SUBMITTAL

Project

WAYNE STATE UNIVERSITY FACULTY/ADMINISTRATION BUILDING

Submitted To:

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Date

February 12, 2015

Engineer and Owner Review Notes:

Table Of Contents

Project: 141085-WSU ADMIN BLDG 02/12/2015
Prepared By: Mike McLaughlin 11:08AM

RTU-1-4

Tag Cover Sheet
Unit Report
Certified Drawing
Performance Report
Guide Specification

Unit Report For RTU-1-4

Project: 141085-WSU ADMIN BLDG 02/12/2015
Prepared By: Mike McLaughlin 11:08AM

Unit Parameters

Unit Size:.....**105 tons**
Volts-Phase-Hertz:.....**460-3-60**
Supply / Return:**Horizontal Supply/Horizontal Return**
Configuration:.....**VAV**
Evaporator Coil Type:**Std Capacity Evaporator**
Heating Capacity:.....**No Heat, Plenum Unit**
Filter Option:**12" MERV 14 Cart w/ 4" MERV 8 pre-filters**
.....

Shipping Dimensions

Unit Length with Exhaust Hood:.....**40' 5"**
Unit Width:.....**11' 11"**
Unit Height: .....**8' 2"**

Total Operating Weight: ..... **17464** lb

Controls

Application Type:.....**VAV**
Siemens to interface via BACnet MS/TP .....

Exhaust/Economizer

Exhaust/Economizer: ..... **Economizer w/ Return Fan**
P.E./ R.F. Motor HP: .....**30 hp Pwr Exh/Ret. Fan Motor**

Supply Fan

Supply Fan Type:.....**High Static Airfoil Fan**
Supply Fan Motor HP:.....**60 hp Supply Fan Motor**
Supply Fan Motor Type:..... **ODP**

Condenser Coil

Cond. Coil Fin Coating:..... **Standard MCHX**

Mixed-Air and Outdoor Filters

Mixed-Air Filter:.....**12 in. MERV 14 Cartridge**
:.....**(15) 20 x 24 x 12, (5) 24 x 24 x 12**

Warranty Information

Complete Unit 2 Year Parts & Carrier Service Labor
Compressor Year 2-5 Parts Only
Start-up, All four (4) units

Part Number	Description	Quantity
50N5HQ600B6HRZRQ44	Rooftop Unit	4
	Base Unit	
	High Static Airfoil Supply Fan	
	Enthalpy/CO2 Economizer w/ Return Fan	
	12" MERV 14 Cart w/ 4" MERV 8 pre filters	
	Wire Security Grille	
	Convenience Outlet	
	Service Valve & Replaceable Core Drier	
	Digital Compressor (lead compressor only)	
	No Heat, Plenum Unit	
	Non-fused Disconnect	
	BACnet MS/TP communication & Controls Expansion Module	

Accessories included for <u>FIELD installation</u>

Accessory Part #	Description	Quantity
CRFLTKTN009A00	Return Air Filters	4
CRSTATUS002A00	Plugged Filter Indicator	4
CRCBDIOX002A00	Return CO2 Sensor	4
33CSENTSEN	Enthalpy Transmitter	4
CRHUMDSN001B00	Return Air Humidity Sensor	4
HK05ZG019	Transducer	4

NOTES:
1. DIMENSIONS ARE IN INCHES.
2. ⊕ UNIT WEIGHT AND CENTER OF GRAVITY INCLUDES ECONOMIZER, LARGEST INDOOR FAN MOTOR AND HIGH CAPACITY EVAPORATOR COIL.
3. UNIT CLEARANCES
   TOP - DO NOT RESTRICT CONDENSER FANS
   ECONOMIZER END - 10'-0"
   SIDES AND CONDENSER END 6'- 0"
   FOR SMALLER SERVICE AND OPERATIONAL CLEARANCES, CONTACT CARRIER APPLICATION ENGINEERING DEPARTMENT.
4. SUGGESTED FIELD CONNECTIONS TO MADE INSIDE OR OUTSIDE OF DUCT FLANGES.
5. WHEN UNIT IS SLAB MOUNTED ALLOW ADEQUATE HEIGHT FOR CONDENSATE DRAIN TRAP.
6. ECONOMIZER SIDE HOODS ARE SHIPPED INSIDE OF UNIT.
7. HEAT RECLAIM COIL DIMENSIONS (MAXIMUM)
   - LENGTH (HEADER INCLUDED): 121"
   - WIDTH: 6.00"
   - HEIGHT: 64.50"
8. HEAT RECLAIM COIL FIELD SUPPLIED OR FACTORY INSTALLED.
9. PIPE CHASE LOCATIONS ARE RECOMMENDATIONS ONLY. OPENINGS ARE NOT FACTORY PROVIDED.
10. OPERATIONAL FACTORY SUPPLIED HOT WATER AND STEAM COILS ON UNITS WITHOUT ELECTRIC HEAT.
    HOT WATER COIL DIMENSIONS:
    - LENGTH: 108.75" WIDTH: 6.00" HEIGHT: 64.50"
    - TUBE O. D.: 1/2"- ROWS 2
    - PIPE SIZE 1 1/2" NPT
    STEAM COIL DIMENSIONS:
    - LENGTH : 110.00" WIDTH: 5.00" HEIGHT: 54.00"
    - TUBE O. D.: 1.00"- ROWS 2
    - PIPE SIZE 2 1/2" NPT

UNITED TECHNOLOGIES CARRIER P.O. BOX 4808 SYRACUSE, NY 13221

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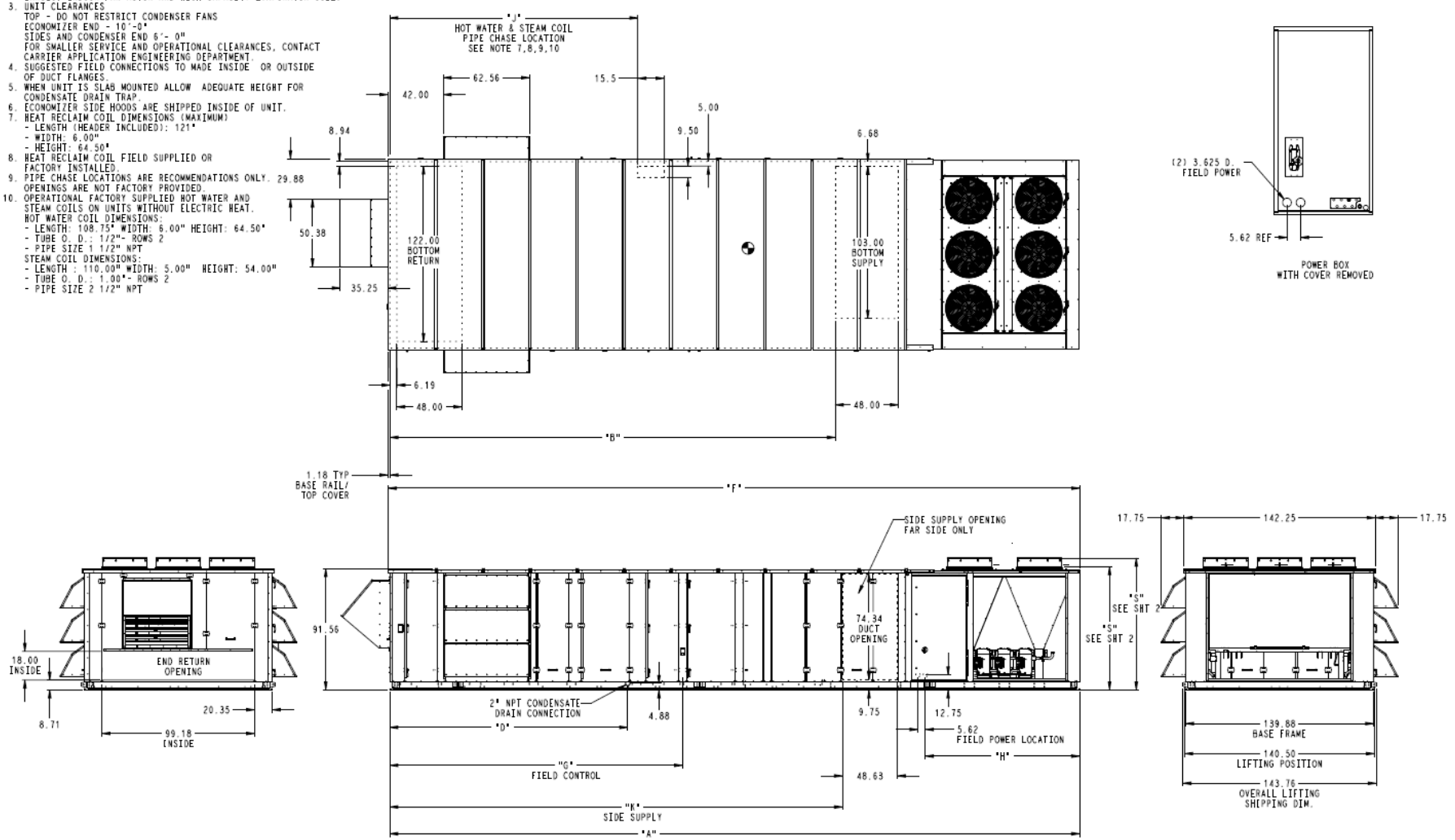


SHEET	DATE	SUPERCEDES			REV
1 OF 2	5/23/13	-	50N*075-105 NEXT GEN ROOFTOP	48NG500990	-

Performance Summary For RTU-1-4

Project: 141085-WSU ADMIN BLDG 02/12/2015
Prepared By: Mike McLaughlin 11:08AM

Part Number: **50N5HQ600B6HRZRQ44**

EER (ARI 360):	**10.1**	
IEER:	**12.1**	
Total Operating Weight:	**17464**	lb

Shipping Dimensions

Unit Length Including Exhaust Hood:	**40' 5"**	
Unit Width:	**11' 11"**	
Unit Height:	**8' 2"**	

Unit

Supply/Return:	**Horizontal Supply/Horizontal Return**	
Application Type:	**VAV**	
Voltage:	**460-3-60**	
Evaporator Type:	**Std Capacity Evaporator**	
Cooling Airflow:	**38800**	CFM
Altitude:	**0**	ft
Cond. Ent. Air Temp:	**95.0**	F
Ent. Air Dry Bulb:	**80.0**	F
Ent. Air Wet Bulb:	**67.0**	F
Ent. Air Enthalpy:	**31.44**	BTU/lb
Lvg. Air Dry Bulb:	**57.4**	F
Lvg. Air Wet Bulb:	**56.8**	F
Lvg. Air Enthalpy:	**24.27**	BTU/lb
Gross Cooling Capacity:	**1251.59**	MBH
Gross Sensible Clg. Cap:	**946.54**	MBH
Compressor Power:	**90.4**	kW
Coil Bypass Factor:	**0.078**	

Supply Fan Information:

Ext.Static Pressure:	**3.00**	in wg
Economizer Loss:	**0.29**	in wg
Cartridge Filters Loss:	**0.78**	in wg
Selection Static Pressure:	**4.06**	in wg
Supply Fan Type:	**High Static Airfoil Fan**	
Supply Fan RPM:	**1038**	
Supply Fan BHP:	**51.88**	BHP
Supply Fan Motor HP:	**60 hp Supply Fan Motor**	

Return Fan Information:

Airflow:	**36800**	CFM
Ext. Static:	**1.00**	in wg
Tot. Static:	**1.00**	in wg
Fan RPM:	**1089**	
Fan BHP:	**29.8**	BHP
Motor HP:	**30 hp Pwr Exh/Ret. Fan Motor**	

Electrical Data

Minimum Voltage:	**414**
Maximum Voltage:	**506**
Condenser Fan Motor Qty:	**6**
Condenser Fan Motor FLA (ea):	**5.6**
Power Supply MCA:	**324**
Power Supply MOCP (Fuse or HACR):	**350**
Condenser Fan Motor Eff.:	**STD**
Compressor RLA (ea), (B1,B2,B3):	**26.3**
Compressor LRA (ea), (B1,B2,B3):	**179**
Number of Compressors, (B1,B2,B3):	**3**

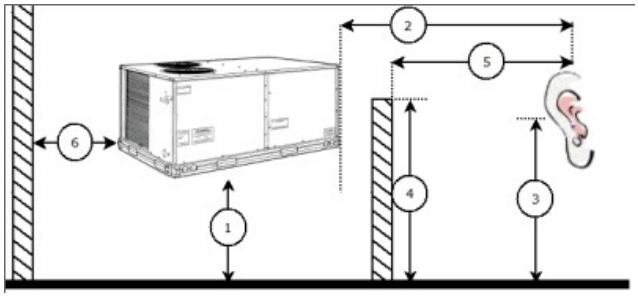
Evaporator Fan Motor HP: **60**
Evaporator Fan Motor FLA:..... **72.1**
Return Fan t [Qty / Hp(ea) / FLA(ea)]:..... **1 / 30 / 36.6**
Compressor RLA (ea), (A1,A2,A3):..... **26.3**
Compressor LRA (ea), (A1,A2,A3):..... **179**
Number of Compressors, (A1,A2,A3):..... **3**

Acoustic Information

	Discharge, Lw	Inlet, Lw	Outdoor, Lw
63 Hz	107.7	100.3	91.9
125 Hz	103.5	105.0	97.4
250 Hz	101.6	104.9	95.7
500 Hz	93.2	97.7	96.6
1000 Hz	87.2	94.8	98.0
2000 Hz	84.3	89.9	91.4
4000 Hz	82.0	86.2	89.8
8000 Hz	76.1	80.9	78.0

Calculation methods used in this program are patterned after the ASHRAE Guide; other ASHRAE Publications and the AHRI Acoustical Standards. While a very significant effort has been made to insure the technical accuracy of this program, it is assumed that the user is knowledgeable in the art of system sound estimation and is aware of the tolerances involved in real world acoustical estimation. This program makes certain assumptions as to the dominant sound sources and sound paths which may not always be appropriate to the real system being estimated. Because of this, no assurances can be offered that this software will always generate an accurate sound prediction from user supplied input data. If in doubt about the estimation of expected sound levels in a space, an Acoustical Engineer or a person with sound prediction expertise should be consulted.

Advanced Acoustics



Advanced Accoustics Parameters

1. Unit height above ground: ..... **30.0** ft
2. Horizontal distance from unit to receiver: ..... **50.0** ft
3. Receiver height above ground: ..... **5.7** ft

Detailed Acoustics Information

Octave Band Center Freq. Hz	63	125	250	500	1k	2k	4k	8k	Overall
A	91.9	97.4	95.7	96.6	98.0	91.4	89.8	78.0	103.8 Lw
B	65.7	81.3	87.1	93.4	98.0	92.6	90.8	76.9	100.9 LwA
C	58.2	63.7	62.0	62.9	64.3	57.7	56.1	44.3	70.1 Lp

Performance Summary For RTU-1-4

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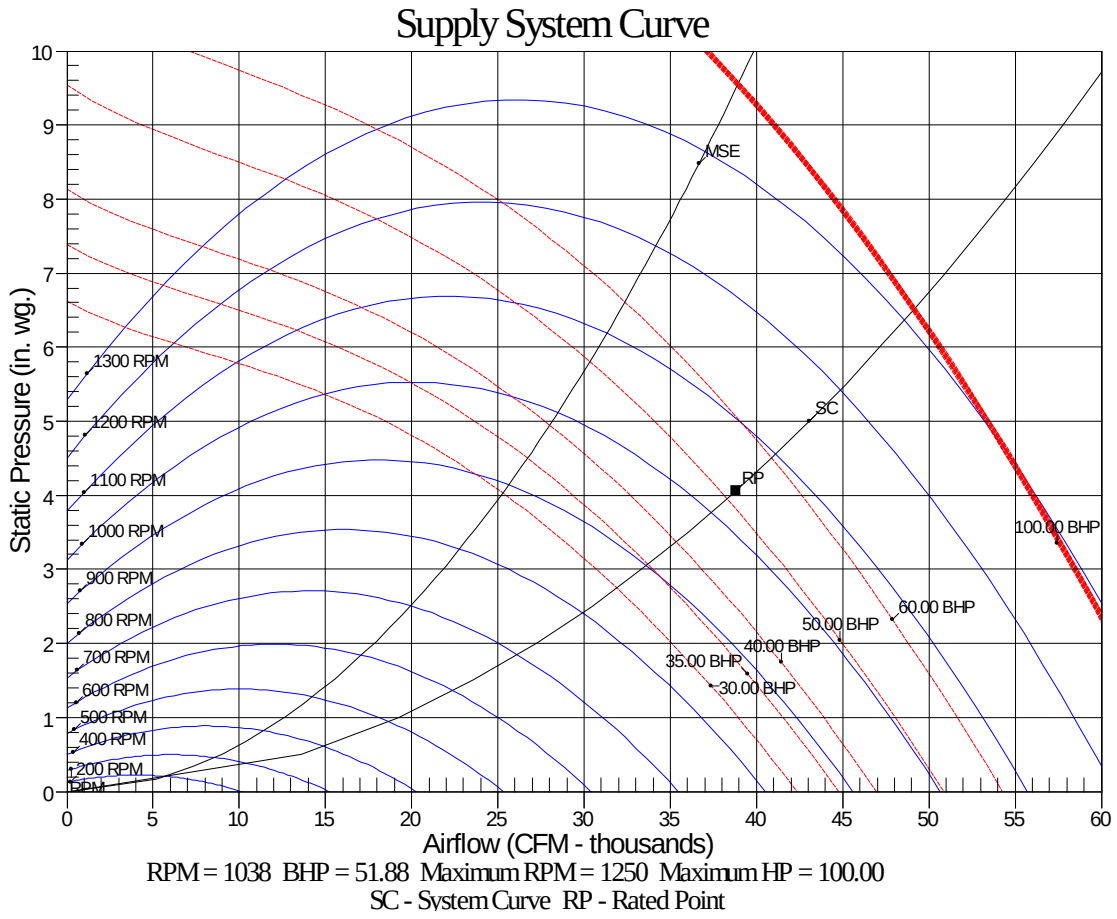
D	32.0	47.6	53.4	59.7	64.3	58.9	57.1	43.2	67.1 LpA

Legend
A Sound Power Levels at Unit's Acoustic Center, Lw
B A-Weighted Sound Power Levels at Unit's Acoustic Center, LwA
C Sound Pressure Levels at Specific Distance from Unit, Lp
D A-Weighted Sound Pressure Levels at Specific Distance from Unit, LpA



RPM = 1038 BHP = 51.88 Maximum RPM = 1250 Maximum HP = 100.00
SC - System Curve RP - Rated Point

Performance Summary For RTU-1-4

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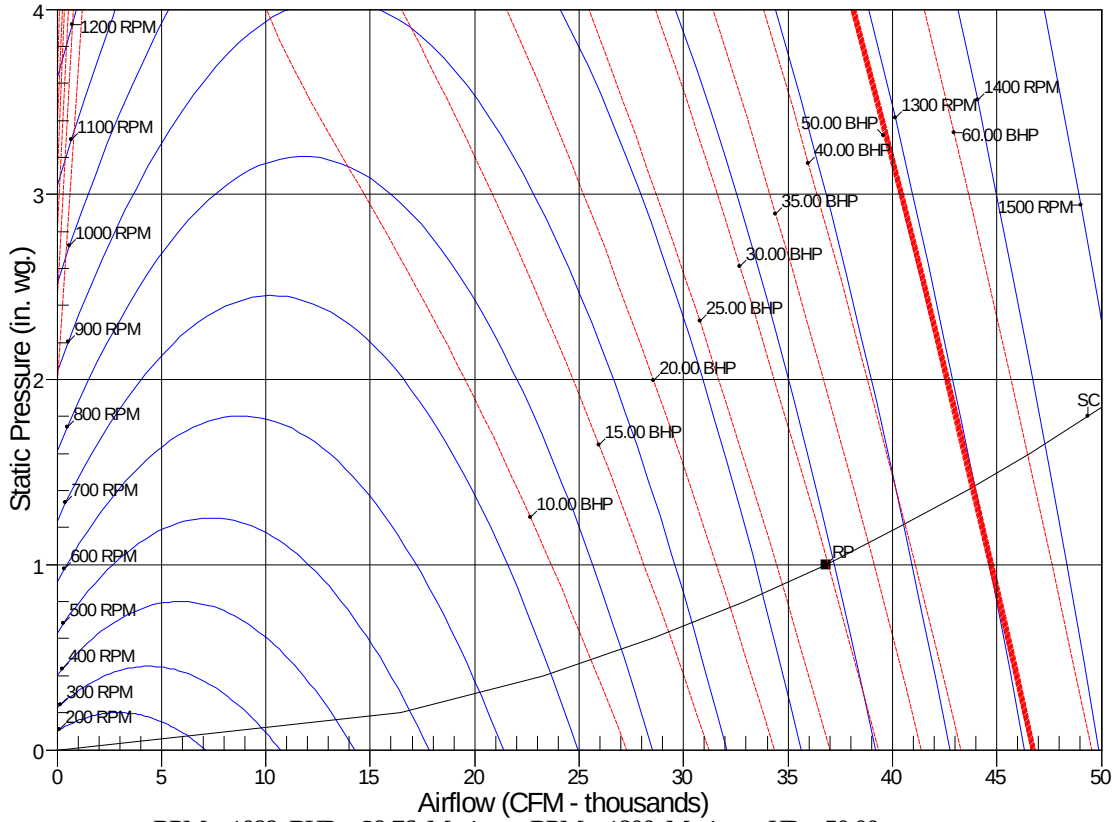
Return Fan Curve



RPM = 1089 BHP = 29.76 Maximum RPM = 1800 Maximum HP = 50.00
SC - System Curve RP - Rated Point

Certified Drawing Dimensions:

Dimension A:	**448.2"**
Dimension D:	**177.02"**
Dimension F:	**449.44"**
Dimension G:	**217.84"**
Dimension H:	**119.76"**
Dimension K:	**263.45"**
Dimension S:	**98.06"**

HVAC Guide Specifications — Section 50N5
Packaged Rooftop Cooling Unit with *Comfort*Link Controls

Size Range:
105 Tons, Nominal

Carrier Model Number:
50N5 (Horizontal Supply/Return, Variable Air Volume Application)

Part 1 — General

1.01 SYSTEM DESCRIPTION

Outdoor, post-up mounted, electronically controlled cooling unit utilizing hermetic scroll compressors with crankcase heaters for cooling duty. Units shall supply air horizontally and return air horizontally as shown on the contract drawings.

1.02 QUALITY ASSURANCE

A. Units shall be manufactured in a facility registered to ISO 9001 manufacturing quality standard.
B. Unit shall be rated in accordance with AHRI (Air-Conditioning, Heating, and Refrigeration Institute) Standard 340/360, latest edition.
C. Unit shall be designed to conform to ANSI (American National Standards Institute)/ASHRAE (American Society of Heating, Refrigeration and Air Conditioning) 15 (latest edition), ASHRAE 62, and UL Standard 1995.
D. Unit shall be listed by ETL and ETL, Canada, as a total package.
E. Insulation and adhesive shall meet NFPA (National Fire Protection Association) 90A requirements for flame spread and smoke generation.

1.03 DELIVERY, STORAGE, AND HANDLING

A. All units shall be completely shrink-wrapped from the factory for protection during shipment. Tarping of units is unacceptable.
B. Inspect for transportation damage and store in clean dry place and protect from weather and construction traffic. Handle carefully to avoid damage to components, enclosures, and finish.

Part 2 — Products

2.01 EQUIPMENT

A. Factory-assembled, single-piece cooling unit. Contained within the unit enclosure shall be all factory wiring, piping, refrigerant charge (R-410A), operating oil charge, dual refrigerant circuits, microprocessor-based control system and associated hardware, and all special features required prior to field start-up.
B. Unit Cabinet:
   1. Unit shall be double-wall construction with insulation sealed between the inner and outer panels. Panel assemblies shall not carry an R-value of less than 8. The panels shall be galvanized steel (designated G60 per ASTM Standard A653 - minimum coating weight of 0.6 oz of zinc per square foot), bonderized and primer-coated on both sides and coated with a baked polyester thermosetting powder coating finish on the outer surface.
   2. Unit casing shall be capable of withstanding ASTM (American Society for Testing and Materials) Standard B117 500-hour salt spray test.

3. Casing shall be watertight at negative 7 in. wg of internal pressure when tested per the UL 1995 rain test requirements. Leakage rate shall be tested and documented on a routine basis on random production units.
4. Sides shall have person-size hinged access doors for easy access to the control box and other areas requiring servicing. Each door shall seal against a rubber gasket to prevent air and water leakage. Access doors shall be one piece, double-wall construction with insulation sealed between the inner and outer panels. Panel assemblies shall not carry an R-value of less than 8. Access doors shall be equipped with tiebacks.
5. Side panels shall be easily removable for access to unit and shall seal against a full perimeter automotive style gasket to ensure a tight seal.
6. Unit shall contain a double sloped drain pan, to prevent standing water from accumulating. Pan shall be fabricated of stainless steel. Unit shall contain a factory-installed nonferrous main condensate drain connection.
7. Top cover of airside section to be sloped to prevent standing water.
8. Units shall be equipped with lifting lugs to facilitate overhead rigging. Lifting lugs shall also be suitable as tie down points.

C. Compressors:
1. Fully hermetic scroll type compressors with overload protection and short cycle protection with minimum on and off timers. Lead compressor on each unit shall be a digital scroll.
2. Factory rubber-in-shear mounted for vibration isolation.
3. Reverse rotation protection capability.
4. Crankcase heaters shall only be activated during compressor off mode.

D. Coils:
1. Evaporator Coil:
   a. Intertwined circuiting constructed of aluminum fins mechanically bonded to seamless copper tubes.
   b. Full-face active type during full and part load conditions.
   c. Coils shall be leak tested at 150 psig and pressure tested at 650 psig.
2. Condenser Coils:
   a. Condenser coils shall be microchannel design. The coils shall have a series of flat tubes containing a series of multiple, parallel flow microchannels layered between the refrigerant manifolds. Microchannel coils shall consist of a two-pass arrangement. Coil construction shall consist of aluminum alloys for the fins, tubes and manifolds.
   b. Air-cooled condenser coils shall be leak tested at 150 psig and pressure tested at 650 psig.

E. Fans:
1. Supply Fan:
   a. Unit shall have only one fan wheel, scroll, and motor.
   b. Fan scroll, wheel, shaft, bearings, drive components and motor shall be mounted on a formed steel assembly which shall be isolated from the unit outer casing with factory-installed 2-in. deflection spring isolators and vibration-absorbent fan discharge seal.
   c. Fan shall be double-width, double-inlet, centrifugal belt-driven airfoil type with single outlet discharge.
   d. Fan wheel shall be designed for continuous operation at the maximum rated fan speed and motor horsepower.
   e. Fan wheel and shaft shall be selected to operate at 25% below the first critical speed and shall be statically and dynamically balanced as an assembly.
   f. Fan shaft shall be solid steel, turned, ground and polished, and coated with rust preventative oil.
   g. Fan shaft bearings shall be self-aligning, pillow-block, regreasable ball or roller-type selected for a minimum average life of 200,000 hours at design operating conditions in accordance with ANSI B3.15.
   h. A single motor shall be mounted within the fan section casing on slide rails equipped with adjusting screws. Motor shall be mounted on a horizontal flat surface and shall not be supported by the fan or its structural members. Motor speed shall be controlled by a variable frequency drive.
   i. Fan drive shall be constant-speed fixed-pitch. All drives shall be factory-mounted, with belts aligned and tensioned.

2. Condenser Fans:
   a. Direct-driven propeller type.
   b. Discharge air vertically upward.
   c. Protected by PVC-coated steel wire safety guards.
   d. Statically and dynamically balanced.

e. Three-phase, totally enclosed motors.

F. Variable Frequency Drive:
Supply and return/exhaust motors shall be equipped with variable frequency drive (VFD) inverters. The VFD shall be provided with a metal enclosure and shall be factory-mounted, wired, and tested. The variable speed drive shall include the following features:
1. Full digital control with direct control from the unit ComfortLink controls.
2. Insulated gate bi-polar transistors (IGBT) used to produce the output pulse width modulated (PWM) waveform, allowing for quiet motor operation.
3. Inverters capable of operation at a frequency of 8 kHz so no acoustic noise shall be produced by the motor.
4. VFDs shall include EMI/RFI (electromagnetic / radio frequency interference) filters.
5. Digital display keypad module, mounted on the VFD enclosure.
6. Local/Remote and Manual/Auto function keys on the keypad.
7. UL-listed electronic overload protection.
8. Critical frequency avoidance.
9. Self diagnostics.
10. On-board storage of unit manufacturer's customer user settings, retrievable from the keypad.
11. RS485 communications capability (accessory card source required).
12. Internal thermal overload protection.
13. 5% swinging (non-linear) chokes for harmonic reduction and improved power factor.
14. All printed circuit boards shall be conformal coated.

G. Outdoor-Air Hood Assembly:

K. Refrigerant Components:
Unit shall be equipped with dual refrigerant circuits, each containing:
1. Replaceable core filter driers on each circuit.
2. Moisture indicating sight glass.
3. Electronic expansion valves.
4. Fusible plug(s).

L. Filter Section:
1. Mixed air filter section shall consist of 2-in. thick, MERV-8 disposable fiberglass filters.
2. Final filters shall be MERV-14.

M. Controls, Safeties, and Diagnostics:
1. Controls:
a. Control shall be accomplished through the use of a factory-installed BACnet MS/TP, microprocessor-based control system and associated electronic and electrical hardware. Control system shall determine control sequences through monitoring the following operational variables:
1) Day and Time.
2) Schedule (Unoccupied/Occupied).
3) Set points (Unoccupied/Occupied, Economizer, Duct Pressure, others).
4) Space temperature.
5) Outdoor-air temperature.
6) Unit supply-air temperature.
7) Unit return-air temperature and CO2 (in PPM).
8) Supply-air fan status.
9) Economizer position.
10) Compressor suction and discharge pressure.
11) Navigator display.
12) Accessory and/or field-supplied sensors, function switches and/or signals.
b. Controls shall be capable of performing the following functions:
1) Capacity control based on supply-air temperature and compensated by rate of change of return-air temperature (VAV) or room temperature (CV). Capacity control shall be accomplished through the use of compressor staging or optional variable output compressors.
2) Perform a quick test to check the status of all input and output signals to the control system using the Navigator™ display.
3) Control of integrated economizer operation, based on unit supply-air temperature.
4) Supply fan volume control shall control output from a variable frequency drive to maintain duct static pressure at user-configured set point (VAV). Static pressure reset in conjunction with Carrier

communicating terminals to reduce supply fan power requirements. Control system calculates the amount of supply static pressure reduction necessary to cause the most open damper in the system to open more than the minimum value (60%) but not more than the maximum value (90% or negligible static pressure drop).

5) Adaptive optimal start shall determine the time unit will commence cooling (or heating or heating for morning warm-up) during the unoccupied mode to ensure occupied space reaches the set point in time for occupied mode.
6) Adaptive optimal stop shall turn off the compressors a preset amount of time before the end of the occupied mode to conserve energy (CV only).
7) Alerts and Alarms: Control shall continuously monitor all sensor inputs and control outputs to ensure safe and proper system operation. Alerts shall be generated whenever sensor conditions have gone outside criteria for acceptability. Alarms shall be initiated when unit control detects that a sensor input value is outside its valid range (indicating a defective device or connection that prevents full unit operation) or that an output has not functioned as expected or that a safety device has tripped. Current alarms shall be maintained in STATUS function; up to 9 (current or reset) shall be stored in HISTORY function for recall.
8) BACnet MSTP.
9) Timed override function shall permit a system in unoccupied mode to be returned to occupied mode for a user-configured period of 1, 2, 3 or 4 hours by pressing the override button on the front of the space temperature sensor.
10) Nighttime Free Cooling (NTFC) shall start the supply fan and open the economizer on cool nights to pre-cool the building structure mass using only outdoor air. Function shall be restricted to operation above a user-configured low lockout temperature set point.
11) Modulating power exhaust control shall utilize a VFD to modulate capacity of exhaust fan system. Capacity of exhaust air shall be modulated in response to building static pressure at user-configured set point. Power exhaust fan operation shall be interlocked with supply fan operation.
12) Return fan control shall measure supply fan cfm and shall utilize a VFD to modulate the return fan to maintain constant cfm differential between supply and return fan. Return fan operation shall be interlocked with supply fan operation. Capacity of exhaust air shall modulated in response to building static pressure at user-configured set point.
13) ~~Smoke control functions~~: Not applicable to Carrier scope on WSU FAB project.
14) Support demand controlled ventilation through a reset of the economizer's minimum position. This reset based on differential CO2 ppm (outdoor and indoor) can be chosen as linear or as fast or slow-acting exponential curves.
15) Indoor air quality (IAQ) mode shall admit fresh outdoor air into the space whenever space air quality sensors detect unsuitable space conditions, by overriding economizer minimum damper position. IAQ shall be permitted only during occupied periods, unless configured to be allowed during unoccupied periods also.
16) ~~Provide control for reheat via auxiliary heating coil during ventilation~~: Not applicable to WSU-FAB
17) IAQ pre-occupancy purge function shall provide complete exchange of indoor air with fresh air during unoccupied periods, when outdoor conditions permit. Function shall energize supply fan and open economizer two hours before next occupied period; duration of purge shall be user-configured (5 to 60 minutes).
18) Outdoor Air Control (OAC) function shall maintain a minimum quantity of outdoor airflow into an occupied space. OAC mode shall be available only during an occupied period. Outdoor airflow shall be monitored by an airflow station and transducer. Economizer maximum damper opening position during OAC mode shall be user-configured.
19) ~~Dehumidification and Reheat: Dehumidification function shall override comfort condition set points to deliver cooler air into the space and satisfy a user-configured humidity set point at the space or return air humidity sensor. Reheat function shall energize an auxiliary heating device should dehumidification operation result in cooling of the space down to the occupied heating set point.~~
20) Supply Air Temperature Set Point Reset: Control shall automatically reset the unit supply air temperature set point on VAV models from either space temperature or return-air temperature, at user-configured rate and limit. Control shall also reset supply air temperature set point via external 2 to 10 vdc signal representing 0° to 20 F range of reset. Control shall respond to higher of either reset if both are active.

21) Space Temperature Offset function shall permit occupants to adjust space temperature set point by ±5° F using T-56 space sensor (equipped with sliding scale adjuster).
22) Lead-lag function shall distribute starts between the two refrigeration circuits in an effort to equalize the running time on the two circuits.
23) Condenser-fan cycling control shall maintain correct head pressure down to 32 F.
24) Refrigeration system pressures shall be monitored via pressure transducers. Alarms for low pressure, high pressure will be permitted.
25) Timed Discrete Output function shall control an external function or device via user-configured activity schedule. This schedule shall be separate and different from the unit's occupied/unoccupied time schedule.

2. Safeties:
Unit components shall be equipped with the following protections:
a. Compressors:
1) Overcurrent using calibrated circuit breakers (shuts down individual compressor).
2) Crankcase heaters.
3) High-pressure switch (shuts down individual circuit, automatic reset type).
4) Low-pressure monitoring (shuts down individual circuit, automatic reset type).
b. Check filter switch.
c. Belt-Drive Fan Motors:
Overcurrent protection manual reset circuit breakers.
3. Diagnostics:
a. The display shall be capable of indicating a safety lockout condition (alarm).
b. The display shall also be capable of indicating an alert condition which does not lock out the unit, but informs the system monitor of a condition which could be detrimental to either the unit or the comfort of the occupants if allowed to continue.
c. Test mode must also be capable of displaying outputs of microprocessor-controller and to verify operation of every thermistor, actuator motor, fan, and compressor before unit is started.

N. Operating Characteristics:
1. Unit shall be capable of starting and running at 115 F (125 F for high-efficiency models) ambient outdoor temperature per maximum load criteria of AHRI Standard 340/360, latest edition.
2. Unit shall be capable of mechanical cooling operation down to 32 F ambient outdoor temperature (–20 F with low ambient accessory).
3. Provides multi-stage cooling capability.

O. Motors:
1. Compressor motors shall be cooled by suction gas passing over motor windings.
2. Condenser-fan motors shall be 3-phase, totally enclosed type with permanently lubricated ball bearings and internal over-temperature protection.
3. Supply and exhaust fan motors shall be of the 3-phase, NEMA (National Electrical Manufacturers Association) rated, open drip-proof (ODP), ball bearing type, with efficiencies per EISA (Energy Independence and Security Act) of 2007 (U.S.A.) requirements.

P. Electrical Requirements:
All unit power wiring shall enter unit cabinet at a single location. 460v/3Ph/60Hz

Q. Special Features:
1. Digital Compressor:
A digital compressor shall be available on the lead circuit for constant volume and variable air volume configurations. The ComfortLink control system shall be capable of unloading this compressor in an infinite number of steps from 100% of unit capacity down to 50% of unit capacity.
2. Condenser Coil Grille Guard:
Welded wire grille complete with support retainers and fasteners shall be provided for protection of condenser coils.
3. Service Valves:
Shall be equipped with ball type service valves in the suction, discharge and liquid line for each circuit.
4. Replaceable Core Filter Drier:
Shall be equipped with a replaceable core filter drier with isolation valves in each liquid line.
5. Ultra Low Leak Economizer:
Dry bulb, differential dry bulb temperature, enthalpy, or optional differential enthalpy controlled integrated type

consisting of dampers, actuator, and linkages in conjunction with control system to provide primary cooling using outdoor air, enthalpy permitting, supplemented with mechanical cooling when necessary.
   a. Economizer shall meet the requirements of the California Energy Commission Title 24 economizer requirements.
   b. Dampers shall be a gear driven ultra-low leakage type with blade and edge seals. Dampers shall exhibit a maximum leakage rate of 3 cfm per square foot of area at 1 in. wg pressure differential when tested in accordance with AMCA (Air Movement and Control Association) Standard 500.
   c. Actuator shall have a spring-return feature which shuts dampers upon a power interruption or unit shutdown. Actuators are capable of internal diagnostics.
   d. Equipped with a solid-state humidity sensor that is capable of sensing outdoor-air heat content (temperature and humidity) and controlling economizer cut-in point at most economical level. The user can also configure dew point limiting.

6. Return Fan/Building Pressure Control:
   a. Functions provided shall be:
      1) Airflow control for return duct path (dedicated to overcoming flow losses in return duct system).
      2) Modulate return airflow rate to track supply fan airflow rate and maintain a user set delta cfm between the supply and return airflow.
      3) Maintain building pressure by sensing building pressure and modulating fan motor speed.
   b. Option shall consist of following hardware:
      1) Plenum fan assembly, with welded steel airfoil blade fan.
      2) Spring isolation
      3) Belt-drive fan system, fixed pitch for maximum belt life and reliability.
      4) Variable frequency drive (VFD) for return fan modulation control.
      5) Supply air cfm and return air cfm sensors to measure supply and return airflow.
      6) Exhaust damper with outlet hood.
      7) Building pressure transducer.
   c. Installation:
      1) Site installation shall require supply and installation of building pressure (BP) sensing pick-up and tube to connect to BP transducer in unit.
      2) All other wiring and pressure tubing shall be factory-supplied and factory installed.
   d. A high-static return fan option shall be available.
7. Mixed Air Filters:
   Unit shall be factory equipped with:
   a. 12 in. MERV 14 bag filters having the following characteristics: Efficiency of no less than 90% based on testing per ASHRAE Standard 52 and a minimum average arrestance of >98%. This option shall be available with 4 in. MERV-8 pre-filters.
8. Supply Fan Static Pressure Control (VAV units):
   Variable air volume units shall be equipped with a supply fan VFD. The VFD shall control motor speed to maintain set point static pressure control at the supply duct sensor tube location. The supply fan drive shall be field-adjustable to maintain supply duct static pressure set point from 0.0-in. wg to 5-in. wg, adjusted via scrolling marquee display or Navigator™ display. A pressure transducer shall be factory-mounted and wired. **(Control tubing from sensor tube location to transducer shall be field-supplied and installed.)** Transducer shall provide a 4 to 20 mA signal to the unit control module; unit control module shall provide a 4 to 20 mA signal to the VFD indicating desired VFD output level.
9. Non-Fused Disconnect:
   A non-fused electrical disconnect for main unit power shall be factory installed. The disconnect shall be an interlocking through-the-door type.
10. 115-Volt Convenience Outlet:
    A duplex GFCI (ground fault circuit interrupt) receptacle shall be factory mounted in a weatherproof enclosure and wired for a 10-amp load. It will remain powered when all unit circuit breakers have been turned off. The outlet will be deenergized by the unit disconnect.
11. Controls Expansion Module (CEM):
    Factory-installed package shall include all hardware for additional control of base unit operation and product integrated controls features. The functions supported are:
    a. Building pressurization, evacuation, and smoke purge control.
    b. Supply air reset from external 4 to 20 mA signal.

c. Two-step demand limit inputs (when used with the CCN [Carrier Comfort Network]).
d. Indoor air quality (IAQ) monitoring.
e. Outdoor airflow monitoring.
f. Outdoor humidity monitoring.
g. Space humidity monitoring (via enthalpy sensing at economizer).
h. Return air humidity monitoring (via enthalpy sensing at economizer).
i. Demand limiting from an external 4 to 20 mA signal.
j. Static pressure reset from an external 4 to 20 mA signal.
k. Pre and post filter pressure drop monitoring

12. Relative Humidity Sensors:

Package shall contain relative humidity sensing of the air within the occupied space via return duct.

13. Indoor Air Quality (CO_2) Sensor:
    a. Shall have the ability to provide demand ventilation indoor-air quality (IAQ) control through the economizer with an indoor air quality sensor.
    b. IAQ sensor with LED display of CO2 in parts per million. The set point shall have adjustment capability.
14. Differential Enthalpy Switch or Sensors
    a. Capable of comparing heat content (temperature and humidity) of outdoor and return air and controlling economizer cut-in point at the most economical level.
15. BACnet Communication Option:

Shall provide factory-installed communication capability with a BACnet MS/TP network.