaluation did not raise any concerns to fire or electrical safety.

Per the request of the research team from UConn Health and the UConn School of Engineering, an additional experiment was conducted using the assistance of the UConn Fire Department to operate the device in an 85-degree Fahrenheit, high relative humidity environment. The purpose of this experiment was intended to address any fire safety concerns if the device was used in a non-conditioned, more realistic classroom environment.

Based upon previous research, and considering the safety features built into the fans used in the Corsi-Rosenthal device, the hypothesis was that the fire safety of this device would not be adversely affected by the increased environmental conditions posed in the test environment.

At the conclusion of the experiment, it was confirmed using test data, and is the objective opinion of this researcher, that the Corsi-Rosenthal box, created using the instructions provided by the research team, and with the use of the commercially-available fan tested in the experiment, that the device does not pose any electrical fire concerns above and beyond those normally considered for a normal fan used according to the manufacturer's instructions.

Problem Definition and Hypothesis

The primary concerns that were discussed to be investigated included the use of the Corsi-Rosenthal Box for long periods of time, as they are intended to be used in classrooms throughout an entire academic day period. As the device is an aftermarket modification to a standard, commercially available box fan, there is no direct documentation from a fan manufacturer indicating that this use will be deemed acceptable with regards to the safe use of the fan. A previous study by the Chemical Insights Institution, a division of Underwriters Laboratories, used a timed experiment of the device to properly address its use for an 8-hour period with no noticeable resistance heating found. With that noted, the previous experience was conducted in a cool,

conditioned room at approximately 68-degrees Fahrenheit, which may not always be indicative of the field conditions that the device will be used in.

The scope of this experiment will take place using an 85-degree climate-controlled room, with high levels of humidity, to simulate a non-conditioned classroom that may not have central ventilation already installed.

The hypothesis of this experiment is that the temperature of the Corsi-Rosenthal box will not raise to a hazardous level, through electrical resistance heating or an overcurrent condition, that may result in a temperature increase that could cause pyrolysis or autoignition of any combustible components.

Collection of Data Methods

To properly determine whether any mechanical components prone to overheating would present any of these concerns during the experiment, an environmental chamber in the UConn Engineering Science Building was used to set a realistic test scenario.

The test room was set to 30-degrees Celsius (approximately 85-degrees Fahrenheit nominal temperature) for a period of 48 hours for stability.

Two electrical appliances were plugged into GFI receptacles for the test.

Control Model: Utilitech #809483 Box Fan, listed in results as *Fan Temperature*.

Variable Model: Utilitech #809483 Box Fan, constructed as a Corsi-Rosenthal Filter Box, with MERV-13 filters built around it to form a cube. Listed in results as *Filter Temperature*.

Additional Reading Location: Two ground fault interrupter duplex receptacles, with the above appliances plugged into. Listed in results as *Outlet Temperature*.

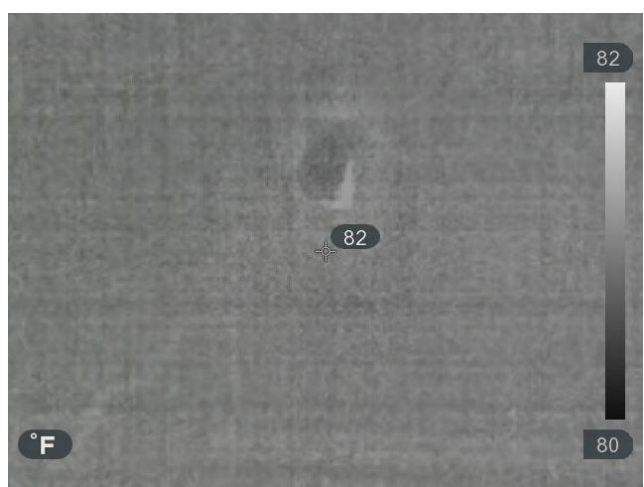
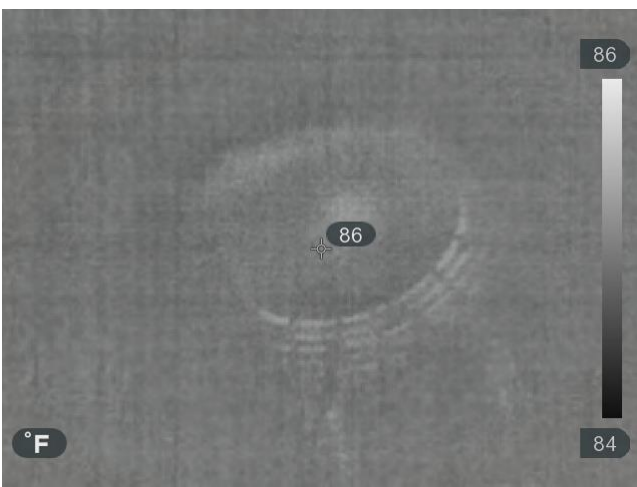
To take readings, a Seek Shot infrared thermal camera was used, as well as anecdotal observations using the senses of the investigators.

The experiment would then be monitored for a period of 8 hours, with hourly readings taken at an hourly benchmark. All readings were recorded for all three test devices. Any other concerns with signs of overheating or equipment malfunction would be noted, and the experiment stopped if any issues were identified.

The test took place on Thursday, September 21, 2023, over a time period of 08:22 to 16:22, reflected in 24 hour time.

Test Setup:





Data Analysis

The following data was collected over the course of the 8-hour experiment. All readings are in Fahrenheit.

Reading	Time	Filter Temperature	Outlet Temperature	Box Fan Temperature
1	8:22	91	87	87
2	9:22	84	86	82
3	10:22	84	82	84
4	11:22	84	80	82
5	12:22	82	82	84
6	13:22	82	84	84
7	14:22	82	82	84
8	15:22	84	82	84
9	16:22	86	84	84

There were no indications with the test readings that any electrical components heated in any way due to the environmental conditions, electrical resistance, or any other observable reason. All readings were similar to the

ambient temperatures within the room. In addition, there were no concerns found with electrical or mechanical components being hot to the touch, or any odors of smoke or overheating conditions found.

Conclusion

At the conclusion of the experiment, it was confirmed using the above test data, and is the objective opinion of this researcher, that the Corsi-Rosenthal box, created using the instructions provided by the research team, and with the use of the commercially-available fan tested in the experiment, that the device does not pose any electrical fire concerns above and beyond those normally considered for a normal fan used according to the manufacturer's instructions.

It is further confirmed that the increased test environment temperatures did not cause any additional heating above those observed during the initial laboratory test by the Chemical Insights Institute/Underwriters Laboratories.

There were no concerning anecdotal observations apparent to the researchers during the experiment.

References

Chemical Insights Wildfire Safety Research, *An Evaluation of DIY Air Filtration*
Aika Davis, PhD, Underwriters Laboratories Inc., Marilyn Black, PhD, Underwriters Laboratories Inc. July 2021