

BEKOLAY & Associates. Ltd.

Consulting Engineers

Shop Drawing Review Comments

Consultant: **Barry J. Hobin & Associates Architects** Project: **Dovercourt Phase 2**
63 Pamilla St. Ottawa On. K1S 3K7 411 Dovercourt Ave

Contractor: Tal-Co BAL No.: **2017-09**

Attn: **Doug van den Ham** Date: 2018-06-25
Sandy Davis

Mech Shop Drawing Review Comments

1. General:

The documents in the list have been examined for general conformance with the Contract Documents prepared by Bekolay & Associates Ltd. (BAL) for this project. This review may not be extended to any other contract, trade, division or project. Review by BAL does not imply approval or verification of information presented in these drawings and the responsibility for installation and performance lies solely with the Contractor submitting the documents including dimensional conformance and co-ordination with other trades. All changes, comments and notes by BAL shall be incorporated (at no cost to the Owner) into actual installation when indicated "Reviewed As Follows" or be included in a re-submission (when requested).

2. Shop Drawings: submitted in the attached files

Item	Description	Submitted File	Comments
2.1	Roof Top Unit	1- Masters- RTU- For Review May 31, 2018.pdf	Reviewed, see 3.1

3. Additional Notes:

3.1. Drawings call for High efficiency model with EER of 12.5. Shop drawings indicate mid-efficiency with 11.5 EER



SUBMITTAL DATA

For: Approval

Order #:

Date: 06/09/2017

Project:

ZH120N18D5B1BAA1A1

Project #:

Location:

Project Name

Dovercourt Rec Center



APPROVED

REJECTED

REVISE

REVIEWED

BY NDewar

DATE 6/1/2018

SUBMITTAL# 1

SPEC

Date

06/09/2017

Project Name

ZH120N18D5B1BAA1A1

Project Number

Client / Purchaser



Submittal Summary Page

Qty	Tag #	Model #	Description
1		ZH120N18D5B1BAA1A1	<p>10 Ton, Single Packaged R-410A Air Conditioner, Mid-Efficiency, Two Stage Cooling, 11.5 EER / 12.0 IEER (CV) / 14.6 IEER (IntelliSpeed) / 12.0 IEER (VAV), 180 MBH Input Aluminized Steel, Two Stage Gas Heat, 575-3-60</p> <ul style="list-style-type: none">• Dry Bulb Low Leak Economizer w/Barometric Relief and Hoods (Bottom or Horizontal End Return Only) with Economizer Fault Detection & Diagnostic (Meets ASHRAE 90.1-2013, IECC 2015, California Title 24, AMCA 511).• 3 HP High Static Belt Drive Blower• Standard 2" Throwaway Filters• Simplicity® SE Controller including Discharge Air, Return Air, and Outdoor Air Temperature Sensors• Phase Monitor• Micro-Channel "all-aluminum" condenser coil, Copper tube/aluminum fin evaporator coil• Composite Drain Pan - Front Connection

Equipment start-up and commissioning by a factory trained technician is recommended.
Contact your supplying distributor or sales representative for additional information & guidance.



Predator (3-12.5 Ton Package) N524

York Single Package R-410A Air Conditioner

Project Name: ZH120N18D5B1BAA1A1

Unit Model #: ZH120N18D5B1BAA1A1

Quantity: 1

System: ZH120N18D5B1BAA1A1

Cooling Performance

Total gross capacity	135.2 MBH
Sensible gross capacity	94.8 MBH
Efficiency (at ARI)	11.50 EER
Integrated eff. (at ARI)	12.00 IEER
Ambient DB temp.	87.1 °F
Entering DB temp.	80.0 °F
Entering WB temp.	67.0 °F
Leaving DB temp.	58.0 °F
Leaving WB temp.	56.2 °F
Power input (w/o blower)	7.87 kW
Sound power	91 dB(A)

Refrigerant

Refrigerant type	R-410A
Sys1	8 lbs 8 oz
Sys2	7 lbs 7 oz

Gas Heating Performance

Entering DB temp.	60 °F
Heating output capacity (Max)	144 MBH
Supply air	4000 CFM
Heating input capacity (Max)	180 MBH
Leaving DB temp.	93.3 °F
Air temp. rise	33.3 °F
SSE	80.0 %
Stages	2

Supply Air Blower Performance

Supply air	4000 CFM
Ext. static pressure	0.6 IWG
Addl. Unit Losses (Options/Accessories)	0.46 IWG
Blower speed	1153 RPM
Max BHP of Motor (including service factor)	3.45 HP
Duct location	Bottom
Motor rating	3.00 HP
Actual required BHP	2.86 HP
Power input	2.66 kW
Elevation	374 ft.
Drive type	BELT
Requires field-supplied drive	true

Outside/Mixed Air

Outside Air Cfm	400 CFM
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Electrical Data

Power supply	575-3-60
Unit min circuit ampacity	19.1 Amps
Unit max over-current protection	20 Amps

Dimensions & Weight

Hgt	51 in.	Len	89 in.	Wth	59 in.
Weight with factory installed options	1285 lbs.				

Clearances

Right	12 in.	Front	36 in.	Back	36 in.
Top	72 in.	Bottom	0 in.	Left	36 in.

Note: Please refer to the tech guide for listed maximum static pressures



10 Ton

- York Predator units are manufactured at an ISO 9001 registered facility and each rooftop is completely computer-run tested prior to shipment.

Unit Features

- Two Stage Cooling
- 180 MBH Input Aluminized Steel, Two Stage Gas Heat
- Full perimeter base rails with built in rigging capabilities
- Unit Cabinet Constructed of Powder Painted Steel, Certified At 1000 Hours Salt Spray Test (ASTM B-117 Standards)
- Scroll Compressors
- Dry Bulb Low Leak Economizer w/Barometric Relief and Hoods (Bottom or Horizontal End Return Only) with Economizer Fault Detection & Diagnostic (Meets ASHRAE 90.1-2013, IECC 2015, California Title 24, AMCA 511).
- Slide-out Blower/3 HP Belt Drive Motor Assembly
- Unit Ships with 2" Throwaway Filters
- Solid Core Liquid Line Filter Driers
- Replacement Filters: 4 - (24" x 20"). Unit accepts 2" or 4" wide filters.
- Short Circuit Current: 5kA RMS Symmetrical
- Single Point Power Connection
- Through-the-Curb and Through-the-Base Utility Connections
- Micro-Channel "all-aluminum" condenser coil, Copper tube/aluminum fin evaporator coil
- Composite Drain Pan - Front Connection
- Hinged Access Panels

Standard Unit Controller: Simplicity Control Board

- Safety Monitoring - Monitors the High and Low-Pressure Switches, the Freezestats, the Gas Valve, if Applicable, and the Temperature Limit Switch on Gas and Electric Heat Units. The Unit Control Board will Alarm on Ignition Failures, Safety Lockouts and Repeated Limit Switch Trips.
- An Integrated Low-Ambient Control, Anti-Short Cycle Protection, Lead-Lag, Fan On and Fan off Delays, Low Voltage Protection, On-Board Diagnostic and Fault Code Display. Allows all units to operate in the cooling mode down to 0 °F outdoor ambient without

BAS Controller

- Simplicity SE Controller including Discharge Air, Return Air, and Outdoor Air Temperature Sensors

Warranty

- One (1) Year Limited Warranty on the Complete Unit
- Five (5) Year Warranty - Compressors and Electric Heater Elements
- Ten (10) Year Limited Warranty - Aluminized Steel Heat Exchanger





**Predator (3-12.5 Ton Package)
N524**

York Single Package R-410A Air Conditioner

Project Name: ZH120N18D5B1BAA1A1

Unit Model #: ZH120N18D5B1BAA1A1

Quantity: 1

System: ZH120N18D5B1BAA1A1

Factory Installed Options

ZH120N18D5B1BAA1A1

Product Category:	ZH	Single Packaged R-410A Air Conditioner, Mid-Efficiency 11.5 EER / 12.0 IEER (CV) / 14.6 IEER (IntelliSpeed) / 12.0 IEER (VAV)
Nominal Cooling Capacity:	120	10 Ton Two Stage Cooling
Heat Type and Nominal Heat Capacity:	N18	180 MBH Input Aluminized Steel, Two Stage Gas Heat
Airflow:	D	3 HP High Static Belt Drive Blower
Voltage:	5	575-3-60
Economizer / Damper:	B	Dry Bulb Low Leak Economizer w/Barometric Relief and Hoods (Bottom or Horizontal End Return Only) with Economizer Fault Detection & Diagnostic (Meets ASHRAE 90.1-2013, IECC 2015, California Title 24, AMCA 511).
Service Options:	1	
Sensor Options:	B	
Controls:	A	Simplicity® SE Controller including Discharge Air, Return Air, and Outdoor Air Temperature Sensors
Refrigeration:	A	Micro-Channel "all-aluminum" condenser coil, Copper tube/aluminum fin evaporator coil
Additional Options:	1	Standard 2" Throwaway Filters Phase Monitor
Cabinet Options:	A	Composite Drain Pan - Front Connection
Product Generation:	1	

Field Installed Accessories

Project Name: **ZH120N18D5B1BAA1A1**

Unit Model #: **ZH120N18D5B1BAA1A1**

Quantity: **1**

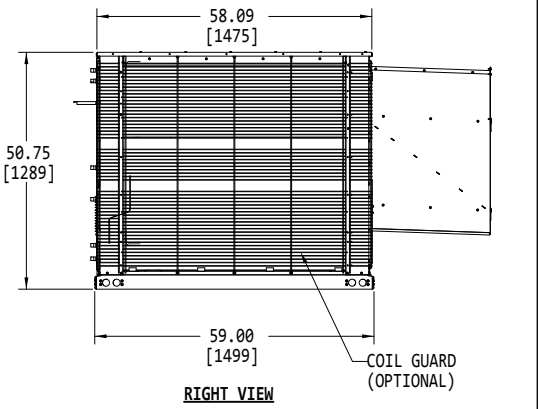
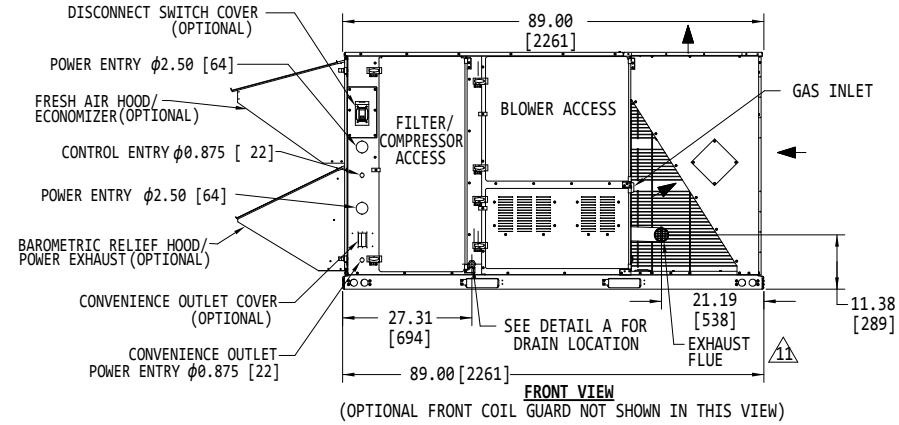
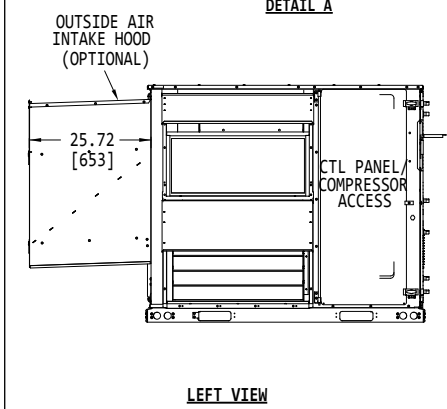
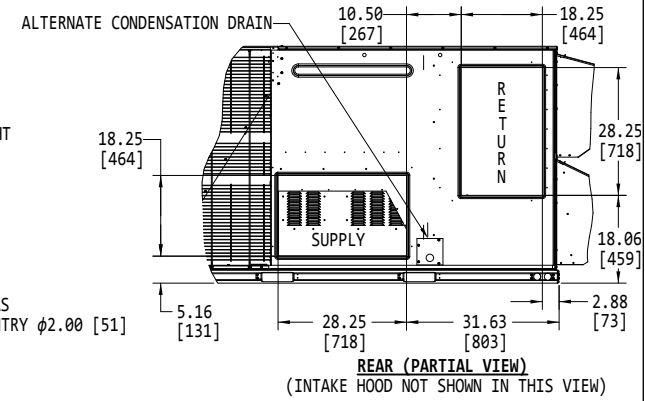
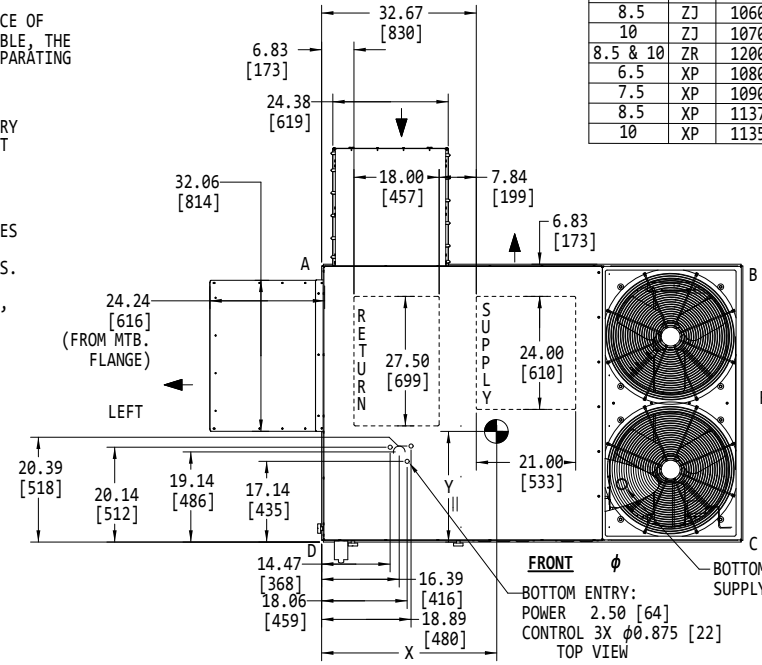
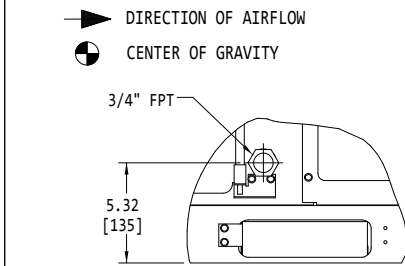
System: **ZH120N18D5B1BAA1A1**

Consolidated Drawing

NOTES:

1. FOR OUTDOOR USE ONLY.
2. WEIGHTS SHOWN ARE FOR COOLING ONLY UNITS.
3. MIN. CLEARANCES TO BE:
 RIGHT SIDE: 12 [305]
 LEFT SIDE: 36 [915]
 FRONT: 36 [915]
 REAR: 36 [915]
 TOP: 72 [1830]
 BOTTOM: 0 [0]
4. TO REMOVE THE SLIDE-OUT DRAIN PAN, A REAR CLEARANCE OF 60 in (1525 mm) IS REQUIRED. IF SPACE IS UNAVAILABLE, THE DRAIN PAN CAN BE REMOVED THROUGH THE FRONT BY SEPARATING THE CORNER WALL.
5. FOR SMALLER SERVICE AND OPERATIONAL CLEARANCES CONTACT YOUR APPLICATION ENGINEERING DEPARTMENT.
6. DOWNFLOW DUCTS DESIGNED TO BE ATTACHED TO ACCESSORY ROOF CURB ONLY. IF UNIT IS MOUNTED SIDE SUPPLY, IT IS RECOMMENDED THAT THE DUCTS ARE SUPPORTED BY CROSS BRACES, AS DONE ON ACCESSORY ROOF CURBS.
7. SIDE DUCT FLANGES ARE 0.75" HIGH. BOTTOM DUCTS DO NOT HAVE FLANGES.
8. MINIMUM CONDENSATION TRAP HEIGHT SHALL BE 1.5 TIMES THE LOWEST NEGATIVE STATIC.
9. DIMENSIONS IN [] ARE IN MILLIMETERS OR KILOGRAMS.
10. OPTIONAL COIL GUARDS, POWER EXHAUST, GAS HEAT, ECONOMIZER, DISCONNECT SWITCH, CONVENIENCE OUTLET, AND BAROMETRIC RELIEF AND FRESH AIR HOODS SHOWN. EXCEPT XP (HEAT PUMP) UNITS.

TONNAGE	UNIT	OPERATING WEIGHT (LBS) (BASE UNIT)	CENTER OF GRAVITY LOCATION (BASE UNIT)		4 POINT CORNER LOADS (LBS) (BASE UNIT)										
			X	Y	A	B	C	D							
8.5	ZF	1007	458	38	965	24	610	235	107	175	79	255	116	342	155
10	ZF	1103	501	38	965	24	610	257	117	192	87	279	127	375	170
8.5	ZH	1030	467	38	965	24	610	240	109	179	81	261	118	350	159
10	ZH	1090	494	38	965	24	610	254	115	189	86	276	125	371	168
6.5	ZJ	1030	467	39	991	25	635	245	111	191	87	260	118	333	151
7.5	ZJ	1050	476	39	991	25	635	250	113	195	89	265	120	340	154
8.5	ZJ	1060	481	38	965	24	610	247	112	184	84	268	122	360	163
10	ZJ	1070	485	39	991	24	610	245	111	191	87	278	126	357	162
8.5 & 10	ZR	1200	544	38	965	25.5	648	297	135	221	100	291	132	390	177
6.5	XP	1080	490	38	965	25	635	262	119	195	89	266	121	357	162
7.5	XP	1090	494	38	965	23	584	243	110	181	82	284	129	381	173
8.5	XP	1137	516	38	965	25.5	648	282	128	210	95	276	125	370	168
10	XP	1135	515	38	965	25.5	648	281	127	209	95	275	125	369	167





Project Name: ZH120N18D5B1BAA1A1

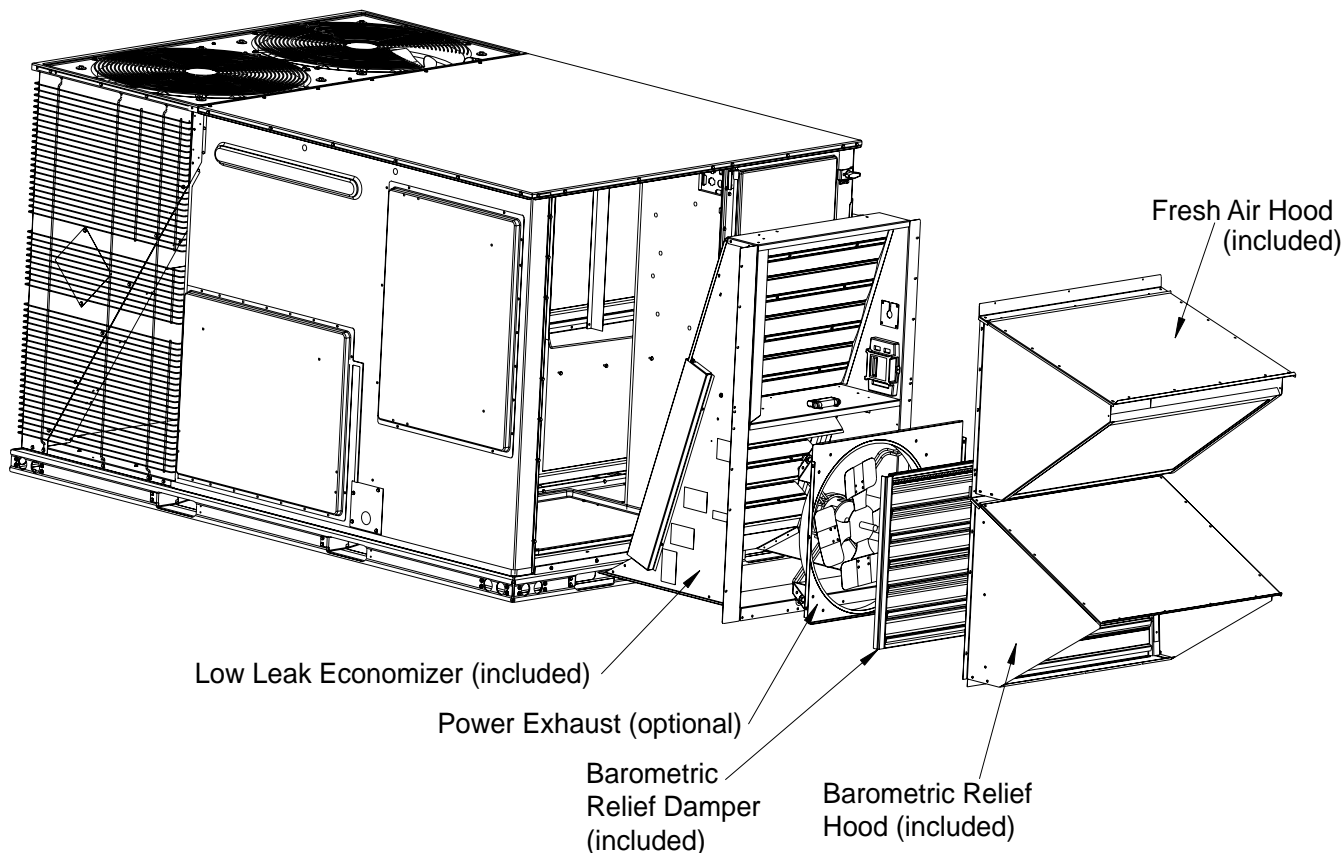
Unit Model #: ZH120N18D5B1BAA1A1

Quantity: 1

System: ZH120N18D5B1BAA1A1

Low Leak Downflow Economizer

Low Leak Downflow Economizer (shown with optional Power Exhaust)



Low leak economizers are capable achieving low leakage rates of 3 cfm/sq. ft at 1" of static pressure, meeting or exceeding the following standards:

- ASHRAE 90.1-2010
- ASHRAE 62
- AMCA 511 (licensed as Class 1A damper)
- International Energy Conservation Code (IECC)
- California Title 24

The outdoor intake opening shall be covered with a rain hood that matches the exterior of the unit. Water eliminator/filters shall be provided.

Simultaneous economizer/compressor operation is also possible. Dampers shall fully close on power loss.

York Single Package R-410A Air Conditioner

Project Name: ZH120N18D5B1BAA1A1

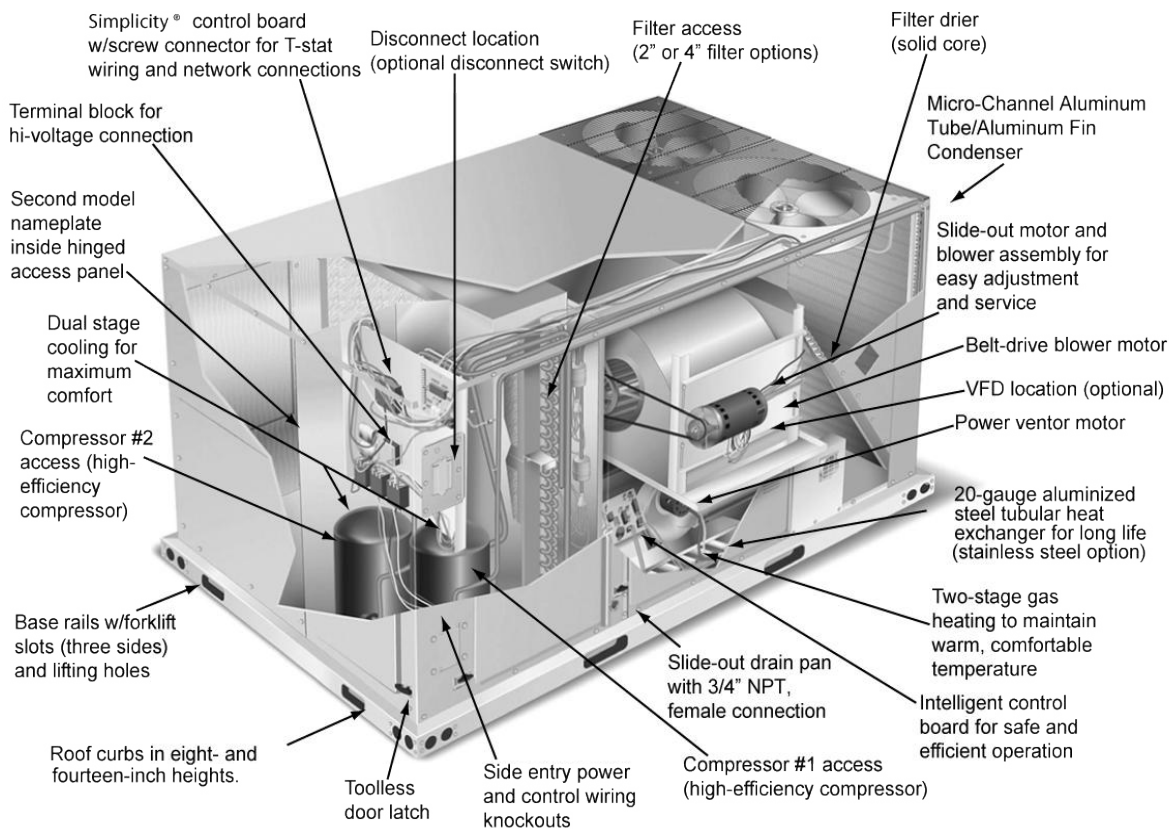
Unit Model #: ZH120N18D5B1BAA1A1

Quantity: 1

System: ZH120N18D5B1BAA1A1

Component Location

6 1/2 Through 10 Tons



Date

06/09/2017

Project Name

ZH120N18D5B1BAA1A1

Project Number

Client / Purchaser



Guide Specification Summary Page

Product Series	Models and Unit Tags
Predator (3-12.5 Ton Package) N524	ZH120N18D5B1BAA1A1

GENERAL

Units shall be manufactured by Unitary Products in an ISO 9001 certified facility. York Predator units are convertible single packages with a common footprint cabinet and common roof curb for all 6-1/2 through 12-1/2 ton models. All units have two compressors with independent R-410A refrigeration circuits to provide 2 stages of cooling. The units were designed for light commercial applications and can be easily installed on a roof curb, slab, or frame. All units are self-contained and assembled on rigid full perimeter base rails allowing for 3-way forklift access and overhead rigging. Every unit is completely charged with R-410A, wired, piped, and tested at the factory to provide a quick and easy field installation. All units are convertible between side and down airflow. Independent economizer designs are used on side and down discharge applications, as well as all tonnage sizes. Units are available in the following configurations: cooling only, cooling with electric heat, cooling with gas heat, reheat only, reheat with electric heat, reheat with gas heat, heat pump and heat pump with electric heat. Electric heaters are available as factory-installed options or field-installed accessories.

DESCRIPTION

Units shall be factory assembled, single package, (Elec/Elec, Gas/ Elec), designed for outdoor installation. They shall have built in field convertible duct connections for down discharge supply/return or horizontal discharge supply/return and be available with factory installed options or field installed accessories. The units shall be factory wired, piped and charged with R-410A refrigerant and factory tested prior to shipment. All unit wiring shall be both numbered and color coded. The cooling performance shall be rated in accordance with DOE and AHRI test procedures. Units shall be CSA certified to ANSI Z21.47 and UL 1995/CAN/CSA No. 236-M90 standards.

UNIT CABINET

Unit cabinet shall be constructed of galvanized steel with exterior surfaces coated with a non-chalking, powder paint finish, certified at 1000 hour salt spray test per ASTM-B117 standards. Indoor blower sections shall be insulated with up to 1" thick insulation coated on the airside. Either aluminum foil faced or elastometric rubber insulation shall be used in the unit's compartments and be fastened to prevent insulation from entering the air stream. Cabinet doors shall be hinged with toolless access for easy servicing and maintenance. Full perimeter base rails shall be provided to assure reliable transit of equipment, overhead rigging, fork truck access and proper sealing on roof curb applications. Disposable 2" filters shall be furnished as standard and be accessible through hinged access door. Fan performance measuring ports shall be provided on the

outside of the cabinet to allow accurate air measurements of evaporator fan performance without removing panels or creating bypass of the coils. Condensate pan shall be slide out design, constructed of a non corrosive material, internally sloped and conforming to ASHRAE 62-B9 standards. Condensate connection shall be a minimum of 3/4" I.D. female and be rigid mount connection.

OUTDOOR (CONDENSER) FAN ASSEMBLY

The outdoor fans shall be of the direct drive type, discharge air vertically, have aluminum blades riveted to corrosion resistant steel spider brackets and shall be dynamically balanced for smooth operation. The outdoor fan motors shall have permanently lubricated bearings internally protected against overload conditions and staged independently. A cleaning window shall be provided on two sides of the units for coil cleaning.

REFRIGERANT COMPONENTS

Compressors:

- Shall be fully hermetic type, direct drive, internally protected with internal high-pressure relief and over temperature protection. The hermetic motor shall be suction gas cooled and have a voltage range of + or - 10% of the unit nameplate voltage.
- Shall have internal spring isolation and sound muffling to minimize vibration and noise, and be externally isolated on a dedicated, independent mounting.

Coils:

- Evaporator coils shall have aluminum plate fins mechanically bonded to seamless internally enhanced copper tubes with all joints brazed. Special Phenolic coating shall be available as a factory option.
- Evaporator coils shall be of the direct expansion, draw-thru design.
- Condenser coils shall have aluminum plate fins mechanically bonded to seamless internally enhanced copper tubes with all joints brazed or Micro-Channel aluminum tube, aluminum fins. Special Phenolic coating shall be available as a factory option.
- Condenser coils shall be of the draw-thru design.

Refrigerant Circuit and Refrigerant Safety Components shall include:

- Independent fixed-orifice or thermally operated expansion devices.
- Solid core filter drier/strainer to eliminate any moisture or foreign matter.



- c. Accessible service gage connections on both suction and discharge lines to charge, evacuate, and measure refrigerant pressure during any necessary servicing or troubleshooting, without losing charge.
- d. The unit shall have two independent refrigerant circuits, equally split in 50% capacity increments.

Unit Controls:

- a. Unit shall be complete with self-contained low-voltage control circuit protected by a resettable circuit breaker on the 24-volt transformer side.
- b. Unit shall incorporate a lockout circuit which provides reset capability at the space thermostat or base unit should any of the following standard safety devices trip and shut off compressor:
 - Loss-of-charge/Low-pressure switch.
 - High-pressure switch.
 - Freeze condition sensor on evaporator coil. If any of these safety devices trip, the LCD screen will display the alarm message.
- c. Unit shall incorporate "AUTO RESET" compressor over temperature, over current protection.
- d. Unit shall operate with conventional thermostat designs and have a low voltage terminal strip for easy hook-up.
- e. Unit control board shall have on-board diagnostics and fault message display.
- f. Standard controls shall include anti-short cycle and low voltage protection, and permit cooling operation down to a selectable value as low as 0 °F.
- g. Control board shall monitor each refrigerant safety switch independently.

GAS HEATING SECTION

Heat exchanger and exhaust system shall be constructed of aluminized steel and shall be designed with induced draft combustion with post purge logic, energy saving direct spark ignition, and redundant main gas valve. The heat exchanger shall be of the tubular type, constructed of T1-40 aluminized steel for corrosion resistance and allowing minimum mixed air entering temperature of 40 °F. Burners shall be of the in-shot type, constructed of aluminum-coated steel. All gas piping shall enter the unit cabinet at a single location, through either the side or bottom, without any field modifications. An integrated control board shall provide timed control of evaporator fan functioning and burner ignition. Heating section shall be provided with the following minimum protection:

- a. Primary and auxiliary high-temperature limit switches.
- b. Induced draft pressure sensor.
- c. Flame proving controls.

- d. All two stage gas units shall have two independent stages of capacity (70% or 75% 1st stage, 100% 2nd stage) 3 through 5 ton and (60% 1st stage, 100% 2nd stage) 6-1/2 through 12-1/2 ton.

UNIT OPERATING CHARACTERISTICS

Unit shall be capable of starting and running at 125 °F outdoor temperature, exceeding maximum load criteria of AHRI Standard 340/360. The compressor, with standard controls, shall be capable of operation down to 0 °F outdoor temperature. Unit shall be provided with fan time delay to prevent cold air delivery before heat exchanger warms up. (Gas heat only)

ELECTRICAL REQUIREMENTS - All unit power wiring shall enter unit cabinet at a single factory provided location and be capable of side or bottom entry to minimize roof penetrations and avoid unit field modifications. Separate side and bottom openings shall be provided for the control wiring.

STANDARD LIMITED WARRANTIES - Compressor – 5 Years, Heat Exchanger – 10 Years, Stainless Steel Heat Exchanger – 15 Years, Elect. Heat Elem. – 5 Years, Parts – 1 Year.

FACTORY INSTALLED OPTIONAL OUTDOOR AIR
(Shall be made available by either/or):

- **ELECTRONIC ENTHALPY AUTOMATIC ECONOMIZER** – Outdoor and return air dampers that are interlocked and positioned by a fully-modulating, spring-return damper actuator. The maximum leakage rate for the outdoor air intake dampers shall be designed to meet ASHRAE 90.1-2010, AMCA 511 Class 1A damper, and the International Energy Conservation Code (IECC) certification requirements by achieving leakage rates of 3 cfm/sq. ft. at 1" of static pressure. During economizer operation, a mixed-air temperature control shall modulate the outdoor and return air damper assembly to prevent the supply air temperature from dropping below 55 °F. Changeover from compressor to economizer operation shall be provided by an integral electronic enthalpy control that feeds input into the basic module. The outdoor intake opening shall be covered with a rain hood that matches the exterior of the unit. Water eliminator/filters shall be provided. Simultaneous economizer/compressor operation is also possible. Dampers shall fully close on power loss.

ADDITIONAL FACTORY INSTALLED OPTIONS



Guide Specification for York Predator

- **Alternate Indoor Blower Motor** – For applications with high restrictions, units are available with optional indoor blower motors that provide higher static output and/or higher airflow.
- **BAS Controls** – Include supply air sensor, return air sensor, outdoor air sensor.

FIELD INSTALLED OPTIONS

Date

06/09/2017

Project Name

ZH120N18D5B1BAA1A1

Project Number

Client / Purchaser



Control Summary Page

Control	Models and Unit Tags
Standard Simplicity Control	ZH120N18D5B1BAA1A1

23 09 23 Direct- digital Control system for HVAC23 09 23. 13 Decentralized, Rooftop Units:23 09 23. 13.A. Unit Control Board

1. ASHRAE 62- 2001 compliant. BTL certified.
2. Shall accept 20-30 VAC input power, 50/60Hz. 24 VAC nominal.
3. Operating temperature range from -40F to 158F; 10-90% RH (non-condensing UI), and -4F to 158F; 10-90% Rh (non-condensing), with a storage temperature range from -40F to 194F; 5-95% RH (non-condensing).
4. Shall include an option of and Economizer microprocessor controller which communicates directly with the Unit Control Board and has 8 Analog outputs, 2 Analog inputs, 2 Binary outputs, 3 Binary outputs.
5. Controller shall accept the following inputs: space temperature, return air temperature sensor, setpoint adjustment, outdoor air temperature, indoor air quality, outdoor air quality, indoor relative humidity, compressor lock- out, fire/smoke shutdown, single and dual enthalpy, fan status, remote time clock, SA Bus communicated temperature/humidity/CO2 values from Network sensors, FC Bus Network Overrides for space temperature, outdoor air temperature, space humidity, outdoor air quality, Indoor air quality, System purge.
6. Shall accept a single CO₂ sensor or multiple CO₂ sensors networked together via communication bus in the conditioned space, and be Demand Control Ventilation (DCV) ready.
7. Shall provide the following outputs: economizer, fan, cooling stage 1, cooling stage 2, heat stage 1, heat stage 2, heat stage 3/ exhaust/ reversing valve/ dehumidify/occupied.
8. Unit shall provide surge protection for the controller through a circuit breaker.
9. Shall be Internet capable, and communicate at a Baud rate of 38.4K or faster.
10. Shall have an LED display independently showing the status of activity on the communication bus, and processor operation.
11. Unit shall incorporate a lockout circuit which provides reset capability at the space thermostat or base unit should any of the following standard safety devices trip and shut off compressor. If any of these safety devices trip, the LCD screen will display alarm message indicating the specific safety device that caused the lockout.
 - a. Loss of charge/Low-pressure switch.
 - b. High-pressure switch.
 - c. Freeze condition sensor on evaporator coil.
12. Unit control board must support each usage case:
 - a. Conventional thermostat with low voltage input terminals for easy installation
 - b. Communicating network sensors in the occupied space to provide feedback on space conditions for unit control board to compare with associated setpoints
 - c. Communication via BACnet MS/TP, Modbus RTU, N2 protocols for integration into a building automation/management system
13. Anti-short cycle and low voltage protection features included.
14. Internal occupied/unoccupied scheduling
15. Unit control board shall permit cooling operation down to a selectable value as low as 0 degrees F.
16. Shall allow for start-up, commissioning, troubleshooting, parameter adjustment, setpoint adjustment via onboard display and navigable menu with no additional interface tool or controls technician required.
17. The unit control board shall run a self-test diagnostics algorithm at startup that operated the cooling cycle, heating cycle, fan operation. A status report shall be provided upon completion of the diagnostic self-test.
18. Utilize any wi-fi enabled smart device to access the HVAC or multiple HVAC units if communication wiring between them is present (FC Bus or SA Bus). Remote access shall allow complete ability to perform start-up, commissioning, troubleshooting, parameter adjustment, setpoint adjustment.
19. Local embedded trending and scheduling. Trending data and occupancy scheduling predefined from the factory. Occupancy schedule to be modified via control board joystick menu navigation and remotely using a smart device (cellular phone, laptop, tablet)
20. A menu on the onboard screen shall display the unit status and allow changing parameters where applicable. These include but are not limited to:
 - a. Demand Ventilation Mode – enable or disable
 - b. Operational Setpoint – display current value
 - c. Supply Air Temperature (SAT) – display current value
 - d. Return Air Temperature (RAT) – display current value

- e. Operational Supply Humidity (OprSH) – display current value as provided by a 0-10VDS input, SA Bus Network Sensor, or FC Bus communicated value
 - f. Return Air Humidity (RAH) – display current value
 - g. Operational outdoor Air Temperature (OprOAT) – enthalpy calculated from OAH 0-10VDC input to Economizer board and OprOAT only if economizer is present
 - h. Operational Outdoor Air Humidity (OprOAH) – the buffered outdoor air humidity. May be from economizer boards OAH 0-10VDC input or FC Bus communicated value
 - i. Operational outdoor Air Quality (OprOAQ) – the buffered outdoor air quality in use. May be from economizer boards OAQ 0-10VDC input or FC Bus communicated value
 - j. Operational Indoor Air Quality (OprIAQ) – the buffered indoor air quality in use. May be from economizer board IAQ 0-10VDC input, SA Bus Network Sensor, or FC Bus communicated value
21. A menu shall display and allow modification to the following operations and settings:
- a. HVAC Zone Fan
 - b. Cooling
 - c. Heating
 - d. Economizer
 - e. Demand Ventilation
 - f. Power Exhaust
 - g. Sensors
 - h. Network
22. A menu shall display and allow modification to the following operations and settings:
- a. HVAC Zone – Occupied status
 - b. Indoor Fan status
 - c. Cooling status
 - d. Heating status
 - e. Economizer indication whether free-cooling is available or not
 - f. Enabling or disabling of Demand Ventilation
 - g. Power Exhaust
 - 1) Enable/disable hot-gas reheat if available
 - 2) Warmup/Cooldown
 - 3) Title 24 Load Shed
 - 4) Defrost
23. A menu shall display and allow modification to the following operations and settings:
- a. Firmware version (of UCB, Economizer, other peripheral boards)
 - b. Setting time zone
 - c. Network information
 - 1) Device name that will appear on the FC Bus
 - 2) Selection of communication protocol
 - 3) Operational Baud Rate
 - 4) Device ID
24. A menu shall display and allow modification to the following operations and settings:
- a. Version of firmware
 - b. Ability to Load new firmware
 - c. Create a backup file of the firmware and parameter setting via USB port
 - d. Restore factory default parameter values and setup
 - e. Full and Partial Cloning of parameter setpoints from or to other units
 - f. Data trend exporting
25. A menu shall display and allow modification to the following operations and settings:

- a. Unit serial number, model number and name
- b. Ability to reset Lockouts
- c. Controller name
- d. Displays the current values of all setpoints in use
- e. Displays all current values for the indoor and outdoor zones
- f. Displays current values related to:
 - 1) Indoor Fan
 - 2) Cooling
 - 3) Heating
 - 4) Heat Pump operation
 - 5) Economizer operation
 - 6) Power Exhaust
 - 7) Demand Ventilation
 - 8) Air monitoring station
 - 9) Hot Gas Reheat
 - 10) Smoke Control
- g. Current information for inputs; including
 - 1) Sensors
 - 2) Coil Sensors
 - 3) Thermostat
 - 4) Binary Inputs
 - 5) Unit Protection
 - 6) Network Inputs
 - 7) All outputs (relay and binary)
- h. Self-Test
 - 1) A patented self-test system that runs through a series of algorithms to provide a report of all functioning characteristics of the system at time of startup and commissioning.

23 09 23. 13.B. Auxiliary Control Boards

1. ASHRAE 62- 2001 compliant. BTL certified.
2. Economizer controller CEC Title 24 Compliant
 - a. Display alarms if the following occur
 - 1) Economizer is economizing when conditions do not support
 - 2) Economizer is not economizing when conditions do support
 - 3) Damper Stuck
 - 4) Excess Outdoor Air
 - 5) Failed Sensor
3. Refrigeration Fault Detection & Diagnostics
 - a. There is insufficient refrigerant in any circuit
 - b. There is excessive refrigerant in any circuit
 - c. There is excessive refrigerant flow
 - d. There is insufficient refrigerant flow (restriction)
 - e. Inefficient compressor
 - f. Insufficient High-side heat transfer
 - g. Excessive High-side heat transfer (low ambient control problem, low ΔP)
 - h. Insufficient Low-side heat transfer
 - i. Excessive Low-side heat transfer

- j. Sensor fault- The liquid temperature is greater than the condenser temperature (Could also be triggered if refrigerant level is very low in the system)
- k. Sensor fault- Sensor data is not available
- l. The unit is off
- m. The ambient temperature is too low
- n. The ambient temperature is too high
- o. The return air wet-bulb temperature is too low
- p. The return air wet-bulb temperature is too high
- q. Sensor fault- The condensing temperature is lower than the ambient temperature (Could also be triggered when the condenser is wet)
- r. The suction line temperature is less than the evaporator temperature
- s. The evaporator temperature is greater than the ambient temperature
- t. The liquid temperature is lower than the ambient temperature
- u. Sensor fault- Suction temperature or ambient temperature is invalid
- v. Sensor fault- The return air dry-bulb or wet-bulb temperature is invalid
- w. Sensor fault- The liquid pressure or suction pressure is invalid
- x. Sensor fault- The suction line temperature is invalid
- y. The return air dry-bulb temperature is too low
- z. The return air dry-bulb temperature is too high
- aa. The Efficiency Index is below 75% of ideal
- bb. The Capacity Index is below 75% of ideal

23 09 23. 13.C Remote Accessibility:

1. ASHRAE 62- 2001 compliant. BTL certified.
2. Provide the ability to adjust parameter values, setpoints, limits remotely
3. Connectivity to an Ethernet network via static IP address or Dynamic Name Server (DNS)
4. Allow a maximum of 100 devices on the same FC bus trunk and accessed by one remote device