BOATMAN
CONSTRUCTION LLC

TRANSMITTAL

TO: **Xavier Cantu, AIA, RID**
XΛ|COLLECTIVE
21750 Hardy Oak Blvd
Suite 102
San Antonio, TX 78258

DISTRIBUTION:
Owner ☐
Architect ■
Contractor ■
Construction Mgr. ■

FROM: Morgan E. Chambers

VIA: Email

PHONE/E-MAIL: MorganC@BoatmanConst.com / 281-516-9826

DATE: July 20, 2022

SUBJECT: **Legent North Houston Surgical Hospital**

WE TRANSMIT:
X Attached
_____ Under Separate Cover

THE FOLLOWING:

_____	Drawings	_____	Shop Drawings
_____	Specifications	X	Submittals
_____	Change Order	X	Product Data / Cut Sheets
_____	Contract	_____	Other

BCLLC PROJECT NO.: 2222

ARCHITECTS PROJECT NO.: H.101.002

COPIES	DATE	DESCRIPTION
1	20-Jul-22	~~23 74 14~~.13 RTU.R1
		23 74 16.13

REMARKS:

Attached is the revised RTU submittal for Legent Hospital. Please expedite response due to current lead times. Current lead time is 20-22 weeks for unit; 6-8 weeks for curb and platform.

Please return set (1) set of submittals for future action.

Thank you,
Morgan E. Chambers

cc:
Shane D. Boatman
Marshall Reid
Kameron Raisi

☐ No Exceptions Taken ☐ No Action Taken ☐ Revise & Resubmit

☑ Exceptions Noted, Resubmittal Not Required

This review is only for general conformance with the design concept and the information given in the Construction Documents. Corrections or comments made on the shop drawings during this review do not relieve the contractor from compliance with the requirements of the plans and specifications. Review of a specific item shall not include review of an assembly of which the item is a component. The Contractor is responsible for dimensions to be confirmed and correlated at the jobsite: information that pertains solely to the fabrication process or to the means, methods, techniques, sequences and procedures of construction: coordination of the Work with that of all other trades and performing Work in a safe and satisfactory manner.

BY Brandon Rupp **DATE** 7/26/2022

SUBMITTAL#

SPEC#

KCI TECHNOLOGIES

1. Coordinate maintenance platform location with structural engineer and architect. Maintain all new and existing rooftop equipment clearance requirements.

2. Ensure controls for unit can be configured to accept signal from a low voltage kill switch to shut off power. Ensure electrical contractor is aware of the exact wiring requirements for kill switch.

LETSOS COMPANY
MECHANICAL CONTRACTORS

TRANSMITTAL MEMORANDUM

To: Boatman Construction, LLC
27905 Commercial Park Road, Suite 100
Tomball, TX 77375

Attn: Morgan Elizabeth Chambers

PROJECT: Legent Tomball Hospital

DATE: ***July 20, 2022***

Transmitted To You Herewith / Under Separate Cover is the Following:

☐	Prints	☐	Shop Drawings	☐	Supplementary Drawings
☐	Letter	☐	Specifications	☐	Samples
☐	Other	☒	ReSubmittal	☐	Hazcom/MSDS Manuals

One (1) electronic copy of :

23 74 14.13 - RTU.R1

Sent To You For The Following Reasons:

☐	Issued for Cost Estimate	☐	For Your Files
☐	Issued for Construction	☒	For Your Review and Approval
☐	For Your Information	☐	Return for Revisions
☐	Other		

REMARKS:

BY: *Cory Byrnes*

cc: ***23 74 14.13***

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E-Mail: letsosco@letsos.com Web Site: http://www.letsos.com

LETSOS COMPANY
MECHANICAL CONTRACTORS

RESUBMITTAL FOR

Legent Tomball Hospital

LETSOS JOB NO: 22111-12-13

ARCHITECT:	*Collective*
ENGINEER:	*KCI*
GENERAL CONTRACTOR:	*Boatman Construction, LLC*
SUBMITTED BY:	*Letsos Company*
SPECIFICATION NUMBER:	*23 74 14.13*
ITEM DESCRIPTION:	*RTU. R1*

LETSOS STAMP

THIS SHOP DRAWING HAS BEEN CHECKED PRIOR TO SUBMITTAL AND COMPLIES WITH THE GENERAL CONCEPT, SUBCONTRACTOR - SUPPLIER REMAINS RESPONSIBLE FOR COMPLYING WITH THE CONTRACT DOCUMENTS, VERIFYING AND CORRELATING DIMENSIONS AND QUANTITIES, AND FOR ANY EXCEPTIONS NOTED AFTER APPROVAL.
LETSOS COMPANY

BY: *Cory Byrnes*

DATE: July 20, 2022

GENERAL CONTRACTORS STAMP

SHOP DRAWING / SUBMITTAL REVIEW
☐ APPROVED ☒ APPROVE WITH CHANGES NOTED
☐ REVISE AND RESUBMIT ☐ REJECTED
SUBMITTAL WAS REVIEWED FOR DESIGN CONFORMITY AND GENERAL CONFORMANCE TO CONTRACT DOCUMENTS ONLY. THE SUBCONTRACTOR IS RESPONSIBLE FOR CONFIRMING AND CORRELATING DIMENSIONS AT JOBSITE FOR TOLERANCE, CLEARANCE, QUANTITIES, FABRICATION PROCESSES AND TECHNIQUES OF CONSTRUCTION, COORDINATION OF HIS WORK WITH OTHER TRADES AND FULL COMPLIANCE WITH CONTRACT DOCUMENTS
By: Morgan Chambers Date: 07/27/2022
BOATMAN CONSTRUCTION LLC

ARCHITECTS STAMP

ENGINEERS STAMP

TEXAS AIRSYSTEMS

SUBMITTAL
AS BUILT

AAON
AIR-COOLED PACKAGED DX ROOFTOP UNIT

LEGENT NORTH HOUSTON SURGICAL HOSPITAL

24429 TOMBALL PKWY, SUITE 200
TOMBALL, TX 77375

Architect:	XA Collective
Mechanical Engineer:	KCI Technologies
Mechanical Contractor:	Letsos Company
Date:	July 19, 2022
Revision:	1 – As Built
Submitted By:	J. Chase Williamson, P.E., LEED AP
Equipment Manufacturer:	AAON
Equipment Type:	Packaged, Large-Capacity, Rooftop Air-Conditioning Units
Specification Section:	237416.13
Unit Tags:	RTU-2-1
Notes:	Based on Plans Dated 6/30/2022 (Issue for Construction)

TEXAS AIRSYSTEMS

SUBMITTAL
AS BUILT

EQUIPMENT DESCRIPTION

AAON AIR-COOLED PACKAGED DX ROOFTOP UNIT

Qty. (1) Model RN Series, Vertical Airflow, DX Cooling, No Heating, Air-Cooled Packaged DX Rooftop Unit Designed for **460V/3Ph/60HZ** Power and Complete as Follows:

- G90 Galvanized Steel Casing with Enamel Finish Withstanding 2,500 Hour Salt Spray per ASTM B117-95
- Unit Cabinet is Thermally Broken Double Wall Construction with 2" Thick, R-13 Foam Insulated Panels
- Access Doors with Full Length, Stainless Steel, Piano Hinges and Quarter Turn, Zinc Cast Lockable Handles
- Modulating Variable Capacity Digital Scroll Compressors – All Circuits
- OA Hood w/ Birdscreen + Enthalpy Controlled, Fully Modulating, Economizer + Barometric Relief Dampers
- Qty. (2) Power Return Fans + Prem. Eff., Shaft Grounded, ODP Motors + VFDs
- 2" MERV 8 Unit Filters (2 Sets) + Magnehelic Gauge + Clogged Filter Switch
- R-410a DX Evaporator Coil in Galv. Steel Casing + #304 SS Drain Pan + Float Switch
  - UV-C Lights per Spec Section 230566
- Qty. (2) Direct Drive Plenum Supply Fans + Prem. Eff., Shaft Grounded, ODP Motors + VFDs
- Microchannel AL Modulating Hot Gas Reheat Coil
- AL Microchannel Air-Cooled Condenser Coils + Variable Speed ECM Condenser Fan Head Pressure Controls
- Single Point Power Connection + Non-Fused Disconnect Switch + Powered Convenience Outlet + Phase and Brown Out Protection
- AAON VCCX2 DDC Controller w/ BACnet MS/TP Interface
  - Factory Installed Sensors: OA Temp/RH, Proof of Flow, Dirty Filter, Drain Pan Float
  - Field Installed Sensors: Supply Air Temp, Space Temp/RH, SA Duct Static Pressure

Field Installed Items Provided by TAS:

- Custom Final Filter Roof Curb
  - HEPA Filters (2 Sets)
  - Integral Two-Sided Catwalk w/ Handrails & Access Ladder
  - Wind/Seismic Construction (Includes PE Stamped/Signed Curb Calculations)

Services and Warranties:

- Freight to Jobsite
- Standard One Year Warranty on All Parts
- Five Year Compressor Parts Warranty
- Factory Start-Up & Owner Training

Clarifications:

1) All Airflow Measurement Stations are Excluded and are to be Provided, Installed, & Monitored by the BAS Subcontractor.
2) Smoke Detectors are Excluded and are to be Provided, Installed, & Wired to the RTU Emergency Shutdown Terminals by the Fire Alarm Subcontractor.
3) CO2 Sensors for Demand Control Ventilation are Excluded and are to be Provided, Installed, & Monitored by the BAS Subcontractor.

Not Included: Labor Warranties; Airflow Monitoring Stations; CO2 Sensors; Motorized Relief Dampers; VFD Feedback; Coil Coatings; Smoke Detector; Installation and Wiring of Field Mounted Sensors; Fire Stats; Additional Sets of Filters; Items Not Specifically Listed Above.

SECTION 237416.13 - PACKAGED, LARGE-CAPACITY, ROOFTOP AIR-CONDITIONING UNITS

NOTED

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes packaged, large-capacity, rooftop air conditioning units (RTUs) with the following components:

1. Casings.
2. Fans, drives, and motors.
3. Coils.
4. Refrigerant circuit components.
5. Air filtration.
6. UV germicidal irradiation section.
7. Dampers.
8. Electrical power connections.
9. Controls.
10. Roof curbs.
11. Accessories.

1.3 DEFINITIONS

A. RTU: Rooftop unit. As used in this Section, this abbreviation means packaged, large-capacity, rooftop air-conditioning units. This abbreviation is used regardless of whether the unit is mounted on the roof or on a concrete base on ground.

COMPLY

1.4 ACTION SUBMITTALS

A. Product Data: For each RTU.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
2. Include rated capacities, dimensions, required clearances, characteristics, furnished specialties, and accessories.
3. Include unit dimensions and weight.
4. Include cabinet material, metal thickness, finishes, insulation, and accessories.
5. Fans:

COMPLY

a. Include certified fan-performance curves with system operating conditions indicated.
b. Include certified fan-sound power ratings.
c. Include fan construction and accessories.
d. Include motor ratings, electrical characteristics, and motor accessories.

6. Include certified coil-performance ratings with system operating conditions indicated.
7. Include filters with performance characteristics.
8. Include gas furnaces with performance characteristics.
9. Include factory selection calculations for each antimicrobial ultraviolet lamp installation.
10. Include dampers, including housings, linkages, and operators.

B. Shop Drawings: For each packaged, large-capacity, rooftop air-conditioning units.

1. Include plans, elevations, sections, and mounting details.
2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Include diagrams for power, signal, and control wiring.

C. Delegated-Design Submittal: For RTU supports indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
1. Detail mounting, securing, and flashing of roof curb to roof structure. Indicate coordinating requirements with roof membrane system.
2. Wind-Restraint Details: Detail fabrication and attachment of wind and seismic restraints and snubbers. Show anchorage details and indicate quantity, diameter, and depth of penetration of anchors.

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Floor plans and other details, or BIM model, drawn to scale, showing the items described in this Section, and coordinated with all building trades.

B. Sample Warranty: For manufacturer's warranty.

C. Product Certificates: Submit certification that specified equipment will withstand wind forces identified in "Performance Requirements" Article and in Section 230548 "Vibration and Seismic Controls for HVAC."

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculations.
2. Dimensioned Outline Drawings of Equipment Unit: Identify center of wind force and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

D. Source quality-control reports.

COMPLY

E. System startup reports.

F. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For RTUs to include in emergency, operation, and maintenance manuals.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Filters: One set(s) of filters for each unit.

1.8 WARRANTY

A. Warranty: Manufacturer agrees to repair or replace components of outdoor, semi-custom, air-handling unit that fail in materials or workmanship within specified warranty period.

1. Warranty Period: one year(s) from date of Substantial Completion.
2. Warranty Period for Heat Exchangers: Manufacturer's standard, but not less than five years from date of Substantial Completion

NOTE: ALL WARRANTIES ARE PARTS ONLY; LABOR IS NOT INCLUDED.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and application.

B. NFPA Compliance: Comply with NFPA 90A for design, fabrication, and installation of RTUs and components.

C. ASHRAE 62.1 Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and Startup."

D. ASHRAE 15 Compliance: For refrigeration system safety.

E. ASHRAE/IES 90.1 Compliance: Applicable requirements in ASHRAE/IES 90.1, Section 6 - "Heating, Ventilating, and Air-Conditioning."

F. UL Compliance: Comply with UL 1995.

COMPLY

G. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design mounting and restraints for RTUs, including comprehensive engineering analysis.

1. Design RTU supports to comply with wind performance requirements.

H. Wind-Restraint Performance:

1. Basic Wind Speed: 140.
2. Building Classification Category: IV.
3. Minimum 10 lb/sq. ft. multiplied by the maximum area of the mechanical component projected on a vertical plane that is normal to the wind direction, and 45 degrees either side of normal.

2.2 MANUFACTURERS

A. ~~Carrier, Daikin,~~ Aaon, ~~Trane, & JCI~~

2.3 UNIT CASINGS

A. General Fabrication Requirements for Casings: Formed and reinforced double-wall insulated panels, fabricated to allow removal for access to internal parts and components, with joints between sections sealed.

B. Double-Wall Construction:

1. Outside Casing Wall: Galvanized steel, minimum 18 gauge thick with manufacturer's standard finish, with pitched roof panels and knockouts with grommet seals for electrical and piping connections and lifting lugs.
2. Inside Casing Wall: G90-coated galvanized steel, 0.034 inch thick.
3. Floor Plate: G90 galvanized steel, minimum 18 gauge thick.
4. Casing Insulation:

a. Materials: Injected polyurethane foam insulation.
b. Casing Panel R-Value: Minimum R-13.
c. Insulation Thickness: 2 inches.
d. Thermal Break: Provide continuity of insulation with no through-casing metal in casing walls, floors, or roof of unit.

C. Airstream Surfaces: Surfaces in contact with airstream shall comply with requirements in ASHRAE 62.1.

D. Static-Pressure Classifications:

1. For Unit Sections Upstream of Fans: Minus 3-inch wg.
2. For Unit Sections Downstream and Including Fans: 4-inch wg.

E. Panels and Doors:

COMPLY

1. Panels:

   a. Fabrication: Formed and reinforced with same materials and insulation thickness as casing.
   b. Fasteners: Two or more camlock type for panel lift-out operation. Arrangement shall allow panels to be opened against air-pressure differential.
   c. Gasket: Neoprene, applied around entire perimeters of panel frames.
   d. Size: Large enough to allow inspection and maintenance of air-handling unit's internal components. Dimensions to be at least 18 inches wide by full height of unit casing up to a maximum height of 72 inches.

2. Access Doors:

   a. Hinges: A minimum of two ball-bearing hinges or stainless steel piano hinge and two wedge-lever-type latches, operable from inside and outside. Arrange doors to be opened against air-pressure differential.
   b. Gasket: Neoprene, applied around entire perimeters of panel frames.
   c. Size: Large enough to allow inspection and maintenance of air-handling unit's internal components. Dimensions to be at least 18 inches wide by full height of unit casing up to a maximum height of 72 inches.

3. Locations and Applications:

   a. Fan Section: Doors.
   b. Access Section: Doors.
   c. Coil Section: Inspection and access panels.
   d. Damper Section: Doors.
   e. Filter Section: Doors large enough to allow periodic removal and installation of filters.
   f. Mixing Section: Doors.

DEVIATION NOT AVAILABLE ON PACKAGED RTUs

4. Service Light: 100-W vaporproof fixture with switched junction box located outside or inside adjacent to door.

   a. Locations: Each section accessed with door.

COMPLY

F. Condensate Drain Pans:

1. Location: Each type of cooling coil and rotary heat exchanger.
2. Construction:
   a. Double-wall, stainless steel sheet with space between walls filled with foam insulation and moisture-tight seal.

3. Drain Connection:

   a. Located at lowest point of pan and sized to prevent overflow. Terminate with threaded nipple on one end or both ends of pan.
   b. Minimum Connection Size: NPS 1.

COMPLY

4. Slope: Minimum 0.125-in./ft. slope, to comply with ASHRAE 62.1, in at least two planes to collect condensate from cooling coils (including coil piping connections, coil headers, and return bends) and from humidifiers and to direct water toward drain connection.
5. Length: Extend drain pan downstream from leaving face for distance to comply with ASHRAE 62.1.
6. Width: Entire width of water producing device.
7. Depth: A minimum of 2 inches deep.
8. Units with stacked coils shall have an intermediate drain pan to collect condensate from top coil.

2.4 FANS, DRIVES, AND MOTORS

A. Fan and Drive Assemblies: Statically and dynamically balanced and designed for continuous operation at maximum-rated fan speed and motor horsepower.

B. Supply-Air Fans: Centrifugal, rated according to AMCA 210; galvanized or painted steel; mounted on solid-steel shaft.

1. Shafts: With field-adjustable alignment.

   a. Turned, ground, and polished hot-rolled steel with keyway.

2. Shaft Bearings:

   a. Heavy-duty, self-aligning, pillow-block type with an L-50 rated life of minimum 100,000 hours according to ABMA 9.

3. Housings: Formed- and reinforced-steel panels to form curved scroll housings with shaped cutoff and spun-metal inlet bell.

   a. Bracing: Steel angle or channel supports for mounting and supporting fan scroll, wheel, motor, and accessories.

4. Centrifugal Fan Wheels: Inlet flange, backplate, and shallow blades with inlet and tip curved forward in direction of airflow and mechanically fastened to flange and backplate; steel or aluminum hub swaged to backplate and fastened to shaft with setscrews.
5. Mounting: For internal vibration isolation. Factory-mount fans with manufacturer's standard vibration isolation mounting devices having a minimum static deflection of 1 inch.
6. Shaft Lubrication Lines: Extended to a location outside the casing.
7. Flexible Connector: Factory fabricated with a fabric strip minimum 3-1/2 inches wide, attached to two strips of minimum 2-3/4-inch-wide by 0.028-inch-thick, galvanized-steel sheet.

   a. Flexible Connector Fabric: Glass fabric, double coated with neoprene. Fabrics, coatings, and adhesives shall comply with UL 181, Class 1.

C. Drives, Direct: Factory-mounted, direct drive.

N/A

D. Drives, Belt: Factory-mounted, V-belt drive, with adjustable alignment and belt tensioning, and with 1.5 service factor based on fan motor.

1. Pulleys: Cast iron or cast steel with split, tapered bushing, dynamically balanced at the factory.
2. Belts: Oil resistant, non-sparking and nonstatic; in matched sets for multiple-belt drives.
3. Belt Guards: Comply with requirements specified by OSHA and fabricate according to SMACNA's "HVAC Duct Construction Standards"; 0.146-inch- thick, 3/4-inch diamond-mesh wire screen, welded to steel angle frame; prime coated.

COMPLY

E. Condenser-Coil Fan: Variable-speed propeller, mounted on shaft of permanently lubricated ECM motors.

F. Motors:

1. Comply with NEMA designation, temperature rating, service factor, and efficiency requirements for motors specified in Section 230513 "Common Motor Requirements for HVAC Equipment."
2. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
3. Motor Pulleys: Adjustable pitch for use with 5-hp motors and smaller; fixed pitch for use with motors larger than 5 hp. Select pulley size so pitch adjustment is at the middle of adjustment range at fan design conditions.
4. Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in electrical Sections.

2.5 COILS

A. General Requirements for Coils:

1. Comply with AHRI 410.
2. Fabricate coils section to allow removal and replacement of coil for maintenance and to allow in-place access for service and maintenance of coil(s).
3. Coils shall not act as structural component of unit.

COMPLY AS NOTED

B. Supply-Air Refrigerant Coil:

1. Tubes: Copper.
2. Fins:

   a. Material: ~~Copper.~~ → ALUMINUM: APPROVED BY EOR
   b. Fin Spacing: Maximum 12 fins per inch.

3. Fin and Tube Joints: Mechanical bond.
4. Headers: Seamless-copper headers with brazed connections.
5. Frames: ~~Stainless steel.~~ → GAVL. STEEL DUE TO GLOBAL MATERIAL SHORTAGES
6. Coatings: None.
7. Ratings: Designed, tested, and rated according to ASHRAE 33 and AHRI 410.

COMPLY AS NOTED

a. Working Pressure: Minimum 300 psig.

C. Outdoor-Air Refrigerant Coil:

1. Tubes: ~~Copper.~~ > ALUMINUM MICROCHANNEL
2. Fins:

a. Material: Aluminum or Copper.
b. Fin Spacing: Maximum 12 fins per inch.

3. Fin and Tube Joints: Mechanical bond.
4. Headers: Seamless-copper headers with brazed connections.
5. Frames: ~~Stainless steel.~~ > ALUMINUM
6. Coatings: None.
7. Ratings: Designed, tested, and rated according to ASHRAE 33 and AHRI 410.

a. Working Pressure: Minimum 300 psig.

D. Hot-Gas Reheat Refrigerant Coil:

1. Tubes: ~~Copper.~~ > ALUMINUM MICROCHANNEL
2. Fins:

a. Material: ~~Copper.~~ > ALUMINUM MICROCHANNEL
b. Fin Spacing: Maximum 12 fins per inch.

3. Fin and Tube Joints: Mechanical bond.
4. Headers: Seamless-copper headers with brazed connections.
5. Frames: ~~Stainless steel.~~ > ALUMINUM
6. Coatings: None.
7. Ratings: Designed, tested, and rated according to ASHRAE 33 and AHRI 410.

a. Working Pressure: Minimum 300 psig.

8. Suction-discharge bypass valve.

COMPLY

2.6 REFRIGERANT CIRCUIT COMPONENTS

A. Compressor: Hermetic, variable speed scroll, mounted on vibration isolators; with internal overcurrent and high-temperature protection, internal pressure relief, and crankcase heater.

B. Refrigeration Specialties:

1. Refrigerant: R-410A.
2. Expansion valve with replaceable thermostatic element.
3. Refrigerant filter/dryer.
4. Manual-reset high-pressure safety switch.
5. Automatic-reset low-pressure safety switch.
6. Minimum off-time relay.

COMPLY

7. Automatic-reset compressor motor thermal overload.
8. Brass service valves installed in compressor suction and liquid lines.
9. Low-ambient kit high-pressure sensor.
10. Hot-gas reheat solenoid valve modulating with a replaceable magnetic coil.
11. Four-way reversing valve with a replaceable magnetic coil, thermostatic expansion valves with bypass check valves, and a suction line accumulator.

2.7 AIR FILTRATION

A. Particulate air filtration is specified in Section 234100 "Particulate Air Filtration."

B. Adhesive, Sustainability Projects: As recommended by air-filter manufacturer and with a VOC content of 80 g/L or less.

2.8 ANTIMICROBIAL ULTRAVIOLET LAMP SYSTEM NOTE: SUBMITTED UNDER SEPARATE COVER

A. UV-C Systems: Comply with requirements in Section 230566 " AntiMicrobial Ultraviolet Lamp Systems for HVAC"

2.9 DAMPERS NOTE: DAMPERS ARE CONSTRUCTED OF ALUMINUM

A. Dampers: Comply with requirements in Section 230923.12 "Control Dampers."

B. Damper Operators: Comply with requirements in Section 230923.12 "Control Dampers."

2.10 ELECTRICAL POWER CONNECTIONS

A. RTU shall have a single connection of power to unit with unit-mounted disconnect switch accessible from outside unit and control-circuit transformer with built-in overcurrent protection.

2.11 CONTROLS

A. Basic Unit Controls:

1. Control-voltage transformer.
2. Wall-mounted thermostat or sensor with the following features:

    a. Heat-cool-off switch.
    b. Fan on-auto switch.
    c. Fan-speed switch.
    d. Automatic changeover.
    e. Adjustable deadband.
    f. Exposed set point.
    g. Exposed indication.
    h. Degree F indication.
    i. Unoccupied-period-override push button.

COMPLY

j. Data entry and access port to input temperature and humidity set points, occupied and unoccupied periods, and output room temperature and humidity, supply-air temperature, operating mode, and status.

3. Wall-mounted humidistat or sensor with the following features:

a. Exposed set point.
b. Exposed indication.

4. Unit-Mounted Annunciator Panel for Each Unit:

a. Lights to indicate power on, cooling, heating, fan running, filter dirty, and unit alarm or failure.
b. DDC controller or programmable timer and interface with HVAC instrumentation and control system.
c. Digital display of outdoor-air temperature, supply-air temperature, return-air temperature, economizer damper position, indoor-air quality, and control parameters.

COMPLY AS NOTED B. DDC Controller:

1. Controller shall have volatile-memory backup.
2. Safety Control Operation:

NOTE: SMOKE DETECTORS AND FIRESTATS BY FIRE ALARM SUBCONTRACTOR

a. Smoke Detectors: Stop fan and close outdoor-air damper if smoke is detected. Provide additional contacts for alarm interface to fire alarm control panel.
b. Firestats: Stop fan and close outdoor-air damper if air greater than 130 deg F enters unit. Provide additional contacts for alarm interface to fire alarm control panel.
c. Fire Alarm Control Panel Interface: Provide control interface to coordinate with operating sequence described in Section 284621.11 "Addressable Fire-Alarm Systems." or Section 284621.13 "Conventional Fire-Alarm Systems."

COMPLY

d. Defrost Control for Condenser Coil: Pressure differential switch to initiate defrost sequence.

3. Scheduled Operation: Occupied and unoccupied periods on seven-day clock with a minimum of four programmable periods per day.
4. Unoccupied Period:

a. Heating Setback: Plus 10 deg F.
b. Cooling Setback: System off.
c. Override Operation: Two hours.

5. Supply Fan Operation:

a. Occupied Periods: Run fan continuously.
b. Unoccupied Periods: Cycle fan to maintain setback temperature.

6. Refrigerant Circuit Operation:

a. Occupied Periods: Cycle or stage compressors to match compressor output to cooling load to maintain room temperature and humidity. Cycle condenser fans to

COMPLY

maintain maximum hot-gas pressure. Operate low-ambient control kit to maintain minimum hot-gas pressure.

b. Unoccupied Periods: Cycle compressors and condenser fans for heating to maintain setback temperature.
c. Switch reversing valve for heating or cooling mode on air-to-air heat pump.

7. Hot-Gas Reheat-Coil Operation:

a. Occupied Periods: Humidistat opens hot-gas valve to provide hot-gas reheat, and cycles compressor.
b. Unoccupied Periods: Reheat not required.

8. Economizer Outdoor-Air Damper Operation:

a. Morning cool down cycles.
b. Occupied Periods: Open to 15 percent fixed minimum intake, and maximum 100 percent of the fan capacity. Controller shall permit air-side economizer operation when outdoor air is less than 65 deg F. Use outdoor-air temperature to adjust mixing dampers. During economizer cycle operation, lock out cooling.
c. Unoccupied Periods: Close outdoor-air damper and open return-air damper.

BY BAS

d. Outdoor-Airflow Monitor: Accuracy maximum plus or minus 5 percent within 15 and 100 percent of total outdoor air. Monitor microprocessor shall adjust for temperature, and output shall range from 2- to 10-V dc or 4 to 20 mA.

9. Terminal-Unit Relays:

a. Provide heating- and cooling-mode changeover relays compatible with terminal control system required in Section 233600 "Air Terminal Units" and Section 230923 "Direct Digital Control (DDC) System for HVAC."

COMPLY

C. Interface Requirements for HVAC Instrumentation and Control System:

1. Interface relay for scheduled operation.
2. Interface relay to provide indication of fault at the central workstation and diagnostic code storage.
3. Provide BACnet compatible interface for central HVAC control workstation for the following:

a. Adjusting set points.
b. Monitoring supply fan start, stop, and operation.
c. Inquiring data to include outdoor-air damper position, supply- and room-air temperature and humidity.
d. Monitoring occupied and unoccupied operations.
e. Monitoring constant and variable motor loads.
f. Monitoring variable-frequency drive operation.
g. Monitoring cooling load.
h. Monitoring economizer cycles.
i. Monitoring air-distribution static pressure and ventilation air volume.

COMPLY

2.12 ROOF CURBS

A. Roof curbs with vibration isolators and wind or seismic restraints are specified in Section 230548 "Vibration and Seismic Controls for HVAC."

B. Materials: Galvanized steel with corrosion-protection coating, watertight gaskets, and factory-installed wood nailer; complying with NRCA standards.

1. Curb Insulation and Adhesive: Comply with NFPA 90A or NFPA 90B.

   a. Materials: ASTM C1071, Type I or II.
   b. Thickness: minimum 1-1/2 inches.

2. Application: Factory applied with adhesive and mechanical fasteners to the internal surface of curb.

   a. Liner Adhesive: Comply with ASTM C916, Type I.
   b. Mechanical Fasteners: Galvanized steel, suitable for adhesive attachment, mechanical attachment, or welding attachment to duct without damaging liner when applied as recommended by manufacturer and without causing leakage in cabinet.
   c. Liner materials applied in this location shall have air-stream surface coated with a temperature-resistant coating or faced with a plain or coated fibrous mat or fabric depending on service air velocity.
   d. Liner Adhesive: Comply with ASTM C916, Type I.

C. Curb Dimensions: minimum Height of 12 inches.

2.13 ACCESSORIES

A. Duplex, 115-V, ground-fault-interrupter outlet with 15-A overcurrent protection. Include transformer if required. Outlet shall be energized even if the unit main disconnect is open.

B. Low-ambient kit using variable-speed condenser fans for operation down to 35 deg F.

C. Filter differential pressure switch with sensor tubing on either side of filter. Set for final filter pressure loss.

D. Remote potentiometer to adjust minimum economizer damper position.

N/A

E. Return-air bypass damper. NOTE: PROVIDING MODULATING HOT GAS REHEAT

BY BAS IF REQUIRED

F. Factory- or field-installed demand-controlled ventilation.

COMPLY AS NOTED

G. Safeties:

1. ~~Smoke detector~~ NOTE: SMOKE DETECTORS AND FIRESTATS BY FIRE ALARM SUBCONTRACTOR
2. Condensate overflow switch.
3. Phase-loss protection.

COMPLY

4. High and low pressure control.

N/A

H. Hail guards of galvanized steel, painted to match casing. NOTE: COILS ARE SLANTED INWARD AND ARE NOT EXPOSED

I. Concentric diffuser with white louvers and polished aluminum return grilles, insulated diffuser box with mounting flanges, and interior transition.

J. Vertical vent extensions to increase the separation between the outdoor-air intake and the flue-gas outlet.

BY BAS IF REQUIRED

K. Door switches to disable heating or reset set point when open.

COMPLY

L. Outdoor air intake weather hood with moisture eliminator as required.

DEVIATION NOT AVAILABLE ON PACKAGED RTUs

M. Service Lights and Switch: Factory installed in each accessible section with weatherproof cover. Factory wire lights to a single-point field connection.

COMPLY

2.14 MATERIALS

A. Steel:

1. ASTM A36/A36M for carbon structural steel.
2. ASTM A568/A568M for steel sheet.

B. Stainless Steel:

1. Manufacturer's standard grade for casing.
2. Manufacturer's standard type, ASTM A240/A240M for bare steel exposed to airstream or moisture.

C. Galvanized Steel: ASTM A653/A653M.

D. Aluminum: ASTM B209.

2.15 SOURCE QUALITY CONTROL

A. AHRI Compliance:

1. Comply with AHRI 340/360 for testing and rating energy efficiencies for RTUs.
2. Comply with AHRI 210/240 for testing and rating energy efficiencies for RTUs
3. Comply with AHRI 270 for testing and rating sound performance for RTUs.
4. Comply with AHRI 1060 for testing and rating performance for air-to-air exchanger.

B. AMCA Compliance:

1. Comply with AMCA 11 and bear the AMCA-Certified Ratings Seal for air and sound performance according to AMCA 211 and AMCA 311.
2. Damper leakage tested in accordance with AMCA 500-D.
3. Operating Limits: Classify according to AMCA 99.

COMPLIANCE BY INSTALLING CONTRACTOR

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of RTUs.

B. Examine roughing-in for RTUs to verify actual locations of piping and duct connections before equipment installation.

C. Examine roofs for suitable conditions where RTUs will be installed.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Roof Curb: Install on roof structure or concrete base, level and secure, according to NRCA's "NRCA Roofing Manual: Membrane Roof Systems." or AHRI Guideline B. Install RTUs on curbs and coordinate roof penetrations and flashing with roof construction specified in Section 077200 "Roof Accessories." Secure RTUs to upper curb rail, and secure curb base to roof framing or concrete base with anchor bolts. Coordinate sizes and locations of roof curbs with actual equipment provided.

N/A 1. Install RD NIC-DS-52-E, BRD Hushcore DS-52, or equal manufacturer and method on mechanical rooftop units used for comfort or process cooling or heating on metal roof deck.

B. Unit Support: Install unit level on structural curbs. Coordinate wall penetrations and flashing with wall construction. Secure RTUs to structural support with anchor bolts.

C. Equipment Mounting:
1. Comply with requirements for vibration isolation devices specified in Section 230548.13 "Vibration Controls for HVAC."

3.3 PIPING CONNECTIONS

A. Piping installation requirements are specified in other Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Where installing piping adjacent to RTU, allow space for service and maintenance.

C. Connect piping to unit mounted on vibration isolators with flexible connectors.

D. Connect condensate drain pans using NPS 1-1/4, ASTM B88, Type M copper tubing. Extend to nearest equipment or roof drain. Construct deep trap at connection to drain pan and install cleanouts at changes in direction.

COMPLIANCE BY INSTALLING CONTRACTOR

E. Refrigerant Piping: Comply with applicable requirements in Section 232300 "Refrigerant Piping." Install shutoff valve and union or flange at each supply and return connection.

3.4 DUCT CONNECTIONS

A. Comply with duct installation requirements specified in other HVAC Sections. Drawings indicate the general arrangement of ducts. The following are specific connection requirements:

1. Install ducts to termination at top of roof curb.
2. Remove roof decking only as required for passage of ducts. Do not cut out decking under entire roof curb.
3. Connect supply ducts to RTUs with flexible duct connectors specified in Section 233300 "Air Duct Accessories."
4. Install return-air duct continuously through roof structure.

3.5 ELECTRICAL CONNECTIONS

A. Connect electrical wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

B. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."

C. Install electrical devices furnished by manufacturer, but not factory mounted, according to NFPA 70 and NECA 1.

D. Install nameplate for each electrical connection, indicating electrical equipment designation and circuit number feeding connection.

1. Nameplate shall be laminated acrylic or melamine plastic signs as specified in Section 260553 "Identification for Electrical Systems."
2. Locate nameplate where easily visible.

3.6 CONTROL CONNECTIONS

A. Install control and electrical power wiring to field-mounted control devices.

B. Connect control wiring according to Section 260523 "Control-Voltage Electrical Power Cables."

COMPLY

3.7 STARTUP SERVICE

A. Perform startup service.

B. Complete installation and startup checks according to manufacturer's written instructions.

1. Inspect for visible damage to unit casing.

COMPLY

2. Inspect for visible damage to furnace combustion chamber.
3. Inspect for visible damage to compressor, coils, and fans.
4. Inspect internal insulation.
5. Verify that labels are clearly visible.
6. Verify that clearances have been provided for servicing.
7. Verify that controls are connected and operable.
8. Verify that filters are installed.
9. Clean condenser coil and inspect for construction debris.
10. Remove packing from vibration isolators.
11. Inspect operation of barometric relief dampers.
12. Verify lubrication on fan and motor bearings.
13. Inspect fan-wheel rotation for movement in correct direction without vibration and binding.
14. Adjust fan belts to proper alignment and tension.
15. Start unit according to manufacturer's written instructions.

    a. Start refrigeration system.
    b. Do not operate below recommended low-ambient temperature.
    c. Complete startup sheets and attach copy with Contractor's startup report.

16. Inspect and record performance of interlocks and protective devices; verify sequences.
17. Operate unit for an initial period as recommended or required by manufacturer.

18. Calibrate thermostats.
19. Adjust and inspect high-temperature limits.
20. Inspect outdoor-air dampers for proper stroke and interlock with return-air dampers.
21. Start refrigeration system and measure and record the following when ambient is a minimum of 15 deg F above return-air temperature:

    a. Coil leaving-air, dry- and wet-bulb temperatures.
    b. Coil entering-air, dry- and wet-bulb temperatures.
    c. Outdoor-air, dry-bulb temperature.
    d. Outdoor-air-coil, discharge-air, dry-bulb temperature.

22. Inspect controls for correct sequencing of heating, mixing dampers, refrigeration, and normal and emergency shutdown.
23. Measure and record the following minimum and maximum airflows. Plot fan volumes on fan curve.

    a. Supply-air volume.
    b. Return-air volume.
    c. Relief-air volume.
    d. Outdoor-air intake volume.

24. Simulate maximum cooling demand and inspect the following:

    a. Compressor refrigerant suction and hot-gas pressures.
    b. Short circuiting of air through condenser coil or from condenser fans to outdoor-air intake.

COMPLY

25. Verify operation of remote panel including pilot-light operation and failure modes. Inspect the following:

    a. High-temperature limit on gas-fired heat exchanger.
    b. Low-temperature safety operation.
    c. Filter high-pressure differential alarm.
    d. Economizer to minimum outdoor-air changeover.
    e. Relief-air fan operation.
    f. Smoke and firestat alarms.

26. After startup and performance testing and prior to Substantial Completion, replace existing filters with new filters.

COMPLIANCE BY INSTALLING CONTRACTOR

3.8 ADJUSTING

A. Adjust damper linkages for proper damper operation.

B. Comply with requirements in Section 230593 "Testing, Adjusting, and Balancing for HVAC" for air-handling system testing, adjusting, and balancing.

C. Occupancy Adjustments: When requested within 12 months from date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose.

3.9 CLEANING

A. After completing system installation and testing, adjusting, and balancing RTUs and air-distribution systems and after completing startup service, clean RTUs internally to remove foreign material and construction dirt and dust. Clean fan wheels, cabinets, dampers, coils, and filter housings, and install new, clean filters.

3.10 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. After installing RTUs and after electrical circuitry has been energized, test units for compliance with requirements.
2. Inspect for and remove shipping bolts, blocks, and tie-down straps.
3. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

B. RTU will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

COMPLY

3.11 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain RTUs.

END OF SECTION 237416.13

Unit Submittal

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1 2 3A 3B 3C 3D 3E 4A 4B 4C 5A 5B 5C 5D 5E 6A 6B 6C 6D 6E 7 8 9A 9B 9C 9D

RNA-070-D-0-3-EAB0B-00000:00-AAFAL-H00-BCCAH-00000-DC-000J-
00-E0-A-AV0-0K-DA0B-00-000-A00A00-C000AA-000000X

10A 10B 11A 11B 12 13A 13B 13C 14 15 16A 16B 16C 16D 17A 17B 18A 18B 18C 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37

Tag: RTU-2-1

Job Name: *Legent North Houston Surgical Hospital*

Job Number: *HCW-22*

Unit Submittal For:

Unit Submittal Date: *July 19, 2022*

	Base Option	Description
RN	Generation	RN Series
A	Major Revision	Major Revision A
070	Unit Size	Seventy
D	Series	D Series
0	Minor Revision	Minor Revision 0
3	Voltage	460V/3?/60Hz
E	Compressor Style	R410A Variable Capacity Scroll Comp (4-circuit)
A	Condenser Style	Microchannel Air-Cooled Condenser
B	Indoor Coil Configuration	6 Row Evaporator
0	Cooling Heat Exchanger Construction	Standard
B	Cooling Staging	2 Variable Capacity Comp + 2 On/Off Comp
0	Heat Type	No Heat
0	Heat Construction	Standard
0	Heat Designation	No Heat
0	Heat Staging	No Heat
0	Heat Pump Auxiliary Heating	No Heat Pump

	Feature Option	Description
0	1. Unit Orientation	Standard Access - Hinged Access Doors with Lockable Handles
0	2. Supply & Return Locations	Bottom Supply--Bottom Return
A	3A. Supply Fan Quantity	2 Fans
A	3B. Supply Fan Configuration	1 Fan per VFD + Full Width Fan
F	3C. Supply Fan Size	24" Direct Drive Backward Curved Aluminum
A	3D. Supply Fan Motor Type	High Efficiency Open Motor (1,800 nominal rpm)
L	3E. Supply Fan Motor Size	15 hp
H	4A. Outside Air Section	Economizer + Power Return
0	4B. Energy Recovery Type	No Energy Recovery
0	4C. Energy Recovery Size	No Energy Recovery
B	5A. Return Fan Quantity	2 Fans
C	5B. Return Fan Configuration	2 Fans per VFD
C	5C. Return Fan Size	36" Axial Fan
A	5D. Return Fan Motor Type	High Efficiency Open Motor (1,200 nominal rpm)
H	5E. Return Fan Motor Size	3 hp
0	6A. Exhaust Fan Quantity	No Exhaust Fan
0	6B. Exhaust Fan Configuration	No Exhaust Fan
0	6C. Exhaust Fan Size	No Exhaust Fan
0	6D. Exhaust Fan Motor Type	No Exhaust Fan
0	6E. Exhaust Fan Motor Size	No Exhaust Fan
D	7. Outside Air Control	Fully Modulating Actuator - Enthalpy Limit
C	8. Return and Exhaust Air Options	Standard Barometric Relief EA Dampers
0	9A. Unit Filter Type	2" Pleated - 30% Eff. - MERV 8
0	9B. Unit Filter Size & Location	Standard Filters in Standard Position
0	9C. Final Filter Type	No Final Filters

Unit Submittal

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Tag: RTU-2-1

Job Name: *Legent North Houston Surgical Hospital*

Unit Submittal For:

Job Number: *HCW-22*

Unit Submittal Date: *July 19, 2022*

	Feature Option	Description
J	**9D.** Filter Options	CFS + Magnehelic Gauge - Unit Filters
0	**10A.** Refrigeration Control A	Standard - Adj Comp. Cooling Lock Out Through Unit Controls
0	**10B.** Refrigeration Control B	Standard
E	**11A.** Refrigeration Options A	Parallel Modulating Hot Gas Reheat Microchannel Coil [MHGR-MC] - Lead Circuit
0	**11B.** Refrigeration Options B	Standard Packaged Unit
A	**12.** Refrigeration Accessories	Sight Glass
A	**13A.** Unit Disconnect Type	Single Point Power - Non-fused Disconnect Power Switch
V	**13B.** Disconnect 1 Size	250 Amps
0	**13C.** Disconnect 2 Size	Standard
0	**14.** Safety Options	None
K	**15.** Electrical Accessories	Phase & Brown Out Protection + UV Lights
D	**16A.** Control Sequence	VAV Unit Controller - VAV Cool + CAV Heat
A	**16B.** Control Supplier	AAON Controls
0	**16C.** Control Supplier Options	None
B	**16D.** BMS Connection & Diagnostics	BACnet MSTP
0	**17A.** Preheat Configuration	Standard - None
0	**17B.** Preheat Sizing	Standard - None
0	**18A.** Option Box Location	None
0	**18B.** Option Box Size	None
0	**18C.** Option Box Accessories	None
A	**19.** Outside Air Accessories	Outside Air Hood
0	**20.** Cabinet Options	Standard - None
0	**21.** Accessories	Standard
A	**22.** Maintenance Accessories	Factory Wired 115V Convenience Outlet
0	**23.** Code Options	Standard - ETL U.S.A. Listing
0	**24.** Shipping Splits	Standard
C	**25.** Air-Cooled Condenser Accessories	ECM Condenser Fan Head Pressure Control
0	**26.** Evap-Cooled Condenser Accessories	Standard
0	**27.** Water-Cooled Condenser Accessories	None
0	**28.** Energy Recovery Accessories	None
A	**29.** VFD Options	Shaft grounding kit on all SA, RA, EA motors
A	**30.** Miscellaneous Options	Condensate Overflow Switch
0	**31.** Blank	Standard
0	**32.** Blank	Standard
0	**33.** Blank	Standard
0	**34.** Blank	Standard
0	**35.** Warranty	Standard Warranty
0	**36.** Cabinet Material	Galvanized Cabinet - Double Wall + R-13 Foam Insulation
X	**37.** Specials & Paint	SPA + Premium AAON Gray Paint Exterior Paint

Unit Rating

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RNA-070-D-0-3-EAB0B-00000:00-AAFAL-H00-BCCAH-00000-DC-000J-00-E0-A-AV0-0K-DA0B-00-000-A00A00-C000AA-000000X

Tag: RTU-2-1

(Values do not account for changes described in SPA)

Job Information

Job Name:	*Legent North Houston Surgical Hospital*
Job Number:	*HCW-22*
Site Altitude:	*0 ft*
Refrigerant	*R410A*

Unit Information

***WEIGHT AND PERFORMANCE DO NOT INCLUDE SPA*

Approx. Op./Ship Weights:	*6259 / 6259 lbs. (±5%)*
Supply CFM/ESP:	*14180 / 3.50 in. wg.*
Coil Filter FV / Qty:	*295.42 fpm / 24*
Return CFM/ESP/TSP:	*14180 / 1.00 / 1.05 in. wg.*
Outside CFM:	*2500*
Ambient Temperature:	*105.00 °F DB / 80.00 °F WB*
Return Temperature:	*70.00 °F DB / 60.00 °F WB*

Static Pressure

External:	*3.50 in. wg.*
Evaporator:	*0.35 in wg*
Coil Filters Clean:	*0.12 in wg*
Dirt Allowance	*0.00 in. wg.*
Economizer:	*0.17 in wg*
Heating:	*0.00 in wg*
Cabinet:	*0.14 in. wg.*
Re-Heat Coil:	*0.09 in wg*
Total:	*4.41 in wg*

Cooling Section

	Gross	Net
Total Capacity:	*643.20*	*590.60 MBH*
Sensible Capacity:	*431.10*	*378.50 MBH*
Latent Capacity:	*212.10 MBH*	
Mixed Air Temp:	*73.00 °F DB*	*62.00 °F WB*
Entering Air Temp:	*73.00 °F DB*	*62.00 °F WB*
Lv Air Temp (Coil):	*44.61 °F DB*	*44.56 °F WB*
Lv Air Temp (Unit)	*47.88 °F DB*	*46.13 °F WB*
Supply Air Fan:	*DT - 2 x 245D @ 9.61 BHP Ea.*	
SA Fan RPM / Width:	*1733 / 5.5600"*	
Return Air Fan:	*2 x MW3505-20-RN @ 1.71 BHP Ea.*	
RA Fan RPM / Pitch:	*1166 / °*	
Evaporator Coil:	*43.8 ft² / 6 Rows / 12 FPI*	
Evaporator Face Velocity:	*324.1 fpm*	

Heating Section

PreHeat Type:	*Std (No Preheat)*
Heating Type:	*No Heat*

Re-Heat Coil:

Capacity:	*433.5 MBH*
LA DB / WB:	*73.2 °F / 57.0 °F*
RH:	*35.7%*

Rating Information

Cooling EER: *10.1*

Outside the scope of AHRI Standard 340/360 (I-P). Rated using procedure described in AHRI 340/360 (I-P).

Application EER @ Op. Conditions: *6.6*

Electrical Data

Rating:	*460V/3Ø/60Hz*
Unit FLA:	*181*
SCCR:	*5 KAIC*
Minimum Circuit Amp:	*188*
Maximum Overcurrent:	*200*

	Qty	HP	VAC	Phase	RPM	FLA	RLA
Compressor 1:	4		460	3			26.9
Condenser Fans:	6	1	460	1	1100	3.6	
Supply Fan:	2	15	460	3	1760	21	
Return Fan:	2	3	460	3	1170	4.8	

Cabinet Sound Power Levels*

Octave Bands:	**63**	**125**	**250**	**500**	**1000**	**2000**	**4000**	**8000**
Discharge LW(dB):								
Return LW(dB):								

**Sound power levels are given for informational purposes only. The sound levels are not guaranteed.*

24.5" STAR Plenum

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AAONEcat32 Ver. 4.324 (SN: 7045104-FD35HEDC)

JOB INFORMATION:

Job Name:	*Legent North Houston*
Job Tag:	*Surgical Hospital*
Rep Firm:	*RTU-2-1*
Date:	*842*
	07/19/2022

WHEEL SPECIFICATION:

Max RPM:	*2,000*
Diameter x Qty:	
CFM:	*24.5 in. x 2*
Tip Speed:	*7090*
Inertia:	*11,116 FPM*
	10 WR²

OPERATING CONDITIONS:

Air Flow:	*14,180 CFM*
Static Pressure:	*4.41 in. Wg.*
Plenum DP:	*0.00 in. Wg.*
Inlet Grill DP:	*0.00 in. Wg.*
TSP:	*4.41 in. Wg.*
Site Altitude:	*0.00 Ft*
TSP @ Sea Level:	*4.41 in. Wg.*

MOTOR SELECTION:

Rated HP / Bypass:	*15 x 2 / No*
Frame Size:	*254T*
Nominal RPM:	*1760*
VAC/PH/HZ:	*460V/3Ø/60Hz*
Efficiency	*Premium / 0.93*
Enclosure Type:	*ODP*
Max Inertial Load:	*0 WR²*

FAN PERFORMANCE:

RPM:	*1733*
BHP:	*9.61*
Efficiency:	*51.3%*
In/Out Velocity:	*2168/2387 FPM*
Plenum Out Velocity:	*160 FPM*

Max Duct SP with Blocked Airway: 0 in. Wg. @ 1733 rpm

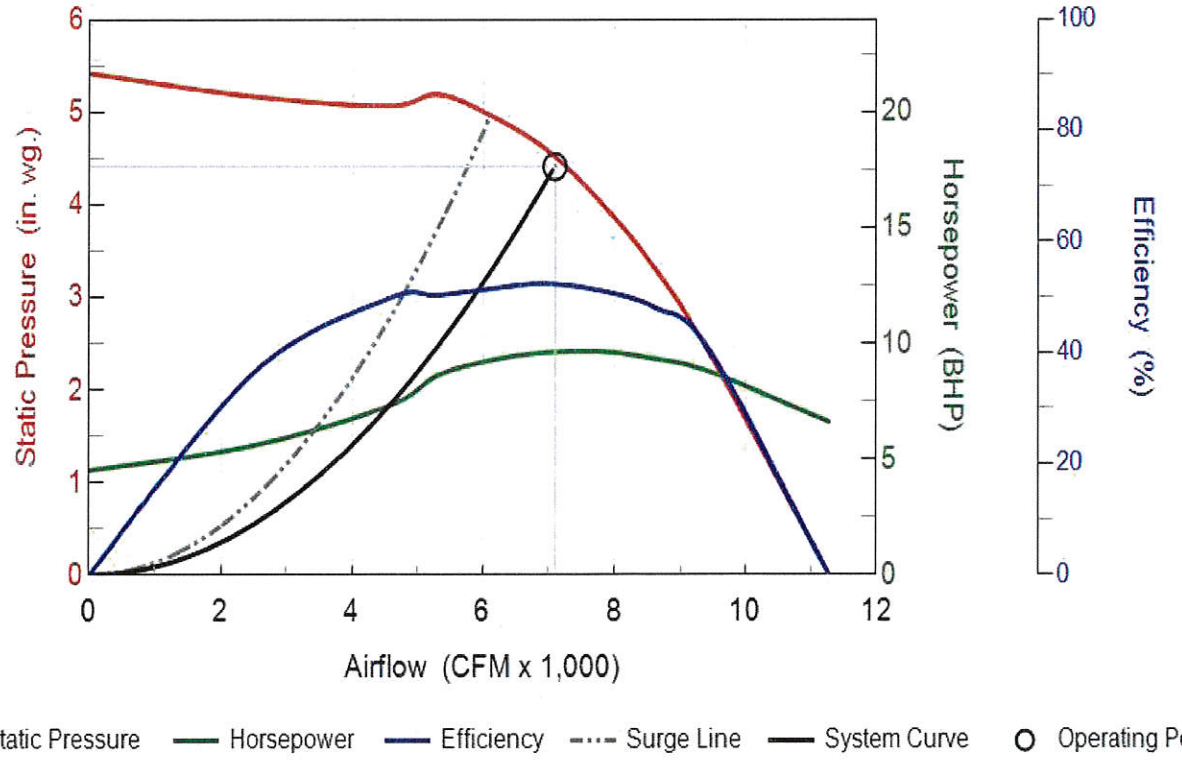
FAN SOUND POWER x 2 Fans (In/Out):

Octave Band: (Re 10^-12 watts)

1	2	3	4	5	6	7	8
97	*96*	*94*	*96*	*92*	*90*	*89*	*85*
97	*95*	*95*	*103*	*102*	*101*	*97*	*90*

SOUND POWER A-Weighted: 100 / 106 dB

Supply Fan Model: 245D x 2 @ 1733 RPM and 82% Width
Design Conditions: 7090 CFM @ 4.41" SP



3505-20 Axial Fan

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JOB INFORMATION:

Job Name:	*Legent North Houston*
Job Tag:	*Surgical Hospital*
Rep Firm:	*RTU-2-1*
Date:	*842*
	07/19/2022

WHEEL SPECIFICATION:

Max RPM:	*1,760*
Diameter x Qty:	
CFM:	*35.5 in. x 2*
Tip Speed:	*7090*
Inertia:	*10,837 FPM*
	9 WR²

OPERATING CONDITIONS:

Air Flow:	*14,180 CFM*
Static Pressure:	*1.05 in. Wg.*
Relief Dampers DP:	*0.00 in. Wg.*
TSP:	*1.05 in. Wg.*
Site Altitude:	*0.00 Ft*
TSP @ Sea Level:	*1.05 in. Wg.*

MOTOR SELECTION:

Rated HP / Bypass:	*3 x 2 / No*
Frame Size:	*213T*
Nominal RPM:	*1170*
VAC/PH/HZ:	*460V/3Ø/60Hz*
Efficiency	*Premium / 0.885*
Enclosure Type:	*ODP*
Max Inertial Load:	*0 WR²*

FAN PERFORMANCE:

RPM:	*1166*
BHP:	*1.71*
Efficiency:	*68.1%*
In/Out Velocity:	*788/788 FPM*
Plenum Out Velocity:	*160 FPM*

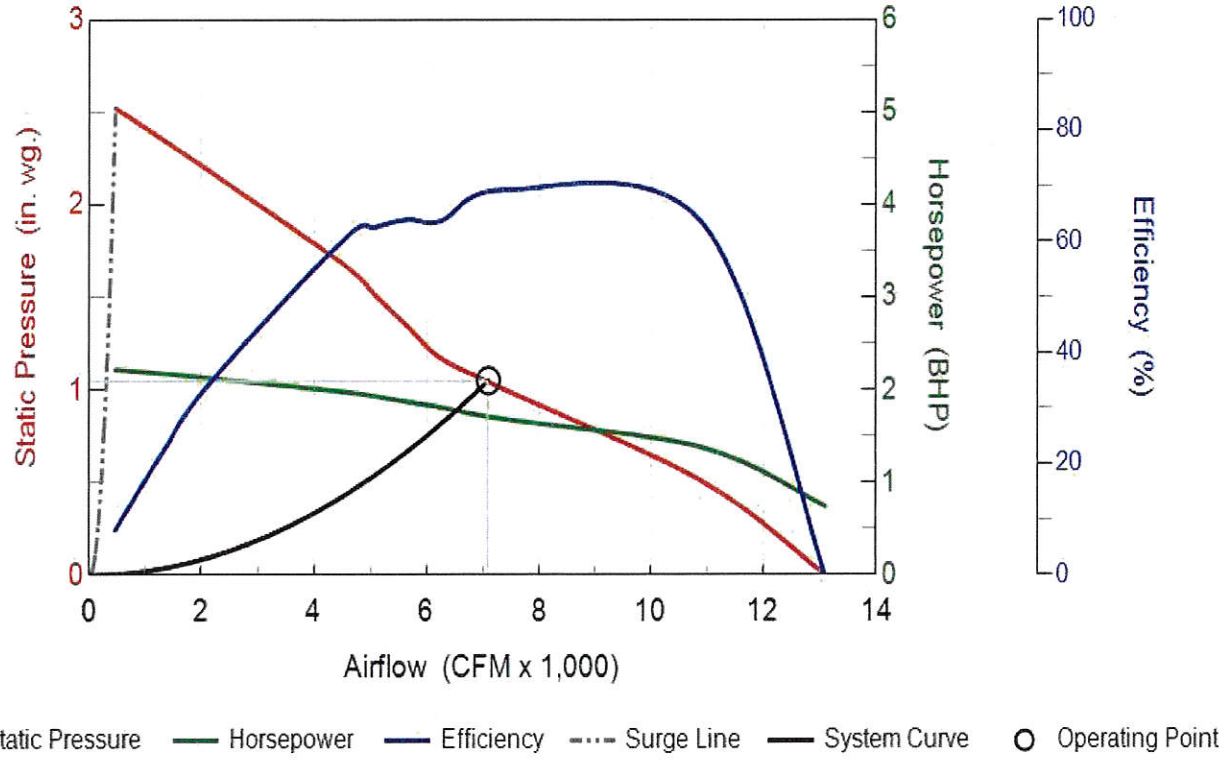
FAN SOUND POWER x 2 Fans (In/Out):

Octave Band: **(Re 10^-12 watts)**

1	2	3	4	5	6	7	8
93	*91*	*90*	*90*	*89*	*86*	*83*	*80*
93	*91*	*90*	*90*	*89*	*86*	*83*	*80*

SOUND POWER A-Weighted: 95 / 95 dB

Return Fan Model: MW3505-20 x 2 @ 1166 RPM and 100% Width
Design Conditions: 7090 CFM @ 1.05" SP



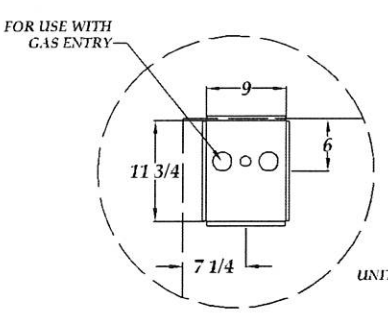
RN UNITS 50-70 TON
AIR COOLED, POWER RETURN

AAON®

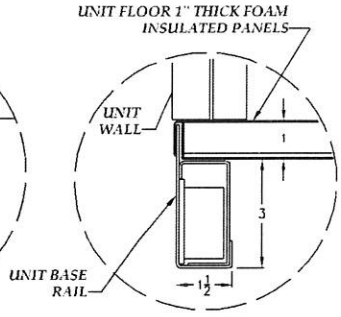
CLEARANCES

LOCATION	UNIT SIZE 50–70 TON
OUTSIDE AIR (BACK)	48
CONTROLS SIDE (FRONT)	48
LEFT SIDE	48
RIGHT SIDE	70
TOP	UNOBSTRUCTED

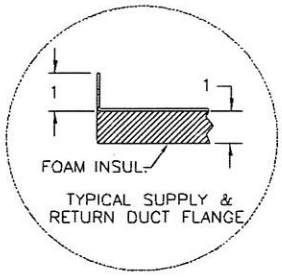
NOTE: RIGHT AND LEFT SIDE UNIT CLEARANCES ARE INTERCHANGEABLE ON UNITS THAT DO NOT HAVE THE HYDRONIC HEATING OPTION. (UNITS WITH HYDRONIC HEAT MUST HAVE 70" RIGHT SIDE ACCESS FOR SERVICE.)



DETAIL A
UTILITY ENTRY

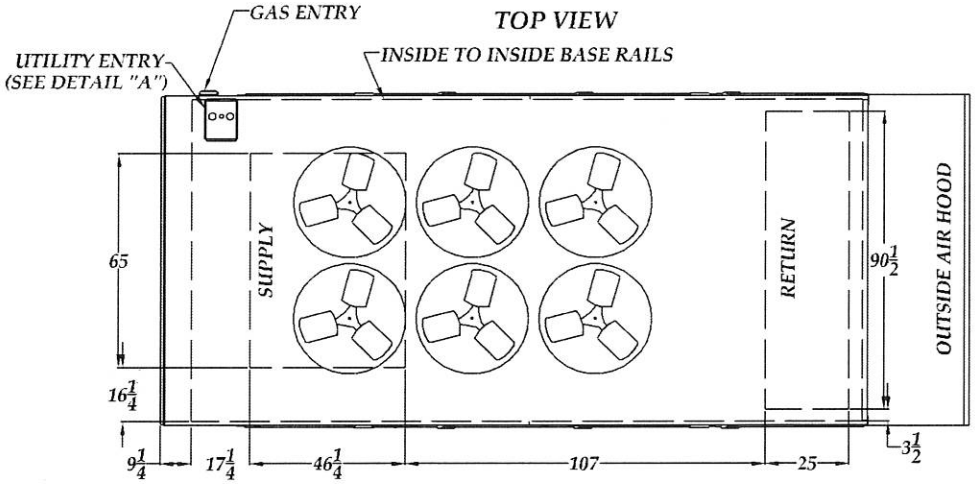


BASE RAIL CLEARANCE

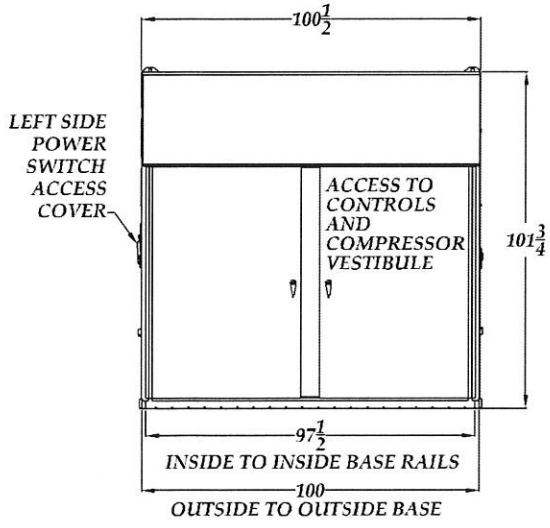


DETAIL B

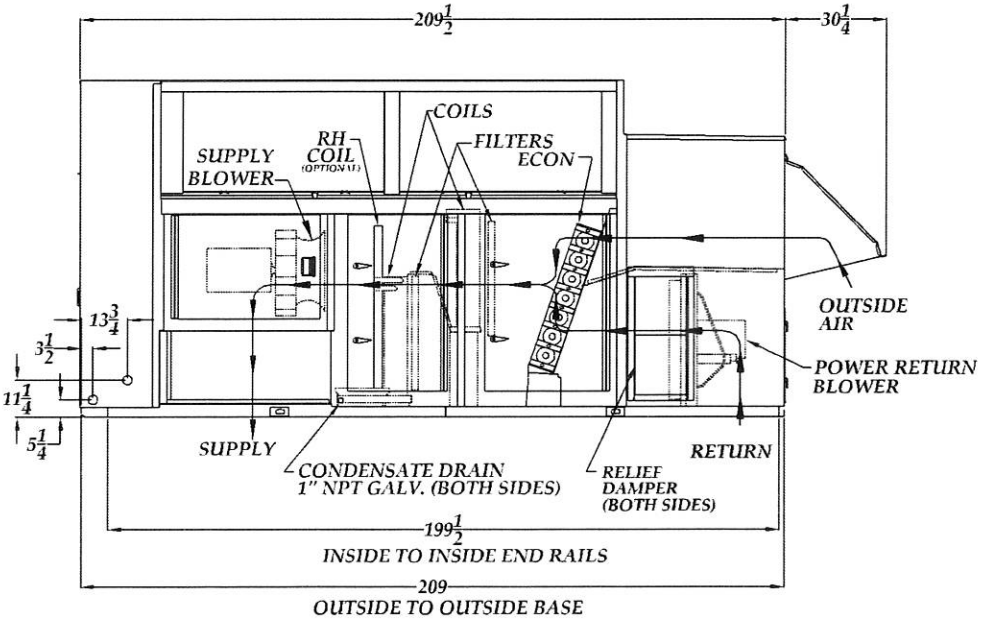
TOP VIEW



FRONT VIEW



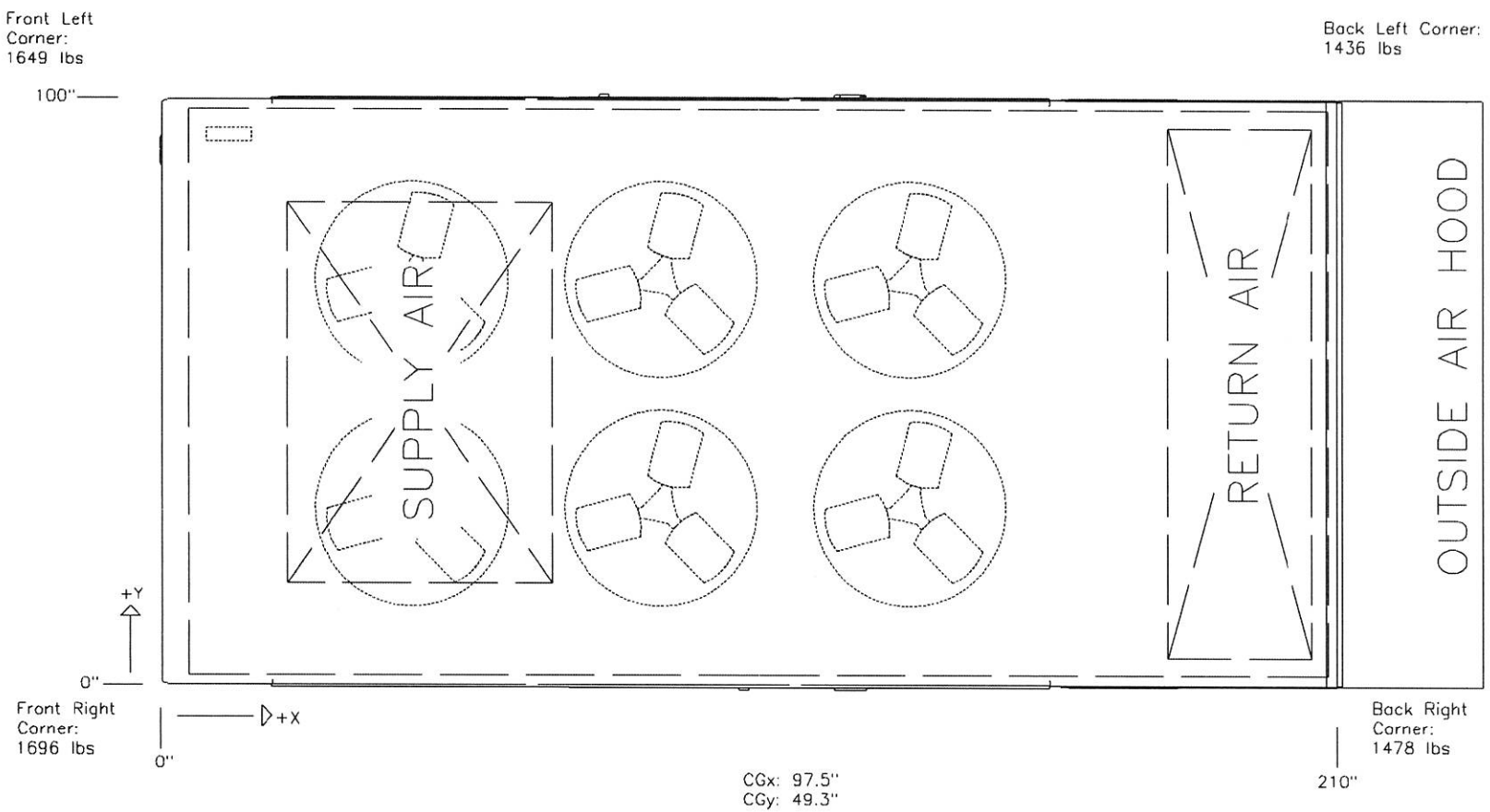
RIGHT SIDE VIEW



ALL DIMENSIONS ARE IN INCHES

RND CABINET
AIR COOLED CONDENSING UNIT
POWER RETURN

RNA-070-D-0-3-EAB0B-00000:00-AAFAL-H00-BCCAH-00000-DC-000J-00-E0-A-AV0-0K-DA0B-00-000-A00A00-C000AA-000000X

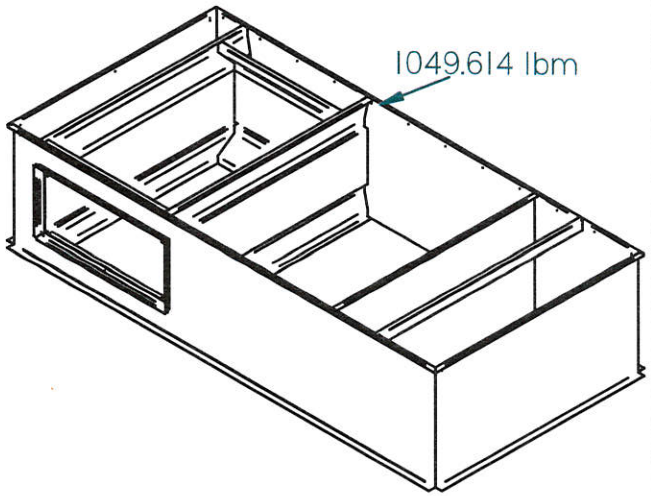


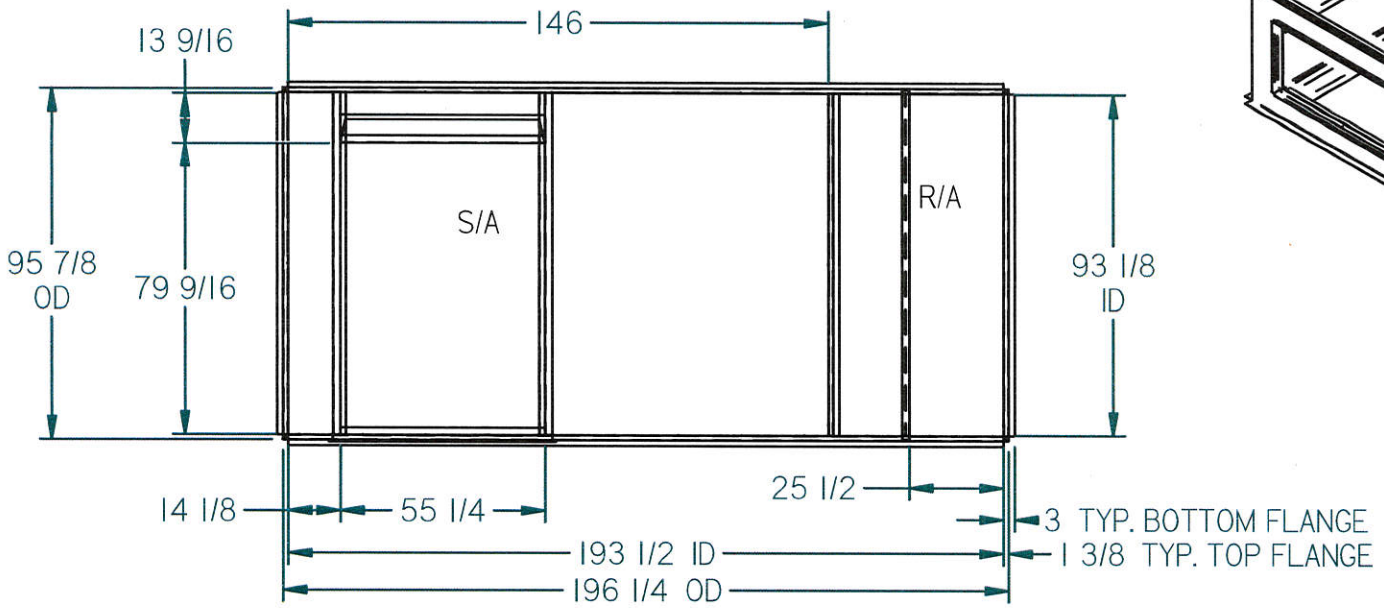
CGx: 97.5"
CGy: 49.3"

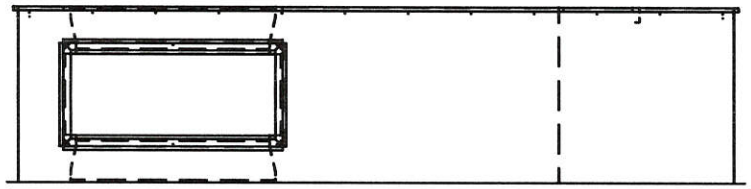
Total Weight:
6259 lbs (±5%)

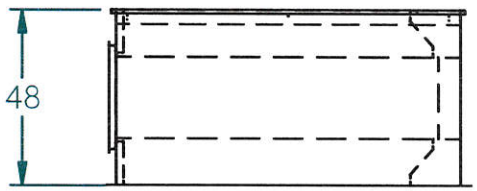
Disclaimer:
This weight estimate does not account for any SPAs.

APPROX. WEIGHT
1600 LBS



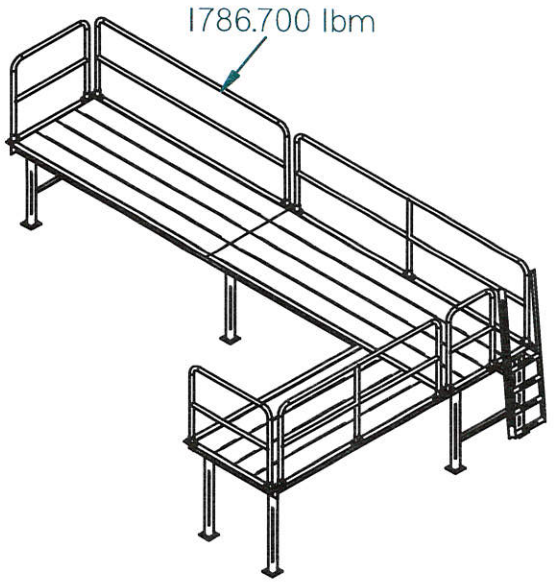


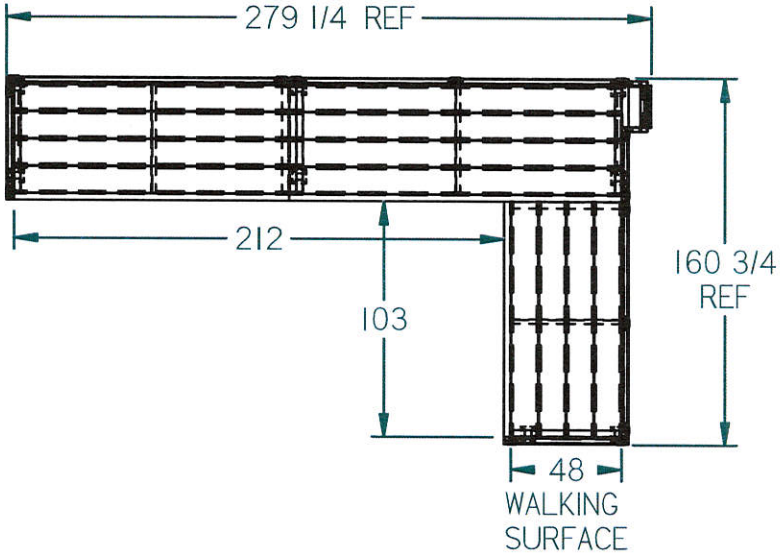


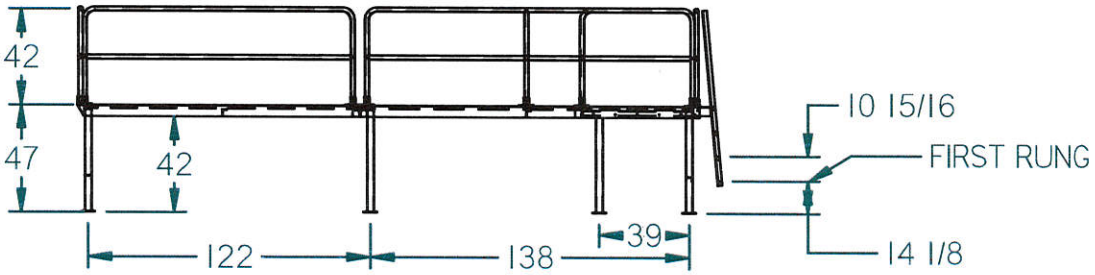


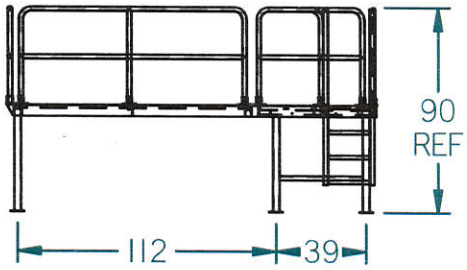
NOTES:
1. CURB SHIPPED FULLY WELDED, ONE PIECE
2. CURB MUST BE INSTALLED SQUARE AND LEVEL
3. MATERIAL IS GALVANIZED 14ga STEEL
4. FACTORY INSTALLED P.T. 2x4 WOOD NAILER
5. INSULATED WITH 2"x1.5# DENSITY DUCT LINER w/ 20ga DOUBLE WALL. NO INSULATION IN SUPPLY AIR STREAM
6. CRANKLOCK STYLE HEPA HOUSING FOR (6) 24x24x12" & (2) 12x24x12" HEPA FILTERS, GASKET SEAL, NO HEADER, FILTERS BY OTHERS
7. 1" DEFLECTION ISOLATION RAILS (FACTORY INSTALLED W/ FLEX DUCT)
8. WIND CALCS AND ATTACHMENT BRACKETS INCLUDED

	CURB TECHNOLOGIES™
QUANTITY: DIMENSIONS: INCHES	PROJECT: Legent North Houston Surgical Houston (220427-TG08) UNIT TAG: RTU-2A-1
DRAWN BY THD	MODEL: A_RN-D000-193 Rev. 01 | 6/10/22









NOTES
1. PLATFORM SHIPPED IN WELDED SECTIONS FOR FIELD ASSEMBLY
2. MATERIAL IS STEEL, PRIMED ONLY. TOP COAT RECOMMENDED BY OTHERS
3. PLATFORM MAY BE BOLTED OR WELDED TO ROOF STRUCTURE
4. WALKING SURFACE IS GALVANIZED GRIP-STRUT
5. HAND RAILS ARE GALVANIZED 1-1/2" PIPE AND FULLY REMOVEABLE
6. LADDER IS REMOVEABLE
7. LADDER AND HAND RAILS SHIPPED LOOSE

APPROX. WEIGHT: 2000 LBS

CURB TECHNOLOGIES™

QUANTITY: 1
DIMENSIONS: INCHES

DRAWN BY THD

PROJECT: Legent North Houston Surgical Houston (220427-TG08)
UNIT TAG:
MODEL: CTCW-1

Rev. 00 | 6/10/22

Control Vendors

AAON - Orion™ Controls System

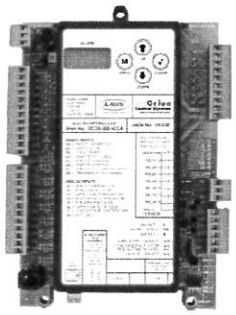


Figure 12- VCC-X Controller

The VCC-X unit controller, which is part of the Orion Controls System, can be factory provided and factory installed in AAON RN and RQ Series units. It provides advanced control features, without complexity, in an easy to install and setup package. The VCC-X controller can be individually configured, including setpoint adjustment, sensor status viewing, and occupancy scheduling. It can control VAV, CV, MUA, Single Zone VAV, PAC, and D-PAC units. Additional features and options can be managed by the controller with the addition of modular expansion I/O boards for the controller.

The VCC-X controller can be operated as a Stand Alone System, connected via modular cable to multiple VCC-X controllers in an Interconnected System, or connected via modular cable to multiple VCC-X controllers, VAV/Zone controllers, and Add-On controllers in a Networked System.

Protocol Adaptability™ is available from AAON for interfacing to LonWorks®, BACnet® or Johnson Controls N2 controls systems with the addition of specific gateways.

Required Options

To configure the VCC-X controller, an operator interface is needed. Available operator interfaces are the Modular Service Tool, Modular System Manager, System Manager TS, Tactio SI Touch Screen Interface connected via a Commlink II and a PC equipped with free Microsoft Windows® based Orion Prism II software connected via a Commlink II. With optional accessories, remote connectivity to the controller via Prism II software can be accomplished.

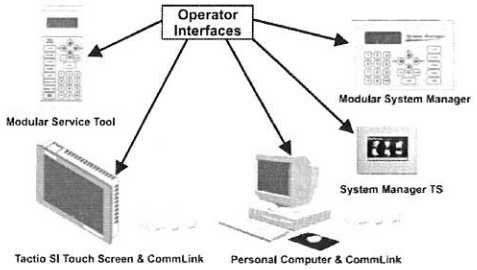


Figure 13- VCC-X Controller Operator Interfaces

Variable Air Volume (VAV) Unit Controller

Operation - Variable Air Volume Cooling and Constant Volume Heating
With standard AAON VAV controls, during the cooling mode of operation the supply fan modulates based on the supply air static pressure while mechanical cooling modulates based on the supply air temperature. During the heating mode of operation the supply fan provides constant airflow and heating modulates based on the controlling temperature.

Factory mounted and tested supply fan VFDs and ECMs are used to vary the speed of the supply fans and thus vary the amount of supply air. Because of the reduced speed, VAV units can be very energy efficient at part load conditions. VAV units can be used to serve multiple spaces with diverse or changing heating and cooling requirements, with only a single unit being required for multiple zones. Space temperature sensor included with AAON controller is used for supply air temperature setpoint reset and unoccupied override. See Controls section following for specifics.

Required Features
Feature 1A - Motorized Outside Air Damper or Economizer

Feature 13 - VAV Unit Controller

Standard Supplied Sensors
Outside Air Temperature
Supply Air Duct Temperature
Supply Air Duct Static Pressure
Return Air Temperature
Space Temperature with Temperature Setpoint Reset and Unoccupied Override (AAON Controls)

Recommended Features
Model Option A4 - Variable Capacity Scroll Compressors on all circuits

Feature 1 - Economizer
Feature 2 - Fully Modulating Actuator

Feature 5 – VFD or ECM Controlled Supply Fans
Feature 8 - Modulating Hot Gas Reheat

VCCX Components

2425 South Yukon Ave - Tulsa, Oklahoma 74107-2728 - Ph. (918) 583-2266 Fax (918) 583-6094
AAONEcat32 Ver. 4.324 (SN: 7045104-FD35HEDC)

1 2 3A 3B 3C 3D 3E 4A 4B 4C 5A 5B 5C 5D 5E 6A 6B 6C 6D 6E 7 8 9A 9B 9C 9D

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10A 10B 11A 11B 12 13A 13B 13C 14 15 16A 16B 16C 16D 17A 17B 18A 18B 18C 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37

Tag: RTU-2-1

Job Name: ***Legent North Houston Surgical Hospital***

VCCX For:

Job Number: ***HCW-22***

VCCX Date: ***July 19, 2022***

Hardware Included For VCCX Controller

Part #	Included Parts	Assigned Channel	BACnet Point
ASM01698	VCCX2 CONTROLLER		
ASM01692	OSA Temp/Hum Sensor	EBUS2 communicating sensor	AI:16,AI:17,AI:18,AI:19
ASM01820	Space Digital Temp/Hum Sensor	EBUS3 communicating sensor	AI:12,AI:13
	Economizer	VCCX control point AO 2	AI:30
R62330	Proof of Air Flow	VCCX control point BI 1	BI:6, BI:24
R64580	Dirty Filter Sensor	VCCX control point BI 2	BI:25
	Supply Fan	Configured Relay Point	BI:47
ASM02201	DIGITAL REFRIGERATION MODULE 1		
R42680	Comp Discharge Temp A	RSMD 1 point TEMP1	AI:66
V38391	Suction Pressure Sensor A	RSMD 1 point SP-1	AI:48
	Comp Status Input A	RSMD 1 point BI1	BI:77
	Comp Status Input C	RSMD 1 point BI2	BI:78
	Emergency Shutdown	RSMD 1 point BI4	BI:83
	Comp Enable A	RSMD 1 Fixed Relay point	BI:84
	Comp Enable C	RSMD 1 Fixed Relay point	BI:85
ASM02201	DIGITAL REFRIGERATION MODULE 2		
R42680	Comp Discharge Temp B	RSMD 2 point TEMP1	AI:91
V38391	Suction Pressure Sensor B	RSMD 2 point SP-1	AI:73
	Comp Status Input B	RSMD 2 point BI1	BI:89
	Comp Status Input D	RSMD 2 point BI2	BI:90
	Emergency Shutdown	RSMD 2 point BI4	BI:95
	Comp Enable B	RSMD 2 Fixed Relay point	BI:96
	Comp Enable D	RSMD 2 Fixed Relay point	BI:97
ASM01670	MODULATING HOT GAS REHEAT MODULE		
	Reheat HGR Valve	MHGRV-X	AI:42
	Reheat 2 Position HGR Valve Enable	MHGRV-X	


UVR
UV RESOURCES
RLM Xtreme™
Value — Lowest Cost of Ownership
Performance — High Output, Low Mercury
Sustainability — Energy Use, Coil Cleanliness and IEQ

BENEFITS

- Specifically designed for Xtreme environments
- Xtreme output: >420 µW/cm² at 1 Meter
- 360° distribution – highest UV-C fluence available
- Unlimited lamp configurations
- Industry's easiest to install and maintain
- Industry's lowest cost of ownership
- Highest reduction of infectious microbes
- Destroys coil/drain pan mold and bacteria
- EncapsuLamp™ technology for superior safety
- Designed for direct water wash-downs
- Worldwide lamp and ballast availability
- Minimal lamp sizes/ less inventory
- Meets/exceeds U.S. mercury content standards
- UL, CUL, CE and other agency listings
- 5-year fixture warranty
- 1-year lamp warranty

UV-C, when specified into new buildings and retrofits, reduces infectious agents, occupant absenteeism, and mechanical system maintenance. UV-C qualifies for LEED points in the energy and sustainability category, and is recognized in many green building standards for being chemical free. Accordingly, UV installations are becoming more commonplace and growing rapidly.

UV-C's role in creating quality indoor environments, sustainable, and green buildings — plus its ability to preclude or correct operation and equipment issues in buildings and A/C systems — prompted ASHRAE to add a chapter on UV-C to the 2008 ASHRAE HVAC Systems Equipment Handbook, as well as to form Technical Committee 2.9, Ultraviolet Air and Surface Treatment. Efforts such as these will help to promote widespread application of UV in building systems around the world.

Fueled by growing demand, today's UV-C systems need to offer application flexibility, ease of sizing and installation, and attractive cost of ownership — and RLM Xtreme leads the way. When compared to other products in the marketplace, Xtreme's features, functions and benefits come out ahead every time.

Forget about filling air handling units with rows of costly, potentially unsafe and awkward metal and glass fixturing… Xtreme offers a simpler, better way!

Born out of two decades of experience and use, this modern UV-C system irradiates coils and kills airborne microbes to create a more energy-efficient system that doesn't have to work as hard to move air. It offers the longest warranties and installation flexibility in the industry — all at an affordable price.

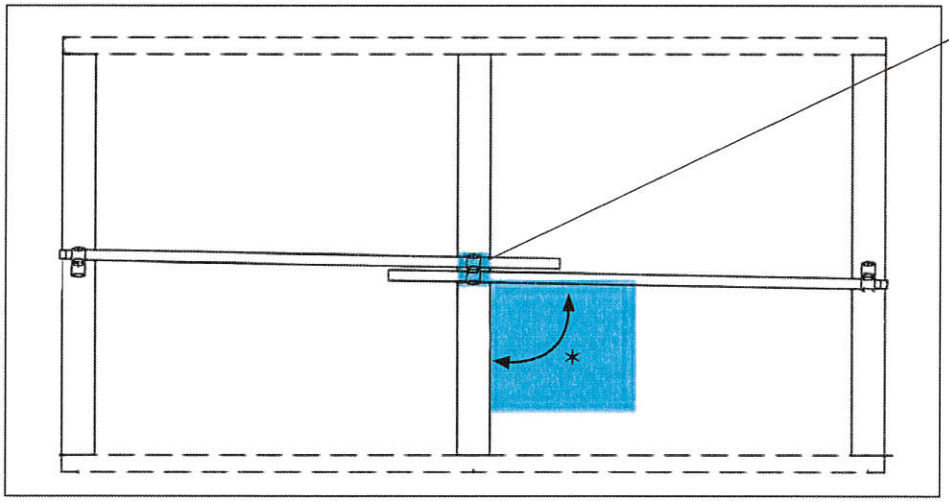
Xtreme's unique LampClamp™ allows lamps to be affixed most anywhere. It also compresses the lamp plug and socket together to fully protect the connection from moisture or direct water. This eliminates lamp pin corrosion and electrical "shorts" that routinely cause lamp and/ or power supply failures in other systems. LampHolsters™ complement the LampClamp by allowing UV lamps to simply "slip-in" and click in place, so that they overlap one another. This eliminates the need for multiple lamp lengths, and provides for more "free" energy where it's needed most.

EncapsuLamp™, UVR's Teflon® lamp coating technology, protects the system, space, and installer from the residues of a broken lamp such as inert gas, mercury, and glass.

Adding to the ease and flexibility of installation is the ability to locate Xtreme's state-of-the-art power supply remotely. The installation kit includes a plenum-rated lamp loom of up to 20-feet to allow the power supply to be located in an out-of-the-way area.

No matter what the application may be, Xtreme is the easiest UV-C system to install and service available in the marketplace.

The reasons to use Xtreme are many—but the cost is less! The choice for UV-C in any air moving system has become clear—RLM Xtreme, "the way it ought to be™."



* Lamps are not to be at right angles to coil fins. RLM's energy scatters non-directionally so lamps can be more correctly mounted to allow for a gravity drip of water off the lamp. This precludes mineral deposits, output attenuation and lamp failure. U.S. Patent #6,539,727 B1.

LAMPHOLDER/LOOM

The LampHolder features Xtreme's unique LampClamp™, along with a loom that enables power supplies to be located remotely away from lamps. The LampClamp compresses the lamp plug and socket together to form a barrier against moisture or direct water. It eliminates loose fits, lamp pin corrosion, and electrical "shorts" that routinely cause lamp and/or power supply failures. The triple-sheathed loom includes a layer of aluminized Mylar® jacketed with carbon impregnated thermoplastic. It meets UL Subject 13, 444, and 1581, and Articles 725 and 800 of the NEC as plenum rated.

POWER SUPPLY

Xtreme power supplies are CSA, CE, and UL Listed as variable input (120–277 Vac ± 10%) types, designed to facilitate PnP wiring of both inputs and outputs. They auto-match to either one "very high output" 150W UV-C lamp, or one or two "very high output" 75W UV-C lamps to maximize their individual performance. Power supplies are warranted for 5 years.

X-BOX XTREME

X-box is NEMA 2 rated, constructed of heavy-gauge galvanized and powder-coated steel for a safe and long-lasting housing that can accommodate up to 8 Xtreme power supplies. They're easy to install, either inside or outside of a plenum, and per NEC recommendations.

LAMPHOLSTER™

LampHolsters enable lamps to provide Xtreme's unique 360° irradiance. They are designed so that the installer can quickly and safely position/suspend and overlap lamps in the UV-C cavity. Constructed of carbon-impregnated polycarbonate, LampHolsters provide unmatched durability where system air velocity is greatest.

ENCAPSULAMP™

EncapsuLamp's encapsulate uniquely contains broken lamp residues of glass, mercury, and other contaminants—and it's completely disposable! The technology isolates lamp materials from the airstream, so that UV-C energy can be used most anywhere. This near destruction-proof construction perfectly fits critical venues such as pharmaceutical and food processing plants, as well as patient care applications in hospitals and nursing homes, etc. Further, it insulates a lamp's surface against air temperature changes to maximize lamp output and performance.

RLMXtreme™
UVR

System energy use starts with overcoming the pressure required to move air through a heat exchanger (Δ delta pressure). The delta requirement is a product of air flow, coil open area and friction. Net open area does not include the area used for coil fins, refrigerant tubing, and the all-important surface build-up of contaminant and mold.

This build-up decreases the open area which will increase coil pressure drop, decrease air flow, and increase energy use (Figure A). If CFM were to remain the same, a proportional increase in velocity would occur (Figure B). This higher interstitial velociy decreases the air-to-surface contact time, which decreases heat transfer and would raise the leaving air temperature. This latent differential of temperature—which is now lower than when clean—combined with reduction in air flow, will increase space temperature and humidity (wet bulb), decreasing the comfort level of building occupants to where system alterations must be performed. Other coil changes include an increase in air friction, insulating effects, and a continual degradation of coil and drain pan surfaces.

A high UV-C energy reflection can be obtained from all grades of aluminum—a phenomena that accentuates UV-C's ability to degrade and rid a coil's surface of contamination (Figure C). There are few organic materials that can escape the destructiveness of UV-C energy.

By looking at a fluorescent lamp (Figure D), you can note the high amount of energy glowing from the lamp's surface, flooding the air and surfaces with direct and reflected rays. This pales in comparison to Xtreme's invisible waveform, which is more than 2.5 times that amount.

Xtreme outperforms all other products in airborne kill, coil cleanliness and sustained system capacity. It also excels at affordability, ease of installation, warranties and total cost of ownership. Xtreme has become number one everywhere.

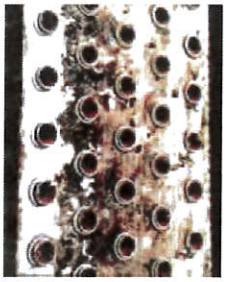


Figure A. Pre-cleaned coil shown cut in half to reveal that it's not actually clean! Instead, the material compacts deeper into it, further reducing air flow and heat transfer. The penetrating power of UV will actually clean all surfaces to restore heat transfer to as new as possible.

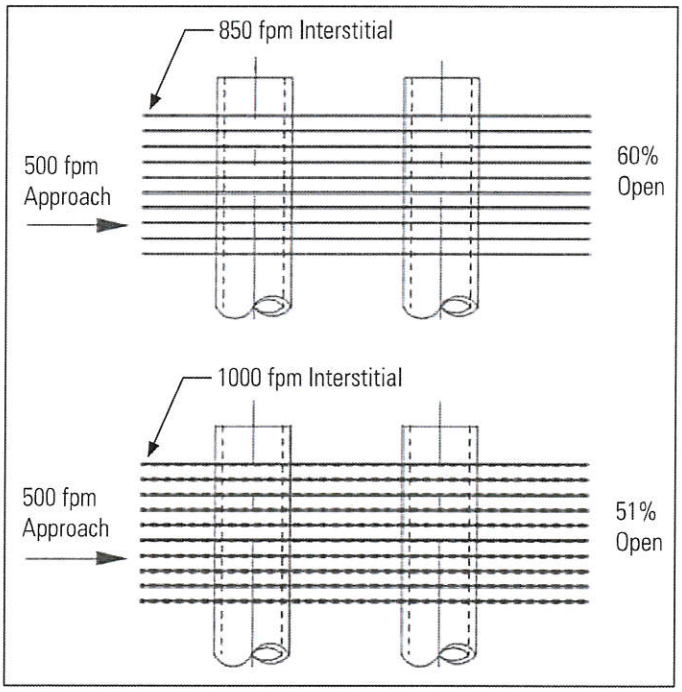


Figure B. A traditional approach velociy of 500 fpm is maintained to show the change in interstitial velociy when open area is decreased by 9% from surface contaminants like mold. With the increase in velocity and thermal insulation, sensible and latent heat transfer is dramatically reduced and space conditions are compromised.

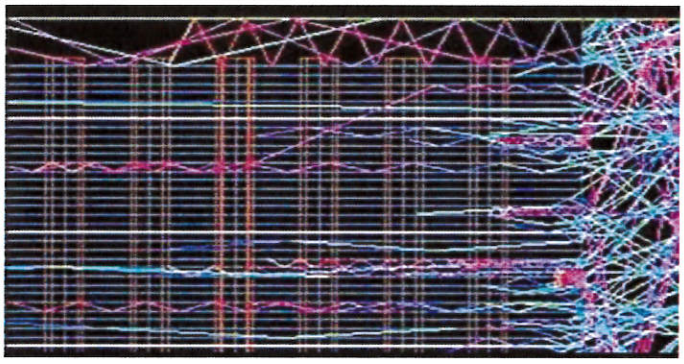


Figure C. Illustration of UV-C spectral lines reflecting off aluminum at angles associated with the entrance angle. At a minimum, aluminum provides a varied, unpredictable and dense fog of reflected radiation throughout. Coil surfaces yield "incident" angle reflection patterns from UV-C's 1/4 micron (0.25) wavelength—a key to UV-C's ability to continuously void a coil of all collected and agglomerated bio-contaminants.

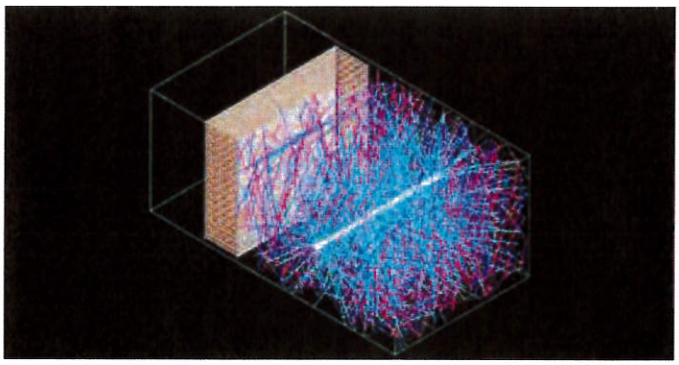


Figure D. Illustrates only a fraction of UV-C flux density and shows the benefit of 360° irradiation (RLM Xtreme). Filling the cavity plus bathing the coil proves the potential of significantly improved airborne kill ratios. The benefits are obvious when compared to the absorption of photons by fixtures and reflectors, which decreases the potential for the death of airborne infectious agents. 360° irradiation is the obvious choice.

ABOUT UV

GOVERNMENT

UVC Emitters/Lamps — "UVC Emitters/Lamps: Ultraviolet light (C band) emitters/lamps shall be incorporated downstream of all cooling coils and above all drain pans to control airborne and surface microbial growth and transfer."
U.S. General Services Administration (GSA); Facilities Standards for the Public Buildings Service

Engineer's Guide to the ENERGY STAR® Label for Buildings — The building should be free of visible signs of microbiological sources such as mold and mildew. *EPA, June 2003*

Energy Savings — A Pacific Gas & Electric (PG&E) study showed that a dirty condenser coil can increase compressor energy consumption by 30 percent. *Federal Energy Management Program Fact Sheet, U.S. Department of Energy, Energy Efficiency and R enewable Energy, by the Pacific Northwest National Laboratory, May 2005*

Bio-terror — Ultraviolet germicidal irradiation (UVGI) should be considered as a c omponent of emergency preparedness plans for existing public buildings and a wide range of congregate settings. *The Application of Ultraviolet Germicidal Irradiation to Control Transmission of Airborne Disease: Bioterrorism Countermeasure, Philip W. Brickner, MD, Public Health Report, Volume 118, March/April 2003*

INSTITUTIONAL

UVGI in HVAC Systems Reduces Bacterial and Fungal Contamination of Tracheal Aspirate in a Neonatal ICU — Microbials isolated (pseudomonas, klebsiella, bacillus, and serratia) from the HVAC system were identical to those in the NICU and TA. Total microbial load markedly decreased in the HVAC system and in tracheal aspirate after installing UVGI. *Rita M. Ryan, MD, Pediatric Academic Society, 2003*

Efficacy of Ultraviolet Irradiation in Controlling TB — UVGI was able to inactivate airborne bacteria spores and mycobacteria and significantly decrease their culturable cell concentrations. *University of Colorado, Boulder, CO, for the CDC, October 14, 2002*

Ability of Fan-Powered UVGI Disinfection to Inactivate Selected Airborne Bacteria — More than 99% of the bacteria irradiated (escherichia coli, pseudomonas fluorescens, serratia marcescens, and micrococcus luteus) were inactivated.
Conference of the Society for Occupational and Environmental Health, NIOSH, 1994

UVGI — UVGI has been recommended as a supplement or adjunct to other TB infection-control and ventilation measures in settings in which the need to kill or inactivate M. tuberculosis is essential. UVGI can be used to increase the number of equivalent air changes per hour (ACH).
Guidelines for Preventing the Transmission of Mycobacterium Tuberculosis in Health-Care Settings, 2005

UV in Schools — UVC technology is effective in reducing microbial growth on air conditioning cooling coils.
Improving indoor environment quality and energy performance of California K-12 schools, Project 3, Effectiveness of UVC light for improving school performance, California Energy Commission, 2006

COMMERCIAL

Effect of Ultraviolet Germicidal Lights — Operation of UVGI resulted in 99% reduction of microbial and endotoxin concentrations within the ventilation systems resulting in significantly fewer work-related respiratory and mucosal symptoms.
The LANCET, Volume 362, November 29, 2003

Defining the Effectiveness of UV Lamps — UVGI was found to inactivate vegetative bacteria, bacterial, and fungal spores (i.e., staphylococcus epidermidis, bacillus subtilis, and aspergillus versicolor), with single-pass efficiencies to >99%.
RTI International for ARTI, November 2002

ASHRAE Standard 62-1999 — Describes conditions and equipment that should be evaluated to ensure proper control of microbial sources. *A. Persily, The Revision of Standard 62: What a Difference a Decade Makes, National Institute of Standards and Technology, Gaithersburg, MD*

Effectiveness of UV Light in Controlling Fungal Contamination — Germicidal UV light can be an effective approach for reducing fungal contamination within AHUs. *Effectiveness of Germicidal UV Irradiation for Reducing Fungal Contamination within Air-Handling Units, E. Levetin, Journal of Allergy and Clinical Immunology, Volume 103, No. 1, January 1999*

- **CARBON BLACK** used in many of the RLM Xtreme accessories, has a high strength-to-weight ratio and has the highest melting/sublimation point of all elements. We use carbon black as a filler/pigment in our plastic compounds and products as this inorganic material is impervious to the effects of UV-C.
- **TEFLON**, or polytetrafluoroethylene (PTFE), is a synthetic fluoropolymer used in covering UV Resources' lamps (EncapsuLamp™). It is one of the toughest materials known. In fact PTFE is used to coat certain types of hardened, armor-piercing bullets, so as to reduce the amount of wear on the firearm's rifling but also giving the ability to ease a bullet's passage through armor.