

# COURSE OUTLINE

## MMC 2015 – Chapter 6, Section 605

### Principals of Air Filtration & Filter Types Section 605 Air Filters

1 Credit Specialty

**Lesson Goals:** After completing this course, the attendees will be able to understand:

**Purpose:** the purpose of this standard is to define Air Filter types, MERV Ratings and ASHRAE 52.2 **15 Minutes**

**Scope:** The requirements of this standard talks about general information, approval and Airflow over the filter. **15 minutes**

**Definitions:** **30 minutes**

Principals of air filtration.

Air filter types.

ASHRAE 52.2 Standards.

MERV air filter ratings.

Micron sizes.

**Compliance:** HVAC

Chapter 6, 605.1, 605.2, 605.3

ASHRAE 52.2

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# MMC 2015

## Chapter 6, Section 605

### PRINCIPALS OF AIR FILTRATION & FILTER TYPES

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### PRINCIPALS OF AIR FILTRATION & FILTER TYPES

Air filters can be grouped into several different categories depending on how they capture airborne contaminants.

**Mechanical air filters** are the most common and the least expensive.

**Electrostatically charged filters** have a passive charge that is added to the mechanical filter so it will attract airborne contaminants.

**Electronic Air Cleaners (EAC)** have collection plates that are used to attract and capture airborne contaminants.

**Pre-charging of airborne contaminants** can be combined with an actively charged filter media, to create an actively charged filtration system.

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## MECHANICAL AIR CLEANERS



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### MECHANICAL AIR FILTERS

**Mechanical Air filters** remove dust by capturing it on the filter element also known as the filter media.

These filters are also referred to as “panel filters” because they look like a panel of filter media held in a cardboard frame.

The effectiveness of this type of air filter is determined by the probability that a dust particle will collide with one of the fibers in the media filter and its ability to hold that particle(s) to the air filter.

To increase the surface area, panel filters are pleated like an accordion to have more surface area to capture more particles as the air flow goes across the air filter.

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## IMPINGEMENT

**Impingement** is the process in which particles are removed from an air stream because of their inertia.

As air containing a particle flows toward a filter fiber or other collecting surface, the particle does not follow the air streamline because of its inertia. Instead it moves in a straight line colliding with the filter fiber or surface that it might become attached to it.

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## INTERCEPTION

**Interception** is the process in which a particle is removed from the air stream as it follows the streamlines around a fiber.

The particle comes in contact with a fiber and stays attached to it because the attractive forces between the fiber and the particle are stronger than the forces of disruption of the moving airstream.

In other words the particle is wrapped around the air filter fiber(s) as the air flow goes through the return air duct and across the air filter.

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## STRAINING

**Straining** is the filtration effect where the size of the particle is larger than the distance between the fibers like a coffee filter.

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## ELECTROSTATICALLY-CHARGED FILTER MEDIA

**Electrostatically-Charged Filter Media** become charged by airflow passing through it.

These air filters are usually made from polypropylene and modacrylic. As dust particles move through air they naturally become charged and Electrostatically-Charged filters have the added advantage of magnetic forces that attract and hold particles to a air filter's media.

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## ELECTRONIC AIR CLEANERS (EAC)

Electronic Air Cleaners (EAC) use high-voltage electrodes installed between grounded plates to create an electrostatic field imposing a charge on the dust particles as they pass by the plates.

These particles are then attracted to oppositely charged collector plates.

Several factors affect the ability of an Electronic Air Cleaner to remove dust: particle size, velocity, voltage, plate spacing and Ionizer spacing.

EAC's can produce various levels of Ozone by each manufacturer and periodic cleaning is required.

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## ACTIVELY-CHARGED FILTRATION SYSTEM

**ACTIVELY-CHARGED FILTRATION SYSTEM(S)** combine the virtues of Electrostatically charged filters with those of Electronic Air Cleaners (EAC).

Rather than charging two sets of plates that must be periodically cleaned or relying on naturally charging fiber media Actively-Charged filtration systems charge particles using an upstream grid and then collect them on an actively-charged filter media.

This way all the mechanical capture mechanisms combine with the charged attraction process of EAC's to provide maximum air cleaning performance.



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## HOW FILTER PERFORMANCE IS RATED

The American Society of Heating, Refrigeration and Air Conditioning (ASHRAE) has established a standard to test various types of air filters.

**ASHRAE 52.2** was created in 1999 and the updated in 2007.

This standard tests the air filters efficiency using a detailed procedure and a special test dust made up of 12 different size particles that are grouped in 3 ranges.

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## ASHRAE 52.2

**RANGE 1 (E1)** particles are from 0.30 to 1.0 microns.

**Sizes: 0.03 – 0.40**

**0.40 – 0.55**

**0.55 – 0.70**

**0.70 – 1.0**

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## ASHRAE 52.2

**RANGE 2 (E2)** particles are from 1.0 to 3.0 microns.

Sizes: 1.00 – 1.30

1.30 – 1.60

1.60 – 2.20

2.20 – 3.00

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## ASHRAE 52.2

**Range 3 (E3)** particles are from 3.0 to 10.0 microns.

Sizes: 3.0 – 4.0

4.0 – 5.50

5.50 – 7.00

7.00 – 10.00

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## ASHRAE 52.2

**Particle size removal efficiency (PSE)** curves are developed as a result of the testing procedure, representing the minimum performance in each range.

When the points on the curve are averaged, a Minimum Efficiency Reporting Value (MERV) is determined.

The MERV scale ranges from a low of 1 to a high of 16 MERV

The higher the MERV rating, the higher its efficiency for smaller particles.

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## FURNACE FILTERS

**Standard furnace filters** are typically basic panel or pleated filters to remove particles and large biologicals (pollen, mold spores, etc..) from the air that passes through the air ducts.

Basic panel filters, a 1" coarse filter provides protection for only the largest particles, 10 microns and larger in size.

These air filters are designed to protect the furnace or fan coil from bulk dust that can clog the cooling coil or decrease heat transfer efficiency.

These basic filters are generally a MERV 1 – 3.

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## PLEATED AIR FILTERS

**1" Pleated air filters** are typically have a MERV 4.  
These air filters are an improvement over the basic panel air filters.  
These air filters are sold at home improvement stores.

**2" to 4" Pleated Box/Cartridge air filters** are typically MERV 8 – 11  
These air filters have the ability to capture particles with some efficiency down to 1 micron.  
Bryant's box air filters achieve a MERV 9 rating and the Bryant's expandable EZ Flex air filters achieve a MERV 10 rating.

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## ELECTRONIC AIR CLEANERS

**Electronic Air Cleaners** (Electrostatic Precipitators) operate by electrically charging and collecting airborne particles onto a collection grid.

An Electronic Air Cleaner (EAC) can effectively remove such particles as dust, dirt, lint and pollen from a home.

The components of a EAC convert the 120 AC volts or 240 AC volts power supply to a 6,200 volts DC that imparts an electrical charge to airborne particles. This charge cause the particles to attach themselves to the charged collecting plates that then cleans the airstream.

EAC's will have an equivalent of a MERV 12 performance.

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## BRYANT EVOLUTION GERMICIDAL AIR PURIFIER

The Bryant Evolution Germicidal Air Purifier is Bryant's premier air filtration system solution.

This air purifier offers extremely high filtration efficiency and patented germicidal technology so effective that it captures and kills airborne pathogens such as bacteria, viruses and mold.

This air purifier is a hybrid between an EAC and media air filter that offers the benefit of a high voltage electrostatic precipitator and the ease of maintenance of a media air filter.

This air purifier filtration efficiency is equivalent to a MERV 15.

A Germicidal Performance of 96% Germicidal/deactivation of human influenza virus, common cold virus and Streptococcus bacteria.

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## REFERENCES

MMC 2015 – Chapter 6, Section 605

ASHRAE Standard 52.2

Bryant Healthy Air Solution Technical Resource Guide.

Bryant Product Data DGAPAXX Evolution Germicidal Air Purifier.

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