Department of Veterans Affairs

Fort Harrison
VA Montana Healthcare System

Replace Penthouse HVAC Systems

Final Narrative

Project No. 436-17-102

August 07, 2018

Ft. Harrison VA
Replace Penthouse HVAC Systems

Final Narrative

Project Location:

3687 Veterans Drive
Ft. Harrison MT 56636
Building 154

Contracting Officer's Representative:

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50% Owner Comment / AE Response …….....

90% Owner Comment / AE Response …….....

100% Owner Comment / AE Response …….....

Introduction

The architectural scope of this project shall include the following:

This project shall include removing and replacing 4 HVAC units located in the existing penthouses at the Fort Harrison, VA Montana Healthcare System.

This work shall include but not be limited to architectural, structural, mechanical, plumbing, & electrical. In general, the project is primarily an HVAC project with minor upgrades. The existing HVAC units will be removed and replaced with new. It's recommended that the contractor visit the site prior to bidding. The contractor will be required to provide coordination drawings as part of this project.

General Project Scope

- The existing penthouse buildings will remain as is. Minor modifications, such as larger doors and/or openings in the walls may need to be considered to allow removal and replacement of the HVAC units. Ultimately, the contractor will be responsible for the means and methods of removing and reinstalling the units.

- Remove and replace the 4 existing HVAC units and all associated components. See the Mechanical and Electrical narrative for additional information.

- The existing housekeeping pads will be removed and the concrete floor repaired in preparations for the new housekeeping pads.

- Most of the existing mechanical penetrations through the floor slab will be reused. Any unused openings in the floor will be infilled with concrete. New openings will require scanning (GPR - Ground Penetrating Radar) and saw cutting. Scanning will be the responsibility of the construction contractor.

- Temporary units and staging platforms may be required to avoid extended shut down time.

- See Structural, Mechanical, Plumbing, and Electrical Narratives for continuation of design scope.

Design Criteria

The following codes and design criteria shall be utilized to the extent applicable:

- VA Directives, Design Manuals, Master Specifications, VA National CAD Standard Application Guide, and other Guidance on the Technical Information Library (TIL) http://www.cfm.va.gov/til/.
- International Building Code (IBC) (Only when specifically referenced in VA Design Documents, see notes below)
- NFPA 101 Life Safety Code
- NFPA National Fire Codes with the exception of NFPA 5000 and NFPA 900
- Occupational, Safety and Health Administration (OSHA) Standards.
- VA Seismic Design Requirements, H-18-8
- National Electrical Code (NEC)

- International Plumbing Code (IPC)
- Safety Code for Elevators and Escalators, American Society of Mechanical Engineers (ASME) A 17.1.
- ASME Boiler and Pressure Vessel Code
- ASME Code for Pressure Piping
- Architectural Barriers Act Accessibility Standards (ABAAS) including VA supplement, Barrier Free Design Guide (PG-18-13)
- Building Code Requirements for Reinforced Concrete, American Concrete Institute and Commentary (ACI 318)
- Manual of Steel Construction, Load and Resistance Factor Design Specifications for Structural Steel Buildings, American Institute of Steel Construction (AISC)
- Energy policy Act of 2005 (EPAct)
- DOE Interim Final Rule: Energy Conservation Standards for New Federal, Commercial and Multi-Family High-Rise Residential Buildings and New Low-Rise Residential Buildings, 10 CFR Parts 433, 434 and 435.
- Federal Leadership in High Performance and Sustainable Buildings: Memorandum of Understanding (MOU)
- Executive Order 13423: Strengthening Federal Environmental, Energy, and Transportation Management.
- The Provisions for Construction and Safety Signs. Stated in the General Requirements Section 01010 of the VA Master Construction Specification.
- Ventilation for Acceptable Indoor Air Quality – ASHRAE Standard 62.1- 2004.
- Safety Standard for Refrigeration Systems – ASHRAE Standard 15 – 2007.

Project Phasing

The contractor shall be required to perform construction operations during time frames approved by the hospital. Hospital staff must be able to perform their duties with a minimum of disruption, throughout the entire demolition and construction process. Ultimately, the precise sequence will be determined after a building contractor has been selected and consultations among the hospital staff, facilities personnel, contractor, and architect can be arranged.

The following items shall be considered for this project prior to the start of construction:

- Staging for construction materials and access information for contractor.
- In-depth site walks with COR
- Phasing and safety plans
- Coordination drawing

Existing Conditions

The project area is located on the roof of building 154 penthouses. The scope of this project will be required to be done at very specific times of the year to avoid disruption of the day to day operations of the campus and may be required to be split into sub phase.

Asbestos Containment

If any asbestos materials are found, demolition practices for removal and disposing of asbestos containing materials will need to be observed per the typical VA guidelines.

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DEPARTMENT OF VETERANS AFFAIRS FT HARRISON HOSPITAL
RADIOLOGY HVAC PENTHOUSE UNITS
STRUCTURAL NARRATIVE

DESCRIPTION

In order to upgrade the mechanical systems for Radiology at the VA Hospital at Ft. Harrison in Helena, Montana, the mechanical engineer shall replace existing HVAC units located in the existing Penthouse enclosures. Updated HVAC units will require the analysis of the existing structure due to the slight increase in weight and updated locations (see attachment sketch and mechanical and architectural drawings).

The existing building structural system consists of a concrete beams and one-way joist/slab floor (and roof) structure spanning to concrete columns. Existing construction documents were provided by the owner (prepared by CTA Architects Engineers dated 05/02/61) and were utilized for purposes of structural evaluation for this mechanical upgrade.

EXISTING BUILDING EVALUATION RESULTS

Existing drawings were used to evaluate current system layout, sizes, and reinforcing. The information was then used to determine the existing load capacities (see design criteria section for loads) and all major design checks including shear, moment and reinforcing stresses for the existing one-way joist/slab and concrete beams were evaluated.

<u>The existing concrete floor/roof system was found to be adequate to support the HVAC changes. However, if the unit weights and locations are updated from the provided Architectural and Mechanical layouts please notify the Engineer of Record for approval/review.</u>

Seismic and Wind lateral loads were not considered as the updated HVAC systems are in the existing penthouse enclosures, therefore, not impacting the overall building system.

DESIGN CRITERIA

BUILDING CODE

2012 International Building Code (IBC)
Risk Category = IV

VERTICAL LOADS

Ground Snow Load = 30 psf + Drift Load 50 psf
Roof Superimposed Dead Load = 25 psf
Roof Live Load = 20 psf
Live Load = 80 psf
HVAC 1 = 7,000 lbs
HVAC 2 = 5,500 lbs
HVAC 3 = 5,000 lbs

EXISTING MATERIAL PROPERTIES (Based on existing drawings)

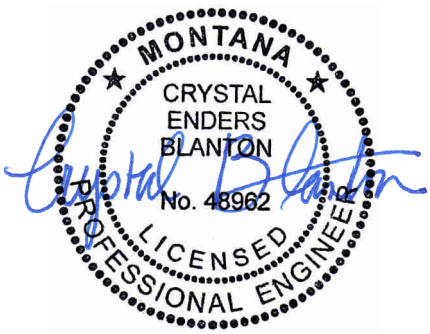
Concrete

All = 3,000 psi

Reinforcing

Non-Weldable: ASTM A615, Deformed, Fy =40 ksi

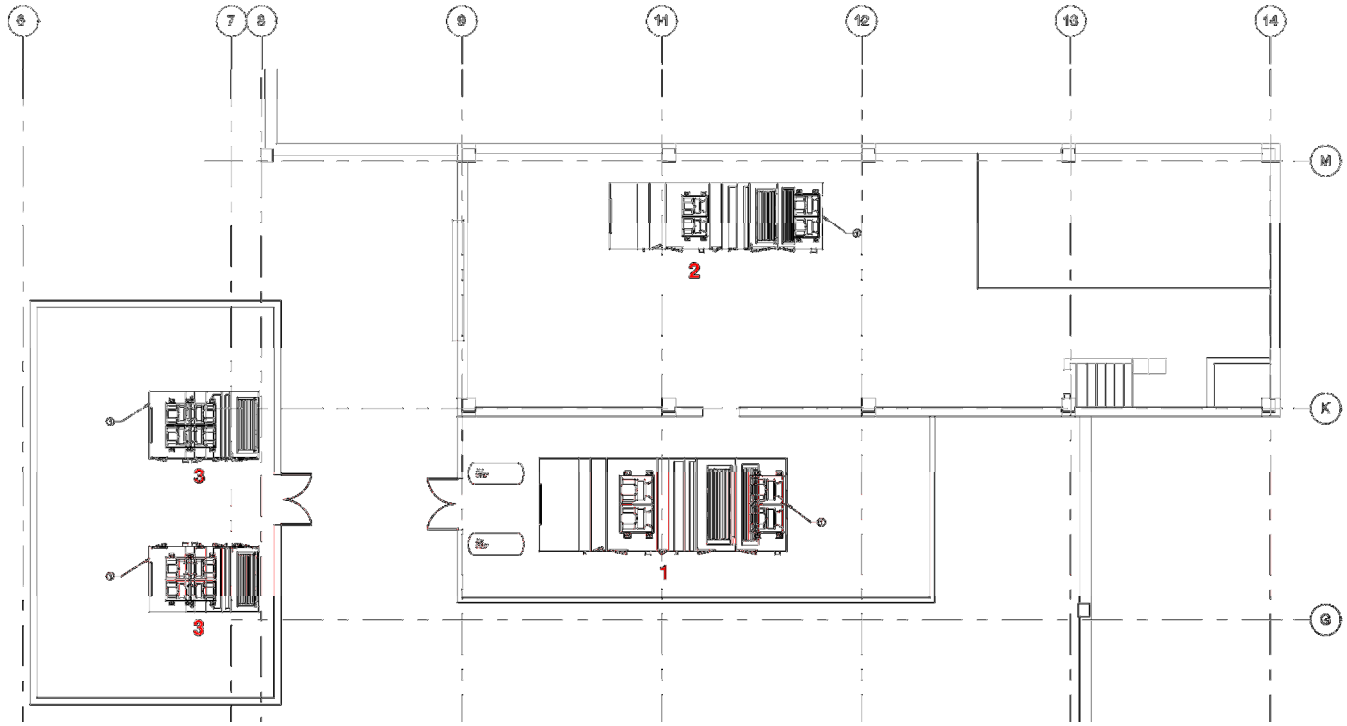
Best Regards,



7/20/2017

CRYSTAL E. BLANTON, P.E.
Principal / Partner
cblanton@pangolinstr.com

ATTACHMENTS:



HVAC UNIT LOCATIONS

HVAC Narrative

Introduction

This narrative discusses the Replace HVAC Penthouse Units Project at the Ft. Harrison VA in Ft. Harrison, Montana.

Project Scope (copied from contract)

The VA Montana Healthcare System requires the services of a qualified Architect / Engineer (A/E) firm to provide design services allowing for the all work as identified in this scope of work for project 436-17-102 Replace HVAC Penthouse Units – Building 154. Primary Aspects of this project are as follows:

S-2 and S1A & S2A Renovations (3rd and 4th Floors of the Hospital)

S-2, S1A and S2A are three large air handlers that serve a mixture of administrative, clinical space, and patient rooms on the third and fourth floors of the hospital. The units are operating at 100 percent capacity several months of the year. The construction of Correct Patient Privacy project on the 3rd and 4th floors of the hospital will upgrade the ICU, Same-Day Surgery Recovery Unit, and Patient rooms, which will greatly impact the requirements for cooling and heating on the 3rd and 4th floors of the hospital. The designer will be required to install design elements that incorporate a range of technologies to enable a higher efficiency to meet new load demands and a system to increase the level of energy recovery from the currently exhausted system air.

AC- 2 Reconfiguration

AC-2 currently serves OR#3 and OR#4 and a significant amount of adjoining clinic operations space with less stringent HVAC criteria. This unit currently appears to operates at full load continuously and utilizes 100 percent outside air. The accompanying design provides for modifications to allow return air to be used as a precooling or heating source, to increase the efficiency and capacity of the unit.

GENERAL

S2 and AC2 are in the elevator penthouse of bldg. 154. S1A and S2A are located in the out board penthouse of bldg. 154 The work will include all associated controls, system piping, insulation, and ductwork upgrades necessary to increase cooling and ventilation efficiency and reduce energy consumption. The exact areas served by systems need to be determined and diagramed. All units shall be replaced with new air handler. Units shall be established on steel curbs at correct elevation for drainage. This design shall include all aspects of AHU replacement and design. Expansion of mechanical spaces shall be part of this design work as necessary to accommodate new machinery. Evaluate and or design hot water coils. All variable frequency drives shall be replaced.

Project Goals

The project goal for this project are listed below:

1. Replace existing outdated air handling units with new air handling units.
2. Include a 20% redundancy on the new units for increased load and future renovations.
3. AHUs shall have more than one fan. The original goal was to provide a fan array on the units, but due to size constraints of the existing penthouses this was not possible. At least two fans are

provided with septum wall. The septum wall allows one fan to be maintained without shutting down the AHU completely.

4. Provide an additional chiller that is an exact match to the existing chiller for increased loads and redundancy.
5. Provide a redundant chilled water loop to the existing loop located in the mechanical room below the penthouse.
6. Replace all steam heating in the penthouse with heating hot water.
7. 154-AHU-15-2ND was previously a 100% OA unit. This unit has been reconfigured with return air.
8. Heat recovery loops have been added to the new AHUs.

Code Requirements

- Code Requirements: The VA HVAC Design Manual shall be used to select equipment and assign airflow requirements to spaces. While the VA is ultimately the authority having jurisdiction, local City of Ft. Harrison codes shall be followed (where practical).

- Energy Reference Documents: ASHRAE 90.1, VA Sustainability Guide, Green Guide for Health Care

- Smoke and Fire Control: HVAC design and equipment shall be in compliance with NFPA 90A and shall be equipped with devices such as fire dampers, smoke dampers, and duct mounted smoke detectors where required. Compliance with the following codes is also mandatory:
    - NFPA 99: Standard for Health Care Facilities
    - NFPA 101: Life Safety Code

- Outside air requirements: Minimum Outside Air quantities for ventilation shall be the highest of the following:
    - ASHRAE Standard 62.1
    - VA Requirements
    - ASHRAE Applications Handbook

Weather Data

External design conditions used for the sizing of building HVAC systems will be as given in the VA HVAC Design Manual, dated March 2011. Data not listed in the VA HVAC Design Manual are obtained from the ASHRAE Fundamentals Handbook.

City: Ft. Harrison, MT
Latitude: 46.61°N
Longitude: 111.96°W
Elevation: 3868 ft above sea level
Summer Design Db/Wb: 92.7°/61.5°
Winter Design Db: -15.4°

Summer figures quoted above represent conditions that are exceeded for 0.4% of the year. Winter figures represent conditions that are exceeded for 99.6% of the year.

Any impact of possible long-term climate change on local climatic conditions at the site is not accounted for in the design.

Infiltration

The building will be positively pressurized to minimize infiltration. Currently, an allowance for 5% over-pressurization is provided. For example, only 5% of supply air will be returned / exhausted, with the balance exfiltrating from the building. Although pressurization is provided, an allowance of 0.15 ACH of infiltration is included in heating and cooling load calculations.

Energy Conservation Measures and Life-cycle Analysis

The following energy and water conservation measures have been taken within the design of the building. Some have been modeled with Life Cycle Costing to evaluate whether the payback is sufficient to warrant the selection, others are adopting merely as good practice:

Energy Conservation Measure	Relevant Discipline	Remarks
High Performance Glass	Architectural	No, Existing Windows.
Daylighting Controls	Architectural/ Lighting	No, Existing Windows.
Occupancy Sensors	Architectural/ Lighting	No, Lighting is not being addressed.
Electronic Ballasts	Architectural/ Lighting	No, Lighting is not being addressed.
High Efficiency Lighting Design	Architectural/ Lighting	No, Lighting is not being addressed.
Variable Frequency Drives	Mechanical	Yes.
Energy Management System	Mechanical	Yes.
Demand Controlled Ventilation	Mechanical	No. Few assembly spaces and rooms require 2 ACH
Mixed Mode/ Natural Ventilation Systems	Mechanical	No. Windows not operable.
Heat Recovery	Mechanical	Yes.
Economizers	Mechanical	Yes.
Multiple Supply Fans	Mechanical	Yes.

Airside Temperature Reset	Mechanical	Yes. Control Strategy to adaptively reduce temperature.
Airside Pressure Reset	Mechanical	Yes. Control Strategy to adaptively reduce pressure.
Condensate to Landscape	Mechanical	Yes, where possible.
Chilled Beams	Mechanical	No.

New Building Mechanical Equipment

This scope consists of removing and replacing existing units. The existing units are typically at 100% of their capacity and need to be upgraded. See table below information on the existing units:

Old Tag	New Tag	Existing CFM*	CFM With 20% Redundancy	CFM Provided	Area Served
AH-2 (AC-2) and RE-2	154-AHU-15-2ND	5,470	6,564	8,000	OR#3 & OR#4
AHU S1A	154-AHU-12-4TH	7,875	9,450	10,200	Fourth Floor
AHU S2	154-AHU-14-3RD	20,155	24,186	24,200	Third Floor
AHU S2A	154-AHU-13-4TH	7,650	9,180	10,000	Fourth Floor

***CFMs were calculated utilizing existing As-Built information for each Air Handling Unit including the addition of the increased CFM from the Renovate ICU to GI Suite project that is under construction.**

All units will be designed with at least 20% redundancy to provide more capacity in future designs.

The following HVAC equipment shall be provided for the design:

New Outboard Penthouse CFM Custom Air Handling Units (154-AHU-12-4th and 154-AHU-13-4TH): Variable air volume, Chilled Water Unit with the following features:

- Stacked sections to reduce length in outboard penthouse.
- (2) Supply Fans (direct drive, reduced noise, high efficiency motors provide for fans)
- (2) Return Fans (direct drive, reduced noise, high efficiency motors provide for fans)
- Chilled Water Coil sized at 500 FPM and 10° delta-T (6 rows min)
- Hot Water Coil for preheat.
- Economizer Section
- VFD, supply and return fans
- Heat Recovery run-around loop.

Note: Steam humidification will be provided in the main supply ductwork for these units.

New 8,000 CFM Air Handling Units (Custom): Chilled Water Unit with the following features:

- (2) Supply Fans (direct drive, reduced noise, high efficiency motors provide for fans)
- (2) Return Fans (direct drive, reduced noise, high efficiency motors provide for fans)
- Chilled Water Coil sized at 400 FPM and 14° delta-T (6 rows min)
- Hot Water Coil for preheat.
- Steam humidification section, 5' section of stainless-lined walls and floor.
- Economizer Section
- VFD, supply and return fans
- Heat Recovery run-around loop.

Note: Steam humidification will be provided in the main supply ductwork for these units.

New 22,200 CFM Air Handling Unit (Custom): Chilled Water Unit with the following features:

- (4) Supply Fans (direct drive, reduced noise, high efficiency motors provide for fans)
- (2) Return Fans (direct drive, reduced noise, high efficiency motors provide for fans)
- Chilled Water Coil sized at 400 FPM and 14° delta-T (6 rows min)
- Hot Water Coil for preheat.
- Economizer Section
- VFD, supply and return fans
- Heat Recovery run-around loop.

Note: Steam humidification will be provided in the main supply ductwork for these units.

AHU and Chiller Control Strategies

The new chilled water and heating water system will utilize Variable Primary Control Systems. Each heating and chilled water coil will have a 2-way control valve. The control valve will regulate the amount of water being circulated through each coil. The system will have a by-pass line with a 2-way control valve. The by-pass line is provided to verify the required minimum flow through the chiller is being maintained.

New Steam to Water Heat Exchanger

- Utilize existing 10# building steam to generate hot water for heating coils.

New Steam Humidification: Steam humidification for all units will be provided in supply air ductwork main.

New VFDs: VFDs for new supply and return fans for all units.

Utilities

Chilled Water:
See plans for routing of chilled water piping.

Steam:
See plans for routing of steam piping.

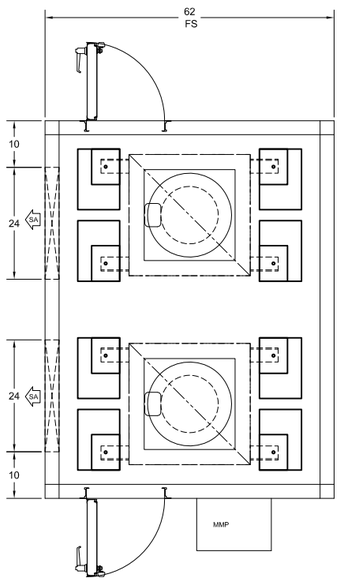
Ductwork:
See plans for ductwork routing of each AHU.

- - - END OF MECHANICAL NARRATIVE - - -

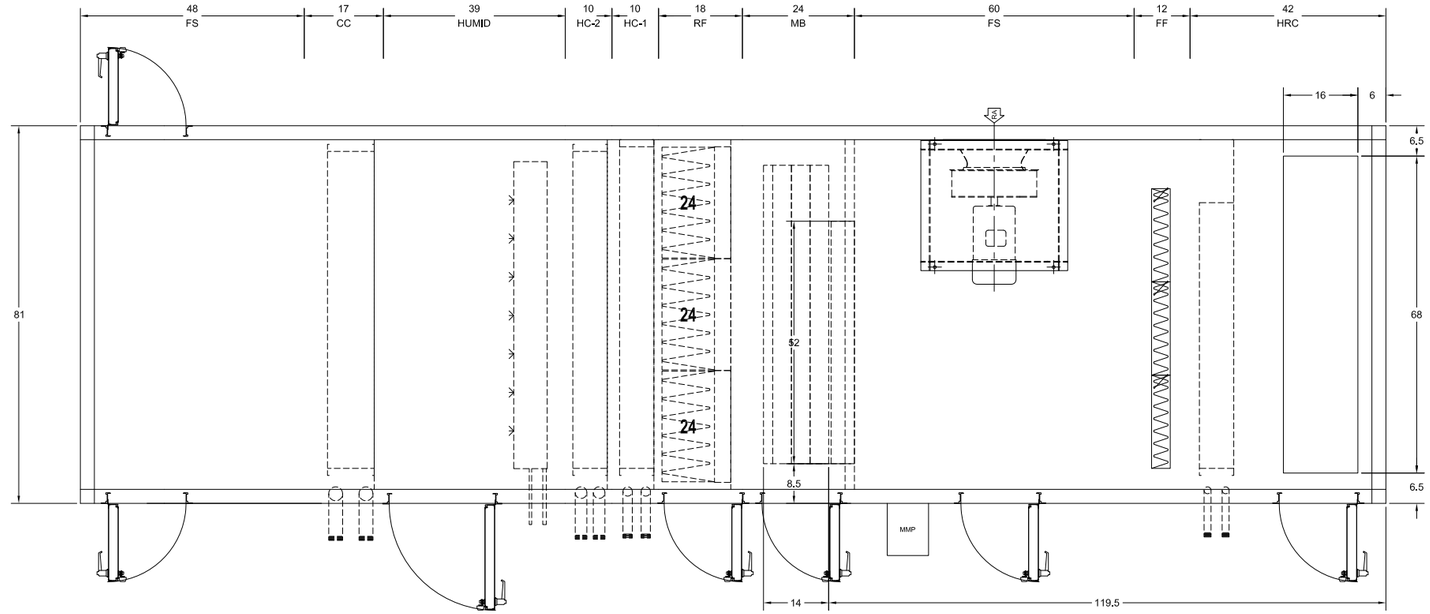
Appendix A:

Basis of design will be Johnson Controls Custom Air Handling Units

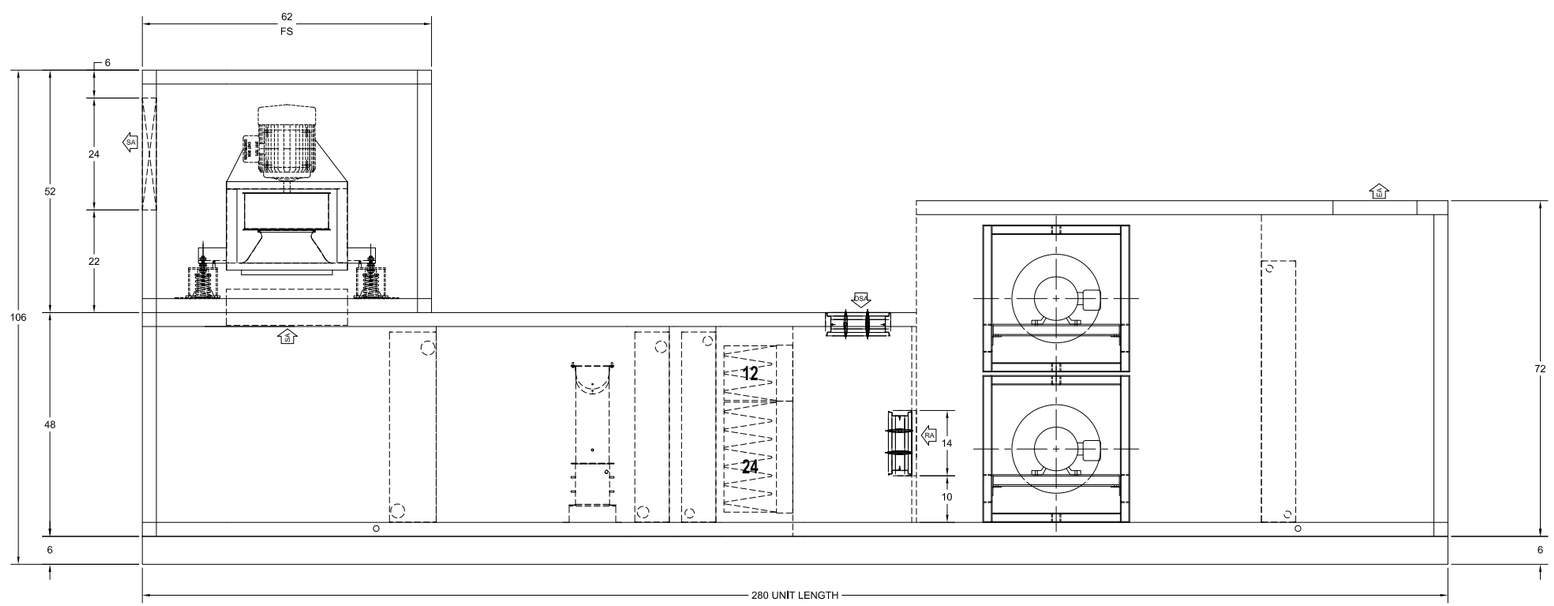
Attached are the submittals for all units.



PLAN VIEW
UPPER LEVEL



PLAN VIEW

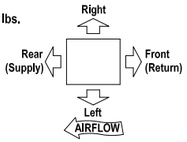


ELEVATION VIEW

UNIT CONSTRUCTION

Model: Solution-XTI-42x81 **Construction: Indoor**
Motor Location:
Unit Weight: 8,978 lbs.

PLAN VIEW



NOTES

Units with a baserail and a bottom opening: Duct connection flush with the bottom of unit, not flush with bottom of baserail.

Refer to performance report for shipping split details.

Allow sufficient space around the unit for removing the access panels and various parts of the unit. A minimum clearance equal to the width of the unit must be provided on one side of the unit for removing the coil or fan assembly.

Contractor responsible for penetrations and connections of all electrical boxes and internal coil connections.

Overall dimensions account for: outdoor roof peak and overhang, motor control and/or factory package control boxes, coil connections, rain hoods, pipe chases, AMS-60 damper/EAML louver (if applicable,) base rail - In order to convey the true space requirements for the unit.

Certain items may extend beyond cabinet dimensions including: door handles, light switches, electrical boxes, lifting lugs, gas fuel system, etc.

The overall unit length includes an additional 1/4" per shipping split due to additional gasketing and split connection hardware.

Dimension tolerances: Unit (+/- 1/2"); Piping (+/- 2")

SL - Designates Shipped Loose Item(s)

PIPING CONNECTIONS
(In order of Airflow)

Segment	Type	Hand	Quantity	Supply	Return
HC	MPT	Left	1 Sup 1 Ret	2"	2"
HC	MPT	Left	1 Sup 1 Ret	2 1/2"	2 1/2"
CC	MPT	Left	1 Sup 1 Ret	3"	3"

Drain pan connection size 1 1/4" MPT SCH 40 (Connections on Left Side of unit)

SECTION LIST

SECT	DESCRIPTION
MB	Mixing Box
RF	High Efficiency Filter
HC-1	Heating Coil
HC-2	Heating Coil
CC	Cooling Coil
FS	Supply Fan - 182EPFN

PRODUCT DRAWING

SOLUTION XT AIR HANDLING UNIT DETAIL
MODEL: Solution-XTI-42x81
NOT FOR CONSTRUCTION

Project Name: Fort Harrison VA
Location:
Engineer:
Contractor:
For:

Sold To:
Cust Purch Order#:
Contract#:
UNIT TAG: AC-2

Date: 2.16.18
Version:
Form No.:
Dwg. Lev.: 5/03
Dwg. Scale: NTS

Serial Number:
SQ Database Number:
YORKworks Release:
Dwg. Name:
Dwg. Location:

Johnson Controls

SOLUTION XT AIR HANDLING UNIT PERFORMANCE SPECIFICATION

Unit Tag	Qty	Model	Air Flow (CFM)
AC-2	1	Indoor Air Handler 48 x 81	8000

FR - Return Plenum Fan Segment

Segment Details

Segment Air Pressure Drop (in. w.g.):	0.42
Air Flow per Fan (CFM):	4000
Air Flow Total (CFM):	8000
Altitude (ft.):	4000
TSP/ESP (in. w.g.):	2.27/ 1.00
Air Inlet:	Front(Front)
Fan Discharge:	Rear(Rear)

Fan Segment Options

Isolation - Rubber Pad Isolators
Interior STD Ga. Galvanized Liner
Insulation: R-13 2" Foam
STD Ga. Galvanized Floor Liner
Exterior STD Ga. Galvanized Liner
Fan AFMS Airflow Constant (K Factor): 1821.92
Transducer Range: 0-25"
Access Door - Refer to adjacent segments
MMP Panels are rated for VFD use ONLY (no bypass).
Flow Isolation: Blank-off Plate(s)

Fan Detail (per fan)

Type: Multiple: Standard Redundancy	Multiple PL-MPQS
Size:	182
Construction:	II
Bearing Options:	None
Fan RPM:	1846
BHP/(Pe/kW)*:	2.25
Total Fan BHP/(Pe/kW)*:	2.25
Outlet Velocity (ft/min):	N/A
% Wheel Width:	100.00
% Wheel Diameter:	100.00

Motor Detail (per motor)

Motor Type:	TECO TEFC Premium Efficiency
HP/kW*	3.0
Voltage/Phase/Frequency:	208/3/60 Hz
Insulation Class:	F
Motor RPM:	1800
Frame Size:	182
Location	Integral to motor
Drive Type:	Direct Drive
Belt Drive Type:	N/A
	Fan Arrangement: 2H x 1W
Full Load Amps (FLA):	8.27
Efficiency:	89.5%

SOLUTION XT AIR HANDLING UNIT PERFORMANCE SPECIFICATION

Unit Tag	Qty	Model	Air Flow (CFM)
AC-2	1	Indoor Air Handler 48 x 81	8000

Motor Control – Return Fan

Motor Control Details(Per VFD)

Motor Control Type:	Variable Frequency Drive Manual motor protection (MMP) with individual non-fused disconnects wired to motors
Motor HP/kW*:	6.0

Motor Control Electrical Details(Per VFD)

Full Load Amps (FLA):	24.2

Motor Control Options

None Disconnect
RFI/EMI EMC Filter
Swinging DC Line Choke (equivalent to 5% Input Line Reactor)
Modbus RTU, Johnson N2, BACnet

Environmental

Ambient Temperature (°F):	5 to 104
Storage Temperature (°F):	-40 to 158
Humidity:	MAX 95% RH non-condensing
Altitude:	3,280 ft. without derate (1% derate for each additional 328 ft.)
Enclosure:	NEMA 1

Input (Per VFD)

Rated Input Voltage:	3 Phase 208-240 VAC +/-10% 48/63Hz +/- 5%
Rated Input Current Amps:	24.20
Heat Loss in Watts 100% Load:	227.00
Efficiency (%):	98.00

Output (Per VFD)

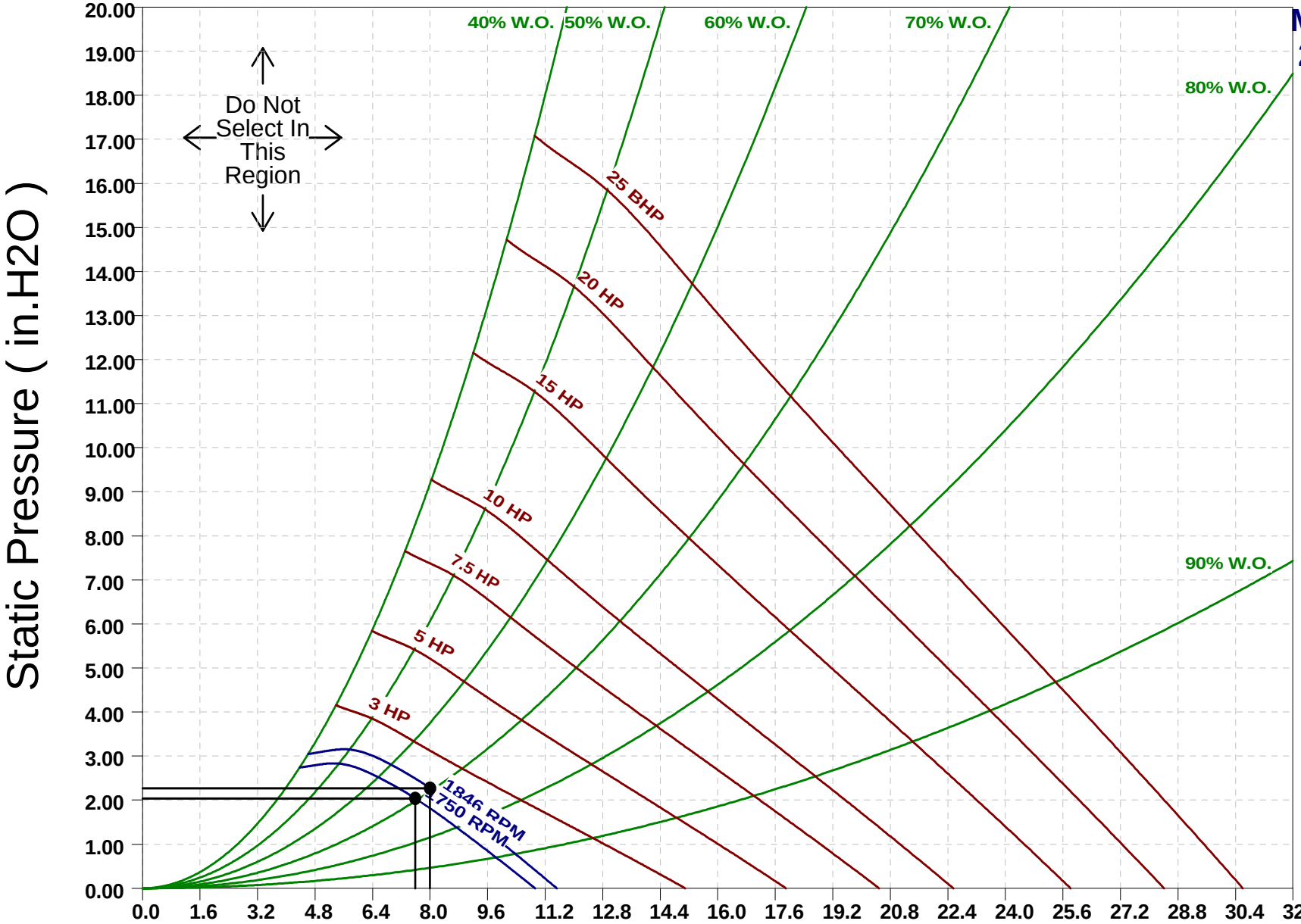
Output Current Amps:	24.2
Overload Current Rating:	110% for 1 minute every 10 minutes

Drives are rated for use below 3,280 ft and 104°F.
Use Airmod AYK Derating Charts for use above these limits.

Copper Conductors Only

Solution XT Fan Rating Curve

Project Name	Unit Tag	Qty	Model	Seg	Fan Type	Class	Size
Fort Harrison VA_2.22.18	AC-2	1	XTI-84x72	FR	PL-MPQS	II	182



Multiple Fans
2 Fans (2X1)

Operating Point
Total Flow (cfm): 8000
TSP (in.H2O): 2.27
Altitude (ft): 4000

Fan Characteristics
Draw Type: Blow-Thru
Drive Type: Direct
Wheel Width: 100%

Design Speed
RPM: 1846
BHP: 2.25
Total Efficiency: 64.42

Synch Speed
RPM: 1750
Total Flow (cfm): 7584
TSP (in H2O): 2.04
BHP: 1.91
Total Eff.: 63.53

Fan Limits
Max RPM: 2930.00

RPM
HP
System

Printed: 02/23/18 @ 10:07:34
Unit Folder:

SOLUTION XT AIR HANDLING UNIT PERFORMANCE SPECIFICATION

Unit Tag	Qty	Model	Air Flow (CFM)
AC-2	1	Indoor Air Handler 48 x 81	8000

FS - Supply Plenum Fan Segment

Segment Details

Segment Air Pressure Drop (in. w.g.):	0.42
Air Flow per Fan (CFM):	4000
Air Flow Total (CFM):	8000
Altitude (ft.):	4000
TSP/ESP (in. w.g.):	4.72/ 4.33
Air Inlet:	Front(Front)
Fan Discharge:	Rear(Rear)

Fan Segment Options

Isolation - Rubber Pad Isolators
Interior STD Ga. Galvanized Liner
Insulation: R-13 2" Foam
STD Ga. Galvanized Floor Liner
Exterior STD Ga. Galvanized Liner
Fan AFMS Airflow Constant (K Factor): 1821.92
Transducer Range: 0-25"
Access Door - Refer to adjacent segments
MMP Panels are rated for VFD use ONLY (no bypass).
Flow Isolation: Blank-off Plate(s)

Fan Detail (per fan)

Type: Multiple: Standard Redundancy	Multiple PL-MPQS
Size:	182
Construction:	II
Bearing Options:	None
Fan RPM:	2369
BHP/(Pe/kW)*:	4.37
Total Fan BHP/(Pe/kW)*:	4.37
Outlet Velocity (ft/min):	N/A
% Wheel Width:	100.00
% Wheel Diameter:	100.00

Motor Detail (per motor)

Motor Type:	TECO TEFC Premium Efficiency
HP/kW*	5.0
Voltage/Phase/Frequency:	208/3/60 Hz
Insulation Class:	F
Motor RPM:	1800
Frame Size:	184
Location	Integral to motor
Drive Type:	Direct Drive
Belt Drive Type:	N/A
	Fan Arrangement: 1H x 2W
Full Load Amps (FLA):	13.71
Efficiency:	90%

SOLUTION XT AIR HANDLING UNIT PERFORMANCE SPECIFICATION

Unit Tag	Qty	Model	Air Flow (CFM)
AC-2	1	Indoor Air Handler 48 x 81	8000

Motor Control – Supply Fan

Motor Control Details(Per VFD)

Motor Control Type:	Variable Frequency Drive Manual motor protection (MMP) with individual non-fused disconnects wired to motors
Motor HP/kW*:	10.0

Motor Control Electrical Details(Per VFD)

Full Load Amps (FLA):	16.7

Motor Control Options

None Disconnect
RFI/EMI EMC Filter
Swinging DC Line Choke (equivalent to 5% Input Line Reactor)
Modbus RTU, Johnson N2, BACnet

Environmental

Ambient Temperature (°F):	5 to 104
Storage Temperature (°F):	-40 to 158
Humidity:	MAX 95% RH non-condensing
Altitude:	3,280 ft. without derate (1% derate for each additional 328 ft.)
Enclosure:	NEMA 1

Input (Per VFD)

Rated Input Voltage:	3 Phase 208-240 VAC +/-10% 48/63Hz +/- 5%
Rated Input Current Amps:	16.70
Heat Loss in Watts 100% Load:	161.00
Efficiency (%):	90.00

Output (Per VFD)

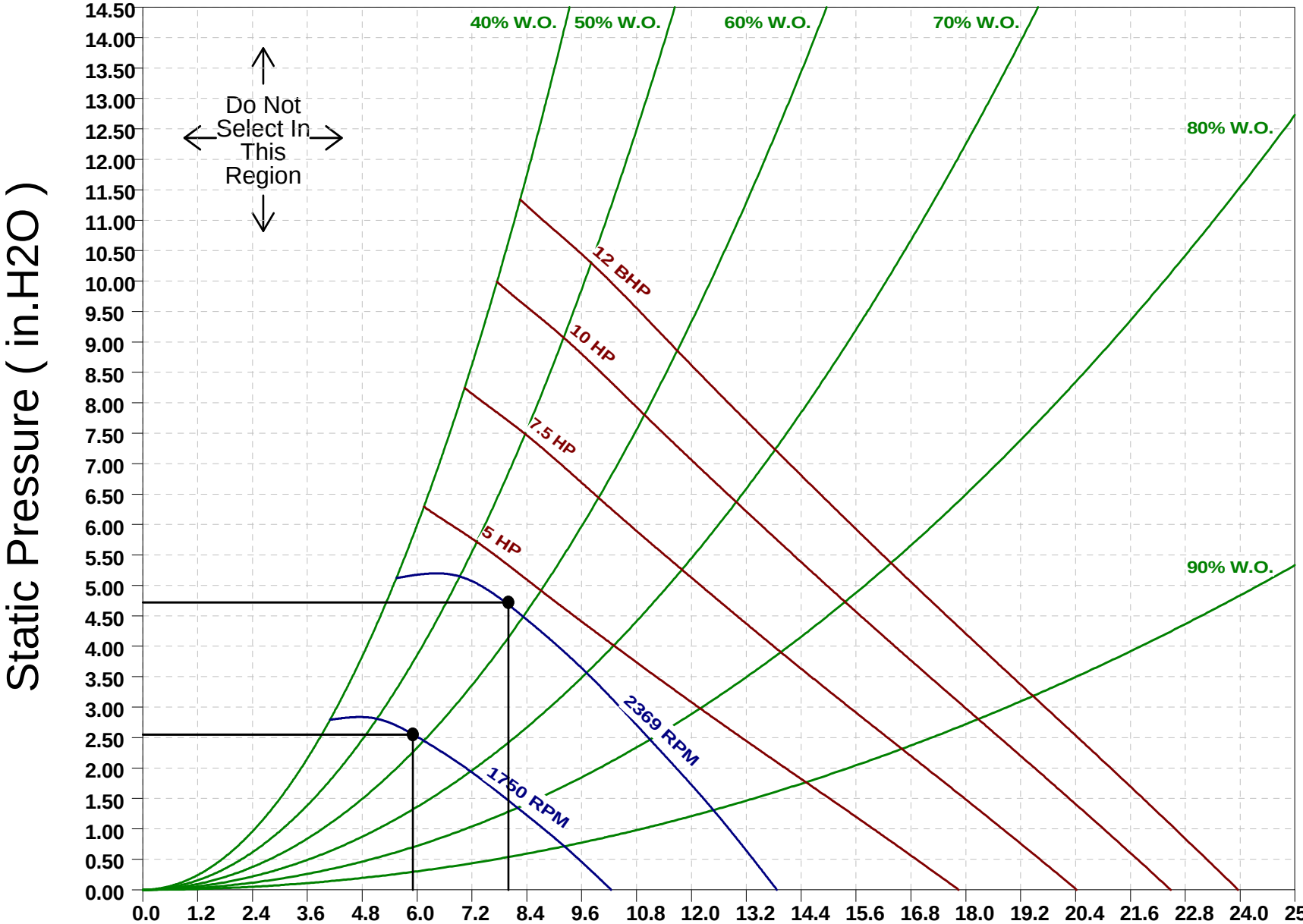
Output Current Amps:	16.7
Overload Current Rating:	110% for 1 minute every 10 minutes

Drives are rated for use below 3,280 ft and 104°F.
Use Airmod AYK Derating Charts for use above these limits.

Copper Conductors Only

York Custom Fan Rating Curve

Project Name	Unit Tag	Qty	Model	Seg	Fan Type	Class	Size
Fort Harrison VA_2.22.18	AC-2	1	YCI-57x108	FS	PL-EPQN	II	182



Dual Fans 50/50%

Operating Point

Total Flow (cfm)	8000
TSP (in.H2O):	4.72
Altitude (ft):	4000

Fan Characteristics

Draw Type:	Blow-Thru
Drive Type:	Direct
Wheel Width:	83%

Design Speed

RPM:	2369
BHP:	4.37
Total Efficiency:	0.70

Synch Speed

RPM:	1750
Total Flow (cfm)	5910
TSP (in H2O):	2.55
BHP:	1.76
Total Eff.:	0.67

Fan Limits

Max RPM:	2930.00

RPM
HP
System

Printed: 02/23/18 @ 10:48:55
Unit Folder:

SOLUTION XT AIR HANDLING UNIT PERFORMANCE SPECIFICATION

Unit Tag	Qty	Model	Air Flow (CFM)
AC-2	1	Indoor Air Handler 48 x 81	8000

Coils & Spacers Listed Starting In Direction Of Air Flow

HR Coil – EXHAUST – Winter Conditions

Coil General/Physical Details		Air Side Performance		Fluid Side Performance	
Location:	0	Air Flow (acfm):	4607	EWT (°F):	49.5
Tag:	AirCoil	Altitude (ft.):	4000	LWT (°F):	51.7
Application:	Cooling	EAT-DB (°F):	70.0	GPM:	75.0
Coil Type:	Water	EAT-WB (°F):	45.0	WPD (ft):	4.5
Face Type:	75%	LAT-DB (°F):	51.0	FPS:	3.4
Tube Diameter:	1/2" BDW	LAT-WB (°F):	35.8	Fluid Type:	Water
Tube Material:	Copper	FV (ft/min):	245	Fluid Weight(lb):	88.9
Tube Wall Thickness:	.016"	SMBH:	82.0	Fluid Volume(ft³):	1.4
Fouling Factor (hft²°F/btu):	0.00000	TMBH:	82.0		
Fin Type:	Corrugated	APD (in. w.g.):	0.08		
Fin Thickness:	.006"				
Fin Material:	Aluminum				
Casing Material:	Stainless Steel				
Connection Material:	Steel*				
Connection Type:	MPT				
Coating:	None				
Rows:	4				
Fins Per Inch:	12				
Tubes Per Circuit:	4				
Finned Height (in.):	47.50				
Finned Length (in.):	57				
Coil Face Area (ft²):	18.8				
Coil Conn. Loc.:	Left(Left)				
Supp Conn Size:	3"				
Rtn Conn Size:	3"				
Supply Conn.(per coil):	1				

*Johnson Controls suggests using red brass or copper connectors when the coil is to be attached to a copper or brass piping system.

Ratings are for coils manufactured by Johnson Controls, Inc., 507 E. Michigan St., Milwaukee WI 53202.

BDW Tube Spacing: 1.25" x 1.08"

AHRI Messages:
This coil is certified in accordance with the AHRI Forced-Circulation Air-Cooling and Air-Heating Coils Certification Program which is based on AHRI Standard 410 within the range of Standard rating conditions listed in Table 1 of the Standard. Certified units may be found in the AHRI Directory at www.ahridirectory.org.

Coil Dll Version: 7.5b.003

SOLUTION XT AIR HANDLING UNIT PERFORMANCE SPECIFICATION

Unit Tag	Qty	Model	Air Flow (CFM)
AC-2	1	Indoor Air Handler 48 x 81	8000

HR Coil – SUPPLY – Winter Conditions

Coil General/Physical Details		Air Side Performance		Fluid Side Performance	
Location:	0	Air Flow (scfm):	8000	EWT (°F):	52.7
Tag:	AirCoil	Altitude (ft.):	4000	LWT (°F):	49.5
Application:	Heating	EAT-DB (°F):	34.6	GPM:	75.0
Coil Type:	Water	LAT-DB (°F):	48.6	WPD (ft):	7.3
Face Type:	Full	FV (ft/min):	444	FPS:	4.3
Tube Diameter:	1/2" BDW	TMBH:	121.2	Fluid Type:	Water
Tube Material:	Copper	APD (in. w.g.):	0.25	Fluid Weight(lb):	80.6
Tube Wall Thickness:	.016"			Fluid Volume(ft³):	1.3
Fouling Factor (hft²°F/btu):	0.00000				
Fin Type:	Corrugated				
Fin Thickness:	.006"				
Fin Material:	Aluminum				
Casing Material:	Stainless Steel				
Connection Material:	Steel*				
Connection Type:	MPT				
Coating:	None				
Rows:	4				
Fins Per Inch:	12				
Tubes Per Circuit:	4				
Finned Height (in.):	37.50				
Finned Length (in.):	69				
Coil Face Area (ft²):	18.0				
Coil Conn. Loc.:	Left(Left)				
Supp Conn Size:	3"				
Rtn Conn Size:	3"				
Supply Conn.(per coil):	1				

SOLUTION XT AIR HANDLING UNIT PERFORMANCE SPECIFICATION

Unit Tag	Qty	Model	Air Flow (CFM)
AC-2	1	Indoor Air Handler 48 x 81	8000

Unit Tag	Coil Type	Air Flow (scfm)
HR Coil – EXHAUST – Summer Conditions	BDW (Water)	4607

Input Data

General		Air Side		Fluid Side	
Application:	Heating	Altitude (ft.):	4000	EWT (°F):	79.2
Tube Diameter:	1/2”	Air Flow (acfm):	4607	LWT (°F):	n/a
Tube Wall Thickness:	0.016”	Face Velocity (ft/min):	245	Flow Rate (gpm):	75.0
Fouling Factor (hft²°F/btu):	0.00000	EAT-DB (°F):	77.0	Max. WPD (ft.):	n/a
Casing Material:	Stainless Steel	Max. APD (in. w.g):	3.00	TPC:	4
Fin Type:	Corrugated	Req. LAT-DB (°F):	n/a	Fluid:	Water
Fin Material:	Aluminum	Req. TMBH:	n/a	Fluid Volume (ft³):	1.4
Fin Thickness:	0.006”	Air Flow Direction:	Horizontal	Fluid Weight (lbs):	88.7
Fin Height:	47.50”				
Fin Length:	57”				
Connection Material:	Steel				
Connection Type:	MPT				
Dry Weight (lbs.):	223.2				

Note: Coil is not coated.

Output Data

General		Air Side Performance		Fluid Side Performance	
Rows:	4	LAT-DB (°F):	79.07	LWT (°F):	78.96
FPI:	12	TMBH:	8.8	Fluid Vel. (fps)	3.4
TPC:	4	APD (in. w.g):	0.08	WPD (ft.):	4.3
Connection Size:	3”			Flow Rate (gpm):	75.0
No. Connections:	1				
Coil Dll Version:	7.5b.003				

SOLUTION XT AIR HANDLING UNIT PERFORMANCE SPECIFICATION

Unit Tag	Qty	Model	Air Flow (CFM)
AC-2	1	Indoor Air Handler 48 x 81	8000

Unit Tag	Coil Type	Air Flow (scfm)
HR Coil – SUPPLY – Summer Conditions	BDW (Water)	4607

Input Data

General		Air Side		Fluid Side	
Application:	Cooling	Altitude (ft.):	4000	EWT (°F):	78.9
Tube Diameter:	1/2”	Air Flow (scfm):	8000	LWT (°F):	n/a
Tube Wall Thickness:	0.016”	Face Velocity (ft/min):	445	Flow Rate (gpm):	75.0
Fouling Factor (hft²°F/btu):	0.00000	EAT-DB (°F):	80.9	Max. WPD (ft.):	n/a
Casing Material:	Stainless Steel	EAT-WB (°F):	57.0	TPC:	4
Fin Type:	Corrugated	Max. APD (in. w.g):	3.00	Fluid:	Water
Fin Material:	Aluminum	Req. LAT-WB (°F):	n/a	Fluid Volume (ft³):	1.3
Fin Thickness:	0.006”	Req. TMBH:	n/a	Fluid Weight (lbs):	80.3
Fin Height:	37.50”	Air Flow Direction:	Horizontal		
Fin Length:	69”				
Connection Material:	Steel				
Connection Type:	MPT				
Dry Weight (lbs.):	216.2				

Note: Coil is not coated.

Output Data

General		Air Side Performance		Fluid Side Performance	
Rows:	4	LAT-DB (°F):	79.32	LWT (°F):	79.27
FPI:	12	LAT-WB (°F):	56.38	Fluid Vel. (fps)	4.3
TPC:	4	TMBH:	13.8	WPD (ft.):	6.9
Connection Size:	3”	SMBH:	13.8	Flow Rate (gpm):	75.0
No. Connections:	1	APD (in. w.g):	0.26		
Coil Dll Version:	7.5b.003				

SOLUTION XT AIR HANDLING UNIT PERFORMANCE SPECIFICATION

Unit Tag	Qty	Model	Air Flow (CFM)
AC-2	1	Indoor Air Handler 48 x 81	8000

Heating Coil

Coil General/Physical Details		Air Side Performance		Fluid Side Performance	
Location:	0	Air Flow (scfm):	8000	EWT (°F):	140.0
Tag:	AirCoil	Altitude (ft.):	4000	LWT (°F):	100.0
Application:	Heating	EAT-DB (°F):	34.6	GPM:	25.0
Coil Type:	Glycol	LAT-DB (°F):	87.4	WPD (ft):	6.2
Face Type:	Full	FV (ft/min):	444	FPS:	2.9
Tube Diameter:	1/2" BDW	TMBH:	457.3	Fluid Type:	Propylene
Tube Material:	Copper	APD (in. w.g.):	0.19	% Glycol:	45.00
Tube Wall Thickness:	.016"			Fluid Weight(lb):	55.0
Fouling Factor (hft²°F/btu):	0.00000			Fluid Volume(ft³):	0.9
Fin Type:	Corrugated				
Fin Thickness:	.006"				
Fin Material:	Aluminum				
Casing Material:	Galvanized				
Connection Material:	Steel				
Connection Type:	MPT				
Coating:	None				
Rows:	3				
Fins Per Inch:	12				
Tubes Per Circuit:	6				
Finned Height (in.):	37.50				
Finned Length (in.):	69				
Coil Face Area (ft²):	18.0				
Coil Conn. Loc.:	Left(Left)				
Supp Conn Size:	2"				
Rtn Conn Size:	2"				
Supply Conn.(per coil):	1				

SOLUTION XT AIR HANDLING UNIT PERFORMANCE SPECIFICATION

Unit Tag	Qty	Model	Air Flow (CFM)
AC-2	1	Indoor Air Handler 48 x 81	8000

Cooling Coil

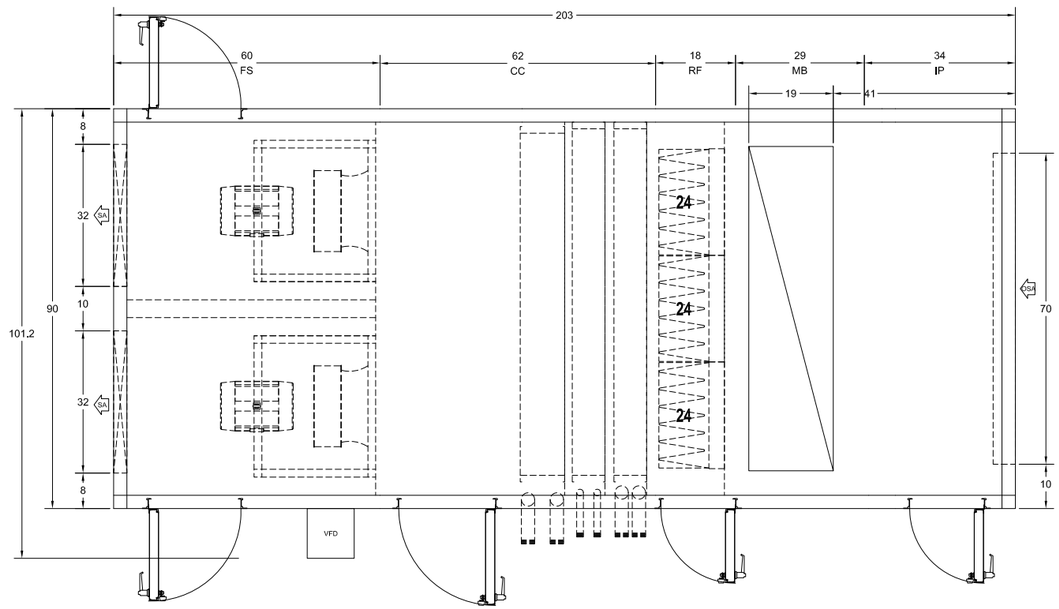
Coil General/Physical Details		Air Side Performance		Fluid Side Performance	
Location:	0	Air Flow (scfm):	8000	EWT (°F):	45.0
Tag:	AirCoil	Altitude (ft.):	4000	LWT (°F):	55.0
Application:	Cooling	EAT-DB (°F):	80.9	GPM:	48.6
Coil Type:	Glycol	EAT-WB (°F):	57.0	WPD (ft):	12.0
Face Type:	Full	LAT-DB (°F):	55.8	FPS:	3.2
Tube Diameter:	5/8" CDW	LAT-WB (°F):	46.3	Fluid Type:	Propylene
Tube Material:	Copper	FV (ft/min):	432	% Glycol:	45.00
Tube Wall Thickness:	.020"	SMBH:	219.2	Fluid Weight(lb):	177.0
Fouling Factor (hft²°F/btu):	0.00000	TMBH:	219.2	Fluid Volume(ft³):	2.7
Fin Type:	Sine	APD (in. w.g.):	0.64		
Fin Thickness:	.008"				
Fin Material:	Aluminum				
Casing Material:	Stainless Steel				
Connection Material:	Steel				
Connection Type:	MPT				
Coating:	None				
Rows:	8				
Fins Per Inch:	12				
Tubes Per Circuit:	12				
Finned Height (in.):	39.25				
Finned Length (in.):	68				
Coil Face Area (ft²):	18.5				
Coil Conn. Loc.:	Left(Left)				
Supp Conn Size:	2-1/2"				
Rtn Conn Size:	2-1/2"				
Supply Conn.(per coil):	1				

Ratings are for coils manufactured by Johnson Controls, Inc., 507 E. Michigan St., Milwaukee WI 53202.

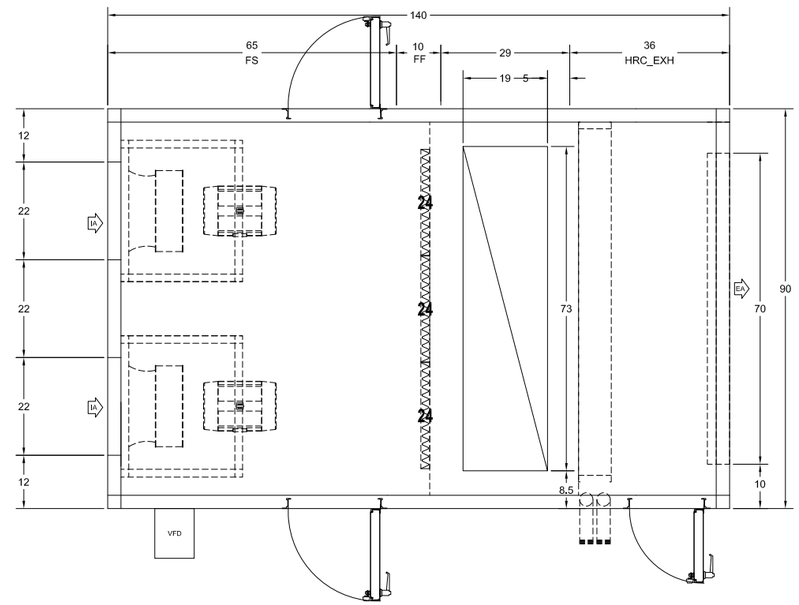
CDW Tube Spacing: 1.50" x 1.30"

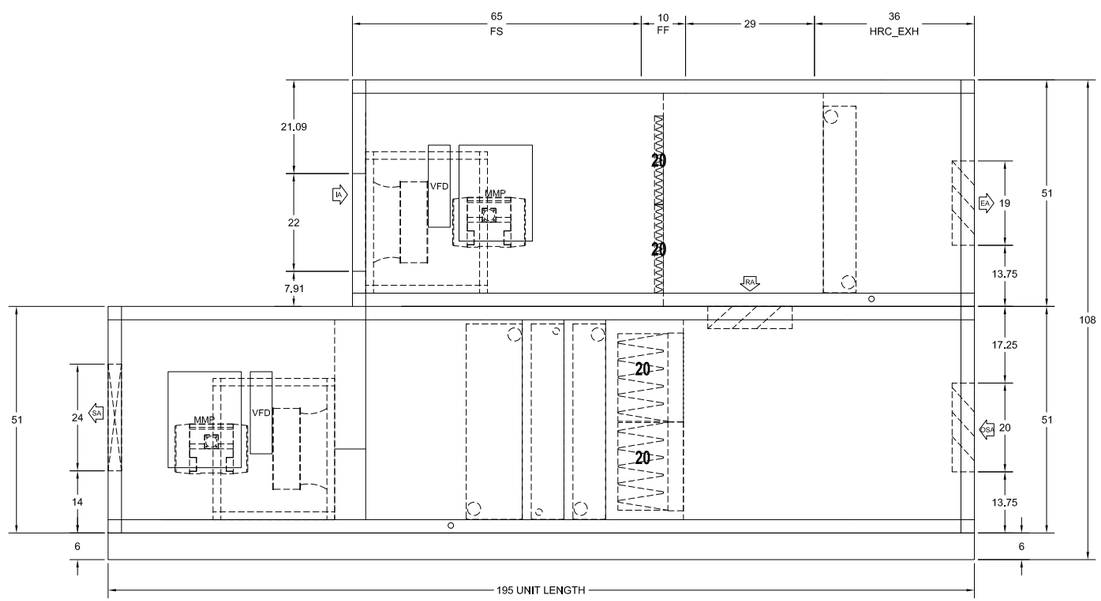
AHRI Messages:
This coil is certified in accordance with the AHRI Forced-Circulation Air-Cooling and Air-Heating Coils Certification Program which is based on AHRI Standard 410 within the range of Standard rating conditions listed in Table 1 of the Standard. Certified units may be found in the AHRI Directory at www.ahridirectory.org.

Coil Dll Version: 7.5b.003



PLAN VIEW





ELEVATION VIEW

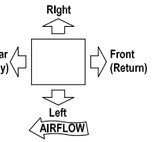
UNIT CONSTRUCTION

Model: Solution-XTI-51x81 **Construction: Indoor**

Motor Location:

Unit Weight: 7,985 lbs.

PLAN VIEW



NOTES

Units with a baserail and a bottom opening; Duct connection flush with the bottom of unit, not flush with bottom of baserail.

Refer to performance report for shipping split details.

Allow sufficient space around the unit for removing the access panels and various parts of the unit. A minimum clearance equal to the width of the unit must be provided on one side of the unit for removing the coil or fan assembly.

Contractor responsible for penetrations and connections of all electrical boxes and internal coil connections.

Overall dimensions account for: outdoor roof peak and overhang, motor control and/or factory package control boxes, coil connections, rain hoods, pipe chases, AMS-60 damper/EAML louver (if applicable,) base rail - In order to convey the true space requirements for the unit.

Certain items may extend beyond cabinet dimensions including: door handles, light switches, electrical boxes, lifting lugs, gas fuel system, etc.

The overall unit length includes an additional 1/4" per shipping split due to additional gasketing and split connection hardware.

Dimension tolerances: Unit (+/- 1/2"); Piping (+/- 2")

SL - Designates Shipped Loose Item(s)

PIPING CONNECTIONS
(In order of Airflow)

Segment	Type	Hand	Quantity	Supply	Return
HC	MPT	Left	1 Sup 1 Ret	3"	3"
HC	MPT	Left	1 Sup 1 Ret	3"	3"
CC	MPT	Left	1 Sup 1 Ret	3"	3"

Drain pan connection size 1 1/4" MPT SCH 40 (Connections on Left Side of unit)

SECTION LIST

SECT	DESCRIPTION
MB	Mixing Box
RF	High Efficiency Filter
HC-1	Heating Coil
HC-2	Heating Coil
CC	Cooling Coil
FS	Supply Fan - 245EPFN

PRODUCT DRAWING

SOLUTION XT AIR HANDLING UNIT DETAIL
MODEL: Solution-XTI-48x81
NOT FOR CONSTRUCTION

Project Name: Fort Harrison VA
Location:
Engineer:
Contractor:
For:

Sold To:
Cust Purch Order#:
Contract#:
UNIT TAG: S1-A

Date: 2.16.18
Version:
Form No.:
Dwg. Lev.: 5/03
Dwg. Scale: NTS

Serial Number:
SQ Database Number:
YORKworks Release:
Dwg. Name:
Dwg. Location:

Johnson Controls

SOLUTION XT AIR HANDLING UNIT PERFORMANCE SPECIFICATION

Unit Tag	Qty	Model	Air Flow (CFM)
S-1A	1	Indoor Air Handler 51 x 90	10300

FR - Return Plenum Fan Segment

Segment Details

Segment Air Pressure Drop (in. w.g.):	0.42
Air Flow per Fan (CFM):	5150
Air Flow Total (CFM):	10300
Altitude (ft.):	4000
TSP/ESP (in. w.g.):	2.33/ 1.00
Air Inlet:	Front(Front)
Fan Discharge:	Rear(Rear)

Fan Segment Options

Isolation - Rubber Pad Isolators
Interior STD Ga. Galvanized Liner
Insulation: R-13 2" Foam
STD Ga. Galvanized Floor Liner
Exterior STD Ga. Galvanized Liner
Fan AFMS Airflow Constant (K Factor): 1821.92
Transducer Range: 0-25"
Access Door - Refer to adjacent segments
MMP Panels are rated for VFD use ONLY (no bypass).
Flow Isolation: Blank-off Plate(s)

Fan Detail (per fan)

Type: Multiple: Standard Redundancy	Multiple PL-MPQS
Size:	182
Construction:	II
Bearing Options:	None
Fan RPM:	2138
BHP/(Pe/kW)*:	3.24
Total Fan BHP/(Pe/kW)*:	3.24
Outlet Velocity (ft/min):	N/A
% Wheel Width:	100.00
% Wheel Diameter:	100.00

Motor Detail (per motor)

Motor Type:	TECO TEFC Premium Efficiency
HP/kW*	5.0
Voltage/Phase/Frequency:	208/3/60 Hz
Insulation Class:	F
Motor RPM:	1800
Frame Size:	184
Location	Integral to motor
Drive Type:	Direct Drive
Belt Drive Type:	N/A
	Fan Arrangement: 1H x 2W
Full Load Amps (FLA):	13.50
Efficiency:	89.5%

SOLUTION XT AIR HANDLING UNIT PERFORMANCE SPECIFICATION

Unit Tag	Qty	Model	Air Flow (CFM)
S-1A	**1**	**Indoor Air Handler 51 x 90**	**10300**

Motor Control – Return Fan

Motor Control Details(Per VFD)

Motor Control Type:	Variable Frequency Drive Manual motor protection (MMP) with individual non-fused disconnects wired to motors
Motor HP/kW*:	10.0

Motor Control Electrical Details(Per VFD)

Full Load Amps (FLA):	30.8

Motor Control Options

None Disconnect
RFI/EMI EMC Filter
Swinging DC Line Choke (equivalent to 5% Input Line Reactor)
Modbus RTU, Johnson N2, BACnet

Environmental

Ambient Temperature (°F):	5 to 104
Storage Temperature (°F):	-40 to 158
Humidity:	MAX 95% RH non-condensing
Altitude:	3,280 ft. without derate (1% derate for each additional 328 ft.)
Enclosure:	NEMA 1

Input (Per VFD)

Rated Input Voltage:	3 Phase 208-240 VAC +/-10% 48/63Hz +/- 5%
Rated Input Current Amps:	30.80
Heat Loss in Watts 100% Load:	285.00
Efficiency (%):	98.00

Output (Per VFD)

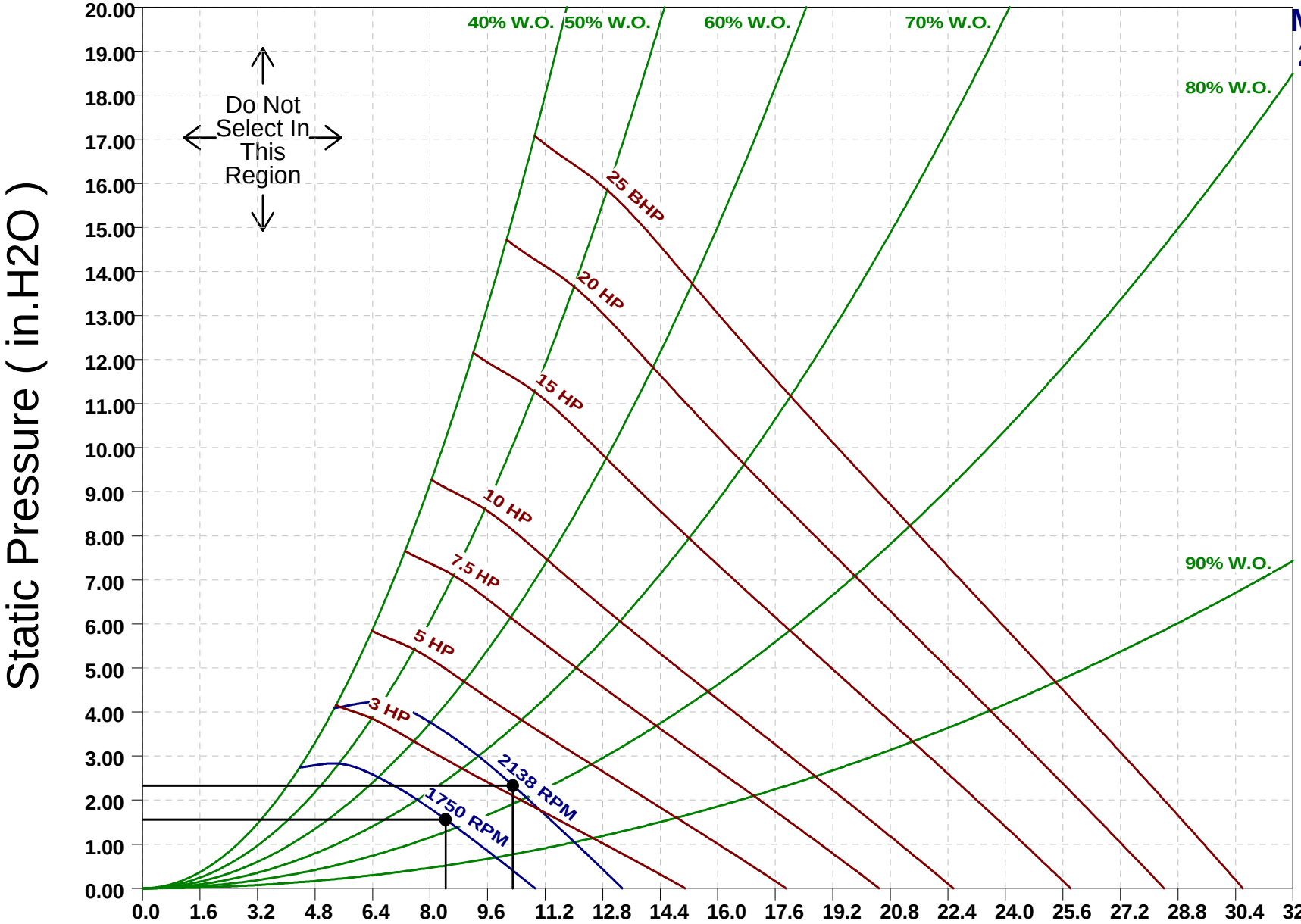
Output Current Amps:	30.8
Overload Current Rating:	110% for 1 minute every 10 minutes

Drives are rated for use below 3,280 ft and 104°F.
Use Airmod AYK Derating Charts for use above these limits.

Copper Conductors Only

Solution XT Fan Rating Curve

Project Name	Unit Tag	Qty	Model	Seg	Fan Type	Class	Size
Fort Harrison VA_2.22.18	S-1A	1	XTI-51x90	FR	PL-MPQS	II	182



Multiple Fans
2 Fans (1X2)

Operating Point

Total Flow (cfm	10300
TSP (in.H2O):	2.33
Altitude (ft):	4000

Fan Characteristics

Draw Type	Blow-Thru
Drive Type:	Direct
Wheel Width:	100%

Design Speed

RPM:	2138
BHP:	3.24
Total Efficiency	59.52

Synch Speed

RPM:	1750
Total Flow (cfm)	8430
TSP (in H2O):	1.56
BHP:	1.78
Total Eff.:	58.20

Fan Limits

Max RPM:	2930.00

Printed: 02/23/18 @ 6:58:13
Unit Folder:

SOLUTION XT AIR HANDLING UNIT PERFORMANCE SPECIFICATION

Unit Tag	Qty	Model	Air Flow (CFM)
S-1A	1	Indoor Air Handler 51 x 90	10300

FS - Supply Plenum Fan Segment

Segment Details

Segment Air Pressure Drop (in. w.g.):	0.42
Air Flow per Fan (CFM):	5150
Air Flow Total (CFM):	10300
Altitude (ft.):	0
TSP/ESP (in. w.g.):	4.87/ 2.00
Air Inlet:	Front(Front)
Fan Discharge:	Rear(Rear)

Fan Segment Options

Isolation - Rubber Pad Isolators
Interior STD Ga. Galvanized Liner
Insulation: R-13 2" Foam
STD Ga. Galvanized Floor Liner
Exterior STD Ga. Galvanized Liner
Fan AFMS Airflow Constant (K Factor): 1821.92
Transducer Range: 0-25"
Access Door - Refer to adjacent segments
MMP Panels are rated for VFD use ONLY (no bypass).
Flow Isolation: Blank-off Plate(s)

Fan Detail (per fan)

Type: Multiple: Standard Redundancy	Multiple PL-MPQS
Size:	182
Construction:	II
Bearing Options:	None
Fan RPM:	2389
BHP/(Pe/kW)*:	5.65
Total Fan BHP/(Pe/kW)*:	5.65
Outlet Velocity (ft/min):	N/A
% Wheel Width:	100.00
% Wheel Diameter:	100.00

Motor Detail (per motor)

Motor Type:	TECO TEFC Premium Efficiency
HP/kW*	7.5
Voltage/Phase/Frequency:	460/3/60 Hz
Insulation Class:	F
Motor RPM:	1800
Frame Size:	213
Location	Integral to motor
Drive Type:	Direct Drive
Belt Drive Type:	N/A
	Fan Arrangement: 1H x 2W
Full Load Amps (FLA):	8.85
Efficiency:	91.7%

SOLUTION XT AIR HANDLING UNIT PERFORMANCE SPECIFICATION

Unit Tag	Qty	Model	Air Flow (CFM)
S-1A	1	Indoor Air Handler 51 x 90	10300

Motor Control – Supply Fan

Motor Control Details(Per VFD)

Motor Control Type:	Variable Frequency Drive Manual motor protection (MMP) with individual non-fused disconnects wired to motors
Motor HP/kW*:	15.0

Motor Control Electrical Details(Per VFD)

Full Load Amps (FLA):	23.0

Motor Control Options

None Disconnect
RFI/EMI EMC Filter
Swinging DC Line Choke (equivalent to 5% Input Line Reactor)
Modbus RTU, Johnson N2, BACnet

Environmental

Ambient Temperature (°F):	5 to 104
Storage Temperature (°F):	-40 to 158
Humidity:	MAX 95% RH non-condensing
Altitude:	3,280 ft. without derate (1% derate for each additional 328 ft.)
Enclosure:	NEMA 1

Input (Per VFD)

Rated Input Voltage:	380/400/415/440/460/480 +10% -15% VAC 3 phase
Rated Input Current Amps:	23.00
Heat Loss in Watts 100% Load:	337.00
Efficiency (%):	98.00

Output (Per VFD)

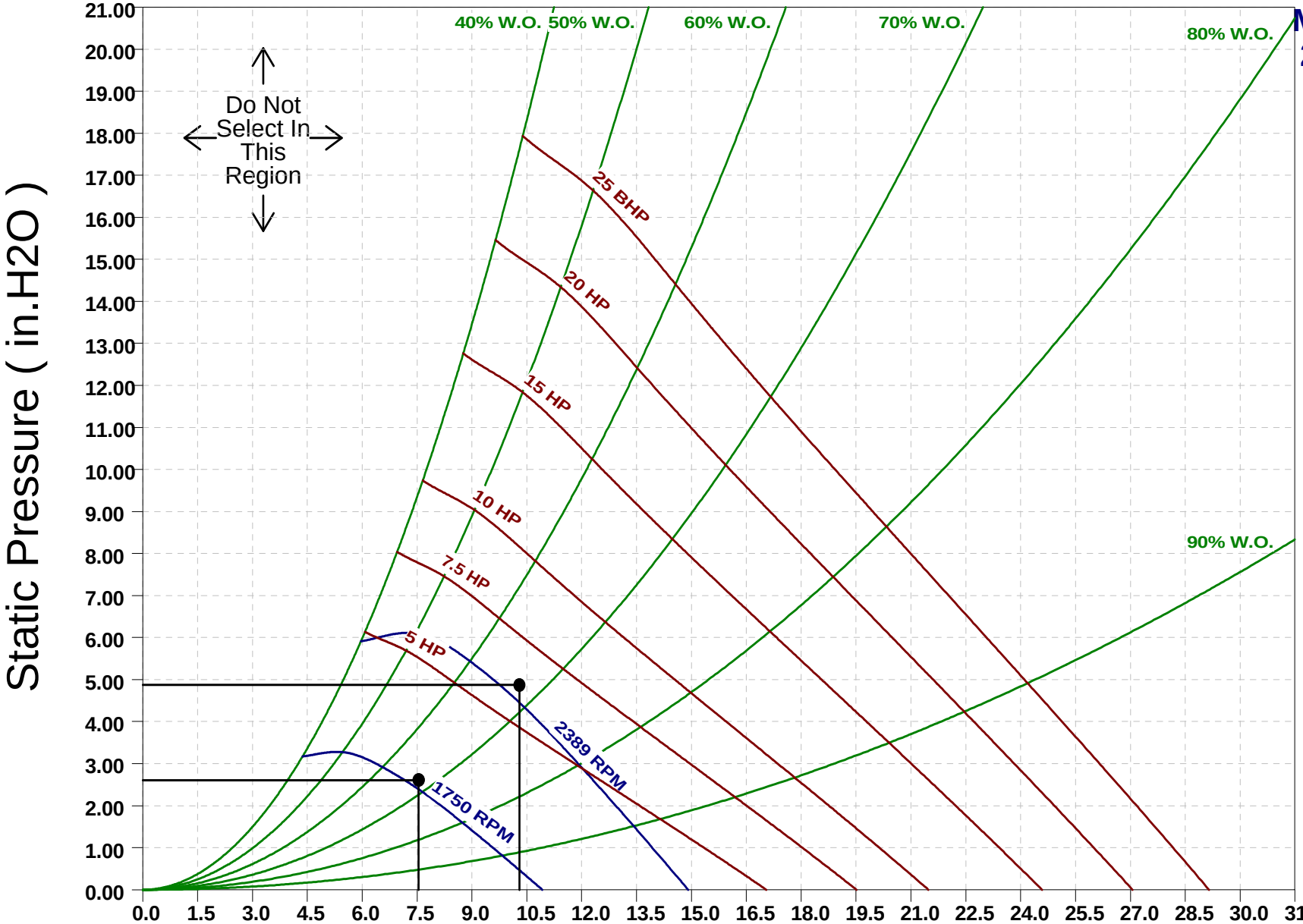
Output Current Amps:	23.0
Overload Current Rating:	110% for 1 minute every 10 minutes

Drives are rated for use below 3,280 ft and 104°F.
Use Airmod AYK Derating Charts for use above these limits.

Copper Conductors Only

Solution XT Fan Rating Curve

Project Name	Unit Tag	Qty	Model	Seg	Fan Type	Class	Size
Fort Harrison VA_2.22.18	S-1A	1	XTI-51x90	FS	PL-MPQS	II	182



Multiple Fans
2 Fans (1X2)

Operating Point

Total Flow (cfm)	10300
TSP (in.H2O):	4.87
Altitude (ft):	0

Fan Characteristics

Draw Type:	Blow-Thru
Drive Type:	Direct
Wheel Width:	100%

Design Speed

RPM:	2389
BHP:	5.65
Total Efficiency:	64.58

Synch Speed

RPM:	1750
Total Flow (cfm):	7544
TSP (in H2O):	2.61
BHP:	2.22
Total Eff.:	69.71

Fan Limits

Max RPM:	2930.00

RPM
HP
System

Printed: 02/23/18 @ 6:55:42
Unit Folder:

SOLUTION XT AIR HANDLING UNIT PERFORMANCE SPECIFICATION

Unit Tag	Qty	Model	Air Flow (CFM)
S-1A	1	Indoor Air Handler 51 x 90	10300

Coils & Spacers Listed Starting In Direction Of Air Flow

Unit Tag	Coil Type	Air Flow (scfm)
HR Coil – EXHAUST – Winter Conditions	BDW (Water)	2438

Input Data

General		Air Side		Fluid Side	
Application:	Cooling	Altitude (ft.):	4000	EWT (°F):	54.7
Tube Diameter:	1/2”	Air Flow (scfm):	2438	LWT (°F):	n/a
Tube Wall Thickness:	0.016”	Face Velocity (ft/min):	106	Flow Rate (gpm):	100.0
Fouling Factor (hft²°F/btu):	0.00000	EAT-DB (°F):	70.0	Max. WPD (ft.):	n/a
Casing Material:	Stainless Steel	EAT-WB (°F):	54.4	TPC:	4
Fin Type:	Corrugated	Max. APD (in. w.g):	3.00	Fluid:	Water
Fin Material:	Aluminum	Req. LAT-WB (°F):	n/a	Fluid Volume (ft³):	1.6
Fin Thickness:	0.006”	Req. TMBH:	n/a	Fluid Weight (lbs):	99.1
Fin Height:	42.50”	Air Flow Direction:	Horizontal		
Fin Length:	78”				
Connection Material:	Steel				
Connection Type:	MPT				
Dry Weight (lbs.):	264.6				

Note: Coil is not coated.

Output Data

General		Air Side Performance		Fluid Side Performance	
Rows:	4	LAT-DB (°F):	54.83	LWT (°F):	55.51
FPI:	12	LAT-WB (°F):	47.84	Fluid Vel. (fps)	5.1
TPC:	4	TMBH:	40.4	WPD (ft.):	11.1
Connection Size:	3”	SMBH:	40.4	Flow Rate (gpm):	100.0
No. Connections:	1	APD (in. w.g):	0.03		
Coil Dll Version:	7.5b.003				

Note(s): Ratings are for coils manufactured by: Johnson Controls, Inc., 507 E. Michigan St., Milwaukee WI 53202

BDW Tube Spacing: 1.25" x 1.08"

This coil is certified in accordance with the AHRI Forced-Circulation Air-Cooling and Air-Heating Coils Certification Program which is based on AHRI Standard 410 within the range of Standard rating conditions listed in Table 1 of the Standard. Certified units may be found in the AHRI Directory at www.ahridirectory.org.

Johnson Controls suggests using red brass or copper connectors when the coil is to be attached to a copper or brass piping system.

SOLUTION XT AIR HANDLING UNIT PERFORMANCE SPECIFICATION

Unit Tag	Qty	Model	Air Flow (CFM)
S-1A	1	Indoor Air Handler 51 x 90	10300

Unit Tag	Coil Type	Air Flow (scfm)
HR Coil – SUPPLY – Winter Conditions	BDW (Water)	10300

Input Data

General		Air Side		Fluid Side	
Application:	Heating	Altitude (ft.):	4000	EWT (°F):	55.6
Tube Diameter:	1/2”	Air Flow (scfm):	10300	LWT (°F):	n/a
Tube Wall Thickness:	0.016”	Face Velocity (ft/min):	447	Flow Rate (gpm):	100.0
Fouling Factor (hft²°F/btu):	0.00000	EAT-DB (°F):	51.2	Max. WPD (ft.):	n/a
Casing Material:	Galvanized Steel	Max. APD (in. w.g):	3.00	TPC:	6
Fin Type:	Corrugated	Req. LAT-DB (°F):	n/a	Fluid:	Water
Fin Material:	Aluminum	Req. TMBH:	n/a	Fluid Volume (ft³):	2.2
Fin Thickness:	0.006”	Air Flow Direction:	Horizontal	Fluid Weight (lbs):	136.1
Fin Height:	42.50”				
Fin Length:	78”				
Connection Material:	Steel				
Connection Type:	MPT				
Dry Weight (lbs.):	363.0				

Note: Coil is not coated.

Output Data

General		Air Side Performance		Fluid Side Performance	
Rows:	6	LAT-DB (°F):	55.13	LWT (°F):	54.72
FPI:	12	TMBH:	43.9	Fluid Vel. (fps)	5.1
TPC:	6	APD (in. w.g):	0.38	WPD (ft.):	15.6
Connection Size:	3”			Flow Rate (gpm):	100.0
No. Connections:	1				
Coil Dll Version:	7.5b.003				

Note(s): Ratings are for coils manufactured by: Johnson Controls, Inc., 507 E. Michigan St., Milwaukee WI 53202

BDW Tube Spacing: 1.25" x 1.08"

EFT < 120.0°F. - This coil is outside the scope of AHRI Standard 410.

Johnson Controls suggests using red brass or copper connectors when the coil is to be attached to a copper or brass piping system.

SOLUTION XT AIR HANDLING UNIT PERFORMANCE SPECIFICATION

Unit Tag	Qty	Model	Air Flow (CFM)
S-1A	1	Indoor Air Handler 51 x 90	10300

Unit Tag	Coil Type	Air Flow (scfm)
HR Coil – EXHAUST – Summer Conditions	BDW (Water)	2438

Input Data

General		Air Side		Fluid Side	
Application:	Heating	Altitude (ft.):	4000	EWT (°F):	79.7
Tube Diameter:	1/2”	Air Flow (scfm):	2438	LWT (°F):	n/a
Tube Wall Thickness:	0.016”	Face Velocity (ft/min):	106	Flow Rate (gpm):	100.0
Fouling Factor (hft²°F/btu):	0.00000	EAT-DB (°F):	77.0	Max. WPD (ft.):	n/a
Casing Material:	Stainless Steel	Max. APD (in. w.g):	3.00	TPC:	4
Fin Type:	Corrugated	Req. LAT-DB (°F):	n/a	Fluid:	Water
Fin Material:	Aluminum	Req. TMBH:	n/a	Fluid Volume (ft³):	1.6
Fin Thickness:	0.006”	Air Flow Direction:	Horizontal	Fluid Weight (lbs):	98.8
Fin Height:	42.50”				
Fin Length:	78”				
Connection Material:	Steel				
Connection Type:	MPT				
Dry Weight (lbs.):	264.6				

Note: Coil is not coated.

Output Data

General		Air Side Performance		Fluid Side Performance	
Rows:	4	LAT-DB (°F):	79.68	LWT (°F):	79.56
FPI:	12	TMBH:	7.1	Fluid Vel. (fps)	5.1
TPC:	4	APD (in. w.g):	0.03	WPD (ft.):	10.6
Connection Size:	3”			Flow Rate (gpm):	100.0
No. Connections:	1				
Coil Dll Version:	7.5b.003				

Note(s): Ratings are for coils manufactured by: Johnson Controls, Inc., 507 E. Michigan St., Milwaukee WI 53202

BDW Tube Spacing: 1.25" x 1.08"

EFT < 120.0°F. - This coil is outside the scope of AHRI Standard 410.

Johnson Controls suggests using red brass or copper connectors when the coil is to be attached to a copper or brass piping system.

SOLUTION XT AIR HANDLING UNIT PERFORMANCE SPECIFICATION

Unit Tag	Qty	Model	Air Flow (CFM)
S-1A	1	Indoor Air Handler 51 x 90	10300

HR Coil – SUPPLY – Summer Conditions

Coil General/Physical Details		Air Side Performance		Fluid Side Performance	
Location:	0	Air Flow (scfm):	10300	EWT (°F):	79.5
Tag:	AirCoil	Altitude (ft.):	4000	LWT (°F):	79.7
Application:	Cooling	EAT-DB (°F):	80.7	GPM:	100.0
Coil Type:	Water	EAT-WB (°F):	54.4	WPD (ft):	10.6
Face Type:	Full	LAT-DB (°F):	79.7	FPS:	5.1
Tube Diameter:	1/2" BDW	LAT-WB (°F):	54.0	Fluid Type:	Water
Tube Material:	Copper	FV (ft/min):	448	Fluid Weight(lb):	98.8
Tube Wall Thickness:	.016"	SMBH:	10.7	Fluid Volume(ft³):	1.6
Fouling Factor (hft²°F/btu):	0.00000	TMBH:	10.7		
Fin Type:	Corrugated	APD (in. w.g.):	0.26		
Fin Thickness:	.006"				
Fin Material:	Aluminum				
Casing Material:	Galvanized				
Connection Material:	Steel*				
Connection Type:	MPT				
Coating:	None				
Rows:	4				
Fins Per Inch:	12				
Tubes Per Circuit:	4				
Finned Height (in.):	42.50				
Finned Length (in.):	78				
Coil Face Area (ft²):	23.0				
Coil Conn. Loc.:	Left(Left)				
Supp Conn Size:	3"				
Rtn Conn Size:	3"				
Supply Conn.(per coil):	1				

*Johnson Controls suggests using red brass or copper connectors when the coil is to be attached to a copper or brass piping system.

Ratings are for coils manufactured by Johnson Controls, Inc., 507 E. Michigan St., Milwaukee WI 53202.

BDW Tube Spacing: 1.25" x 1.08"

AHRI Messages:
This coil is certified in accordance with the AHRI Forced-Circulation Air-Cooling and Air-Heating Coils Certification Program which is based on AHRI Standard 410 within the range of Standard rating conditions listed in Table 1 of the Standard. Certified units may be found in the AHRI Directory at www.ahridirectory.org.

Coil Dll Version: 7.5b.003

SOLUTION XT AIR HANDLING UNIT PERFORMANCE SPECIFICATION

Unit Tag	Qty	Model	Air Flow (CFM)
S-1A	**1**	**Indoor Air Handler 51 x 90**	**10300**

Heating Coil

Coil General/Physical Details		Air Side Performance		Fluid Side Performance	
Location:	1	Air Flow (scfm):	10300	EWT (°F):	140.0
Tag:	AirCoil	Altitude (ft.):	4000	LWT (°F):	99.9
Application:	Heating	EAT-DB (°F):	51.2	GPM:	20.9
Coil Type:	Glycol	LAT-DB (°F):	85.5	WPD (ft):	18.0
Face Type:	Full	FV (ft/min):	448	FPS:	4.5
Tube Diameter:	1/2" BDW	TMBH:	382.2	Fluid Type:	Propylene
Tube Material:	Copper	APD (in. w.g.):	0.12	% Glycol:	45.00
Tube Wall Thickness:	.016"			Fluid Weight(lb):	42.0
Fouling Factor (hft²°F/btu):	0.00000			Fluid Volume(ft³):	0.7
Fin Type:	Corrugated				
Fin Thickness:	.006"				
Fin Material:	Aluminum				
Casing Material:	Galvanized				
Connection Material:	Steel				
Connection Type:	MPT				
Coating:	None				
Rows:	2				
Fins Per Inch:	12				
Tubes Per Circuit:	8				
Finned Height (in.):	42.50				
Finned Length (in.):	78				
Coil Face Area (ft²):	23.0				
Coil Conn. Loc.:	Left(Left)				
Supp Conn Size:	1-1/2"				
Rtn Conn Size:	1-1/2"				
Supply Conn.(per coil):	1				

LOOSE COIL PERFORMANCE SPECIFICATION

Unit Tag	Quantity	Coil Type	Air Flow (acfm)	Function
S1-A Cooling Coil	**1**	**BDW (Glycol)**	**10300**	**Rate**

Input Data

General		Air Side		Fluid Side	
Application:	Cooling	Altitude (ft.):	4000	EWT (°F):	45.0
Tube Diameter:	1/2”	Air Flow (acfm):	10300	LWT (°F):	n/a
Tube Wall Thickness:	0.016”	Face Velocity (ft/min):	447	Flow Rate (gpm):	50.0
Fouling Factor (hft²°F/btu):	0.00000	EAT-DB (°F):	76.9	Max. WPD (ft.):	n/a
Casing Material:	Galvanized Steel	EAT-WB (°F):	54.4	TPC:	16
Fin Type:	Corrugated	Max. APD (in. w.g):	3.00	Fluid:	Propylene Glycol - 45.0 %
Fin Material:	Aluminum	Req. LAT-WB (°F):	n/a	Fluid Volume (ft³):	3.9
Fin Thickness:	0.010”	Req. TMBH:	n/a	Fluid Weight (lbs):	253.4
Fin Height:	42.50”	Air Flow Direction:	Horizontal		
Fin Length:	78”				
Connection Material:	Steel				
Connection Type:	MPT				
Dry Weight (lbs.):	942.0				

Note: Coil is not coated.

Output Data

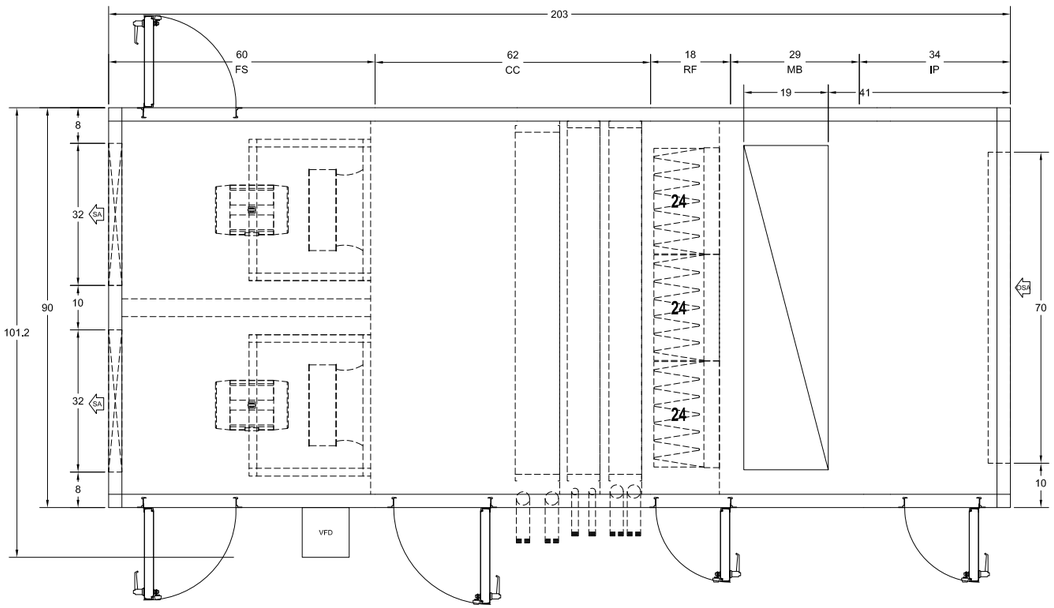
General		Air Side Performance		Fluid Side Performance	
Rows:	12	LAT-DB (°F):	56.64	LWT (°F):	53.52
FPI:	14	LAT-WB (°F):	46.25	Fluid Vel. (fps)	3.4
TPC:	16	TMBH:	193.2	WPD (ft.):	23.3
Connection Size:	3”	SMBH:	193.2	Flow Rate (gpm):	50.0
No. Connections:	1	APD (in. w.g):	0.77		
Coil Dll Version:	7.7c				

Note(s): Ratings are for coils manufactured by: Johnson Controls, Inc., 507 E. Michigan St., Milwaukee WI 53202

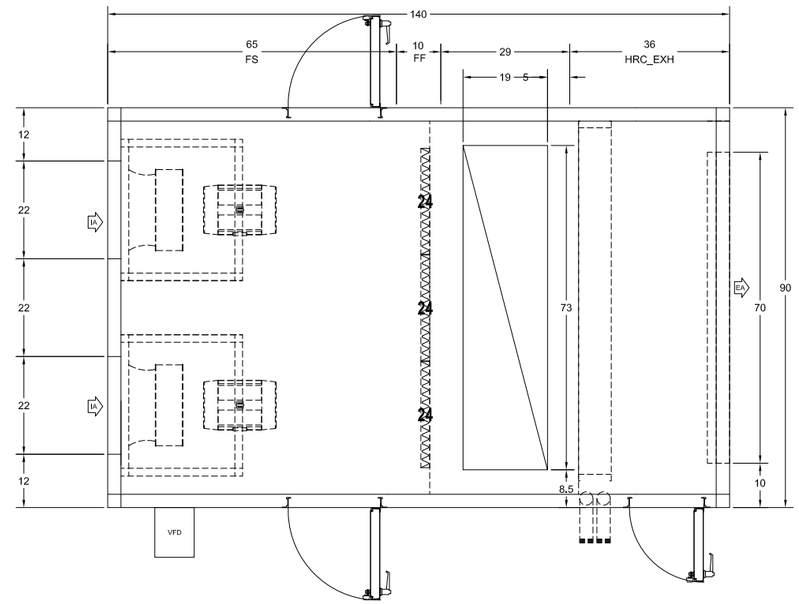
BDW Tube Spacing: 1.25" x 1.08"

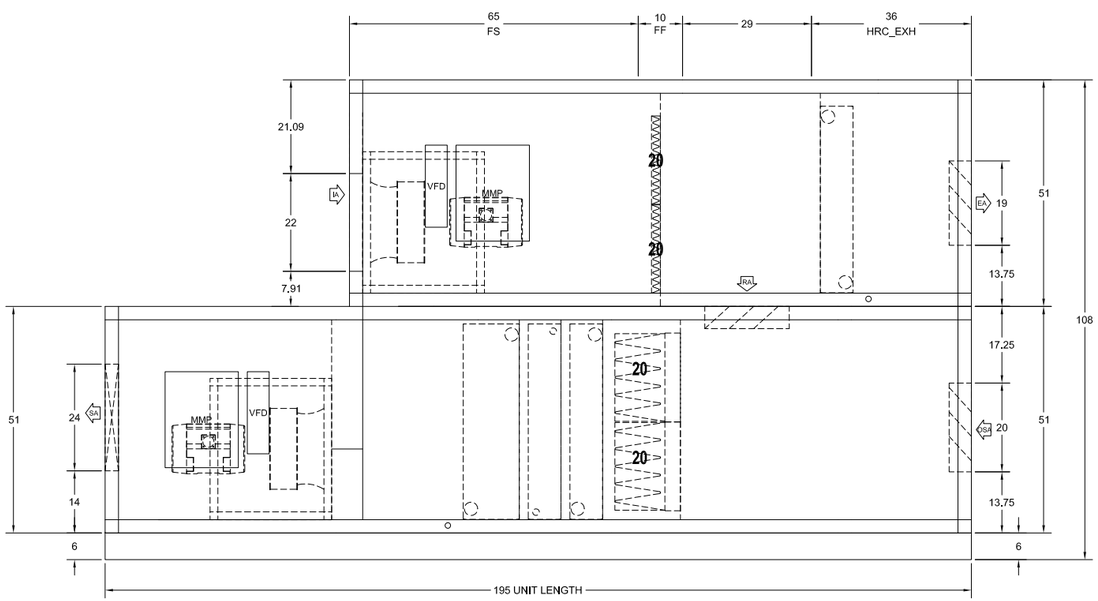
This coil is certified in accordance with the AHRI Forced-Circulation Air-Cooling and Air-Heating Coils Certification Program which is based on AHRI Standard 410 within the range of Standard rating conditions listed in Table 1 of the Standard. Certified units may be found in the AHRI Directory at www.ahridirectory.org.

Johnson Controls suggests using red brass or copper connectors when the coil is to be attached to a copper or brass piping system.



PLAN VIEW





ELEVATION VIEW

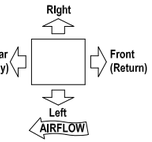
UNIT CONSTRUCTION

Model: Solution-XTI-51x81 **Construction: Indoor**

Motor Location:

Unit Weight: 8,216 lbs.

PLAN VIEW



NOTES

Units with a baserail and a bottom opening; Duct connection flush with the bottom of unit, not flush with bottom of baserail.

Refer to performance report for shipping split details.

Allow sufficient space around the unit for removing the access panels and various parts of the unit. A minimum clearance equal to the width of the unit must be provided on one side of the unit for removing the coil or fan assembly.

Contractor responsible for penetrations and connections of all electrical boxes and internal coil connections.

Overall dimensions account for: outdoor roof peak and overhang, motor control and/or factory package control boxes, coil connections, rain hoods, pipe chases, AMS-60 damper/EAML louver (if applicable,) base rail - In order to convey the true space requirements for the unit.

Certain items may extend beyond cabinet dimensions including: door handles, light switches, electrical boxes, lifting lugs, gas fuel system, etc.

The overall unit length includes an additional 1/4" per shipping split due to additional gasketing and split connection hardware.

Dimension tolerances: Unit (+/- 1/2"); Piping (+/- 2")

SL - Designates Shipped Loose Item(s)

PIPING CONNECTIONS
(In order of Airflow)

Segment	Type	Hand	Quantity	Supply	Return
HC	MPT	Left	1 Sup 1 Ret	3"	3"
HC	MPT	Left	1 Sup 1 Ret	3"	3"
CC	MPT	Left	1 Sup 1 Ret	3"	3"

Drain pan connection size 1 1/4" MPT SCH 40 (Connections on Left Side of unit)

SECTION LIST

SECT	DESCRIPTION
MB	Mixing Box
RF	High Efficiency Filter
HC-1	Heating Coil
HC-2	Heating Coil
CC	Cooling Coil
FS	Supply Fan - 245EPFN

PRODUCT DRAWING

SOLUTION XT AIR HANDLING UNIT DETAIL
MODEL: Solution-XTI-48x81
NOT FOR CONSTRUCTION

Project Name: Fort Harrison VA
Location:
Engineer:
Contractor:
For:

Sold To:
Cust Purch Order#:
Contract#:
UNIT TAG: S2-A

Date: 2.16.18
Version:
Form No.:
Dwg. Lev.: 5/03
Dwg. Scale: NTS

Serial Number:
SQ Database Number:
YORKworks Release:
Dwg. Name:
Dwg. Location:

Johnson Controls

SOLUTION XT AIR HANDLING UNIT PERFORMANCE SPECIFICATION

Unit Tag	Qty	Model	Air Flow (CFM)
S-2A	1	Indoor Air Handler 51 x 90	10000

FR - Return Plenum Fan Segment

Segment Details

Segment Air Pressure Drop (in. w.g.):	0.42
Air Flow per Fan (CFM):	5000
Air Flow Total (CFM):	10000
Altitude (ft.):	4000
TSP/ESP (in. w.g.):	2.35/ 1.00
Air Inlet:	Front(Front)
Fan Discharge:	Rear(Rear)

Fan Segment Options

Isolation - Rubber Pad Isolators
Interior STD Ga. Galvanized Liner
Insulation: R-13 2" Foam
STD Ga. Galvanized Floor Liner
Exterior STD Ga. Galvanized Liner
Fan AFMS Airflow Constant (K Factor): 1821.92
Transducer Range: 0-25"
Access Door - Refer to adjacent segments
MMP Panels are rated for VFD use ONLY (no bypass).
Flow Isolation: Blank-off Plate(s)

Fan Detail (per fan)

Type: Multiple: Standard Redundancy	Multiple PL-MPQS
Size:	182
Construction:	II
Bearing Options:	None
Fan RPM:	2103
BHP/(Pe/kW)*:	3.12
Total Fan BHP/(Pe/kW)*:	3.12
Outlet Velocity (ft/min):	N/A
% Wheel Width:	100.00
% Wheel Diameter:	100.00

Motor Detail (per motor)

Motor Type:	TECO TEFC Premium Efficiency
HP/kW*	5.0
Voltage/Phase/Frequency:	208/3/60 Hz
Insulation Class:	F
Motor RPM:	1800
Frame Size:	184
Location	Integral to motor
Drive Type:	Direct Drive
Belt Drive Type:	N/A
	Fan Arrangement: 1H x 2W
Full Load Amps (FLA):	13.50
Efficiency:	89.5%

SOLUTION XT AIR HANDLING UNIT PERFORMANCE SPECIFICATION

Unit Tag	Qty	Model	Air Flow (CFM)
S-2A	1	Indoor Air Handler 51 x 90	10000

Motor Control – Return Fan

Motor Control Details(Per VFD)

Motor Control Type:	Variable Frequency Drive Manual motor protection (MMP) with individual non-fused disconnects wired to motors
Motor HP/kW*:	10.0

Motor Control Electrical Details(Per VFD)

Full Load Amps (FLA):	30.8

Motor Control Options

None Disconnect
RFI/EMI EMC Filter
Swinging DC Line Choke (equivalent to 5% Input Line Reactor)
Modbus RTU, Johnson N2, BACnet

Environmental

Ambient Temperature (°F):	5 to 104
Storage Temperature (°F):	-40 to 158
Humidity:	MAX 95% RH non-condensing
Altitude:	3,280 ft. without derate (1% derate for each additional 328 ft.)
Enclosure:	NEMA 1

Input (Per VFD)

Rated Input Voltage:	3 Phase 208-240 VAC +/-10% 48/63Hz +/- 5%
Rated Input Current Amps:	30.80
Heat Loss in Watts 100% Load:	285.00
Efficiency (%):	98.00

Output (Per VFD)

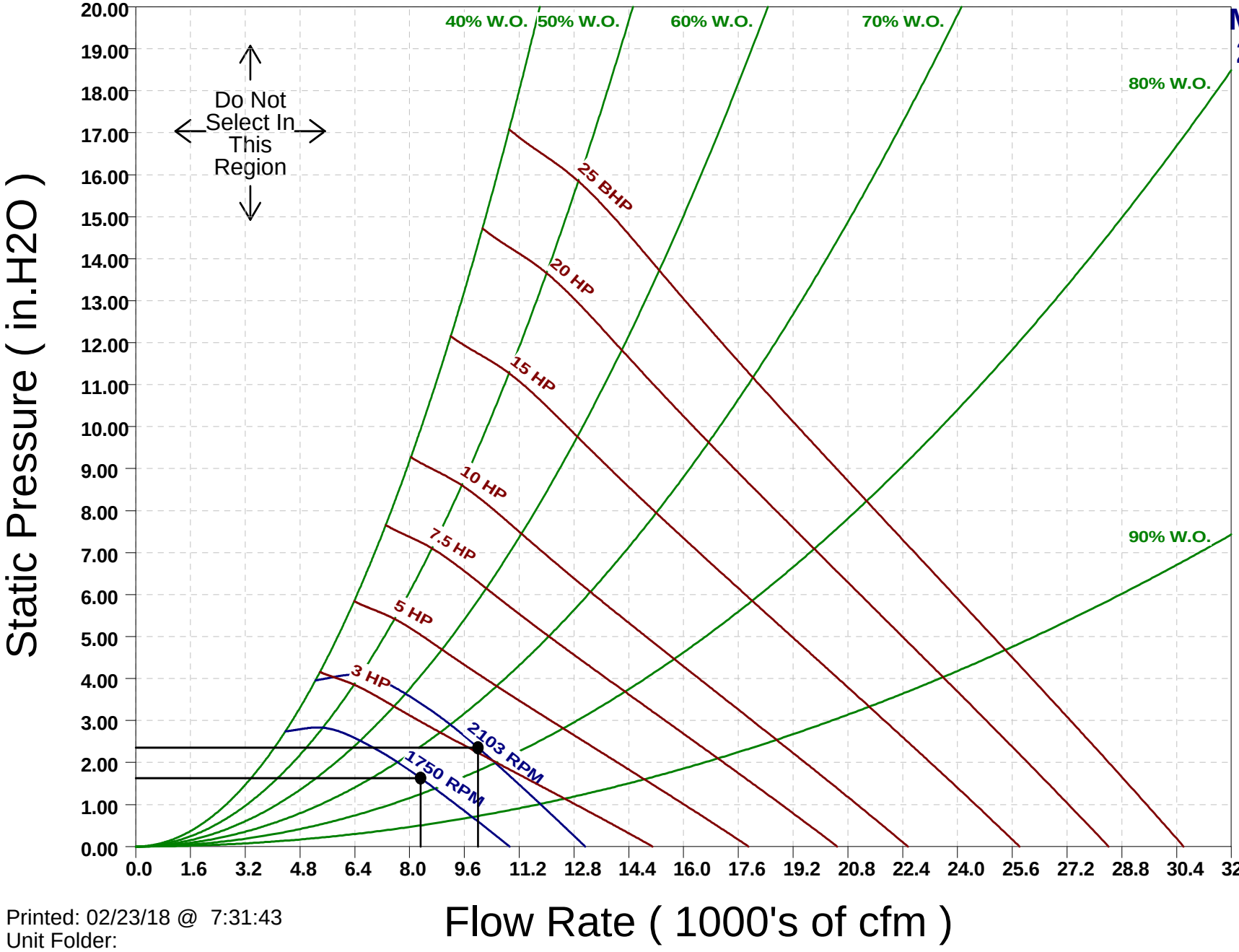
Output Current Amps:	30.8
Overload Current Rating:	110% for 1 minute every 10 minutes

Drives are rated for use below 3,280 ft and 104°F.
Use Airmod AYK Derating Charts for use above these limits.

Copper Conductors Only

Solution XT Fan Rating Curve

Project Name	Unit Tag	Qty	Model	Seg	Fan Type	Class	Size
Fort Harrison VA_2.22.18	S-2A	1	XTI-51x90	FR	PL-MPQS	II	182



Multiple Fans
2 Fans (1X2)

Operating Point

Total Flow (cfm):	10000
TSP (in.H2O):	2.35
Altitude (ft):	4000

Fan Characteristics

Draw Type:	Blow-Thru
Drive Type:	Direct
Wheel Width:	100%

Design Speed

RPM:	2103
BHP:	3.12
Total Efficiency:	60.39

Synch Speed

RPM:	1750
Total Flow (cfm):	8321
TSP (in H2O):	1.63
BHP:	1.80
Total Eff.:	59.14

Fan Limits

Max RPM:	2930.00

SOLUTION XT AIR HANDLING UNIT PERFORMANCE SPECIFICATION

Unit Tag	Qty	Model	Air Flow (CFM)
S-2A	1	Indoor Air Handler 51 x 90	10000

FS - Supply Plenum Fan Segment

Segment Details

Segment Air Pressure Drop (in. w.g.):	0.47
Air Flow per Fan (CFM):	5000
Air Flow Total (CFM):	10000
Altitude (ft.):	4000
TSP/ESP (in. w.g.):	4.51/ 2.00
Air Inlet:	Front(Front)
Fan Discharge:	Rear(Rear)

Fan Segment Options

Isolation - Rubber Pad Isolators
Interior STD Ga. Galvanized Liner
Insulation: R-13 2" Foam
STD Ga. Galvanized Floor Liner
Exterior STD Ga. Galvanized Liner
Fan AFMS Airflow Constant (K Factor): 2185.80
Transducer Range: 0-25"
Access Door - Refer to adjacent segments
MMP Panels are rated for VFD use ONLY (no bypass).
Flow Isolation: Blank-off Plate(s)

Fan Detail (per fan)

Type: Multiple: Standard Redundancy	Multiple PL-MPQS
Size:	200
Construction:	II
Bearing Options:	None
Fan RPM:	2024
BHP/(Pe/kW)*:	4.81
Total Fan BHP/(Pe/kW)*:	4.81
Outlet Velocity (ft/min):	N/A
% Wheel Width:	100.00
% Wheel Diameter:	100.00

Motor Detail (per motor)

Motor Type:	TECO TEFC Premium Efficiency
HP/kW*	5.0
Voltage/Phase/Frequency:	208/3/60 Hz
Insulation Class:	F
Motor RPM:	1800
Frame Size:	184
Location	Integral to motor
Drive Type:	Direct Drive
Belt Drive Type:	N/A
	Fan Arrangement: 1H x 2W
Full Load Amps (FLA):	13.50
Efficiency:	89.5%

SOLUTION XT AIR HANDLING UNIT PERFORMANCE SPECIFICATION

Unit Tag	Qty	Model	Air Flow (CFM)
S-2A	1	Indoor Air Handler 51 x 90	10000

Motor Control – Supply Fan

Motor Control Details(Per VFD)

Motor Control Type:	Variable Frequency Drive Manual motor protection (MMP) with individual non-fused disconnects wired to motors
Motor HP/kW*:	10.0

Motor Control Electrical Details(Per VFD)

Full Load Amps (FLA):	30.8

Motor Control Options

None Disconnect
RFI/EMI EMC Filter
Swinging DC Line Choke (equivalent to 5% Input Line Reactor)
Modbus RTU, Johnson N2, BACnet

Environmental

Ambient Temperature (°F):	5 to 104
Storage Temperature (°F):	-40 to 158
Humidity:	MAX 95% RH non-condensing
Altitude:	3,280 ft. without derate (1% derate for each additional 328 ft.)
Enclosure:	NEMA 1

Input (Per VFD)

Rated Input Voltage:	3 Phase 208-240 VAC +/-10% 48/63Hz +/- 5%
Rated Input Current Amps:	30.80
Heat Loss in Watts 100% Load:	285.00
Efficiency (%):	98.00

Output (Per VFD)

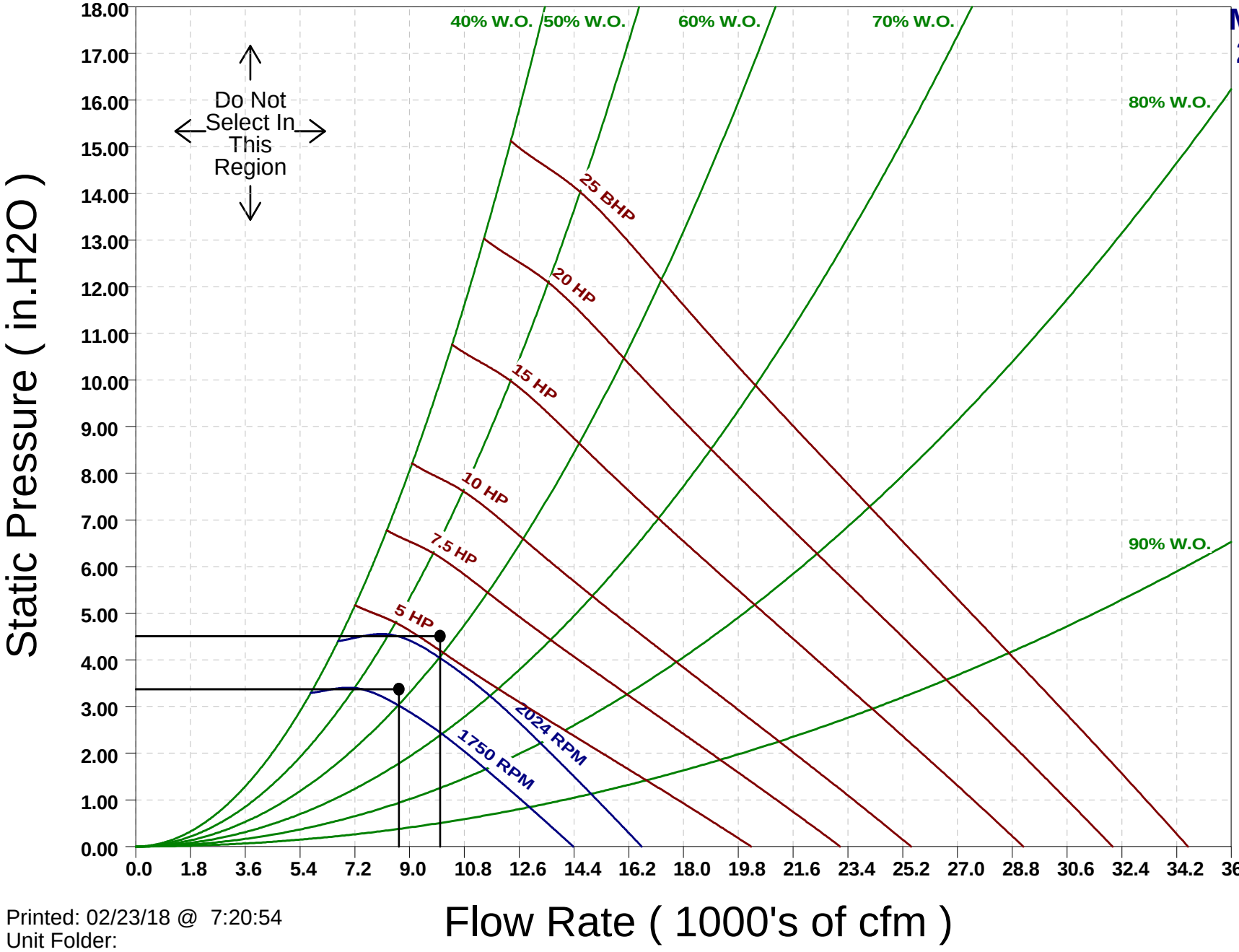
Output Current Amps:	30.8
Overload Current Rating:	110% for 1 minute every 10 minutes

Drives are rated for use below 3,280 ft and 104°F.
Use Airmod AYK Derating Charts for use above these limits.

Copper Conductors Only

Solution XT Fan Rating Curve

Project Name	Unit Tag	Qty	Model	Seg	Fan Type	Class	Size
Fort Harrison VA_2.22.18	S-2A	1	XTI-51x90	FS	PL-MPQS	II	200



Multiple Fans
2 Fans (1X2)

Operating Point

Total Flow (cfm):	10000
TSP (in.H2O):	4.51
Altitude (ft):	4000

Fan Characteristics

Draw Type:	Blow-Thru
Drive Type:	Direct
Wheel Width:	100%

Design Speed

RPM:	2024
BHP:	4.81
Total Efficiency:	66.54

Synch Speed

RPM:	1750
Total Flow (cfm):	8646
TSP (in H2O):	3.37
BHP:	3.11
Total Eff.:	73.65

Fan Limits

Max RPM:	2674.00

RPM
HP
System

Printed: 02/23/18 @ 7:20:54
Unit Folder:

SOLUTION XT AIR HANDLING UNIT PERFORMANCE SPECIFICATION

Unit Tag	Qty	Model	Air Flow (CFM)
S-2A	1	Indoor Air Handler 51 x 90	10000

Coils & Spacers Listed Starting In Direction Of Air Flow

Unit Tag	Coil Type	Air Flow (scfm)
HR Coil – EXHAUST – Winter Conditions	BDW (Water)	2867

Input Data

General		Air Side		Fluid Side	
Application:	Cooling	Altitude (ft.):	4000	EWT (°F):	55.3
Tube Diameter:	1/2”	Air Flow (scfm):	2867	LWT (°F):	n/a
Tube Wall Thickness:	0.016”	Face Velocity (ft/min):	125	Flow Rate (gpm):	100.0
Fouling Factor (hft²°F/btu):	0.00000	EAT-DB (°F):	70.0	Max. WPD (ft.):	n/a
Casing Material:	Stainless Steel	EAT-WB (°F):	54.4	TPC:	4
Fin Type:	Corrugated	Max. APD (in. w.g):	3.00	Fluid:	Water
Fin Material:	Aluminum	Req. LAT-WB (°F):	n/a	Fluid Volume (ft³):	1.6
Fin Thickness:	0.006”	Req. TMBH:	n/a	Fluid Weight (lbs):	99.1
Fin Height:	42.50”	Air Flow Direction:	Horizontal		
Fin Length:	78”				
Connection Material:	Steel				
Connection Type:	MPT				
Dry Weight (lbs.):	264.6				

Note: Coil is not coated.

Output Data

General		Air Side Performance		Fluid Side Performance	
Rows:	4	LAT-DB (°F):	55.52	LWT (°F):	56.21
FPI:	12	LAT-WB (°F):	48.16	Fluid Vel. (fps)	5.1
TPC:	4	TMBH:	45.5	WPD (ft.):	11.1
Connection Size:	3”	SMBH:	45.5	Flow Rate (gpm):	100.0
No. Connections:	1	APD (in. w.g):	0.04		
Coil Dll Version:	7.5b.003				

Note(s): Ratings are for coils manufactured by: Johnson Controls, Inc., 507 E. Michigan St., Milwaukee WI 53202

BDW Tube Spacing: 1.25" x 1.08"

This coil is certified in accordance with the AHRI Forced-Circulation Air-Cooling and Air-Heating Coils Certification Program which is based on AHRI Standard 410 within the range of Standard rating conditions listed in Table 1 of the Standard. Certified units may be found in the AHRI Directory at www.ahridirectory.org.

Johnson Controls suggests using red brass or copper connectors when the coil is to be attached to a copper or brass piping system.

SOLUTION XT AIR HANDLING UNIT PERFORMANCE SPECIFICATION

Unit Tag	Qty	Model	Air Flow (CFM)
S-2A	1	Indoor Air Handler 51 x 90	10000

Unit Tag	Coil Type	Air Flow (scfm)
HR Coil – SUPPLY – Winter Conditions	BDW (Water)	10000

Input Data

General		Air Side		Fluid Side	
Application:	Heating	Altitude (ft.):	4000	EWT (°F):	56.2
Tube Diameter:	1/2”	Air Flow (scfm):	10000	LWT (°F):	n/a
Tube Wall Thickness:	0.016”	Face Velocity (ft/min):	434	Flow Rate (gpm):	100.0
Fouling Factor (hft²°F/btu):	0.00000	EAT-DB (°F):	51.2	Max. WPD (ft.):	n/a
Casing Material:	Galvanized Steel	Max. APD (in. w.g):	3.00	TPC:	4
Fin Type:	Corrugated	Req. LAT-DB (°F):	n/a	Fluid:	Water
Fin Material:	Aluminum	Req. TMBH:	n/a	Fluid Volume (ft³):	1.6
Fin Thickness:	0.006”	Air Flow Direction:	Horizontal	Fluid Weight (lbs):	99.1
Fin Height:	42.50”				
Fin Length:	78”				
Connection Material:	Steel				
Connection Type:	MPT				
Dry Weight (lbs.):	259.9				

Note: Coil is not coated.

Output Data

General		Air Side Performance		Fluid Side Performance	
Rows:	4	LAT-DB (°F):	55.17	LWT (°F):	55.34
FPI:	12	TMBH:	43.0	Fluid Vel. (fps)	5.1
TPC:	4	APD (in. w.g):	0.24	WPD (ft.):	11.1
Connection Size:	3”			Flow Rate (gpm):	100.0
No. Connections:	1				
Coil Dll Version:	7.5b.003				

Note(s): Ratings are for coils manufactured by: Johnson Controls, Inc., 507 E. Michigan St., Milwaukee WI 53202

BDW Tube Spacing: 1.25" x 1.08"

EFT < 120.0°F. - This coil is outside the scope of AHRI Standard 410.

Johnson Controls suggests using red brass or copper connectors when the coil is to be attached to a copper or brass piping system.

SOLUTION XT AIR HANDLING UNIT PERFORMANCE SPECIFICATION

Unit Tag	Qty	Model	Air Flow (CFM)
S-2A	1	Indoor Air Handler 51 x 90	10000

Unit Tag	Coil Type	Air Flow (scfm)
HR Coil – EXHAUST – Summer Conditions	BDW (Water)	10000

Input Data

General		Air Side		Fluid Side	
Application:	Heating	Altitude (ft.):	4000	EWT (°F):	79.8
Tube Diameter:	1/2”	Air Flow (scfm):	2867	LWT (°F):	n/a
Tube Wall Thickness:	0.016”	Face Velocity (ft/min):	125	Flow Rate (gpm):	100.0
Fouling Factor (hft²°F/btu):	0.00000	EAT-DB (°F):	77.0	Max. WPD (ft.):	n/a
Casing Material:	Stainless Steel	Max. APD (in. w.g):	3.00	TPC:	4
Fin Type:	Corrugated	Req. LAT-DB (°F):	n/a	Fluid:	Water
Fin Material:	Aluminum	Req. TMBH:	n/a	Fluid Volume (ft³):	1.6
Fin Thickness:	0.006”	Air Flow Direction:	Horizontal	Fluid Weight (lbs):	98.8
Fin Height:	42.50”				
Fin Length:	78”				
Connection Material:	Steel				
Connection Type:	MPT				
Dry Weight (lbs.):	264.6				

Note: Coil is not coated.

Output Data

General		Air Side Performance		Fluid Side Performance	
Rows:	4	LAT-DB (°F):	79.76	LWT (°F):	79.63
FPI:	12	TMBH:	8.7	Fluid Vel. (fps)	5.1
TPC:	4	APD (in. w.g):	0.04	WPD (ft.):	10.6
Connection Size:	3”			Flow Rate (gpm):	100.0
No. Connections:	1				
Coil Dll Version:	7.5b.003				

Note(s): Ratings are for coils manufactured by: Johnson Controls, Inc., 507 E. Michigan St., Milwaukee WI 53202

BDW Tube Spacing: 1.25" x 1.08"

EFT < 120.0°F. - This coil is outside the scope of AHRI Standard 410.

Johnson Controls suggests using red brass or copper connectors when the coil is to be attached to a copper or brass piping system.

SOLUTION XT AIR HANDLING UNIT PERFORMANCE SPECIFICATION

Unit Tag	Qty	Model	Air Flow (CFM)
S-2A	1	Indoor Air Handler 51 x 90	10000

HR Coil – SUPPLY – Summer Conditions

Coil General/Physical Details		Air Side Performance		Fluid Side Performance	
Location:	0	Air Flow (acfm):	10000	EWT (°F):	79.5
Tag:	AirCoil	Altitude (ft.):	4000	LWT (°F):	79.8
Application:	Cooling	EAT-DB (°F):	81.5	GPM:	100.0
Coil Type:	Water	EAT-WB (°F):	58.0	WPD (ft):	10.6
Face Type:	Full	LAT-DB (°F):	79.8	FPS:	5.1
Tube Diameter:	1/2" BDW	LAT-WB (°F):	57.4	Fluid Type:	Water
Tube Material:	Copper	FV (ft/min):	435	Fluid Weight(lb):	98.8
Tube Wall Thickness:	.016"	SMBH:	15.6	Fluid Volume(ft³):	1.6
Fouling Factor (hft²°F/btu):	0.00000	TMBH:	15.6		
Fin Type:	Corrugated	APD (in. w.g.):	0.19		
Fin Thickness:	.006"				
Fin Material:	Aluminum				
Casing Material:	Stainless Steel				
Connection Material:	Steel*				
Connection Type:	MPT				
Coating:	None				
Rows:	4				
Fins Per Inch:	12				
Tubes Per Circuit:	4				
Finned Height (in.):	42.50				
Finned Length (in.):	78				
Coil Face Area (ft²):	23.0				
Coil Conn. Loc.:	Left(Left)				
Supp Conn Size:	3"				
Rtn Conn Size:	3"				
Supply Conn.(per coil):	1				

*Johnson Controls suggests using red brass or copper connectors when the coil is to be attached to a copper or brass piping system.

Ratings are for coils manufactured by Johnson Controls, Inc., 507 E. Michigan St., Milwaukee WI 53202.

BDW Tube Spacing: 1.25" x 1.08"

AHRI Messages:
This coil is certified in accordance with the AHRI Forced-Circulation Air-Cooling and Air-Heating Coils Certification Program which is based on AHRI Standard 410 within the range of Standard rating conditions listed in Table 1 of the Standard. Certified units may be found in the AHRI Directory at www.ahridirectory.org.

Coil Dll Version: 7.5b.003

SOLUTION XT AIR HANDLING UNIT PERFORMANCE SPECIFICATION

Unit Tag	Qty	Model	Air Flow (CFM)
S-2A	1	Indoor Air Handler 51 x 90	10000

Heating Coil

Coil General/Physical Details		Air Side Performance		Fluid Side Performance	
Location:	1	Air Flow (acfm):	10000	EWT (°F):	140.0
Tag:	AirCoil	Altitude (ft.):	4000	LWT (°F):	100.0
Application:	Heating	EAT-DB (°F):	46.5	GPM:	21.1
Coil Type:	Glycol	LAT-DB (°F):	86.0	WPD (ft):	4.1
Face Type:	Full	FV (ft/min):	435	FPS:	2.2
Tube Diameter:	1/2" BDW	TMBH:	385.3	Fluid Type:	Propylene
Tube Material:	Copper	APD (in. w.g.):	0.14	% Glycol:	45.00
Tube Wall Thickness:	.020"			Fluid Weight(lb):	67.0
Fouling Factor (hft²°F/btu):	0.00000			Fluid Volume(ft³):	1.0
Fin Type:	Corrugated				
Fin Thickness:	.006"				
Fin Material:	Aluminum				
Casing Material:	Galvanized				
Connection Material:	Steel				
Connection Type:	MPT				
Coating:	None				
Rows:	3				
Fins Per Inch:	10				
Tubes Per Circuit:	6				
Finned Height (in.):	42.50				
Finned Length (in.):	78				
Coil Face Area (ft²):	23.0				
Coil Conn. Loc.:	Left(Left)				
Supp Conn Size:	2"				
Rtn Conn Size:	2"				
Supply Conn.(per coil):	1				

LOOSE COIL PERFORMANCE SPECIFICATION

Unit Tag	Quantity	Coil Type	Air Flow (acfm)	Function
COIL-1	**1**	**BDW (Glycol)**	**10000**	**Rate**

Input Data

General		Air Side		Fluid Side	
Application:	Cooling	Altitude (ft.):	4000	EWT (°F):	45.0
Tube Diameter:	1/2”	Air Flow (acfm):	10000	LWT (°F):	n/a
Tube Wall Thickness:	0.016”	Face Velocity (ft/min):	434	Flow Rate (gpm):	50.0
Fouling Factor (hft²°F/btu):	0.00000	EAT-DB (°F):	78.0	Max. WPD (ft.):	n/a
Casing Material:	Galvanized Steel	EAT-WB (°F):	58.0	TPC:	16
Fin Type:	Corrugated	Max. APD (in. w.g):	3.00	Fluid:	Propylene Glycol - 45.0 %
Fin Material:	Aluminum	Req. LAT-WB (°F):	n/a	Fluid Volume (ft³):	3.9
Fin Thickness:	0.010”	Req. TMBH:	n/a	Fluid Weight (lbs):	253.4
Fin Height:	42.50”	Air Flow Direction:	Horizontal		
Fin Length:	78”				
Connection Material:	Steel				
Connection Type:	MPT				
Dry Weight (lbs.):	942.0				

Note: Coil is not coated.

Output Data

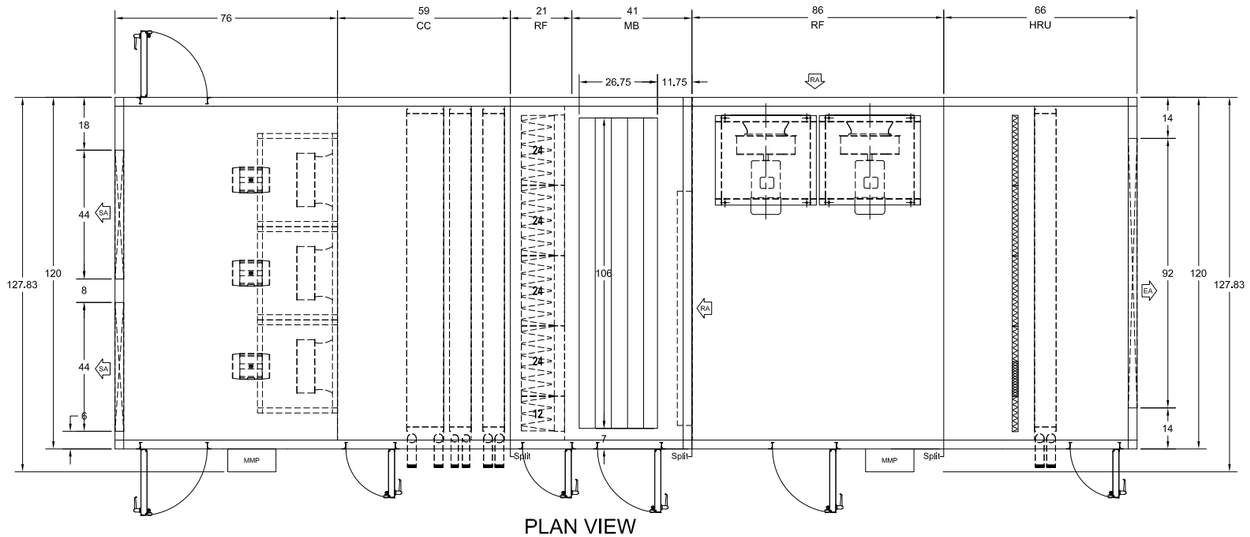
General		Air Side Performance		Fluid Side Performance	
Rows:	12	LAT-DB (°F):	56.67	LWT (°F):	53.72
FPI:	14	LAT-WB (°F):	50.02	Fluid Vel. (fps)	3.4
TPC:	16	TMBH:	197.6	WPD (ft.):	23.2
Connection Size:	3”	SMBH:	197.6	Flow Rate (gpm):	50.0
No. Connections:	1	APD (in. w.g):	0.73		
Coil Dll Version:	7.7c				

Note(s): Ratings are for coils manufactured by: Johnson Controls, Inc., 507 E. Michigan St., Milwaukee WI 53202

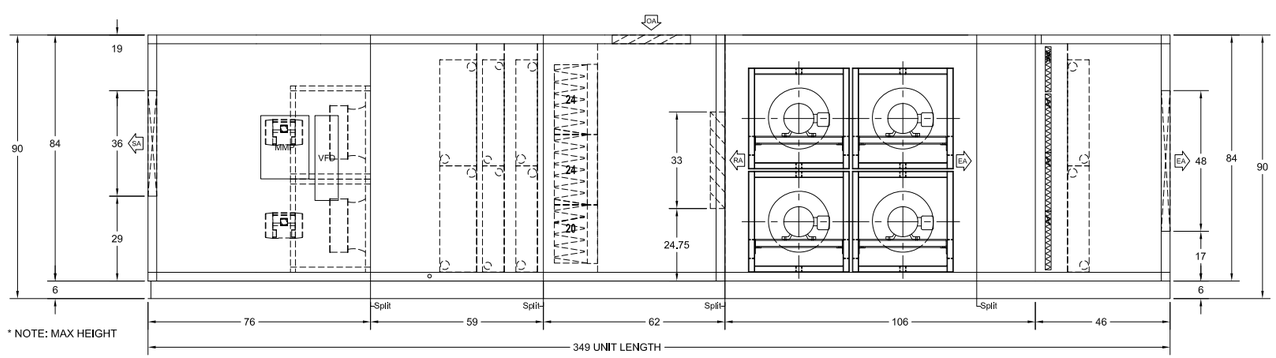
BDW Tube Spacing: 1.25" x 1.08"

This coil is certified in accordance with the AHRI Forced-Circulation Air-Cooling and Air-Heating Coils Certification Program which is based on AHRI Standard 410 within the range of Standard rating conditions listed in Table 1 of the Standard. Certified units may be found in the AHRI Directory at www.ahridirectory.org.

Johnson Controls suggests using red brass or copper connectors when the coil is to be attached to a copper or brass piping system.



PLAN VIEW



* NOTE: MAX HEIGHT

ELEVATION VIEW

UNIT CONSTRUCTION

Model: XTI-84x120 Construction: Indoor

Motor Location:

Unit Weight: 15,515 lbs. (+/- 10%)

PLAN VIEW

Right

Rear (Supply) Front (Return)

Left

AIRFLOW

NOTES

Units with a baserail and a bottom opening; Duct connection flush with the bottom of unit, not flush with bottom of baserail.

Refer to performance report for shipping split details.

Allow sufficient space around the unit for removing the access panels and various parts of the unit. A minimum clearance equal to the width of the unit must be provided on one side of the unit for removing the coil or fan assembly.

Contractor responsible for penetrations and connections of all electrical boxes and internal coil connections.

Overall dimensions account for: outdoor roof peak and overhang, motor control and/or factory package control boxes, coil connections, rain hoods, pipe chases, AMS-60 damper/EAML louver (if applicable,) base rail - In order to convey the true space requirements for the unit.

Certain items may extend beyond cabinet dimensions including: door handles, light switches, electrical boxes, lifting lugs, gas fuel system, etc.

The overall unit length includes an additional 1/4" per shipping split due to additional gasketing and split connection hardware.

Dimension tolerances: Unit (+/- 1/2"); Piping (+/- 2")

SL - Designates Shipped Loose Item(s)

PIPING CONNECTIONS
(In order of Airflow)

Segment	Type	Hand	Quantity	Supply	Return
CC	MPT	Left	1 Sup 1 Ret	3"	3"
CC	MPT	Left	1 Sup 1 Ret	3"	3"
CC	MPT	Left	1 Sup 1 Ret	2 1/2"	2 1/2"
CC	MPT	Left	1 Sup 1 Ret	2 1/2"	2 1/2"
CC	MPT	Left	1 Sup 1 Ret	3"	3"
CC	MPT	Left	1 Sup 1 Ret	3"	3"

Drain pan connection size 1 1/4" MPT SCH 40 (Connections on Left Side of unit)

SECTION LIST

SECT	DESCRIPTION
MB	Mixing Box
RF	High Efficiency Filter
CC	Cooling Coil
FS	Supply Fan - EG1R-240-450-68 - EBM 6.00 kW
DP	Discharge Plenum

PRODUCT DRAWING

SOLUTION YCI AIR HANDLING UNIT DETAIL
MODEL: Custom -YCI-74x132
NOT FOR CONSTRUCTION

Project Name: Fort Harrison VA_2.16.18
Location:
Engineer:
Contractor:
For:

Sold To:
Cust Purch Order#:
Contract#:
UNIT TAG: S-2

Date: 2.22.18
Version:
Form No.:
Dwg. Lev.: 5/03
Dwg. Scale: NTS

Serial Number:
SQ Database Number:
YORKworks Release:
Dwg. Name:
Dwg. Location:

Johnson Controls

SOLUTION XT AIR HANDLING UNIT PERFORMANCE SPECIFICATION

Unit Tag	Qty	Model	Air Flow (CFM)
S-2	1	Indoor Air Handler 84 x 120	24200

FR - Return Plenum Fan Segment

Segment Details

Segment Air Pressure Drop (in. w.g.):	0.42
Air Flow per Fan (CFM):	6050
Air Flow Total (CFM):	24200
Altitude (ft.):	4000
TSP/ESP (in. w.g.):	2.15/ 1.00
Air Inlet:	Front(Front)
Fan Discharge:	Rear(Rear)

Fan Segment Options

Isolation - Rubber Pad Isolators
Interior STD Ga. Galvanized Liner
Insulation: R-13 2" Foam
STD Ga. Galvanized Floor Liner
Exterior STD Ga. Galvanized Liner
Fan AFMS Airflow Constant (K Factor): 1821.92
Transducer Range: 0-25"
Access Door - Refer to adjacent segments
MMP Panels are rated for VFD use ONLY (no bypass).
Flow Isolation: Blank-off Plate(s)

Fan Detail (per fan)

Type: Multiple: Standard Redundancy	Multiple PL-MPQS
Size:	182
Construction:	II
Bearing Options:	None
Fan RPM:	2273
BHP/(Pe/kW)*:	3.47
Total Fan BHP/(Pe/kW)*:	3.47
Outlet Velocity (ft/min):	N/A
% Wheel Width:	100.00
% Wheel Diameter:	100.00

Motor Detail (per motor)

Motor Type:	TECO TEFC Premium Efficiency
HP/kW*	5.0
Voltage/Phase/Frequency:	208/3/60 Hz
Insulation Class:	F
Motor RPM:	1800
Frame Size:	184
Location	Integral to motor
Drive Type:	Direct Drive
Belt Drive Type:	N/A
	Fan Arrangement: 2H x 2W
Full Load Amps (FLA):	13.50
Efficiency:	89.5%

SOLUTION XT AIR HANDLING UNIT PERFORMANCE SPECIFICATION

Unit Tag	Qty	Model	Air Flow (CFM)
S-2	1	Indoor Air Handler 84 x 120	24200

Motor Control – Retun Fan

Motor Control Details(Per VFD)

Motor Control Type:	Variable Frequency Drive Manual motor protection (MMP) with individual non-fused disconnects wired to motors
Motor HP/kW*:	20.0

Motor Control Electrical Details(Per VFD)

Full Load Amps (FLA):	59.4

Motor Control Options

None Disconnect
RFI/EMI EMC Filter
Swinging DC Line Choke (equivalent to 5% Input Line Reactor)
Modbus RTU, Johnson N2, BACnet

Environmental

Ambient Temperature (°F):	5 to 104
Storage Temperature (°F):	-40 to 158
Humidity:	MAX 95% RH non-condensing
Altitude:	3,280 ft. without derate (1% derate for each additional 328 ft.)
Enclosure:	NEMA 1

Input (Per VFD)

Rated Input Voltage:	3 Phase 208-240 VAC +/-10% 48/63Hz +/- 5%
Rated Input Current Amps:	59.40
Heat Loss in Watts 100% Load:	536.00
Efficiency (%):	98.00

Output (Per VFD)

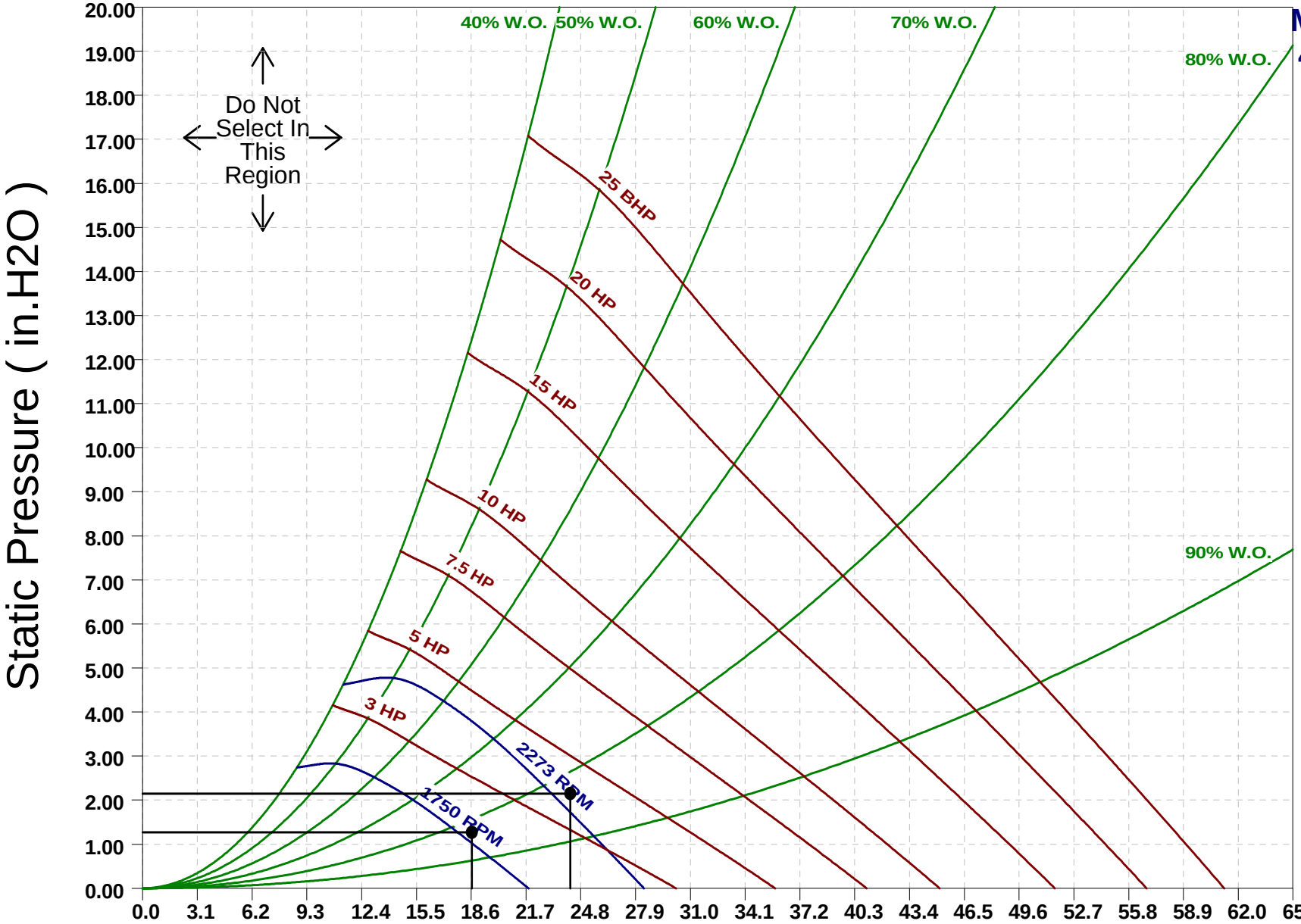
Output Current Amps:	59.4
Overload Current Rating:	110% for 1 minute every 10 minutes

Drives are rated for use below 3,280 ft and 104°F.
Use Airmod AYK Derating Charts for use above these limits.

Copper Conductors Only

Solution XT Fan Rating Curve

Project Name	Unit Tag	Qty	Model	Seg	Fan Type	Class	Size
Fort Harrison VA_2.22.18	S2	1	XTI-84x120	FR	PL-MPQS	II	182



Multiple Fans
4 Fans (2X2)

Operating Point

Total Flow (cfm	24200
TSP (in.H2O):	2.15
Altitude (ft):	4000

Fan Characteristics

Draw Type:	Blow-Thru
Drive Type:	Direct
Wheel Width:	100%

Design Speed

RPM:	2273
BHP:	3.47
Total Efficiency	49.43

Synch Speed

RPM:	1750
Total Flow (cfm	18632
TSP (in H2O):	1.27
BHP:	1.58
Total Eff.:	58.94

Fan Limits

Max RPM:	2930.00

RPM
HP
System

Printed: 02/23/18 @ 8:50:05
Unit Folder:

SOLUTION XT AIR HANDLING UNIT PERFORMANCE SPECIFICATION

Unit Tag	Qty	Model	Air Flow (CFM)
S-2	1	Indoor Air Handler 84 x 120	24200

FS - Supply Plenum Fan Segment

Segment Details

Segment Air Pressure Drop (in. w.g.):	0.42
Air Flow per Fan (CFM):	4033
Air Flow Total (CFM):	24200
Altitude (ft.):	4000
TSP/ESP (in. w.g.):	4.67/ 2.00
Air Inlet:	Front(Front)
Fan Discharge:	Rear(Rear)

Fan Segment Options

Isolation - Rubber Pad Isolators
Interior STD Ga. Galvanized Liner
Insulation: R-13 2" Foam
STD Ga. Galvanized Floor Liner
Exterior STD Ga. Galvanized Liner
Fan AFMS Airflow Constant (K Factor): 1821.92
Transducer Range: 0-25"
Access Door - Refer to adjacent segments
MMP Panels are rated for VFD use ONLY (no bypass).
Flow Isolation: Blank-off Plate(s)

Fan Detail (per fan)

Type: Multiple: Standard Redundancy	Multiple PL-MPQS
Size:	182
Construction:	II
Bearing Options:	None
Fan RPM:	2369
BHP/(Pe/kW)*:	4.49
Total Fan BHP/(Pe/kW)*:	4.49
Outlet Velocity (ft/min):	N/A
% Wheel Width:	92.00
% Wheel Diameter:	100.00

Motor Detail (per motor)

Motor Type:	TECO TEFC Premium Efficiency
HP/kW*	5.0
Voltage/Phase/Frequency:	208/3/60 Hz
Insulation Class:	F
Motor RPM:	1800
Frame Size:	184
Location	Integral to motor
Drive Type:	Direct Drive
Belt Drive Type:	N/A
	Fan Arrangement: 2H x 3W
Full Load Amps (FLA):	13.50
Efficiency:	89.5%

SOLUTION XT AIR HANDLING UNIT PERFORMANCE SPECIFICATION

Unit Tag	Qty	Model	Air Flow (CFM)
S-2	1	Indoor Air Handler 84 x 120	24200

Motor Control – Supply Fan

Motor Control Details(Per VFD)

Motor Control Type:	Variable Frequency Drive Manual motor protection (MMP) with individual non-fused disconnects wired to motors
Motor HP/kW*:	30.0

Motor Control Electrical Details(Per VFD)

Full Load Amps (FLA):	88.0

Motor Control Options

None Disconnect
RFI/EMI EMC Filter
Swinging DC Line Choke (equivalent to 5% Input Line Reactor)
Modbus RTU, Johnson N2, BACnet

Environmental

Ambient Temperature (°F):	5 to 104
Storage Temperature (°F):	-40 to 158
Humidity:	MAX 95% RH non-condensing
Altitude:	3,280 ft. without derate (1% derate for each additional 328 ft.)
Enclosure:	NEMA 1

Input (Per VFD)

Rated Input Voltage:	3 Phase 208-240 VAC +/-10% 48/63Hz +/- 5%
Rated Input Current Amps:	88.00
Heat Loss in Watts 100% Load:	786.00
Efficiency (%):	98.00

Output (Per VFD)

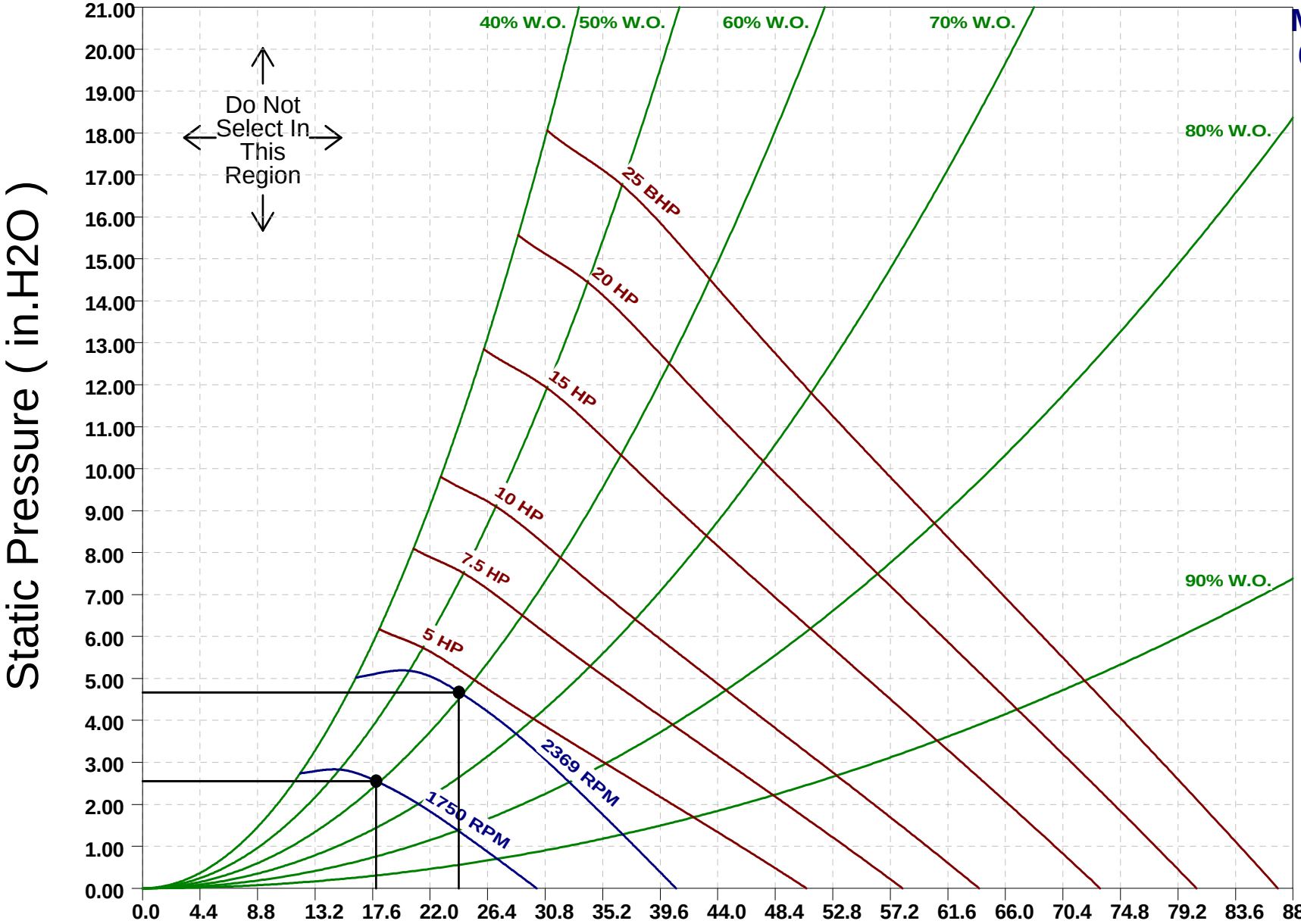
Output Current Amps:	88.0
Overload Current Rating:	110% for 1 minute every 10 minutes

Drives are rated for use below 3,280 ft and 104°F.
Use Airmod AYK Derating Charts for use above these limits.

Copper Conductors Only

Solution XT Fan Rating Curve

Project Name	Unit Tag	Qty	Model	Seg	Fan Type	Class	Size
Fort Harrison VA_2.22.18	S2	1	XTI-84x120	FS	PL-MPQS	II	182



Multiple Fans
6 Fans (2X3)

Operating Point

Total Flow (cfm	24200
TSP (in.H2O):	4.67
Altitude (ft):	4000

Fan Characteristics

Draw Type:	Blow-Thru
Drive Type:	Direct
Wheel Width:	92%

Design Speed

RPM:	2369
BHP:	4.49
Total Efficiency	66.44

Synch Speed

RPM:	1750
Total Flow (cfm	17877
TSP (in H2O):	2.55
BHP:	1.81
Total Eff.:	65.99

Fan Limits

Max RPM:	2930.00

RPM
HP
System

Printed: 02/23/18 @ 8:51:47
Unit Folder:

SOLUTION XT AIR HANDLING UNIT PERFORMANCE SPECIFICATION

Unit Tag	Qty	Model	Air Flow (CFM)
S-2	1	Indoor Air Handler 84 x 120	24200

Coils & Spacers Listed Starting In Direction Of Air Flow

Unit Tag	Coil Type	Air Flow (scfm)
HR Coil – EXHAUST – Winter Conditions	BDW (Water)	11262

Input Data

General		Air Side		Fluid Side	
Application:	Cooling	Altitude (ft.):	4000	EWT (°F):	51.6
Tube Diameter:	1/2”	Air Flow (acfm):	11262	LWT (°F):	n/a
Tube Wall Thickness:	0.016”	Face Velocity (ft/min):	207	Flow Rate (gpm):	200.0
Fouling Factor (hft²°F/btu):	0.00000	EAT-DB (°F):	77.0	Max. WPD (ft.):	n/a
Casing Material:	Stainless Steel	EAT-WB (°F):	54.4	TPC:	4
Fin Type:	Corrugated	Max. APD (in. w.g):	3.00	Fluid:	Water
Fin Material:	Aluminum	Req. LAT-WB (°F):	n/a	Fluid Volume (ft³):	3.4
Fin Thickness:	0.006”	Req. TMBH:	n/a	Fluid Weight (lbs):	213.5
Fin Height:	72.50”	Air Flow Direction:	Horizontal		
Fin Length:	108”				
Connection Material:	Steel				
Connection Type:	MPT				
Dry Weight (lbs.):	613.0				

Note: Coil is not coated.

Output Data

General		Air Side Performance		Fluid Side Performance	
Rows:	4	LAT-DB (°F):	52.60	LWT (°F):	54.14
FPI:	12	LAT-WB (°F):	44.41	Fluid Vel. (fps)	5.9
TPC:	4	TMBH:	254.4	WPD (ft.):	18.5
Connection Size:	3”	SMBH:	254.4	Flow Rate (gpm):	200.0
No. Connections:	1	APD (in. w.g):	0.06		
Coil Dll Version:	7.5b.003				

Note(s): Ratings are for coils manufactured by: Johnson Controls, Inc., 507 E. Michigan St., Milwaukee WI 53202

BDW Tube Spacing: 1.25" x 1.08"

This coil is certified in accordance with the AHRI Forced-Circulation Air-Cooling and Air-Heating Coils Certification Program which is based on AHRI Standard 410 within the range of Standard rating conditions listed in Table 1 of the Standard. Certified units may be found in the AHRI Directory at www.ahridirectory.org.

Johnson Controls suggests using red brass or copper connectors when the coil is to be attached to a copper or brass piping system.

SOLUTION XT AIR HANDLING UNIT PERFORMANCE SPECIFICATION

Unit Tag	Qty	Model	Air Flow (CFM)
S-2	1	Indoor Air Handler 84 x 120	24200

Unit Tag	Coil Type	Air Flow (scfm)
HR Coil – SUPPLY – Winter Conditions	BDW (Water)	24200

Input Data

General		Air Side		Fluid Side	
Application:	Heating	Altitude (ft.):	4000	EWT (°F):	54.2
Tube Diameter:	1/2”	Air Flow (acfm):	24200	LWT (°F):	n/a
Tube Wall Thickness:	0.016”	Face Velocity (ft/min):	449	Flow Rate (gpm):	200.0
Fouling Factor (hft²°F/btu):	0.00000	EAT-DB (°F):	40.6	Max. WPD (ft.):	n/a
Casing Material:	Stainless Steel	Max. APD (in. w.g):	3.00	TPC:	4
Fin Type:	Corrugated	Req. LAT-DB (°F):	n/a	Fluid:	Water
Fin Material:	Aluminum	Req. TMBH:	n/a	Fluid Volume (ft³):	3.4
Fin Thickness:	0.006”	Air Flow Direction:	Horizontal	Fluid Weight (lbs):	211.9
Fin Height:	72.50”				
Fin Length:	107”				
Connection Material:	Steel				
Connection Type:	MPT				
Dry Weight (lbs.):	608.3				

Note: Coil is not coated.

Output Data

General		Air Side Performance		Fluid Side Performance	
Rows:	4	LAT-DB (°F):	51.55	LWT (°F):	51.59
FPI:	12	TMBH:	261.8	Fluid Vel. (fps)	5.9
TPC:	4	APD (in. w.g):	0.22	WPD (ft.):	18.4
Connection Size:	3”			Flow Rate (gpm):	200.0
No. Connections:	1				
Coil Dll Version:	7.5b.003				

Note(s): Ratings are for coils manufactured by: Johnson Controls, Inc., 507 E. Michigan St., Milwaukee WI 53202

BDW Tube Spacing: 1.25" x 1.08"

EFT < 120.0°F. - This coil is outside the scope of AHRI Standard 410.

Johnson Controls suggests using red brass or copper connectors when the coil is to be attached to a copper or brass piping system.

SOLUTION XT AIR HANDLING UNIT PERFORMANCE SPECIFICATION

Unit Tag	Qty	Model	Air Flow (CFM)
S-2	1	Indoor Air Handler 84 x 120	24200

HR Coil – EXHAUST – Summer Conditions

Coil General/Physical Details		Air Side Performance		Fluid Side Performance	
Location:	0	Air Flow (acfm):	11262	EWT (°F):	78.4
Tag:	AirCoil	Altitude (ft.):	4000	LWT (°F):	78.3
Application:	Heating	EAT-DB (°F):	77.0	GPM:	200.0
Coil Type:	Water	LAT-DB (°F):	78.3	WPD (ft):	17.6
Face Type:	Full	FV (ft/min):	207	FPS:	5.9
Tube Diameter:	1/2" BDW	TMBH:	14.1	Fluid Type:	Water
Tube Material:	Copper	APD (in. w.g.):	0.06	Fluid Weight(lb):	213.0
Tube Wall Thickness:	.016"			Fluid Volume(ft³):	3.4
Fouling Factor (hft²°F/btu):	0.00000				
Fin Type:	Corrugated				
Fin Thickness:	.006"				
Fin Material:	Aluminum				
Casing Material:	Galvanized				
Connection Material:	Steel*				
Connection Type:	MPT				
Coating:	None				
Rows:	4				
Fins Per Inch:	12				
Tubes Per Circuit:	4				
Finned Height (in.):	72.50				
Finned Length (in.):	108				
Coil Face Area (ft²):	54.4				
Coil Conn. Loc.:	Left(Left)				
Supp Conn Size:	3"				
Rtn Conn Size:	3"				
Supply Conn.(per coil):	2				

SOLUTION XT AIR HANDLING UNIT PERFORMANCE SPECIFICATION

Unit Tag	Qty	Model	Air Flow (CFM)
S-2	1	Indoor Air Handler 84 x 120	24200

HR Coil – SUPPLY – Summer Conditions

Coil General/Physical Details		Air Side Performance		Fluid Side Performance	
Location:	0	Air Flow (acfm):	24200	EWT (°F):	78.2
Tag:	AirCoil	Altitude (ft.):	4000	LWT (°F):	78.4
Application:	Cooling	EAT-DB (°F):	79.4	GPM:	200.0
Coil Type:	Water	EAT-WB (°F):	59.6	WPD (ft):	9.6
Face Type:	Full	LAT-DB (°F):	78.4	FPS:	4.7
Tube Diameter:	5/8" CDW	LAT-WB (°F):	59.3	Fluid Type:	Water
Tube Material:	Copper	FV (ft/min):	449	Fluid Weight(lb):	261.2
Tube Wall Thickness:	.020"	SMBH:	21.5	Fluid Volume(ft³):	4.2
Fouling Factor (hft²°F/btu):	0.00000	TMBH:	21.5		
Fin Type:	Sine	APD (in. w.g.):	0.27		
Fin Thickness:	.006"				
Fin Material:	Aluminum				
Casing Material:	Galvanized				
Connection Material:	Steel*				
Connection Type:	MPT				
Coating:	None				
Rows:	4				
Fins Per Inch:	12				
Tubes Per Circuit:	4				
Finned Height (in.):	72.50				
Finned Length (in.):	107				
Coil Face Area (ft²):	53.9				
Coil Conn. Loc.:	Left(Left)				
Supp Conn Size:	3"				
Rtn Conn Size:	3"				
Supply Conn.(per coil):	2				

*Johnson Controls suggests using red brass or copper connectors when the coil is to be attached to a copper or brass piping system.

Ratings are for coils manufactured by Johnson Controls, Inc., 507 E. Michigan St., Milwaukee WI 53202.

CDW Tube Spacing: 1.50" x 1.30"

AHRI Messages:
This coil is certified in accordance with the AHRI Forced-Circulation Air-Cooling and Air-Heating Coils Certification Program which is based on AHRI Standard 410 within the range of Standard rating conditions listed in Table 1 of the Standard. Certified units may be found in the AHRI Directory at www.ahridirectory.org.

Coil Dll Version: 7.5b.003

SOLUTION XT AIR HANDLING UNIT PERFORMANCE SPECIFICATION

Unit Tag	Qty	Model	Air Flow (CFM)
S-2	1	Indoor Air Handler 84 x 120	24200

Heating Coil

Coil General/Physical Details		Air Side Performance		Fluid Side Performance	
Location:	2	Air Flow (acfm):	24200	EWT (°F):	140.0
Tag:	AirCoil	Altitude (ft.):	4000	LWT (°F):	100.0
Application:	Heating	EAT-DB (°F):	40.6	GPM:	62.2
Coil Type:	Glycol	LAT-DB (°F):	88.1	WPD (ft):	6.6
Face Type:	Full	FV (ft/min):	449	FPS:	2.9
Tube Diameter:	5/8" CDW	TMBH:	1135.7	Fluid Type:	Propylene
Tube Material:	Copper	APD (in. w.g.):	0.21	% Glycol:	45.00
Tube Wall Thickness:	.020"			Fluid Weight(lb):	198.4
Fouling Factor (hft²°F/btu):	0.00000			Fluid Volume(ft³):	3.1
Fin Type:	Sine				
Fin Thickness:	.006"				
Fin Material:	Aluminum				
Casing Material:	Galvanized				
Connection Material:	Steel				
Connection Type:	MPT				
Coating:	None				
Rows:	3				
Fins Per Inch:	10				
Tubes Per Circuit:	6				
Finned Height (in.):	72.50				
Finned Length (in.):	107				
Coil Face Area (ft²):	53.9				
Coil Conn. Loc.:	Left(Left)				
Supp Conn Size:	2-1/2"				
Rtn Conn Size:	2-1/2"				
Supply Conn.(per coil):	2				

SOLUTION XT AIR HANDLING UNIT PERFORMANCE SPECIFICATION

Unit Tag	Qty	Model	Air Flow (CFM)
S-2	1	Indoor Air Handler 84 x 120	24200

Cooling Coil

Coil General/Physical Details		Air Side Performance		Fluid Side Performance	
Location:	4	Air Flow (acfm):	24200	EWT (°F):	45.0
Tag:	AirCoil	Altitude (ft.):	4000	LWT (°F):	55.0
Application:	Cooling	EAT-DB (°F):	79.4	GPM:	121.0
Coil Type:	Glycol	EAT-WB (°F):	59.6	WPD (ft):	8.8
Face Type:	Full	LAT-DB (°F):	55.0	FPS:	2.8
Tube Diameter:	5/8" CDW	LAT-WB (°F):	50.7	Fluid Type:	Propylene
Tube Material:	Copper	FV (ft/min):	449	% Glycol:	45.00
Tube Wall Thickness:	.020"	SMBH:	547.3	Fluid Weight(lb):	504.8
				Fluid Volume(ft³):	7.7
Fouling Factor (hft²°F/btu):	0.00000	TMBH:	547.3		
Fin Type:	Sine	APD (in. w.g.):	0.49		
Fin Thickness:	.006"				
Fin Material:	Aluminum				
Casing Material:	Galvanized				
Connection Material:	Steel				
Connection Type:	MPT				
Coating:	None				
Rows:	8				
Fins Per Inch:	12				
Tubes Per Circuit:	8				
Finned Height (in.):	72.50				
Finned Length (in.):	107				
Coil Face Area (ft²):	53.9				
Coil Conn. Loc.:	Left(Left)				
Supp Conn Size:	3"				
Rtn Conn Size:	3"				
Supply Conn.(per coil):	2				

Electrical Narrative

Introduction

This portion of the narrative discusses the electrical scope of the Replace HVAC Penthouse Units Project at the Fort Harrison VA in Ft. Harrison, Montana.

Project Scope

Existing Air Handling Units "S1A" and "S2A", are located in the outboard penthouse of building 154. Existing Air Handling Units "S-2" and "AC-2" are located in the elevator penthouse of building 154. Each of these units will be replaced with new air handling units. Existing starters serving these units shall be replaced with integral Variable Speed Drives.

The new Air Handling Unit replacing "S1A" will be named "154-AHU-12-4th". The new air handling unit replacing "S2A" will be named "154-AHU-13-4th" The new Air Handling Unit replacing "S2" will be named "154-AHU-14-3rd". The new air handling unit replacing "AC2" will be named "154-AHU-15-2nd".

A new chiller is being added northeast of the outboard penthouse, between the penthouse and existing rooftop chiller "154-CHLR-05A". A new power feed will be provided to this unit from existing switchboard "SES-144B". This unit will be named "154-CHLR-05B". A load test is required for this switchboard to ascertain spare capacity is available to serve this unit.

Existing surgical exhaust fan EF14 is being replaced with a new unit in the same location. The new exhaust fan will run continuously and will be served through the circuit breaker serving the existing unit.

As the result of field observations and careful survey of the existing electrical installation, the following line items are presented:

- Existing fused disconnects in motor control center "MCC-5" currently serving "S1A" and "S2A" shall be listed as "spare". New distribution board "154-DBPHN" will be provided to the north penthouse to serve new air handling units "154-AHU-12-4th and "154-AHU-13-4th supply fans, return fans and pumps.

- Existing starter in motor control center "MCC-5" currently serving chilled water pumps "P1" and "P2" shall be listed as "spare".

- Existing H.O.A.'s in motor control center "MCC-3" currently serving "S2" supply and return fans shall be listed as "spare". New distribution board "154-DBPHS" will be provided to the north penthouse to serve new air handling unit "154-AHU-14-3RD supply fan, return fan, pump, "154-CHP-1" pump, "154-CHP-2" pump, "154-HWP-1" pump and "154-HWP-2" pump.

- Existing circuit breaker in panelboard "154-PEE4" currently serving "AC-2" shall be listed as "spare". The existing 15 ampere, 3 pole circuit breaker in circuit #2 of this panelboard, currently in the off position, listed as serving exhaust fan E30 shall be field verified as being a spare circuit breaker and shall also be listed as spare. Existing 20 ampere, 3 pole circuit breaker in circuit #1 serving EF14 shall be re-used to serve new exhaust fan EF-14.

- New variable speed drives, integral to the units, shall be provided to serve each of the new air handling unit supply fans and return fans. New external variable speed drives will be provided for

the air handling unit pumps. New variable speed drives will also be provided to serve new "154-CHP-1", "154-CHP-2", "154-HWP-1" and "154-HWP-2" pumps. The variable speed drives shall be installed as shown on the electrical sheets and shall be listed as capable of serving as main disconnecting means. National Electrical Code (NEC) required clearances shall be maintained about units.

- New power conduit and conductors shall be provided from the upstream source through the new variable speed drives to each of these air handling units and pumps.

- A new circuit breaker will be provided to existing switchboard "SES-144B" to serve the new roof mounted chiller. New power conduits and conductors will be provided from this existing switchboard to the unit at roof level. A new weatherproof fused disconnect will be provided immediately adjacent to the unit.

- Additionally, new conduit and conductors shall be provided from each of the new air handling units, pumps new chillers and all other devices to the building EMS system as required for controls.

- The existing spare 400 ampere, 3 pole circuit breaker in switchboard "154-MSBD" will be used to provide a new feed to new distribution board "154-DBPHS" in the elevator penthouse to serve new air handling unit "154-AHU-14-3RD" supply fan, return fan and pump, "154-CHP-1", "154-CHP-2", 154-HWP-1" and 154-HWP-2".

- A new 200 ampere, 3 pole circuit breaker will be provided to existing panelboard "154-DEE" to serve new panelboard "154-PEE4A" in the south penthouse to serve new air handling unit "154-AHU-15-2ND" supply fan, return fan and pump.

A 30 day load test will be required for the following electrical distribution equipment:

- 154-MSBD
- 154-DEE
- 154-GSBD
- SES-144B

The contractor shall provide a line item to the bid the installation of an alternative power source to the new equipment. This consists of the provision of a new medium voltage to low voltage transformer, a new distribution board and alternate feeds to "154-DBPHN", 154-DBPHS" and "154-CHLR-05B". See "Electrical Alternate One-Line Diagram SES-144C" on sheet E602 for details.

Construction Phasing
The project's successful completion depends on coordinated phasing which permits construction to proceed in an efficient and orderly manner. The precise sequence of construction will be determined after a contractor has been selected, however initially the construction phases are broadly described as follows below. As the design evolves, the phasing plan will become more detailed.

General Phasing:
1. Remove and replace the existing chiller.
2. Remove existing HVAC units and associated ductwork. Mechanical and electrical equipment shall be strategically disconnected and reconnected to allow for normal operation to occur. Temporary units may be necessary to minimize shut downs.
3. Demolish existing housekeeping pads and prep slab for new unit. All slabs shall be ground down to provide a smooth walking surface.
4. Install new housekeeping pads and/or curbs. Verify exact size and dimensions with unit manufactures.
5. Install new HVAC units and ductwork.
6. Connection of all utilities to the new mechanical equipment.

HVAC Unit Phasing
Each unit will need to be replaced separately and during mild weather conditions. Replacing during mild weather conditions (April, May, September, October) will reduce the size of the auxiliary temporary conditioning required for each AHU. Replacing each separately will reduce the amount of time each space will be non-operational. See below for specifics.

154-AHU-12-4TH & 154-AHU-13-4TH
These units are located in the Outboard Penthouse and total 20,300 CFM combined.
1. The contractor shall provide a Tee fitting at the existing elbow fitting for the return and supply air for each unit. This shall be installed during non-occupied or lightly occupied hours. There shall be a manual damper at each Tee connection to isolate the supply and return air from the temporary unit when necessary.
2. After the Tee fitting has been installed for each unit a 10,000 CFM Heating/Cooling temporary unit shall be connected to one connection of the installed Tee fitting.
3. The manual damper shall be closed for the existing to be demolished AHU and opened for the temporary unit.
4. The temporary unit shall connect with flex ductwork routed through the existing door or a temporary opening in the outboard penthouse.
5. The existing unit shall be demolished and the new unit shall be installed in its place connected to the Tee fitting installed by the contractor.
6. The new unit shall be started and tested.
7. When the new unit has passed all testing and deemed ready for operation the temporary unit shall be disconnected.
8. The Tee fitting shall be demolished and replaced with a permanent elbow.

154-AHU-15-2ND
This units is located in the Elevator Penthouse and is 9,000 CFM.
1. The contractor shall provide a Tee fitting at the existing elbow fitting for the return and supply air for the unit. This shall be installed during non-occupied or lightly occupied hours. There shall be a manual damper at each Tee connection to isolate the supply and return air from the temporary unit when necessary.
2. After the Tee fitting has been installed for each unit a 4,000 CFM Heating/Cooling temporary unit shall be connected to one connection of the installed Tee fitting.

3. The manual damper shall be closed for the existing to be demolished AHU and opened for the temporary unit.
4. The temporary unit shall connect with flex ductwork routed through the existing door or a temporary opening in the outboard penthouse.
5. The existing unit shall be demolished and the new unit shall be installed in its place connected to the Tee fitting installed by the contractor.
6. The new unit shall be started and tested.
7. When the new unit has passed all testing and deemed ready for operation the temporary unit shall be disconnected.
8. The Tee fitting shall be demolished and replaced with a permanent elbow.

154-AHU-14-3RD

This units is located in the Elevator Penthouse and is 22,400 CFM.

1. The contractor shall provide a Tee fitting at the existing elbow fitting for the return and supply air for the unit. This shall be installed during non-occupied or lightly occupied hours. There shall be a manual damper at each Tee connection to isolate the supply and return air from the temporary unit when necessary.
2. After the Tee fitting has been installed for each unit a 10,000 CFM Heating/Cooling temporary unit shall be connected to one connection of the installed Tee fitting.
3. The manual damper shall be closed for the existing to be demolished AHU and opened for the temporary unit.
4. The temporary unit shall connect with flex ductwork routed through the existing door or a temporary opening in the outboard penthouse.
5. The existing unit shall be demolished and the new unit shall be installed in its place connected to the Tee fitting installed by the contractor.
6. The new unit shall be started and tested.
7. When the new unit has passed all testing and deemed ready for operation the temporary unit shall be disconnected.
8. The Tee fitting shall be demolished and replaced with a permanent elbow.

Replace Penthouse HVAC Systems 436-17-102
100% Review Comments
7-25-2018

Item	Location/ Sheet	Review Comments	Response/Action
1	A-102	Penthouse shows a new double door on the south side of the building. Is it required? (Windy side of complex).	The double door on the south side of the building is a relocatd door for maintenance access and coil pull.
2	A-102	Specify a skid resisetn epoxy coating.	See revised keynote #11 on sheet A-102 and specification.
3	A-102	Gridlines 13-14 show a duct running down on the ICU mechanical room roof. Need to add access ladder and guard railing full length to the east side, so maintenance does not have to walk down to 3rd floor.	See revised plan and details on sheet A-102.
4	A-301	Detail 5: Shows a vent pipe with no boot extending above the roof. (water & snow).	See revised detail. Added notes for roof boot and welded seam.
5	A-301	Detail 3: Rubber rap/seal on roof post needs to call out height above roof line.	See revised detail. Added notes for roof boot and welded seam.
6	A-302	Details 2 & 3: Shows a galvanized handrail but to must meet sign and safety for markings and signing paint yellow with epoxy paint?	See revised notes.
7	MD 101	Grid line 9: Shows the piping to the HEPA air handling system being demo, what is the plan to keep the unit in operation since it services the isolation rooms in the hospital?	These piping lines served as heat recovery for the air handlers inside the penthouse. All of the new air handlers have their own means of heat recovery so this piping is no longer required. The flow in the pipes can be shut down @ the valves located next to the unit.
8	MH 101	How are UH-3 &4 going to be mounted and not interfere with the operation and maintenance of the AHU?	Note has been added to coorindate location of UHs with maintenance areas of AHUs
9	MH 101, 2xB	Call out detiai for railing	detail is now called out on plans

10	MH 101, 2xB	Call out detial for the bridge.	detail is now called out on plans
11	MH102	I would add a note to deal with the medical gas piping in the area around rooms 211-214. (add sheet with location)?	Keynote 4 has been added to sheet addressing medical gas piping.
12	MP100	Estblish the pumps for 154-AHU-12-4TH and 154-AHU-13-4TH In the penthouse where the AHU's are located.	Pumps have been relocated to the other penthouse.
13	MP100	The UH-1 is blowing are on the digital controls for the CHPs and the elevator controls (east end of room) are real heat sensitive controls. How is this addressed?	UH-1 is shown at the plan north west corner of penthouse.
14	M 501	Provide detail and schedul to place removable pad insulators on all pipe features and fixtures.	new sheet M505 has been added to show removable pad insulators.
15	M610	Signafy the the air handler scheduled will fit thrpought the douple doors.	Note has been added to MD100 addressing the fit of all equipment.
16	M610	Why is the GPM higher on the 8000 CFM than that of the 10,000 CFM?	This has been addressed with the manufacturer and modified.
17	E 200	I would recommend adding another row of lights on the north wall in the elevator machine room area. (2-3 lights)	The number of luminaires provided for these spaces was dictated by the wattage ofg luminaires removed during demo phase. Please note, although 16 luminaires were removed during the demp phase, 26 liminairew have been provided.Per telephone conversation with Wayne Delzer on July 23, 2018, the new luminaires have been relocated and additional switching has been provided to address this comment and comments #24, 25 and 26.
18	E300	Note 3: The proposed location of the new distribution board is in front of the conduit sleeve and will hamstring us in the future for running new conduits.	The distribution board has been relocated so it is no longer in front of the conduit sleeves.
19	E002	Mark the floor and room numbers.	Keynotes #1 and #2 have been expanded to include the equipment room names. The room label layer has also been turned on.

20	E302	Need to coordinate the conduit runs in the electrical with the Four North project. Have Aaron run the most of the conduit through the floor while the work going on.	Per telephone convesation with Wayne Delzer on July 23, 2018, a note detailing the availability of spare conduit stubs has been added to the corresponding sheets to address this comment and comments #21 and #22.
21	E303	Need to coordinate the conduit runs in the electrical with the Four North project.	Please see response to comment #20.
22	E304	Need to coordinate the conduit runs in the electrical with the Four North project.	Please see response to comment #20.
23	ED100	Where is key note #5?	Keynote #5 indicates MCC-3. This is located inside the outboard penthouse along the western wall.
24	E200, 11,12,A,B	Not enough ligthing on the North Est side of the air handler.	Please see response to comment #17.
25	E200, 9,A,B	Light need to over top of campressors.	Please see response to comment #17.
26	E200, 12, 14, A	Space lighting evenly above Elevator equipment.	Please see response to comment #17.
27	Exxx	Estabish more outlets per code in all mechanical areas.	Equipment maintenance receptacles have been added to both the inboard and the outboard penthouses.