



# WASBO SUMMER MIDWEST FACILITY MASTERS CONFERENCE



# UNDERSTANDING H.V.A.C.

PRESENTATION  
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PRESENTED BY:



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## ASHRAE HANDBOOK APPENDIX

## EQUIPMENT LIFE CYCLE COSTS

EQUIPMENT TYPE	AVERAGE USEFUL LIFE IN YEARS
<b>AIR CONDITIONING UNITS</b>	
▪ Window Units	10
▪ Residential Units	15
▪ Commercial Through the Wall	15
▪ Computer Room Units	15
▪ Water-Cooled Package	15
<b>HEAT PUMPS</b>	
▪ Residential Air-to-Air	10
▪ Commercial Air-to-Air	15
▪ Commercial Water-to-Air	19
<b>ROOFTOP AIR CONDITIONERS</b>	
▪ Single-zone	15
▪ Multizone	15
<b>BOILERS, HOT WATER (STEAM)</b>	
▪ Steel Water-Tube	24 (30)
▪ Steel Fire-Tube	25(25)
▪ Cast Iron	35(30)
▪ Electric	15
<b>BURNERS</b>	21
<b>FURNACES</b>	
▪ Gas or Oil-Fired	18
<b>UNIT HEATERS</b>	
▪ Gas or Electric	13
▪ Hot Water or Steam	20
<b>RADIANT HEATERS</b>	
▪ Electric	10
▪ Hot Water or Steam	25
<b>AIR TERMINALS</b>	
▪ Diffusers, Grills, and Registers	27
▪ Induction and Fan-coil units	20
▪ Air-Washers	17
▪ Duct Work	30

EQUIPMENT TYPE	AVERAGE USEFUL LIFE IN YEARS
<b>COILS</b>	
▪ DX, Water, or Steam	20
▪ Electric	15
<b>HEAT EXCHANGERS</b>	
▪ Shell-and-Tube	24
<b>Reciprocating Compressors</b>	20
<b>Package Chillers</b>	
▪ Reciprocating	20
▪ Centrifugal	23
▪ Absorption	23
<b>Cooling Towers</b>	
▪ Galvanized Metal	20
▪ Wood	20
▪ Ceramic	34
<b>Air-Cooled Condensers</b>	20
<b>Evaporative Condensers</b>	20
<b>Insulation</b>	
▪ Molded	20
▪ Blanket	24
<b>Pumps</b>	
▪ Base-Mounted	20
▪ Pipe-Mounted	10
▪ Sump and Well	10
▪ Condensate	15
<b>Reciprocating Engines</b>	20
<b>Steam Turbines</b>	30
<b>Electric Motors</b>	18
<b>Motor Starters</b>	17
<b>Electric Transformers</b>	30
<b>Controls</b>	
▪ Pneumatic	20
▪ Electric, or Electronic	15

## ASHRAE HANDBOOK APPENDIX

**COMPONENT LIFE CYCLE COSTS**

HVAC COMPONENT	TYPICAL FAILURE RATE EXPECTANCY
Compressors	Typically 5-15 year range for failures. Most manufacturers warranty 1-5 years only.
Condenser Fan Motors	Starts after 3-5 years.
Blower Motor	Rarely fail in the first 10 years.
Blower Wheels	Rarely fail themselves; are typically replaced due to shaft or bearing failures.
Contactors	Typical wear item. Replace every few years.
Bearings	Typical wear item. Life span is 1-10 years.
Relays	Typical wear item. Replace every few years.
Thermostats	Low maintenance item. Failure rate is minimal. More subject to damage by occupant.
Timers	Typical life span 5-10 years.
Fan Blades	High wear item. Typically replaced with condenser fan motors after 3-5 years.
Condensers	Normally last unit life except for severe hail damage.
Evaporators	Normally last unit life unless filters are not changed regularly.
Heat Exchangers	Failure typically starts at 10 years due to rust and cracks. <i>Note: newer units have thinner metal.</i>
Gas Valves	Failures begin at 5-10 year range.
Igniters	Typical wear item. Should be replaced every few years.
Gas Regulators	Failures begin at 5-10 year range.
Actuators	Failures begin at 5-10 year range.
Circuit Boards	No-maintenance item. Failures are normally due to other component failures.

**Note:** Component failure rates will depend largely on owner's proactive approach with planned maintenance versus breakdown repair only. A good planned maintenance program can add 20% or more life to existing equipment. No planned maintenance can deduct 20-30% from typical unit life expectancy.

**TEMPERATURE CONTROLS – SERVICE AND LIFESPAN**

The life expectancy of a building automation system varies by manufacturer. It is typical for most manufacturers such as Trane, Carrier, Johnson Controls and Honeywell, etc. to offer annual software or firmware updates to keep the installed systems current. While software and firmware are kept current through these annual updates the hardware will eventually become obsolete, or electronic components installed on the circuit boards become obsolete or fail, and as such the typical lifespan for hardware within a building automation system is ten to twelve years.

FILTER MANUFACTURER EQUIPMENT DATA

MERV RATING CHART

MERV STANDARD 52.5	DUST SPOT EFFICIENCY	ARRESTANCE	TYPICAL CONTROLLED CONTAMINANT	TYPICAL APPLICATIONS	TYPICAL AIR FILTER / CLEANER TYPE
20	n/a	n/a	< 0.30 <sub>ppm</sub> particle size	Cleanrooms	> 99.999% eff on 0.10 – 0.20 <sub>ppm</sub> Particles
19	n/a	n/a	Virus (unattached)	Radioactive Materials	Particles
18	n/a	n/a	Carbon Dust	Pharmaceutical Mfg	Particulates
17	n/a	n/a	All Combustion Smoke	Carcinogenetic Materials	> 99.97% eff on 0.30 <sub>ppm</sub>
16	n/a	n/a	0.30 – 1.00 <sub>ppm</sub> particle size Talcum Dust	General Surgery	Bag Filter – Nonsupported microfine fiberglass or synthetic media. 12-36in deep w/ 6 – 12 pockets
15	> 95%	n/a	All Bacteria Smoke	Hospital Inpatient Care	
14	90 – 95 %	> 98%	Most Tobacco	Smoking Lounges	
13	89 – 90%	> 98%	Droplet Nuclei (Sneeze) Bacteria	Superior Commercial Buildings	Box Filter – Rigid Style Cartridge Filters 6 to 12" deep may use lofted or paper media
12	70 – 75%	> 95%	1.00 – 3.00 <sub>ppm</sub> particle size Legionella Welding Fumes	Superior Residential Buildings	Bag Filter – Nonsupported microfine fiberglass or synthetic media. 12-36in deep w/ 6 – 12 pockets
11	60 – 65%	> 95%	Humidifier Dust Lead Dust		
10	50 – 55%	> 95%	Auto Emissions		
9	40 – 45%	> 90%	Milled Flour	Hospital Laboratories	Box Filter – Rigid Style Cartridge Filters 6 to 12" deep may use lofted or paper media
8	30 – 35 %	> 90%	1.00 – 3.00 <sub>ppm</sub> particle size Mold Spores	Commercial Buildings	Pleated Filters – Disposable, extended surface area, thick with cotton-polyester blend media & cardboard frame.
7	25 – 30%	> 90%	Hair Spray	Better Residential	
6	< 20%	85 – 90%	Fabric Protector Dusting Aids	Industrial Workplaces	Cartridge Filters – Graded density viscous coated cube or pocket filters, synthetic media
5	< 20%	80 – 85%	Cement Dust Pudding Mix	Paint Booth Inlets	Throwaway – Disposable synthetic panel filter
4	< 20%	75 – 80%	> 10.00 <sub>ppm</sub> particle size Pollen	Minimal Filtration	Throwaway – Disposable synthetic or fiberglass panel filter
3	< 20%	70 – 75%	Dust Mites	Residential	
2	< 20%	65 – 70%	Sanding Dust Spray Paint Dust		Washable – Aluminum Mesh
1	< 20%	< 65%	Textile / Carpet Fibers Lint	Window AC Units	Electrostatic – Self-charging woven panel filter

MERV is an acronym for Minimum Efficiency Reporting Value, and it is a standard scale used to rate the effectiveness of air filters in terms of filtering particulate from the air

The American Society of Heating, Refrigeration and Air-Conditioning Engineers, also known as ASHRAE, created the MERV scale. The MERV scale goes from 1 to 20, where the higher the number, the more effective it is at removing the smallest particulates. Filters with ratings above 16 are classified as HEPA, commonly referred to as High Efficiency Particulate Arrestance.

- Arrestance: the ability of a filter to remove synthetic dust
  - used to determine the efficiency of low MERV filters.
- Atmospheric Dust Spot Efficiency: the ability of a filter to remove atmospheric dust from the air
  - used for higher MERV filters.
- Dust-Holding Capacity: the measure of the amount of dust that a filter could hold.



**PLANNED MAINTENANCE - EQUIPMENT INFORMATION**

**CONDENSER COILS**

**PROGRESSIVE EFFECTS OF SCALE ON AIR COOLED CONDENSER**

THICKNESS OF SCALE IN INCHES	% LOSS OF HEAT TRANSFER
.000	0
.006 Human Hair	16%
.012 Index Card	20%
.024	27%
.036 Paper Clip	33%



**PARTICLE SETTLING RATE**

*Measured at Distance of 8 feet*

MICRONS	MINUTES
10 Microns	6.8 Minutes
1 Micron	58 Minutes
0.1 Micron	37.7 Hours

# ILLINGWORTH-KILGUST MECHANICAL CAPABILITIES

## SERVICES & CAPABILITIES

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### Environmental Control Systems

- Customized Maintenance Programs
- Preventive/Predictive

### HVAC (Heating, Ventilating, Air Conditioning)

### Medical Gases

### Piping (Industrial)

### Plumbing/Installations

- Interior & Exterior Site Utilities
- Medical Gas Systems
- 3D CAD & Modeling
- Backflow Preventer Testing
- Solar Systems

### Refrigeration

### Sheet Metal

### Temperature & Process Controls

- Testing, Adjusting & Balancing
- On-site Operations
- Mobile Services

### Additional Services

- Building Automation Services & Integration
- Commission & Start-up
- Design/Build

## MARKETS

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### Biotech/Healthcare

- Hospitals/Laboratories/Dialysis

### Commercial

- Multi-Unit Residential
- Office Buildings/Real Estate
- Retail

### Education

### Manufacturing/Industrial

### Public/Government

### Technology

- Data Centers/Telecommunication

## ADVANTAGES/BENEFITS

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### Over 35 years of experience

### Certifications

- Flamebar Installation
- Flammable Liquid Storage Tank
- National Environmental Balancing Bureau (NEBB)
- Air & Water Balancing and Commissioning
- Certified welding
- Refrigerant Reclamation
- OSHA Safety
- LEED Accredited (Green Building Counsel)
- BIM (3D CAD Design)
- MSCA (STAR) Contractor Certified

### State-of-the-art Prefabrication

### Remote Monitoring

### 24/7/365 Mobile Service



**Illingworth-Kilgust**

Mechanical

An EMCOR Company