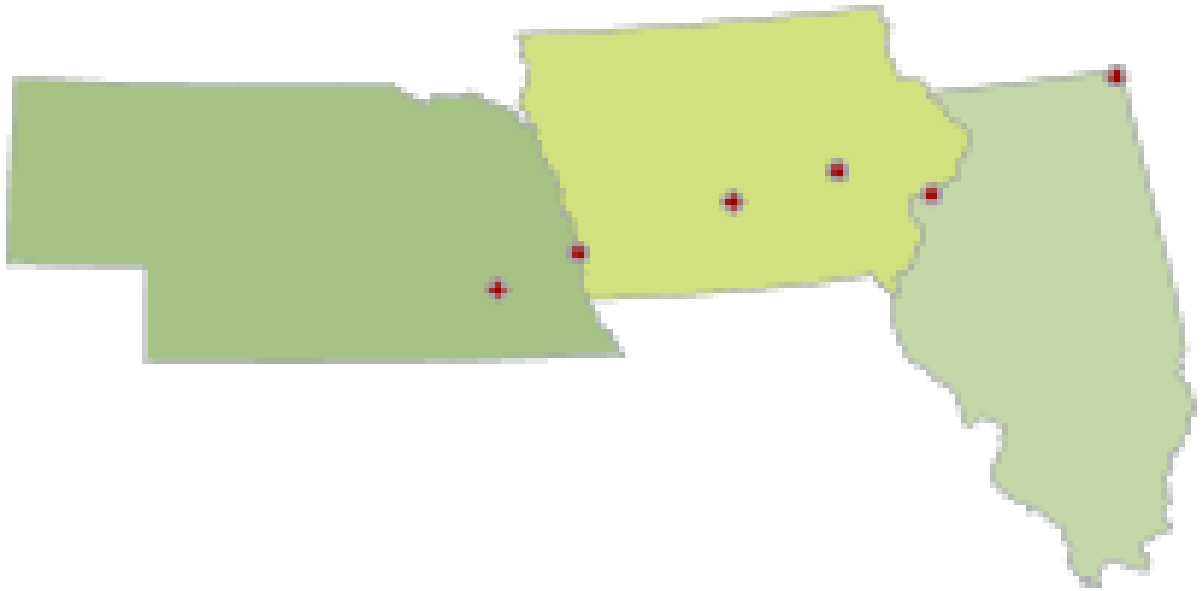
HVAC Air Handling Systems - Rebuild vs. Replace

Mechanical Sales Inc. - Iowa

- Presented to: Illinois APPA Chapter

Mechanical Sales – Who Are We?



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MSI – Flagship Lines

Kelvion

CCS Towers

MSI – MUA & Specialty Products

Titus
The Leader in Air Management

SLD TECHNOLOGY

Steel Ceilings Inc.
Manufacturer of Metal Ceilings and Specialty Systems
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MSI – Sheet Metal

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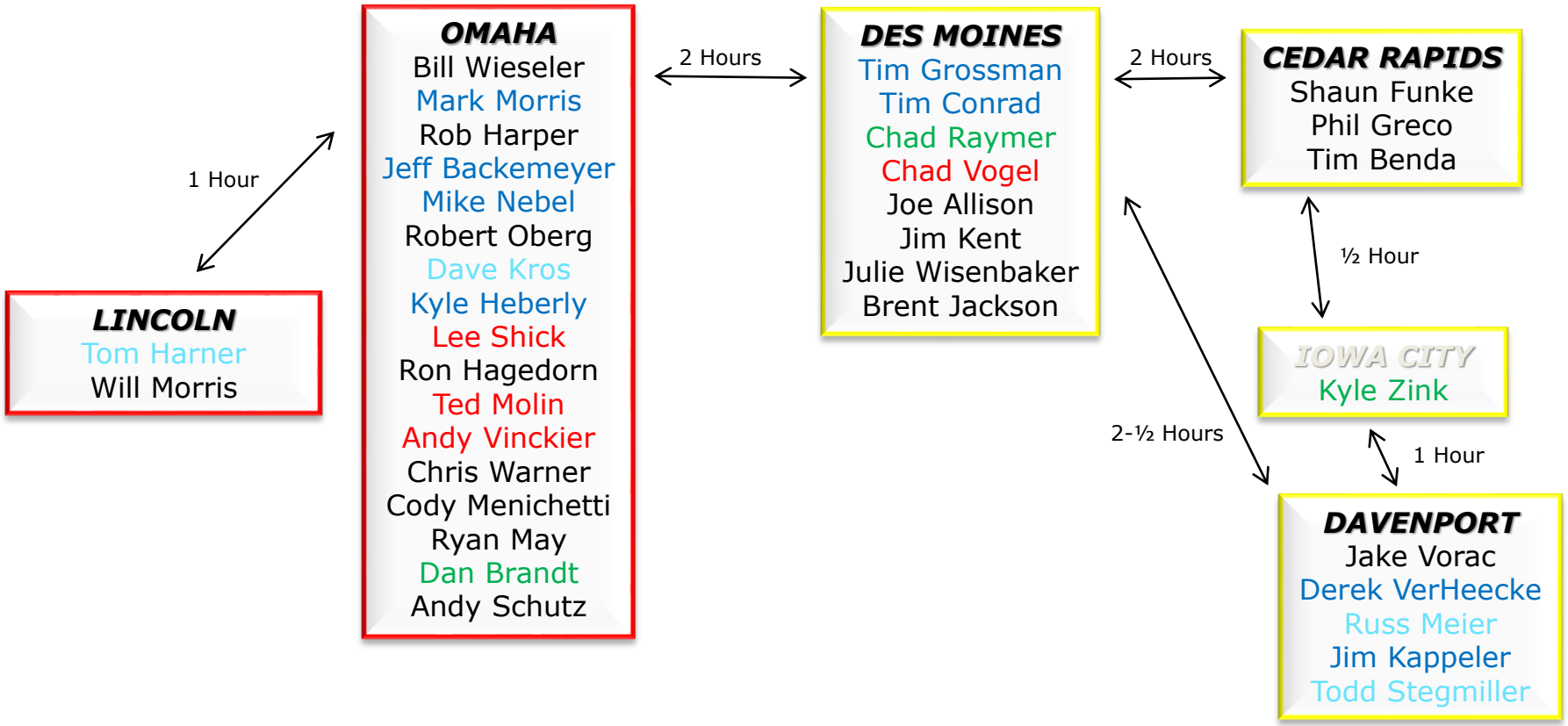
Industry Expertise

8 CONTROLS **4 ENGINEERING** **17 MFGR-REP** **3 CONTRACTOR** **4 MANUFACTURER**



+ 14 Service and 9 Administrative Professionals for Customer Satisfaction & Support

How We Go To Market

- Strong Presence with Engineering Community, Design-Build Contractors
- Support Bid/Install with MC's
- Service Techs for Startup/Warranty/Service
  - *MSI does now offer 24-hr service for customers that require that level of support*
  - *Control Commissioning/Checkout*
- Owner Training and Service Contractor Training for Life of Equipment
- ***MSI Stock – What do you need/want on our shelves?***

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NORTEK AIR SOLUTIONS

Agenda

I. Background
II. Service Life
III. End of Service Life – Replace or Rebuild Review
IV. Bid Approach
V. Cost Savings Review
VI. Project Review

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NORTEK AIR SOLUTIONS

Agenda

I. Background
   I. AHU 101
   II. Custom Versus Modular
II. Service Life
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IV. Bid Approach
V. Cost Savings Review
VI. Project Review

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Air Handling Unit 101

- What are the parts of air handling unit (AHU)?
- Custom Versus Modular
  - *What defines quality for an AHU?*

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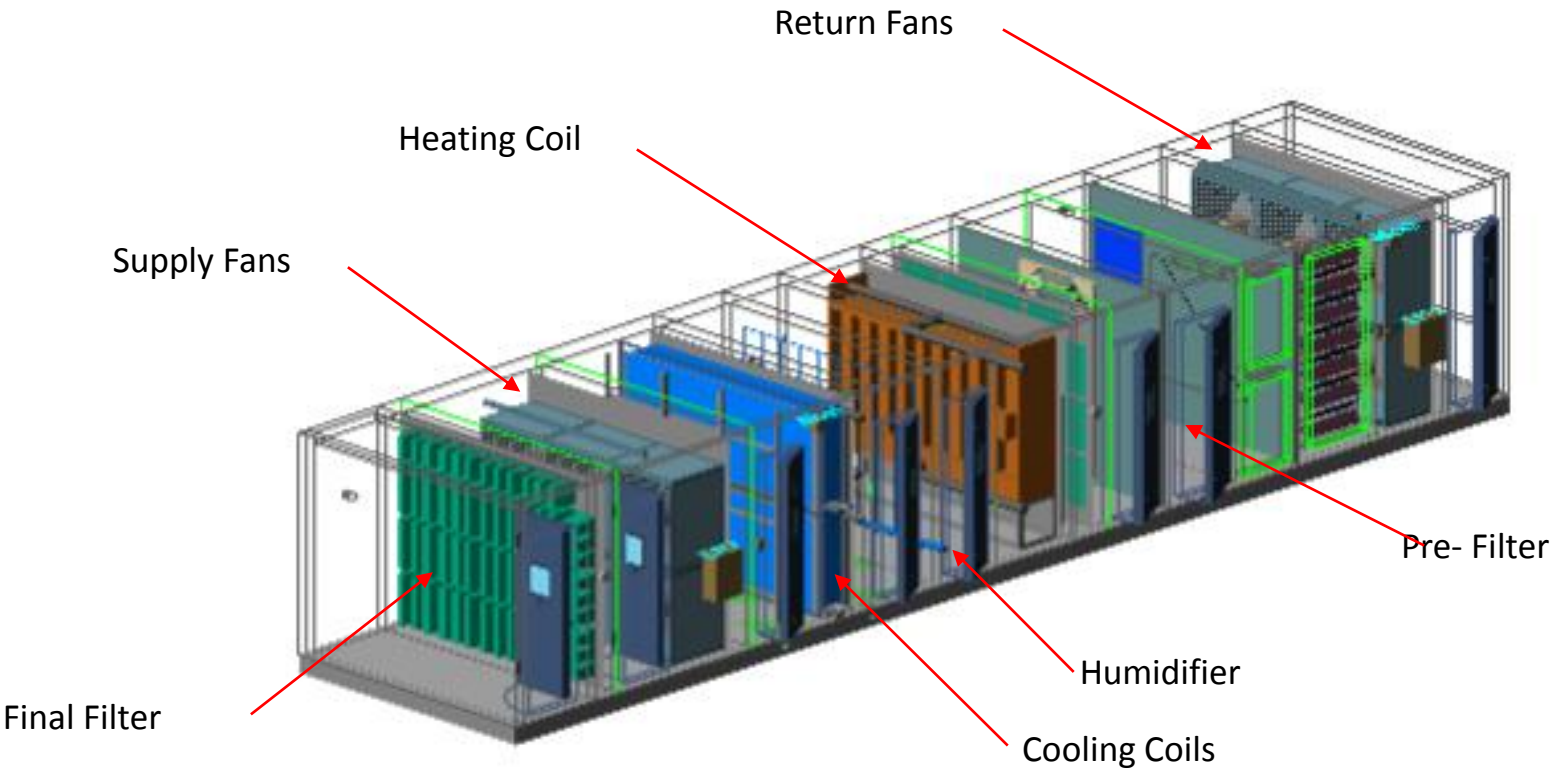
Air Handling Unit 101



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Air Handling Unit 102

- **What are the parts of air handling unit (AHU)?**
  - Cabinet
    - Walls
    - Floor/Drain Pans
    - Baserail
    - Pressure Rating/Class
    - Seismic Requirements?
    - Access Door Size/Seal
  - Dampers/Mixing Box/Blenders
    - Single OA Damper or Econ and Min OA Damper Arrangement (Better Mixing)
    - Blenders Selection/Options
    - Damper Type/Mfg (Airflow Measurement, Insulated, etc.)
  - Filters
    - Access and Type of Rack
    - Standard Filter Sizes?

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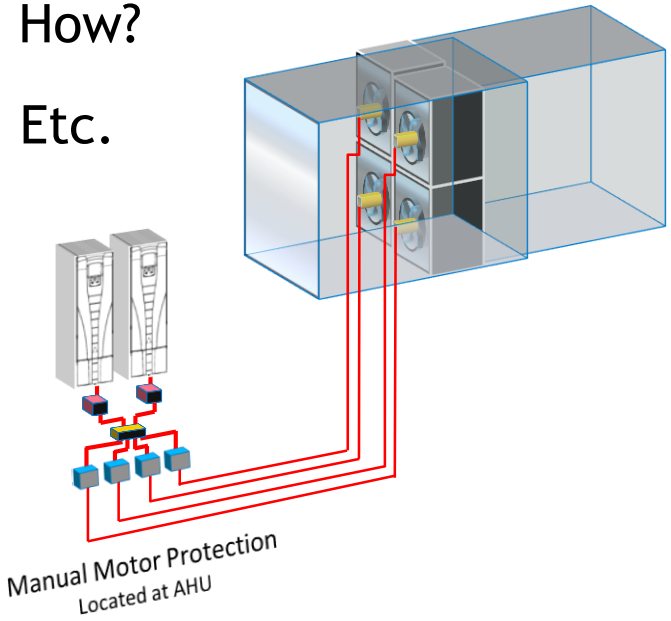
Air Handling Unit 102

- **What are the parts of air handling unit (AHU) Continued…**
  - Fans
    - FC or AF (Motor Behind/Beside for Access)
    - Single or Dual Plug
    - Fan Array/FANWALL
  - Heat Recovery
    - Wheel
    - Plate
    - Run-Around, Heat Pipe
  - Coils
    - Coil Racking/Intermediate Drain Options
    - IFB Mfg and Options (LJ Wing Dual Circuit)
    - Materials/Coatings/Stub out Material (Steel, Brass)
    - Vents/Drains
    - UV Lights – Std or Custom Selections
  - Humidifiers
    - Factory or Field Installed
    - Trap Location

Air Handling Unit 102

- **What are the parts of air handling unit (AHU) Continued…**
  - Electrical
    - Single or Dual Pt Power
    - GFI/Lights Powered by Who? How?
    - VFD's by Who? Redundancy?
    - Damper Actuators/UV Lights, Etc.



Custom vs. Modular

- Cost
- Dimensional Restrictions (Lines are Blurring, Most Modular Mfgs offer 2” increments for box size H and W”
- Existing Jobsite Restrictions
- Complex Design Requirements
- Optimized Air Handler Performance
- Unit Life Expectancy
- Cost Savings
- Customer Service

Custom – Assembler versus Manufacturer

CUSTOM Unit Construction

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- 1,000 to 400,000+ CFM
- Indoor or outdoor cabinet construction
- Modular construction for ease of transport and installation
- Knockdown construction
- All welded, heavy-duty tubular steel frame with lifting brackets
- Steel, aluminum or stainless steel cabinet
- Variable wall thickness
- Smooth interior or exterior
- Foam panel, hybrid foam panel and fiberglass insulation
- Large access panel doors with heavy-duty hinges and latches
- Anti-skid and diamond-plate floors
- Prefinished powder coating of all cabinet panels, roof, base, interior partitions and doors
- Thermal break technology
- Anti-corrosive and anti-microbial construction
- Factory roof curb
- Standard and severe duty components
- FANWALL® array and factory-wired controls
- Multiple options of fan type, style, and discharge arrangement
- Energy recovery ventilation: wheels, plate, and heat pipe technology
- Vertical units
- Cooling options: Chilled water, DX and direct or indirect evaporative
- Heating options: Hot water, steam, direct or indirect gas, and electric resistance
- Pitched stainless steel drain pans
- Filtration options: Pre-filters, high efficiency, HEPA/ULPA, odor control media, electrostatic precipitation
- UV lights
- Service vestibules
- Power panels
- Unit controls
- Interior lights and receptacles
- Air monitoring devices
- Door sealing and aligning hinges
- Dampers, louvers, and hoods
- Viewing ports
- Silencers
- Air blenders
- Humidifiers
- Variable Frequency Drives (VFDs)
- Food grade units
- Washdown construction

Non-Custom AHU Construction Base

- Formed sheet metal, bolted base.
  - *Short lifespan*
  - *Susceptible to corrosion*
- Fiberglass or foam board insulation in floor.
  - *Does not seal floor penetrations (water and air)*
  - *Thermal properties are not consistent*
  - *Does not provide rigid support for floor.*
- Light gauge steel floor
  - *"Oil Canning" due to flexibility and lack of support from insulation.*
- Poorly sealed floor seams
  - *Leakage into wall insulation is likely.*

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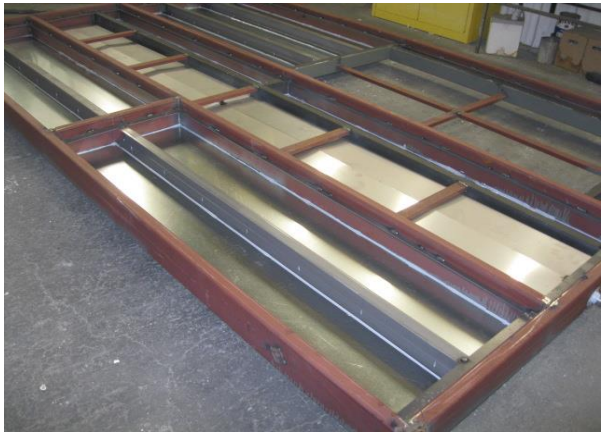
Custom AHU Construction Base

- HSS type rectangular structural tube. Fully welded.
- Optional Stainless Steel and Aluminum
- Epoxy primed and coated or powder coated, minimum 1,000 hour salt spray coating
- Polyurethane foamed floor. Minimum R-20

The unit base frame is manufactured with an electrostatic pre-primed powder coated HSS type rectangular structural tubing. The completed unit base coating must be able to sustain salt spray testing of 1000 hours, per ASTM 117B. ***Sheet metal formed unit bases are not acceptable.***

The entire unit base must be polyurethane foamed in place with a minimum thickness of 3" and a minimum R value of 20. ***Fiberglass insulated unit bases will not be acceptable.*** *Maximum deflection of floor shall be L/360 at design loading (L=span in inches), the minimum floor design load is 150 lbs/sqft (distributed load), and the maximum point load on floor shall be 300 lbs (over 1 square foot).*



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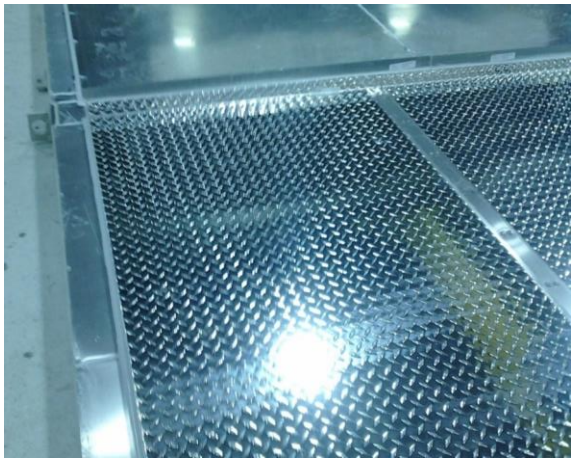
Custom AHU Construction Floor

- Foamed floor provides rigid, water and airtight floor.
- Gasket or polyblock between floor and base provide thermal break.
- Available 1” recessed floor or 2” raised lip and no floor penetrations provide additional security.
- Variety of material options



Maximum deflection of floor shall be L/360 at design loading (L=span in inches), the minimum floor design load is 150 lbs/sqft (distributed load), and the maximum point load on floor shall be 300 lbs (over 1 square foot).

Floor seams shall be sealed to create leak free joints. All seams shall be continuously welded to form a water tight assembly . The perimeter of the unit consists of a 2” upturned perimeter lip to create a drainable floor.

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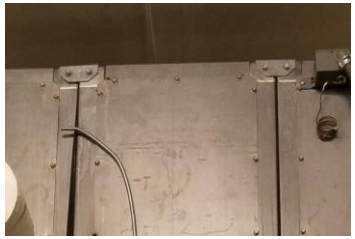
Non-Custom AHU Construction Cabinet

- Fixed aspect ratio for some
- Thermal break?
- Light gauge galvanized steel walls and liners
- Single color with minimal corrosion protection
- Typically only 2” cabinet thickness. (R13 or less)
- Low pressure
- Seismic and Miami Dade compliance?

Unit size	35	40	50	57	66	80	100	120
Nominal airflow[a]	17,500	20,000	25,000	28,500	33,000	40,000	50,000	60,000
Airflow at 625 fpm[b]	23,263	25,519	34,375	39,581	47,225	53,475	65,106	76,388
Height - indoor unit[c]	67.25	67.25	75.75	85.50	92.50	107.50	119.75	119.75
Width	100.00	112.50	125.50	125.50	140.50	140.50	154.50	182.00
Height for outdoor unit includes base drip lip[d]	75	75	84.38	94.13	97.63	112.63	124.88	124.88



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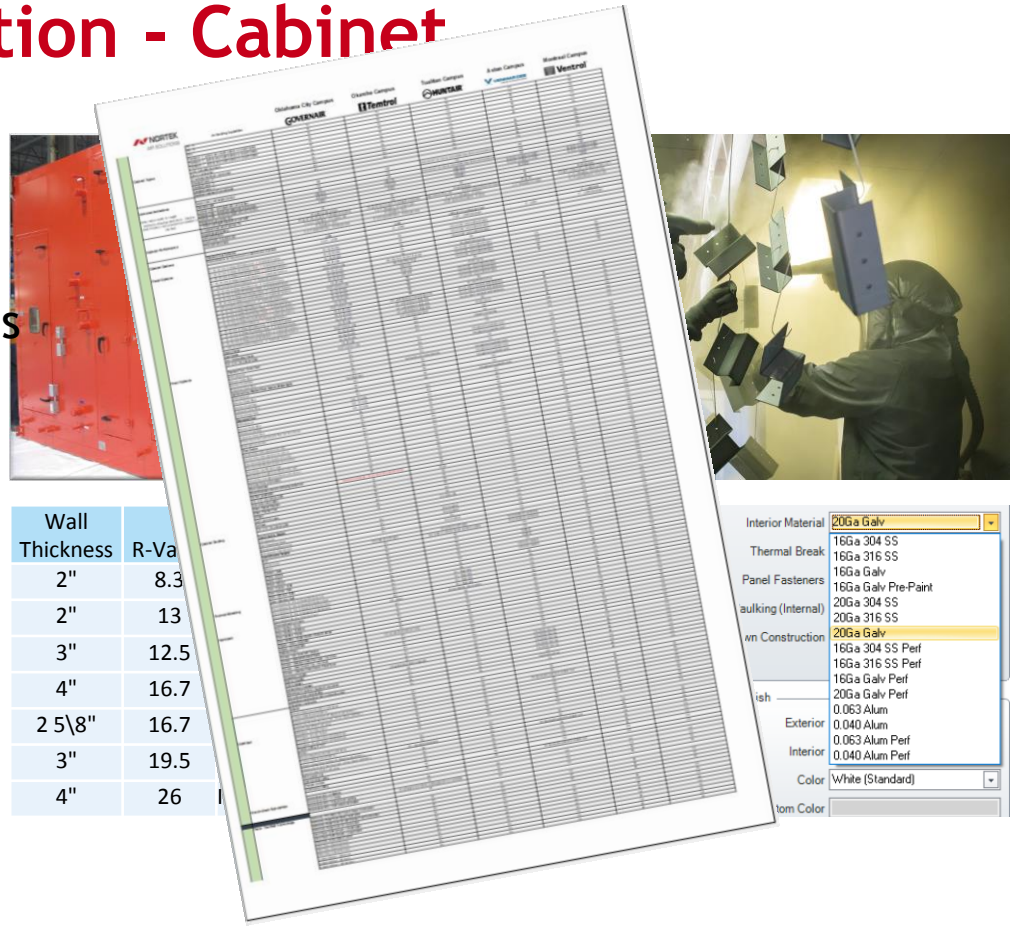
Custom AHU Construction - Cabinet

- No cabinet size restrictions
- High pressure, low deflection
- Variety of panel and liner options
- Coating options
  - *Custom Color*
  - *Powder Coat or Epoxy Paint*
  - *Up to 7,000 hr salt spray coating*
- Variety of thermal break and insulation options



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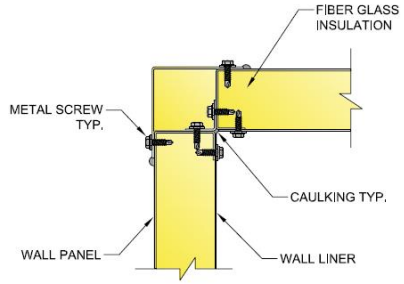
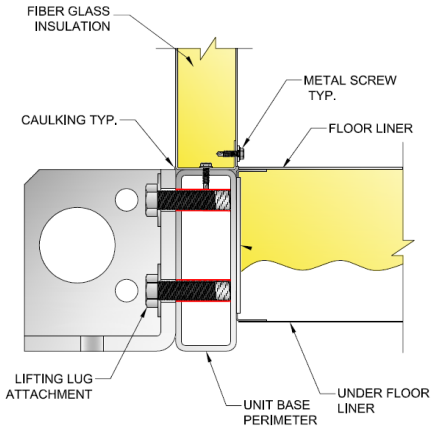
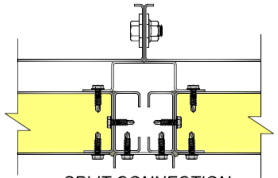
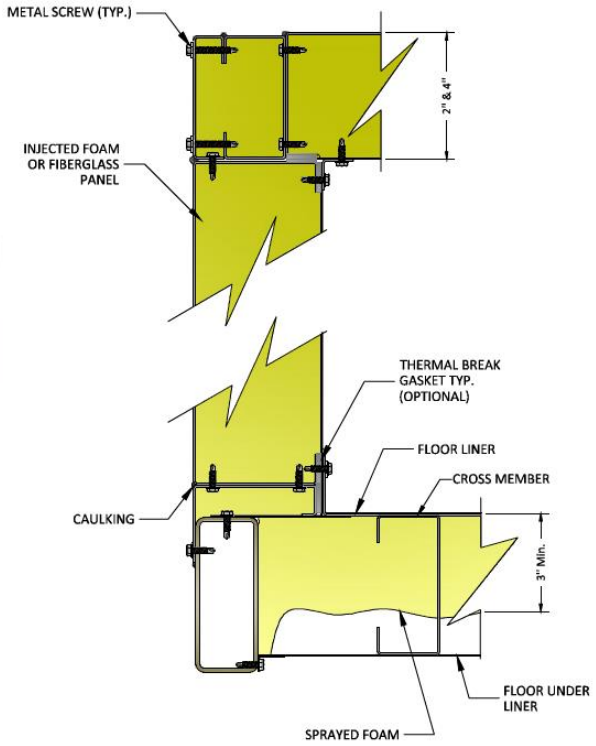
Custom AHU Construction - Cabinet






SPLIT CONNECTION



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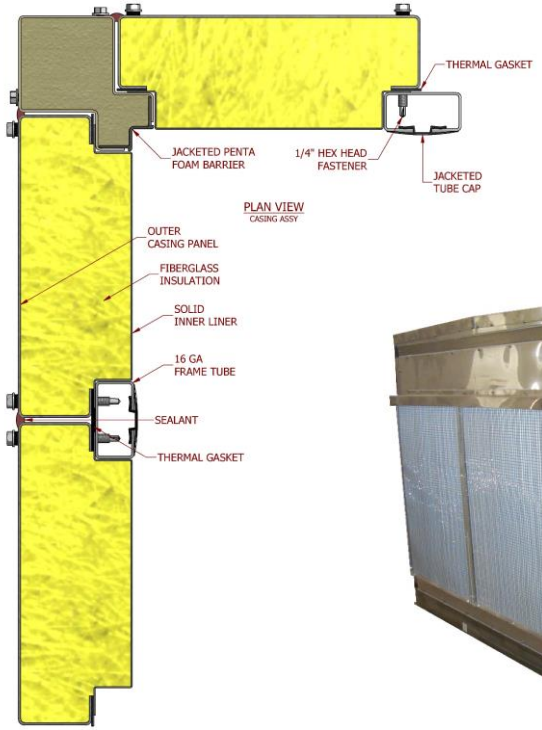
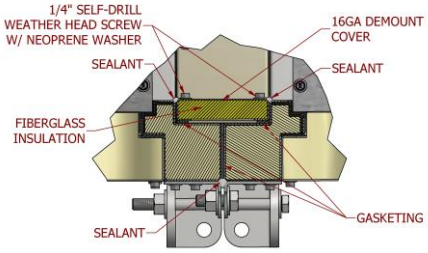
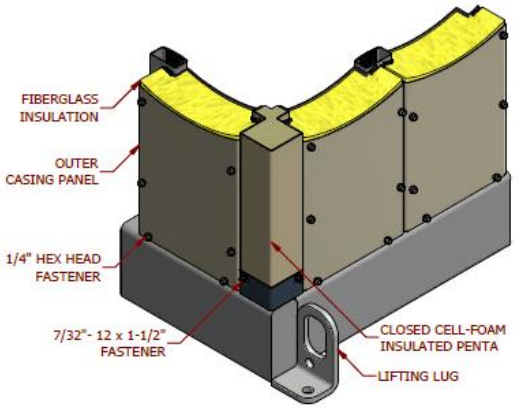
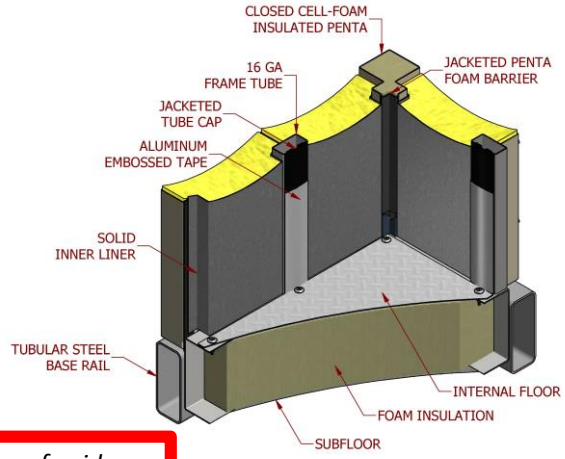
Custom AHU Construction - Cabinet









Injected foam insulation shall completely fill the panel cavity in all directions so that the cabinet is free of voids.

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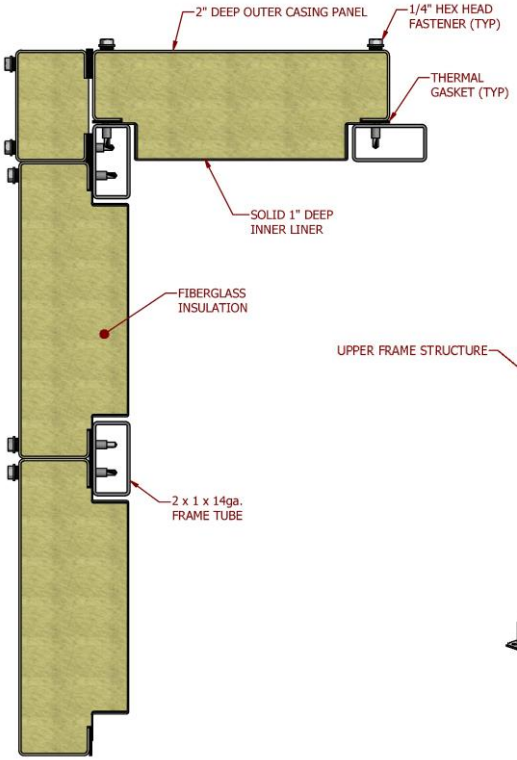
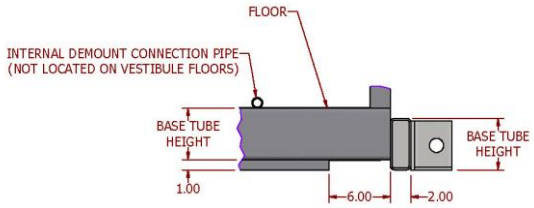
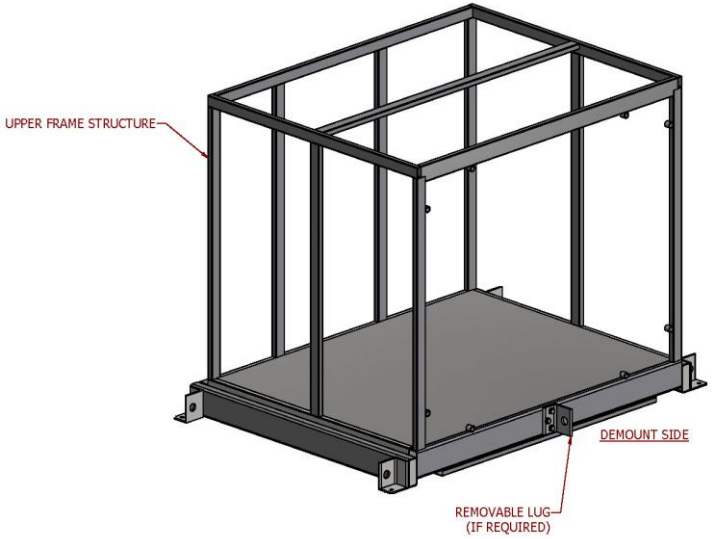
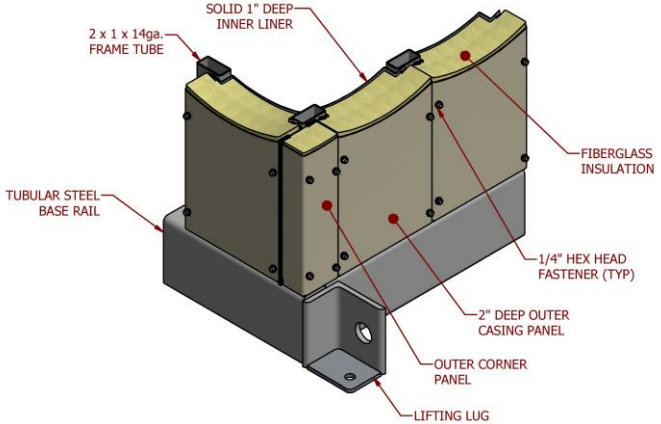
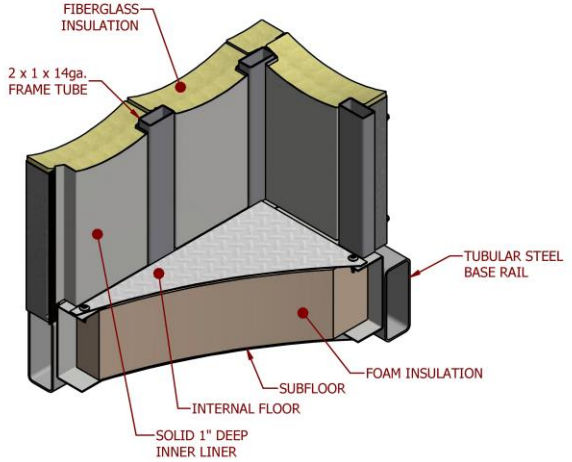
Custom AHU Construction - Cabinet











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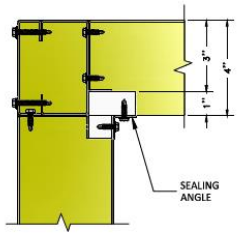
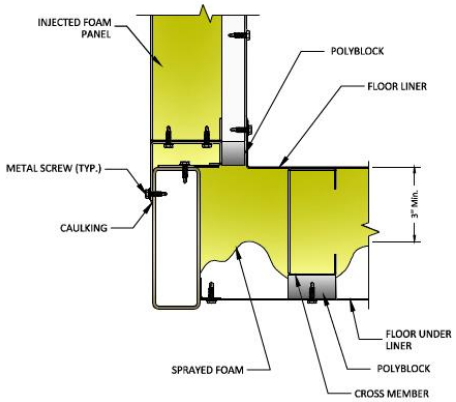
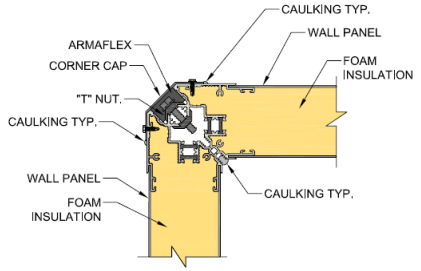
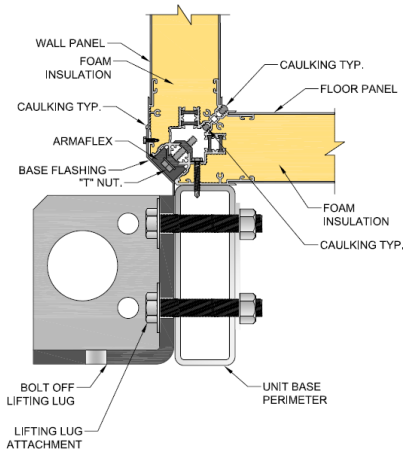
Custom AHU Construction - Cabinet









*A true thermal break shall be provided such that no member of the exterior of the unit, **including fasteners**, has through metal contact with any member on the interior of the unit*

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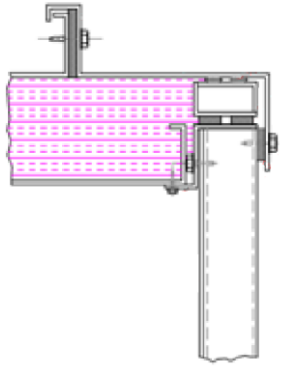
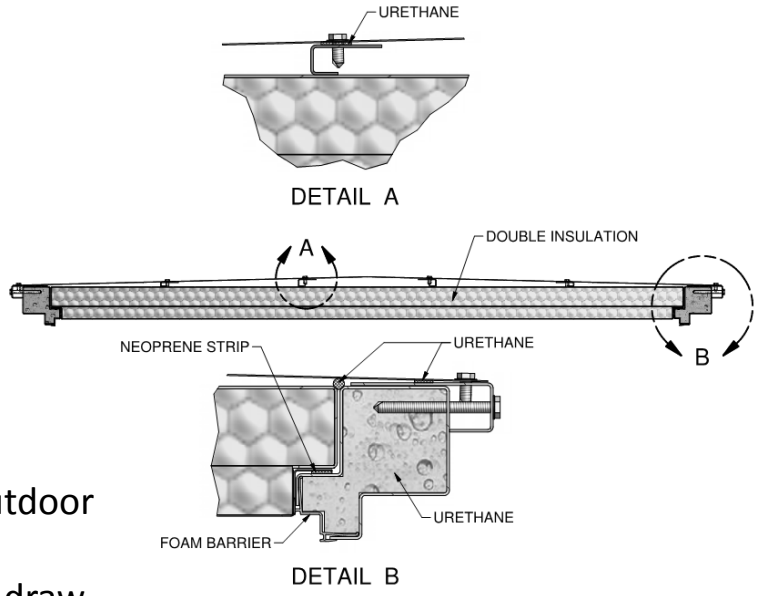
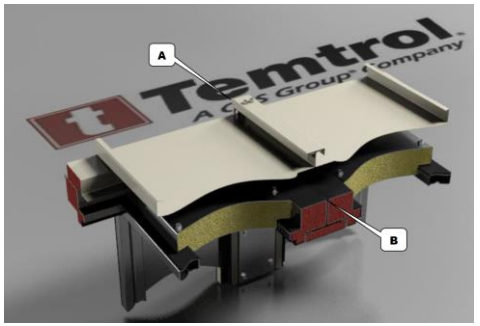
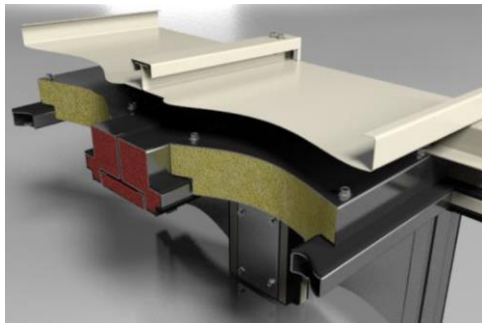
Custom AHU Construction - Outdoor Roof

Common Roof Design







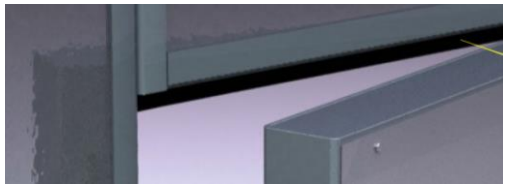


- Is roof sloped?
- No separation from outdoor roof and cabinet.
- Negative pressure can draw water into unit.

Each outdoor unit shall incorporate a triple layer roof design. The first two layers shall seal the air tunnel to preserve performance integrity and shall be of the same construction as the rest of the casing. Casing shall then be completely covered with a third layer 3" deep lock formed standing seam roof.

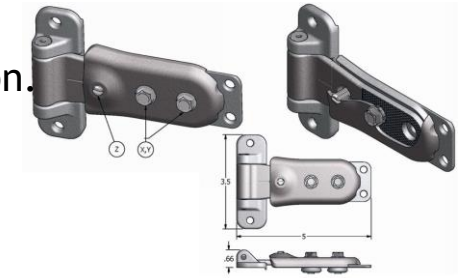
Non-Custom AHU Construction - Doors

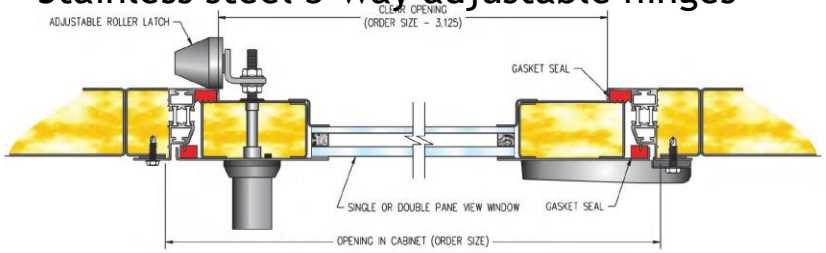
- Door not thermally broken
- Door frame not thermally broken
- Hinges are not adjustable
- Single gasket
- Handles provide metal bridge
- Low pressure.



Custom AHU Construction – Doors

- True, no thru metal frame construction.
- Thermally broken door
- Dual gasket frame and door
- Thermally broken door handles
- Double pane tempered glass windows.
- Stainless steel 3-way adjustable hinges



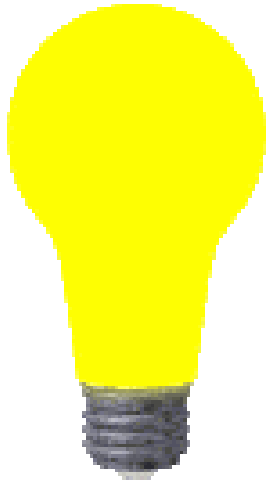


The door frame features a built-in no-through-metal high density resin barrier and a perimeter gasket. Door frames with no thermal break are not acceptable. The door gasket is seamed together at each corner to prevent leakage through the door. Door is attached to the unit with 3 axes adjustable stainless steel hinges.

Driving Force For Innovation

NORTEK AIR SOLUTIONS

- Reasons to upgrade
  - *Too much downtime*
  - *Excessive maintenance*
  - *Desire more airflow*
  - *High energy use*
  - *Noisy*
- Obstacles to upgrading
  - *Difficult access to fan room*
  - *Electrical service*
  - *New equipment size*
  - *Door/elevator size*
  - *Crane expense*
  - *24/7 use of facility*
  - *Capital costs*



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The Idea

Break down large fans into small fans

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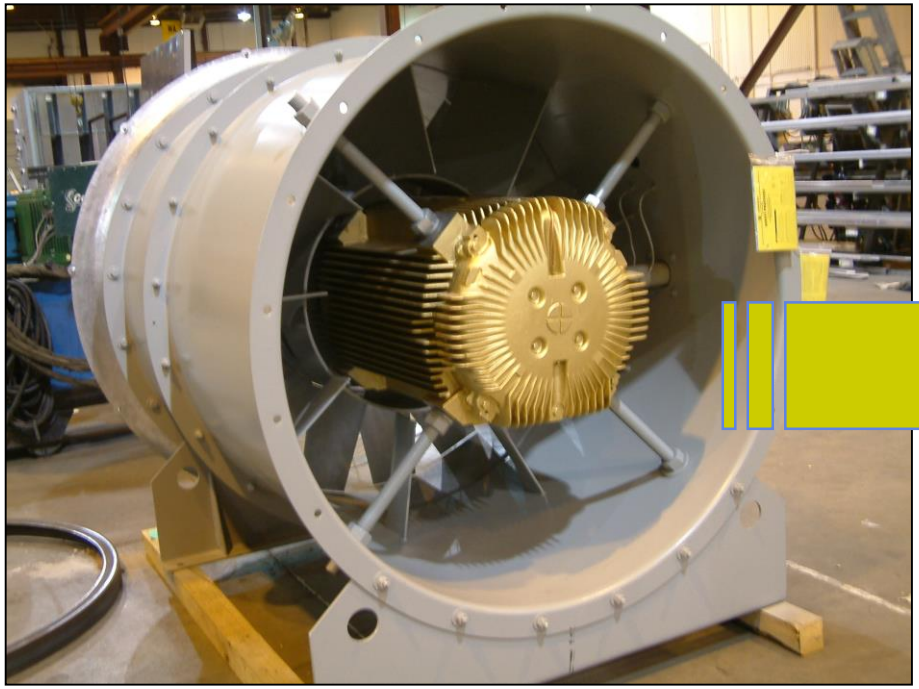

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Easily Scalable

NORTEK AIR SOLUTIONS

150,000+ cfm

30,000 cfm

10,000 cfm

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Fan Retrofits Made Easy
St. Joseph Hospital, Phoenix, AZ

NORTEK AIR SOLUTIONS

- Reduction of motor power by 50% – from 39 to 21 FLA

Cut-out old fan

Bring new FANWALL® cells through standard doorway

Stack FANWALL cells in any shape

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AHU Component Performance FANWALL TECHNOLOGY®

- Robust frame
- Sturdy motor rail
- Variable cell size
- Multiple material options
- Coplanar Silencer
- FANWALL Backdraft Damper
- Integrated wire channel
- Aluminum or Polymer Wheels
- Induction, PM and ECMi motors
- AMCA certified for performance and sound.

amca CERTIFIED RATINGS
AIR PERFORMANCE
AIR MOVEMENT AND CONTROL ASSOCIATION, INC.

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AHU Component Performance Reducing System Effect

- System effect can significantly reduce performance of fans
- Reduce system effect with **uniform airflow**.
- Uniform airflow also improves component performance.
- Uniform airflow is best achieved with a fan array that comprises the full width and height of the air tunnel.
- FANWALL TECHNOLOGY® offers most flexibility helping to eliminate or significantly reduce system effect.

Uniform Airflow Reduces System Effect

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AHU Component Performance FANWALL

- 72+% static efficiency
- Aluminum and polymer wheel options
- AMCA certified sound and performance

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AHU Component Performance FANWALL - Motors

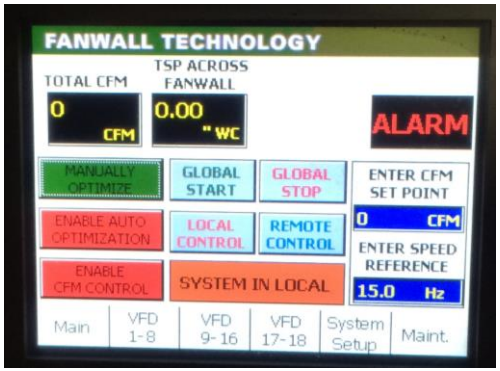
- Induction Motors
  - (24) different HP offerings between 1HP and 15HP allows you to more closely match BHP of the fan.
  - Reduce total connected horsepower
  - Reduce wire sizing and associated electrical costs
- ECMi
  - Individual motor control.
  - More compact electrical panel.
  - Improved turndown efficiencies.
- Permanent Magnet
  - Most efficient motor option. Especially on turndown.

3600 RPM Motors			
		FLA	
HP	EFF	460V	Max Hz
1	84.0	1.4	75
1.5	85.5	2.0	75
2	86.5	2.5	75
2.5	86.5	3.1	75
3	89.5	3.5	75
3.5	89.5	4.0	75
4	89.5	4.5	75
4.5	88.5	5.0	75
5	90.2	5.7	75
5.5	90.2	6.3	75
6	90.2	6.8	75
6.5	89.5	7.4	75
7	89.5	7.9	75
7.5	91.0	8.6	75
8	91.0	9.1	75
8.5	91.0	9.6	75
9	91.0	10.1	75
9.5	91.0	10.6	75
10	91.7	11.2	75
10.5	91.7	11.6	75
11	91.5	12.1	75
11.5	91.5	12.6	75
12	91.5	13.1	75
15	91.7	17.2	75

NORTEK AIR SOLUTIONS

AHU Component Performance FANWALL - VFDs and Controls

- Variety of VFD configurations
- Optimization Control
  - Reconfigures the number of active fans and motors while controlling the speed of enabled fans
  - Optimizes efficiency over the range of system operation of an air handler



Micro-drive


SmartCube

Individual, Bypass, Split Load, Redundant


MOP Panel

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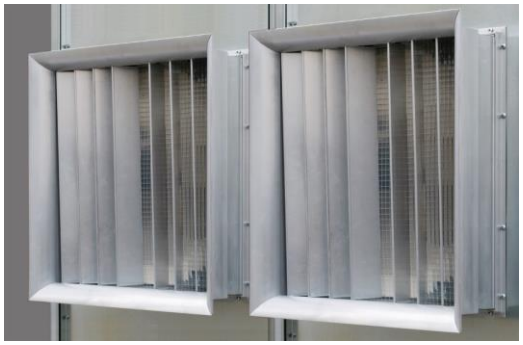
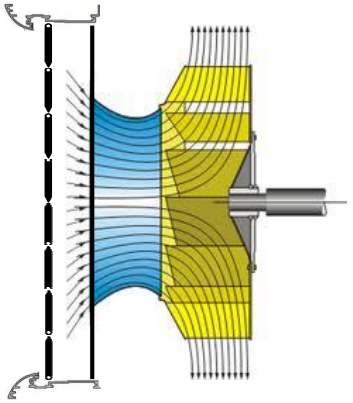
AHU Component Performance FANWALL Backdraft Damper

- A backdraft damper is critical for providing on/off control of fans
  - Prevents recirculation of system air in disabled fans
- FBD backdraft damper provides this capability with industry leading results
  - Near zero net system effect
  - Extremely low leakage
  - Positive impact on acoustics





Each fan applied in multiple fan applications shall be provided with an integral back flow prevention device that prohibits recirculation of air in the event a fan, or multiple fans, becomes disabled. The system effect for the submitted back flow prevention device shall be included in the calculation to determine the fan TSP for fan selection purposes, and shall be indicated as a separate line item SP loss in the submitted fan selection data.

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AHU Component Performance FANWALL - Low Vibration

- AMCA 204-96 Fan Applications Category
- No spring isolation bases or concrete inertia bases required
- Aluminum fans are dynamically balanced to an AMCA 204-96 grade of BV-5 (G.55, .55 mm /.022 inch per second peak, filter in)

Table 4-1 Fan Application Categories

APPLICATION	EXAMPLES	DRIVER POWER kW (HP) LIMITS	FAN APPLICATION CATEGORY, BV
RESIDENTIAL	Ceiling fans, attic fans, window AC	<= .15 (0.2) > .15 (0.2)	BV-1 BV-2
HVAC & AGRICULTURAL	Building ventilation and air conditioning; commercial systems	<= 3.7 (5.0) > 3.7 (5.0)	BV-2 BV-3
INDUSTRIAL PROCESS & POWER GENERATION, ETC.	Baghouse, scrubber, mine, conveying, boilers, combustion air, pollution control, wind tunnels	<= 298 (400) > 298 (400)	BV-3 BV-4
TRANSPORTATION & MARINE	Locomotives, trucks, automobiles	<= 15 (20) > 15 (20)	BV-3 BV-4
TRANSIT/TUNNEL	Subway emergency ventilation, tunnel fans, garage ventilation, Tunnel Jet Fans	<= 75 (100) > 75 (100) ANY	BV-3 BV-4 BV-4
PETROCHEMICAL PROCESS	Hazardous gases, process fans.	<= 37 (50) > 37 (50)	BV-3 BV-4
COMPUTER CHIP MANUFACTURE	Clean room	ANY	BV-5

Each fan/motor assembly shall be dynamically balanced to meet AMCA standard 204-96, for fan application class BV-5, to meet or exceed a rotational imbalance Grade G.55, producing a maximum rotational imbalance of 0.022 inches per second peak, filter in. "Filter in" measurement indicates that the specified balance grade must be achieved at the submitted design operating speed for the fan(s).

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Acoustic Performance FANWALL - Low Noise

- Coplanar Silencer
- Active Noise Control
- Higher frequency
- Reduced turbulence

Coplanar silencer(s) and/or sound attenuator(s) shall be provided to meet specified acoustical requirements. Sound attenuator cross sectional area shall be selected to not exceed 500 fpm. Losses from sound attenuating devices must be included in the fan performance selection.

Agenda

I. Background
II. Service Life
III. End of Service Life – Replace or Rebuild Review
IV. Bid Approach
V. Cost Savings Review
VI. Project Review

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Unit Life Expectancy
Which one Lasts Longer

Non-Custom Commercial Unit

Custom Air Handler

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Service Life

What defines end of life? Who Quantifies and Tracks This?

- Poor thermal performance
- Poor airflow performance
- Poor humidity performance (OR's, industrial, etc.)
- Cabinet Failures - Leaks
- Maintenance costs/downtime

Additional Concerns

- Future capacity (CFM/temp/static)?
- Redundancy requirements?
- Filtration?
- Acoustics?
- Energy Usage and Reduction?

- ***MOST FACILITIES ARE MAKING DECISIONS PURELY ON COST AND ACCEPTING THE MODULAR PRODUCTS. NEW ENERGY CODES HAVE LOWERED TOTAL UNIT STATIC PRESSURE AND ALLOWED THESE CABINETS TO BARELY MEET DUTY IN SOME CASES (HEALTHCARE).***

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ASHRAE Service Life Database

https://xp20.ashrae.org/publicdatabase/default.asp

		Currently in Service							Replaced						
	Total Units	No.of Units	Equipment Age (years)						No.of Units	Age at Removal (years)					
			Mean	Median	Std Dev	95% C.I.	Max	Min		Mean	Median	Std Dev	95% C.I.	Max	Min
Air handling unit, constant volume	206	184	25.9	27.0	11.9	4.8	46.0	6.0	22	34.7	40.0	20.5	23.2	52.0	12.0
Air handling unit, dual duct	20	20	36.5	37.0	6.6	5.3	45.0	25.0	0	n/a	n/a	n/a	n/a	n/a	n/a
Air handling unit, multizone	229	229	30.4	24.5	18.4	8.5	76.0	6.0	0	n/a	n/a	n/a	n/a	n/a	n/a
Air handling unit, single zone	87	87	21.7	18.5	12.5	7.7	44.0	10.0	0	n/a	n/a	n/a	n/a	n/a	n/a
Air handling unit, variable air volume	962	893	18.6	20.0	8.8	1.8	47.0	-20.0	69	28.2	26.0	12.4	6.3	64.0	12.0
Air handling unit, variable volume, variable temperature	196	61	20.1	21.5	9.2	5.2	34.0	4.0	135	12.0	12.0	n/a	n/a	12.0	12.0
Fan coil unit	2884	1605	26.8	27.0	13.8	6.0	51.0	6.0	1279	36.5	36.5	24.4	19.5	65.0	4.0
Heat pump, air-to-air	1296	1295	14.1	14.0	5.7	4.2	20.0	3.0	1	17.0	17.0	n/a	n/a	17.0	17.0
Heat pump, water-to-air, geothermal application	15090	11368	11.9	12.0	5.4	0.8	37.0	5.0	3722	27.6	25.0	13.5	3.6	69.0	8.0
Heat pump, water-source	1484	1379	17.5	21.0	7.1	2.8	27.0	4.0	105	16.5	16.5	0.7	1.0	17.0	16.0
Heat pump, water-to-water, geothermal application	28	28	12.0	13.0	1.7	1.9	13.0	10.0	0	n/a	n/a	n/a	n/a	n/a	n/a

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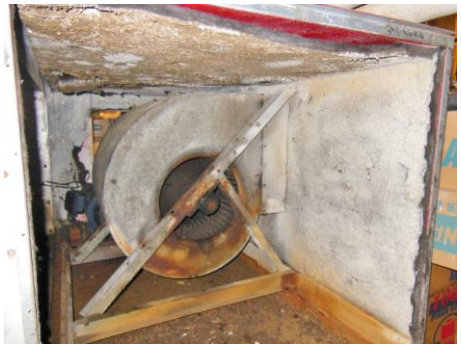
NORTEK AIR SOLUTIONS

Background



- AHU upgrades as well as most infrastructure upgrades are ideal for rebuild versus replacement when all items are evaluated; downtime, maintenance cost, performance or space use (more airflow?), energy and noise, etc..

- Obstacles such as maintenance access, replacement access – doors/elevators, electrical service, new code complaint equipment size, crane location/size and capital cost all keep these units on the deferred maintenance list.

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NORTEK AIR SOLUTIONS

Background

- The traditional approach of design-bid-build often lends itself to a larger project with significant scope creep and full unit replacement.
- Significant cost savings (often 50%) and downtime can be realized by rebuilding most units in place.
- Facility downtime is also less of an issue. Mechanical Sales has completed many of these projects locally.

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AHU Replacement - Best Practice

- At (20) Years, Begin Cap-X Budget Process, Replace at 25-30 Year Window to Limit Catastrophic Failures
- Define Replacement Strategy
  - Know Your Options
  - Secure Mngt Buy-In for Decision
- Understand Quality and Support
- Fight for Cap-X $$$ and Quality
- MANDATORY PRE-BID, Vendors Included!!!

- **Where to Start?**
  - Take the Free Inspection from a Vendor to Startup
  - Hire a DB Contractor or MEP Firm to Do a Evaluation

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MSI-Nortek Jobsite Inspection Checklist(s)

- Nortek Checklist
- MSI Checklist

FANWALL® Retrofit Survey Worksheet

Job Name: _____ **AHU #:** _____

Original submittal data available? ☐ Yes ☐ No **Project design drawings?** ☐ Yes ☐ No

General AHU Condition (attach copy of submittal drawing):

1. **Year Installed (years in operation)?** _____ **Manufacturer?** _____
2. **Design CFM and Total Static Pressure?** _____
3. **Fan type?** _____ **Manufacturer?** _____
4. **Fan arrangement (DWDI, SWSI, Vane Axial, Mixed Flow)?** _____
5. **Fan wheel size?** _____
6. **Cabinet condition** ☐ Replace ☐ Keep _____
7. **Coil(s) condition** ☐ Replace ☐ Keep _____
8. **Inlet damper(s)** ☐ Replace ☐ Keep _____
9. **Discharge damper(s)** ☐ Replace ☐ Keep _____
10. **Other components creating system effect (check AHU and supply and return ductwork)**

Sound attenuators	☐ Yes ☐ No	**Fan isolation dampers?**	☐ Yes ☐ No
Crowded fan inlet?	☐ Yes ☐ No	**Discharge diffuser plates?**	☐ Yes ☐ No
Inlet guide vanes and/or screens?	☐ Yes ☐ No	**Discharge turning vanes?**	☐ Yes ☐ No
Other (please describe)?			

Overall AHU Performance

1. **Constant volume or VAV?** _____
2. **Noise concerns?** ☐ Yes ☐ No _____
3. **Vibration concerns?** ☐ Yes ☐ No _____
4. **Uneven flow patterns?** ☐ Yes ☐ No _____
5. **Dirt on coils in low flow areas?** ☐ Yes ☐ No _____
6. **Uneven filter loading?** ☐ Yes ☐ No _____
7. **Moisture carryover?** ☐ Yes ☐ No _____
8. **Are inlet & outlet duct transitions satisfactory?** _____

February 13, 2019

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AHU Re-Life Checklist

Completed By: Jake Vorac
ME: N/A
MC: N/A
Project: Test Project

I. Owner Items
- a. Does current unit have enough capacity (CFM, ESP, LAT)?
  - i. Relife ESP =
  - ii. Relife CFM =
- b. Does existing unit meet current and future redundancy requirements?
  - i. Will space usage change in the future?
- c. Do final filters need to be added to the unit?
- d. Are we matching other units in the facility (common spare parts)?
- e. Is existing unit sound a concern?
- f. Is energy savings being used to sell retrofit to management/C-Level?
  - i. Need elec/gas rate and demand charge info with simple unit operating load profile to calculated estimated savings
  - ii. Is this a Performance Contract; if so, who guarantees savings?
- g. Is reduced maintenance cost being used to sell retrofit to management/C-Level?
  - i. What information is needed to for owner/service contractor to complete this part of the evaluation?
- h. Does the space require temporary heat/cool during work?
- i. Warranty requirements; parts only, parts and labor, duration?
- j. Review FANWALL®
  - i. Review coil performance and saturated air concerns; do blenders needed added to the system?
  - ii. Do we need to modify unit from blow-thru to draw-thru or vice-versa?

Continued…

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Many Reasons to Upgrade

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Re-occurring bearing failures

Throwing blades or Maintenance time

More airflow needed or Noise

Expensive belt replacements

Energy hog or excessive downtime

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Obstacles To A Retrofit

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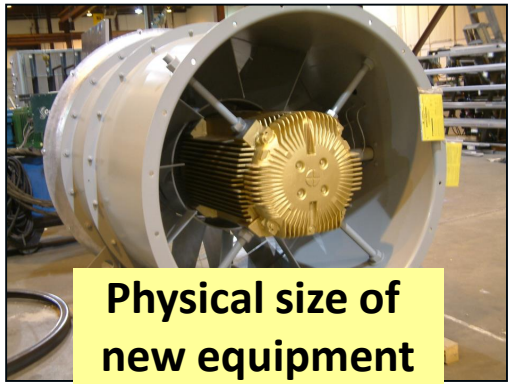
Costs to rig new equipment

Impossible access

Electrical service

Fitting through doors/elevators



Physical size of new equipment

24/7 use of facility

Cost and time to upgrade

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Existing Jobsite Restrictions

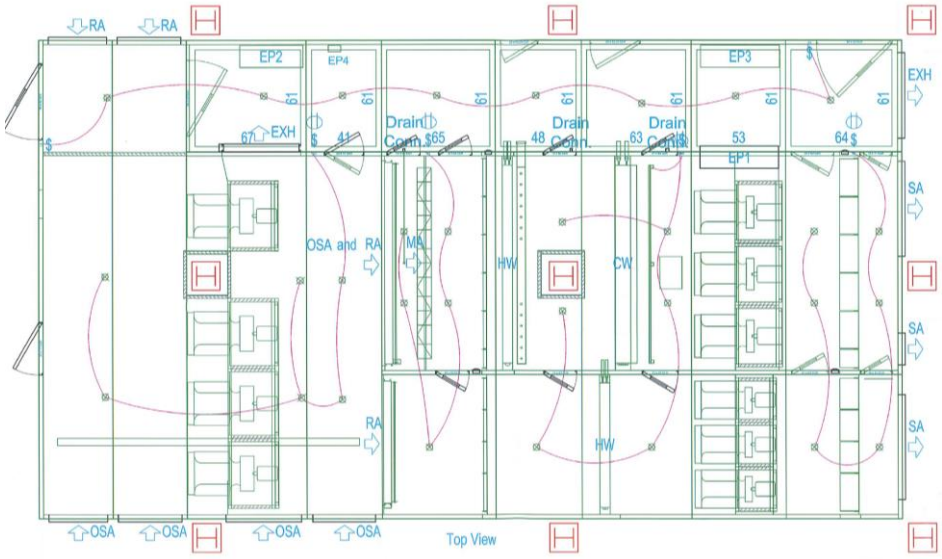
- Mechanical room or rooftop size
- Existing structural components
- Other mechanical equipment
- Weight restrictions
- Access to unit location

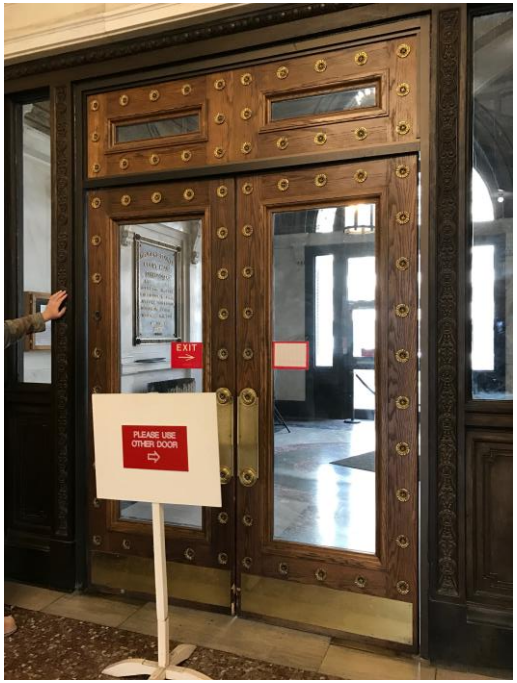
Existing Jobsite Restrictions Federal Courthouse

26K CFM Replacement Unit

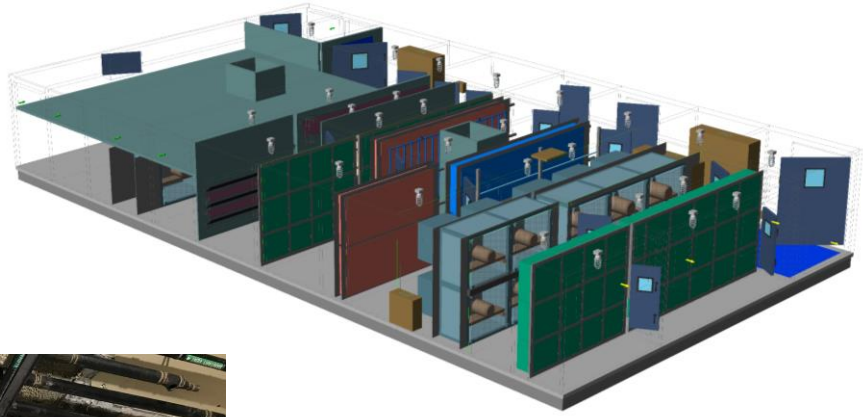
Sound Sensitive Project

Existing structural pillars through center of unit





Existing Jobsite Restrictions Federal Courthouse



Unit split into (9) modules

Active Noise Control on supply and return

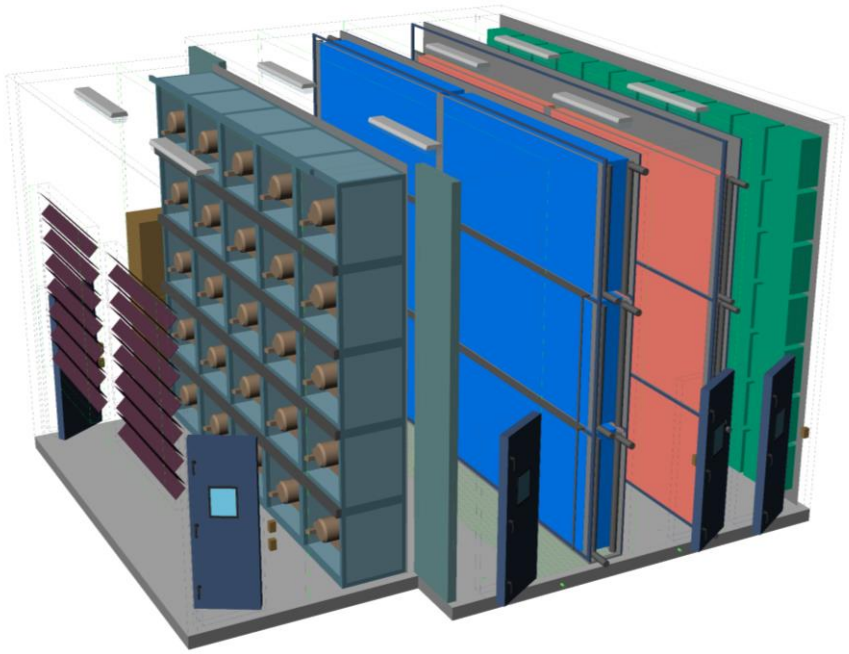
FANWALL™

Existing Jobsite Restrictions University Building Knockdown

120K and 160K CFM Units

16 feet tall, 23 feet wide

Pathway through freight elevators and standard doors

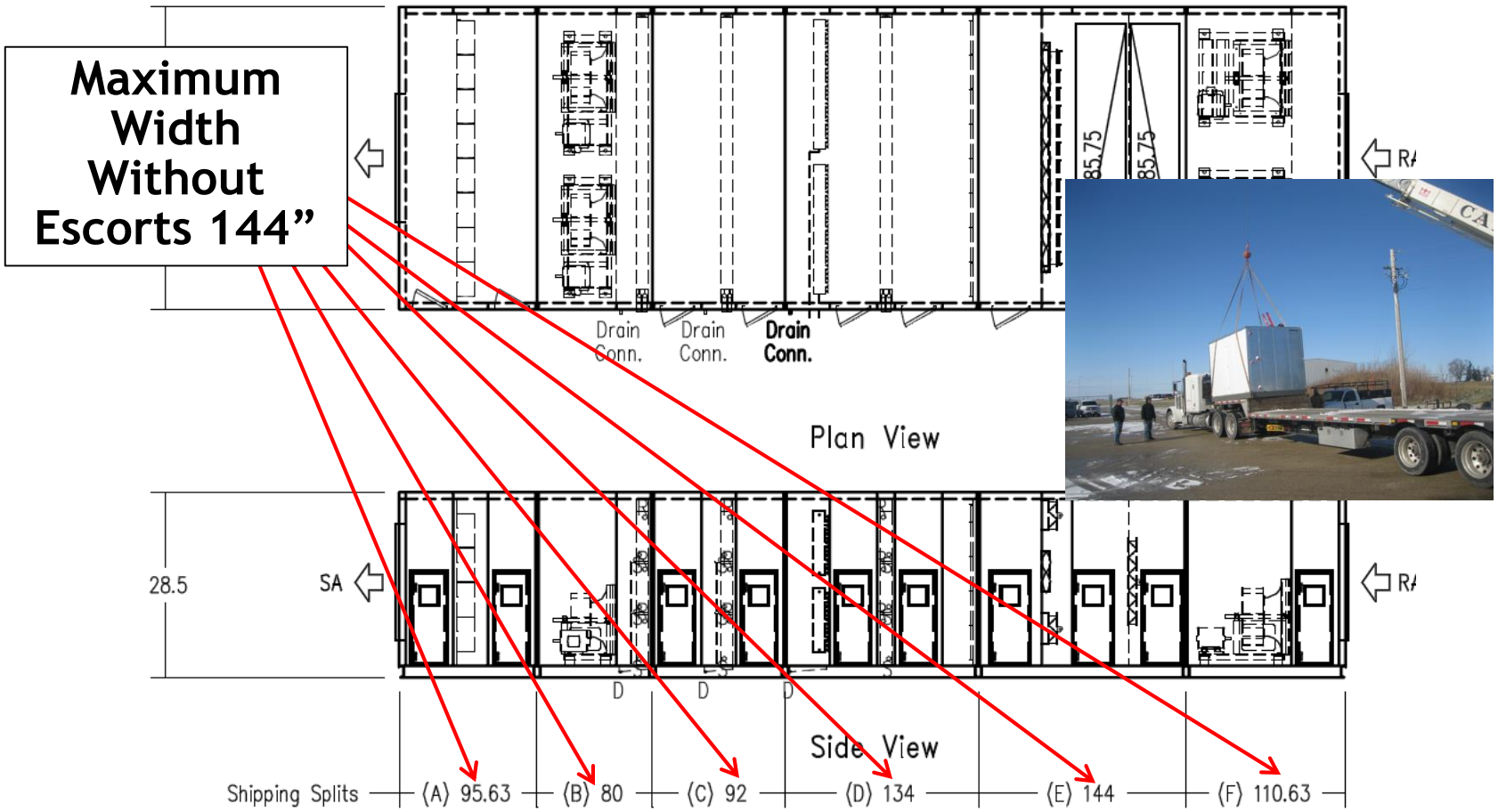


What are the options for Replacement?

- **Full AHU Replacement Project**
  - ***New Unit***
  - ***KD Unit***
- **Relife**
  - ***Coils/Fans***
  - ***Full Unit Relife with New Doors, etc..***

AHU Replacement - New Unit

AHU Sections Rigged into Facility



- **KD Retrofit – What is it?**

Path#1 – KD

Ideal for Retrofits, Renovations & Upgrades

NORTEK AIR SOLUTIONS

- Why Knock-down air handlers
- Standard KD units
- Quick KD units
- Rapid (Field) KD units
- Dimensional and configuration flexibility

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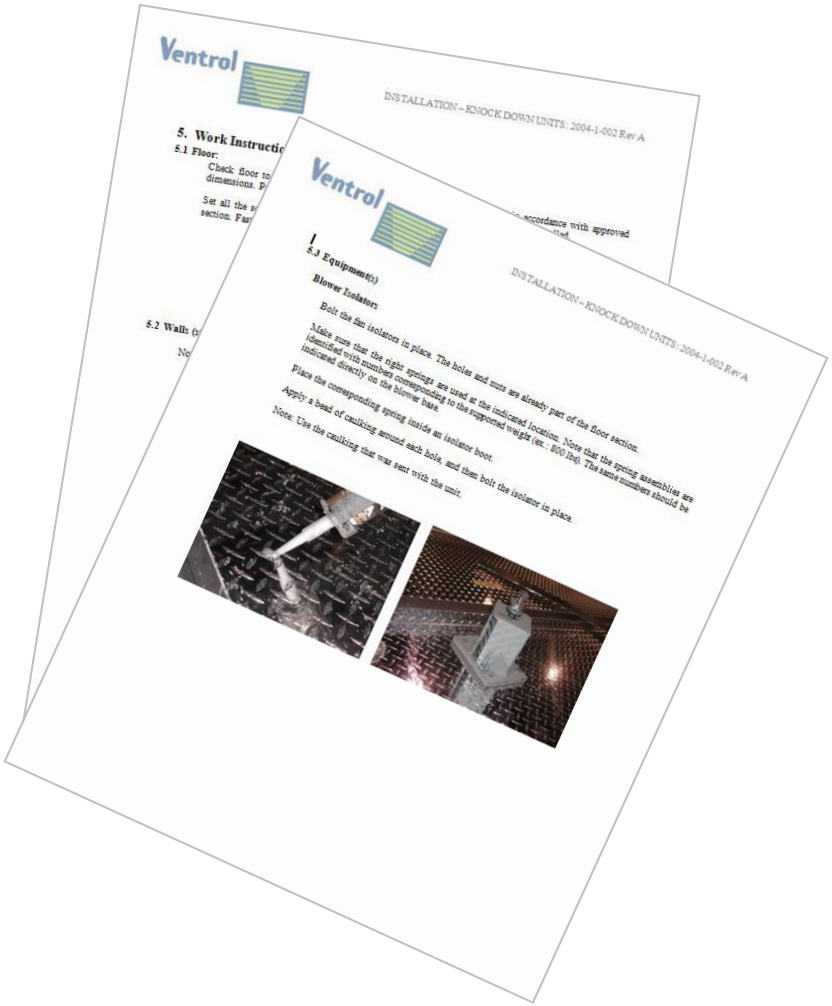
KD Install Process

Ventrol KD Innovations

KD capabilities

NORTEK AIR SOLUTIONS

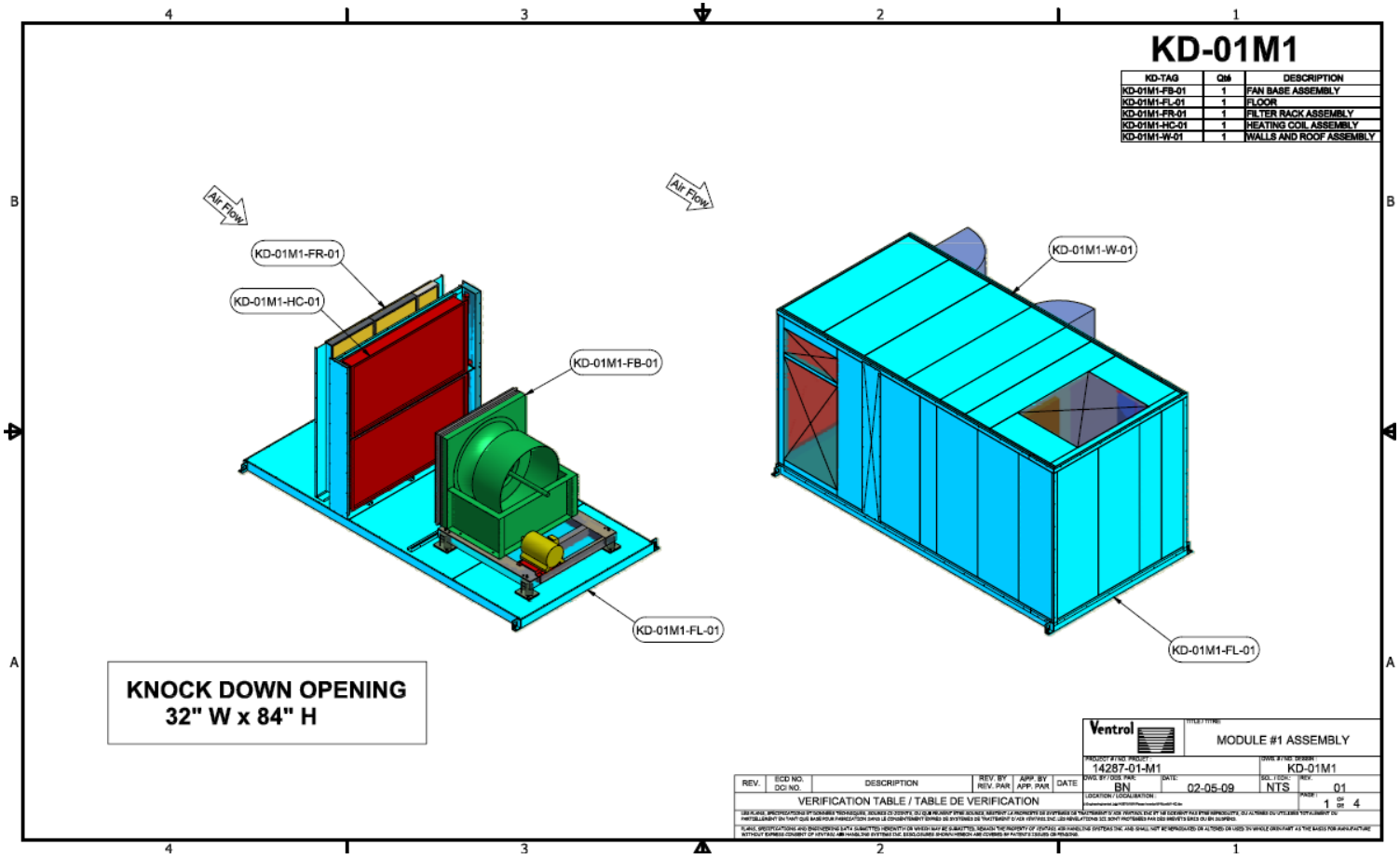
- KD units complete with:
  - *Unit specific 3D unit drawings*
  - *General detailed assembly instructions*
  - *Recommended factory site supervision*
  - *Optional: 3D mechanical room audit*



Ventrol KD Innovations

KD capabilities

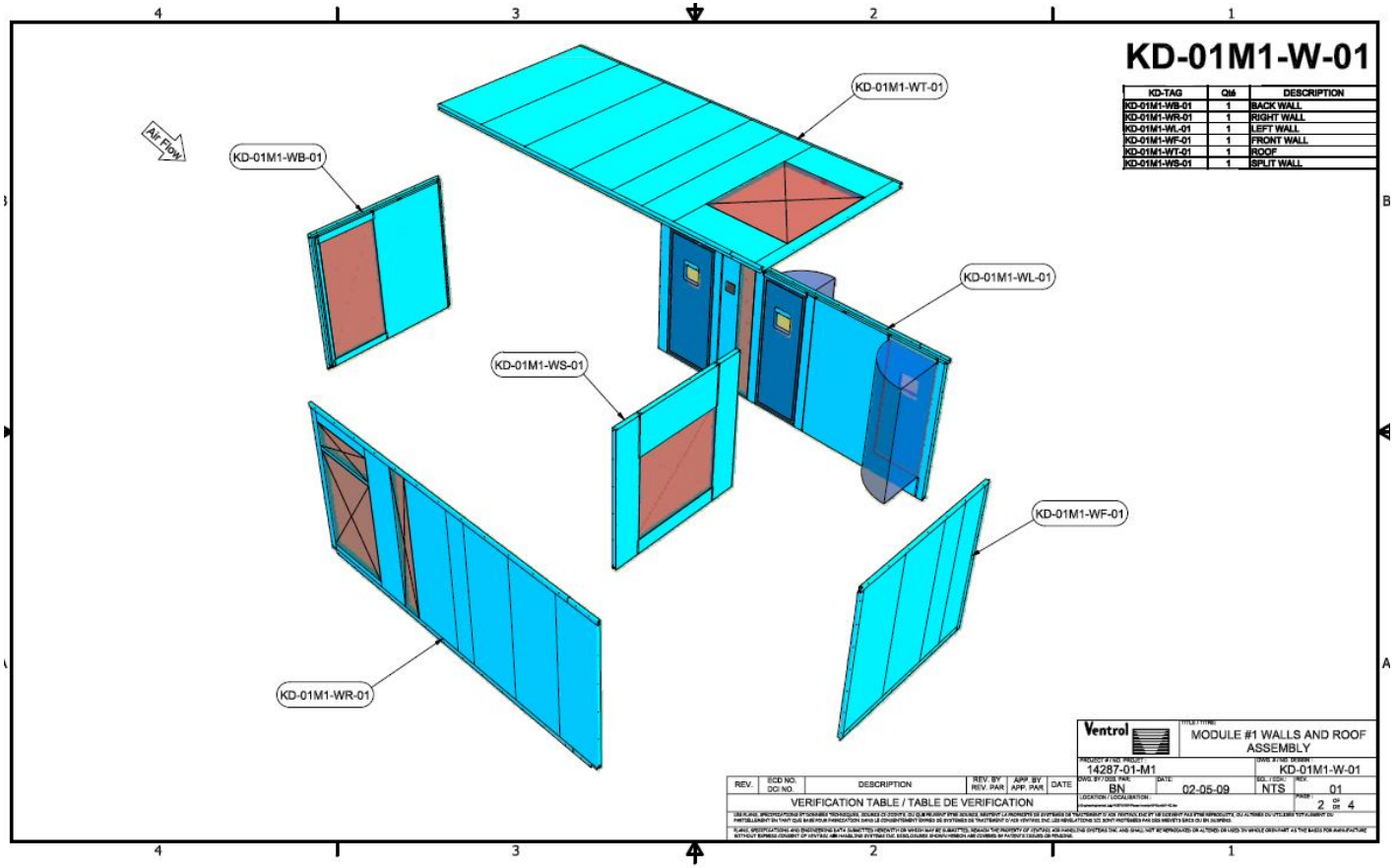
- KD units 3D unit drawings:



Ventrol KD Innovations

KD capabilities

- KD units 3D unit drawings:

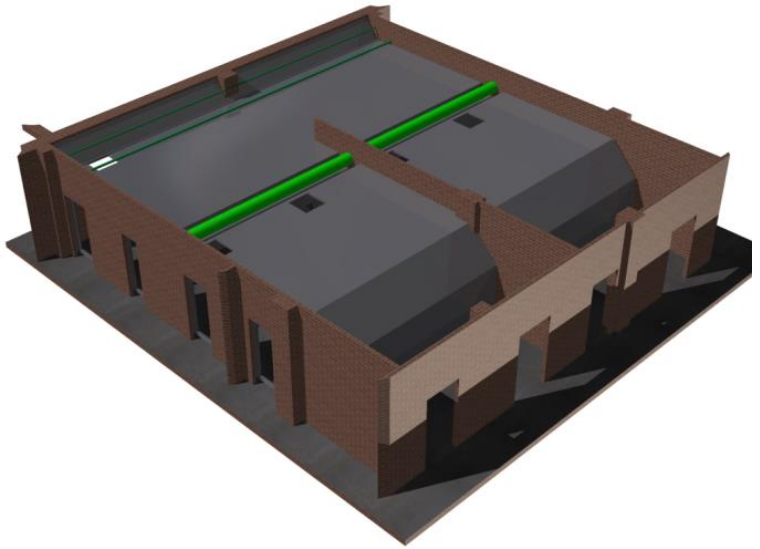


Ventrol® KD Innovations

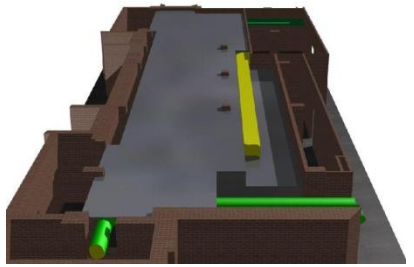
KD capabilities

NORTEK AIR SOLUTIONS

- Ventrol KD + mechanical room audit:
  - Mechanical room drawn in 3D
  - Field measured constraints such as columns, ductwork and piping
  - Drawings allows us to optimize unit design along with preassembly



- Purdue University:
  - (2) 43K and (1) 90K cfm KD units
  - Notched cabinet to accommodate existing piping and ductwork.
  - Provisions for existing piping to pass through units.

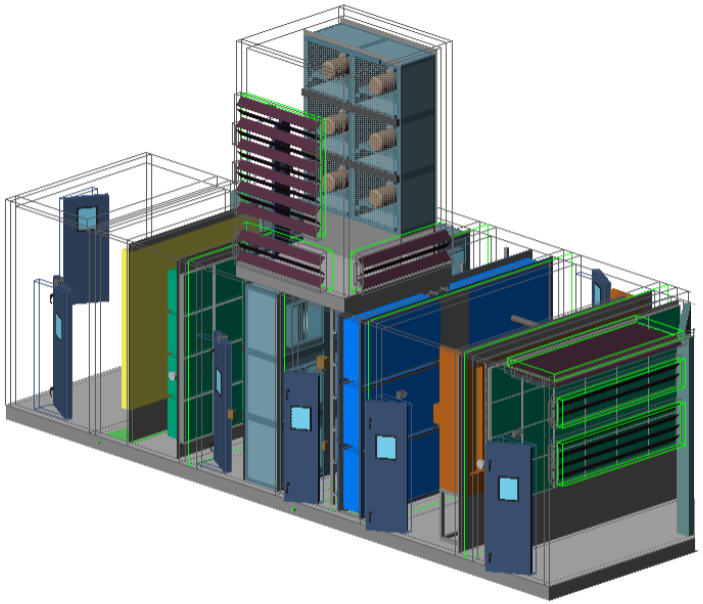


UIHC AHU-16

NORTEK AIR SOLUTIONS

Critical Air Handling Unit Upgrade – AHU-16 JCP Phase 2

- *Single 40,000 CFM unit with stacked return fan and economizer.*
- *Optimized FANWALL controls*
  - *Dedicated VFD for each fan.*
  - *Individual air flow station for each fan in array.*
  - *High efficiency back draft damper.*
  - *Optimization for airflow and static pressure at wide range of operating conditions.*
- *Redundancy on unit level - by using dedicated VFDs with fans selected to meet design with two fans off.*



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UIHC LL2 Project

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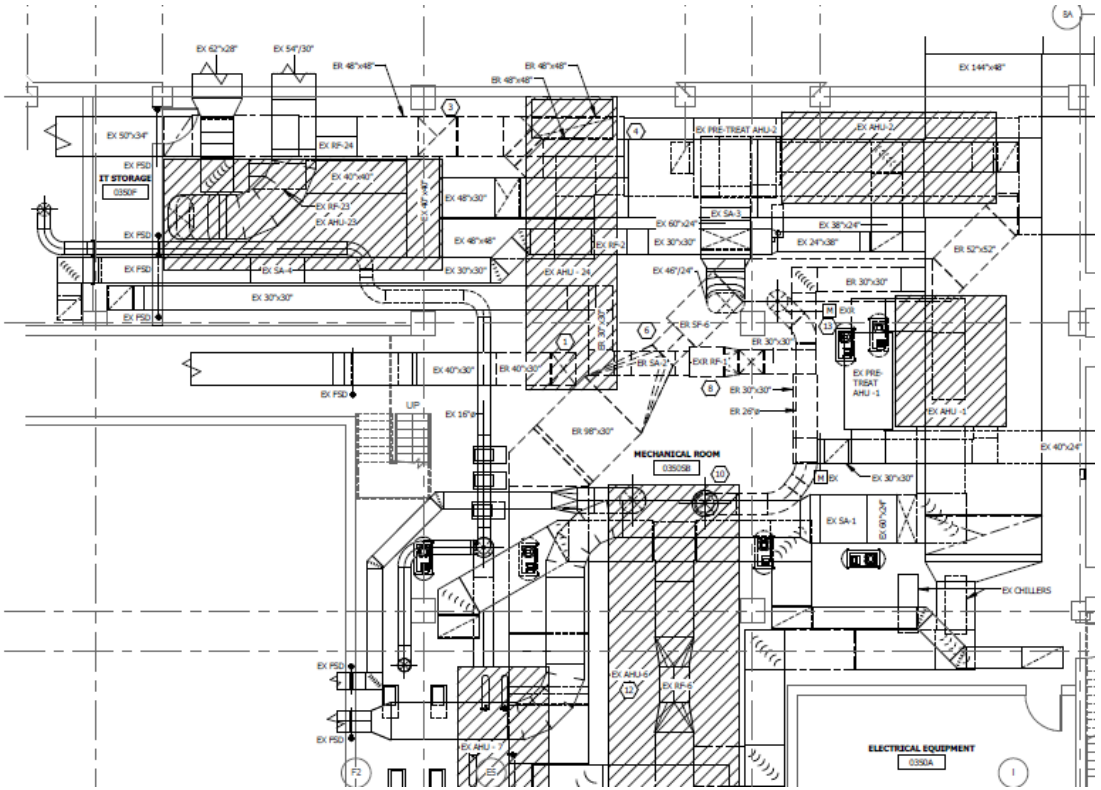
Qty (4) total unit

- (18) month duration
- Multi-million dollar construction project



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OPTION#1 - FULL KD REPLACEMENT - TAKEAWAYS

- MSI experience has shown these projects to be 6-12 months in duration
- Massive interruptions to owner
- Scope creep is part of every project

OPTION#2 - Relife

- Relife – What is it?
- 2-Day Process (up to a week for off-hr labor savings)
- Downtime Reduction
  - *Not uncommon for rebuild to be done over a weekend (coils/UV/fans)*

How do you retrofit a 20-year old 25,000 cfm air handler located way up here?

Relife

Component Replacement

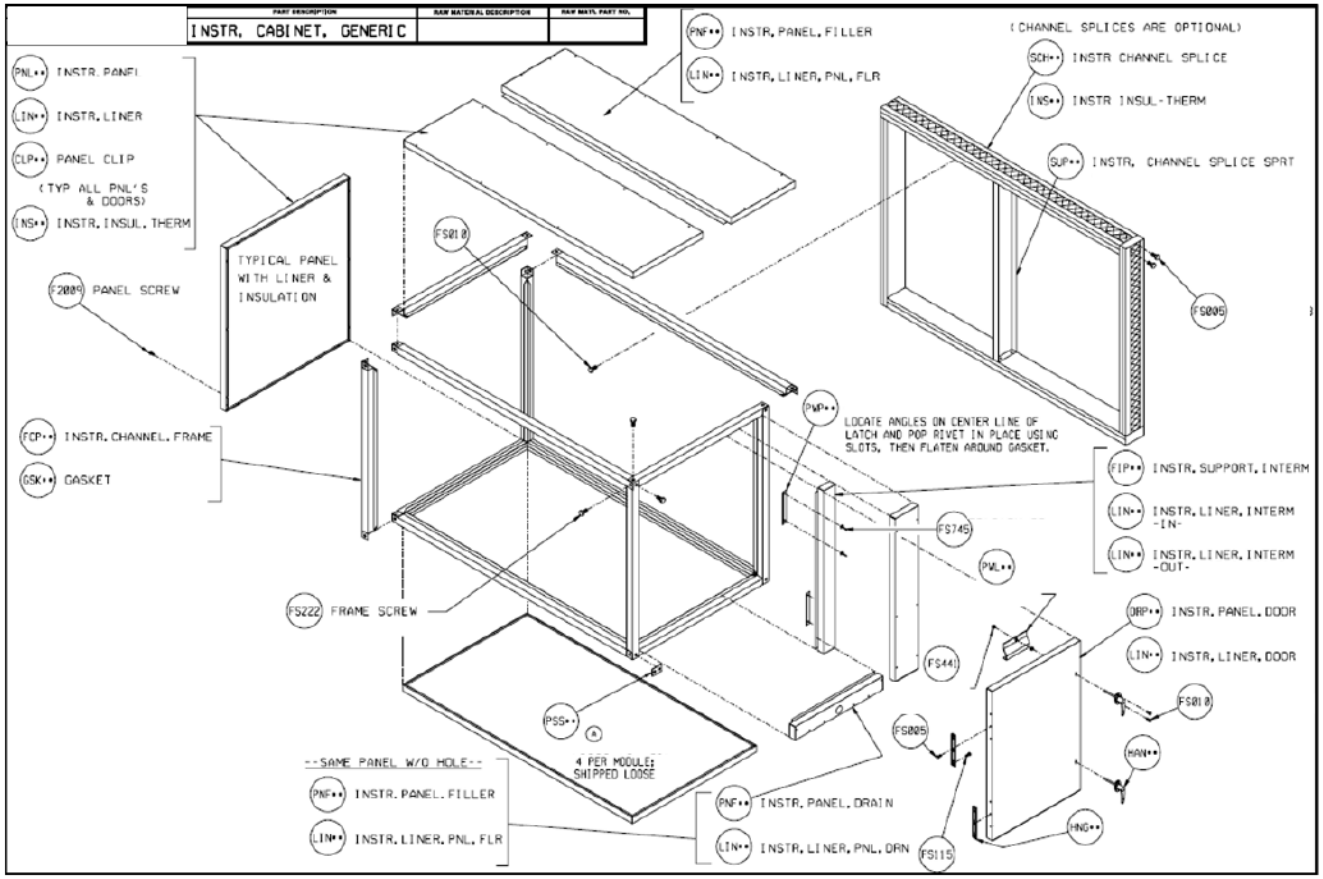
- Works best with existing field built units, some modular
- Replace Fans
- Replace Coils/UV Lights
- Replace Humidifiers
- Replace Drain Pans, Add Coatings
- Piping Upgrades
- Controls Upgrades
- Damper/Mixing Upgrades
- New Access Doors/Casing Sealing

NOTE - Modular Can to Taken Apart

NORTEK AIR SOLUTIONS

- Lower Cost
- High Air Leakage Potential
- Ideal for Back of House and Non-Critical Units

Disassembling Panels and Frame Channels



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Bid Approach

- **Traditional Design/Bid/Build (go hire an engineer)**
  - *Scope Creep - How many ceiling tiles and lights get changes as part of an AHU upgrade?*
  - Owner has little control over installing contractor and equipment buy decision usually based on a relationship and not end-user concerns.
  - Multiple AHU's packaged together pushes job cost and facility interrupts up, pushed project out
- **Design-Build**
  - *Stronger owner influence, not available to all public entities; often see multiple options evaluated*
- **Owner Pre-Purchase and Assign**
  - Control Cost and Quality
  - Gives Owner Better Control over Vendors/Installations
  - Exposes TCC Pricing

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II. Service Life
III. End of Service Life – Replace or Rebuild Review
IV. Bid Approach
V. Cost Savings Review
VI. Project Review

KD Vs Relife

- Cost
  - ***Usually ½ of Plan and Spec Project***
  - *Can be done with limited engineering (reduced fees, turn around time)*
  - *Limited General Trade Impacts*

NORTEK AIR SOLUTIONS

Cost Savings

Air Handler Replacement Project

- Equipment Cost (Modular) ~ $5/CFM
- Equipment Cost (Custom) ~ $7/CFM
- Install Cost ~ $5/CFM

Rebuild Costs

- CW Coils ~ $0.50/CFM
- UV Lights ~ $0.15/CFM
- HW Coils ~ $0.10/CFM
- Humidifiers ~ $0.10-0.50/CFM
- SF/RF ~ $2/CFM (includes VFD's)
- Install Cost ~ Varies but often $1-3/CFM

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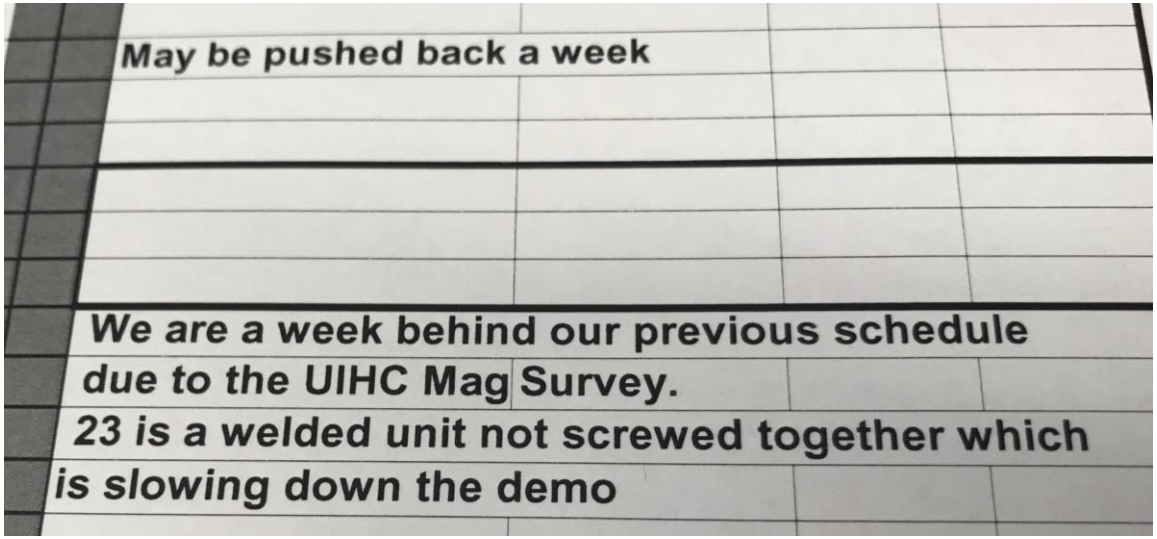
KD Vs Relife

- Time is a COST; Schedule Impact
  - *Weekends vs Weeks/Months*
  - *UIHC Project 3-Week Look Ahead Comment*



NORTEK AIR SOLUTIONS

Agenda

I. Background
II. Service Life
III. End of Service Life – Replace or Rebuild Review
IV. Bid Approach
V. Cost Savings Review
VI. Project Review

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MSI Sioux Falls St Luke's Project (Multiple in QCA)

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FANWALL® Is Easy To Unpack For Installation

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Easy To Cart FANWALL® Cells To Location

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Easy to Move FANWALL Through Hallways

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FANWALL® Fits Inside Standard Elevator

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Staging Area for FANWALL® Cells

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16-Year Old Temtrol® Air Handler

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Removing Old 30HP Motor

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Cutting Out Single Fan Wheel

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Future As A Boat Anchor

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Goodbye Belts

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Scrap

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Reconfigured from Blow-Thru to Draw-Thru

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Cooling Coil Still Good After 16 Years

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Reusing Existing Panels and Frame - Temtrol® Welded-Frame Construction Solid After 16-Years

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Heating Coils In Good Shape After 16 Years

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Reuse of Drain Pan

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Relocating Drain Pan

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Pre-Filter Section Reused

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FANWALL® retrofit pieces for sealing around FANWALL cells

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Past Cooling Coil Base Reinforced For FANWALL® Cells

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Time to bring in the FANWALL® Cells

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FANWALL® Cells Fit Thru Tight Spaces

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Four Men Safely Lift The FANWALL® Cell

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One

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Two

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Three

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And Four

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Ready for Electrical Wiring

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Space Downstream Of FANWALL® Cells Often Dictated By Access Requirements

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Repositioning the Coils

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Motor Wiring To Common Conduit Channel

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Conduit Channel Conceals Wiring

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Inlet Screens Upstream of FANWALL® Cell Help to Reduce Air Turbulence and Sound

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Space Savings From FANWALL® Cells Allowed Addition Of Air Blenders

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Unit Reconfigured And Re-piped

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Frequency Drive Re-Programmed for Design Condition Speed of 89 Hz

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Automation System Updated With New Set Points

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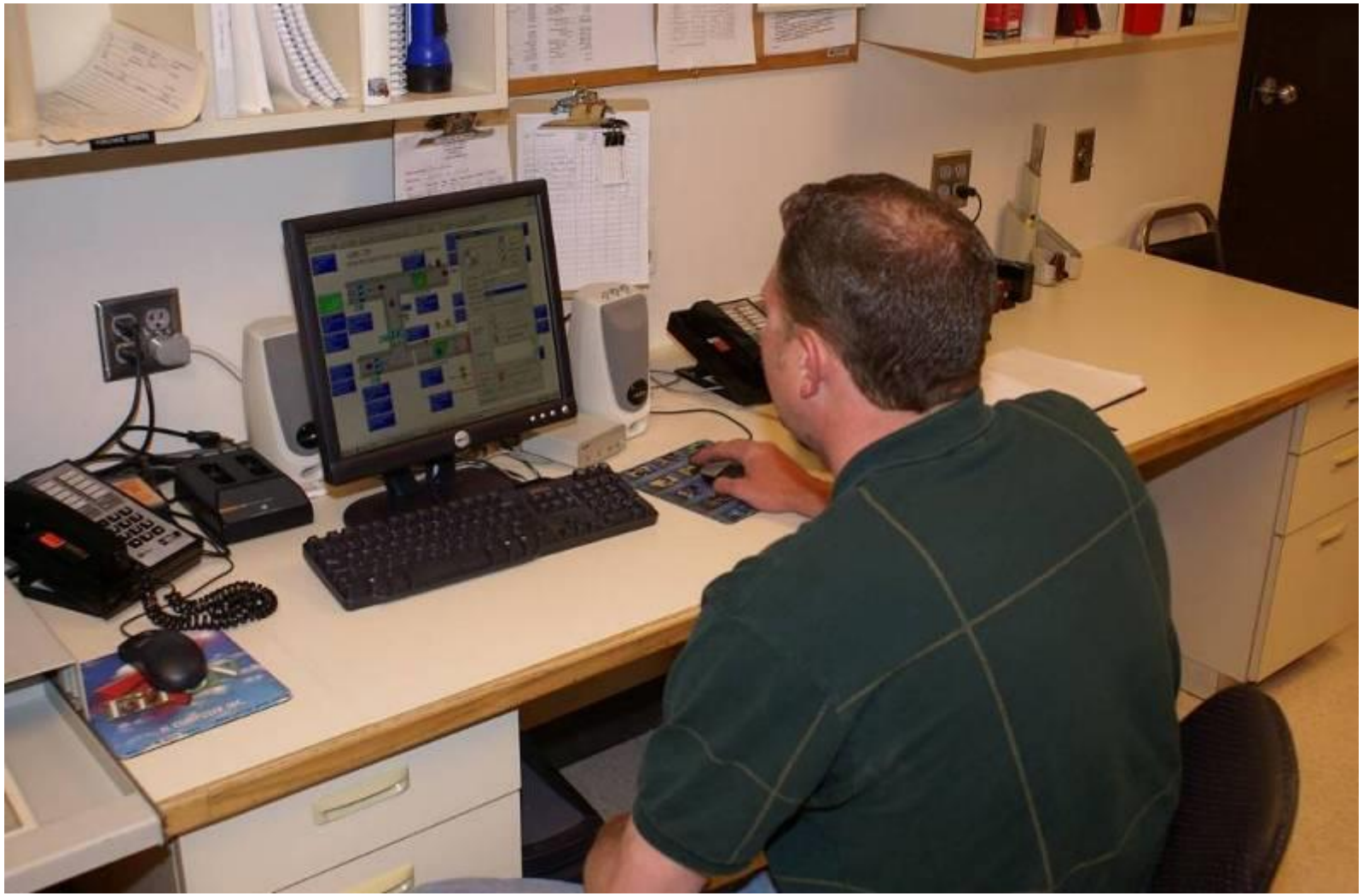

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New Drain Trap Designed Due To Static Pressure Change

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Timeline Overview

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- **4 pm Friday**
  - *Disassemble unit*
  - *Cut-out old fan*
  - *Rearrange sections from blow-thru to draw-thru*
- **Saturday**
  - *Install FANWALL™ array*
  - *Wire Fans*
  - *Reinstall Cooling Coils, Heating Coils and Humidifier*
  - *Add Air Blender*
- **6 pm Sunday**
  - *Re-pipe coils*
  - *Program VFD*
  - *Reprogram Automation System*
  - *Start-up*
- **Completed ahead of schedule**

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NORTEK™

Lifestyle innovations for home and work.

Thank You

Questions???

ILAPPA
Illinois Chapter of APPA

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