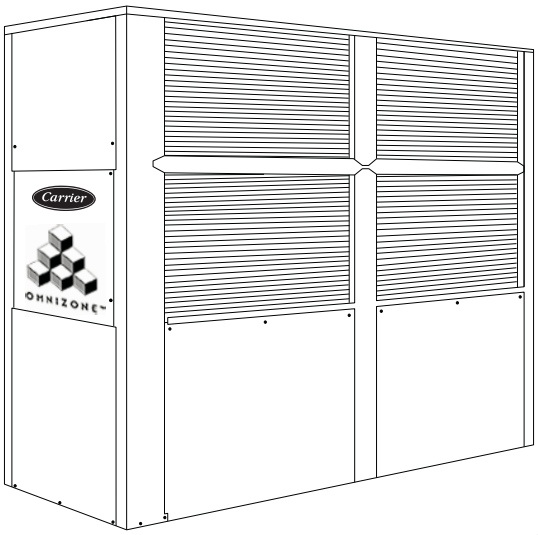
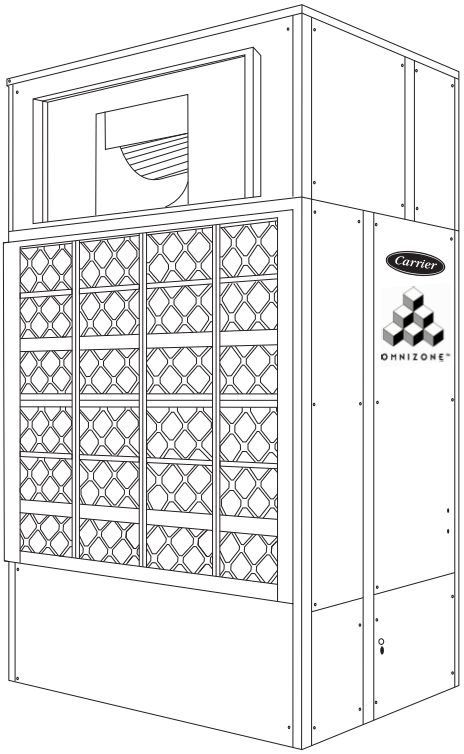
Product Data

Omnizone™
50BV020-064
Water-Cooled
Indoor Self-Contained Systems and Water Source Heat Pumps

18 to 60 Nominal Tons



50BVC,J,Q020-034
SINGLE PIECE OMNIZONE UNIT



50BVT,V,W034-064
MODULAR OMNIZONE UNIT

Omnizone 50BV units offer:

- Puron® (R-410A) refrigerant
- High-boy modular units that break down to fit through a standard 36-in. doorway
- Either two or four high-efficiency scroll compressors for efficient part load control, quiet operation, and system redundancy
- Suction and discharge Schrader valves on manifold gage connections
- EERs (energy efficiency ratios) meet ASHRAE (American Society of Heating, Refrigerating, and Air-Conditioning Engineers) Standard 90.1-2013

Features/Benefits

Omnizone 50BV units are self-contained, water-cooled indoor cooling units or water source heat pumps.

Flexible, efficient, and economical

Units are available for constant volume (CV) or variable air volume (VAV) applications (with the exception of heat pumps) in both modular and single-piece construction. Single-piece units are completely factory wired, piped, and charged, ready for installation.

Units use Puron (R-410A) refrigerant and have EERs (Energy Efficiency Ratios) up to 14.6.

Units include a direct expansion evaporator coil, compressors, and water-cooled cleanable condensers. The VAV units include a single or multiple belt drive evaporator fan(s) with VFD (variable frequency drive) controlled motor and complete microprocessor control system.

Features/Benefits (cont)

Optional water economizers and hot water heating may also be added.

These vertical package units offer flexible economical air conditioning for today's office environment.

Compressors are mounted on vibration isolators.

Each compressor is equipped with a coaxial tube-in-tube condenser for maximum heat transfer efficiency and performance. All condensers are rated at 600 psig operating refrigerant pressures and 400 psig water-side pressures.

Evaporators are enhanced fin, rifled tube type for maximum performance. Large face areas ensure low airside pressure drops and reduced face velocities to prevent condensate carry over and maximum moisture removal.

Coils are either three or four rows deep depending on unit model and mounted in small area, sealed drain pans to inhibit condensate build-up levels.

Units contain either one or two forward curved high-pressure class II fan assemblies depending on the model size. Fans are double width, double inlet welded assemblies statically and dynamically balanced.

Three-phase evaporator-fan motor is compatible with use on variable frequency drive with thermal overload protection.

Puron refrigerant

Carrier's 50BVC,BVQ units are available with the Puron refrigerant option. Puron refrigerant is a non-chlorine based (R-410A) refrigerant. Puron refrigerant characteristics, compared to R-22, have:

- Binary and near azeotropic mixture of 50% R-32 and 50% R-125.
- Non-ozone depleting potential.
- Virtually no glide. Unlike other alternative refrigerants, the two components in Puron refrigerant have virtually the same leak rates. Therefore, refrigerant can be added if necessary without recovering the charge.

Controls and sensors provide maximum control

Factory-mounted variable frequency drive is sized to handle full motor operating current at full load operation. The VFD is provided with duct static sensor, which is field-installed.

Carrier's factory mounted DDC (Direct Digital Controls) controller is preprogrammed, installed, and fully tested at the factory. The unit will operate in stand-alone mode or connect to a Building Automation System using open protocols BACnet*, Modbus†, N2 or LonWorks**.

- Leaving-air temperatures and water temperatures can be monitored from the front end.
- A BACview handheld device is available to allow local access via the unit control or wall sensor to display and modify user-defined properties without any computer interface or software.

Safety features and easy servicing

Each compressor has its own independent refrigerant circuit and is protected by individual branch fusing. Additional protection is provided by thermal overloads and high and low-pressure safety switches.

- High and low-pressure switches on each circuit.
- Thermostatic expansion valves (TXV) on each circuit mounted outside the airstream.
- Stainless steel condensate pan.
- Condensate overflow switch provides protection against condensate overflow.
- Freeze protection switch provides evaporator coil protection against freezing.
- Single point electrical connections and piping connections.
- High discharge static pressure control standard for VAV units.

Quality and reliability are built in

All units are UL (Underwriters Laboratories) and UL, Canada listed.

All units come with a standard one-year product warranty.

Table of contents

* BACnet is a registered trademark of ASHRAE (American Society of Heating, Refrigerating and Air Conditioning Engineers).
† Modbus is a registered trademark of Schneider Electric.
**LonWorks is a registered trademark of Echelon Corporation.

Model number nomenclature

50BV C 020 - B - 6 - F - -

Model Series
50BV – OMNIZONE Indoor Self-Contained Unit

Unit Type
C – (CV) Cool Only, W/C, Single Piece*
J – (VAV) Cool Only, W/C, Single Piece† **
Q – (CV) Heat Pump, W/C, Single Piece*
T – (CV) Cool Only, W/C, Modular*
V – (CV) Heat Pump, W/C, Modular*
W – (VAV) Cool Only, W/C, Modular† **

Nominal Capacity
50BVC, 50BVQ, 50BVJ
020 – 18 Tons **028** – 25 Tons
024 – 20 Tons **034** – 30 Tons

50BVT, 50BVV, 50BVW
034 – 30 Tons **054** – 50 Tons
044 – 40 Tons **064** – 60 Tons

Economizer and Hot Gas Reheat Options
- – None
A – Water Economizer with 3-Way Valve
C – Cycling Hot Gas Reheat Coil
D – Cycling Hot Gas Reheat and Economizer with 3-Way Valve
F – Modulating Hot Gas Re-Heat††
G – Modulating Hot Gas Re-Heat and Economizer with 3-Way Valve††

Factory-Installed Options

Revision
D – Current Build with factory-installed 6126 controller (50BVJ,W)†
F – Current Build with no controller (50BVC,Q,T,V)*

Design Changes
- – Standard Design (50BVJ,C,Q)
1 – High-Boy Design (50BVT,W,V)
2 – Low-Boy Design (50BVT,W,V)

NOTE: See dimensional diagrams for physical size difference between High and Low-Boy.

Voltage Description
1 – 575-3-60
5 – 208/230-3-60
6 – 480-3-60

Airflow Configuration
- – Front Return, Top Supply
B – Front Return, Rear Supply
C – Rear Return, Top Supply
D – Rear Return, Front Supply
E – Rear Return, Rear Supply

50BVC, Q may select -, B, C, or D
50BVJ may select C only
50BVT, W, V (Low-Boy) may select C or D only
50BVT, W, V (High-Boy) may select D or E only

Indoor Motor and Drive Options

HP	STD	MED STATIC	HIGH STATIC
1.5	B	M	n/a
2	C	N	n/a
3	D	P	3
5	E	n/a	n/a
7.5	F	R	5
10	G	S	6
15	H	T	7
20	J	U	8

NOTE: HP ratings are per motor. Most 50BV units have two indoor-fan motors. See price pages for additional information.

LEGEND
CV – Constant Volume
HP – Horsepower
VAV – Variable Air Volume
VFD – Variable Frequency Drive
W/C – Water-Cooled

* CV units (50BVC, 50BVQ, 50BVT, and 50BVV) do not receive factory-installed controls and can only have the no-controller option.
† Only VAV units (50BVJ and 50BVW) will have the factory-installed controller.
** VAV requires factory-installed modulating hot gas re-heat.
†† F or G required for VAV units (50BVJ and 50BVW).

AHRI/ISO capacity ratings

UNIT	SIZE	AIRFLOW (CFM)	CAPACITY (Btuh)	EER
50BVC	024	7,000	239,800	13.8
	028	10,000	288,200	12.4
	034	11,500	359,500	14.4
50BVJ	024	7,000	239,800	13.8
	028	10,000	288,200	12.4
	034	11,500	359,500	14.4
50BVQ	020	7,200	215,900	14.0
	024	7,450	241,600	13.8
	028	10,000	288,200	12.4
	034	11,000	359,900	14.4
50BVT	034	9,000	385,000	14.0
	044	12,000	500,600	14.1
	054	15,000	651,600	14.6
	064	18,000	769,900	13.8
50BVV	034	9,000	385,000	14.0
	044	12,000	500,600	14.1
	054	15,000	651,600	14.6
	064	18,000	769,900	13.8
50BVW	034	9,000	385,000	14.0
	044	12,000	500,600	14.1
	054	15,000	651,600	14.6
	064	18,000	769,900	13.8

LEGEND

AHRI — Air-Conditioning, Heating, and Refrigeration Institute
EER — Energy Efficiency Ratio
ISO — International Organization for Standardization

→ NOTE: Rated in accordance with AHRI/ISO 13256-1.

Physical data — 50BVC,J,Q units

UNIT 50BVC,J,Q	020	024	028	034
NOMINAL CAPACITY (Tons)	18	20	25	30
OPERATING WEIGHT (lb)				
50BVC,Q…50BVJ	1192…1227	1378…1413	1428…1473	1680…1725
COMPRESSOR	Copeland Scroll			
Quantity	2	2	2	2
Number of Refrigerant Circuits	2	2	2	2
Oil (oz) Ckt 1…Ckt 2	85…85	110…110	110…110	140…140
REFRIGERANT TYPE	R-410A			
Expansion Device	TXV	TXV	TXV	TXV
Operating Charge (oz) per Ckt	130	145	145	288
CONDENSER (50BVC,Q,J only)	Tube-in-Tube Coaxial			
Quantity of Manifolded Circuits	2	2	2	2
Nominal Flow Rate (gpm)	54	60	75	90
Water Flow Range (gpm)	36-72	40-80	50-100	60-120
Max Water Working Pressure (psig)	400	400	400	400
Max Refrig. Working Pressure (psig)	450	450	450	450
Min Entering Water Temp (F)	50	50	50	50
Max Entering Water Temp (F)	110	110	110	110
Waterside Volume (gal)	3.6	4.0	5.0	6.0
EVAPORATOR COIL				
Rows…Fins/in.	3…14	3…14	3…14	3…14
Total Face Area (sq ft)	18.1	18.1	18.1	22.0
EVAPORATOR FAN				
Quantity…Size	2…15x15	2…15x15	2…15x15	2…15x15
Type Drive	Belt	Belt	Belt	Belt
Nominal cfm	7200	8000	10,000	12,000
Std Motor Qty…hp…Frame Size	2…1.5…56	2…2…56H	2…3…56HZ	2…5…56HZ
Alt 1 Motor Qty…hp…Frame Size	2…2…56H	2…3…56HZ	2…5…56HZ	—
Alt 2 Motor Qty…hp…Frame Size	2…3…56HZ	2…5…56HZ	—	—
Alt 3 Motor Qty…hp…Frame Size	2…5…56HZ	—	—	—
Motor Nominal rpm (1.5, 2, 3, hp)	1725	1725	1725	—
Motor Nominal rpm (5 hp)	3450	3450	3450	3450
Fan Drive rpm Range				
Std Fan Drive (1.5, 2, 3 hp)	753-952	753-952	753-952	—
Std Fan Drive (5 hp)	967-1290	967-1290	967-1290	967-1290
Med Static Fan Drive (1.5, 2, 3 hp)	872-1071	872-1071	872-1071	—
Motor Bearing Type	Ball	Ball	Ball	Ball
Maximum Allowable rpm	1300	1300	1300	1300
Motor Pulley Pitch Diameter				
Std Fan Drive (1.5, 2, 3 hp)	3.7-4.7	3.7-4.7	3.7-4.7	—
Std Fan Drive (5 hp)	2.9-3.9	2.9-3.9	2.9-3.9	2.9-3.9
Med Static Fan Drive (1.5, 2, 3 hp)	4.3-5.3	4.3-5.3	4.3-5.3	—
Motor Shaft Diameter (in.) (1.5, 2 hp)	5/8	5/8	—	—
Motor Shaft Diameter (in.) (3, 5 hp)	7/8	7/8	7/8	7/8
Belt, Qty…Type…Length (in.)				
Std Fan Drive (1.5, 2 hp)	1…B…39	1…B…39	—	—
Std Fan Drive (3 hp)	2…B…39	2…B…39	2…B…39	—
Std Fan Drive (5 hp)	2...BX…42	2...BX…42	2...BX…42	2...BX…42
Med Static Fan Drive (1.5, 2 hp)	1…B…40	1…B…40	—	—
Med Static Fan Drive (3 hp)	2…B…40	2…B…40	2…B…40	—
Pulley Center Line Distance (in.)	10.1-10.9	10.1-10.9	10.1-10.9	10.1-10.9
Speed Change Per Full Turn of Moveable Pulley Flange (rpm)				
Std Fan Drive (1.5, 2, 3 hp)	33	33	33	—
Std Fan Drive (5 hp)	54	54	54	54
Med Static Fan Drive (1.5, 2, 3 hp)	33	33	33	—
Fan Shaft Diameter (in.)	1	1	1	1
HIGH PRESSURE SWITCHES (psig)				
Cutout	600 ± 10	600 ± 10	600 ± 10	600 ± 10
Reset (Auto)	500 ± 10	500 ± 10	500 ± 10	500 ± 10
LOW PRESSURE SWITCHES (psig)				
Cutout	40 ± 3	40 ± 3	40 ± 3	40 ± 3
Reset (Auto)	60 ± 5	60 ± 5	60 ± 5	60 ± 5

LEGEND

TXV — Thermostatic Expansion Valve

Physical data — 50BVT,V,W units

UNIT 50BVT,V,W	034	044	054	064
NOMINAL CAPACITY (Tons)	30	40	50	60
OPERATING WEIGHT (lb)				
50BVT,V…50BVW	2580…2645	4334…4404	5198…5298	5230…5330
COMPRESSOR		Copeland Scroll		
Quantity	2	4	4	4
Number of Refrigerant Circuits	2	4	4	4
Oil (oz)				
Circuit 1…Circuit 2	140…140	110…110	140…140	140…140
Circuit 3…Circuit 4	—	110…110	140…140	140…140
REFRIGERANT TYPE		R-410A		
Expansion Device	TXV	TXV	TXV	TXV
Operating Charge (oz per Ckt)	288	160	288	288
CONDENSER (50BVT,V,W only)		Tube-in-Tube Coaxial		
Quantity of Manifolded Circuits	2	4	4	4
Nominal Flow Rate (gpm)	90	120	150	180
Water Flow Range (gpm)	60-120	80-160	100-200	120-240
Max Water Working Pressure (psig)	400	400	400	400
Max Refrig. Working Pressure (psig)	450	450	450	450
Min Entering Water Temp (F)	50	50	50	50
Max Entering Water Temp (F)	110	110	110	110
Waterside Volume (gal)	6.0	9.0	11.3	13.5
EVAPORATOR COIL				
Rows…Fins/in.	4…12	3…12	4…12	4…12
Total Face Area (sq ft)	23.2	46.4	46.4	46.4
EVAPORATOR FAN				
Quantity…Size	1…18x18	2…18x18	2…18x18	2…18x18
Type Drive	Belt	Belt	Belt	Belt
Nominal cfm	12,000	16,000	20,000	24,000
Motor Option 1 Qty…hp…Frame Size	1…7.5…213T	2…7.5…213T	2…7.5…213T	2…7.5…213T
Motor Option 2 Qty…hp…Frame Size	1…10…215T	2…10…215T	2…10…215T	2…10…215T
Motor Option 3 Qty…hp…Frame Size	1…15…254T	2…15…254T	2…15…254T	2…15…254T
Motor Option 4 Qty…hp…Frame Size	1…20…256T	—	2…20…256T	2…20…256T
Motor Nominal rpm	1750	1750	1750	1750
Fan Drive RPM Range				
Standard (7.5 hp)	780-960	780-960	780-960	780-960
Standard (10, 15, 20 hp), Med Static (7.5 hp)	805-991	805-991	805-991	805-991
Med Static (10, 15, 20 hp), High Static (7.5 hp)	960-1146	960-1146	960-1146	960-1146
High Static (10, 15, 20 hp)	1119-1335	1119-1335	1119-1335	1119-1335
Motor Bearing Type	Ball	Ball	Ball	Ball
Maximum Allowable rpm	1450	1450	1450	1450
Motor Pulley Pitch Diameter				
Std Fan Drive (7.5 hp)	5.2-6.4	5.2-6.4	5.2-6.4	5.2-6.4
Std Fan Drive (10, 15, 20 hp), Med Static (7.5 hp)	4.8-6.0	4.8-6.0	4.8-6.0	4.8-6.0
Med Static Fan Drive (10, 15, 20 hp), High Static (7.5 hp)	5.8-7.0	5.8-7.0	5.8-7.0	5.8-7.0
High Static Fan Drive (10, 15, 20 hp)	5.8-7.0	5.8-7.0	5.8-7.0	5.8-7.0
Motor Shaft Diameter (in.) (7.5, 10 hp)	$1^{3}/_{8}$	$1^{3}/_{8}$	$1^{3}/_{8}$	$1^{3}/_{8}$
Motor Shaft Diameter (in.) (15, 20 hp)	$1^{5}/_{8}$	$1^{5}/_{8}$	$1^{5}/_{8}$	$1^{5}/_{8}$
Belt, Qty…Type…Length (in.)				
Std Fan Drive (7.5 hp)	2…B…48	2...B...48	2…B…48	2…B…48
Std Fan Drive (10, 15, 20 hp), Med Static (7.5 hp)	2…B…46	2…B…46	2…B…46	2…B…46
Med Static Fan Drive (10, 15, 20 hp), High Static (7.5 hp)	2…B…48	2…B…48	2…B…48	2…B…48
High Static Fan Drive (10, 15, 20 hp)	2…B…45	2…B…45	2…B…45	2…B…45
Pulley Center Line Distance (in.)	10.2-11.4	10.2-11.4	10.2-11.4	10.2-11.4
Speed Change Per Full Turn of Moveable Pulley Flange (rpm)				
Std Fan Drive (7.5 hp)	36	36	36	36
Std Fan Drive (10, 15, 20 hp), Med Static (7.5 hp)	31	31	31	31
Med Static Fan Drive (10, 15, 20 hp), High Static (7.5 hp)	31	31	31	31
High Static Fan Drive (10, 15, 20 hp)	36	36	36	36
Fan Shaft Diameter (in.)	$1^{7}/_{16}$	$1^{7}/_{16}$	$1^{7}/_{16}$	$1^{7}/_{16}$
HIGH PRESSURE SWITCHES (psig)				
Cutout	600 ± 10	600 ± 10	600 ± 10	600 ± 10
Reset (Auto)	500 ± 10	500 ± 10	500 ± 10	500 ± 10
LOW PRESSURE SWITCHES (psig)				
Cutout	40 ± 3	40 ± 3	40 ± 3	40 ± 3
Reset (Auto)	60 ± 5	60 ± 5	60 ± 5	60 ± 5
RETURN AIR FILTERS				
Quantity…Size (in.)	8…17x27x4	16…17x27x4	16…17x27x4	16…17x27x4

LEGEND

TXV — Thermostatic Expansion Valve

Factory-installed options

Waterside economizer — A condenser water pre-cooling coil located before the direct expansion cooling coils allows the use of the condenser water to provide free cooling. When the condenser water temperature is less than an adjustable set point, condenser water is directed to the economizer coil to obtain free cooling. When free cooling is available the economizer coil functions as the first stage of cooling. The economizer coil valve can be modulated to control discharge-air temperature when the economizer can meet or exceed the cooling needs. If the economizer coil cannot control the discharge-air temperature, stages of compressors are brought on to control the discharge-air temperature.

The waterside economizer option consists of the economizer coil, one three-way valve, vent and drain fittings, and the required piping. The economizer coils are 2 or 4-row coils. The unit controller controls all required control logic and changeover.

Hot water coil — The hot water coil can be factory-installed on the inlet side of the direct expansion cooling coils with field piping connections on the side of the unit. The hot water coil requires separate in/out water connects. The hot water coil is installed internal to the 50BVT, W, and V units, and external to the 50BVC, J, and Q units.

Hot gas re-heat — When indoor air quality is a concern, a hot gas re-heat coil can be ordered to help control humidity levels on constant volume units. Normally, bringing humidity levels down to acceptable levels requires cooling the air to relatively low temperatures producing uncomfortable conditions in the space. This option uses hot refrigerant gas to re-heat the air and is controlled by space humidity levels only operating when needed. Cycling and modulating hot gas re-heat is available. Cycling provides on/off type re-heat, while modulating will vary the amount of re-heat to maintain a pre-determined hot gas re-heat set point as well as a precise supply air set point for VAV application.

Energy management and alarm relay package — A 24-vac relay can be provided to remotely start and stop units with constant volume configuration. An additional relay is provided to close when a compressor malfunction is detected, providing remote signaling to a building automation system.

Cupronickel condenser — Cupronickel (Cu/Ni) condensers are available for higher corrosion protection.

Hot gas bypass — Hot gas bypass is available on constant volume units (standard on VAV units) for extended capacity operation and to prevent coil freezing at low load conditions.

Insulated basepan — This option is available for additional sound deadening characteristics and corrosion protection in the compressor compartment.

Extended range option — This option provides condensate protection on the condenser waterside for humid applications or for low entering water temperatures.

Blower orientation — To change the airflow direction, the blower orientation is rotated while the blower section remains in the same unit configuration (top, front, etc.).

Dimensions

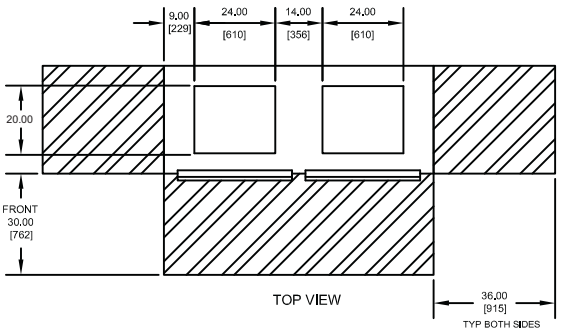
50BVC,J,Q020-034

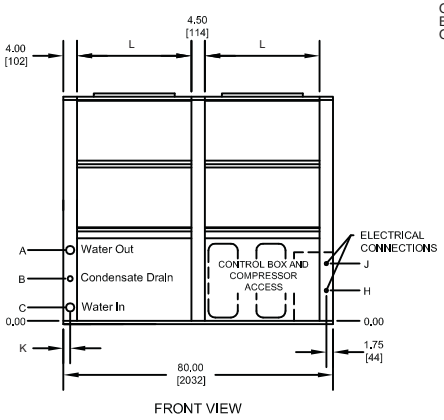
	50BV(C)(Q)(J) UNIT NOMINAL SIZE			
	020	024	028	034
A	14.75 [375]	14.75 [375]	14.75 [375]	18.88 [479]
B	8.50 [216]	8.50 [216]	8.50 [216]	8.75 222]
C	2.75 [70]	2.75 [70]	2.75 [70]	2.75 [70]
D	40.00 [1016]	40.00 [1016]	40.00 [1016]	61.00 [1549]
E	20.00 [508]	20.00 [508]	20.00 [508]	30.00 [762]
F	38.00 [965]	38.00 [965]	38.00 [965]	58.00 [1473]
G	62.00 [1575]	62.00 [1575]	62.00 [1575]	86.50 [2197]
H	4.00 [101]	4.00 [101]	4.00 [101]	4.00 [101]
J	18.75 [476]	18.75 [476]	18.75 [476]	18.75 [476]
K	3.25 [83]	3.25 [83]	3.25 [83]	3.50 [89]
L	33.00 [838]	33.00 [838]	33.00 [838]	32.00 [813]
WATER CONN.	2" FPT	2" FPT	2" FPT	2" FPT
CONDENSATE CONN.	1-1/4" FPT	1-1/4" FPT	1-1/4" FPT	1-1/4" FPT
FILTER QTY & SIZE	(4) 20 x 34-1/2 x 1"	(4) 20 x 34-1/2 x 1"	(4) 20 x 34-1/2 x 1"	(4) 30 x 34-1/2 x 1"

NOTES:
1. Dimensions in inches [mm].
2. 50BVJ units are rear return, top supply only.
3. Compressor, controls, and condenser access are through front panels.
4. Field power connections are 1 3/4 inches. Control connections are 7/8 inches.
5. Optional blower orientation is selected in model number nomenclature as option 9 in FIOP section (digits 15 and 16).

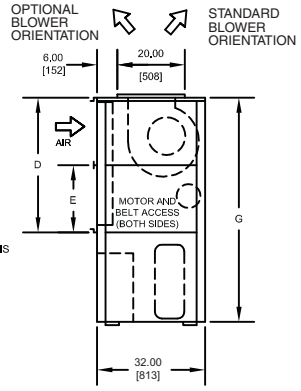
Shows recommended minimum service clearances.

FRONT RETURN, TOP SUPPLY



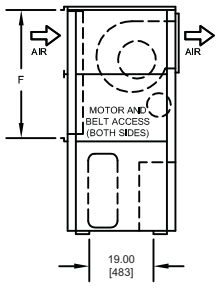


FRONT VIEW

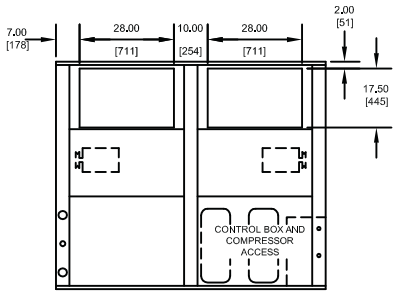


RIGHT SIDE VIEW

REAR RETURN, FRONT SUPPLY

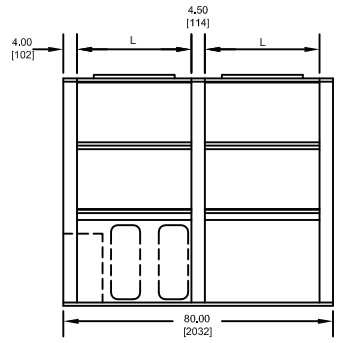


LEFT SIDE VIEW

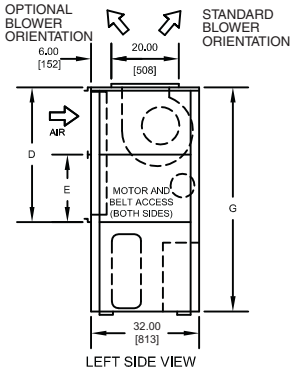


FRONT VIEW

REAR RETURN, TOP SUPPLY

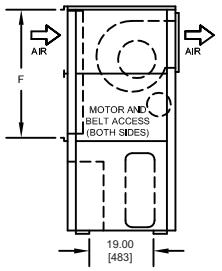


REAR VIEW

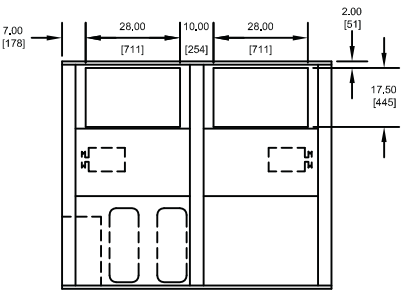


LEFT SIDE VIEW

FRONT RETURN, REAR SUPPLY

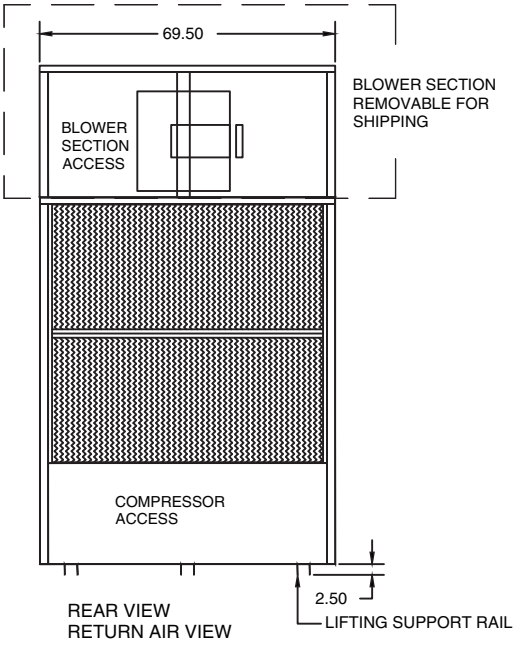


RIGHT SIDE VIEW

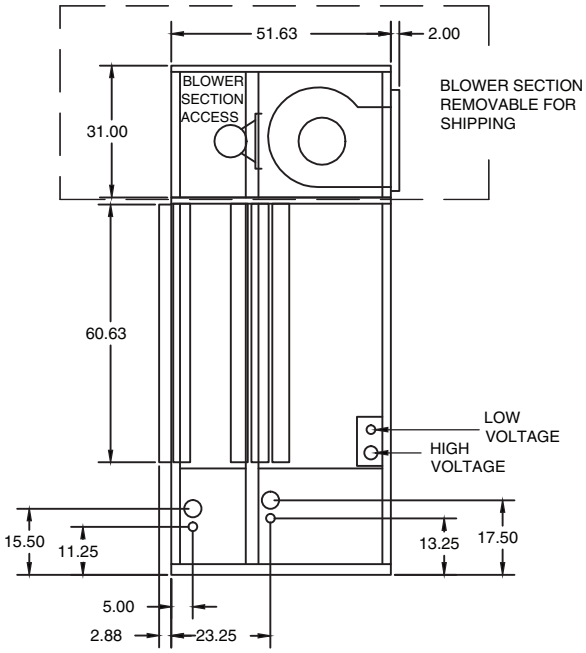


REAR VIEW

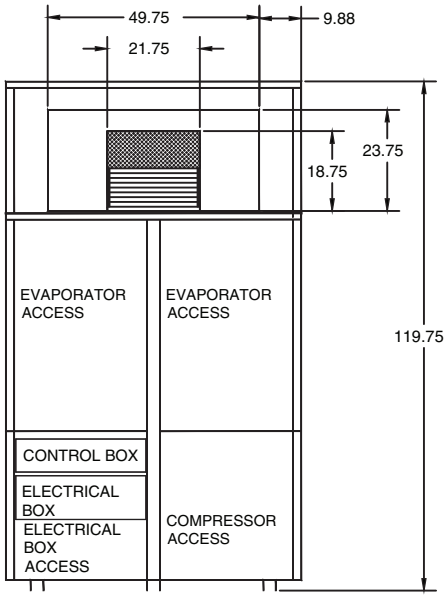
50BVT,W,V034 HIGH BOY REAR RETURN, FRONT SUPPLY WITH WATERSIDE ECONOMIZER AND HOT WATER COIL



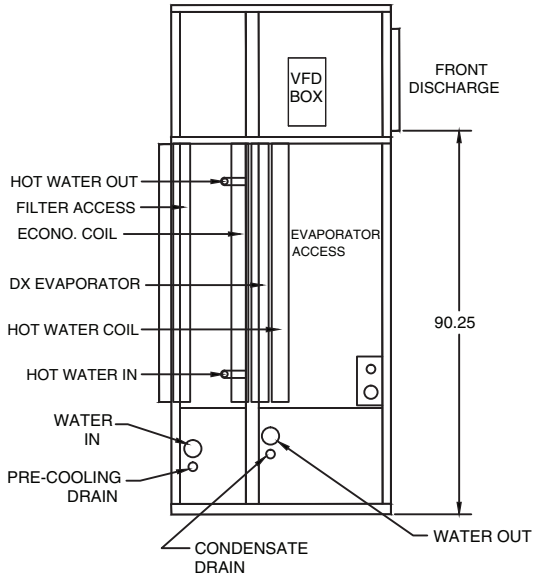
REAR VIEW
RETURN AIR VIEW



LEFT SIDE VIEW



FRONT VIEW



LEFT SIDE VIEW

FILTERS		
NOMINAL	ACTUAL	QUANTITY
17 X 30	16.5 X 29.75	8

**4 INCHES THICK

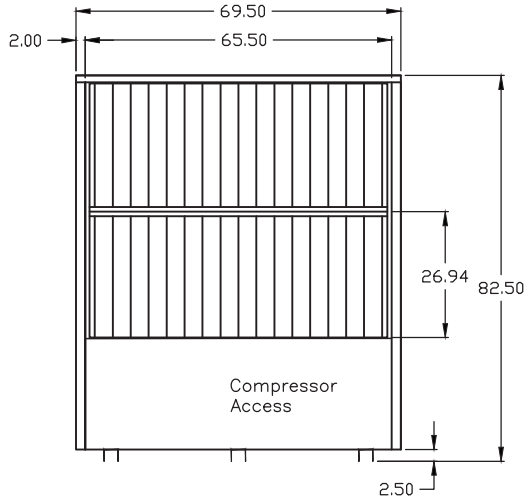
WATER CONNECTIONS	
H20 IN*	2.5
H20 OUT*	2.5
CONDENSATE*	1.25
PRE-COOLING DRAIN*	1.25
HW IN/OUT (SWEAT)	1.38

*F.P.T. TYPE CONNECTION

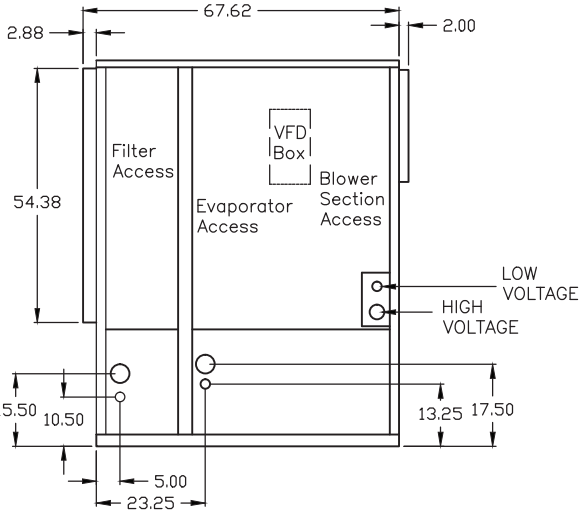
NOTES:
1. Dimensions in inches [mm].
2. Recommended minimum service clearances are as follows:
   a. Front and rear — 30 [762]
   b. Left or right side — 65 [1651] for coil removal
   c. Side opposite coil removal — 20 [508]
3. For all other airflow configuration drawings see SCUBuilder program.

Dimensions (cont)

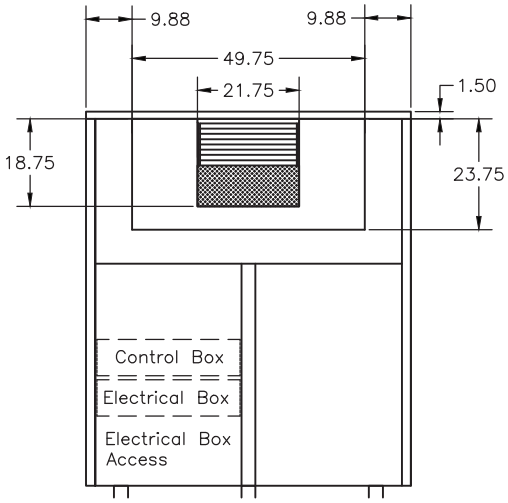
50BVT,W,V034 LOW BOY REAR RETURN, FRONT SUPPLY WITH WATERSIDE ECONOMIZER AND HOT WATER COIL



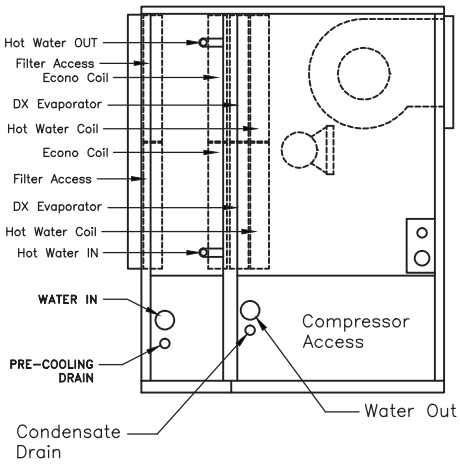
REAR VIEW
RETURN AIR VIEW



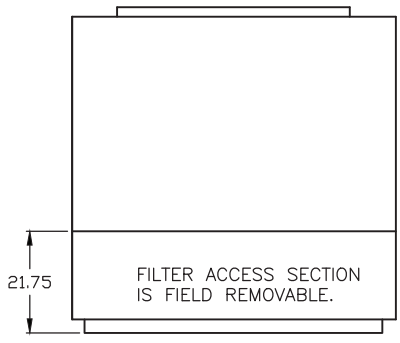
LEFT SIDE VIEW
FRONT DISCHARGE



FRONT VIEW



LEFT SIDE VIEW
FRONT DISCHARGE



TOP REAR VIEW

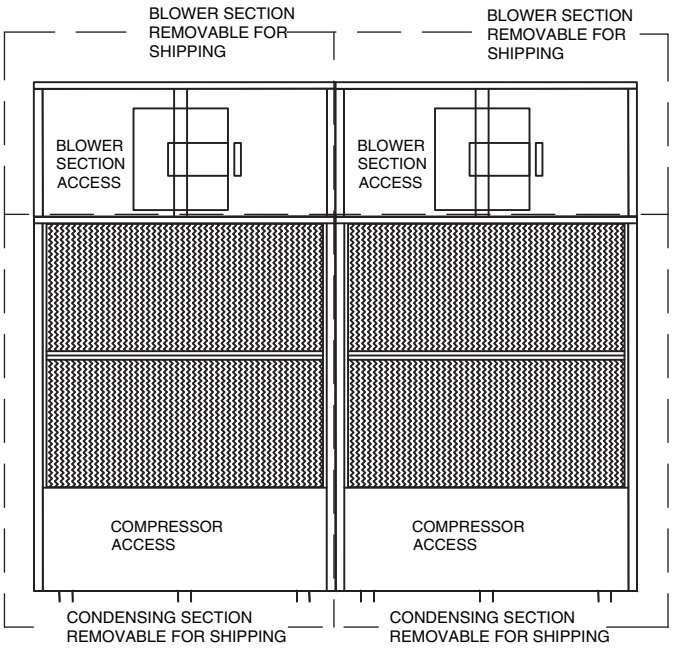
FILTERS			
NOMINAL	ACTUAL	QUANTITY	
17 X 27	16.5 X 26.50	8	**4 INCHES THICK

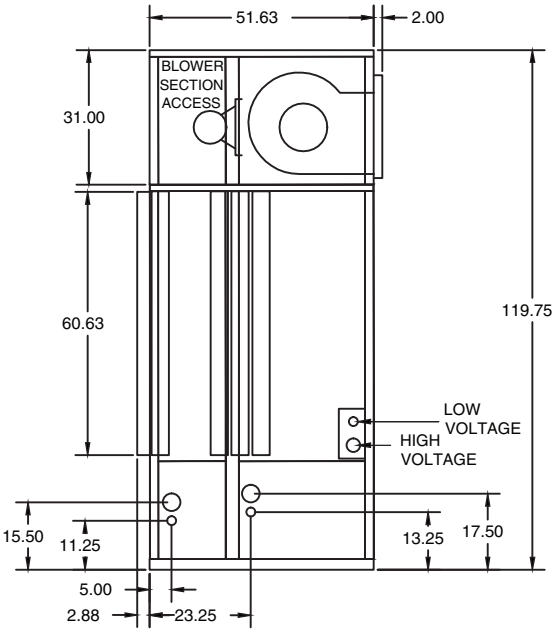
WATER CONNECTIONS	
H20 IN*	2.5
H20 OUT*	2.5
CONDENSATE*	1.25
PRE-COOLING DRAIN*	1.25
HW IN/OUT (SWEAT)	1.38

*F.P.T. Type Connection

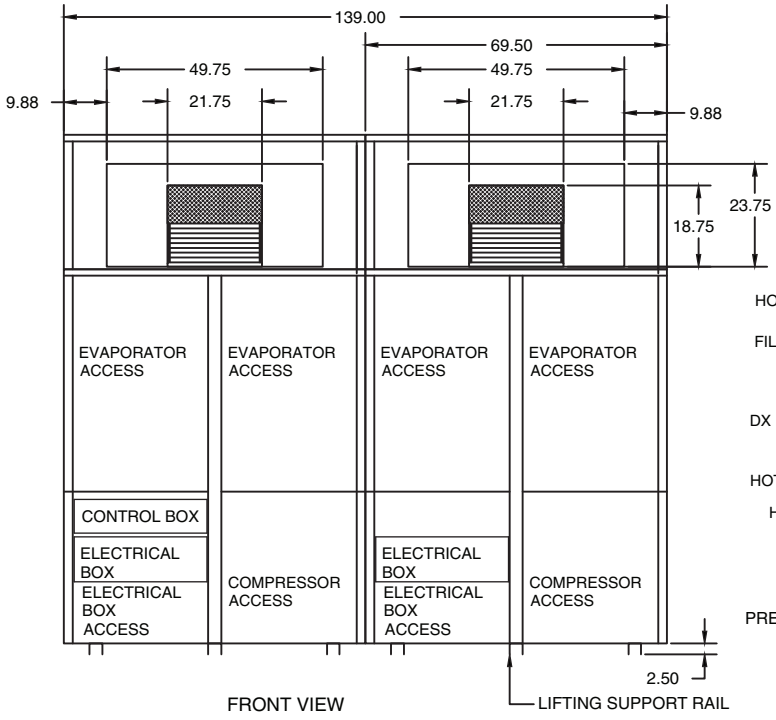
NOTES:
1. Dimensions in inches [mm].
2. Recommended minimum service clearances are as follows:
   a. Front and rear — 30 [762]
   b. Left or right side — 65 [1651] for coil removal
   c. Side opposite coil removal — 20 [508]
3. For all other airflow configuration drawings see SCUBuilder program.

50BVT,W,V044-064 HIGH BOY REAR RETURN, FRONT SUPPLY WITH WATERSIDE ECONOMIZER AND HW COIL



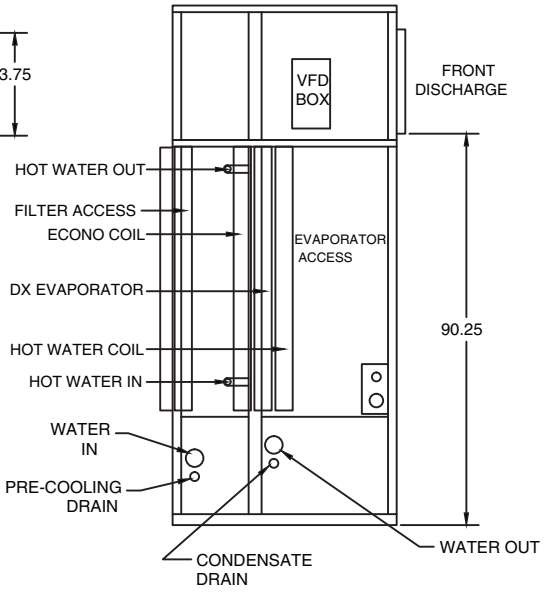


REAR VIEW RETURN AIR



FRONT VIEW

LEFT SIDE VIEW



FILTERS		
NOMINAL	ACTUAL	QUANTITY
17 X 30 X 4	16.5 X 29.75 X 4	16

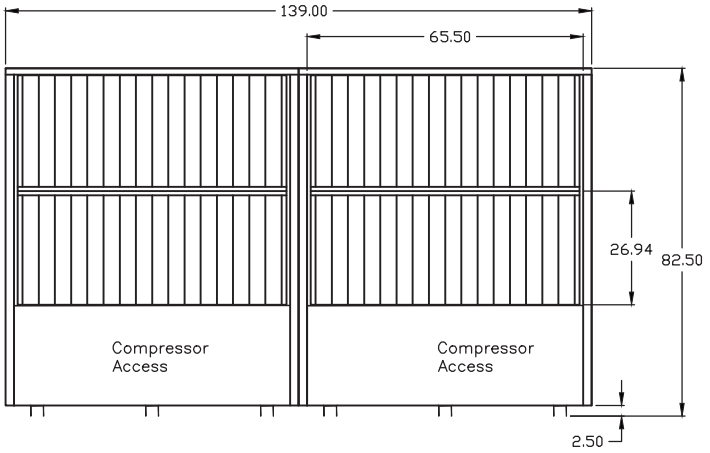
WATER CONNECTIONS			
Model	44	54	64
H2O IN*	2.5	3.0	3.0
H2O OUT*	2.5	3.0	3.0
Condensate*	1.25	1.25	1.25
Pre-Cooling Drain*	1.25	1.25	1.25
HW IN/OUT (Sweat)	1.38	1.38	1.38

*F.P.T. Type Connection

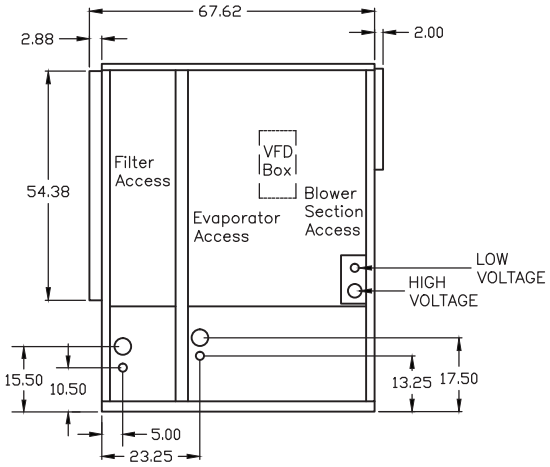
NOTES:
1. Dimensions in inches [mm].
2. Recommended minimum service clearances are as follows:
   a. Front and rear — 30 [762]
   b. Left or right side — 65 [1651] for coil removal
   c. Side opposite coil removal — 20 [508]
3. For all other airflow configuration drawings see SCUBuilder program.

Dimensions (cont)

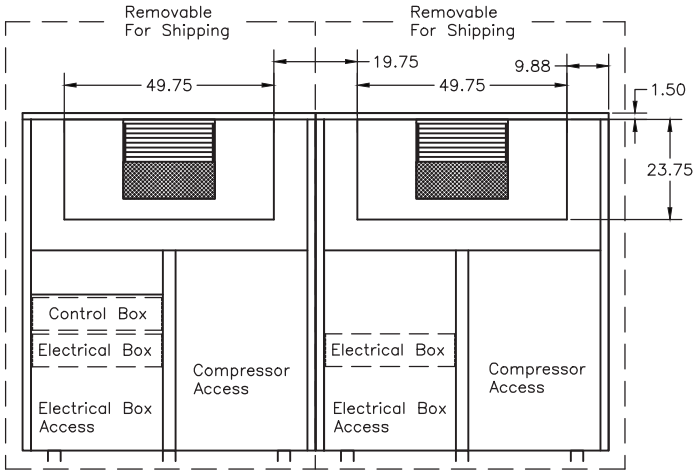
50BVT,W,V044-064 LOW BOY REAR RETURN, FRONT SUPPLY WITH WATERSIDE ECONOMIZER AND HOT WATER COIL



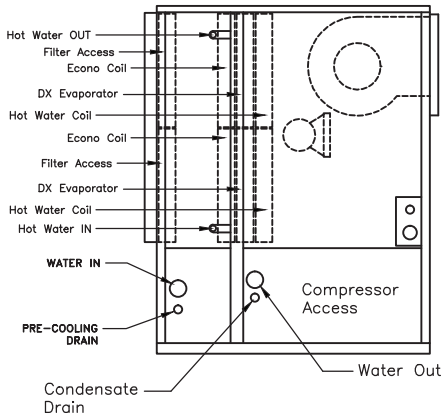
REAR VIEW RETURN AIR



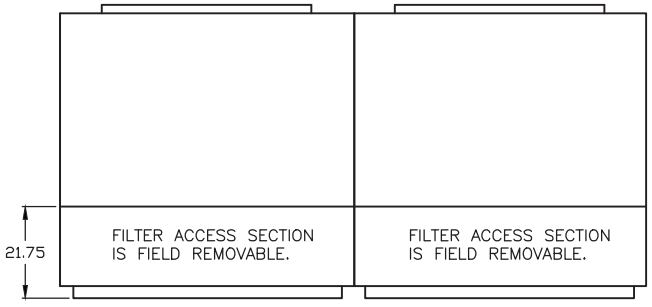
LEFT SIDE VIEW TOP DISCHARGE



FRONT VIEW



LEFT SIDE VIEW TOP DISCHARGE



TOP VIEW

FILTERS		
NOMINAL	ACTUAL	QUANTITY
17 X 30 X 4	16.5 X 29.75 X 4	16

WATER CONNECTIONS			
Model	44	54	64
H2O IN*	2.5	3.0	3.0
H2O OUT*	2.5	3.0	3.0
Condensate*	1.25	1.25	1.25
Pre-Cooling Drain*	1.25	1.25	1.25
HW IN/OUT (Sweat)	1.38	1.38	1.38

*F.P.T. Type Connection

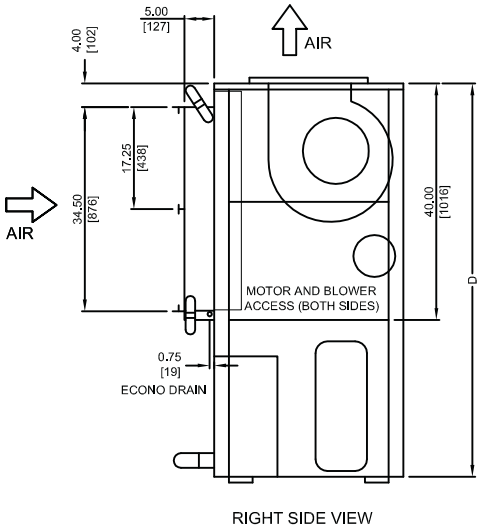
NOTES:
1. Dimensions in inches [mm].
2. Recommended minimum service clearances are as follows:
   a. Front and rear — 30 [762]
   b. Left or right side — 65 [1651] for coil removal
   c. Side opposite coil removal — 20 [508]
3. For all other airflow configuration drawings see SCUBuilder program.

50BVC,J,Q020-028 WITH OPTIONAL WATERSIDE ECONOMIZER

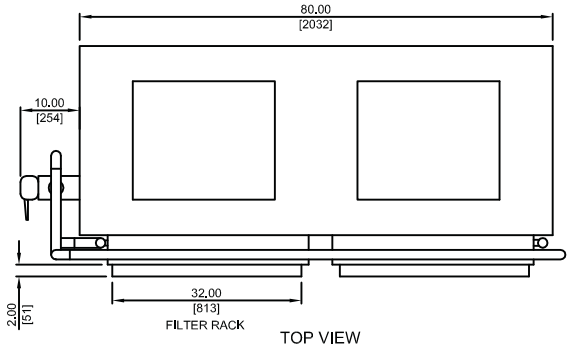
NOTES:
1. Dimensions in inches [mm].
2. Refer to base unit certified drawing for additional unit dimensions, service clearance, and alternate airflow configurations.
3. For all other airflow configuration drawings see SCUBuilder program.
4. 50BVJ are Rear Return, Top Supply only.

FRONT RETURN, TOP SUPPLY SHOWN

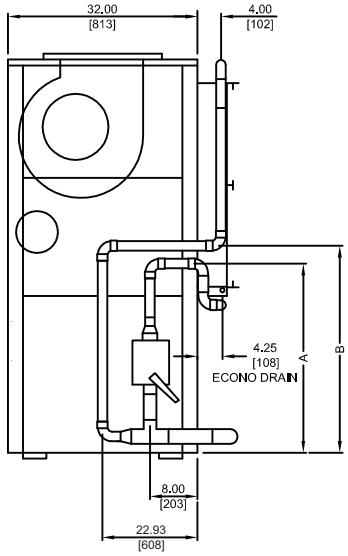
	50BV(C)(Q)(J) UNIT NOMINAL SIZE		
	020	024	028
A	28.00 [711]	32.00 [813]	32.00 [813]
B	31.00 [787.4]	35.00 [889]	35.00 [889]
C	17.50 [445]	18.75 [476]	18.75 [476]
D	62.00 [1575]	66.50 [1689]	66.50 [1689]
WATER CONN.	2" FPT	2" FPT	2" FPT
CONDENSATE CONN.	1-1/4" FPT	1-1/4" FPT	1-1/4" FPT
FILTER QTY. & SIZE	(4) 17 x 34-1/2 x 1"	(4) 17x 34-1/2 x 1"	(4) 17x 34-1/2 x 1"



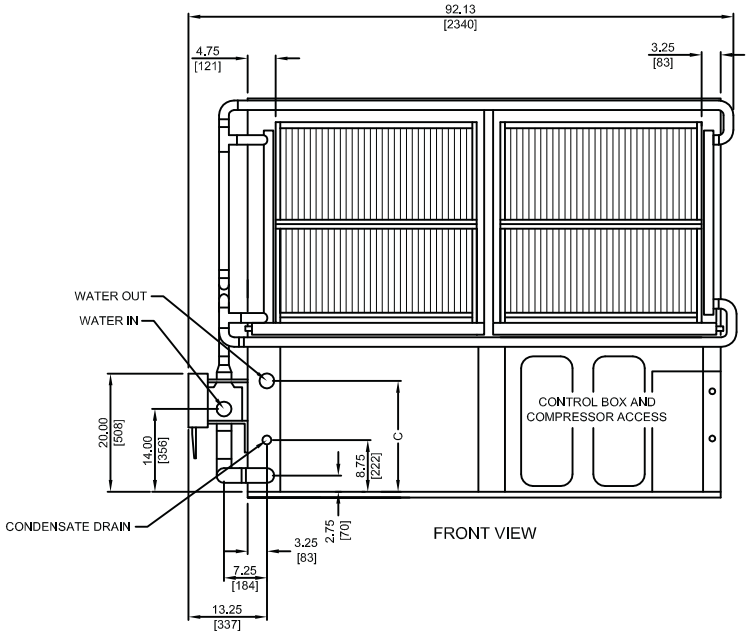
RIGHT SIDE VIEW



TOP VIEW



LEFT SIDE VIEW



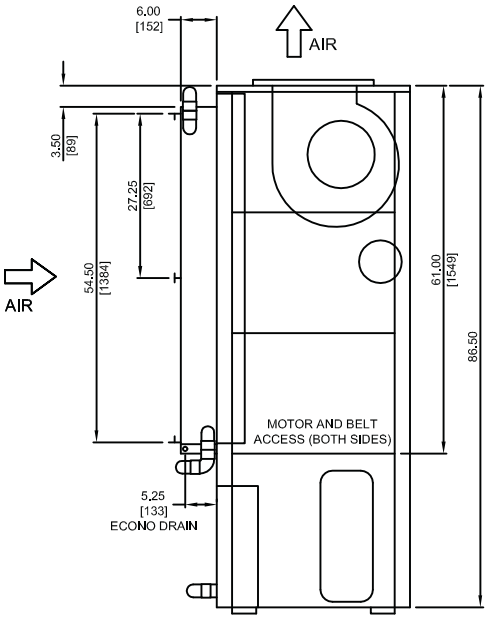
FRONT VIEW

Dimensions (cont)

50BVC,J,Q,034 WITH OPTIONAL WATERSIDE ECONOMIZER

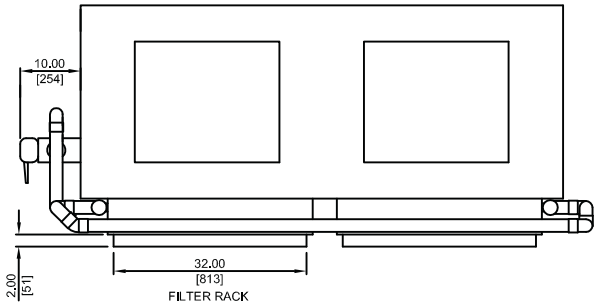
NOTES:
1. Dimensions in inches [mm].
2. Refer to base unit certified drawing for additional unit dimensions, service clearances, and alternate airflow configurations.
3. For all other airflow configuration drawings see SCUBuilder program.
4. 50BVJ are Rear Return, Top Supply only.

FRONT RETURN, TOP SUPPLY SHOWN

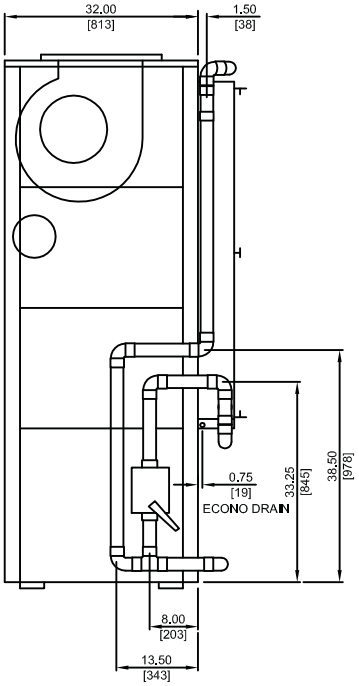


RIGHT SIDE VIEW

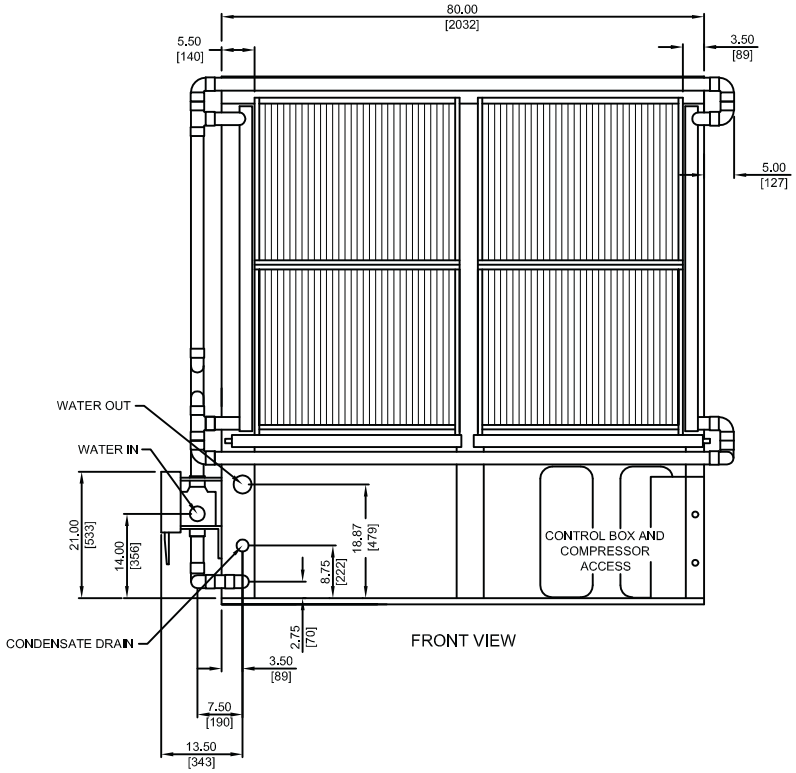
50BV(C)(Q)(J) 034	
DESCRIPTION	SIZE
WATER CONN.	2" FPT
CONDENSATE CONN.	1-1/4" FPT
FILTER QTY. & SIZE	(4) 27" x 34-1/2" x 1"



TOP VIEW

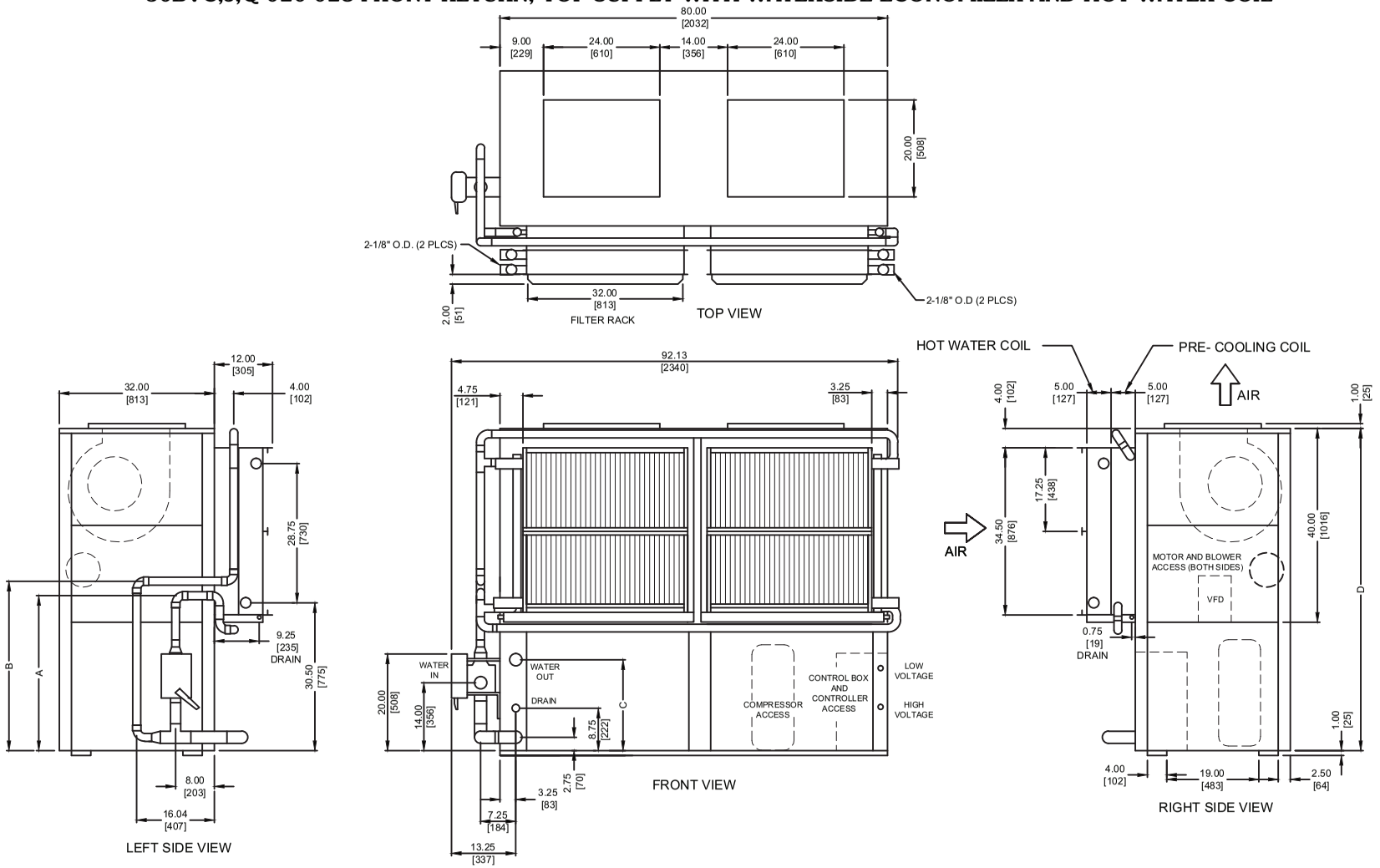


LEFT SIDE VIEW



FRONT VIEW

50BVC,J,Q 020-028 FRONT RETURN, TOP SUPPLY WITH WATERSIDE ECONOMIZER AND HOT WATER COIL

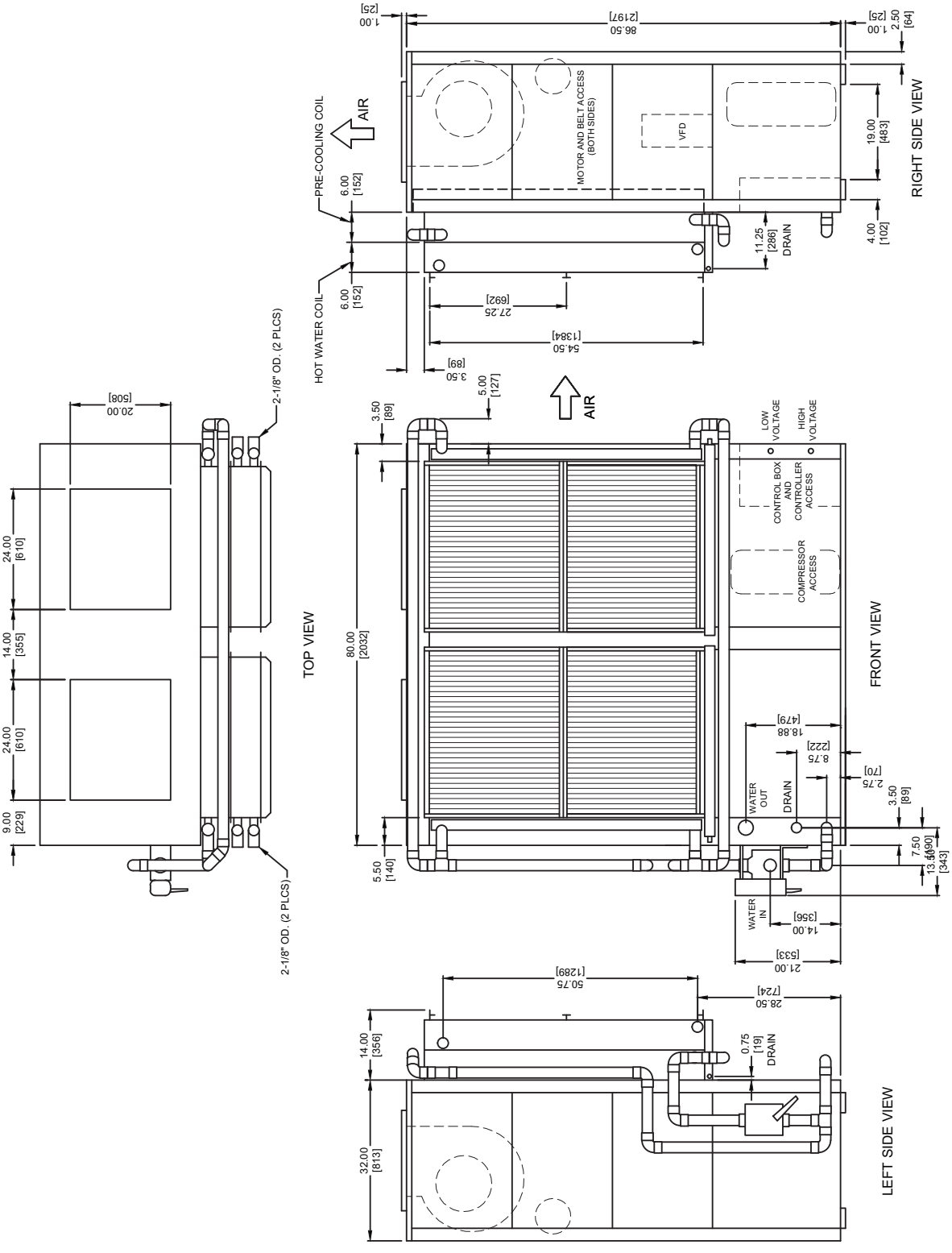


SIZE	020	024	028
HOT WATER COIL CONN.	(4) 2-1/8" O.D.	(4) 2-1/8" O.D.	(4) 2-1/8" O.D.
FILTER QTY. & SIZE	(4) 17 x 34-1/2 x 1"	(4) 17x 34-1/2 x 1"	(4) 17x 34-1/2 x 1"
CONDENSATE CONN.	1-1/4" FPT	1-1/4" FPT	1-1/4" FPT
WATER CONN.	2" FPT	2" FPT	2" FPT
D	62"	66.5"	66.5"
C	17.5"	18.75"	18.75"
B	31"	35"	35"
A	28"	32"	32"

NOTES:
1. Dimensions in inches [mm].
2. Refer to base unit certified drawing for additional unit dimensions, service clearances, and alternate airflow configurations.
3. For all other airflow configuration drawings see SCUBuilder program.
4. 50BVJ are Rear Return, Top Supply only.

Dimensions (cont)

50BVC,J,Q 034 FRONT RETURN, TOP SUPPLY WITH WATERSIDE ECONOMIZER AND HOT WATER COIL



DESCRIPTION	SIZE
WATER CONN.	2" FPT
CONDENSATE CONN.	1-1/4" FPT
FILTER QTY. & SIZE	(4) 27" x 34-1/2" x 1"

NOTES:
1. Dimensions in inches [mm].
2. Refer to base unit certified drawing for additional unit dimensions, service clearances, and alternate airflow configurations.
3. For all other airflow configuration drawings see SCUBuilder program.
4. 50BVJ are Rear Return, Top Supply only.

Selection procedure

Please use Carrier's *SCU*Builder performance and selection software to perform unit selections at a variety of actual operating conditions. All 50BV performance data can be found in Carrier's *SCU*Builder selection software.

Electrical data

50BVC,J,Q UNITS

UNIT SIZE	NOMINAL VOLTAGE (3 Ph, 60 Hz)	VOLTAGE RANGE		COMPRESSOR No. 1		COMPRESSOR No. 2		INDOOR FAN MOTOR			POWER SUPPLY		DISCONNECT SIZE
		Min	Max	RLA	LRA	RLA	LRA	Qty	HP (ea)	FLA (ea)	MCA	MOCP	FLA
020	208/230	187	253	32.9	195	32.9	195	2	1.5	5.0	84.0	110	75.8
								2	2	6.4	86.8	110	78.6
								2	3	9.0	92.0	110	83.8
								2	5	12.2	98.4	110	90.2
	460	414	506	16.5	95	16.5	95	2	1.5	2.5	42.1	50	38.0
								2	2	3.2	43.5	50	39.4
								2	3	4.5	46.1	50	42.0
								2	5	6.1	49.3	50	45.2
	575	518	633	13.6	80	13.6	80	2	1.5	2.0	34.6	45	31.2
								2	2	2.0	34.6	45	31.2
								2	3	3.6	37.8	45	34.4
								2	5	5.4	41.4	45	38.0
024	208/230	187	253	33.6	225	33.6	225	2	2	6.4	88.4	120	80.0
								2	3	9.0	93.6	120	85.2
								2	5	12.2	100.0	120	91.6
	460	414	506	18.6	114	18.6	114	2	2	3.2	48.3	60	43.6
								2	3	4.5	50.9	60	46.2
								2	5	6.1	54.1	60	49.4
	575	518	633	13.6	80	13.6	80	2	2	2.0	34.6	45	31.2
								2	3	3.6	37.8	45	34.4
								2	5	5.4	41.4	45	38.0
028	208/230	187	253	53.6	245	53.6	245	2	3	9.0	138.6	190	125.2
								2	5	12.2	145.0	190	131.6
	460	414	506	20.7	125	20.7	125	2	3	4.5	55.6	70	50.4
								2	5	6.1	58.8	70	53.6
	575	518	633	16.4	100	16.4	100	2	3	3.6	44.1	60	40.0
								2	5	5.4	47.7	60	43.6
034	208/230	187	253	59.1	425	59.1	425	2	5	12.2	157.4	200	142.6
	460	414	506	26.4	187	26.4	187	2	5	6.1	71.6	90	65.0
	575	518	633	20.5	148	20.5	148	2	5	5.4	56.9	70	51.8

LEGEND

FLA — Full Load Amps
HP — Horsepower
LRA — Locked Rotor Amps
RLA — Rated Load Amps

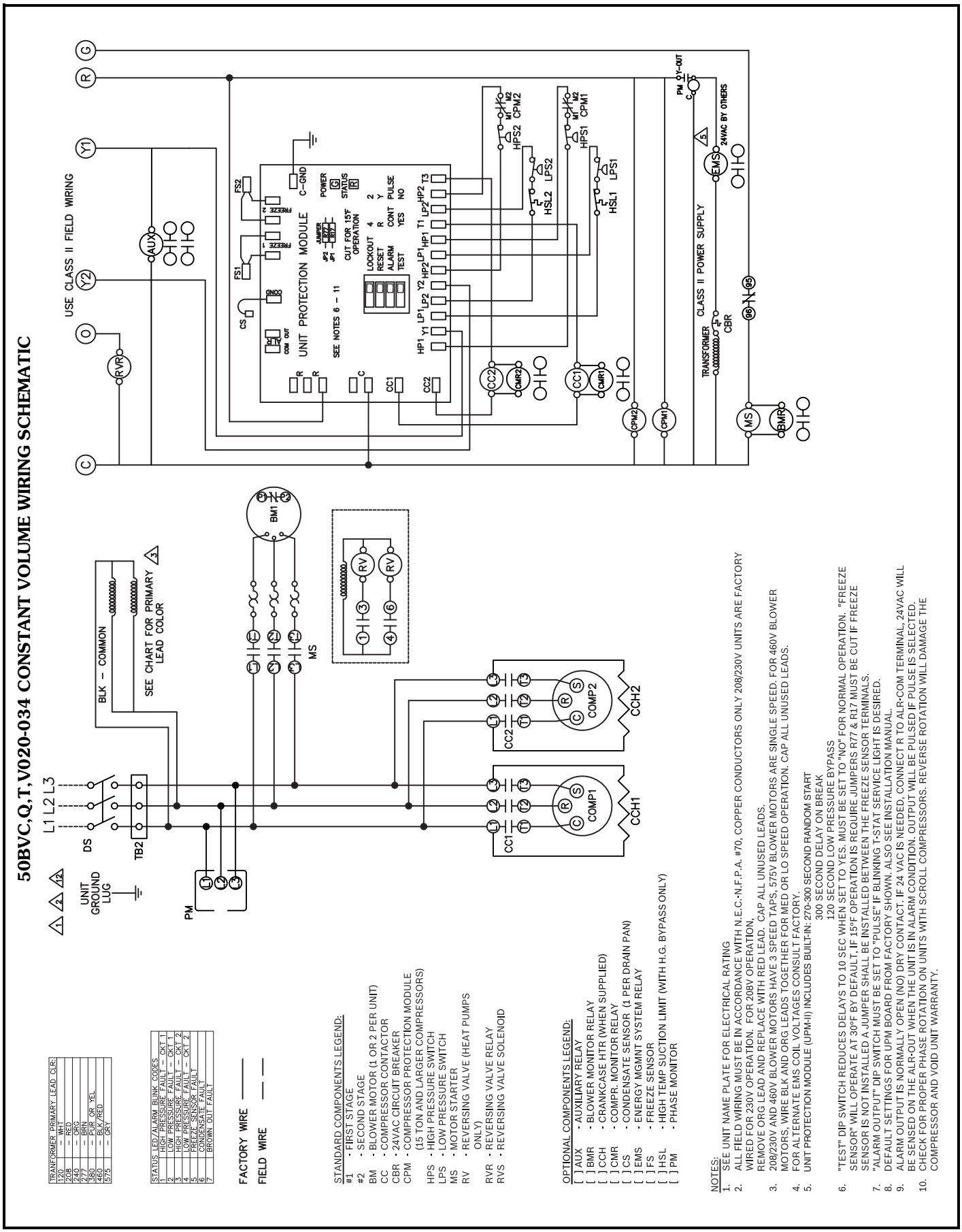
50BVT,V,W UNITS

UNIT SIZE	NOMINAL VOLTAGE (3 Ph, 60 Hz)	VOLTAGE RANGE		COMPRESSOR				INDOOR FAN MOTOR			POWER SUPPLY		DISCONNECT SIZE
				No. 1 / No. 2		No. 3 / No. 4							
		Min	Max	RLA	LRA	RLA	LRA	Qty	HP (ea)	FLA (ea)	MCA	MOCP	FLA
034	208/230	187	253	62.2	376	—	—	1	7.5	19.4	159.4	200	143.8
								1	10	25.8	165.8	225	150.2
								1	15	38.6	178.6	225	163.0
								1	20	49.6	189.6	250	174.0
	460	414	506	27.6	178	—	—	1	7.5	9.7	71.8	90	64.9
								1	10	12.9	75.0	100	68.1
								1	15	19.3	81.4	100	74.5
								1	20	24.8	86.9	110	80.0
	575	518	633	20.5	148	—	—	1	7.5	7.8	53.9	70	48.8
								1	10	10.3	56.4	70	51.3
								1	15	15.4	61.5	80	56.4
								1	20	19.8	65.9	80	60.8
044	208/230	187	253	42.0	239	42.0	239	2	7.5	19.4	217.3	250	206.8
								2	10	25.8	230.1	250	219.6
								2	15	38.6	255.7	250	245.2
	460	414	506	19.2	125	19.2	125	2	7.5	9.7	101.0	110	96.2
								2	10	12.9	107.4	125	102.6
								2	15	19.3	120.2	125	115.4
	575	518	633	12.4	80	12.4	80	2	7.5	7.8	68.3	80	65.2
								2	10	10.3	73.3	80	70.2
								2	15	15.4	83.5	90	80.4
054	208/230	187	253	47.1	318	47.1	318	2	7.5	19.4	239.0	250	227.2
								2	10	25.8	251.8	250	240.0
								2	15	38.6	277.4	300	265.6
								2	20	49.6	299.4	300	287.6
	460	414	506	22.6	158	22.6	158	2	7.5	9.7	115.5	125	109.8
								2	10	12.9	121.9	125	116.2
								2	15	19.3	134.7	150	129.0
								2	20	24.8	145.7	150	140.0
	575	518	633	17.3	125	17.3	125	2	7.5	7.8	89.1	100	84.8
								2	10	10.3	94.1	110	89.8
								2	15	15.4	104.3	110	100.0
								2	20	19.8	113.1	125	108.8
064	208/230	187	253	62.2	376	62.2	376	2	7.5	19.4	303.2	350	287.6
								2	10	25.8	316.0	350	300.4
								2	15	38.6	341.6	400	326.0
								2	20	49.6	363.6	400	348.0
	460	414	506	27.6	178	27.6	178	2	7.5	9.7	136.7	150	129.8
								2	10	12.9	143.1	150	136.2
								2	15	19.3	155.9	150	149.0
								2	20	24.8	166.9	175	160.0
	575	518	633	20.5	148	20.5	148	2	7.5	7.8	102.7	110	97.6
								2	10	10.3	107.7	125	102.6
								2	15	15.4	117.9	125	112.8
								2	20	19.8	126.7	125	121.6

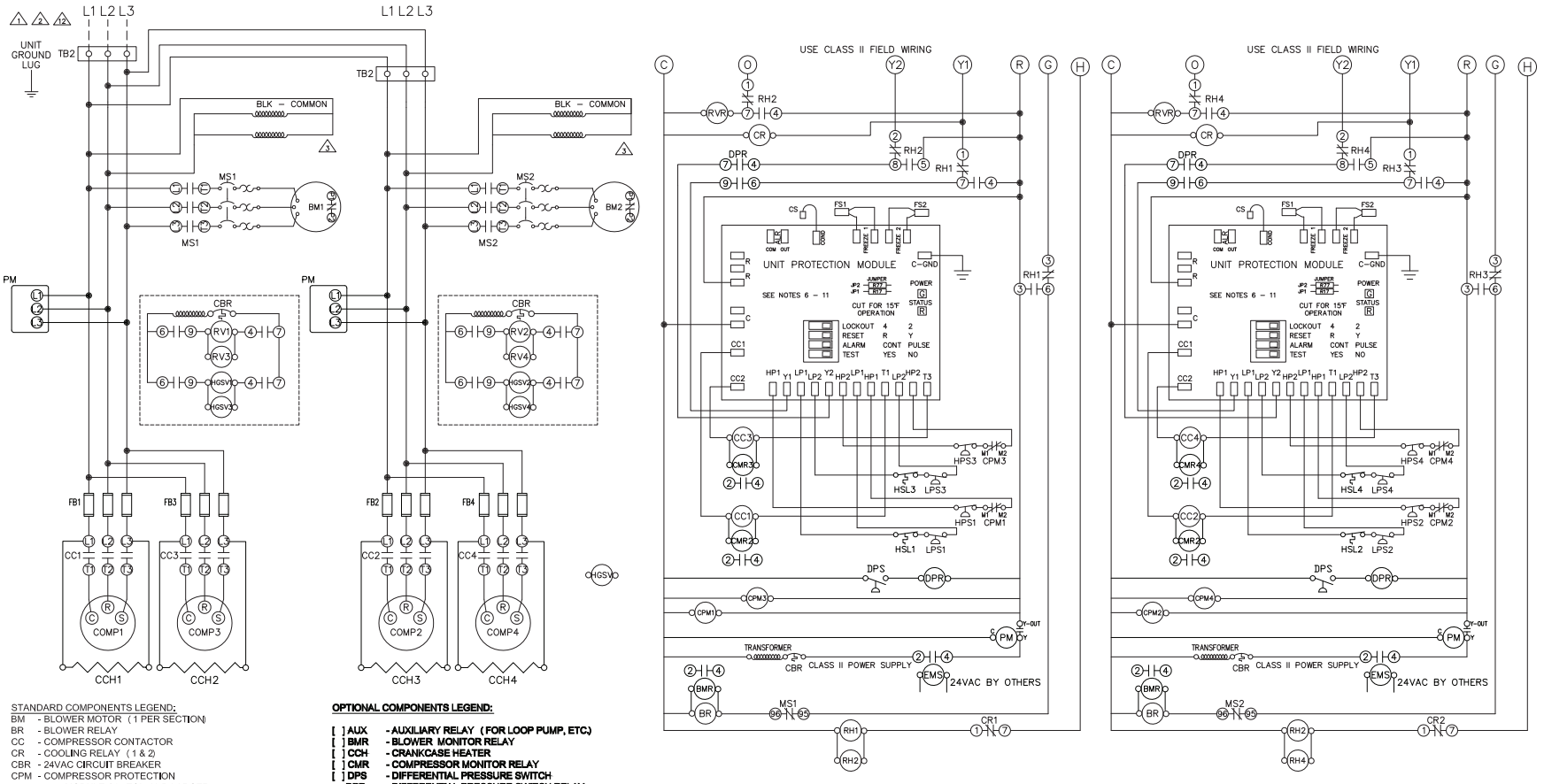
LEGEND

FLA — Full Load Amps
HP — Horsepower
LRA — Locked Rotor Amps
RLA — Rated Load Amps

Typical control wiring schematics



50BVT,V044-064 CONSTANT VOLUME WIRING SCHEMATIC



STANDARD COMPONENTS LEGEND:

BM - BLOWER MOTOR (1 PER SECTION)
BR - BLOWER RELAY
CC - COMPRESSOR CONTACTOR
CR - COOLING RELAY (1 & 2)
CBR - 24VAC CIRCUIT BREAKER
CPM - COMPRESSOR PROTECTION MODULE (15 TON AND LARGER COMPRESSORS)
CS - CONDENSATE SENSOR (1 PER DRAIN PAN)
FS - FREEZE SENSOR
HPS - HIGH PRESSURE SWITCH
LPS - LOW PRESSURE SWITCH
MS - MOTOR STARTER
RVR - REVERSING VALVE RELAY (HEAT PUMPS ONLY)
RVS - REVERSING VALVE SOLENOID (HEAT PUMPS ONLY)

OPTIONAL COMPONENTS LEGEND:

[ ] AUX - AUXILIARY RELAY (FOR LOOP PUMP, ETC.)
[ ] BMR - BLOWER MONITOR RELAY
[ ] CCH - CRANKCASE HEATER
[ ] CMR - COMPRESSOR MONITOR RELAY
[ ] DPS - DIFFERENTIAL PRESSURE SWITCH
DPR - DIFFERENTIAL PRESSURE SWITCH RELAY (ENABLES CC1, CC2)
[ ] EMS - ENERGY MGMNT SYSTEM RELAY
[ ] HSL - HIGH TEMP SUCTION LIMIT (WITH H.G. BYPASS ONLY)
[ ] HGVS - HOT GAS VALVE SOLENOID (USED WITH DDC CONTROLLER ONLY)
[ ] PM - PHASE MONITOR

TRANFORMER PRIMARY LEAD CLR:	
120	– WHT
208	– RED
240	– ORG
277	– BRN
380	– PUR OR YEL
460	– BLK/RED
575	– GRY

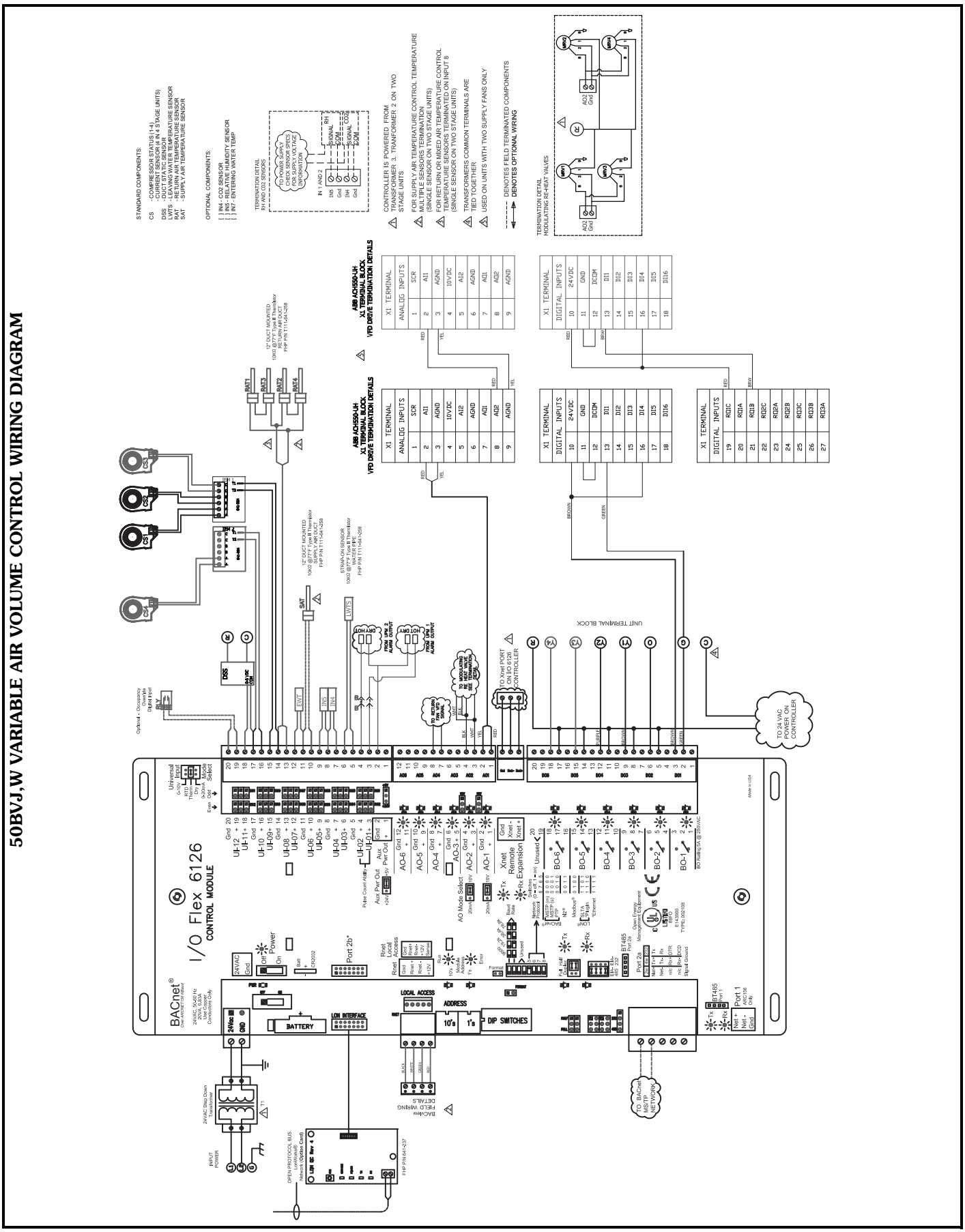
STATUS	LED/ALARM BLINK CODES
1	HIGH PRESSURE FAULT – CKT 1
2	LOW PRESSURE FAULT – CKT 1
3	HIGH PRESSURE FAULT – CKT 2
4	LOW PRESSURE FAULT – CKT 2
5	FREEZE SENSOR FAULT
6	CONDENSATE FAULT
7	BROWN OUT FAULT

FACTORY WIRE ————————
FIELD WIRE — — — —

NOTES:
1. SEE UNIT NAME PLATE FOR ELECTRICAL RATING
2. ALL FIELD WIRING MUST BE IN ACCORDANCE WITH N.E.C.–N.F.P.A. #70, COPPER CONDUCTORS ONLY.
3. 208/230V UNITS ARE FACTORY WIRED FOR 230V OPERATION. FOR 208V OPERATION, REMOVE ORG LEAD AND REPLACE WITH RED LEAD. CAP ALL UNUSED LEADS.
4. 208/230V AND 460V BLOWER MOTORS HAVE 3 SPEED TAPS, 575V BLOWER MOTORS ARE SINGLE SPEED. FOR 460V BLOWER MOTORS, WIRE BLK AND ORG LEADS TOGETHER FOR MED OR LO SPEED OPERATION. CAP ALL UNUSED LEADS.
5. FOR ALTERNATE EMS COIL VOLTAGES CONSULT FACTORY.
6. UNIT PROTECTION MODULE (UPM-II) INCLUDES BUILT-IN: 270-300 SECOND RANDOM START
   300 SECOND DELAY ON BREAK
   120 SECOND LOW PRESSURE BYPASS
7. "TEST" DIP SWITCH REDUCES DELAYS TO 10 SEC WHEN SET TO YES. MUST BE SET TO "NO" FOR NORMAL OPERATION.
8. "FREEZE SENSOR" WILL OPERATE AT 30°F BY DEFAULT, IF 15°F OPERATION IS REQUIRED JUMPER R42 MUST BE CUT IF FREEZE SENSOR IS NOT INSTALLED A JUMPER SHALL BE INSTALLED BETWEEN THE FREEZE SENSOR TERMINALS.
9. "ALARM OUTPUT" DIP SWITCH MUST BE SET TO "PULSE" IF BLINKING T-STAT SERVICE LIGHT IS DESIRED.
10. DEFAULT SETTINGS FOR UPM BOARD FROM FACTORY SHOWN. ALSO SEE INSTALLATION MANUAL.
11. ALARM OUTPUT IS NORMALLY OPEN (NO) DRY CONTACT. IF 24 VAC IS NEEDED, CONNECT R TO ALR–COM TERMINAL, 24VAC WILL BE SENSED ON THE ALR–OUT WHEN THE UNIT IS IN ALARM CONDITION. OUTPUT WILL BE PULSED IF PULSE IS SELECTED.
12. CHECK FOR PROPER PHASE ROTATION ON UNITS WITH SCROLL COMPRESSORS. REVERSE ROTATION WILL DAMAGE THE COMPRESSOR AND VOID UNIT WARRANTY.

Typical control wiring schematics (cont)

50BVJ,W VARIABLE AIR VOLUME CONTROL WIRING DIAGRAM



50BVJ,W VARIABLE AIR VOLUME CONTROL EXPANDER MODULE WIRING DIAGRAM

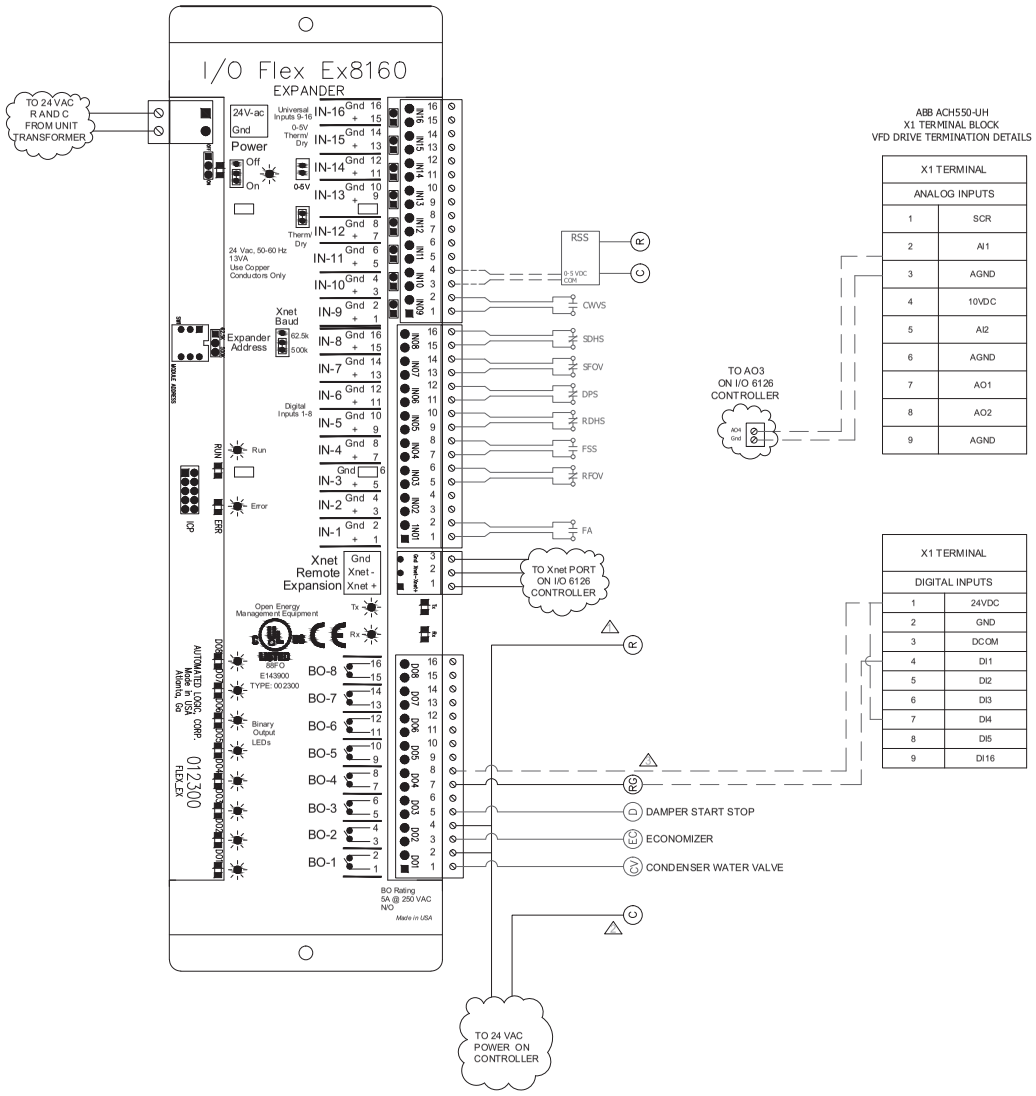


ABB ACH550-UH
X1 TERMINAL BLOCK
VFD DRIVE TERMINATION DETAILS

X1 TERMINAL	
ANALOG INPUTS	
1	SCR
2	AI1
3	AGND
4	10VDC
5	AI2
6	AGND
7	AO1
8	AO2
9	AGND

X1 TERMINAL	
DIGITAL INPUTS	
1	24VDC
2	GND
3	DCOM
4	DI1
5	DI2
6	DI3
7	DI4
8	DI5
9	DI16

STANDARD COMPONENTS:

RSS - RETURN STATIC SENSOR

STANDARD COMPONENTS:

[ ] CWVS - CONDENSER WATER VALVE STATUS
[ ] FA - FIRE ALARM INPUT
[ ] FSS - FILTER STATUS SWITCH
[ ] RFS - RETURN FAN STATUS SWITCH
[ ] RPHS - RELIEF PLENUM HIGH STATIC
[ ] RFOV - RETURN FAN MOTOR OVERLOAD
[ ] SDHS - SUPPLY DUCT HIGH STATIC
[ ] SFOV - SUPPLY FAN MOTOR OVERLOAD

△ CONTROLLER IS POWERED FROM TRANSFORMER 3

△ TRANSFORMERS COMMON TERMINALS ARE TIED TOGETHER

△ RETURN FAN START STOP

— — DENOTES FIELD TERMINATED COMPONENTS

◄—► DENOTES OPTIONAL WIRING

Application data

Location

The unit must be properly located and installed indoors. Selected location should not be adjacent to an acoustically sensitive location such as a conference room or executive office. The best location is a mechanical room, next to elevators, restrooms, or stairways. The mechanical room should be constructed to help isolate the transmission of acoustical energy.

Unit isolation

Unit compressors are internally isolated and the compressor compartment is lined with acoustical insulation. If additional vibration isolation is desired, rubber shear pads are recommended under the four corners of the unit. Spring isolation is not recommended.

Ductwork

The supply duct should be properly supported and the aspect ratio as close to square as possible. The duct should be sized for a maximum of 2000 ft/min. velocity in areas outside the equipment room. The duct should be lined with acoustical insulation for a minimum of 10 ft beyond the equipment room. A flexible duct connection should be used on the connection to the unit to prevent transmission of any unit vibrations into the duct. Refer to the Carrier System Design Manual or ASHRAE (American Society of Heating, Refrigerating and Air-Conditioning Engineers) Standards for recommended duct connection to unit with 2 fans.

NOTE: VAV units must use a "pair of pants" configuration.

A return duct may be attached to the unit, but is not necessary. The return to the unit should prevent line of sight visibility to the space. Insulated return duct is also recommended. The maximum velocity should not exceed 1000 ft/min. over occupied spaces. An adequate return area is essential for proper unit operation.

Piping

Recommended system piping configuration includes a reverse return system to minimize balancing. A strainer is recommended at the inlet to each unit to prevent sediments from plugging the condensers. Pressure gages are also recommended before the strainer and at the unit outlet to check any potential condenser fouling. Gate type isolation valves are also recommended at each unit to allow service without the need to drain the entire system.

Condenser head pressure control

When tower bypass control is not used and the unit will be required to operate with entering water temperatures bellow 55 F, a water regulating valve is required. The valve should be located on the water leaving side of the unit condenser. The valve is controlled by the refrigerant pressure of compressor number 1, using the refrigerant service gage port connection.

Operational limits

Airflow: 200 to 500 Cfm/ton
Air Temperature Cooling: Max 90 F, Min 70 F
Water Flow: 1.5 to 4.0 gpm/ton
Water Temperature: Max 105 F, Min 55 F

Multiple independent circuit operation

Units have multiple compressors, each fully independent. Four-stage control is possible with a thermostat that will allow four stages of cooling. Most likely, the fourth stage can be controlled by outdoor-air temperature to provide an additional stage with higher outdoor-air temperature. When staging the compressors, always stage the circuits such that the first compressor operating is the bottom circuit of the evaporator coil. After that, proceed up the coil in sequence.

Operation with dry cooler

The unit may be operated on a system that uses a dry cooler rather than a cooling tower. In this case, the saturated condensing temperature must be kept below 130 F for proper unit operation. If ethylene glycol is used in the system, the capacity must be adjusted for the solution concentration.

Operation on ethylene glycol

When the unit will be operated in a system that will use ethylene glycol to prevent freezing, the following table can be used to estimate system performance. Solution concentrations above 40% are not recommended. Capacity and pressure drop from the selection tables are multiplied by the percent factors in the table below.

% EG	% Capacity	% Pressure
0	100	100
10	98.8	104
20	97.2	108
30	95.6	114
40	95.6	124

LEGEND

EG — Ethylene Glycol

NOTE: Pressure drop is based on 85 F entering water with 10° F water temperature rise.

WATER QUALITY GUIDELINES

CONDITION	HX MATERIAL*	CLOSED RECIRCULATING†	OPEN LOOP AND RECIRCULATING WELL**
Scaling Potential — Primary Measurement Above the given limits, scaling is likely to occur. Scaling indexes should be calculated using the limits below.			
pH/Calcium Hardness Method	All	N/A	**pH < 7.5 and Ca Hardness, <100 ppm**
Index Limits for Probable Scaling Situations (Operation outside these limits is not recommended.)			
Scaling indexes should be calculated at 150 F for direct use and HWG applications, and at 90 F for indirect HX use. A monitoring plan should be implemented.			
Ryznar Stability Index	All	N/A	**6.0 - 7.5** If >7.5 minimize steel pipe use.
Langelier Saturation Index	All	N/A	**–0.5 to +0.5** If <–0.5 minimize steel pipe use. Based upon 150 F HWG and direct well, 85 F indirect well HX.
Iron Fouling			
Iron Fe^{2+} (Ferrous) (Bacterial Iron Potential)	All	N/A	**<0.2 ppm (Ferrous)** If Fe^{2+} (ferrous) >0.2 ppm with pH 6 - 8, O_2<5 ppm check for iron bacteria.
Iron Fouling	All	N/A	**<0.5 ppm of Oxygen** Above this level deposition will occur.
Corrosion Prevention††			
pH	All	6 - 8.5 Monitor/treat as needed.	**6 - 8.5** Minimize steel pipe below 7 and no open tanks with pH <8.
Hydrogen Sulfide (H_2S)	All	N/A	**<0.5 ppm** At H_2S>0.2 ppm, avoid use of copper and cupronickel piping or HXs. Rotten egg smell appears at 0.5 ppm level. Copper alloy (bronze or brass) cast components are okay to <0.5 ppm.
Ammonia Ion as Hydroxide, Chloride, Nitrate and Sulfate Compounds	All	N/A	**<0.5 ppm**
Maximum Chloride Levels			Maximum allowable at maximum water temperature.
			50 F (10 C) / 75 F (24 C) / 100 F (38 C)
	Copper	N/A	<20 ppm / NR / NR
	Cupronickel	N/A	<150 ppm / NR / NR
	304 SS	N/A	<400 ppm / <250 ppm / <150 ppm
	316 SS	N/A	<1000 ppm / <550 ppm / <375 ppm
	Titanium	N/A	>1000 ppm / >550 ppm / >375 ppm
Erosion and Clogging			
Particulate Size and Erosion	All	<10 ppm of particles and a maximum velocity of 6 fps. Filtered for maximum 800 micron size.	<10 ppm (<1 ppm "sandfree" for reinjection) of particles and a maximum velocity of 6 fps. Filtered for maximum 800 micron size. Any particulate that is not removed can potentially clog components.
Brackish	All	N/A	Use cupronickel heat exchanger when concentrations of calcium or sodium chloride are greater than 125 ppm are present. (Seawater is approximately 25,000 ppm.)

LEGEND

HWG — Hot Water Generator
HX — Heat Exchanger
N/A — Design Limits Not Applicable Considering Recirculating Potable Water
NR — Application Not Recommended
SS — Stainless Steel

*Heat exchanger materials considered are copper, cupronickel, 304 SS (stainless steel), 316 SS, titanium.
†Closed recirculating system is identified by a closed pressurized piping system.
**Recirculating open wells should observe the open recirculating design considerations.

††If the concentration of these corrosives exceeds the maximum allowable level, then the potential for serious corrosion problems exists.
Sulfides in the water quickly oxidize when exposed to air, requiring that no agitation occur as the sample is taken. Unless tested immediately at the site, the sample will require stabilization with a few drops of one Molar zinc acetate solution, allowing accurate sulfide determination up to 24 hours after sampling. A low pH and high alkalinity cause system problems, even when both values are within ranges shown. The term pH refers to the acidity, basicity, or neutrality of the water supply. Below 7.0, the water is considered to be acidic. Above 7.0, water is considered to be basic. Neutral water contains a pH of 7.0.
To convert ppm to grains per gallon, divide by 17. Hardness in mg/l is equivalent to ppm.

Unit Protection Module (UPM)

General description

The Unit Protection Module (UPM) is a printed circuit board (PCB) that interfaces with the thermostat for constant volume units or the digital direct controller. The main purpose of this device is to protect the compressors by monitoring the different states of switches and sensors of each refrigerant circuit. This device provides time delays and protects the unit against freezing of the water and refrigerant heat exchangers as well as condensate overflow when the appropriate sensors are installed.

Features and safeties

Alarm output is Normally Open (NO) dry contact. If 24 VAC output is needed, R must be wired to the ALR-COM terminal; 24 VAC will be available on the ALR-OUT terminal when the unit is in alarm condition. If pulse is selected, the alarm output will be pulsed.

Condensation overflow — The UPM controller continuously monitors the drain pan for high condensate water level by utilizing a sensor. It identifies an alarm condition when the sensor's impedance drops below 230,000 ohms ± 15%. Once the UPM senses this resistance value it enters into a hard lockout and reports the corresponding code via its status LED (6 flashes).

Power random start-up — This feature prevents multiple units sharing the same electrical circuit or network from starting at the same time. It assures that units sharing the same electrical circuit do not demand high inrush currents simultaneously when starting back up after a power failure.

If the controller has been completely powered down for more than 28 milliseconds, a random delay is initiated. If the controller is set to normal operation (test switch set to NO), then typically the unit will start within the time range of 270 and 300 seconds.

In order for the random sequence to initiate the unit power must be removed completely.

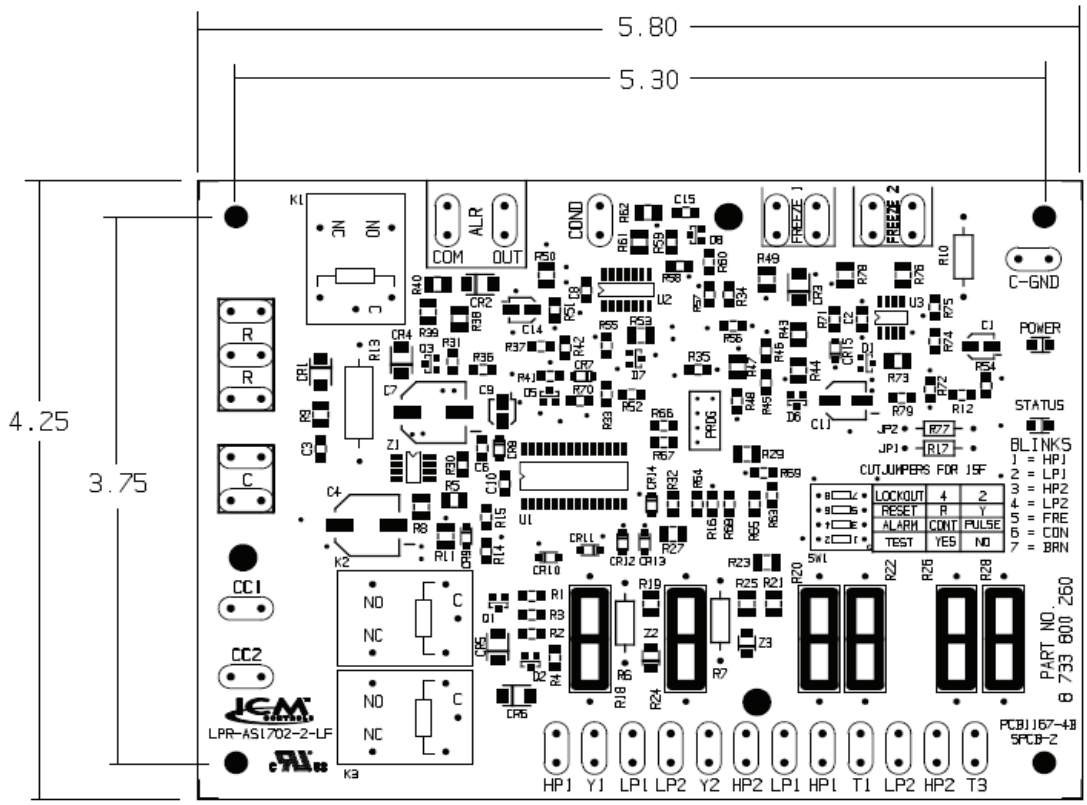
IMPORTANT: If the board is set to "TEST" mode through the "TEST" DIP switch, SW1 delay will be 10 seconds.

Anti-short cycle delay — This feature protects the compressor short cycling if the Y call is set and removed. The anti-short cycle delay is 300 seconds on break during normal operation.

NOTE: If the board is set to test mode through the "TEST" DIP switch, the delay will be 5 seconds.

High and low pressure protection — The UPM monitors the state of the High and Low pressure switch inputs of each refrigerant circuit, HP1, LP1, HP2, and LP2. These switches must be closed for the controller to energize the compressor output (CC1 and CC2). The CC output will only be energized when the switches are closed and the anti-short cycle (and/or random start-up when applicable) has expired.

TWO-STAGE UNIT PROTECTION MODULE



Dimensions are in inches.

High pressure protection — If the HP1 or HP2 switches are open upon a Y1 or Y2 call, the UPM will not energize the respective CC1 or CC2 outputs; the corresponding compressor will remain off, the fault LED will flash 1 time for the HP1 and 3 times for HP2, and the alarm contact will remain off.

If a compressor is running in normal mode on a Y call (Y1 or Y2 or both) and the high pressure switch opens, the UPM will shut down the compressor output and will keep it off until the switch closes and the anti-short cycle has expired. The controller will keep track of the number of times the switch opens; if, within a 1-hour period. the switch opens the number of times set via the DIP switch, the controller will shut down the compressor and perform a hard lockout condition. Under this condition the alarm contact will be energized.

The UPM allows the user to configure the counts that the HP will be allowed to open within 1 hour before the UPM performs a hard lockout on the compressor. The user can select either two or four times by changing switch 4 on the DIP switch SW1 on the UPM board.

Low pressure protection — If the LP1 or LP2 switches are open upon a Y1 or Y2 call (Y1 or Y2 or both) the UPM will not energize the CC1 or CC2 outputs and therefore the corresponding compressor will remain off, the fault LED will flash 2 times for the LP1 and 4 times for the LP2, and the alarm contact will remain off.

If the compressor is running in normal mode on a Y call (Y1 or Y2 or both) and the low pressure switch opens, the UPM will keep the compressor running for 2 minutes. If the condition remains after this period of time, the compressor will shut down and the UPM will start a soft lockout. The UPM will flash 2 times for the LP1 and 4 times for the LP2 and the alarm contact will remain off.

If the switches close, the UPM will start the compressor after the anti-short cycle has expired and UPM will energize the compressor output.

IMPORTANT: To exit the hard lockout the controller must be reset from the Y or R terminal by removing the power from the selected terminal. The user can choose which will be the reset point via the DIP switch SW1.

Ground — The UPM controller takes its ground reference from the unit chassis which is connected to the controller via the C-GND spade terminal.

Sequence of operation, CV units

The following sequence of operation applies to constant volume units.

Cooling is initiated when the set point in the remote thermostat is not met (space temperature is higher than set point). The unit sequence of operation is as follows:

Contact closure at the 'G' terminal will provide power to the supply fan contactor energizing the supply fan. The supply fan will be off during unoccupied schedule, depending upon the features of the thermostat used.

The 'O' terminal energizes the reversing valve (heat pump units only). Typically 'Y1' will also be energized at this time for cooling operation. The second stage of cooling 'Y2' will be initialized after a minimum run time and there is a differential from set point plus a deadband or a proportional plus integral calculation based upon demand and length of time space temperature is greater than set point.

Additional assurance is provided by a delay on make timer in the second-stage compressor contactor circuit to avoid dual compressor in-rush starting current.

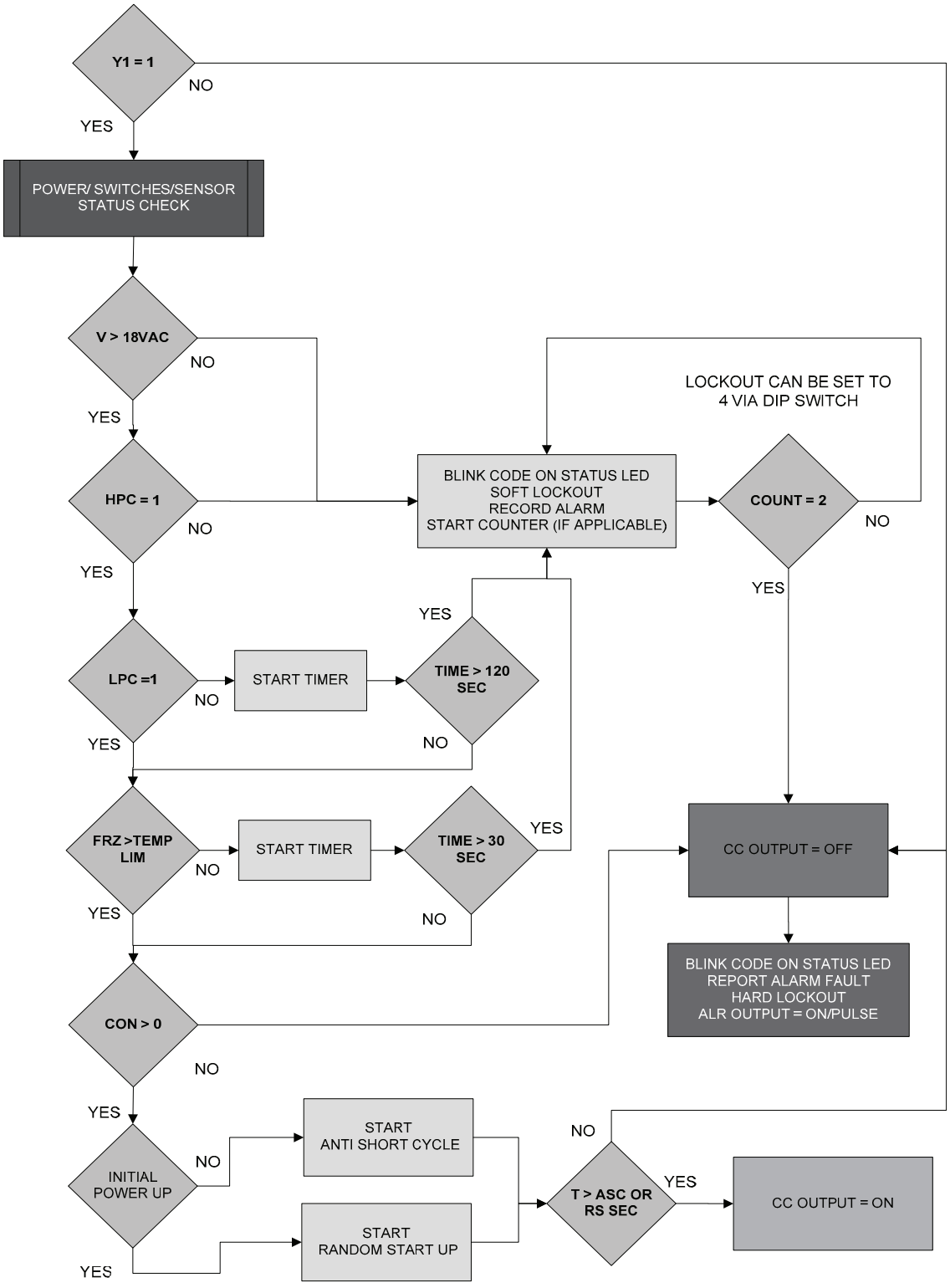
Heating mode (heat pump models only) follows the same sequence as above except that the reversing valve is not energized.

Water economizer cooling — The unit diverts condenser inlet waterflow through an optional economizer coil to precool evaporator entering airflow. If the entering water temperature is colder than the setting on the Aquastat and the return-air temperature is warmer than the setting on the return air thermostat, the two-position diverting valve will direct water to the economizer coil.

Economizer water flow is in series with the condensers allowing compressor operation while the economizer is operating.

Y call (cooling or heating) — The UPM will energize the compressor's output (CC) in an event of a "Y" call from a thermostat or controller (after the random start-up and/or the anti-short cycle delays have elapsed). Y input terminal must be energized with a 24 VAC signal.

UPM SEQUENCE OF OPERATION (SOO) FLOWCHART



Controls — 50BVJ,W

General description

The factory-mounted I/O Flex 6126 controller and I/O Flex EX8160 expander are factory configured with the Water to Air application program and factory installed in the unit to be job site ready to run.

The unit will operate in a 100% stand-alone control mode or connect to a Building Automation System (BAS) using open protocols including BACnet (ARCNET and MS/TP) or Modbus RTU. The controllers also support communications for BACview keypad/display panels.

Key features and benefits

- Point count: 6 digital outputs, 12 universal inputs, and 6 analog outputs.
- Point count: 8 digital outputs, 8 digital inputs and 8 analog inputs
- Built-in protocol support: BACnet (ARCNET and MS/TP) and Modbus.
- Built-in local access support: BACview6 keyboard/display.
- On-board lithium battery holds controller time clock settings
- Program archived in non-volatile memory allows unit to be ready after long periods of power outages.
- Parameter settings archived in nonvolatile memory allows unit configuration to be available after long periods of power outages.

Control and status parameters and alarms

Control

- BACview occupancy schedule
- System control: Schedule, Manual ON, BAS command, or DI Enable
- Unit blower control
- Compressor 1 control
- Compressor 2 control
- Compressor 3 control
- Compressor 4 control
- Unit enable manual control (optional)
- Humidity control (modulating hot gas re-heat optional)
- Condenser water valve control (flex required)
- Economizer control
- Damper control

Status

- Cooling control status
- Cooling demand percentage (0-100%)
- Discharge air temperature
- Return air temperature
- Leaving water temperature
- Entering water temperature
- Unit filter status (optional)
- Fan-hours runtime counter (filter replacement indicator)
- Fan starts counter
- Compressor 1 starts counter
- Compressor 2 starts counter
- Compressor 3 starts counter
- Compressor 4 starts counter

Alarms

- Leaving water temperature high/low trip
- Discharge air temperature high/low trip
- Entering water temperature high/low trip
- Sensor failure alarm
- Unit filter runtime trip (optional)
- Comp 1 runtime trip
- Comp 2 runtime trip
- Comp 3 runtime trip
- Comp 4 runtime trip
- Freeze stat sensor UPM alarm (optional)
- Low pressure sensor UPM alarm
- High pressure sensor UPM alarm
- Low pressure sensor UPM alarm
- High pressure sensor UPM alarm
- Condensate overflow UPM alarm
- High/low voltage UPM alarm

Sequence of operation, VAV units

Control source (run conditions) — The unit may have external or internal control sources to initiate heating or cooling operation.

External control source — The unit may be controlled from the following external sources:

- Digital Input
- BAS – Building Automation System
- Manual On

Digital input — Provides a method of running the unit by providing a contact closure (On/Off) to UI-12. Digital input provides a simple interface for enabling unit operation. Once enabled, the unit will run until the occupied set point has been satisfied.

BAS — Provides a network interface to the heat pump. The I/O Flex 6126 controller supports the following building automation protocols:

COMMUNICATION PROTOCOL	
BACnet	Building Automation and Control network
Modbus	Common open industrial protocol standard
LonWorks	LonWorks Automation and control network (Card required)

Manual On — Places the unit in manual run mode; the unit will operate until the set point is satisfied.

Internal control source (keypad) — All controllers are provided with a battery backup real time clock. When configured for Keypad, the internal scheduler uses the local time and user schedule to initiate unit operation. Occupied schedule: 56 F supply air set-point (adjustable)

Unit mode

The unit mode is used to configure the unit per its specific design configuration and application. A unit mode may be selected from the following:

- Cooling only
- Cooling only with hot gas re-heat

Cooling only — The unit is configured for mechanical cooling.

Cooling only with hot gas re-heat — The unit is configured for cooling only with active humidity control. Please see Discharge Air Control with Modulating Re-heat on page 31 for additional details.

Fan modes

The Fan mode option is used to select the type of fan hardware being used with the unit. Fan hardware is application

specific and will determine the behavior for the specific application for which it is being applied.

The Fan option may be configured with one of the following options:

- Supply Air Fan (SAF) Start/Stop (also known as On/Off signaling)
- Variable Frequency Drive (or Variable Fan used in VAV applications)
- Return Fan interlock with Supply Fan (if SAF runs RAF runs)

Start/stop fans — The fan enable signal is provided on BO-1 of the I/O Flex 6126 controller; operation is interlocked with cooling and re-heat operations. The return air fan can be enabled via the BACview tool, and it will be commanded 5 seconds after the supply fan has been engaged at all times.

The supply fan can also be set to stop if the return fan is in alarm via the BACview tool.

Variable frequency drive (VFD) fan — The VFD uses an analog signal (0-10V) to control the speed of the blower. This signal is output from Analog Output 1 (AO-1) of the I/O Flex 6126 controller.

The supply and return air fan speeds are modulated by independent PID loops to maintain independent static pressure set points; the factory-provided duct static pressure sensor is required as input (connected to UI 11 for supply and IN-10 for return) on the I/O Flex 6126 controller and I/O Flex EX8160 expander, for the VFD blower option. Units do not allow for mounting of the return fan VFD inside the equipment and require the VFD equipment to be mounted close to the unit. An inside wall in the mechanical room close to the unit is typically used for mounting an external VFD. Return fans are not included inside the 50BV units.

Supply and return fan operation — When the unit control is set for occupied operation the fan will run continuously as the default behavior. If the return fan is enabled, it will follow the operation of the supply fan mode which may be modified to cycle only during mechanical operation. During unoccupied operation the fan will only cycle during a call to maintain a cooling set point. Return fans are not included inside the 50BV units.

Fan operation during discharge (supply air temperature) air control (DAC) — For DAC applications, the fan speed is calculated as a demand percent calculated based on the PID static pressure sensor value and the static pressure set point.

If static pressure reset strategies are utilized, the minimum fan speed recommended is 40% of nominal CFM. If the fan demand is less than 40% of nominal CFM (20% for the return fan) the PID loop will be disregarded and the fan will run at the minimum value.

Units configured for discharge air control will run only when the controller is in occupancy mode.

VFD control — The following applies for VFD Control:

- Variable frequency drive fan control requires a static pressure measurement. A duct static pressure sensor is factory supplied to be installed in the field.
- The static pressure sensor uses inches of water column as the unit of measure.
- The static pressure sensor is configured for UI-11 port of the I/O Flex 6126 controller for the supply duct and IN-10 for the return air duct.
- The static pressure set point is user configurable and is used by the static pressure PID control.
- The minimum VFD fan speed is user configurable and is set during the test and balance phase of the commissioning phase.
- A high static pressure alarm will be generated for a static pressure exceeding the maximum static pressure trip point for a minimum of 10 minutes.
- The static pressure sensor will be range-validated and a sensor failure alarm will be generated for a missing sensor.
- The VFD output may be switched to a constant value for a smoke event if enabled.
- For VFD factory-installed parameters, please see latest 50BV Installation, Start-Up, Service and Controls Operation and Troubleshooting manual.

Fan operation during smoke event — The speed of the fan during a smoke event is user configurable for VFD enabled units (defaults to 100%).

Fan history statistics — The controller will collect fan history statistics and sum the total number of fan start events that occurred in the preceding 1-hour period. The fan history may be reset by the user. Fan history reset may be performed locally at the unit with a BACview terminal.

Digital inputs for monitoring

The controller software may be configured to provide digital inputs for monitoring unit faults and alarms. The equipment integrator must configure the input for the appropriate installed option and desired function. The functional options may be configured via a local terminal or building automation system.

Filter status (DFS) — The I/O Flex 6126 controller has the option of providing a filter alarm for indicating that the filter needs servicing. The filter-status service option may be implemented with hardware or with fan run time. The filter switch hardware is field provided and installed, and is connected directly to IN-4 on the I/O Flex EX8160 expander with a contact closure indicating a service event.

The following applies to the filter status:

- The filter status (replacement) may be configured for accumulated running time.
- The total fan run time prior to filter service is user configurable, factory default 2000 hrs.
- The filter timer may be reset upon the filter being serviced.

Water differential pressure switch (DPS) — The differential pressure switch is applied to a unit for which the flow of water through the heat exchange must be confirmed prior to the unit operating. The differential pressure switch hardware is connected directly to IN-6.

In addition, the following applies to the DPS option:

- An alarm notification is set if the DPS is asserted True (No flow condition).
- A DPS alarm will terminate compressor operation.
- Three DPS events will hard lockout the unit.
- The DPS hard lockout condition which will keep the unit off can be cleared by a reset via the BACview tool.
- A sum of all DPS events will be logged for a 1-hour period.

Smoke detector status (SDS) — The unit may be set up to receive a smoke event via a contact closure. The smoke detector input is available for field wiring on IN-1 of the I/O Flex EX8160 expander.

The response to a smoke event must be determined by safety regulations and jurisdiction of the local governing body. The smoke detector response must be enabled and set up upon system start-up. The default behavior for a smoke event will terminate the operation of the unit (fan and compressor).

The unit may be configured for operation during a smoke event for specific safety applications. Variable frequency drive configured units can be configured for a specific fan speed during a smoke event.

A smoke detector contact closure on IN-1 will produce a Smoke Alert.

Compressor status — The unit is equipped with compressor status current transducers and Input Expansion Modules (IEMs) and will verify that the compressor stages are running by monitoring the status of the current switches. If the compressor fails (no current flow) an individual alarm per compressor stage will occur.

The controller will identify the compressor operating in the following three modes:

- Auto (No alarm)
- Hand Mode
- Failed

Cooling operation

The controller will maintain the supply air temperature and set point by staging the compressor(s). To prevent short-cycling, there is a 10-minute delay between compressor stages. Additionally, there will be a 3-minute delay (adj.) to prove water flow prior to Compressor 1 operation when the unit is first powered on. The compressor will run subject to internal safeties and controls provided by the UPM board.

For discharge air control applications the following minimum on-times and off-times are applicable:

DISCHARGE AIR CONTROL

COMPRESSOR 1		COMPRESSOR 2		COMPRESSOR 3		COMPRESSOR 4	
Min ON	Min OFF	Min ON	Min OFF	Min ON	Min OFF	Min ON	Min OFF
10	5	10	5	10	5	7	5

If for any reason the compressor alarms reset, the unit compressors will start within 10 seconds of each other.

Cooling — Cooling will be enabled whenever:

- Unit is in occupied mode
- The fan output is on
- The loop valve is open

Cooling mode — When commanded into cooling mode, the unit will energize the condenser water valve and wait for its valve end switch to be made prior to energizing the compressors.

Once the valve has been proved open the unit will command the compressor to stage according to the cooling percentage required. This value is provided via a reverse acting PID loop which compares the supply air temperature (SAT) value and the SAT cooling set point.

The unit monitors return air temperature to assure air entering the unit is greater than 60 F (adj.) prior to running in the cooling with modulating hot gas re-heat, when the controller is set to operate with multiple reset points. If the controller is set to operate with single return temperature reset the factory default value will be the free cooling value 50 F (adj.)

If at any time the cooling set point is greater than the return air temperature (RAT) the unit will enter into economizer assist mode.

Compressors will be staged as follows.

Compressor 1 will run:

When the fan is running

AND the condenser valve is proved.

AND the cooling demand is greater than 25%

Compressor 2 will run:

When compressor 1 has run for 10 min

AND the cooling demand is greater than 50%

Compressor 3 will run:

When compressor 2 has run for 10 min

AND the cooling demand is greater than 75%

Compressor 4 will run:

When compressor 2 has run for 10 min

AND the cooling demand is greater than 90%

When the unit runs in cooling mode the hot gas re-heat valve will be enabled and modulated to maintain supply air temperature set point; factory default is 55 F ± 4° F.

Discharge air control with modulating re-heat — When in cooling mode, if the unit is equipped with modulating hot gas re-heat, the hot gas re-heat will be enabled and modulated to maintain supply air temperature set point; factory default is 55 F (adj.) ± 4° F.

Controls — 50BVJ,W (cont)

The cooling stages can be reset based on a single point or multiple return air temperature (RAT) values as follows:

Single:	
Free Cooling	50 F < RAT
Mechanical Cooling	RAT > 50 F (enabled)
Multiple:	
Free Cooling	50 F <RAT < 59 F
Mechanical Cooling (Comp 1)	60 F <RAT < 69 F (adj.)
Mechanical Cooling (Comp 2)	70 F <RAT < 77 F (adj.)
Mechanical Cooling (Comp 3)	78 F <RAT < 83 F (adj.)
Mechanical Cooling (Comp 4)	RAT > 83 F (adj.)

All values have a hysteresis of 2.0° F.

If discharge air set point reset is required, when the value of the discharge air set point is greater than the value of the return air reset for a particular compressor, the return limit will have to be adjusted via BACnet to compensate for the demand changes and release. The particular compressor stage or the unit must be set to a single reset point and the discharge set point reset can be adjusted as needed.

Any of the following alarms will immediately shut down all compressor stages. Refer to the sensor section or the integration points list in the Installation, Start-Up, Service and Controls Operation and Troubleshooting manual for default values:

- Leaving water high
- Leaving water low
- Entering later low
- Fan alarms
- Low static pressure
- Water differential pressure switch (DPS)
- Smoke

Discharge (supply) air temperature (DAT) sensor — The DAT sensor is shipped loose in the electrical controls box compartment and is to be field installed in the supply duct work and terminated on UI-6 of the I/O Flex 6126 controller.

The sensor should be installed where the air flow pattern is laminar to avoid temperature stratification. If supplemental heating is to be installed then the DAT sensor should be mounted downstream of the discharge side of the heating coil.

High discharge (supply) air temperature condition (cooling) — DAT measurements are tested for a high limit trip above 70 F. An alarm is asserted for high discharge air temperature under the following conditions:

- DAT is above the high limit for 5 minutes
- Fan operation asserted
- Cooling mode
- Valid DAT sensor measurement

High static lock — The controller will monitor the static pressure high limit switch (if installed) and will increment a counter every time the static pressure switch trips. A High Static Alarm will be generated, and will reset automatically. Upon receiving the alarm 3 times, the unit will lock out to protect the ductwork and prevent cycling of major unit components.

Waterside economizer mode — If the entering water temperature is less than the set point 55 F (adj.) the unit will transition to economizer mode:

- Disable mechanical cooling stage 1 operation for minimum of 12 minutes.
- Enable economizer valve.
- Waterside economizer will operate until the entering water temperature reset value is reached; default is 58 F (adj).

When in economizer mode, if the entering water temperature reaches the reset value in less than 5 minutes, the first stage of mechanical cooling operation will be disabled for at least 5 minutes.

In economizer operation, if the unit requires additional stages of mechanical cooling the controller will command them according to the unit demand percentage calculated by the Cooling PID. If additional stages of cooling were running those will be maintained.

The fan will continue to modulate to meet the static pressure set point and the economizer valve will be commanded to open and the economizer will be treated as the first stage of cooling.

Leaving water temperature — The controller will monitor the leaving water temperature. Refer to the Factory-Provided Sensors table. Alarms will be provided as follows:

- High Leaving Water Temp: If compressor(s) is running and the leaving water temperature is greater than 135 F (adj.).
- Low Leaving Water Temp: If compressor(s) is running and the leaving water temperature is less than 33 F (adj.).
- Leaving Water Sensor Failure: If leaving water sensor outside of normal operating limits. Should a High or Low Leaving Water Temperature Alarm occur, the call for cooling will be removed.

UPM fault monitor

The controller will monitor both Unit Protection Modules (UPM1 and UPM2) fault inputs.

Upon hard lockout alarm, compressors are disabled by the UPM board.

Alarms will be provided through BACnet point current alarm as follows:

- HP1: High Pressure Alarm (circuit 1)
- HP2: High Pressure Alarm (circuit 2)
- LP1: Low Pressure Alarm (circuit 1)
- LP2: Low Pressure Alarm (circuit 2)
- HP3: High Pressure Alarm (circuit 3)
- HP4: High Pressure Alarm (circuit 4)
- LP3: Low Pressure Alarm (circuit 3)
- LP4: Low Pressure Alarm (circuit 4)
- FRE: Freeze Alarm
- FRE2: Freeze Alarm
- CON: Condensate Alarm B
- RN: Brownout Alarm

FACTORY-PROVIDED SENSORS FOR VAV UNITS 50BVJ,W

UNIT	DESCRIPTION	QTY	SHIPPING LOCATION	INSTALLATION LOCATION
50BVJ 020-034	Supply Air Temperature Sensor	1	loose for field installation	Supply air stream
	Return Air Temperature Sensor	1	loose for field installation	Return air stream
	Entering Water Temperature	1	Installed	Condenser entering water
	Leaving Water Temperature	1	Installed	Condenser leaving water
	Duct Static Pressure Sensor	1	loose for field installation	Supply air stream
	Compressor Current Transducer	*	Installed	Unit electrical box
50BVW 034-064	Supply Air Temperature Sensor	1	loose for field installation	Supply air stream
	Return Air Temperature Sensor	4	loose for field installation	Return air stream
	Entering Water Temperature	1	Installed	Condenser entering water
	Leaving Water Temperature	1	Installed	Condenser leaving water
	Duct Static Pressure Sensor	1	loose for field installation	Supply air stream
	Compressor Current Transducer	*	Installed	Unit electrical box

*1 per compressor.

Guide specifications — 50BVC, Q units

Indoor Packaged Unit
Constant Volume Application

HVAC Guide Specifications

Size Range: **18 to 30 Tons**

Carrier Model Number:

50BVC — Water-Cooled Packaged Cooling Unit

50BVQ — Water-Cooled Vertical Heat Pump

Part 1 — General

1.01 SYSTEM DESCRIPTION

Units shall be water-cooled, cooling only; or water-cooled heat pump series self-contained packaged air-conditioning units. Capacities, models, and unit arrangement shall be as shown on the unit schedule and the contract drawings.

1.02 QUALITY ASSURANCE

A. Units shall be listed for UL (Underwriters Laboratories) and UL, Canada. Units shall conform to ANSI (American National Standards Institute)/UL standard 1995. Unit shall be accepted for use in the City of New York by the Department of Buildings (MEA).

B. Each unit shall be completely factory assembled, piped, wired, and tested. Units shall be leak tested and charged with a full operating charge of R-410A refrigerant.

C. Factory test shall include, but not be limited to: complete run check of all electrical components and safeties, including proper control sequencing; pressure test of refrigerant coils and condensers; leak check of completed refrigerant circuits; leak check of completed water circuit (water-cooled units only); compressor run check.

Part 2 — Products

2.01 EQUIPMENT

A. General:

The unit shall be factory assembled. Water-cooled units shall be built for an entering-water temperature range from 55 to 105 F. Contained within the unit enclosure shall be all factory wiring, piping, controls, refrigerant charge (R-410A), and special features required prior to field start-up.

B. Unit Cabinet:

1. Unit shall be post and panel construction. Unit exterior panels shall be 18 gage G90 galvanized steel for corrosion protection (unpainted).
2. Interior of the unit shall be insulated with $^1/_2$-in. thick, dual density, coated fiberglass.
3. Two blower and two compressor compartment access panels shall be removable with supply and return ductwork in place. A duct collar shall be provided on the supply air opening of all units.
4. Units shall have an insulated divider panel between the air-handling section and the compressor section to minimize the transmission of compressor noise, and to permit operational service testing without air bypass.
5. Units shall have a stainless steel condensate drain pan.

C. Evaporator:

1. The direct expansion coil shall be a minimum of 3 rows and be fabricated from $^3/_8$-in. or $^3/_4$-in. OD seamless copper tubing, mechanically bonded to rippled and corrugated aluminum fins.
2. Each individual evaporator coil shall be removable for replacement without disturbing the remaining refrigerant circuits.
3. Each evaporator coil circuit shall be fed by an adjustable thermostatic expansion valve, with external equalizer, sized to provide efficient operation at full and part load operating points in the cooling and heating (heat pump only) modes.

D. Supply Fan:

1. Supply fans shall be double-width double-inlet (DWDI) forward-curved type with dynamically balanced wheels.
2. The housings and wheels shall be designed for quiet low velocity operation.
3. Fan motors shall be 1725 or 3450 rpm, 56 frame sealed ball bearing type. Motors shall be permanently lubricated and have thermal overload protection.
4. The drive shall include a fixed pitch blower sheave and variable pitch motor sheave with multiple matched belts, sized for 115% of the fan brake horsepower.
5. Units shall be available with factory-installed optional blower orientation. See unit certified drawing for details.
6. Airflow configurations shall include front return, top supply; front return, rear supply; rear return, top supply; and rear return, front supply.

E. Reverse Cycle Operation (Heat Pump Only):

Heat pump units shall be equipped with reversing valves to allow operation in the reverse cycle heating mode.

F. Refrigeration Circuit:

1. Each unit shall contain multiple independent refrigeration circuits.
2. Each circuit shall include a high-efficiency heavy-duty scroll compressor.
3. Each circuit shall have high and low pressure cutouts.
4. Each circuit shall be dehydrated and factory charged with R-410A. Remote air-cooled units will be shipped with a nitrogen holding charge only.
5. Suction and discharge Schrader valves shall be provided for manifold gage connections to facilitate servicing.
6. Optional hot gas re-heat shall be provided, either cycling or modulating, to help control humidity levels.

7. Optional hot gas bypass shall be provided to allow unit operation under extended operating conditions to avoid coil freeze-up.

G. Compressors:
   1. Each unit shall have multiple high-efficiency scroll compressors with internal or external motor protection and a time delay to prevent short cycling and simultaneous starting of compressors following a power failure.
   2. Each compressor shall be on an independent refrigerant circuit.
   3. The compressors shall be mounted on rubber isolators.

H. Water-Cooled Condensers:
   1. All condensers shall be coaxial tube-in-tube for maximum heat transfer efficiency and performance.
   2. Inner water tubes shall be either standard copper or optional cupronickel with large internal diameters for reduced waterside pressure drops.
   3. Outer tubes shall be steel, painted for corrosion protection.
   4. All condensers shall be rated at 600 psig operating refrigerant pressures and 400 psig waterside pressures.
   5. Units shall be rated down to 50 F without the use of water regulating valves.

I. Filter Section:

   The unit shall be supplied with 1-in. thick, 30% efficiency filters.

J. Electrical:
   1. Each unit shall be wired and tested at the factory prior to shipment.
   2. Wiring shall comply with NEC requirements and shall conform with all applicable UL standards.
   3. The units shall have a single point power connection. Control power shall be supplied through a factory-installed, low voltage control circuit transformer with an integral resettable circuit breaker.
   4. A terminal block shall be provided for the main power connection.

K. Controls, Safeties, and Diagnostics
   1. The Unit Protection Module (UPM) is a printed circuit board (PCB) that interfaces with the thermostat or the digital direct controller. The main purpose of this device is to protect the compressors by monitoring the different states of switches and sensors of each refrigerant circuit. This device provides time delays and protects the unit against freezing of the water and refrigerant heat exchangers as well as condensate overflow.
   2. Controls shall be capable of performing the following functions:
      a. Random power start-up. This feature prevents multiple units sharing same electrical circuit or network from starting at the same time.
      b. Anti-short cycle delay. This feature protects the compressor short cycling if the Y call is set and removed.
      c. High pressure protection.
      d. Selectable Alarm Mode. The UPM controller can be configured to have either a constant signal or a pulse.
      e. Freeze protection.
      f. Condensation overflow.
      g. Brownout protection. The UPM controller will constantly monitor the power supply. If the nominal voltage drops below 25% of its value (18 vac approximately), the unit will enter brownout protection mode.

L. Special Features:
   1. Waterside Economizer:
      a. Shall function as first stage of cooling when free cooling is available. Economizer coil valve can be modulated to control discharge-air temperature when the economizer can meet or exceed cooling needs.
      b. Consists of the economizer coil, one 3-way valve, vent and drain fittings and the required piping. Economizer coils are 2 or 4-row coils. The unit controller controls all required control logic and changeover.
   2. Hot water coil shall be factory-installed on the inlet side of the direct expansion cooling coils with field piping connections on the side of the unit.
   3. Energy management and alarm 24-vac relay package shall be provided to remotely start and stop units with constant volume configuration. An additional relay is provided to close when a compressor malfunction is detected, providing remote signaling to a building automation system.
   4. Cupronickel condenser shall provide higher corrosion protection.
   5. Insulated basepan shall provide additional sound deadening characteristics and corrosion protection in the compressor compartment.
   6. Condensate overflow switch shall provide protection against condensate overflow. The mechanical safety switch shall be located in the unit's evaporator basepan.
   7. Extended range option shall provide condensate protection on the condenser waterside for humid applications.
   8. Freeze protection switch shall provide evaporator coil protection against freezing.

Guide specifications — 50BVJ units

Indoor Packaged Unit
Variable Air Volume Application

HVAC Guide Specifications

Size Range: **18 to 30 Tons**

Carrier Model Number:

50BVJ — Water-Cooled Packaged Cooling Unit

Part 1 — General

1.01 SYSTEM DESCRIPTION

Units shall be water-cooled, cooling only self-contained packaged air-conditioning units. Capacities, models, and unit arrangement shall be as shown on the unit schedule and the contract drawings.

1.02 QUALITY ASSURANCE

A. Units shall be listed for UL (Underwriters Laboratories) and UL, Canada. Units shall conform to ANSI (American National Standards Institute)/UL standard 1995. Unit shall be accepted for use in the City of New York by the Department of Buildings (MEA).

B. Each unit shall be completely factory assembled, piped, wired, and tested. Water-cooled units shall be leak tested and charged with a full operating charge of R-410A refrigerant.

C. Factory test shall include, but not be limited to: complete run check of all electrical components and safeties, including proper control sequencing; pressure test of refrigerant coils and condensers; leak check of completed refrigerant circuits; leak check of completed water circuit (water-cooled units only); compressor run check.

Part 2 — Products

2.01 EQUIPMENT

A. General:

The unit shall be factory assembled. Water-cooled units shall be built for an entering-water temperature range from 55 to 105 F. Contained within the unit enclosure shall be all factory wiring, piping, controls, refrigerant charge (R-410A), and special features required prior to field start-up.

B. Cabinet:

1. Unit shall be post and panel construction. Unit exterior panels shall be 18 gage G90 galvanized steel for corrosion protection (unpainted).
2. Interior of the unit shall be insulated with 1/2-in. thick, dual density, coated fiberglass.
3. Two blower and two compressor compartment access panels shall be removable with supply and return ductwork in place. A duct collar shall be provided on the supply-air opening of all units.
4. Units shall have an insulated divider panel between the air-handling section and the compressor section to minimize the transmission of compressor noise, and to permit operational service testing without air bypass.
5. Units shall have a stainless steel condensate drain pan.

C. Evaporator Coil:

1. The direct expansion coil shall be a minimum of 3 rows and be fabricated from 3/8-in. or 1/2-in. OD seamless copper tubing, mechanically bonded to rippled and corrugated aluminum fins.
2. Each individual evaporator coil shall be removable for replacement without disturbing the remaining refrigerant circuits.
3. Each evaporator coil circuit shall be fed by an adjustable thermostatic expansion valve, with external equalizer, sized to provide efficient operation at full and part load operating points in the cooling mode.

D. Supply Fan:

1. Supply fans shall be double-width double-inlet (DWDI) forward-curved type with dynamically balanced wheels.
2. The housings and wheels shall be designed for quiet low velocity operation.
3. Fan motors shall be 1725 or 3450 rpm, 56 frame sealed ball bearing type. Motors shall be permanently lubricated and have thermal overload protection. Motors shall be compatible with variable frequency drive (VFD).
4. The drive shall include a fixed pitch blower sheave and variable pitch motor sheave with multiple matched belts, sized for 115% of the fan brake horsepower, and provide maximum static capability in stable fan operation and when applied with variable frequency drive (VFD).
5. Units shall be available with factory-installed optional blower orientation. See unit certified drawings for details.

E. Supply Fan Capacity Control/Variable Frequency:

Variable frequency drive (VFD) shall include:

1. Factory-installed VFD motor control device, provided with a NEMA Type 1 enclosure, and factory-mounted, wired and tested. The VFD shall control motor speed to maintain set point static pressure at the supply duct sensor location.
2. Differential pressure transducer, 2 to 10 vdc output to unit control module, with adjustable set point range (0.0 to 5.0 in. wg [0 to 1246 Pa]), adjustable via unit control keypad (BACview).
3. Low pressure reference tube factory installed.

F. Refrigeration Circuit:

1. Each unit shall contain multiple independent refrigeration circuits.
2. Each circuit shall include a high-efficiency heavy-duty scroll compressor.
3. Each circuit shall have high and low pressure cutouts.
4. Each circuit shall be dehydrated and factory charged with R-410A (water-cooled units).

5. Suction and discharge Schrader valves shall be provided for manifold gage connections to facilitate servicing.
6. Hot gas bypass shall be provided to allow unit operation under extended operating conditions to avoid coil freeze-up.
7. Modulating hot gas re-heat shall be provided to help control discharge air conditions.

G. Compressors:
1. Each unit shall have multiple high-efficiency scroll compressors with internal or external motor protection and a time delay to prevent short cycling and simultaneous starting of compressors following a power failure.
2. Each compressor shall be on an independent refrigerant circuit.
3. The compressors shall be mounted on rubber isolators.

H. Water-Cooled Condensers:
1. All condensers shall be coaxial tube-in-tube for maximum heat transfer efficiency and performance.
2. Inner water tubes shall be either standard copper or optional cupronickel with large internal diameters for reduced waterside pressure drops.
3. Outer tubes shall be steel, painted for corrosion protection.
4. All condensers shall be rated at 600 psig operating refrigerant pressures and 400 psig waterside pressures.
5. Units shall be rated down to 50 F without the use of water regulating valves.

I. Filter Section:

The unit shall be supplied with 1-in. thick, 30% efficiency filters.

J. Electrical:
1. Each unit shall be wired and tested at the factory prior to shipment.
2. Wiring shall comply with NEC requirements and shall conform with all applicable UL standards.
3. The units shall have a single point power connection. Control power shall be supplied through a factory-installed, low voltage control circuit transformer with an integral resettable circuit breaker.
4. A terminal block shall be provided for the main power connection.

K. Controls, Safeties, and Diagnostics:
1. The Unit Protection Module (UPM) is a printed circuit board (PCB) that interfaces with the thermostat or the digital direct controller. The main purpose of this device is to protect the compressors by monitoring the different states of switches and sensors of each refrigerant circuit. This device provides time delays and protects the unit against freezing of the water and refrigerant heat exchangers as well as condensate overflow.
2. Controls shall be capable of performing the following functions:
   a. Random power start-up. This feature prevents multiple units sharing same electrical circuit or network from starting at the same time.
   b. Anti-short cycle delay. This feature protects the compressor short cycling if the Y call is set and removed.
   c. High pressure protection.
   d. Selectable Alarm Mode. The UPM controller can be configured to have either a constant signal or a pulse.
   e. Freeze protection.
   f. Condensation overflow.
   g. Brownout protection. The UPM controller will constantly monitor the power supply. If the nominal voltage drops below 25% of its value (18 vac approximately), the unit will enter brownout protection mode.
3. Variable air volume (VAV) controls shall be capable of performing the following monitoring and alarm functions:
   a. High static lock
   b. Supply fan status
   c. Return fan status
   d. Filter status
   e. Smoke detector
   f. Low leaving water temperature
   g. Leaving water temp sensor failure
   h. Supply air sensor failure
   i. High and low supply air temperature

L. Special Features:
1. Waterside Economizer:
   a. Shall function as first stage of cooling when free cooling is available. Economizer coil valve can be modulated to control discharge-air temperature when the economizer can meet or exceed cooling needs.
   b. Consists of the economizer coil, one 3-way valve, vent and drain fittings and the required piping. Economizer coils are 2 or 4- row coils. The unit controller controls all required control logic and changeover.
2. Hot water coil shall be factory-installed on the inlet side of the direct expansion cooling coils with field piping connections on the side of the unit.
3. Energy management and alarm 24-vac relay package shall be provided to remotely start and stop units with constant volume configuration. An additional relay is provided to close when a compressor malfunction is detected, providing remote signaling to a building automation system.

4. Cupronickel condenser shall provide higher corrosion protection.
5. Insulated basepan shall provide additional sound deadening characteristics and corrosion protection in the compressor compartment.
6. Condensate overflow switch shall provide protection against condensate overflow. The mechanical safety switch shall be located in the unit's evaporator basepan.
7. Extended range option shall provide condensate protection on the condenser waterside for humid applications.
8. Freeze protection switch shall provide evaporator coil protection against freezing.

M. Accessories:

1. Keypad/Display Module (BacView6):

   Module shall provide hardware necessary for human interface with the unit integrated system controls. Module shall contain a keypad and display for interactive communication. Display shall be two-line, backlit alphanumeric liquid crystal display (LCD). Each line of the LCD shall display up to 24-character (with expanded scrolling display capability). Keypad shall contain 12 numeric keys, 6 function keys, and 4 operative keys. Module shall contain RJ-14 data cable connection for simple installation and to facilitate remote location installation. Module shall be powered by unit's 24-v control circuit.

Guide specifications — 50BVT,V units

Indoor Packaged Unit
Constant Volume Application

HVAC Guide Specifications

Size Range: **30 to 60 Tons**

Carrier Model Number:

50BVT — Water-Cooled Packaged Cooling Unit

50BVV — Water-Cooled Vertical Heat Pump

Part 1 — General

1.01 SYSTEM DESCRIPTION

Units shall be water-cooled, cooling only or water-cooled heat pump self-contained packaged air-conditioning units. Capacities, models, and unit arrangement shall be as shown on the unit schedule and the contract drawings.

1.02 QUALITY ASSURANCE

A. Units shall be listed for UL (Underwriters Laboratories) and UL, Canada. Units shall conform to ANSI (American National Standards Institute)/UL standard 1995. Unit shall be accepted for use in the City of New York by the Department of Buildings (MEA).

B. Each unit shall be completely factory assembled, piped, wired, and tested. Units shall be leak tested and charged with a full operating charge of refrigerant.

C. Units shall then be disassembled into their individual modules for shipping and assembly on site.

D. Factory test shall include, but not be limited to: complete run check of all electrical components and safeties, including proper control sequencing; pressure test of refrigerant coils and condensers; leak check of completed refrigerant circuits; leak check of completed water circuit (water-cooled units only); compressor run check.

Part 2 — Products

2.01 EQUIPMENT

A. General:

The unit shall be comprised of two distinct modules: the main air-conditioning section and the filter/pre-cooling coil section. Water-cooled units shall be built for an entering water temperature range from 55 to 105 F. The unit shall be designed for easy assembly. The refrigeration circuit shall remain intact during disassembly and reassembly. All high-boy modules shall be able to pass through a 36-in. steel framed door.

B. Cabinet:

1. The frame shall be fabricated of an angle iron framework. Unit exterior panels shall be 18 gage G90 galvanized steel for corrosion protection.
2. Each section shall incorporate removable access panels. The complete cabinet frame and access panels shall be insulated with 1/2-in., dual density, coated fiberglass insulation.
3. The main air conditioning section and the filter/pre-cooling coil section shall contain a stainless steel drain pan.
4. Low-boy cabinet shall be available on all models. Blower shall be dropped into main coil section, reducing the overall height of the unit. This is for those applications where there is a restriction in the height of the unit.

C. Evaporator:

1. The direct expansion coil shall be a minimum of 3 rows and be fabricated from 3/8-in. or 3/4-in. OD seamless copper tubing, mechanically bonded to rippled and corrugated aluminum fins.
2. Each individual evaporator coil shall be removable for replacement without disturbing the remaining refrigerant circuits.
3. Each evaporator coil circuit shall be fed by an adjustable thermostatic expansion valve, with external equalizer, sized to provide efficient operation at full and at part load operating points in the cooling modes.

D. Supply Fan:

1. Supply fans shall be double-width double-inlet (DWDI) forward curved type of Class II construction.
2. All fans shall be statically and dynamically balanced.
3. Fan shafts shall be mounted in heavy-duty 150,000-hour greasable pillow-block bearings.
4. The fan motor shall be open drip-proof (ODP), three-phase, NEMA T-frame E high-efficiency EPACT rated, 1800 rpm, with grease lubricated ball bearings.
5. The drive shall include a fixed pitch blower sheave and variable pitch motor sheave with multiple V-belts sized for 115% of the fan brake horsepower.
6. Airflow configurations shall include rear return, front supply; and rear return, rear supply.
7. Units shall be available with factory-installed optional blower orientation. See unit certified drawings for details.

E. Reverse Cycle Operation (Heat Pump Only):

Heat pump units shall be equipped with reversing valves to allow operation in the reverse cycle heating mode.

F. Refrigeration Circuit:

1. Each unit shall contain multiple independent refrigeration circuits.
2. Each circuit shall include a high-efficiency heavy-duty scroll compressor.
3. Each circuit shall have high and low pressure cutouts.
4. Each circuit shall be dehydrated and factory charged with R-410A (water-cooled units).
5. Suction and discharge Schrader valves shall be provided for manifold gage connections to facilitate servicing.

6. Optional hot gas bypass shall be provided to allow unit operation under extended operating conditions to avoid coil freeze-up.

G. Compressors:
1. Each unit shall have multiple high-efficiency scroll compressors with internal or external motor protection and a time delay to prevent short cycling and simultaneous starting of compressors following a power failure.
2. Each compressor shall be on an independent refrigerant circuit.
3. The compressors shall be mounted on rubber isolators.

H. Water-Cooled Condensers:
1. All condensers shall be coaxial tube-in-tube for maximum heat transfer efficiency and performance.
2. Inner water tubes shall be either standard copper or optional cupronickel with large internal diameters for reduced waterside pressure drops.
3. Outer tubes shall be steel, painted for corrosion protection.
4. All condensers shall be rated at 600 psig operating refrigerant pressures and 400 psig waterside pressures.
5. Units shall be rated down to 50 F without the use of water regulating valves.

I. Filter Section:

The unit shall be supplied with 4-in. deep pleated, 30% high-efficiency filters. The filters shall have side access capability through an access panel.

J. Electrical:
1. Each unit shall be wired and tested at the factory prior to shipment.
2. Wiring shall comply with NEC requirements and shall conform with all applicable UL standards.
3. The units shall have a single point power connection. Control power shall be supplied through a factory-installed, low voltage control circuit transformer with an integral resettable circuit breaker.
4. The fan motor starter shall have a magnetic three-line, ambient compensated overload protector with a manual reset.
5. A terminal block shall be provided for the main power connection.

K. Controls, Safeties, and Diagnostics:
1. The Unit Protection Module (UPM) is a printed circuit board (PCB) that interfaces with the thermostat or the digital direct controller. The main purpose of this device is to protect the compressors by monitoring the different states of switches and sensors of each refrigerant circuit. This device provides time delays and protects the unit against freezing of the water and refrigerant heat exchangers as well as condensate overflow.
2. Controls shall be capable of performing the following functions:
   a. Random power start-up. This feature prevents multiple units sharing same electrical circuit or network from starting at the same time.
   b. Anti-short cycle delay. This feature protects the compressor short cycling if the Y call is set and removed.
   c. High pressure protection.
   d. Selectable Alarm Mode. The UPM controller can be configured to have either a constant signal or a pulse.
   e. Freeze protection.
   f. Condensation overflow.
   g. Brownout protection. The UPM controller will constantly monitor the power supply. If the nominal voltage drops below 25% of its value (18 vac approximately), the unit will enter brownout protection mode.

L. Special Features:
1. Waterside Economizer:
   a. Shall function as first stage of cooling when free cooling is available. Economizer coil valve can be modulated to control discharge-air temperature when the economizer can meet or exceed cooling needs.
   b. Consists of the economizer coil, one 3-way valve, vent and drain fittings and the required piping. Economizer coils are 2 or 4-row coils. The unit controller controls all required control logic and changeover.
2. Hot water coil shall be factory-installed on the inlet side of the direct expansion cooling coils with field piping connections on the side of the unit.
3. Hot gas re-heat shall help control humidity levels.
4. Energy management and alarm 24-vac relay package shall be provided to remotely start and stop units with constant volume configuration. An additional relay is provided to close when a compressor malfunction is detected, providing remote signaling to a building automation system.
5. Cupronickel condenser shall provide higher corrosion protection.
6. Hot gas bypass shall provide extended capacity operation and prevent coil freezing at low load conditions.
7. Insulated basepan shall provide additional sound deadening characteristics and corrosion protection in the compressor compartment.
8. Condensate overflow switch shall provide protection against condensate overflow. The mechanical safety switch shall be located in the unit's evaporator basepan.

9. Extended range option shall provide condensate protection on the condenser waterside for humid applications.
10. Freeze protection switch shall provide evaporator coil protection against freezing.

M. Accessories:

1. Keypad/Display Module (BacView6):

   Module shall provide hardware necessary for human interface with the unit integrated system controls. Module shall contain a keypad and display for interactive communication. Display shall be two-line, backlit alphanumeric liquid crystal display (LCD). Each line of the LCD shall display up to 24-character (with expanded scrolling display capability). Keypad shall contain 12 numeric keys, 6 function keys, and 4 operative keys. Module shall contain RJ-14 data cable connection for simple installation and to facilitate remote location installation. Module shall be powered by unit's 24-v control circuit.

Guide specifications — 50BVW units

Indoor Packaged Unit
Variable Air Volume Application

HVAC Guide Specifications

Size Range: **30 to 60 Tons**

Carrier Model Number:

50BVW — Water-Cooled Packaged Cooling Unit

Part 1 — General

1.01 SYSTEM DESCRIPTION

Units shall be water-cooled, cooling only self-contained packaged air conditioning units. Capacities, models, and unit arrangement shall be as shown on the unit schedule and the contract drawings.

1.02 QUALITY ASSURANCE

A. Units shall be listed for UL (Underwriters Laboratories) and UL, Canada. Units shall conform to ANSI (American National Standards Institute)/UL standard 1995. Unit shall be accepted for use in the City of New York by the Department of Buildings (MEA).

B. Each unit shall be completely factory assembled, piped, wired, and tested. Units shall be leak tested and charged with a full operating charge of refrigerant (water-cooled only).

C. Units shall then be disassembled into their individual modules for shipping and assembly on site.

D. Factory test shall include, but not be limited to: complete run check of all electrical components and safeties, including proper control sequencing; pressure test of refrigerant coils and condensers; leak check of completed refrigerant circuits; leak check of completed water circuit (water-cooled units only); compressor run check.

Part 2 — Products

2.01 EQUIPMENT

A. General:

The unit shall be comprised of two distinct modules: the main air-conditioning section and the filter/pre-cooling coil section. The unit shall be designed for easy assembly. Water-cooled units shall be built for an entering water temperature range from 55 to 105 F. The refrigeration circuit shall remain intact during disassembly and reassembly. All high-boy modules shall be able to pass through a 36-in. steel framed door.

B. Cabinet:

1. The frame shall be fabricated of an angle iron framework. Unit exterior panels shall be 18 gage G90 galvanized steel for corrosion protection.
2. Each section shall incorporate removable access panels. The complete cabinet frame and access panels shall be insulated with $^1/_2$-in., dual density, coated fiberglass insulation.
3. The main air conditioning section and the filter/pre-cooling coil section shall contain a stainless steel drain pan.
4. Low-boy cabinet shall be available on all models. Blower shall be dropped into main coil section reducing the overall height of the unit. This is for those applications where there is a restriction in the height of the unit.

C. Evaporator:

1. The direct expansion coil shall be a minimum of 3 rows and be fabricated from $^3/_8$-in. or $^3/_4$-in. OD seamless copper tubing, mechanically bonded to rippled and corrugated aluminum fins.
2. Each individual evaporator coil shall be removable for replacement without disturbing the remaining refrigerant circuits.
3. Each evaporator coil circuit shall be fed by an adjustable thermostatic expansion valve, with external equalizer, sized to provide efficient operation at full and at part load operating points in the cooling mode.

D. Supply Fan:

1. Supply fans shall be double-width double-inlet (DWDI) forward curved type of Class II construction.
2. All fans shall be statically and dynamically balanced.
3. Fan shafts shall be mounted in heavy-duty 150,000-hour greasable pillow-block bearings.
4. The fan motor shall be open drip-proof (ODP), three-phase, NEMA T-frame E high-efficiency EPACT rated, 1800 rpm, with grease lubricated ball bearings. Motor shall be compatible with variable frequency drive (VFD).
5. Fan shall be belt driven with fixed-pitch motor and fan pulley, with multiple matched belts; drive shall be selected for 110% of motor horsepower and to provide maximum static capability in stable fan operation and when applied with variable frequency drive (VFD).
6. Units shall be available with factory-installed optional blower orientation. See unit certified drawings for details.

E. Supply Fan Capacity Control/Variable Frequency:

Variable frequency drive (VFD) shall include:

1. Factory-installed VFD motor control device, provided with a NEMA Type 1 enclosure, and factory-mounted, wired and tested. The VFD shall control motor speed to maintain set point static pressure at the supply duct sensor location.
2. Differential pressure transducer, 2 to 10 vdc output to unit control module, with adjustable set point range (0.0 to 5.0 in. wg [0 to 1246 Pa]), adjustable via unit control keypad (BACview module).
3. Low pressure reference tube factory installed.

F. Refrigeration Circuit:

1. Each unit shall contain multiple independent refrigeration circuits.

2. Each circuit shall include a high-efficiency heavy-duty scroll compressor.
3. Each circuit shall have high and low pressure cutouts.
4. Suction and discharge Schrader valves shall be provided for manifold gage connections to facilitate servicing.
5. Hot gas bypass shall be provided to allow unit operation under extended operating conditions to avoid coil freeze-up.
6. Modulating hot gas re-heat shall be provided to help control discharge air conditions.

G. Compressors:
1. Each unit shall have multiple high-efficiency scroll compressors with internal or external motor protection and a time delay to prevent short cycling and simultaneous starting of compressors following a power failure.
2. Each compressor shall be on an independent refrigerant circuit.
3. The compressors shall be mounted on rubber isolators.

H. Water-Cooled Condensers:
1. All condensers shall be coaxial tube-in-tube for maximum heat transfer efficiency and performance.
2. Inner water tubes shall be either standard copper or optional cupronickel with large internal diameters for reduced waterside pressure drops.
3. Outer tubes shall be steel, painted for corrosion protection.
4. All condensers shall be rated at 600 psig operating refrigerant pressures and 400 psig waterside pressures.
5. Units shall be rated down to 50 F without the use of water regulating valves.

I. Filter Section:

The unit shall be supplied with 4-in. deep pleated, 30% high-efficiency filters. The filters shall have side access capability through an access panel.

J. Electrical:
1. Each unit shall be wired and tested at the factory prior to shipment.
2. Wiring shall comply with NEC requirements and shall conform with all applicable UL standards.
3. The units shall have a single point power connection. Control power shall be supplied through a factory-installed, low voltage control circuit transformer with an integral resettable circuit breaker.
4. The fan motor starter shall have a magnetic three-line, ambient compensated overload protector with a manual reset.
5. A terminal block shall be provided for the main power connection.

K. Controls, Safeties, and Diagnostics:
1. Control shall be accomplished through the use of a factory-installed, microprocessor-based control system and associated electronic and electrical hardware. Control system shall determine control sequences through monitoring the following operational variables:
   a. Day and time.
   b. Schedule (Unoccupied/Occupied).
   c. Set points (Unoccupied/Occupied, Duct Pressure, others).
   d. Return-air, Mixed-air, or Outdoor-air temperature.
   e. Unit supply-air temperature.
   f. Supply-air fan status.
   g. Accessory and/or field-supplied sensors, function switches and/or signals.
2. Controls shall be capable of performing the following functions:
   a. Capacity control based on discharge-air temperature and compensated by rate of change of return-air temperature (VAV [variable air volume]). Capacity control shall be accomplished through the use of compressor staging and modulating hot gas re-heat.
   b. Perform a quick test to check the status of all input and output signals to the control system using diagnostic display module.
   c. Supply fan volume control shall control output from a variable frequency drive to maintain duct static pressure at user-configured set point.
   d. 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 user-configured 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), that an output has not functioned as expected, or that a safety device has tripped.

L. Special Features:
1. Waterside Economizer:
   a. Shall function as first stage of cooling when free cooling is available. Economizer coil valve can be modulated to control discharge-air temperature when the economizer can meet or exceed cooling needs.
   b. Consists of the economizer coil, one 3-way valve, vent and drain fittings and the required piping. Economizer coils are 2 or 4-row coils. The unit controller controls all required control logic and changeover.

2. Hot water coil shall be factory-installed on the inlet side of the direct expansion cooling coils with field piping connections on the side of the unit.
3. Energy management and alarm 24-vac relay package shall be provided to remotely start and stop units with constant volume configuration. An additional relay is provided to close when a compressor malfunction is detected, providing remote signaling to a building automation system.
4. Cupronickel condenser shall provide higher corrosion protection.
5. Insulated basepan shall provide additional sound deadening characteristics and corrosion protection in the compressor compartment.
6. Condensate overflow switch shall provide protection against condensate overflow. The mechanical safety switch shall be located in the unit's evaporator basepan.
7. Extended range option shall provide condensate protection on the condenser waterside for humid applications.
8. Freeze protection switch shall provide evaporator coil protection against freezing.

M. Accessories:

1. Keypad/Display Module (BacView6):

   Module shall provide hardware necessary for human interface with the unit integrated system controls. Module shall contain a keypad and display for interactive communication. Display shall be two-line, backlit alphanumeric liquid crystal display (LCD). Each line of the LCD shall display up to 24-character (with expanded scrolling display capability). Keypad shall contain 12 numeric keys, 6 function keys, and 4 operative keys. Module shall contain RJ-14 data cable connection for simple installation and to facilitate remote location installation. Module shall be powered by unit's 24-v control circuit.

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