

Submittal item detail

#238123-1-0: CRAC Unit Product Data



Status	Created on	Ball in court due date
Closed	Jul 7, 2026	
ID	33	
Ball in court	Josh Zuber (Comfort Systems USA (AR) NWA)	
Manager	Ben Adair (Clark Contractors, LLC (NWA))	
Responsible contractor	Josh Zuber (Comfort Systems USA (AR) NWA)	
Watchers	Ben Adair (Clark Contractors, LLC (NWA)) Jacob Evans (Clark Contractors, LLC (NWA))	
Spec section	238123 Computer Room Air Conditioning Units	
Spec sub section		
Type	Product Data	
Description		
Final Response	Approved as Noted	
Final Response Attachments	238123-01 CRAC UNIT PRODUCT DATA - REVIEWED.PDF , Jul 17, 2026, 1:37 PM UTC	
Final Response Comments		
Package		

Ball in court	Sent	Due	Returned	Response/Action	Attachments
Submitted					
Josh Zuber (Comfort Systems USA (AR) NWA) Submitted by Ben Adair	Jul 7, 2026	Jul 7, 2026	Jul 7, 2026	Submitted	23 81 23 CRAC Units Submittal.pdf
Comments	-				
Sent for review					
Ben Adair (Clark Contractors, LLC (NWA)) Sent by Ben Adair	Jul 7, 2026	-	-	Sent for review	23 81 23 CRAC Units Submittal.pdf
Comments	-				
Review Step 1					
Mark Owings (Crafton Tull) Reviewed By Mark Owings	Jul 7, 2026	Jul 22, 2026	Jul 16, 2026	Approved as Noted	238123-01 CRAC Unit Product Data - Reviewed.pdf
Comments					
Matthew Cabe (Crafton Tull)	Jul 7, 2026	Jul 22, 2026	-		
Comments					
Michael Davis (Crafton Tull)	Jul 7, 2026	Jul 22, 2026	-		

Ball in court	Sent	Due	Returned	Response/Action	Attachments
Comments					
Wes Burgess (Crafton Tull)	Jul 7, 2026	Jul 22, 2026	-		
Comments					



SUBMITTAL COMMENT SHEET

Project: 1763 - Highlands Building at Pinnacle Hills

Submittal

Spec: 23 81 23

Title: Computer Room Air Conditioners

General Notes by Clark:



☐ APPROVED
☐ APPROVED AS NOTED
☐ REVISE & RESUBMIT
☒ REVIEWED
☐ REJECTED

THIS SUBMITTAL HAS BEEN REVIEWED FOR COMPLIANCE WITH THE CONTRACT DOCUMENTS. APPROVAL DOES NOT RELIEVE THE SUBCONTRACTOR/SUPPLIER OF THE RESPONSIBILITY FOR CONFORMANCE TO THE QUALITY STANDARDS AS SET FORTH IN THE CONTRACT DOCUMENTS. NOR DOES IT RELIEVE THE RESPONSIBILITY FOR FIELD VERIFICATION OF ALL CONDITIONS RELATING TO THIS CONTRACT.

OK'D BY: BA DATE: 07/07/26

CLARK
CONTRACTORS

- ☐ REVIEWED, NO NOTATIONS
- ☒ REVIEWED AS NOTED; NO RESUBMITTAL
- ☐ REVISE AND RESUBMIT
- ☐ REJECTED

This review is only for general conformance with the design concept of the project and general compliance with the information given in the contract documents. Notations made on the shop drawings during this review do not relieve the contractor from compliance with the requirements of the contract documents. Review of a specific item shall not include acceptance of an assembly of which the item is a component. The contractor is solely responsible for confirming and correlating all quantities and dimensions; selecting fabrication processes and techniques of construction; coordination of his or her work with that of all other trades; and performing all work in a safe and satisfactory manner.

Date: 07/15/2026 By: ebattleson



IMEG 2026-07-15 : The 2 Ton model is acceptable. MFR indicates 277V is not available in new model. 208V is acceptable. Coordinate new electrical requirements with Electrical Contractor

Comfort Systems USA (Arkansas), Inc.
P.O. Box 16620
Little Rock, AR 72231
Phone 501-834-3320
Fax 501-834-5416

Date: 06/12/2026
Return Request: 06/30/2026
Project: Highlands Building at Pinnacle Hills
Supplier: Comfort Systems USA
Manufacturer: Liebert
Submittal: CRAC Units
Submittal Number: 23 81 25 -01
Drawing # and Installation: Mechanical

ARCHITECT

Crafton Tull
Fayetteville, Ar

ENGINEER

IMEG

GENERAL CONTRACTOR

Clark Contractors
Rogers, Ar

MECHANICAL SUBCONTRACTOR

Comfort Systems USA (Arkansas), Inc.
116 Commercial Ave.
Lowell, AR 72745
(479) 770.8992

NOTES:

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CSUSA PROJECT NO.
26-5034

jzuber@comfortar.com



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LIEBERT COOLPHASE CEILING DX CEILING-SUSPENDED PRECISION COOLING SYSTEM

Schedule calls for a 1.5 ton.
A/E please verify that 2 ton
is acceptable.

Job Name	Highland's Oncology Group - Pinnacle
Equipment Tags	LU-1 & LU-2
Spec. Section	238125 – Computer Room Air Conditioners – Ceiling Mounted
Model	Liebert CoolPhase Ceiling - 2-Ton
Description	2-Ton Ceiling Suspended DX Precision Cooling Systems
Quantity	2
Date	June 25, 2026
Submitted By	Sam White

Submittal Note:

This project was initially designed around the legacy Liebert MiniMate2 and MiniMate3 DX systems with R407 and R410A refrigerants. These systems are currently in End of Production phase and have been replaced by the Liebert CoolPhase Ceiling DX systems with Low GWP refrigerant (R32). EPA has mandated all Computer Room Air Conditioning systems installed after 1/1/2027 must comply with Low GWP refrigerant requirements. Submitting on the new Liebert CoolPhase Ceiling DX systems.

Liebert CoolPhase Ceiling Ceiling Suspended Precision Cooling System 2-Ton DX Air-Cooled

Two (2) 2-Ton Liebert CoolPhase Ceiling Precision Cooling Split Systems – Indoor Unit

- Model Number: MMI24E00A008R
- Nominal Cooling Capacity: 2-tons (7kW)
- Air Volume: 1,451 CFM; Fans: 1 (.37hp)
- Electrical: 208/230V-1ph, 60 Hz; OPD: 60A
- Refrigerant: R32 (field supplied and charged)
- Evaporator type: copper tubes – aluminum fins with hydrophilic coating
- Variable speed EC fan – (1) fan per system
- Steam canister humidifier: 5 lb/h
- Modulating electric reheat: 4.7kW (16.04 kBTU/h)
- Filter clog and high temperature sensors
- Liebert iCOM microprocessor control with embedded Unity
- Wall-mounted 7" color touchscreen display (field mounted and wired)
- Room Temperature/humidity sensor (field mounted and wired)
- Locking disconnect switch, factory mounted and wired, with short-circuit current rating (SCCR) of 65,000 amps
- IS-UNITY-DP network communications card (SNMP, BACnet and Modbus protocols)

Alternate model number
due to manufacturer
upgrades

Schedule calls for a 270V
indoor unit

Two (2) Liebert Outdoor Air Cooled Condensing Units – Outdoor Unit

- Model Number: CUD070-E000A
- Outdoor Design Ambient : -4°F - 118°F
- Electrical: 208/230V-1ph, 60 Hz; OPD: 50A
- Inverter, variable capacity compressor (R32)
- High head pressure switch
- Nitrogen holding charge (System field charged, with field-supplied R32 refrigerant)

Ship-Loose Accessories (field installed)

- One (1) condensate pump kit per system
- One (1) return air filter box kit per system
- One (1) set of remote temp/humidity sensors per system
- One (1) LT410 spot leak detector per system

Services Include:

- Startup/Warranty Inspection – 8x5
 - Final connections, leak checking, evacuation and refrigerant **not included**
- Assistance with communications and controls setup; Owner Training
- Standard one (1) year parts and limited labor warranty
 - Extended compressor warranty through year 5

AHRI Certified Performance Data*Unit Information - Indoor**

Cooling Type	DX Indoor	Unit Model	MMI24E00R0000A0000
Configuration	Air Cooled	Power Supply	230V/1ph/60Hz
Operation Mode	DX Mode	Airflow Configuration	Frontal Air
Refrigerating Circuits No	1	Compressor 1 - Circuit 1	Variable Speed Scroll
Refrigerant	R32	Fan Type	Axial Fan
Product Line	CoolPhase Ceiling	Fan Quantity	1
Product Family	MM	Filter Class	Merv8

Options

External Filter	Not selected	Electric Reheat	Selected
Humidifier	Selected	Damper	Not selected

Unit Information - Outdoor

Product Line	CoolPhase Condensing Unit	Fan Module	Standard
Product Family	Condensing Unit	Fan Type	Axial Fan
Unit Model	CUD070-E000A_MMI24	Fan Quantity	1
Unit Power Supply	208/230V/1ph/50-60Hz		

Design Conditions -Data Input

Calculation Mode	Return Airflow + Compressor Modulation	Compressor Modulation	90.0 %
Indoor Return Air Temperature	75.0 °F	Outdoor Air Temp	95.0 °F
Indoor Return Air RH	45.0 %	Outdoor Airflow	2714 cfm
Altitude Sea Level	0.0 ft	Subcooling	13.4 R
Atmospheric Pressure	14.7 psi	Outdoor ESP	0.000 In-H2O
Indoor ESP	0.200 in-H2O	Fan Speed Control	On
Indoor Return Airflow	1451.0 cfm		

General Performance at Design Conditions

Gross Total Capacity	6.74 kW	Supply Air RH	42.4 %
Gross Sensible Capacity	6.74 kW	Supply Air DP	52.3 °F
nSHR	1	Return Airflow	1451 cfm
Net Total Capacity	6.17 kW	Indoor Fan Modulation	86.8 %
Net Sensible Capacity	6.17 kW	Actual Room SPL @2m f.f.	51.9 dBA
Compressor Modulation	90.0 %	System Net Sens nSCOP	2.48

General Performance at Design Conditions

System Power Input	2.48 kW	Outdoor Airflow	2714 cfm
Supply Air DB	76.8 °F	Outdoor Fan Modulation	100.0 %
Supply Air WB	61.8 °F	Outdoor Actual SPL @5m f.f.	57.4 dBA

2 System Data

2.1 Air Cooled System Performance and Physical Data

Table 2.1 Vertiv™ CoolPhase Ceiling technical specifications

Models		1 Ton	2 Ton	3 Ton	4 Ton	5 Ton	8 Ton
		MMI12	MMI24	MMI36	MMI48	MMI60	MMI96
Region		NAM					
Certification marks		cCSAus					
Piping Connections		Flare Connection					
Condenser Fan		EC Motor					
External Static Pressure		0.20 inH2O (50 Pa)					
Sensible Cooling Capacity (kW) @26.7 °C (80 °F) RAT, 38% Rh, 35 °C (95 °F) outdoor temp		1 (3.5)	2 (7)	3 (11)	4 (15)	6 (21)	8 (28)
Power Supply Evaporator		208/230 V, 1-Ph, 50/60 Hz		208/230 V, 1-Ph, 50/60 Hz 208/230 V, 3-Ph, 60 Hz 460 V, 3-Ph, 60 Hz		208/230 V, 3-Ph, 60 Hz 460 V, 3-Ph, 60 Hz	
Controls		Vertiv™ ICOM™					
Refrigerant (Field supplied/field charged. Not factory charged)		R-32					
Max Equivalent Length of Pipe between Indoor Unit and Condensing Unit		196.85 ft (60 m)			295.27 ft (90 m)		
Height between Indoor and Condensing Unit	Condensing unit placed higher than indoor unit	98.43 ft (30 m)			60 ft (18.3 m)	98.43 ft (30 m)	
	Condensing unit placed lower than indoor unit	-26.25 ft (-8 m)			-15 ft (4.6 m)	-26.25 ft (-8 m)	

1. Certified in accordance with the AHRI Datacom Cooling Certification Program at AHRI Standard 1360 (I-P) Standard Rating Conditions. Certified units may be found in the AHRI Directory at www.ahridirectory.org.
2. Some options or combinations of options may result in reduced air flow. Consult factory for recommendations.
3. Data rated at 100% fan speed and with Standard Feature filter.
4. Net capacity data has fan motor heat factored in for all ratings.
5. Performance data generated in GRS (Global Rating System).

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Table 2.2 Vertiv™ CoolPhase Condensing Unit technical specifications for small units (3.5, 7 and 11 kW)

Models		CUD030	CUD070	CUD111	CUD114
		CUL030	CUL070	CUL111	CUL114
Region		Global			NAM
Certification marks		cETLus, CE & UKCA			cETLus
Piping Connections		Flare Connection			
Operating Temperature range		Low ambient Condensing Unit: -31 °F (-35 °C) ~118 °F (48 °C) Standard Ambient Condensing Unit with Wind Baffle Accessory: -4 °F (-20 °C) ~118 °F (48 °C) Standard Ambient Condensing Unit without Wind Baffle Accessory: 23 °F (-5 °C) ~118 °F (48 °C)			
Compressor		Variable speed rotary compressor			
Condenser Fan		EC Motor			
External Static Pressure		0.20 inH2O (50 Pa)	0.12 inH2O (30 Pa)		
Noise Data		68 dB		71 dB	
Noise Data of night mode		58 dB		56 dB	
Power Supply		208/230 V, 1-Ph, 50/60 Hz (-10%/+10%)		208/230 V, 3-Ph, 50/60 Hz (-10%/+10%)	460 V, 3-Ph, 60 Hz (±10%)
Refrigerant		R-32			
Max Equivalent Length of Pipe between Indoor Unit and Condensing Unit		196.85 ft (60 m)			
Height between Indoor and Condensing Unit	Condensing unit placed higher than indoor unit	98.4 ft (30 m)			
	Condensing unit placed lower than indoor unit	26.3 ft (8 m)			

NOTE: When the ambient temperature is below -4 °F (-20 °C) up to -31 °F (-35 °C), the low-ambient version must be used. Low Ambient versions of the units do not require a Wind Baffle accessory.

NOTE: The Low Ambient version of the Condensing Unit cannot be installed in plenum areas; only the standard version is plenum rated.

Table 2.5 Air Cooled Data, 60 Hz

Evaporator Model		MMI12	MMI24	MMI36	MMI48	MMI60	MMI96
Condensing Unit Type		Outdoor	Outdoor	Outdoor	Outdoor	Outdoor	Outdoor
DX Evaporator- Net Capacity Data - kW (kBTU/h) @ High-Speed CFM							
80 °F DB, 62.8 °F WB (26.7 °C DB, 17.1 °C WB) 38% Rh	Total	3.4 (11.6)	6.7 (22.8)	9.2 (31.3)	14.7 (51.0)	19.1 (65.2)	26.7 (91.1)
	Sensible	3.4 (11.6)	6.7 (22.8)	9.2 (31.3)	14.7 (51.0)	19.0 (64.8)	24.2 (82.6)
75 °F DB, 61 °F WB (23.9 °C DB, 16.1 °C WB) 45% Rh	Total	3.1 (11.6)	6.2 (21.1)	8.6 (29.3)	13.5 (46.1)	18.2 (62.1)	25.5 (87.0)
	Sensible	3.1 (11.6)	6.2 (21.1)	8.5 (29.1)	13.5 (46.1)	17.1 (58.4)	20.5 (70.0)
72 °F DB, 60 °F WB (22.2 °C DB, 15.5 °C WB) 50% Rh	Total	3.0 (10.1)	5.9 (20.0)	8.3 (28.4)	12.9 (44.0)	17.8 (59.7)	24.9 (85.0)
	Sensible	2.9 (10.0)	5.5 (18.8)	7.9 (26.8)	12.8 (43.7)	15.7 (53.6)	18.7 (63.8)
Fan Data - Evaporator							
CFM (CMH)		816 (1,386)	1,451 (2,465)	1,533 (2,605)	2,710 (4,607)	2,746 (4,665)	3,759 (6,387)
Fan Motor, HP (W)		0.16 (0.12)	0.37 (0.28)	0.56 (0.42)	0.95 (0.71)	1.10 (0.82)	1.60 (1.19)
External Static Pressure, in (mm) water gauge		0.2 (5.1)					
Evaporator Coil - Copper Tube/Aluminum Fin							
Face Area, ft2 (m2)		2.5 (0.23)	3.0 (0.28)	3.0 (0.28)	5.56 (0.52)	5.56 (0.52)	7.64 (71)
Coil Rows		3	5	5	6	6	6
Max Face Velocity, fpm (m/s)		500 (2.54)					
Unit Refrigerant Charge, lb (kg)		0.5 (0.2)	1.0 (0.5)	1.8 (0.8)	2.8 (1.3)	3.3 (1.5)	3.7 (1.7)
Unit Operating Weight DX, lb (kg)		269 (122.2)	295 (134.0)	299 (136.0)	416 (187.5)	484 (219.5)	673 (305.4)
Unit Operating Weight DX+FC, lb (kg)		292 (132.6)	325 (147.6)	329 (149.6)	484 (219.5)	504 (228.5)	752 (341.4)
Electric Reheat Capacity, kW (kBTU/h)		SSR (Solid State Relay)					
Input Voltage 230-1-60		4.5 (15.35)	4.7 (16.04)	4.0 (13.65)	—	—	—
Input Voltage 230-3-60		—	—	7.0 (23.89)	10.0 (34.12)	15.0 (51.18)	10.0 (34.12)
Input Voltage 460-3-60		—	—	4.0 (13.65)	10.0 (34.12)	10.0 (34.12)	10.0 (34.12)
Humidifier Data - Steam Generator Type							
Steam capacity, lb/h (kg/h)		5 (2.27)			12 (5.44)		
Electrical Input Power 230-1-60, kW		10.6	14.4	17.4	N/A	N/A	N/A
Electrical Input Power 230-3-60, kW		N/A	N/A	18.1	20.7	20.7	24.8
Electrical Input Power 460-3-60, kW		N/A	N/A	8.4	10.8	10.8	14.4
Evaporator Connection Sizes							
Liquid line Diameter, in O.D. Cu		3/8	3/8	3/8	5/8	5/8	5/8
Suction Line Diameter, in O.D. Cu		1/2	1/2	1/2	7/8	7/8	7/8

Table 2.5 Air Cooled Data, 60 Hz (continued)

Evaporator Model	MMI12	MMI24	MMI36	MMI48	MMI60	MMI96
Humidifier Supply	¾ in OD Copper Compression Fitting					
Evaporator/Condensate Drain	¾ in NPT-Female					
MERV 8 Filter						
External Filter Box, Nom. Size WxHxD, in (mm)	Qty. 1 20x16x4 (508x406x102)	Qty. 2 20x20x4 (508x508x102)		Qty. 2 25x20x4 (635x508x102)		
Air Distribution Plenum, Nom. Size WxHxD, in (mm)	Qty. 1 16x25x4 (406x635x102)			N/A		
Return Grille, Nom. Size WxHxD, in (mm)	Qty. 1 20x20x1 (508x508x25)			N/A		
Condensing Unit Model Number	CUD/L03	CUD/L07	CUD/L11	CUD/L15	CUD/L21	CUD/L28
Condensing Unit Rating Conditions	95 °F (35 °C) Ambient					
Coil Face Area ft2 (m2)	3.3 (0.31)	4.82 (0.45)	7.06 (0.66)	10.11 (0.94)	24.37 (2.3)	24.37 (2.3)
Type of Coil	Microchannel					
CFM (CMH)	2,222 (3,778)	2,714 (4,612)	3,892 (6,613)	5,113 (8,688)	8,839 (15,023)	8,447 (14,352)
Motor Hp (KW)	0.36 (0.27)	0.40 (0.3)	0.55 (0.41)	0.36 (0.27)	0.75 (0.57)	1.25 (0.93)
External Static Pressure, in (mm) water gauge	N/A					
STD Unit Refrigerant Charge, lb (kg)	1.3 (0.6)	1.5 (0.7)	1.8 (0.8)	2.9 (1.3)	3.0 (1.4)	5.0 (2.3)
LAK Unit Refrigerant Charge, lb (kg)	2.4 (1.1)	2.9 (1.3)	5.3 (2.4)	5.7 (2.6)	10.1 (4.6)	17.2 (7.8)
STD Unit Operating Weight, lb (kg)	110 (50)	118 (53.5)	175 (79.5)	268 (121.37)	425 (193)	425 (193)
LAK Unit Operating Weight, lb (kg)	117 (53)	130 (59)	184 (83.5)	277 (125.32)	458 (208)	458 (208)
Condensing Unit Connection Sizes						
Liquid Line Diameter, in O.D. Cu	1/4	3/8	3/8	1/2	5/8	5/8
Suction Line Diameter, in O.D. Cu	1/2	1/2	5/8	3/4	7/8	7/8

2.1.1 Operating Limits for Air Cooled Systems

The Vertiv™ CoolPhase Ceiling operates within the working ranges as shown in the table below. These limits refer to new units and those that have been correctly installed and serviced.

Table 2.6 Operating limits—Air Cooled Systems

Parameter		Design Condition	
		Minimum	Maximum
Unit Entering Air Conditions	Temperature	64.4 °F (18 °C)	113 °F (45 °C)
	Relative Humidity	17%	60%
Storage Conditions	Temperature	-4 °F (-20 °C)	118 °F (48 °C)
		NOTE: Unit remains operational up to 125.6 °F (52 °C) with reduced capacity.	
Power Supply Tolerances		Voltage ± 10%, Frequency ±2 Hz	

For working ranges of the Condensing units, refer to tables below.



Table 2.7 Operating limits—Condensing Units from 3 kW to 15 kW

Models	CUD030	CUD070	CUD111	CUD114	CUD151	CUD154
	CUL030	CUL070	CUL111	CUL114	CUL151	CUL154
Operating Temperature range	Low ambient Condensing Unit: -31 °F (-35 °C) ~118 °F (48 °C)					
	Standard Ambient Condensing Unit with Wind Baffle Accessory: -4 °F (-20 °C) ~118 °F (48 °C)					
	Standard Ambient Condensing Unit without Wind Baffle Accessory: 23 °F (-5 °C) ~118 °F (48 °C)					

NOTE: When the ambient temperature is between -4 °F (-20 °C) and -31 °F (-35 °C), the Low Ambient version must be used. Low Ambient versions of units do not require a Wind Baffle accessory.

NOTE: The Low Ambient version of the Condensing Unit cannot be installed in plenum areas; only the standard version is plenum rated.

NOTE: All CUD15 and CUL15 Condensing Unit models on the table above are not plenum-rated.

4.1 Air Cooled Systems Electrical Data

Table below lists the power requirements for each Vertiv™ CoolPhase Ceiling model number.

Table 4.1 CoolPhase Ceiling Electrical Data

Model	Power Supply	Feature	FLA (A)	MCA (A)	MOP (A)
MMI12	230 V / 1-Ph	Reheat	28.0	35.0	35
		Reheat + Humidifier	28.0	35.0	45
		Humidifier	10.6	16.5	15
		Air Cooling	6.2	7.0	15
MMI24	230 V / 1-Ph	Reheat	41.0	51.3	60
		Reheat + Humidifier	41.0	51.3	60
		Humidifier	14.4	18.0	15
		Air Cooling	7.4	8.0	15

Table 4.2 Vertiv™ CoolPhase Condensing unit electrical data

Models	Nom. Tons	Volts / Phases	Compressor Qty.	Compressor Inverter (A)	Crank Case + Heating belt (A)	FLA (A)	MCA (A)	MOP (A)
CUD03 / CUL03	1	208/230 1-Ph	1	14	0/0.4	17	21	35
CUD07 / CUL07	2	208/230 1-Ph	1	20	0/0.4	23	28	50
CUD111 / CUL111	3	208/230 3-Ph	1	17	0/0.4	21	25	40
CUD114 / CUL114	3	460 3-Ph	1	11	0/0.4	15	18	30
CUD151	4	208/230 3-Ph	1	14	0/32.2	20	23	35
CUL151	4	460 3-Ph	1	14	0.5/32.2	20	24	35
CUD154	4	208/230 3-Ph	1	9	0/21.9	11	13	20
CUL154	4	460 3-Ph	1	9	0.25/21.9	11	13	20
CUD211	6	208/230 3-Ph	1	22	0/41.3	31	36	50
CUL211	6	460 3-Ph	1	22	0.5/41.3	31	37	50
CUD214	6	208/230 3-Ph	1	19	0/32.9	22	27	45
CUL214	6	460 3-Ph	1	19	0.25/32.9	23	27	45
CUD281	8	208/230 3-Ph	1	40	0/51.3	49	58	90
CUL281	8	460 3-Ph	1	40	0.5/51.3	49	59	90
CUD284	8	208/230 3-Ph	1	30	0/39.7	33	40	70
CUL284	8	460 3-Ph	1	30	0.25/39.7	33	41	70

FLA = Full Load Amps; MCA = Minimum Circuit Ampacity; MOP = Maximum Overcurrent Protection Device.

5.5 Connecting Gas Pipe and Liquid Pipe

Table 5.3 Vertiv™ CoolPhase Ceiling recommended refrigerant line sizes, O.D. CU for Vertiv™ CoolPhase Condensing Unit

CoolPhase Ceiling	Total Equivalent Length ft (m)	Suction Line, in (mm)	Liquid Line in. (mm)
MMI12 (1 Ton) + CU03A	0 to 32.80 (0 to 10)	½ (12.70)	¾ (6.35)
	32.80 to 196.90 (10 to 60)	½ (12.70)	5/16 (7.93)
MMI24 (2 Ton) + CU07A	0 to 16.40 (0 to 5)	½ (12.70)	3/8 (9.52)
	16.40 to 65.60 (5 to 20)	5/8 (15.87)	3/8 (9.52)
	65.60 to 196.85 (20 to 60)	¾ (19.05)	3/8 (9.52)
MMI36 (36 Ton) + CU11A	0 to 16.40 (0 to 5)	½ (12.70)	3/8 (9.52)
	16.40 to 49.20 (5 to 15)	5/8 (15.87)	3/8 (9.52)
	49.20 to 65.60 (15 to 20)	5/8 (15.87)	½ (12.70)
	65.60 to 131.20 (20 to 40)	¾ (19.05)	½ (12.70)
	131.20 to 196.85 (40 to 60)	7/8 (22.22)	½ (12.70)
MMI48 (4 Ton) + CU15A	0 to 32.80 (0 to 10)	¾ (19.05)	½ (12.70)
	32.80 to 295.30 (10 to 90)	7/8 (22.22)	½ (12.70)
MMI60 (6 Ton) + CU21A	0 to 49.20 (0 to 15)	7/8 (22.22)	5/8 (15.87)
	49.20 to 295.30 (15 to 90)	1-1/8 (28.58)	5/8 (15.87)
MMI96 (8 Ton) + CU28A	0 to 16.40 (0 to 5)	7/8 (22.22)	5/8 (15.87)
	16.40 to 98.40 (5 to 30)	1-1/8 (28.58)	5/8 (15.87)
	98.40 to 295.30 (30 to 90)	1-3/8 (34.93)	¾ (19.05)

NOTE: Must downsize vertical riser one trade size (1-1/8" to 7/8", 7/8" to 3/4", 3/4" to 5/8", 5/8" to 1/2").

NOTE: If the condensing unit is installed indoors, the total system refrigerant charge (Indoor unit + Condensing unit + Piping) can't exceed 4 lbs.

NOTE: Contact your representative for line sizing for runs longer than 295.30 ft (90 m) equivalent length.

Table 5.4 Equivalent Length of Components

Liquid Pipe, External Diameter in (mm)	Equivalent Length ft (m)			
	90° Bend Way	45° Bend Way	T Type Way	Three-Way Way
½ (12.70)	1.31 (0.40)	0.65 (0.20)		2.49 (0.76)
5/8 (15.87)	1.80 (0.55)	0.88 (0.27)		2.49 (0.76)
¾ (19.05)	1.96 (0.60)	0.98 (0.30)		2.49 (0.76)
7/8 (22.22)	2.29 (0.70)	1.14 (0.35)		3.60 (1.10)

Table 5.4 Equivalent Length of Components (continued)

Liquid Pipe, External Diameter in (mm)	Equivalent Length ft (m)		
	90° Bend 45° Bend T Type Three- Way	90° Bend 45° Bend T Type Three- Way	90° Bend 45° Bend T Type Three- Way
1 1/8 (28.58)	2.85 (0.87)	1.44 (0.44)	4.60 (1.04)
1 3/8 (34.93)	3.45 (1.05)	1.72 (0.53)	5.30 (1.60)
1-5/8 (41.00)	4.10 (1.25)	2.05 (0.63)	5.30 (1.60)

NOTE: Suitable piping thickness must be used to support the pressure of the CoolPhase Ceiling Units

Installing Pipelines

1. Release the pre-charged nitrogen. Open all the Schrader valves in the system to release nitrogen.
2. Cut the liquid pipe and gas pipe connectors on the evaporator and condenser.
3. Lay the pipes between the evaporator and condenser.
4. Connect a nitrogen cylinder to the Schrader valve. Purge the pipe with nitrogen to flow through the pipe while welding the pipe.

Table 5.5 Pipe length and condensing unit elevation relative to evaporator

Model	Maximum Condensing Unit Level Above Evaporator, ft (m)	Maximum Condensing Unit Level Below Evaporator, ft (m)
MMI12	49.2 (15)	16.4 (5)
MMI24	49.2 (15)	16.4 (5)
MMI36	49.2 (15)	16.4 (5)
MMI48	49.2 (15)	16.4 (5)
MMI60	98.4 (30)	26.2 (8)
MMI96	98.4 (30)	26.2 (8)

Table 5.5 Pipe length and condensing unit elevation relative to evaporator

Model	Maximum Condensing Unit Level Above Evaporator, ft (m)	Maximum Condensing Unit Level Below Evaporator, ft (m)
MMI12	49.2 (15)	16.4 (5)
MMI24	49.2 (15)	16.4 (5)
MMI36	49.2 (15)	16.4 (5)
MMI48	49.2 (15)	16.4 (5)
MMI60	98.4 (30)	26.2 (8)
MMI96	98.4 (30)	26.2 (8)

Table 5.8 Outdoor condenser approximate R-32 refrigerant charge for standard units

Model	Refrigerant charge lb (kg)
CUD03	1.3 (0.6)
CUD07	1.5 (0.7)
CUD11	1.8 (0.8)
CUD15	2.9 (1.3)
CUD21	3.0 (1.4)
CUD28	5.0 (2.3)

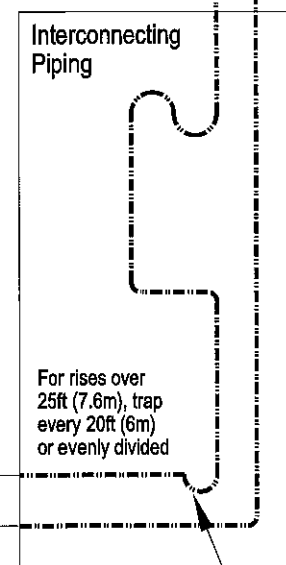
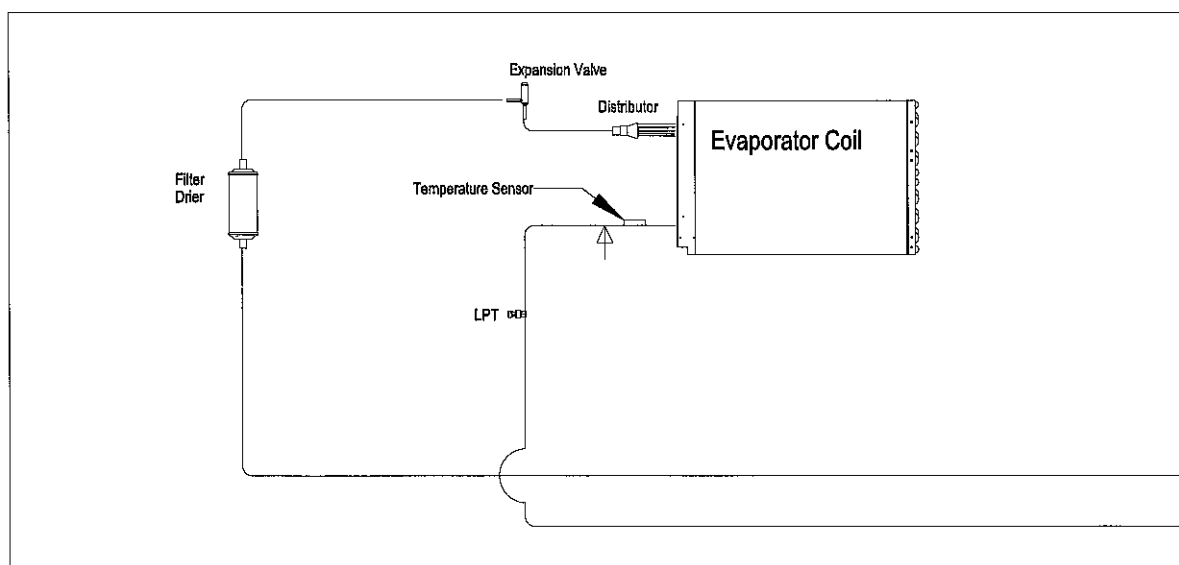
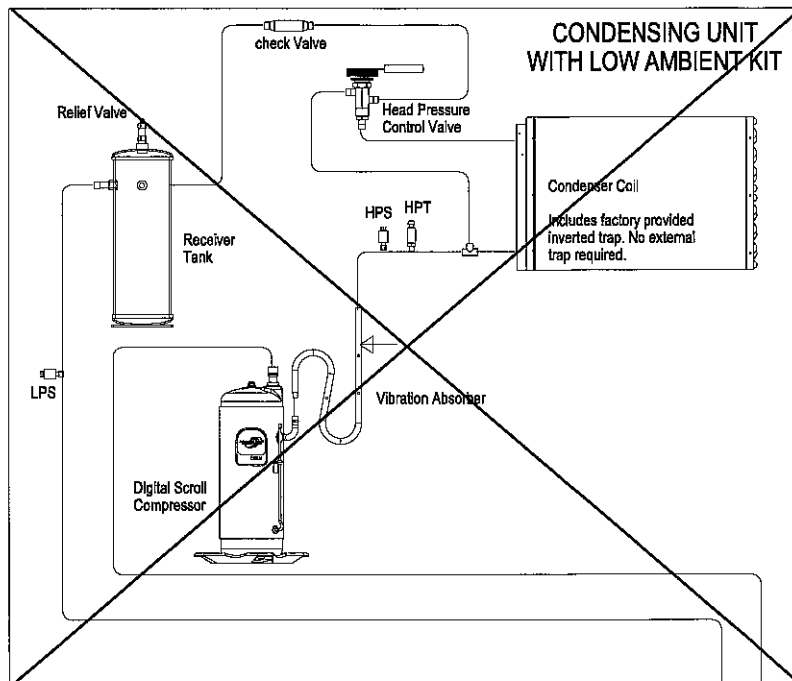
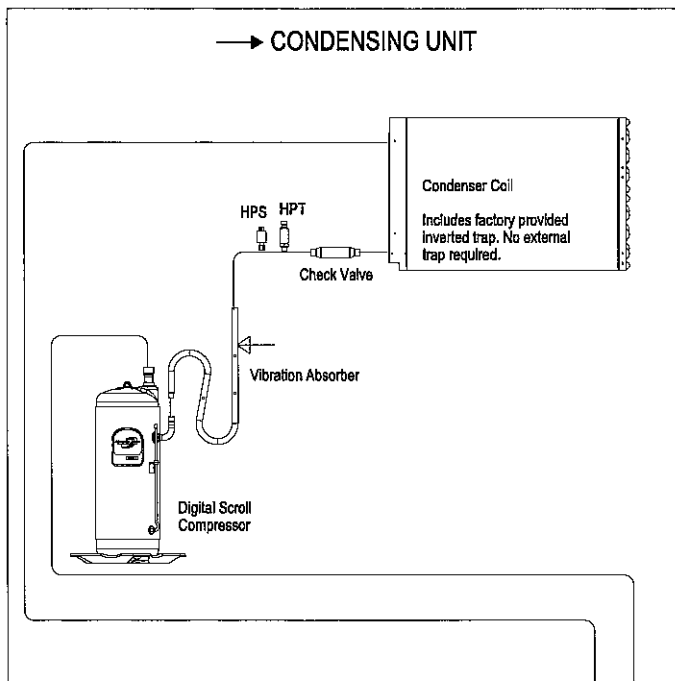
Table 5.11 Interconnecting piping refrigerant charge for R-32 for type L Tube

Line Size O.D.	Liquid Line, lb/100 ft (kg/30 m)	Suction Line, lb/100 ft (kg/30 m)
3/8	2.9 (1.3)	0.15 (0.07)
1/2	5.5 (2.5)	0.2 (0.1)
5/8	9.0 (4.0)	0.4 (0.2)
3/4	13.5 (6.0)	0.7 (0.3)
7/8	18.5 (8.4)	1.1 (0.5)
1 1/8	31.7 (14.4)	1.8 (0.8)
1 3/8	48.3 (21.9)	2.6 (1.2)



VERTIV COOLPHASE CEILING

GENERAL ARRANGEMENT 1-2 TON DIRECT EXPANSION AIR COOLED



— FACTORY REFRIGERANT PIPING
- - - FIELD PIPING

▽ SERVICE / SCHRADER (ACCESS) CONNECTION NO VALVE CORE
↓ SERVICE / SCHRADER (ACCESS) CONNECTION WITH VALVE CORE

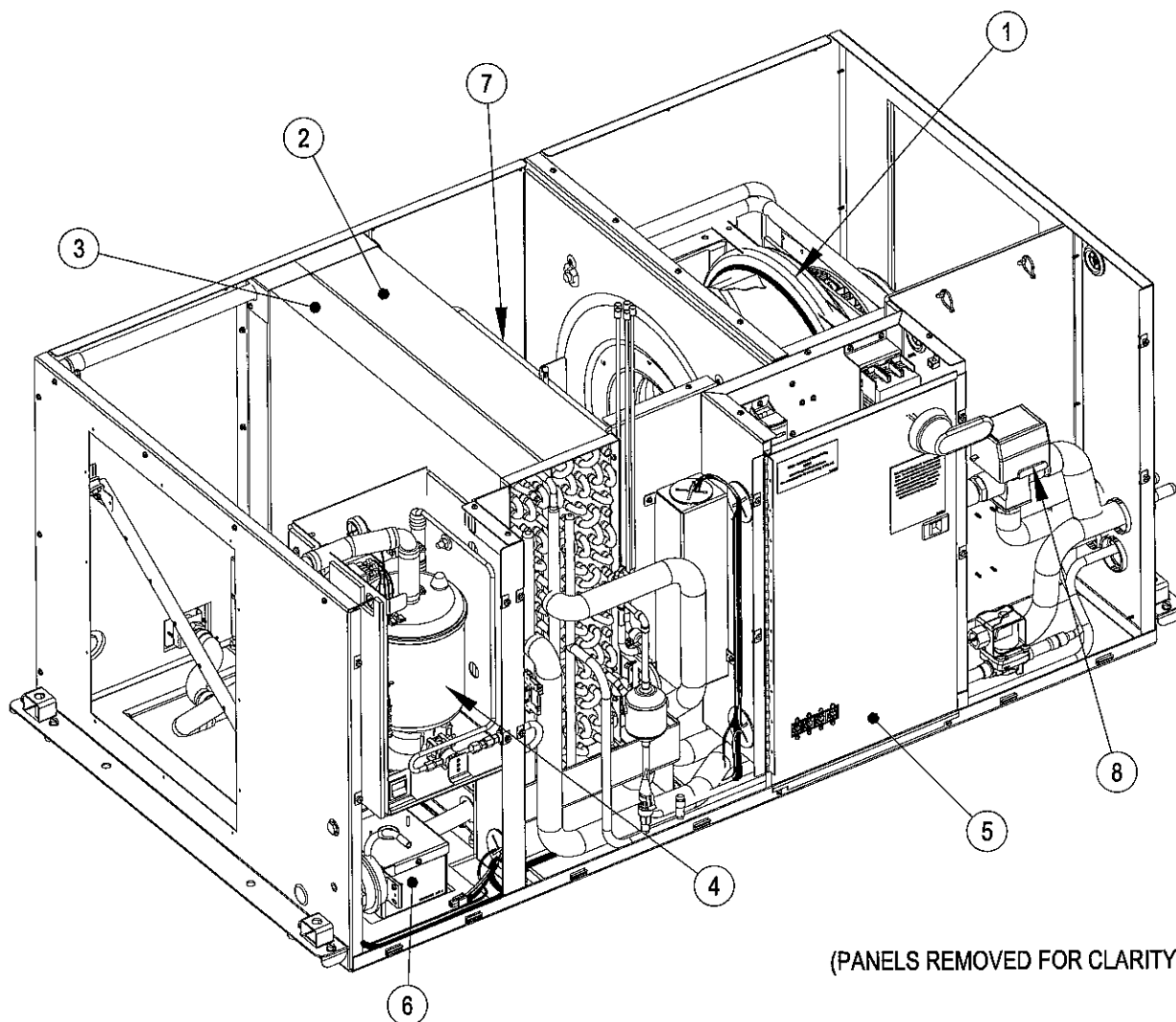
Notes:

1. Schematic representation shown. Do not use for specific connection location.
2. Interconnecting piping are not supplied by Vertiv™, but are required for proper circuit operation and maintenance.
3. Do not isolate any refrigerant circuit from over pressurization protection.
4. Traps must be installed and horizontal lines pitched to ensure proper oil return and to reduce liquid floodback to compressor. Pitch horizontal hot gas piping at a minimum of 1/2" per 10 feet (42mm per 10m) so that gravity will aid in moving oil in the direction of the refrigeration flow.



VERTIV COOLPHASE CEILING

COMPONENT LOCATION EVAPORATOR UNIT, 2 & 3 TON

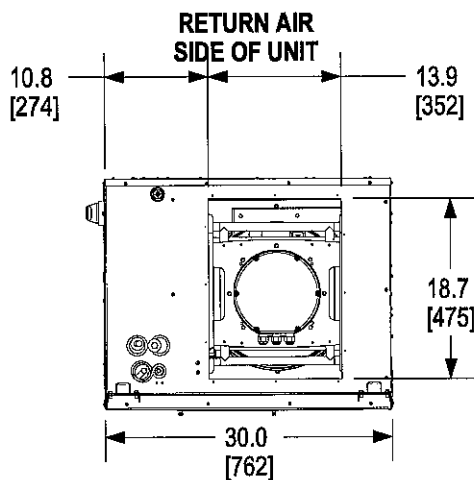
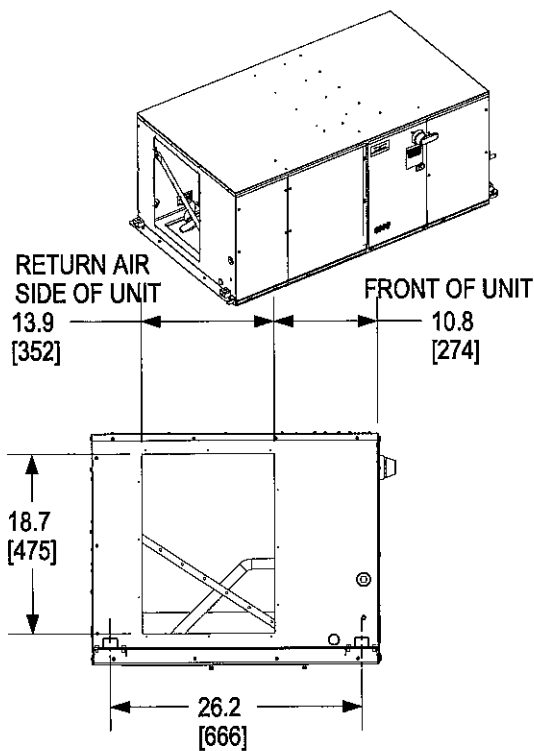


ITEM	DESCRIPTION
1	DIRECT DRIVE FAN WITH VARIABLE SPEED EC MOTOR
2	EVAPORATOR COIL DX
~~3~~	~~EVAPORATOR COIL FREE COOLING (OPTIONAL)~~
4	HUMIDIFIER (OPTIONAL)
5	ELECTRICAL BOX
~~6~~	~~SMOKE SENSOR (OPTIONAL)~~
7	ELECTRICAL REHEAT (OPTIONAL)
~~8~~	~~3-WAY VALVE (ONLY IN FREE COOLING OPTION)~~



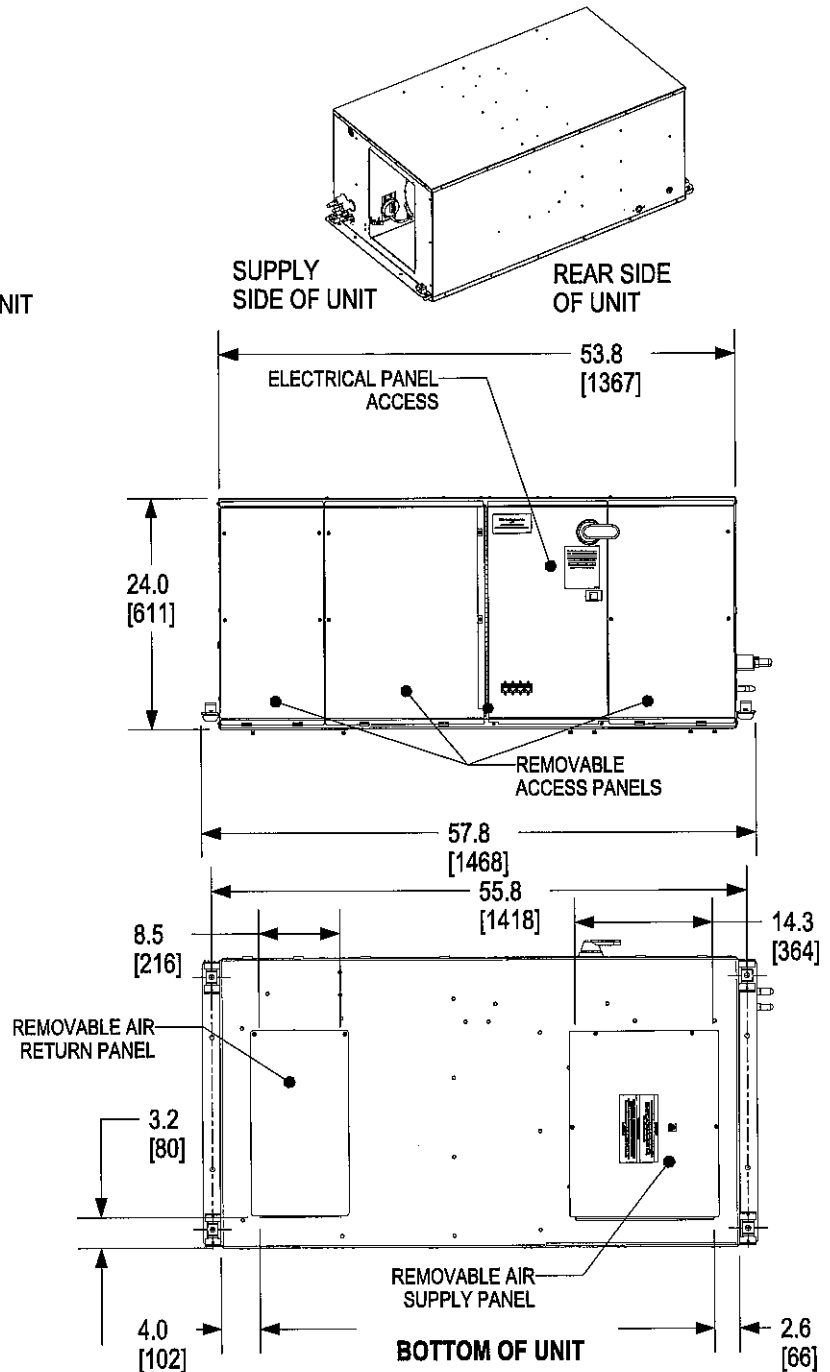
VERTIV COOLPHASE CEILING

DIMENSIONAL DATA CABINET DIMENSIONS, 2 & 3 TON



SUPPLY SIDE OF UNIT

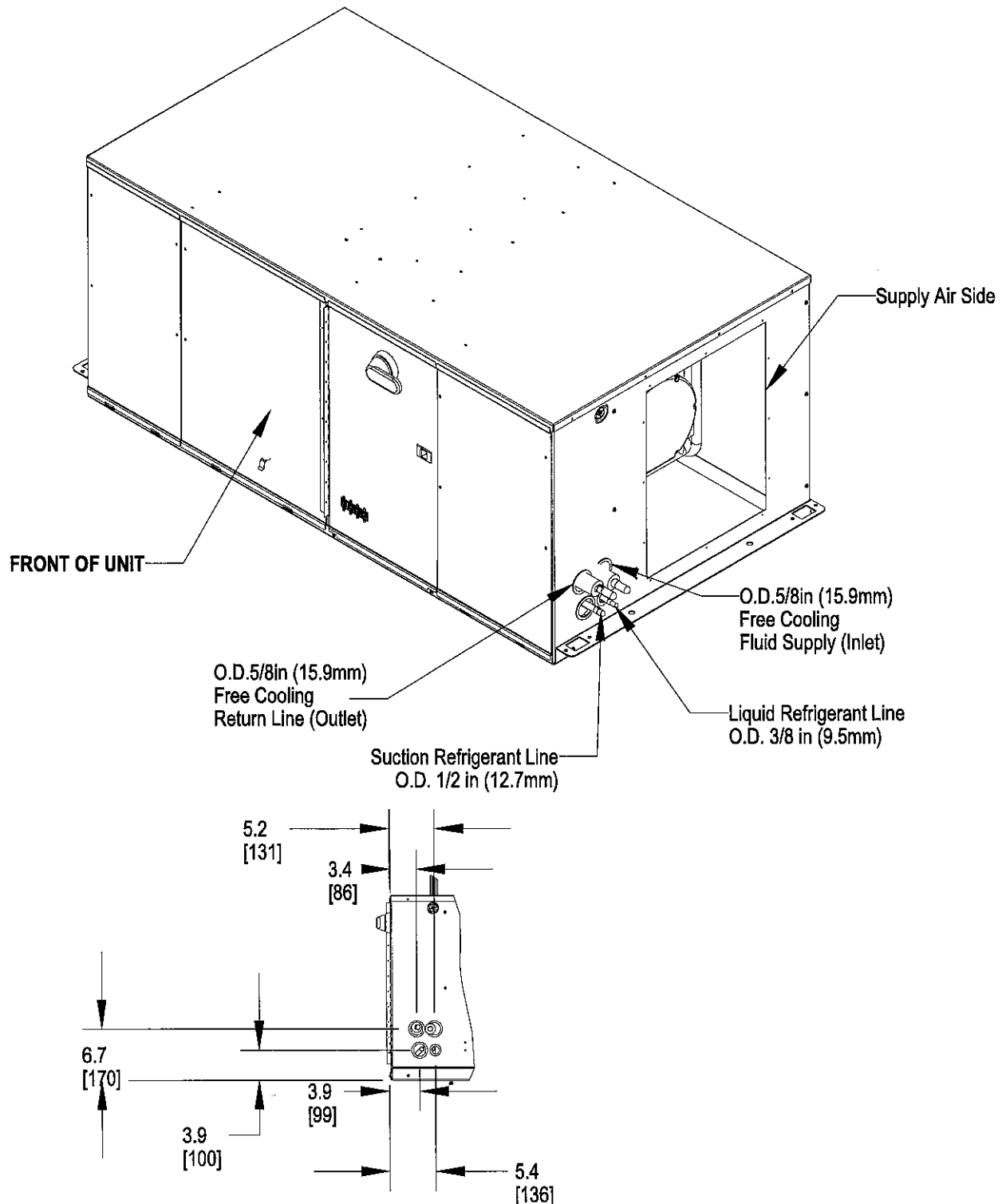
	EVAPORATOR COIL	UNIT NET WEIGHT LBS. (KG)
MMI24 (2 TON) MODEL	→ DX	295.4 (134.0)
	DX + FC	325.4 (147.6)
MMI36 (3 TON) MODEL	DX	299.8 (136.0)
	DX + FC	329.8 (149.6)



VERTIV COOLPHASE CEILING

PRIMARY CONNECTION LOCATIONS

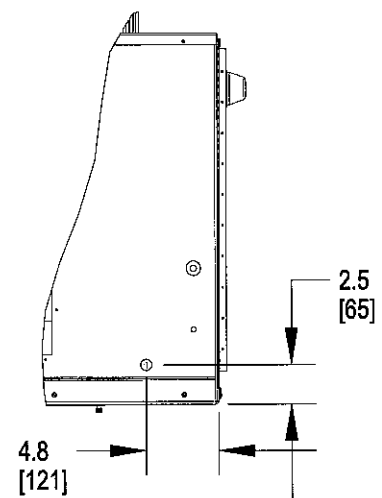
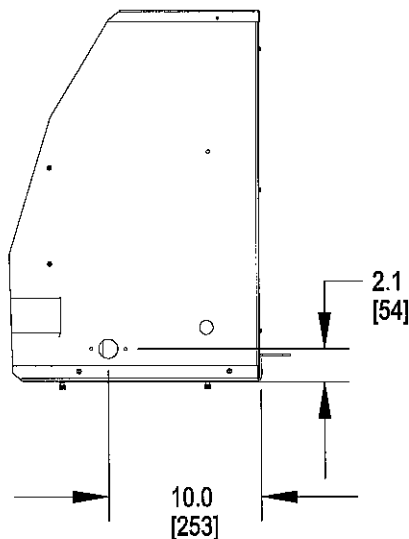
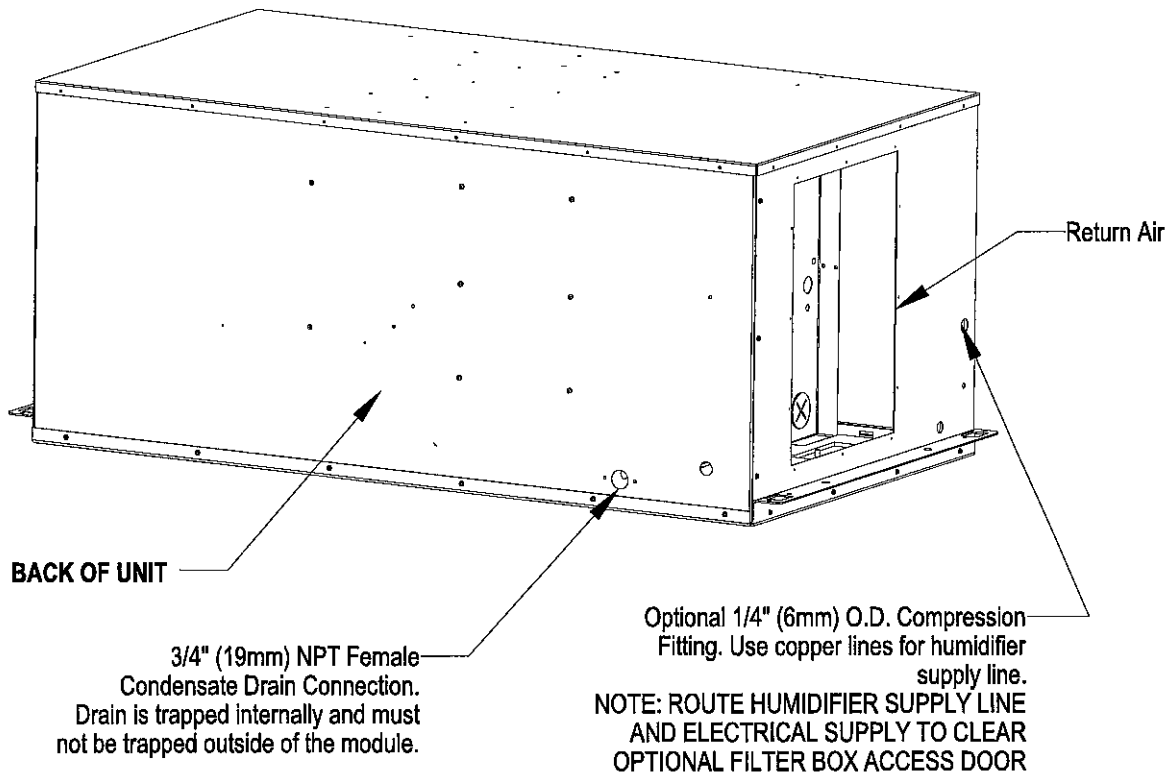
2 & 3 TON DIRECT EXPANSION & FREE COOLING



VERTIV COOLPHASE CEILING

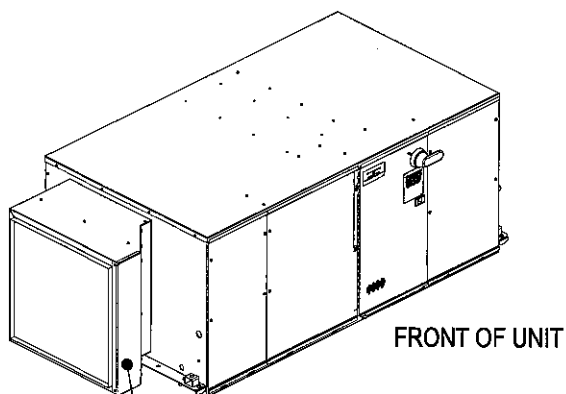
PRIMARY CONNECTION LOCATIONS

2 & 3 TON DIRECT EXPANSION & FREE COOLING

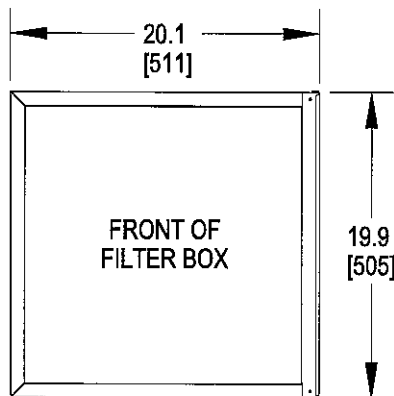
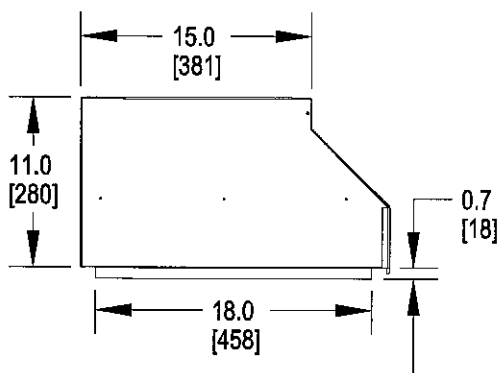
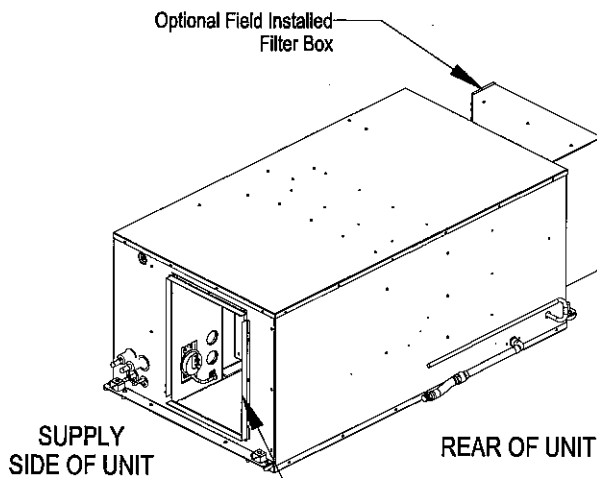


VERTIV COOLPHASE CEILING

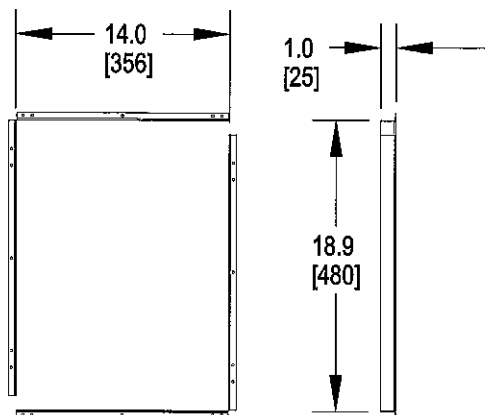
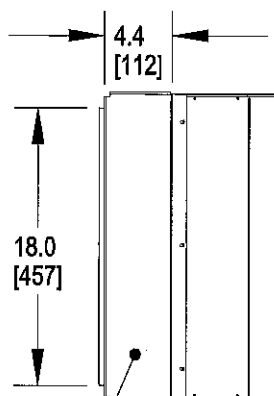
DIMENSIONAL DATA FILTER BOX 2 & 3 TON



Filter access door, recommended clearance of 30" (762mm) be provided for component access and removal.



OPTIONAL FILTER BOX



SUPPLY AIR DUCT FLANGES
INSTALLED DIMENSIONS



VERTIV™

VERTIV COOLPHASE CEILING

PIPING CONNECTIONS

CONDENSATE PUMP CONNECTION LOCATIONS, 2 & 3 TON

FRONT OF UNIT

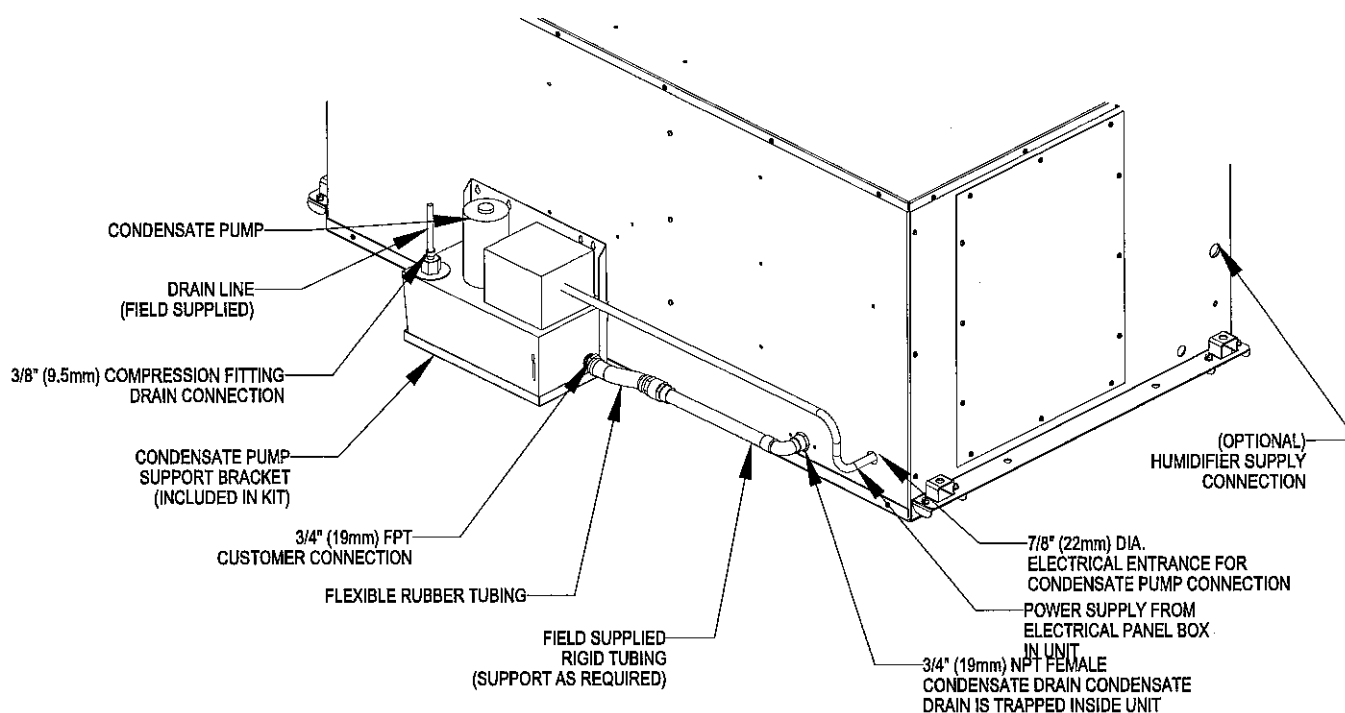
SUPPLY AIR SIDE

RETURN AIR SIDE

TOP VIEW

12.5
[317]27.7
[704]6.7
[170]

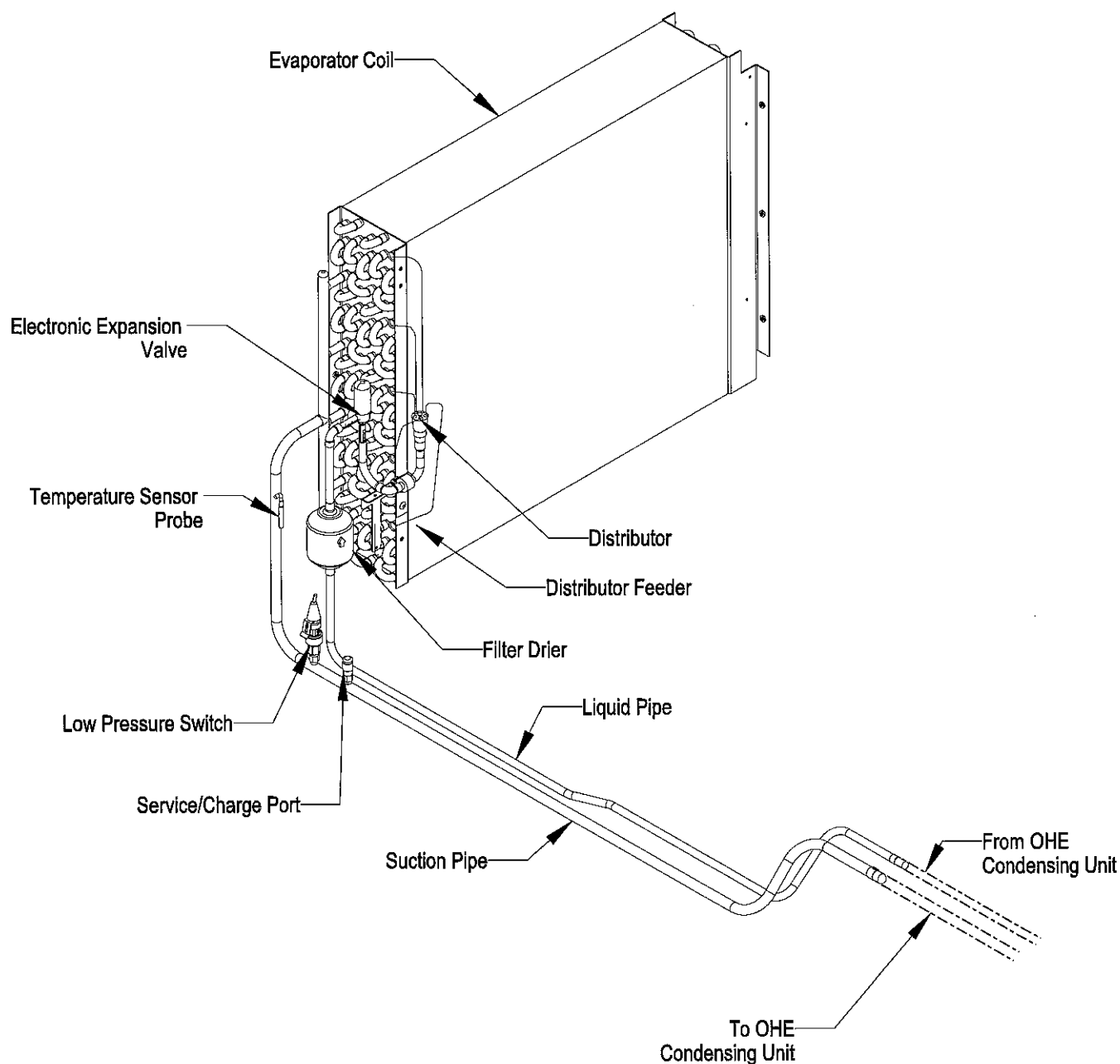
BACK OF UNIT





VERTIV COOLPHASE CEILING

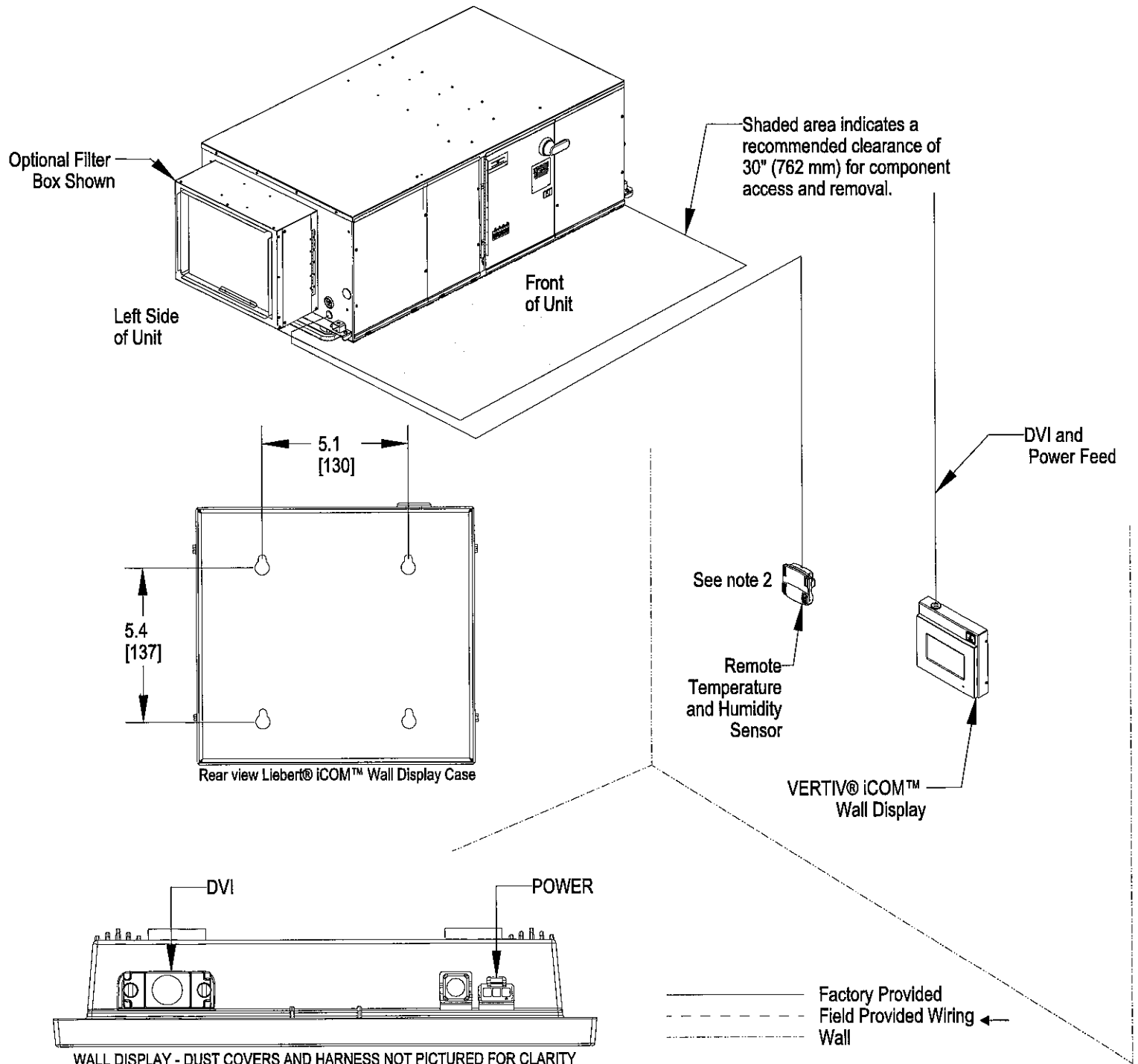
PIPING SCHEMATICS DIRECT EXPANSION UNIT 2 & 3 TON PIPING SCHEMATICS



**VERTIV™**

VERTIV COOLPHASE CEILING

GENERAL ARRANGEMENT, DIMENSIONAL DATA & FIELD CONNECTIONS VERTIV® ICOM™ WALLMOUNT DISPLAY

**Notes:**

1. Refer to 20000913 for connection points on Vertiv™ CoolPhase Ceiling Unit.
2. CANbus cable connection wired form P66 / P67 on the rear of the Remote Temperature / Humidity sensor.
Connection routed to secondary port on rear of Return T/H sensor inside unit or available CANbus port on internal control board (P66 / P67).



VERTIV COOLPHASE CEILING

ELECTRICAL FIELD CONNECTIONS

2 & 3 TON DX & FC

STANDARD ELECTRICAL CONNECTIONS

1) High Voltage connection through the right side of the Ceiling Panel - 1.37" (35mm) diameter concentric knockout

2) Communication connection on the front of the Ceiling Panel
Connect according diagram in the corresponding ethernet port.

3) Electrical service (hard wired) - refer to serial tag information for unit electrical service requirement

- Three Phase - 208-230V 60HZ / 460 60HZ

- Single Phase - 208-230V 60HZ

Connect to terminals on disconnect switch. Electrical service not by Vertiv. Use copper conductors only, wire per local codes. Refer to specification sheet for total unit full load amps, wire size amps and max over current protection device size.

4) Communication Bracket

-P64A: U2U-A Unit-to-Unit Communication

-P64B: U2U-B Unit-to-Unit Communication

-VFD: Condenser Modbus (RS485) Communication

-P74: BMS Connectivity / Embedded Unity

5) Terminal Blocks Control Distribution Voltage / Power Voltage Terminals / Communication RS485

- TBK Terminal Ground

- TBK 24M Control Distribution Voltage 24VAC

- TBK 24-24AS Control Distribution Voltage 24VAC Insulated Voltage from Transformer 1:1

6) Fans Terminal Blocks

- MR relay is the power source for MF (Main Fan Relay)

- Main control signal from ICOM 4 (0-10V Distribution)

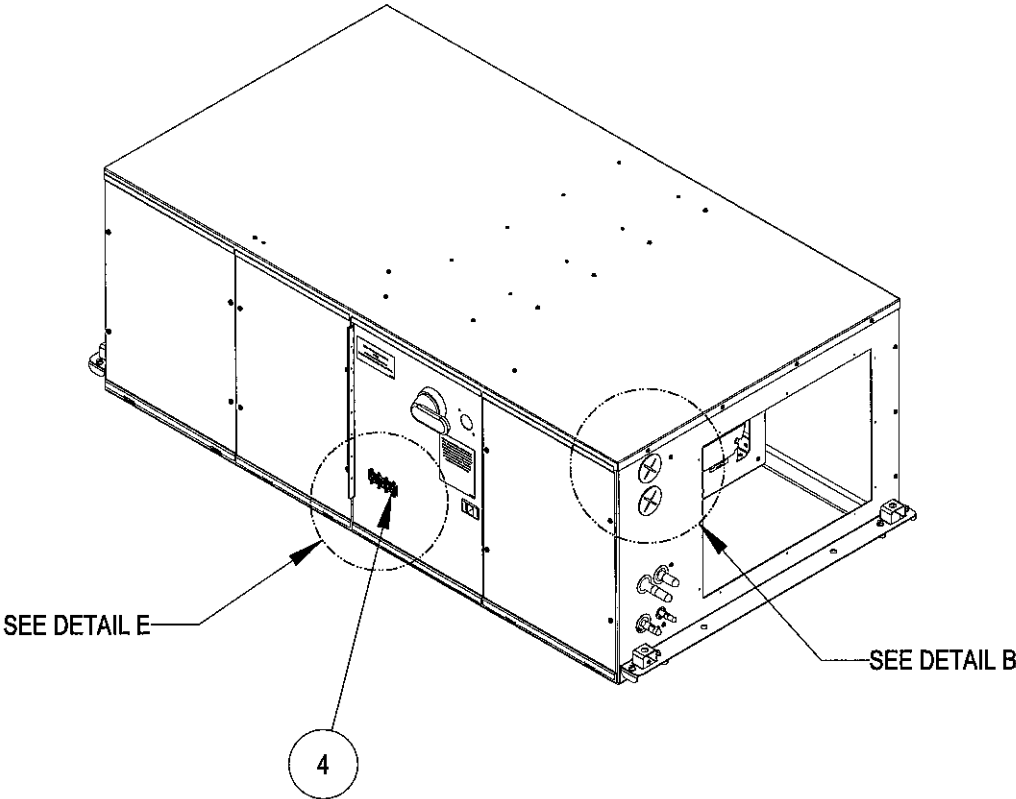
Reference models showed in this document are 300MM units. All connections, terminal block locations and communication ports also apply for 600MM units.



VERTIV COOLPHASE CEILING

ELECTRICAL FIELD CONNECTIONS

2 & 3 TON DX & FC



DETAIL E

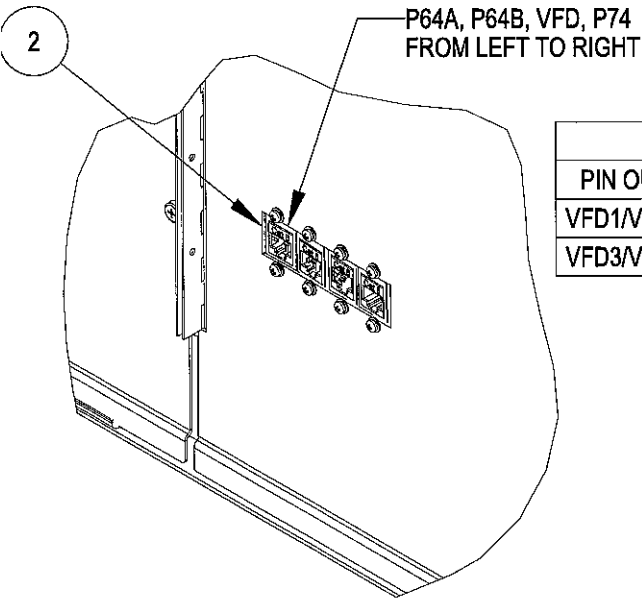
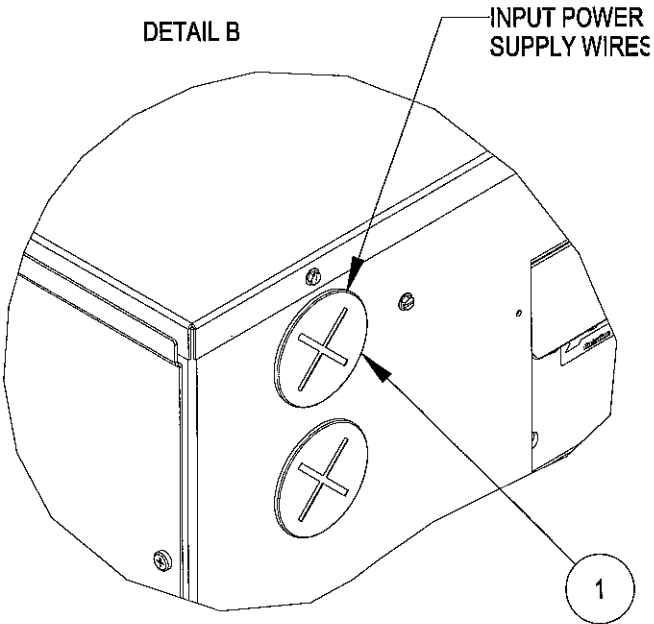


TABLE "A"	
PIN OUT	DESCRIPTION
VFD1/VFD8	MODBUS A/B
VFD3/VFD4	24VAC L/N

DETAIL B



ETHERNET CABLE CONFIGURATION MUST BE STRAIGHT CONFIGURATION.
Z4 PIN OUT(INDOOR - OUTDOOR COMMUNICATION)
SEE TABLE "A"

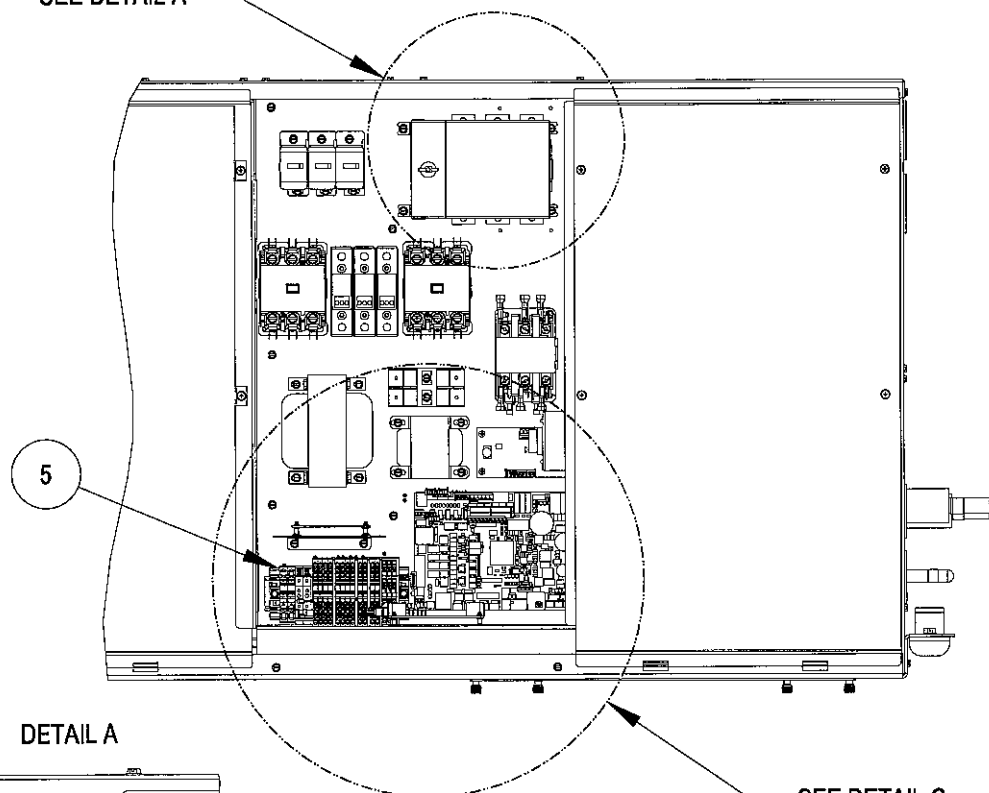


VERTIV COOLPHASE CEILING

ELECTRICAL FIELD CONNECTIONS

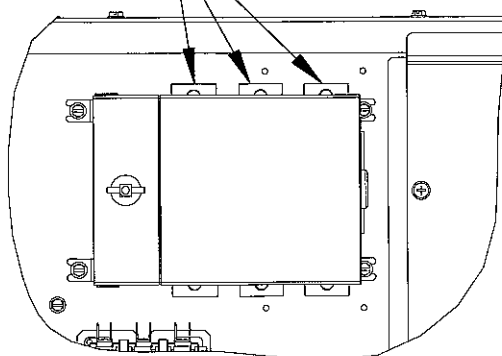
2 & 3 TON DX & FC

SEE DETAIL A

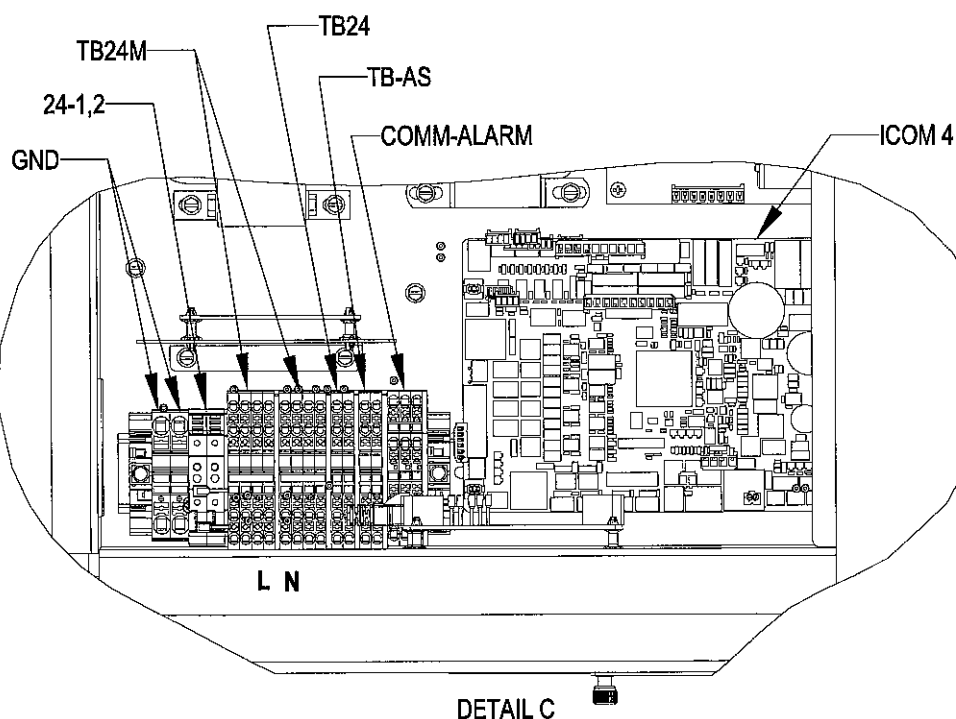


L1,L2,L3

DETAIL A



INPUT MAIN POWER SUPPLY
FROM CUSTOMER

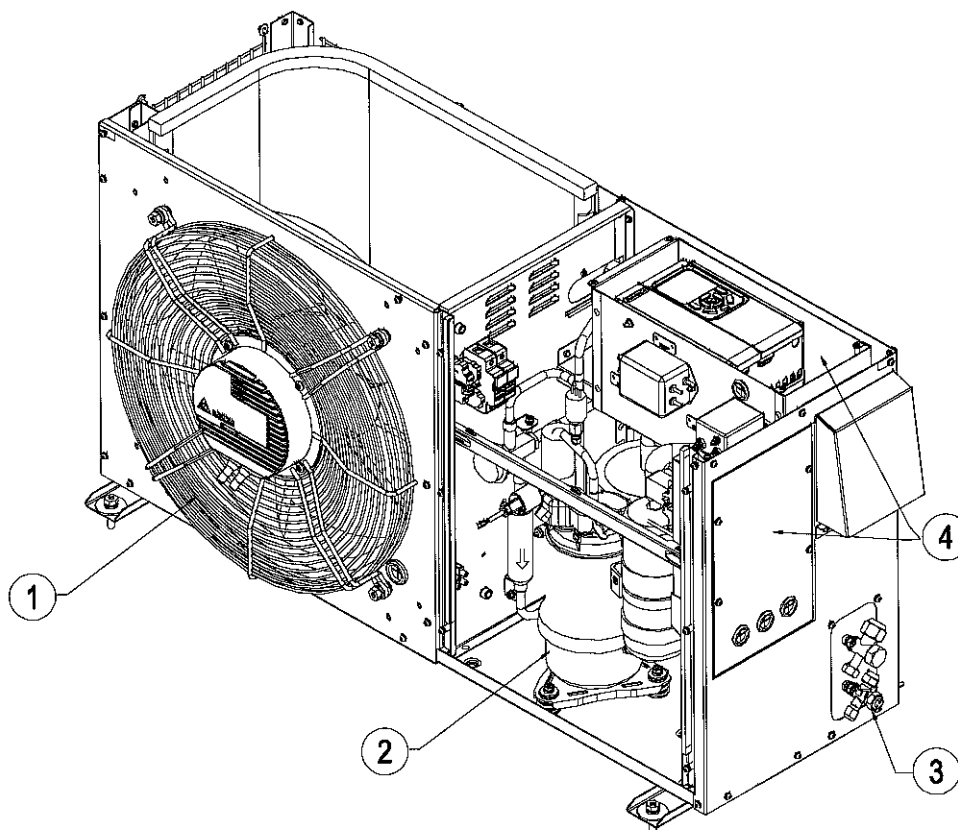




Vertiv CoolPhase Condensing Unit

COMPONENT LOCATION

CONDENSER UNIT 3.5 & 7.0 & 11KW

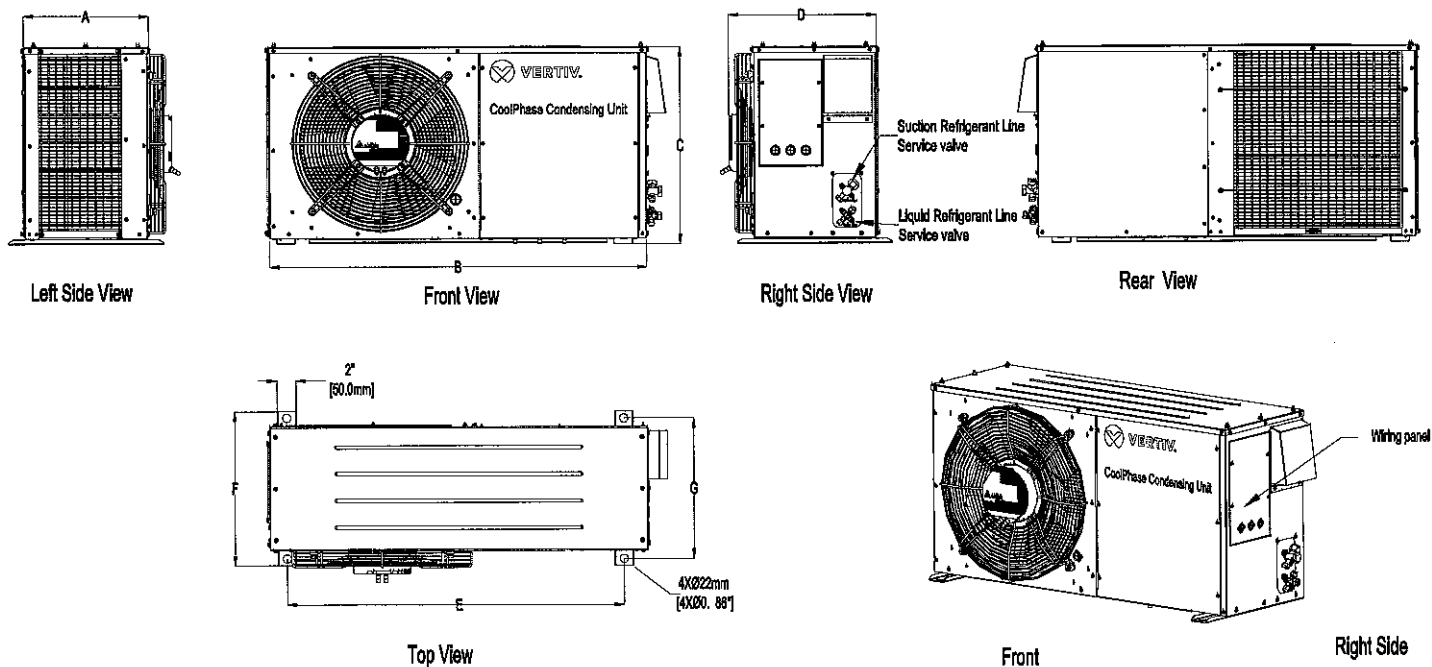
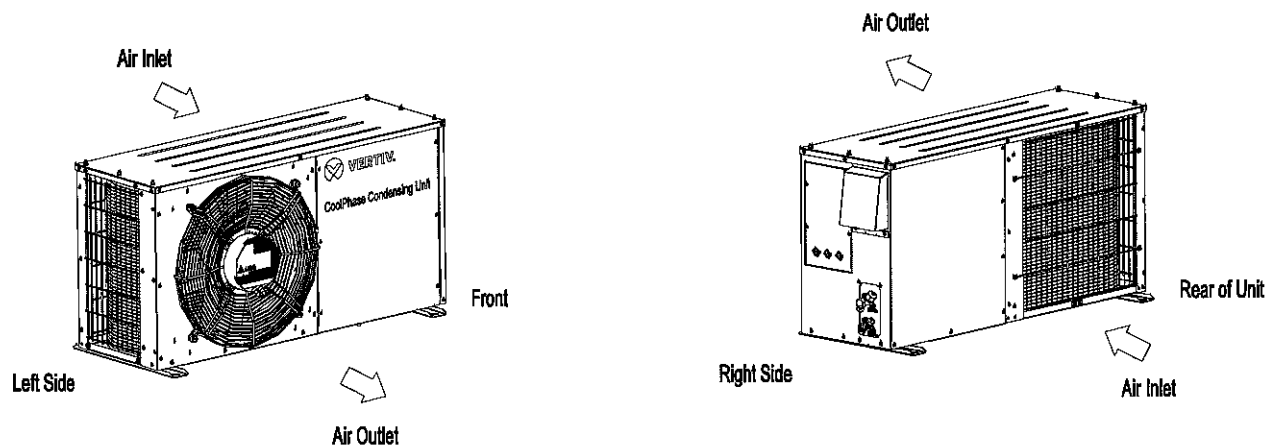


	A	B
1	ITEM	DESCRIPTION
2	1	CONDENSER FAN
3	2	COMPRESSOR
4	3	SERVICE VALVES
5	4	ELECTRICAL BOXES



Vertiv CoolPhase Condensing Unit

DIMENSIONAL DATA



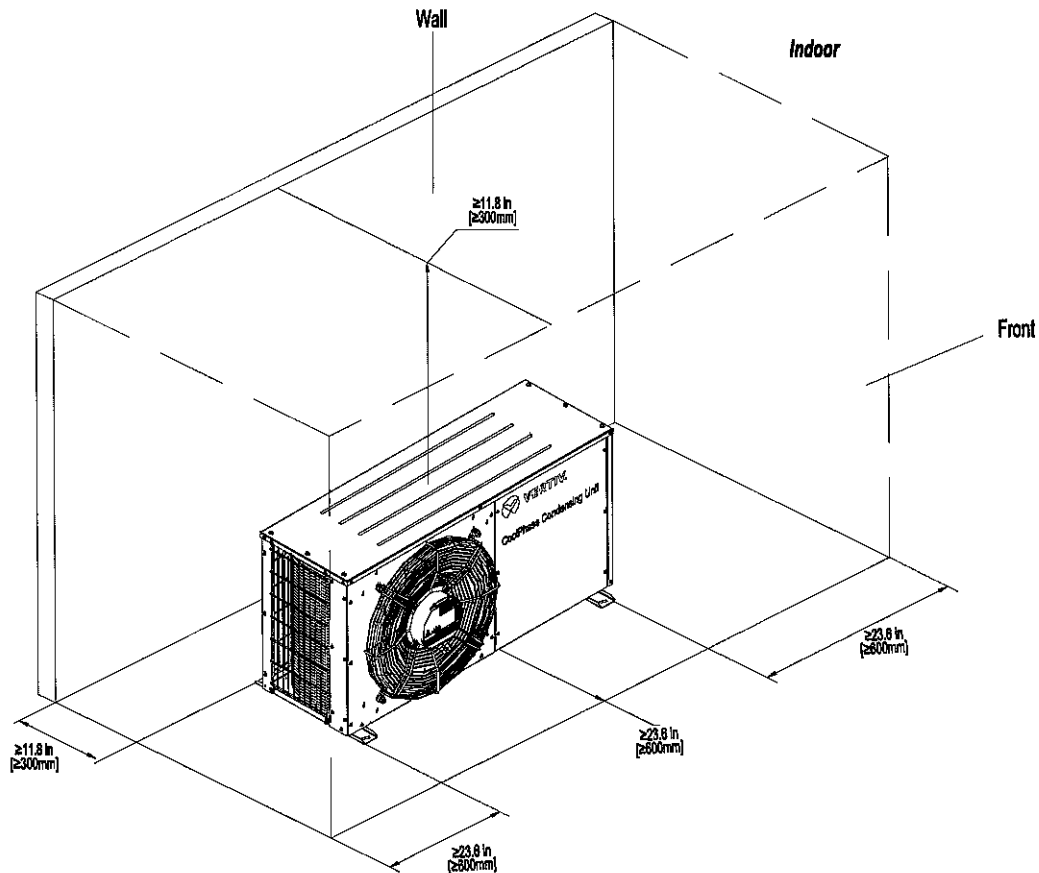
MODEL #	DIMENSIONAL DATA in. (mm).							NET WEIGHT lb (kg)		Shipping Dimensions(WxDxH) in.(mm).		SHIPPING WEIGHT lb (kg)	
	A	B	C	D	E	F	G	CUD	CUL	/		CUD	CUL
CUD090-E000A CUL090-E000A	12.6 (319)	38.8 (985)	20.3 (516)	15.2 (385)	34.7 (881)	15.9 (404)	14.5 (368)	110.2 (50)	116.8 (53)	45.2 x 22 x 28.8 (1149 x 559 x 732)		169.8 (77)	176.4 (80)
CUD070-E000A CUL070-E000A	16.5 (419)	44.4 (1128)		19.1 (485)	40.1 (1018)	19.8 (504)	18.4 (468)	118 (53.5)	130 (59)	50.7 x 26 x 28.8 (1289 x 659 x 732)		188.5 (85.5)	200.6 (91)
CUD111-E000A CUL111-E000A	20.5 (520)	51.3 (1303)	22.8 (580)	23.4 (595)	46.4 (1179)	23.8 (604)	22.4 (568)	175.3 (79.5)	184.1 (83.5)	57.8 x 30.1 x 31.3 (1464 x 764 x 795)		259 (117.5)	272.3 (123.5)
CUD115-E000A CUL115-E000A								174.17 (79)	183 (83)			257.9 (117)	271.2 (123)



Vertiv CoolPhase Condensing Unit

CLEARANCE SPACE

Standard Condensing Unit Install indoor



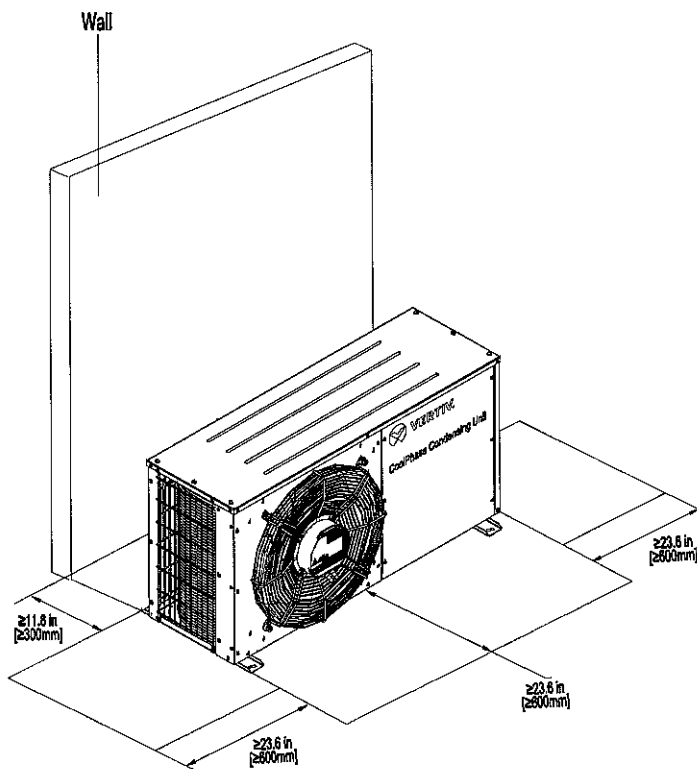
NOTES: When Standard Condensing Unit is installed in indoor environment, it is not necessary to install the wind baffle.



Vertiv CoolPhase Condensing Unit

CLEARANCE SPACE

Standard Condensing Unit Install outdoor





Vertiv CoolPhase Condensing Unit

PRIMARY CONNECTION LOCATIONS

Field-installed piping must comply with all applicable local codes.

The vertical riser pipe size must be reduced according to the following trade sizes: (1-1/8 to 7/8, 7/8 to 3/4, 3/4 to 5/8, 5/8 to 1/2.)

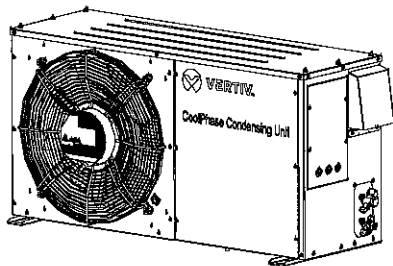


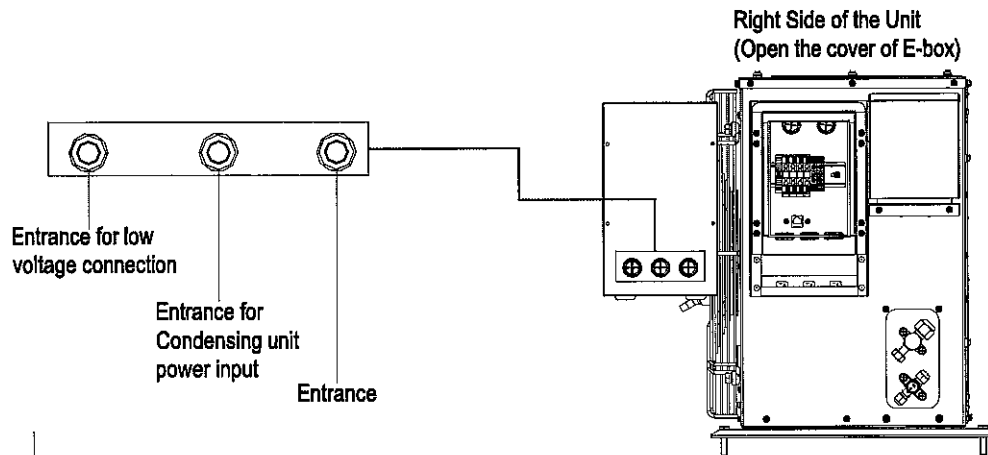
Table 1. Vertiv Coolphase Condensing Unit recommended refrigerant line size of standard units and low ambient units

	A	B	C	D	E	F
1	Outdoor Model	Refrigerant line length ft(m)	Liquid line diameter ANSI(mm)	Suction line diameter ANSI(mm)	"LIQUID LINE SERVICE VALVE"	"SUCTION LINE SERVICE VALVE"
2	CUD030-E000A	$L \leq (33)10$	1/4"(6.35)	1/2"(12.7)	7/16"-20UNF	3/4"-16UNF
3	CUL030-E000A	$33(10) < L \leq 197(60)$	3/8"(9.52)	1/2"(12.7)	7/16"-20UNF	3/4"-16UNF
4	CUD070-E000A	$L \leq (33)10$	3/8"(9.52)	1/2"(12.7)	5/8"-18UNF	3/4"-16UNF
5	CUL070-E000A	$33(10) < L \leq 115(35)$	3/8"(9.52)	5/8"(16)	5/8"-18UNF	3/4"-16UNF
6		$115(35) < L \leq 197(60)$	1/2"(12.7)	5/8"(16)	5/8"-18UNF	3/4"-16UNF
7	CUD111-E000A	$L \leq 66(20)$	3/8"(9.52)	5/8"(16)	5/8"-18UNF	7/8"-14UNF
8	CUL111-E000A	$66(20) < L \leq 148(45)$	1/2"(12.7)	3/4"(19.05)	5/8"-18UNF	7/8"-14UNF
9	CUL115-E000A	$148(45) < L \leq 197(60)$	1/2"(12.7)	7/8"(22.23)	5/8"-18UNF	7/8"-14UNF



Vertiv CoolPhase Condensing Unit

ELECTRICAL FIELD CONNECTIONS



Electric control box layout and power supply system		
CUD030-E000A, CUL030-E000A CUD070-E000A, CUL070-E000A	CUD111-E000A, CUL111-E000A	CUD115-E000A, CUL115-E000A
RJ45-low voltage connector	RJ45-low voltage connector	RJ45-low voltage connector
208/230V/1Ph/50/60Hz	208/230V/3Ph/50/60Hz	400V/3Ph+N/50/60Hz

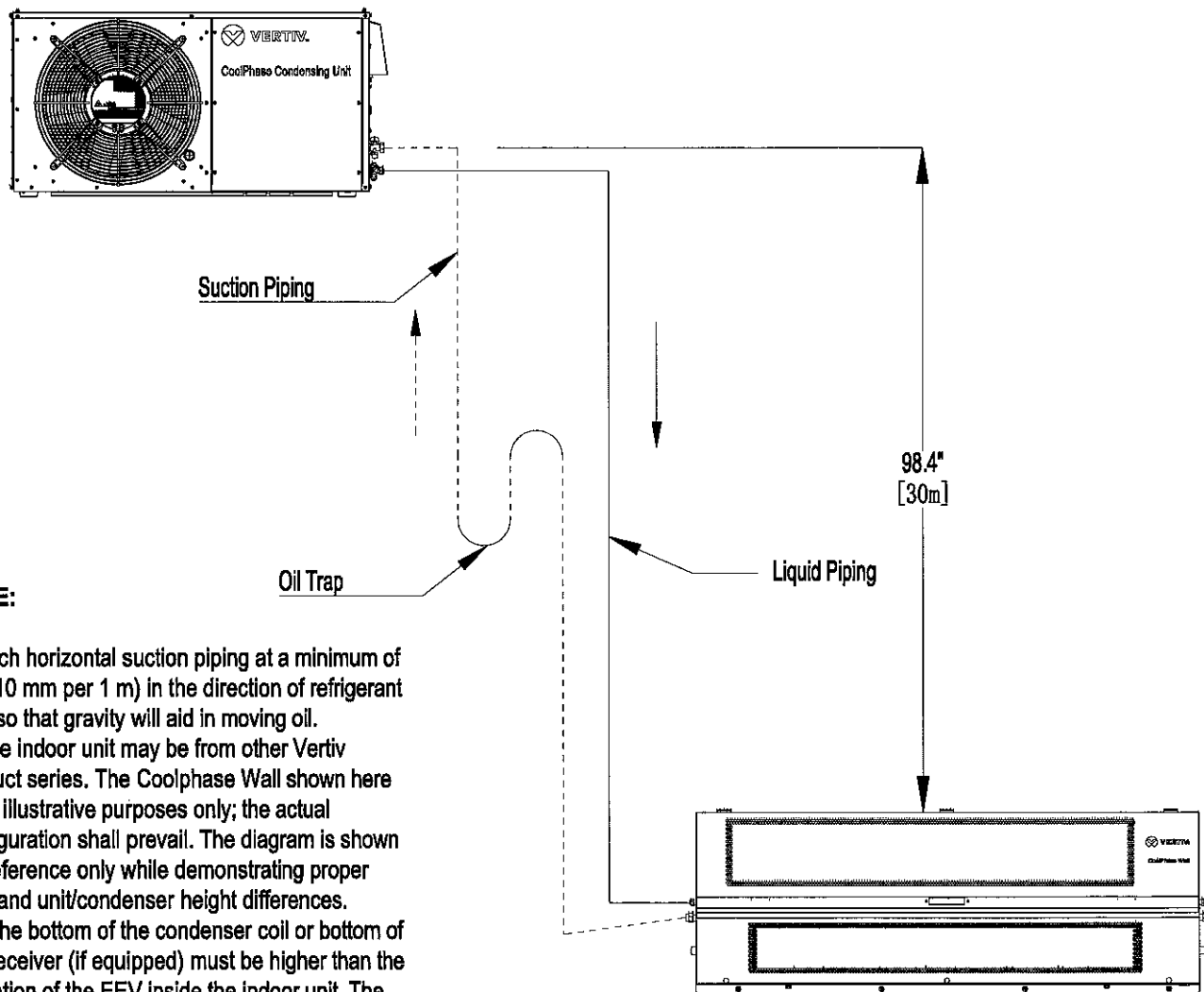
NOTE: After wiring is completed, secure the excess cables with wire ties. The Wire Saddles are at the bottom of the electrical box.



Vertiv CoolPhase Condensing Unit

PIPING SCHEMATIC

CONDENSER UNIT ABOVE INDOOR UNIT 3.5 & 7.0 & 11KW



NOTE:

1. Pitch horizontal suction piping at a minimum of 1% (10 mm per 1 m) in the direction of refrigerant flow so that gravity will aid in moving oil.
2. The indoor unit may be from other Vertiv product series. The Coolphase Wall shown here is for illustrative purposes only; the actual configuration shall prevail. The diagram is shown for reference only while demonstrating proper pipe and unit/condenser height differences.
3. If the bottom of the condenser coil or bottom of the receiver (if equipped) must be higher than the elevation of the EEV inside the indoor unit. The vertical height must not exceed 98.4 feet (30m).
4. Install an oil trap every 24.6 feet (7.5m) of the vertical suction/gas pipe.



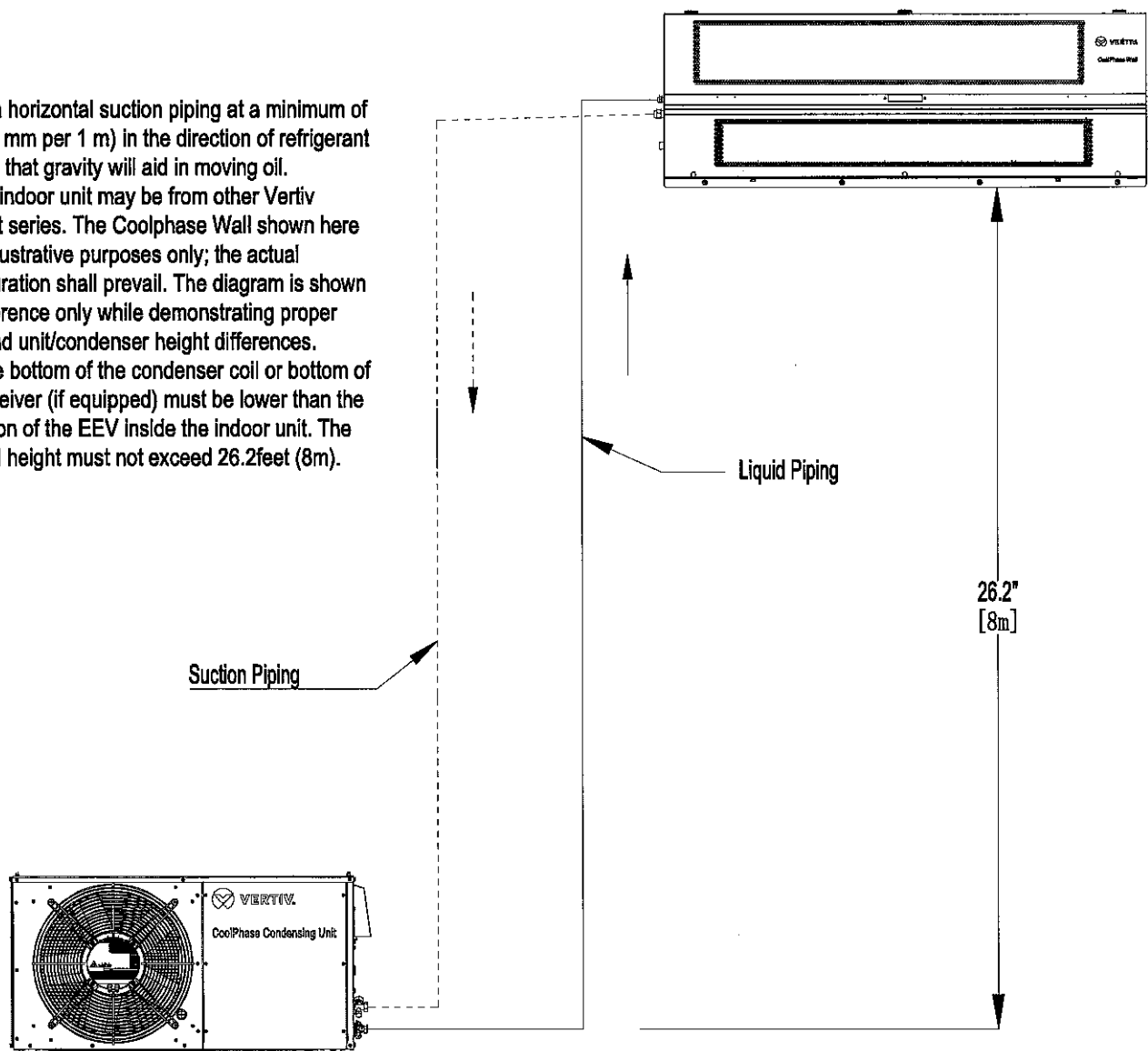
Vertiv CoolPhase Condensing Unit

PIPING SCHEMATIC

CONDENSER UNIT BELOW INDOOR UNIT 3.5 & 7.0 & 11KW

NOTE:

1. Pitch horizontal suction piping at a minimum of 1% (10 mm per 1 m) in the direction of refrigerant flow so that gravity will aid in moving oil.
2. The indoor unit may be from other Vertiv product series. The Coolphase Wall shown here is for illustrative purposes only; the actual configuration shall prevail. The diagram is shown for reference only while demonstrating proper pipe and unit/condenser height differences.
3. If the bottom of the condenser coil or bottom of the receiver (if equipped) must be lower than the elevation of the EEV inside the indoor unit. The vertical height must not exceed 26.2feet (8m).





DX PRODUCTS WITH R32

A2L REFRIGERANT DISPERSAL VOLUME CALCULATION R32

Engineer of record to determine the Refrigerant Charge m_c and required minimum Effective Dispersal Volume V_{ED} of the space to which the appliance can be utilized for the cooling of ITE AREAS.

The required minimum EFFECTIVE DISPERSAL VOLUME V_{ED} is a function of the refrigerant charge, m_c and is represented by the following equation:

$$V_{ED} = m_c / 0.5 \times \text{LFL}$$

V_{ED} = the minimum Effective Dispersal Volume in ft^3 (m^3)

m_c = the refrigerant charge of the largest single circuit of a unit in lbs (kg)

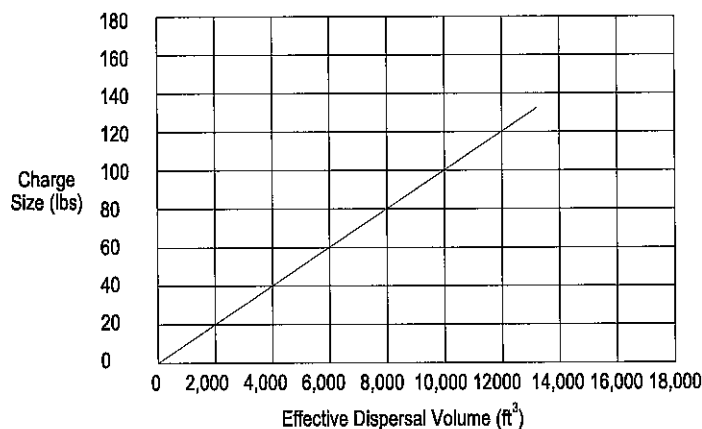
0.5 = the concentration factor

LFL = the Lower Flammability Limit in $\text{lbs}/1000 \text{ ft}^3$ (kg/m^3)

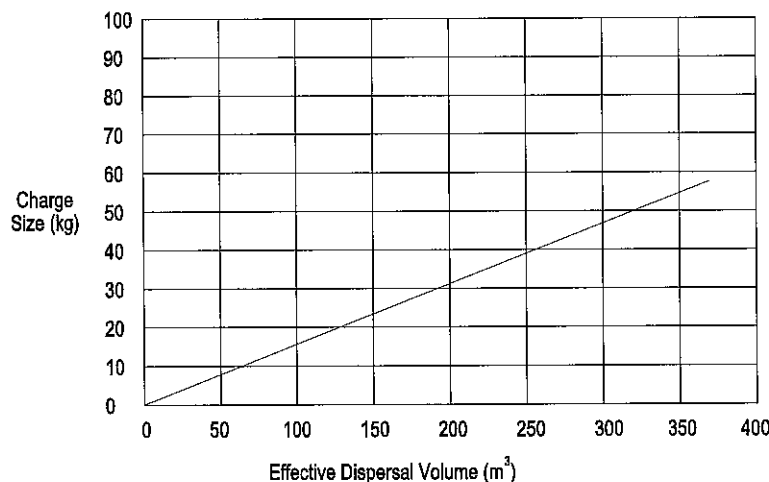
Note: The LFL of R32 is $19.2 \text{ lbs}/1000 \text{ ft}^3$ ($307.0 \text{ g}/\text{m}^3$) according to ASHRAE 34-2022.

Minimum Effective Dispersal Volume V_{ED} of the space shall be based on altitude of the installation location. For locations above sea level, the engineer of record will need to adjust the value of LFL in accordance with ANSI/ASHRAE 34 before applying it to the equation for determining the required minimum Effective Dispersal Volume V_{ED} .

Charge Size vs. Effective Dispersal Volume



Charge Size vs. Effective Dispersal Volume





VERTIV COOLPHASE CEILING

STANDARD & OPTIONAL FEATURES

EVAPORATOR UNIT, 1-8TON

STANDARD FEATURES

EVAPORATOR COIL Constructed of soft copper tubes in a staggered tube pattern. Tubes are expanded into continuous high efficiency aluminum lance type fins. Coil is set in condensate drain pan, with float switch for unit shutdown. The evaporator drain is internally trapped.

REFRIGERATION SYSTEM Single refrigeration circuit, includes a liquid line filter drier, externally equalized expansion valve, and a suction pressure transducer. The module is pre-charged with nitrogen and sealed. R-32 refrigerant must be field supplied and field charged by others.

FAN ASSEMBLY Fan is plug type, with integral direct drive with backward curved blades and Electronically Commutated (EC) motor. The fan speed shall be variable and automatically regulated by the Liebert® iCOM™ control through all modes of operation. The impeller shall be made of aluminum and is dynamically balanced. The fan shall be located to draw air through the coil to ensure even air distribution and maximum coil performance.

LIEBERT® iCOM™ CONTROL SYSTEM The Liebert® iCOM™ controls the Liebert® CoolPhase Ceiling and enables Unit-to-Unit communication with other Liebert® CoolPhase Ceiling units.

BASE-COMMS FOR BMS CONNECTIVITY The Liebert® iCOM™ controller shall provide four ethernet ports dedicated for:

- 1) Unit-to-Unit A
- 2) Unit-to-Unit B
- 3) BMS Connectivity
- 4) Indoor-Outdoor Communication

TOUCH SCREEN DISPLAY The standard user interface is a remote wall mountable 9 inch color touch screen which presents system information and allows all parameters to be viewed and adjusted. The touch screen display comes in a plastic housing for mounting on the wall and is shipped loose with the unit

CABINET AND CHASSIS Constructed of galvanized steel for strength and corrosion resistance with thermal/acoustical insulation to reduce sound levels and prevent condensation. Removable panels allow access to the electric panel or refrigeration components for service or maintenance. Hanging brackets are integral to the chassis with vibration isolators and hardware provided for field supplied 3/8" threaded suspension rods.

UNIT PROTECTIONS AND CONTACTS include a filter clog switch, common alarm contact and remote shutdown contacts.

- Filter clog switch is provided to activate a Liebert® iCOM™ alarm when the pressure drop across the filter exceeds the customer adjustable level. Switch is adjustable outside the cabinet.
- Common Alarm Contact is one set of normally open contacts which close for remote indication of alarms.
- Remote Shutdown Contact allows unit shutdown based on external input

HIGH TEMPERATURE SENSOR senses the return air temperature, shuts down the unit if temperature reaches 125F (52C) and is a manual reset device not meant to replace any fire detection system that may be required by local or national codes.

TEMPERATURE AND HUMIDITY SENSORS are mounted in unit on the return air stream and wired to the Liebert® iCOM™ Control board.



VERTIV COOLPHASE CEILING

STANDARD & OPTIONAL FEATURES

EVAPORATOR UNIT, 1-8TON

OPTIONAL FEATURES

- **LOCKING UNIT DISCONNECT SWITCH** includes a "Locking-Type" factory-mounted fused disconnect switch providing unit with a 5,000 Amp or 65,000 Amp short-circuit current rating (SCCR). Disconnect switch is mounted internally with locking and lockable handle operational from outside the unit. Access to high voltage electric panel can only be obtained with the switch in the "off" position, and the handle is lockable to support lockout/tagout safety programs.
- **ELECTRIC REHEAT** Electric low watt density 304 stainless steel fin tubular reheat element provides one stage of reheat to maintain room dry bulb temperature during dehumidification and is protected by one automatic reset temperature switch and one manual reset temperature safety switch.
- **STEAM GENERATING CANISTER HUMIDIFIER** is housed in a steel enclosure and includes a replaceable canister with all supply and drain valves, 1" (25mm) air gap on fill line, inlet strainer, steam distributor and electronic controls, including high water indicator. System automatically fills and drains and maintains the required water level based on conductivity. Humidifier Problem Alarm annunciates touchscreen display.

SMOKE SENSOR samples the return air, shuts down the unit upon detection, and sends visual and audible alarm. This smoke sensor is not intended to function as or replace any room smoke detection system that may be required by local or national codes. Smoke sensor trouble connections are available for external monitoring

FREE COOLING Air cooled coil, for alternate Water/Glycol Source, Constructed of soft copper tubes in a staggered tube pattern and Header tubes for inled and outlet. Tubes are expanded into continuous high efficiency aluminum lance type fins. Coil is set in condensate drain pan, with float switch for unit shutdown.



VERTIV COOLPHASE CEILING

STANDARD & OPTIONAL FEATURES

EVAPORATOR UNIT, 1-8TON

SHIP LOOSE OPTIONS

- **FILTER BOX** is constructed of galvanized steel, supplied with quantity of two nominal 20" (508mm) x 20" (508 mm) x 4" (102 mm) deep pleated MERV 8 filters (based on ASHRAE 52.2-2007). The box is provided with a 1" (25 mm) duct flange. The filters are accessible via a hinged access door, without shutting the unit down. The filter box option also includes a 1" (25 mm) discharge air duct collar.

DUCT FLANGES 1" (25mm) duct flanges for easy duct integration.

BOTTOM DISCHARGE GRILLE (1, 2 and 3 Ton models only) is a 3-way louvered air grille, painted white, added to a T-bar grid assembly for air discharge directly into room from bottom of unit. Kit includes air baffle and rear discharge block-off plates. Use separate filter box kit for filtration and connection to field provided room air return grille and ductwork.

DISTRIBUTION PLENUM (1, 2 and 3 Ton models only) Easily installed, self-contained air distribution plenum provides air discharge in three directions. The plenum is supplied with a nominal 16" (406mm) x 25" (535mm) x 4" (102mm) deep pleated MERV 8 filter (based on ASHRAE 52.2-2007).

- **CONDENSATE PUMP** has a capacity of 7.5 GPM (28.4 l/m) at 10 ft feet of head for 460/575V units, and 5.1 GPM (19.3 l/m) for 208/230 volt units at 10 ft. of head. Pump assembly is complete with pump, motor assembly, reservoir, integral float switch, and auxiliary safety float switch to shut unit off in event of pump failure. Pump assembly is designed to mount on the side of the evaporator (indoor) module, or other suitable means to allow condensate drainage into the reservoir. The condensate pump is field-mounted on the outside of the cabinet, and is field-wired to the evaporator/fan-coil electric panel for both power supply and float switch interlock. Separate power feed is not necessary.
- **TEMPERATURE AND HUMIDITY SENSORS** are mounted in an attractive case with 30 ft. (9m) of cable, it is shipped loose and ready to be field mounted on the room wall or in unit return air stream and field wired to the Liebert® iCOM™ Control board.



Vertiv CoolPhase Condensing Unit

STANDARD FEATURES AND OPTIONS

STANDARD FEATURES

CABINET is IPX4 rated, made of galvanized sheet metal with powder-coated exterior panels and is equipped with an IPX4-rated waterproof electrical control box.

ROTARY COMPRESSOR is inverter-duty, driven by an inverter, with capacity adjustment range from 20 to 100%.

CONDENSER COIL is an aluminum microchannel heat exchanger, with TCP coating to protect the coil from corrosion.

FAN ASSEMBLY includes an axial EC fan, driven by an Electronically Commutated (EC) motor with speed control from 10% to 100%.

REFRIGERATION SYSTEM is a single-circuit design that includes a compressor, microchannel condenser coil, discharge temperature sensor, high-pressure switch, and check valve. It is designed for field-supplied and charged R32 refrigerant. The standard ambient condenser is capable of operating in temperatures ranging from 23°F to 118°F (-5°C to 48°C). With the addition of the wind baffle assembly (Optional), the unit can operate within a temperature range of -4°F to 118°F (-20°C to 48°C).

HIGH PRESSURE SWITCH is mounted on the compressor discharge line and is set at 595 psi (41 bar) with tolerance of ± 14.5 psi (1 bar). The switch will open when the high pressure exceeds 595 psi (41 bar) and close when the pressure drops below 479 psi (33 bar). If the switch is open, the compressor will be shut down.

DISCHARGE TEMPERATURE SENSOR is installed on the compressor discharge line. If the temperature reaches the limit of 239°F (115°C), the iCOM Edge controller will shut down the compressor.

THE HIGH-PRESSURE TRANSDUCER is installed on the compressor discharge line. If the discharge pressure reaches 565 psi (39 bar), the iCOM Edge controller will shut down the compressor.

CHECK VALVE is mounted on the compressor discharge line to prevent refrigerant migration from the condenser or receiver when the unit is stopped for a long time.

LOW-AMBIENT CONDENSER model includes head pressure valve, liquid receiver, heating belts, relief valve, and low-pressure switch based on the standard units. The condensing unit can operate between -31 to 118°F (-35 to 48°C). The relief valve is installed on the liquid receiver of the low ambient condenser. It features threaded connections for routing refrigerant discharge to the outside. The valve is factory-set to open at 595 psi (45 bar). The check valve is installed on the inlet line of the liquid receiver.

SHIP-LOOSE FEATURE (Optional- FIELD INSTALLED)

DUCT KIT is field attached to the condensing unit to enable ductwork to be connected to the condensing unit. When using the duct kit, please pay attention to the allowable static pressure conditions.

	A	B	C	D	E	F	G	H	I
1		CUD030-E000A	CUL030-E000A	CUD070-E000A	CUL070-E000A	CUD111-E000A	CUL111-E000A	CUD115-E000A	CUL115-E000A
2	Unit Static pressure, (Psi/Pa)	0.2psi(50Pa)	0.2psi(50Pa)	0.12psi(30Pa)	0.12psi(30Pa)	0.12psi(30Pa)	0.12psi(30Pa)	0.12psi(30Pa)	0.12psi(30Pa)

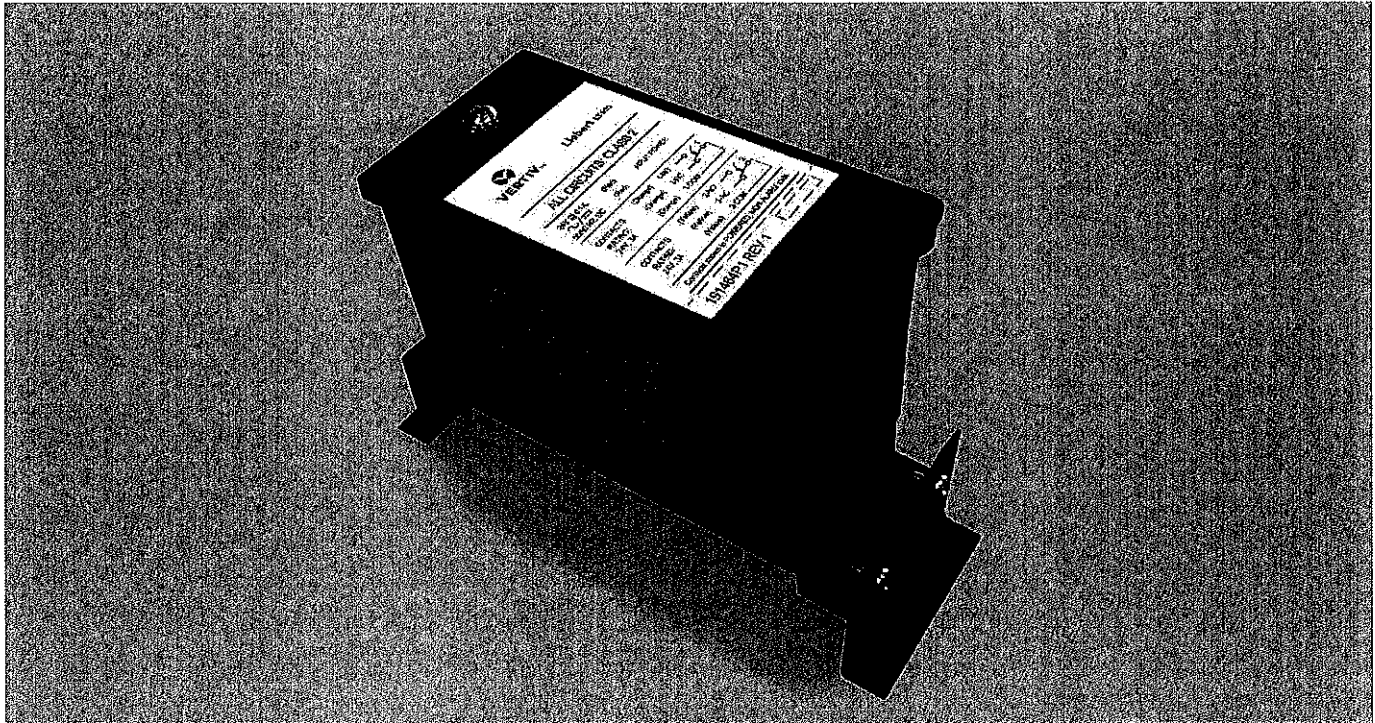
HAILGUARD KIT protects the condensing coil from hail strikes.

→ **WIND BAFFLE** helps shield the condenser from cold wind, enabling the system to operate down to -4°F (-20°C) with standard version unit.

LIEBERT® LIQUI-TECT™ 410

POINT LEAK DETECTION SENSOR

Product Specification/Installation Guide



The Liebert® Liqui-Tect™ 410 (LT410) provides single-point detection of leaks. The point-detection sensor has two gold-plated sensing probes to prevent corrosion and to provide accurate readings. The LT410 constantly monitors for leaks, internal faults, and power failures and warns of any abnormal conditions. Mounting brackets allow for sensor height adjustment and leveling.

The LT410 is the ideal solution for sensing leaks under a raised computer floor or air conditioning drip pans. Two independent outputs provide added flexibility with the capacity to signal both a local alarm panel, Liebert cooling unit and a remote building management system or external equipment, such as motorized water shutoff valves.

LT410 APPLICATIONS

The LT410 is ideally suited for:

- Glycol and chilled water cooling,
- Humidification supply water piping,
- Condensate pumps and drains,
- Unit and ceiling auxiliary drip pans,
- Overhead piping troughs.

LOCATIONS/PLACEMENT

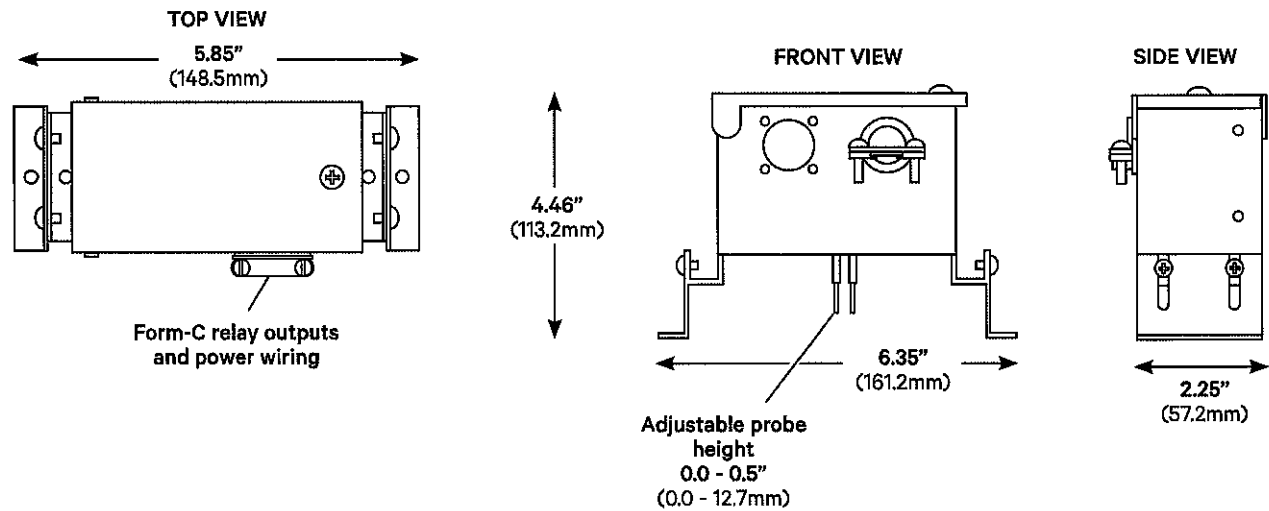
The LT410 is an excellent choice for:

- Large scale network control centers,
- Data centers,
- Server rooms and closets,
- Unattended, remote shelters,
- Mechanical equipment rooms,
- Sensitive areas with overhead piping,
- Industrial process control rooms.

COMPONENTS OF THE LIQUI-TECT™ 410 MODULE

The LT410 consists of a metal enclosure with a hinged top door that provides access to the internal wiring termination. It includes side access through a box connector for installation of the power and contact wiring. The mounting brackets attach to the enclosure with adjustable slots to allow custom setting of the height of the sensing probes.

**DIMENSIONS -
TOP, FRONT AND SIDE**



SPECIFICATIONS

Power Requirements	24 VAC 100 mA, 50/60 Hz, 3 VA (max.)
Dimensions, W x D x H	6.35 in. x 2.25 in. x 4.46 in. (161.2 mm x 57.2 mm x 113.2 mm)
Weight (assembled)	2.0 lb. (0.9 kg)
Metal Enclosure	NEMA 1, IP 30

ENVIRONMENTAL CONDITIONS

Operating Temperature	50°F to 104°F (10°C to 40°C)
Operating Humidity	10% to 95% relative humidity (non-condensing)
Operating Altitude	0 to 10,000 ft. (0 to 3,048 m)
Output Relay Contact Rating	2 Form-C; 3 A rating at 24 VAC

AGENCY LISTINGS

UL	UL916
C-UL	C22.2, No. 205-M1983
CE	Yes
FCC Compliance	47 CFR, Part 15



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LIEBERT COOLPHASE CEILING DX CEILING-SUSPENDED PRECISION COOLING SYSTEM

Job Name	Highland's Oncology Group - Pinnacle
Equipment Tags	LU-3 & LU-6
Spec. Section	238125 – Computer Room Air Conditioners – Ceiling Mounted
Model	Liebert CoolPhase Ceiling - 2-Ton
Description	2-Ton Ceiling Suspended DX Precision Cooling Systems
Quantity	2
Date	June 25, 2026
Submitted By	Sam White

Submittal Note:

This project was initially designed around the legacy Liebert MiniMate2 and MiniMate3 DX systems with R407 and R410A refrigerants. These systems are currently in End of Production phase and have been replaced by the Liebert CoolPhase Ceiling DX systems with Low GWP refrigerant (R32). EPA has mandated all Computer Room Air Conditioning systems installed after 1/1/2027 must comply with Low GWP refrigerant requirements. Submitting on the new Liebert CoolPhase Ceiling DX systems.

Liebert CoolPhase Ceiling Ceiling Suspended Precision Cooling System 2-Ton DX Air-Cooled

Two (2) 2-Ton Liebert CoolPhase Ceiling Precision Cooling Split Systems – Indoor Unit

- Model Number: MMI24E00A008R
- Nominal Cooling Capacity: 2-tons (7kW)
- Air Volume: 1,451 CFM; Fans: 1 (.37hp)
- Electrical: 208/230V-1ph, 60 Hz; OPD: 15A
- Refrigerant: R32 (field supplied and charged)
- Evaporator type: copper tubes – aluminum fins with hydrophilic coating
- Variable speed EC fan – (1) fan per system
- Cooling Only – No reheat or humidifier
- Filter clog and high temperature sensors
- Liebert iCOM microprocessor control with embedded Unity
- Wall-mounted 7" color touchscreen display (field mounted and wired)
- Room Temperature/humidity sensor (field mounted and wired)
- Locking disconnect switch, factory mounted and wired, with short-circuit current rating (SCCR) of 65,000 amps
- IS-UNITY-DP network communications card (SNMP, BACnet and Modbus protocols)

Alternate model number
due to manufacturer
upgrades

Schedule calls for a 270V
indoor unit

Two (2) Liebert Outdoor Air Cooled Condensing Units – Outdoor Unit

- Model Number: CUD070-E000A
- Outdoor Design Ambient : -4°F - 118°F
- Electrical: 208/230V-1ph, 60 Hz; OPD: 50A
- Inverter, variable capacity compressor (R32)
- High head pressure switch
- Nitrogen holding charge (System field charged, with field-supplied R32 refrigerant)

Ship-Loose Accessories (field installed)

- One (1) condensate pump kit per system
- One (1) return air filter box kit per system
- One (1) set of remote temp/humidity sensors per system
- One (1) LT410 spot leak detector per system

Services Include:

- Startup/Warranty Inspection – 8x5
 - Final connections, leak checking, evacuation and refrigerant **not included**
- Assistance with communications and controls setup; Owner Training
- Standard one (1) year parts and limited labor warranty
 - Extended compressor warranty through year 5

AHRI Certified Performance Data*Unit Information - Indoor**

Cooling Type	DX Indoor	Unit Model	MMI24E00R0000A0000
Configuration	Air Cooled	Power Supply	230V/1ph/60Hz
Operation Mode	DX Mode	Airflow Configuration	Frontal Air
Refrigerating Circuits No	1	Compressor 1 - Circuit 1	Variable Speed Scroll
Refrigerant	R32	Fan Type	Axial Fan
Product Line	CoolPhase Ceiling	Fan Quantity	1
Product Family	MM	Filter Class	Merv8

Options

External Filter	Not selected	Electric Reheat	Not selected
Humidifier	Not selected	Damper	Not selected

Unit Information - Outdoor

Product Line	CoolPhase Condensing Unit	Fan Module	Standard
Product Family	Condensing Unit	Fan Type	Axial Fan
Unit Model	CUD070-E000A_MMI24	Fan Quantity	1
Unit Power Supply	208/230V/1ph/50-60Hz		

Design Conditions -Data Input

Calculation Mode	Return Airflow + Compressor Modulation	Compressor Modulation	90.0 %
Indoor Return Air Temperature	75.0 °F	Outdoor Air Temp	95.0 °F
Indoor Return Air RH	45.0 %	Outdoor Airflow	2714 cfm
Altitude Sea Level	0.0 ft	Subcooling	13.4 R
Atmospheric Pressure	14.7 psi	Outdoor ESP	0.000 In-H2O
Indoor ESP	0.200 in-H2O	Fan Speed Control	On
Indoor Return Airflow	1451.0 cfm		

General Performance at Design Conditions

Gross Total Capacity	6.74 kW	Supply Air RH	71.8 %
Gross Sensible Capacity	6.74 kW	Supply Air DP	52.3 °F
nSHR	1	Return Airflow	1451 cfm
Net Total Capacity	6.18 kW	Indoor Fan Modulation	85.0 %
Net Sensible Capacity	6.18 kW	Actual Room SPL @2m f.f.	52.1 dBA
Compressor Modulation	90.0 %	System Net Sens nSCOP	2.50

General Performance at Design Conditions

System Power Input	2.47 kW	Outdoor Airflow	2714 cfm
Supply Air DB	61.4 °F	Outdoor Fan Modulation	100.0 %
Supply Air WB	56.0 °F	Outdoor Actual SPL @5m f.f.	57.4 dBA

2 System Data

2.1 Air Cooled System Performance and Physical Data

Table 2.1 Vertiv™ CoolPhase Ceiling technical specifications

Models		1 Ton	2 Ton	3 Ton	4 Ton	5 Ton	8 Ton
		MMI12	MMI24	MMI36	MMI48	MMI60	MMI96
Region		NAM					
Certification marks		cCSAus					
Piping Connections		Flare Connection					
Condenser Fan		EC Motor					
External Static Pressure		0.20 inH2O (50 Pa)					
Sensible Cooling Capacity (kW) @26.7 °C (80 °F) RAT, 38% Rh, 35 °C (95 °F) outdoor temp		1 (3.5)	2 (7)	3 (11)	4 (15)	6 (21)	8 (28)
Power Supply Evaporator		208/230 V, 1-Ph, 50/60 Hz		208/230 V, 1-Ph, 50/60 Hz 208/230 V, 3-Ph, 60 Hz 460 V, 3-Ph, 60 Hz		208/230 V, 3-Ph, 60 Hz 460 V, 3-Ph, 60 Hz	
Controls		Vertiv™ iCOM™					
Refrigerant (Field supplied/field charged. Not factory charged)		R-32					
Max Equivalent Length of Pipe between Indoor Unit and Condensing Unit		196.85 ft (60 m)			295.27 ft (90 m)		
Height between Indoor and Condensing Unit	Condensing unit placed higher than indoor unit	98.43 ft (30 m)			60 ft (18.3 m)	98.43 ft (30 m)	
	Condensing unit placed lower than indoor unit	-26.25 ft (-8 m)			-15 ft (4.6 m)	-26.25 ft (-8 m)	

1. Certified in accordance with the AHRI Datacom Cooling Certification Program at AHRI Standard 1360 (I-P) Standard Rating Conditions. Certified units may be found in the AHRI Directory at www.ahridirectory.org.
2. Some options or combinations of options may result in reduced air flow. Consult factory for recommendations.
3. Data rated at 100% fan speed and with Standard Feature filter.
4. Net capacity data has fan motor heat factored in for all ratings.
5. Performance data generated in GRS (Global Rating System).

↓

Table 2.2 Vertiv™ CoolPhase Condensing Unit technical specifications for small units (3.5, 7 and 11 kW)

Models		CUD030	CUD070	CUD111	CUD114
		CUL030	CUL070	CUL111	CUL114
Region		Global			NAM
Certification marks		cETLus, CE & UKCA			cETLus
Piping Connections		Flare Connection			
Operating Temperature range		Low ambient Condensing Unit: -31 °F (-35 °C) ~118 °F (48 °C) Standard Ambient Condensing Unit with Wind Baffle Accessory: -4 °F (-20 °C) ~118 °F (48 °C) Standard Ambient Condensing Unit without Wind Baffle Accessory: 23 °F (-5 °C) ~118 °F (48 °C)			
Compressor		Variable speed rotary compressor			
Condenser Fan		EC Motor			
External Static Pressure		0.20 inH2O (50 Pa)	0.12 inH2O (30 Pa)		
Noise Data		68 dB		71 dB	
Noise Data of night mode		58 dB		56 dB	
Power Supply		208/230 V, 1-Ph, 50/60 Hz (-10%/+10%)		208/230 V, 3-Ph, 50/60 Hz (-10%/+10%)	460 V, 3-Ph, 60 Hz (±10%)
Refrigerant		R-32			
Max Equivalent Length of Pipe between Indoor Unit and Condensing Unit		196.85 ft (60 m)			
Height between Indoor and Condensing Unit	Condensing unit placed higher than indoor unit	98.4 ft (30 m)			
	Condensing unit placed lower than indoor unit	26.3 ft (8 m)			

NOTE: When the ambient temperature is below -4 °F (-20 °C) up to -31 °F (-35 °C), the low-ambient version must be used. Low Ambient versions of the units do not require a Wind Baffle accessory.

NOTE: The Low Ambient version of the Condensing Unit cannot be installed in plenum areas; only the standard version is plenum rated.

Table 2.5 Air Cooled Data, 60 Hz

Evaporator Model		MMI12	MMI24	MMI36	MMI48	MMI60	MMI96
Condensing Unit Type		Outdoor	Outdoor	Outdoor	Outdoor	Outdoor	Outdoor
DX Evaporator- Net Capacity Data - kW (kBTU/h) @ High-Speed CFM							
80 °F DB, 62.8 °F WB (26.7 °C DB, 17.1 °C WB) 38% Rh	Total	3.4 (11.6)	6.7 (22.8)	9.2 (31.3)	14.7 (51.0)	19.1 (65.2)	26.7 (91.1)
	Sensible	3.4 (11.6)	6.7 (22.8)	9.2 (31.3)	14.7 (51.0)	19.0 (64.8)	24.2 (82.6)
75 °F DB, 61 °F WB (23.9 °C DB, 16.1 °C WB) 45% Rh	Total	3.1 (11.6)	6.2 (21.1)	8.6 (29.3)	13.5 (46.1)	18.2 (62.1)	25.5 (87.0)
	Sensible	3.1 (11.6)	6.2 (21.1)	8.5 (29.1)	13.5 (46.1)	17.1 (58.4)	20.5 (70.0)
72 °F DB, 60 °F WB (22.2 °C DB, 15.5 °C WB) 50% Rh	Total	3.0 (10.1)	5.9 (20.0)	8.3 (28.4)	12.9 (44.0)	17.8 (59.7)	24.9 (85.0)
	Sensible	2.9 (10.0)	5.5 (18.8)	7.9 (26.8)	12.8 (43.7)	15.7 (53.6)	18.7 (63.8)
Fan Data - Evaporator							
CFM (CMH)		816 (1,386)	1,451 (2,465)	1,533 (2,605)	2,710 (4,607)	2,746 (4,665)	3,759 (6,387)
Fan Motor, HP (W)		0.16 (0.12)	0.37 (0.28)	0.56 (0.42)	0.95 (0.71)	1.10 (0.82)	1.60 (1.19)
External Static Pressure, in (mm) water gauge		0.2 (5.1)					
Evaporator Coil - Copper Tube/Aluminum Fin							
Face Area, ft2 (m2)		2.5 (0.23)	3.0 (0.28)	3.0 (0.28)	5.56 (0.52)	5.56 (0.52)	7.64 (71)
Coil Rows		3	5	5	6	6	6
Max Face Velocity, fpm (m/s)		500 (2.54)					
Unit Refrigerant Charge, lb (kg)		0.5 (0.2)	1.0 (0.5)	1.8 (0.8)	2.8 (1.3)	3.3 (1.5)	3.7 (1.7)
Unit Operating Weight DX, lb (kg)		269 (122.2)	295 (134.0)	299 (136.0)	416 (187.5)	484 (219.5)	673 (305.4)
Unit Operating Weight DX+FC, lb (kg)		292 (132.6)	325 (147.6)	329 (149.6)	484 (219.5)	504 (228.5)	752 (341.4)
~~Electric Reheat Capacity, kW (kBTU/h)~~		SSR (Solid State Relay)					
Input Voltage 230-1-60		4.5 (15.35)	4.7 (16.04)	4.0 (13.65)	—	—	—
Input Voltage 230-3-60		—	—	7.0 (23.89)	10.0 (34.12)	15.0 (51.18)	10.0 (34.12)
Input Voltage 460-3-60		—	—	4.0 (13.65)	10.0 (34.12)	10.0 (34.12)	10.0 (34.12)
~~Humidifier Data - Steam Generator Type~~							
Steam capacity, lb/h (kg/h)		5 (2.27)			12 (5.44)		
Electrical Input Power 230-1-60, kW		10.6	14.4	17.4	N/A	N/A	N/A
Electrical Input Power 230-3-60, kW		N/A	N/A	18.1	20.7	20.7	24.8
Electrical Input Power 460-3-60, kW		N/A	N/A	8.4	10.8	10.8	14.4
Evaporator Connection Sizes							
Liquid line Diameter, in O.D. Cu		3/8	3/8	3/8	5/8	5/8	5/8
Suction Line Diameter, in O.D. Cu		1/2	1/2	1/2	7/8	7/8	7/8

Table 2.5 Air Cooled Data, 60 Hz (continued)

Evaporator Model	MMI12	MMI24	MMI36	MMI48	MMI60	MMI96
Humidifier Supply	¾ in OD Copper Compression Fitting					
Evaporator/Condensate Drain	¾ in NPT-Female					
MERV 8 Filter						
External Filter Box, Nom. Size WxHxD, in (mm)	Qty. 1 20x16x4 (508x406x102)		Qty. 2 20x20x4 (508x508x102)		Qty. 2 25x20x4 (635x508x102)	
Air Distribution Plenum, Nom. Size WxHxD, in (mm)	Qty. 1 16x25x4 (406x635x102)			N/A		
Return Grille, Nom. Size WxHxD, in (mm)	Qty. 1 20x20x1 (508x508x25)			N/A		
Condensing Unit Model Number	CUD/L03	CUD/L07	CUD/L11	CUD/L15	CUD/L21	CUD/L28
Condensing Unit Rating Conditions	95 °F (35 °C) Ambient					
Coil Face Area ft2 (m2)	3.3 (0.31)	4.82 (0.45)	7.06 (0.66)	10.11 (0.94)	24.37 (2.3)	24.37 (2.3)
Type of Coil	Microchannel					
CFM (CMH)	2,222 (3,778)	2,714 (4,612)	3,892 (6,613)	5,113 (8,688)	8,839 (15,023)	8,447 (14,352)
Motor Hp (KW)	0.36 (0.27)	0.40 (0.3)	0.55 (0.41)	0.36 (0.27)	0.75 (0.57)	1.25 (0.93)
External Static Pressure, in (mm) water gauge	N/A					
STD Unit Refrigerant Charge, lb (kg)	1.3 (0.6)	1.5 (0.7)	1.8 (0.8)	2.9 (1.3)	3.0 (1.4)	5.0 (2.3)
LAK Unit Refrigerant Charge, lb (kg)	2.4 (1.1)	2.9 (1.3)	5.3 (2.4)	5.7 (2.6)	10.1 (4.6)	17.2 (7.8)
STD Unit Operating Weight, lb (kg)	110 (50)	118 (53.5)	175 (79.5)	268 (121.37)	425 (193)	425 (193)
LAK Unit Operating Weight, lb (kg)	117 (53)	130 (59)	184 (83.5)	277 (125.32)	458 (208)	458 (208)
Condensing Unit Connection Sizes						
Liquid line Diameter, in O.D. Cu	1/4	3/8	3/8	1/2	5/8	5/8
Suction Line Diameter, in O.D. Cu	1/2	1/2	5/8	3/4	7/8	7/8

2.1.1 Operating Limits for Air Cooled Systems

The Vertiv™ CoolPhase Ceiling operates within the working ranges as shown in the table below. These limits refer to new units and those that have been correctly installed and serviced.

Table 2.6 Operating limits—Air Cooled Systems

Parameter		Design Condition	
		Minimum	Maximum
Unit Entering Air Conditions	Temperature	64.4 °F (18 °C)	113 °F (45 °C)
	Relative Humidity	17%	60%
Storage Conditions	Temperature	-4 °F (-20 °C)	118 °F (48 °C)
		NOTE: Unit remains operational up to 125.6 °F (52 °C) with reduced capacity.	
Power Supply Tolerances		Voltage ± 10%, Frequency ±2 Hz	

For working ranges of the Condensing units, refer to tables below.



Table 2.7 Operating limits—Condensing Units from 3 kW to 15 kW

Models	CUD030	CUD070	CUD111	CUD114	CUD151	CUD154
	CUL030	CUL070	CUL111	CUL114	CUL151	CUL154
Operating Temperature range	Low ambient Condensing Unit: -31 °F (-35 °C) ~118 °F (48 °C)					
	Standard Ambient Condensing Unit with Wind Baffle Accessory: -4 °F (-20 °C) ~118 °F (48 °C)					
	Standard Ambient Condensing Unit without Wind Baffle Accessory: 23 °F (-5 °C) ~118 °F (48 °C)					

NOTE: When the ambient temperature is between -4 °F (-20 °C) and -31 °F (-35 °C), the Low Ambient version must be used. Low Ambient versions of units do not require a Wind Baffle accessory.

NOTE: The Low Ambient version of the Condensing Unit cannot be installed in plenum areas; only the standard version is plenum rated.

NOTE: All CUD15 and CUL15 Condensing Unit models on the table above are not plenum-rated.

4.1 Air Cooled Systems Electrical Data

Table below lists the power requirements for each Vertiv™ CoolPhase Ceiling model number.

Table 4.1 CoolPhase Ceiling Electrical Data

Model	Power Supply	Feature	FLA (A)	MCA (A)	MOP (A)
MMI12	230 V / 1-Ph	Reheat	28.0	35.0	35
		Reheat + Humidifier	28.0	35.0	45
		Humidifier	10.6	16.5	15
		Air Cooling	6.2	7.0	15
MMI24	230 V / 1-Ph	Reheat	41.0	51.3	60
		Reheat + Humidifier	41.0	51.3	60
		Humidifier	14.4	18.0	15
		Air Cooling	7.4	8.0	15

Table 4.2 Vertiv™ CoolPhase Condensing unit electrical data

Models	Nom. Tons	Volts / Phases	Compressor Qty.	Compressor Inverter (A)	Crank Case + Heating belt (A)	FLA (A)	MCA (A)	MOP (A)
CUD03 / CUL03	1	208/230 1-Ph	1	14	0/0.4	17	21	35
CUD07 / CUL07	2	208/230 1-Ph	1	20	0/0.4	23	28	50
CUD111 / CUL111	3	208/230 3-Ph	1	17	0/0.4	21	25	40
CUD114 / CUL114	3	460 3-Ph	1	11	0/0.4	15	18	30
CUD151	4	208/230 3-Ph	1	14	0/32.2	20	23	35
CUL151	4	460 3-Ph	1	14	0.5/32.2	20	24	35
CUD154	4	208/230 3-Ph	1	9	0/21.9	11	13	20
CUL154	4	460 3-Ph	1	9	0.25/21.9	11	13	20
CUD211	6	208/230 3-Ph	1	22	0/41.3	31	36	50
CUL211	6	460 3-Ph	1	22	0.5/41.3	31	37	50
CUD214	6	208/230 3-Ph	1	19	0/32.9	22	27	45
CUL214	6	460 3-Ph	1	19	0.25/32.9	23	27	45
CUD281	8	208/230 3-Ph	1	40	0/51.3	49	58	90
CUL281	8	460 3-Ph	1	40	0.5/51.3	49	59	90
CUD284	8	208/230 3-Ph	1	30	0/39.7	33	40	70
CUL284	8	460 3-Ph	1	30	0.25/39.7	33	41	70

FLA = Full Load Amps; MCA = Minimum Circuit Ampacity; MOP = Maximum Overcurrent Protection Device.

5.5 Connecting Gas Pipe and Liquid Pipe

Table 5.3 Vertiv™ CoolPhase Ceiling recommended refrigerant line sizes, O.D. CU for Vertiv™ CoolPhase Condensing Unit

CoolPhase Ceiling	Total Equivalent Length ft (m)	Suction Line, in (mm)	Liquid Line in. (mm)
MMI12 (1 Ton) + CU03A	0 to 32.80 (0 to 10)	½ (12.70)	¼ (6.35)
	32.80 to 196.90 (10 to 60)	½ (12.70)	5/16 (7.93)
MMI24 (2 Ton) + CU07A	0 to 16.40 (0 to 5)	½ (12.70)	3/8 (9.52)
	16.40 to 65.60 (5 to 20)	5/8 (15.87)	3/8 (9.52)
	65.60 to 196.85 (20 to 60)	¾ (19.05)	3/8 (9.52)
MMI36 (36 Ton) + CU11A	0 to 16.40 (0 to 5)	½ (12.70)	3/8 (9.52)
	16.40 to 49.20 (5 to 15)	5/8 (15.87)	3/8 (9.52)
	49.20 to 65.60 (15 to 20)	5/8 (15.87)	½ (12.70)
	65.60 to 131.20 (20 to 40)	¾ (19.05)	½ (12.70)
	131.20 to 196.85 (40 to 60)	7/8 (22.22)	½ (12.70)
MMI48 (4 Ton) + CU15A	0 to 32.80 (0 to 10)	¾ (19.05)	½ (12.70)
	32.80 to 295.30 (10 to 90)	7/8 (22.22)	½ (12.70)
MMI60 (6 Ton) + CU21A	0 to 49.20 (0 to 15)	7/8 (22.22)	5/8 (15.87)
	49.20 to 295.30 (15 to 90)	1-1/8 (28.58)	5/8 (15.87)
MMI96 (8 Ton) + CU28A	0 to 16.40 (0 to 5)	7/8 (22.22)	5/8 (15.87)
	16.40 to 98.40 (5 to 30)	1-1/8 (28.58)	5/8 (15.87)
	98.40 to 295.30 (30 to 90)	1-3/8 (34.93)	¾ (19.05)

NOTE: Must downsize vertical riser one trade size (1-1/8" to 7/8", 7/8" to 3/4", 3/4" to 5/8", 5/8" to 1/2").

NOTE: If the condensing unit is installed indoors, the total system refrigerant charge (Indoor unit + Condensing unit + Piping) can't exceed 4 lbs.

NOTE: Contact your representative for line sizing for runs longer than 295.30 ft (90 m) equivalent length.

Table 5.4 Equivalent Length of Components

Liquid Pipe, External Diameter in (mm)	Equivalent Length ft (m)			
	90° Bend Way	45° Bend Way	T Type Way	Three-Way Way
½ (12.70)	1.31 (0.40)	0.65 (0.20)		2.49 (0.76)
5/8 (15.87)	1.80 (0.55)	0.88 (0.27)		2.49 (0.76)
¾ (19.05)	1.96 (0.60)	0.98 (0.30)		2.49 (0.76)
7/8 (22.22)	2.29 (0.70)	1.14 (0.35)		3.60 (1.10)

Table 5.4 Equivalent Length of Components (continued)

Liquid Pipe, External Diameter in (mm)	Equivalent Length ft (m)		
	90° Bend 45° Bend T Type Three- Way	90° Bend 45° Bend T Type Three- Way	90° Bend 45° Bend T Type Three- Way
1 1/8 (28.58)	2.85 (0.87)	1.44 (0.44)	4.60 (1.04)
1 3/8 (34.93)	3.45 (1.05)	1.72 (0.53)	5.30 (1.60)
1 5/8 (41.00)	4.10 (1.25)	2.05 (0.63)	5.30 (1.60)

NOTE: Suitable piping thickness must be used to support the pressure of the CoolPhase Ceiling Units

Installing Pipelines

1. Release the pre-charged nitrogen. Open all the Schrader valves in the system to release nitrogen.
2. Cut the liquid pipe and gas pipe connectors on the evaporator and condenser.
3. Lay the pipes between the evaporator and condenser.
4. Connect a nitrogen cylinder to the Schrader valve. Purge the pipe with nitrogen to flow through the pipe while welding the pipe.

Table 5.5 Pipe length and condensing unit elevation relative to evaporator

Model	Maximum Condensing Unit Level Above Evaporator, ft (m)	Maximum Condensing Unit Level Below Evaporator, ft (m)
MMI12	49.2 (15)	16.4 (5)
MMI24	49.2 (15)	16.4 (5)
MMI36	49.2 (15)	16.4 (5)
MMI48	49.2 (15)	16.4 (5)
MMI60	98.4 (30)	26.2 (8)
MMI96	98.4 (30)	26.2 (8)

Table 5.5 Pipe length and condensing unit elevation relative to evaporator

Model	Maximum Condensing Unit Level Above Evaporator, ft (m)	Maximum Condensing Unit Level Below Evaporator, ft (m)
MMI12	49.2 (15)	16.4 (5)
MMI24	49.2 (15)	16.4 (5)
MMI36	49.2 (15)	16.4 (5)
MMI48	49.2 (15)	16.4 (5)
MMI60	98.4 (30)	26.2 (8)
MMI96	98.4 (30)	26.2 (8)

Table 5.8 Outdoor condenser approximate R-32 refrigerant charge for standard units

Model	Refrigerant charge lb (kg)
CUD03	1.3 (0.6)
CUD07	1.5 (0.7)
CUD11	1.8 (0.8)
CUD15	2.9 (1.3)
CUD21	3.0 (1.4)
CUD28	5.0 (2.3)

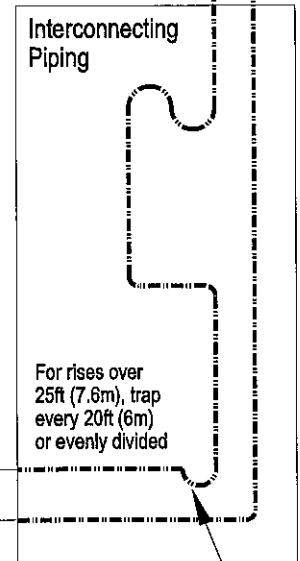
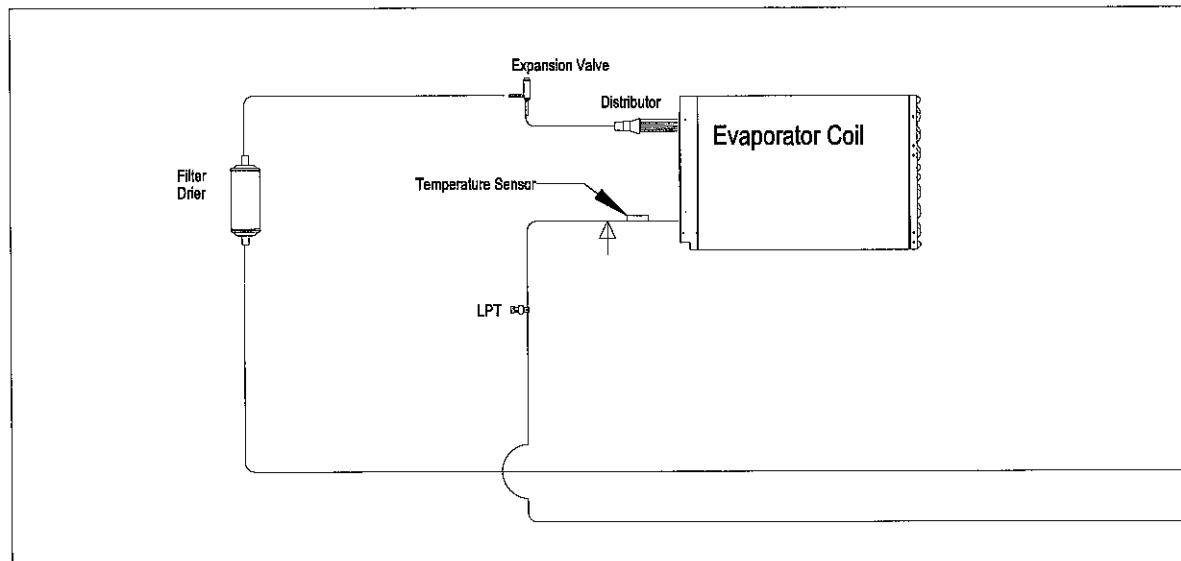
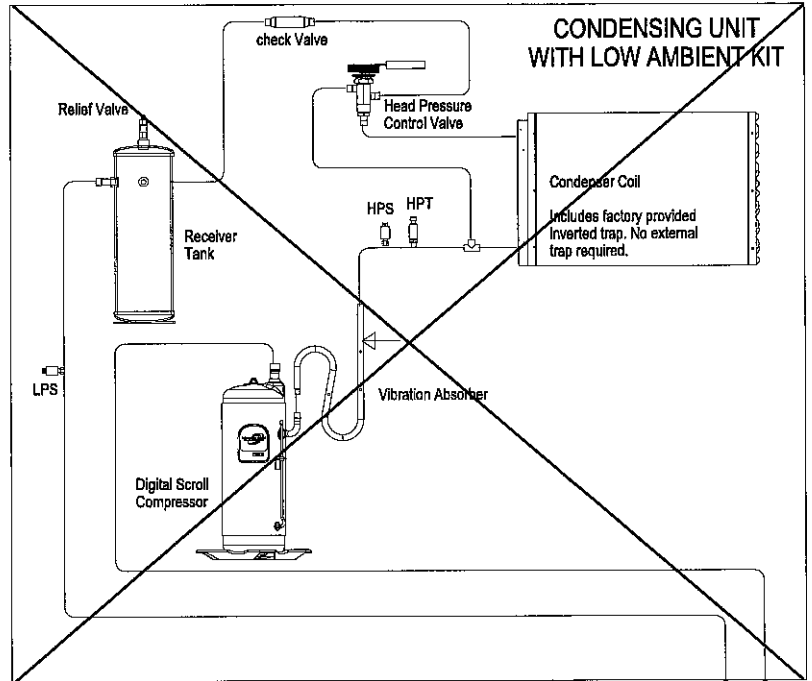
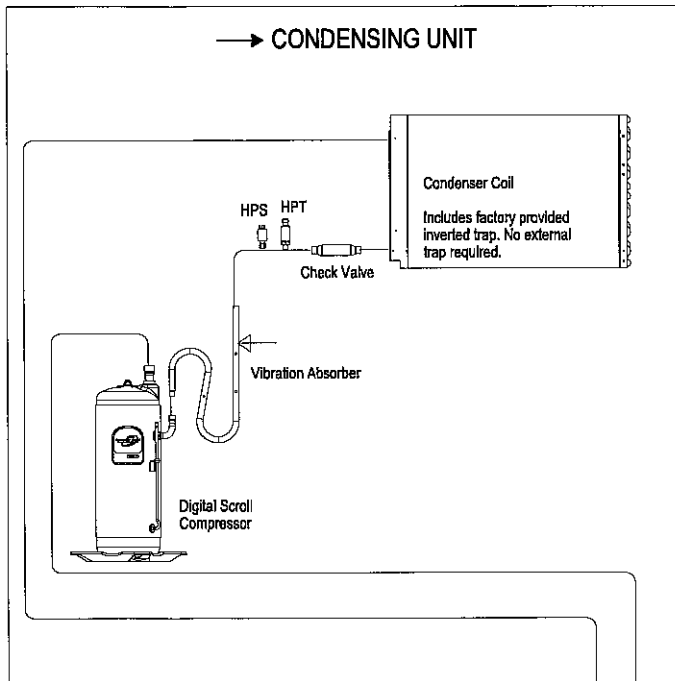
Table 5.11 Interconnecting piping refrigerant charge for R-32 for type L Tube

Line Size O.D.	Liquid Line, lb/100 ft (kg/30 m)	Suction Line, lb/100 ft (kg/30 m)
3/8	2.9 (1.3)	0.15 (0.07)
1/2	5.5 (2.5)	0.2 (0.1)
5/8	9.0 (4.0)	0.4 (0.2)
3/4	13.5 (6.0)	0.7 (0.3)
7/8	18.5 (8.4)	1.1 (0.5)
1 1/8	31.7 (14.4)	1.8 (0.8)
1 3/8	48.3 (21.9)	2.6 (1.2)



VERTIV COOLPHASE CEILING

GENERAL ARRANGEMENT 1-2 TON DIRECT EXPANSION AIR COOLED



————— FACTORY REFRIGERANT PIPING

- - - - - FIELD PIPING

▽ SERVICE / SCHRADER (ACCESS) CONNECTION NO VALVE CORE

▽ SERVICE / SCHRADER (ACCESS) CONNECTION WITH VALVE CORE

Notes:

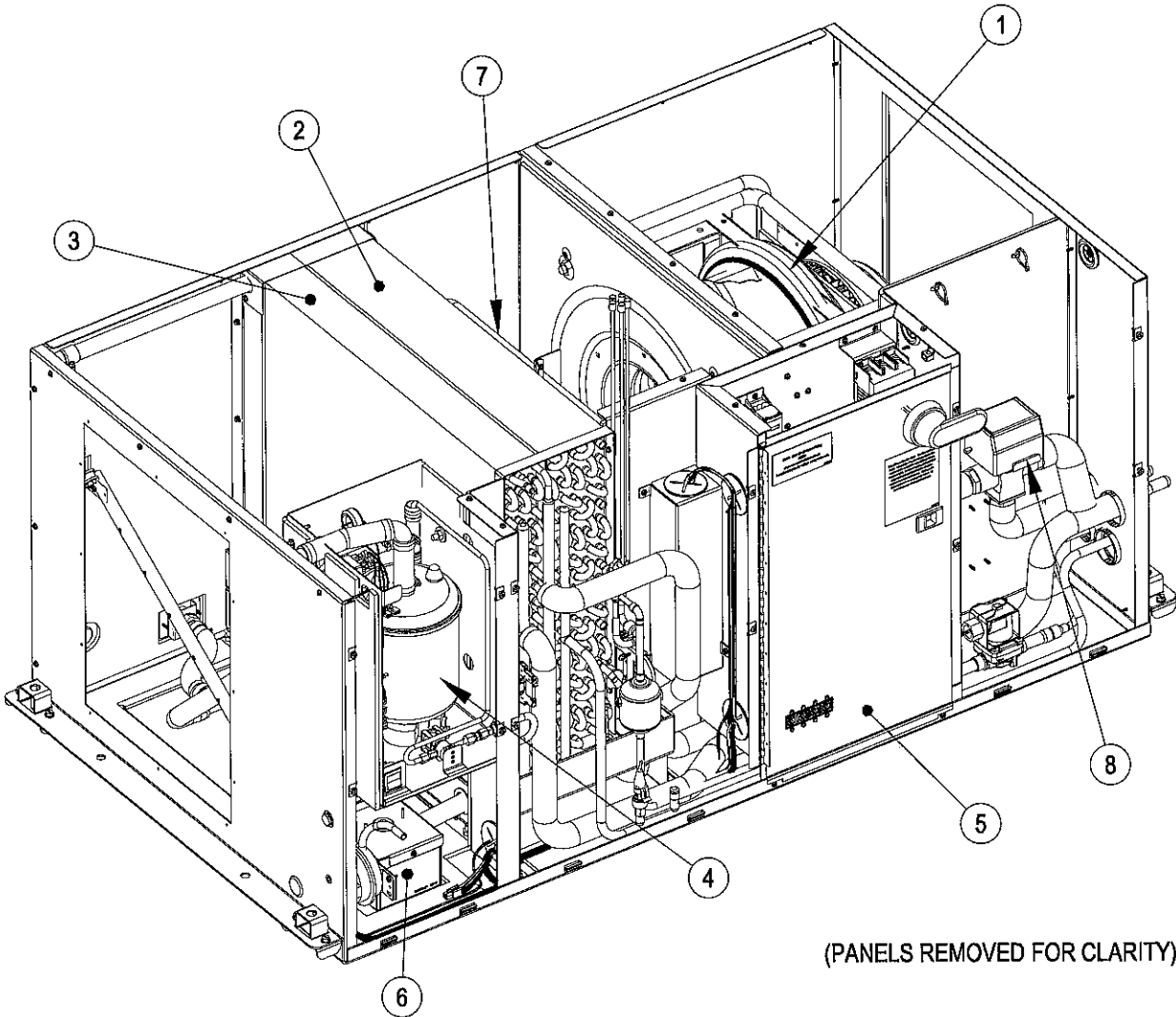
1. Schematic representation shown. Do not use for specific connection location.
2. Interconnecting piping are not supplied by Vertiv™, but are required for proper circuit operation and maintenance.
3. Do not isolate any refrigerant circuit from over pressurization protection.
4. Traps must be installed and horizontal lines pitched to ensure proper oil return and to reduce liquid floodback to compressor. Pitch horizontal hot gas piping at a minimum of 1/2" per 10 feet (42mm per 10m) so that gravity will aid in moving oil in the direction of the refrigeration flow.



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VERTIV COOLPHASE CEILING

COMPONENT LOCATION EVAPORATOR UNIT, 2 & 3 TON

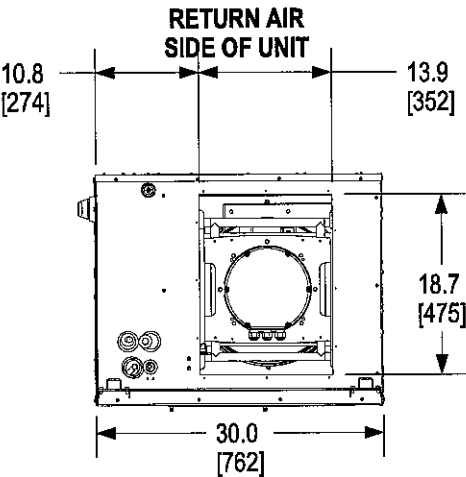
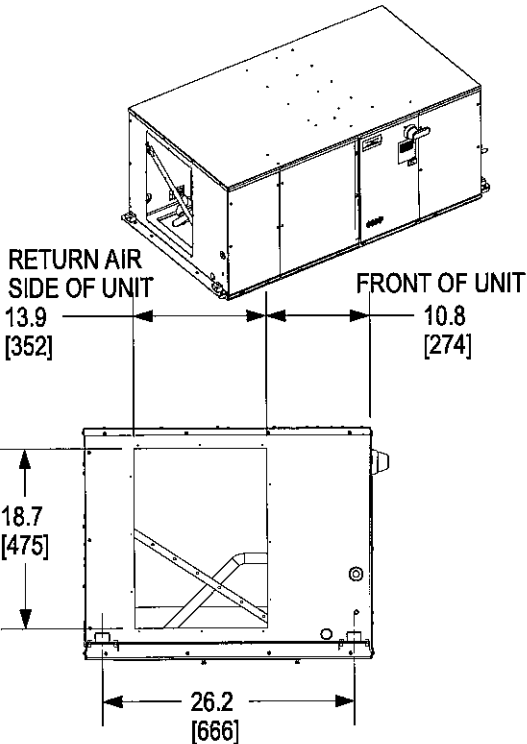


ITEM	DESCRIPTION
1	DIRECT DRIVE FAN WITH VARIABLE SPEED EC MOTOR
2	EVAPORATOR COIL DX
~~3~~	~~EVAPORATOR COIL FREE COOLING (OPTIONAL)~~
~~4~~	~~HUMIDIFIER (OPTIONAL)~~
5	ELECTRICAL BOX
~~6~~	~~SMOKE SENSOR (OPTIONAL)~~
~~7~~	~~ELECTRICAL REHEAT (OPTIONAL)~~
~~8~~	~~3-WAY VALVE (ONLY IN FREE COOLING OPTION)~~



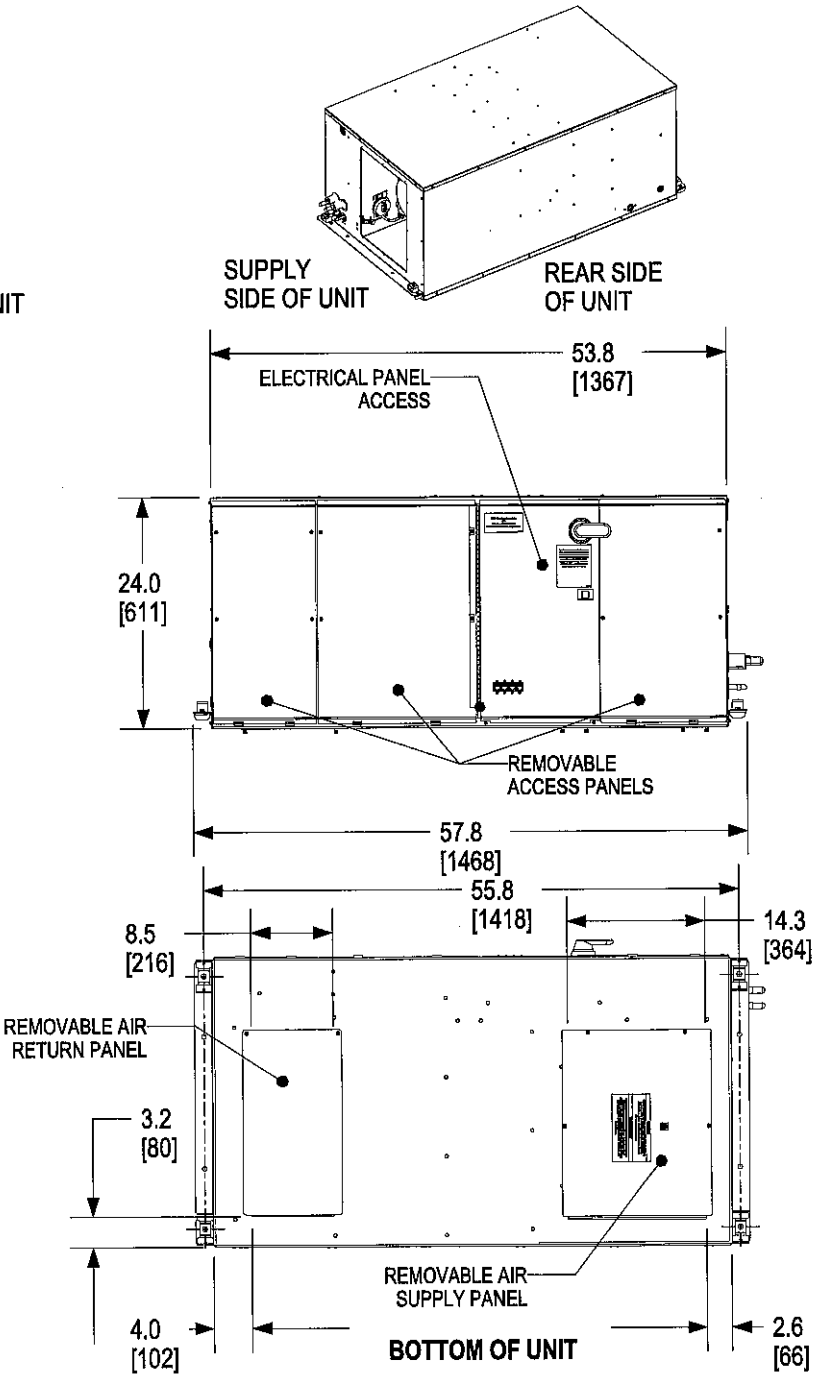
VERTIV COOLPHASE CEILING

DIMENSIONAL DATA CABINET DIMENSIONS, 2 & 3 TON



SUPPLY SIDE OF UNIT

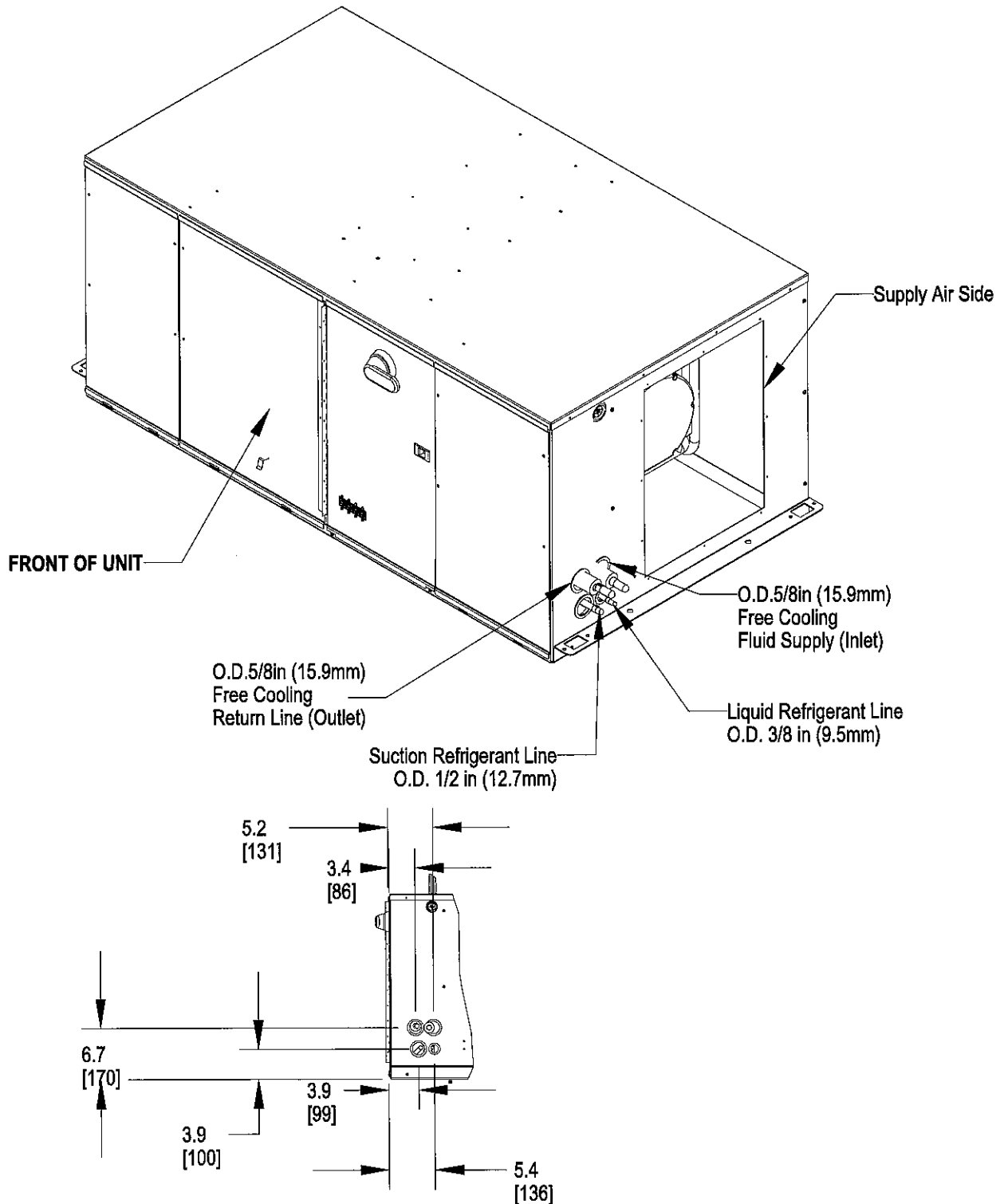
	EVAPORATOR COIL	UNIT NET WEIGHT LBS. (KG)
MMI24 (2 TON) MODEL	→ DX	295.4 (134.0)
	DX + FC	325.4 (147.6)
MMI36 (3 TON) MODEL	DX	299.8 (136.0)
	DX + FC	329.8 (149.6)





VERTIV COOLPHASE CEILING

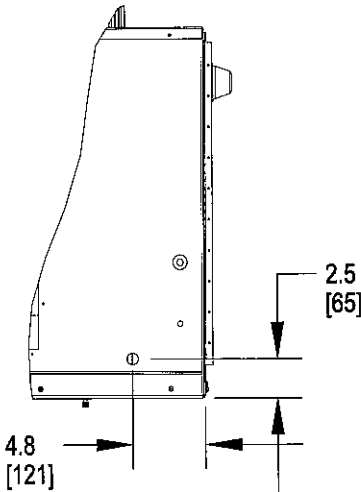
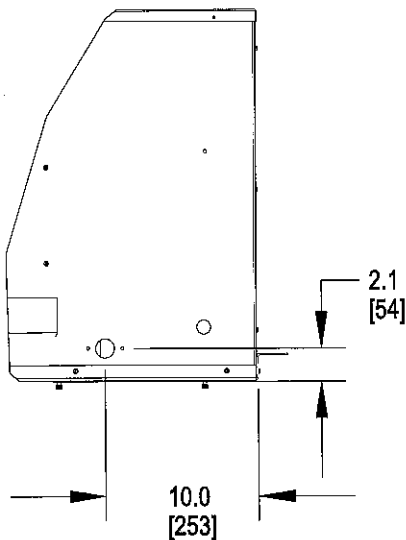
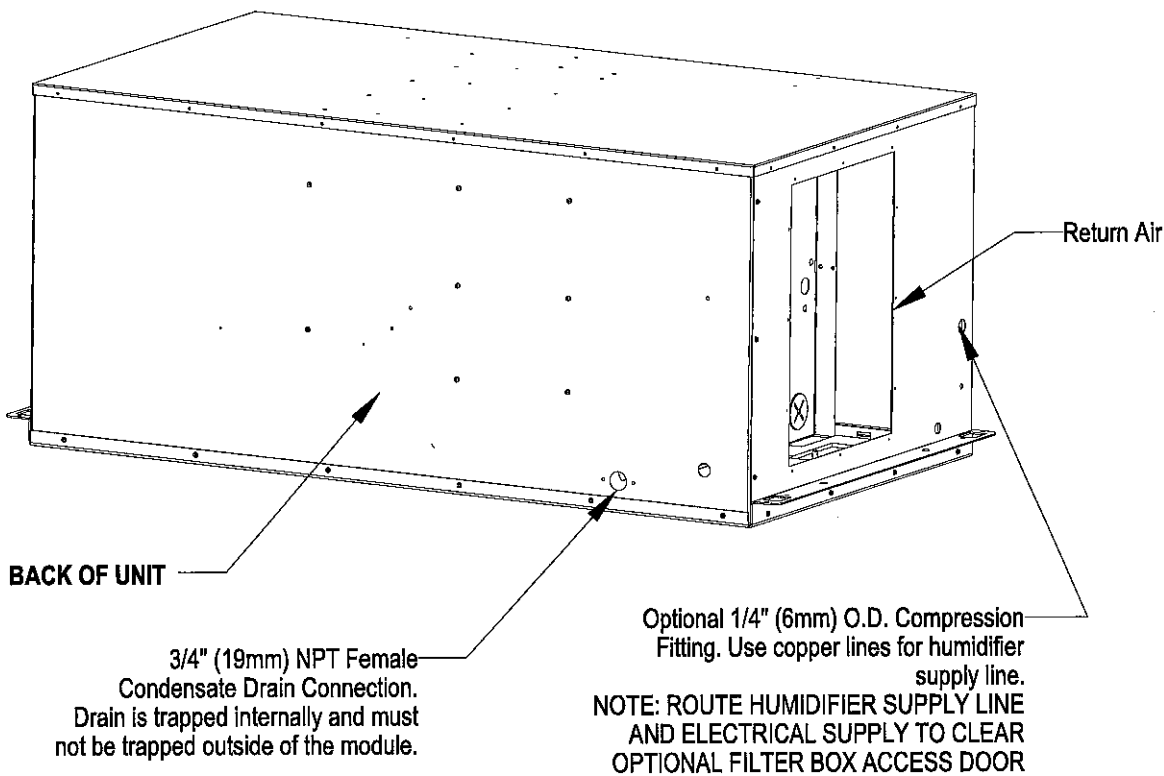
PRIMARY CONNECTION LOCATIONS 2 & 3 TON DIRECT EXPANSION & FREE COOLING





VERTIV COOLPHASE CEILING

PRIMARY CONNECTION LOCATIONS 2 & 3 TON DIRECT EXPANSION & FREE COOLING

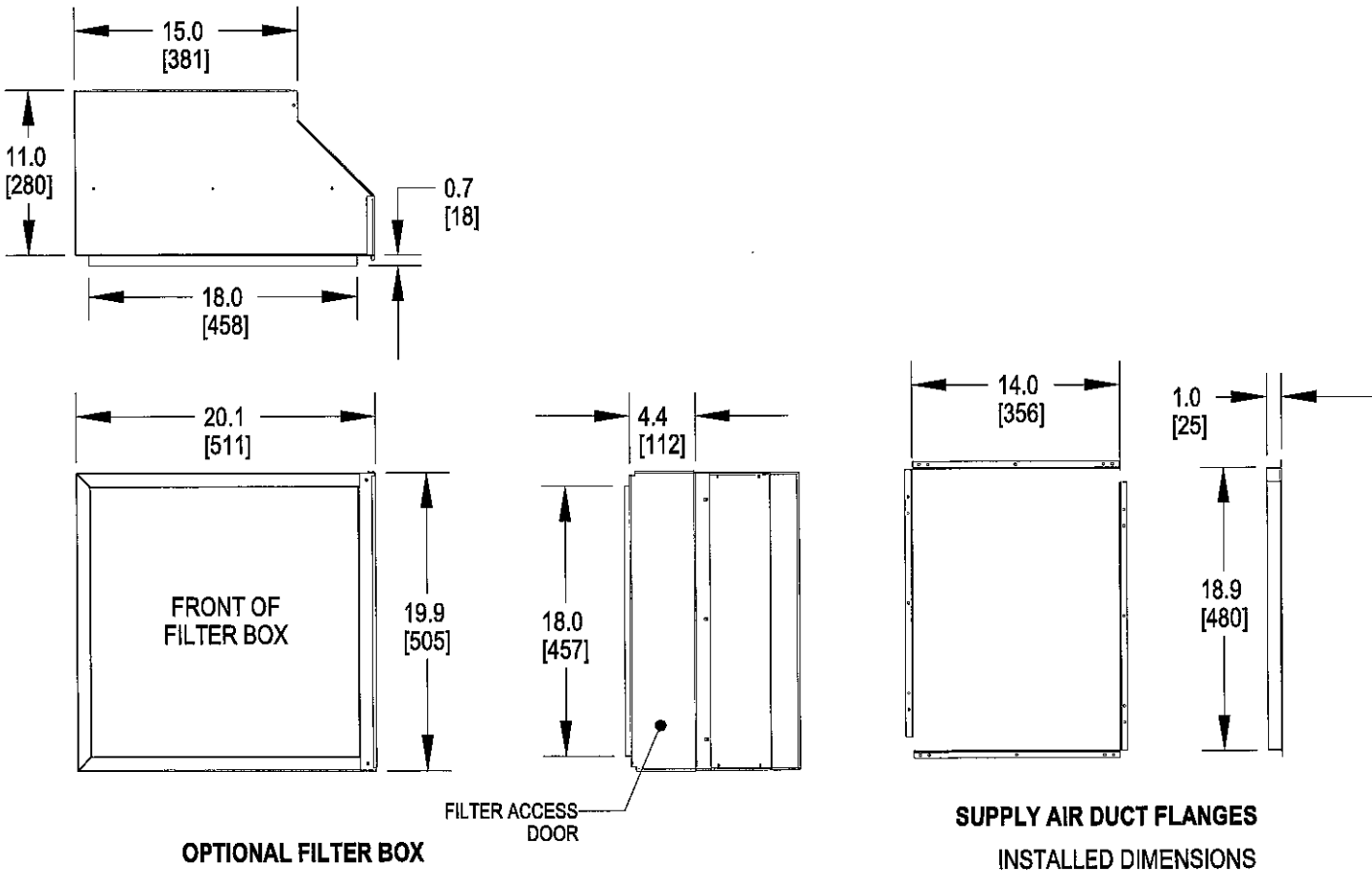
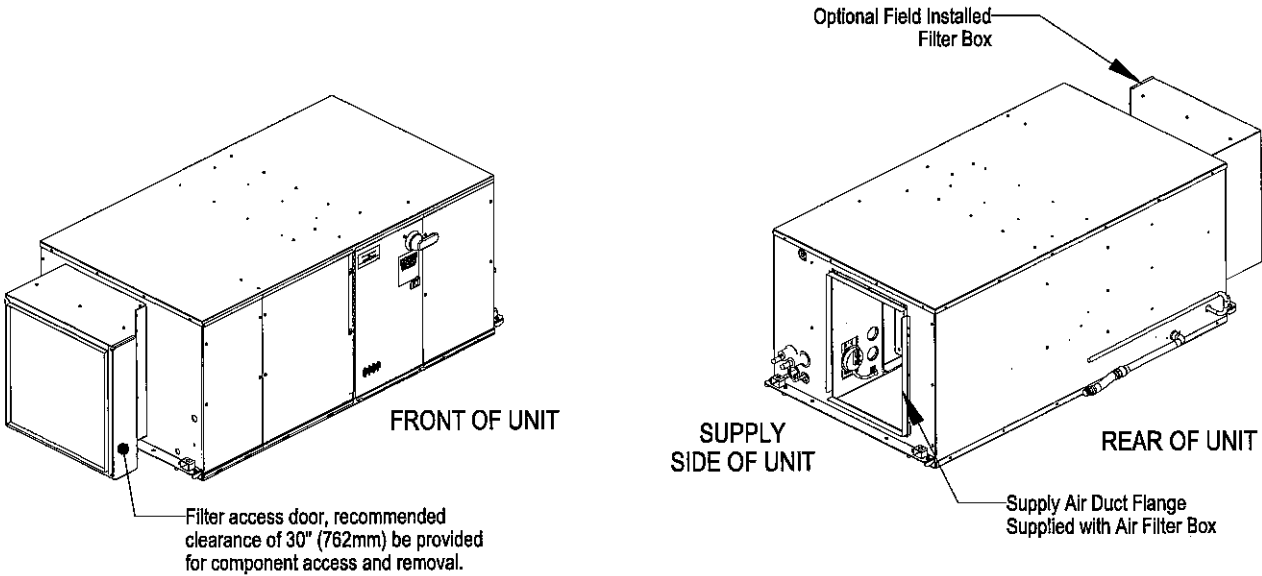




VERTIV™

VERTIV COOLPHASE CEILING

DIMENSIONAL DATA FILTER BOX 2 & 3 TON





VERTIV™ VERTIV COOLPHASE CEILING

PIPING CONNECTIONS CONDENSATE PUMP CONNECTION LOCATIONS, 2 & 3 TON

FRONT OF UNIT

SUPPLY AIR SIDE

RETURN AIR SIDE

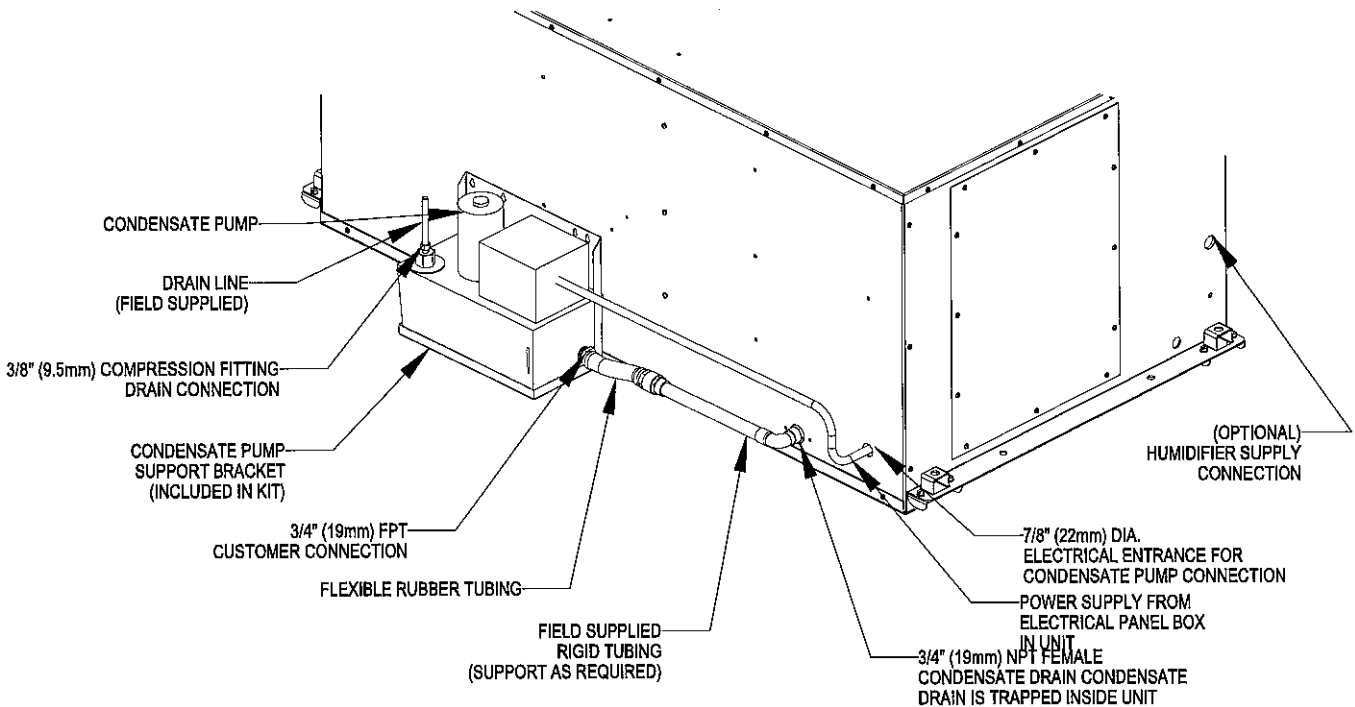
TOP VIEW

12.5
[317]

27.7
[704]

6.7
[170]

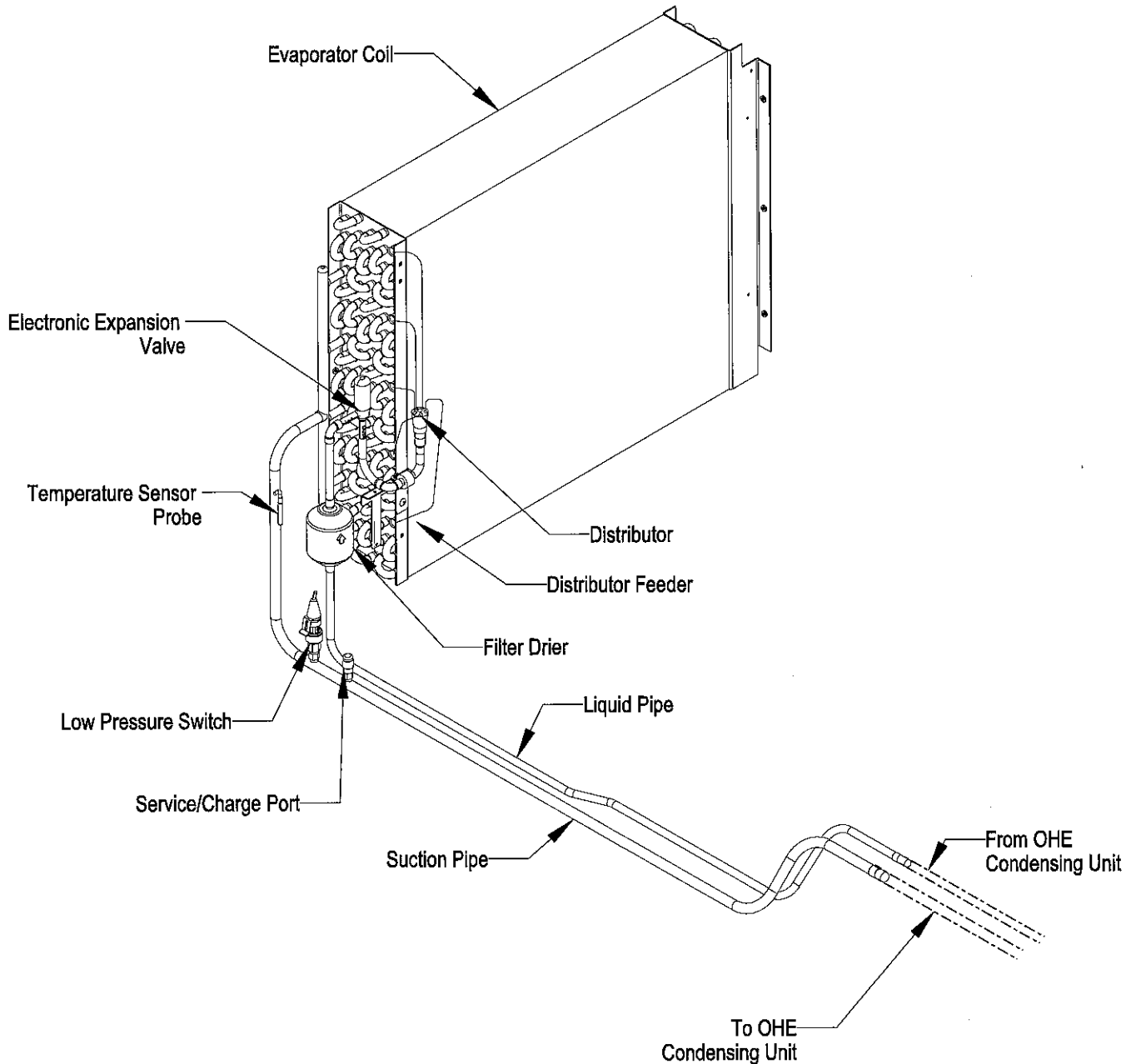
BACK OF UNIT





VERTIV COOLPHASE CEILING

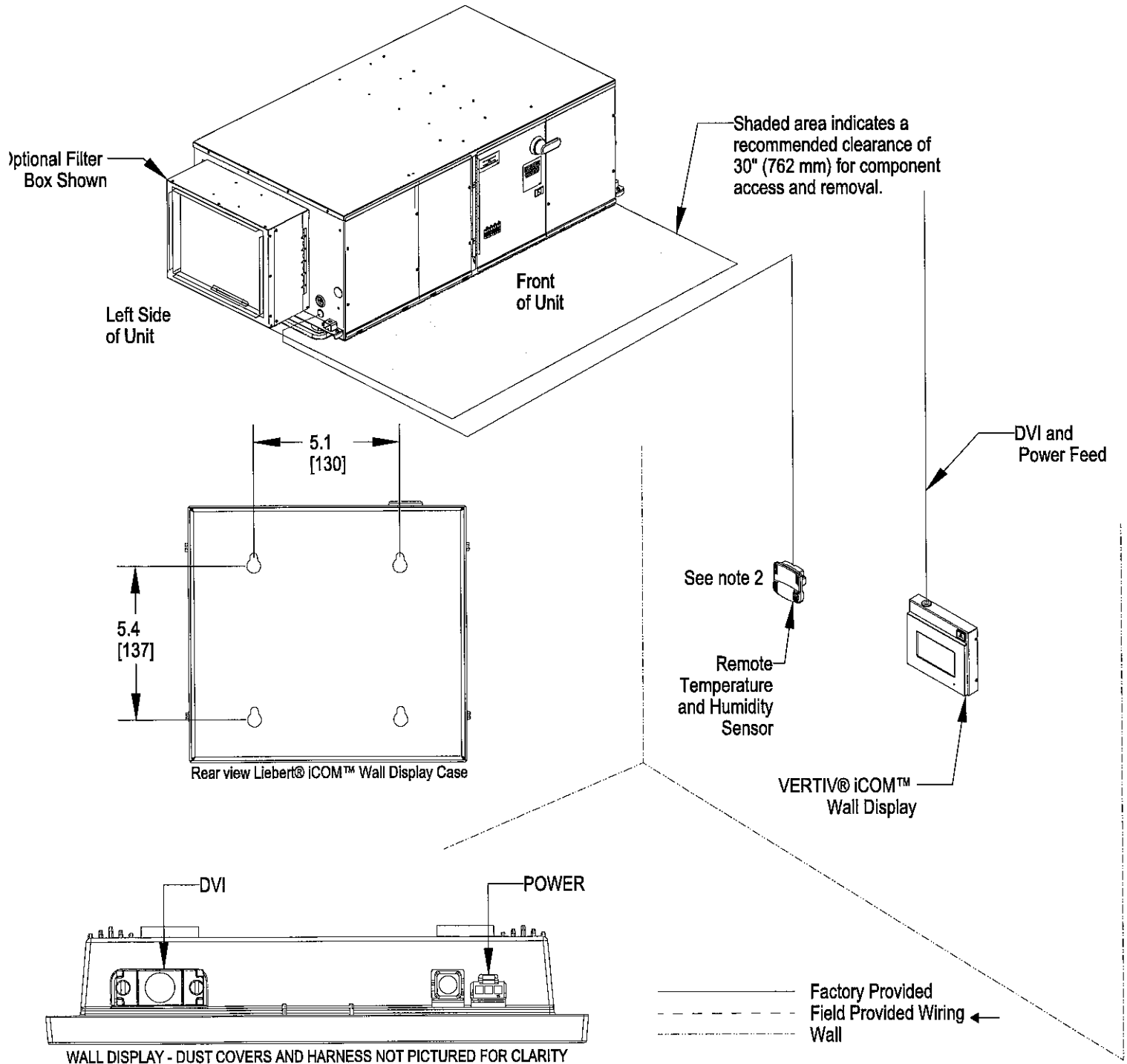
PIPING SCHEMATICS DIRECT EXPANSION UNIT 2 & 3 TON PIPING SCHEMATICS




VERTIV™

VERTIV COOLPHASE CEILING

GENERAL ARRANGEMENT, DIMENSIONAL DATA & FIELD CONNECTIONS VERTIV® ICOM™ WALLMOUNT DISPLAY



Notes:

1. Refer to 20000913 for connection points on Vertiv™ CoolPhase Ceiling Unit.
2. CANbus cable connection wired from P66 / P67 on the rear of the Remote Temperature / Humidity sensor. Connection routed to secondary port on rear of Return T/H sensor inside unit or available CANbus port on internal control board (P66 / P67).



VERTIV COOLPHASE CEILING

ELECTRICAL FIELD CONNECTIONS

2 & 3 TON DX & FC

STANDARD ELECTRICAL CONNECTIONS

1) High Voltage connection through the right side of the Ceiling Panel - 1.37" (35mm) diameter concentric knockout

2) Communication connection on the front of the Ceiling Panel
Connect according diagram in the corresponding ethernet port.

3) Electrical service (hard wired) - refer to serial tag information for unit electrical service requirement

- Three Phase - 208-230V 60HZ / 460 60HZ

- Single Phase - 208-230V 60HZ

Connect to terminals on disconnect switch. Electrical service not by Vertiv. Use copper conductors only, wire per local codes. Refer to specification sheet for total unit full load amps, wire size amps and max over current protection device size.

4) Communication Bracket

-P64A: U2U-A Unit-to-Unit Communication

-P64B: U2U-B Unit-to-Unit Communication

-VFD: Condenser Modbus (RS485) Communication

-P74: BMS Connectivity / Embedded Unity

5) Terminal Blocks Control Distribution Voltage / Power Voltage Terminals / Communication RS485

- TBK Terminal Ground

- TBK 24M Control Distribution Voltage 24VAC

- TBK 24-24AS Control Distribution Voltage 24VAC Insulated Voltage from Transformer 1:1

6) Fans Terminal Blocks

- MR relay is the power source for MF (Main Fan Relay)

- Main control signal from ICOM 4 (0-10V Distribution)

Reference models showed in this document are 300MM units. All connections, terminal block locations and communication ports also apply for 600MM units.



VERTIV COOLPHASE CEILING

ELECTRICAL FIELD CONNECTIONS

2 & 3 TON DX & FC

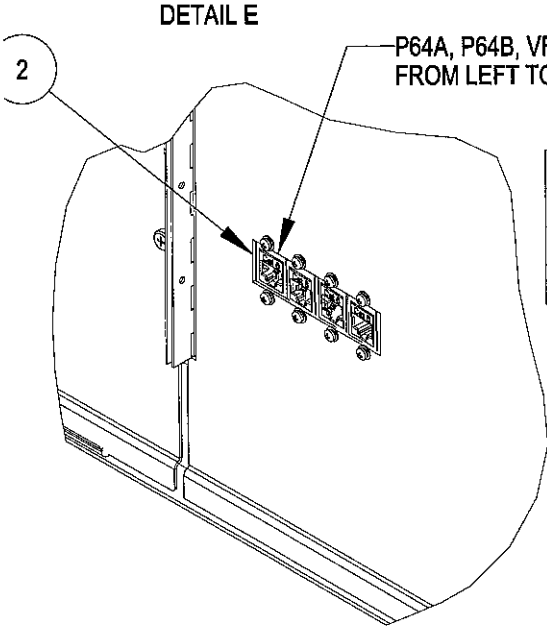
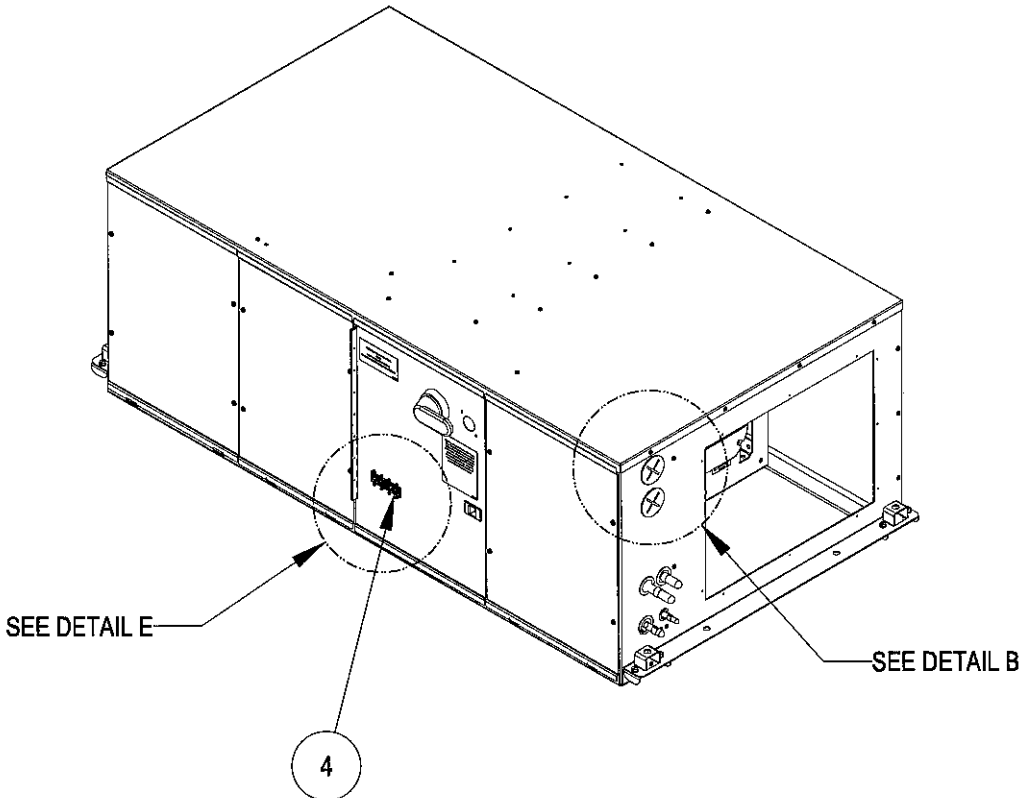
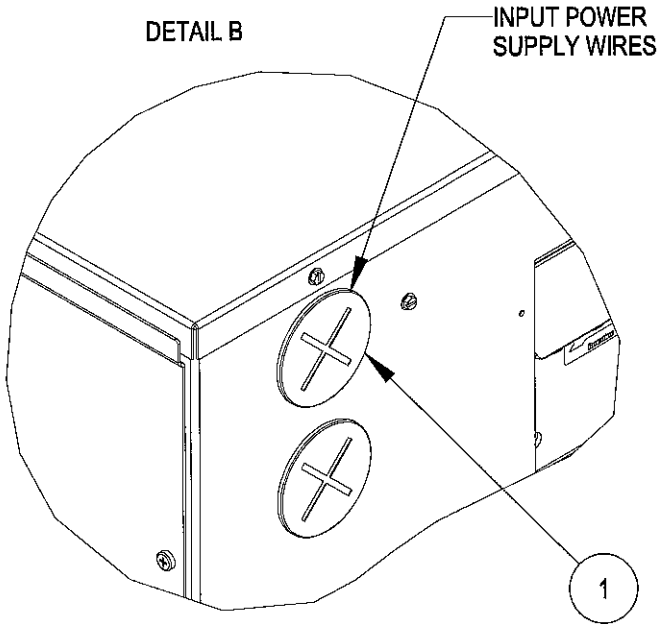


TABLE "A"	
PIN OUT	DESCRIPTION
VFD1/VFD8	MODBUS A/B
VFD3/VFD4	24VAC L/N



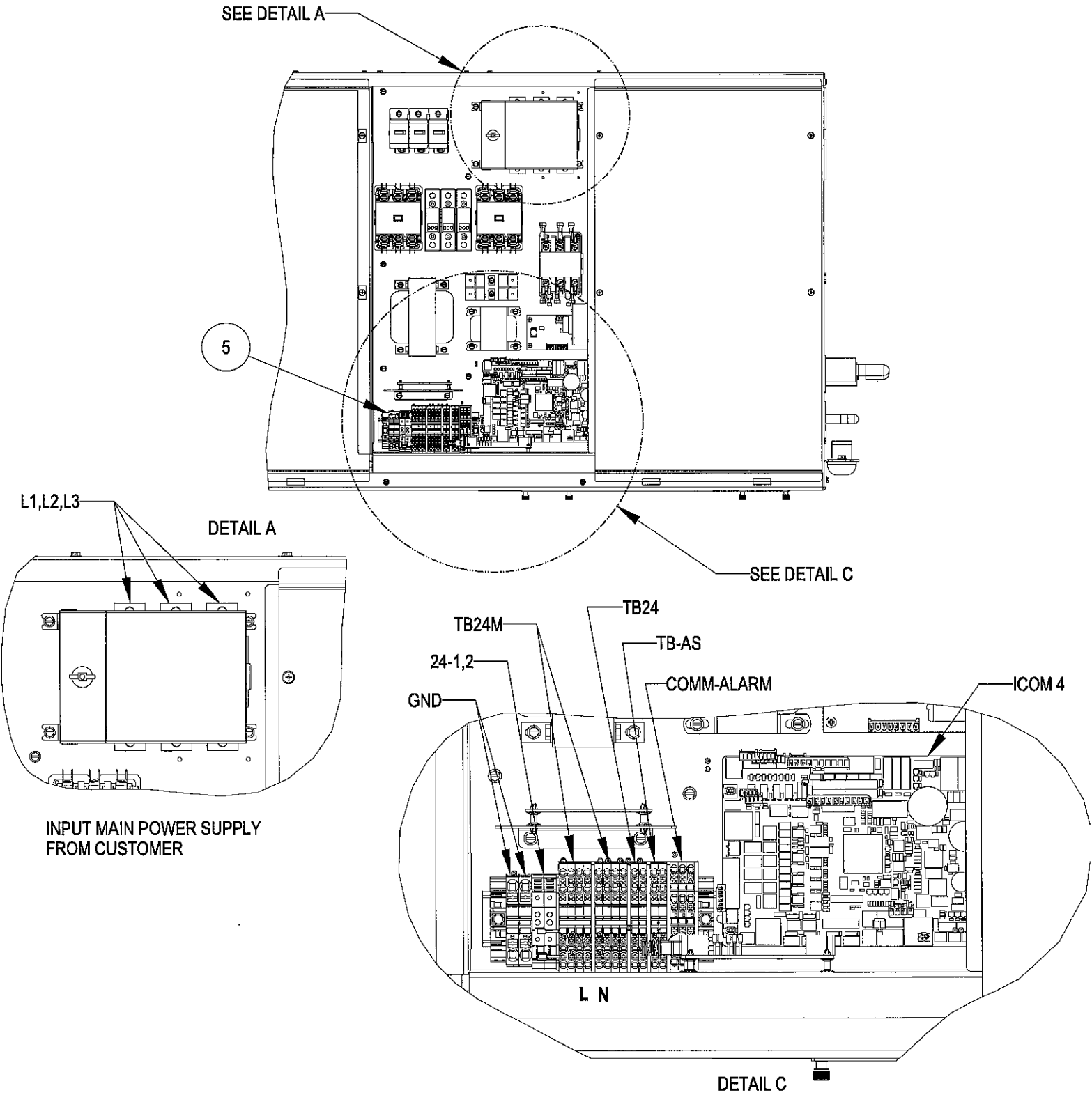
ETHERNET CABLE CONFIGURATION MUST BE STRAIGHT CONFIGURATION.
Z4 PIN OUT (INDOOR - OUTDOOR COMMUNICATION)
SEE TABLE "A"



VERTIV COOLPHASE CEILING

ELECTRICAL FIELD CONNECTIONS

2 & 3 TON DX & FC

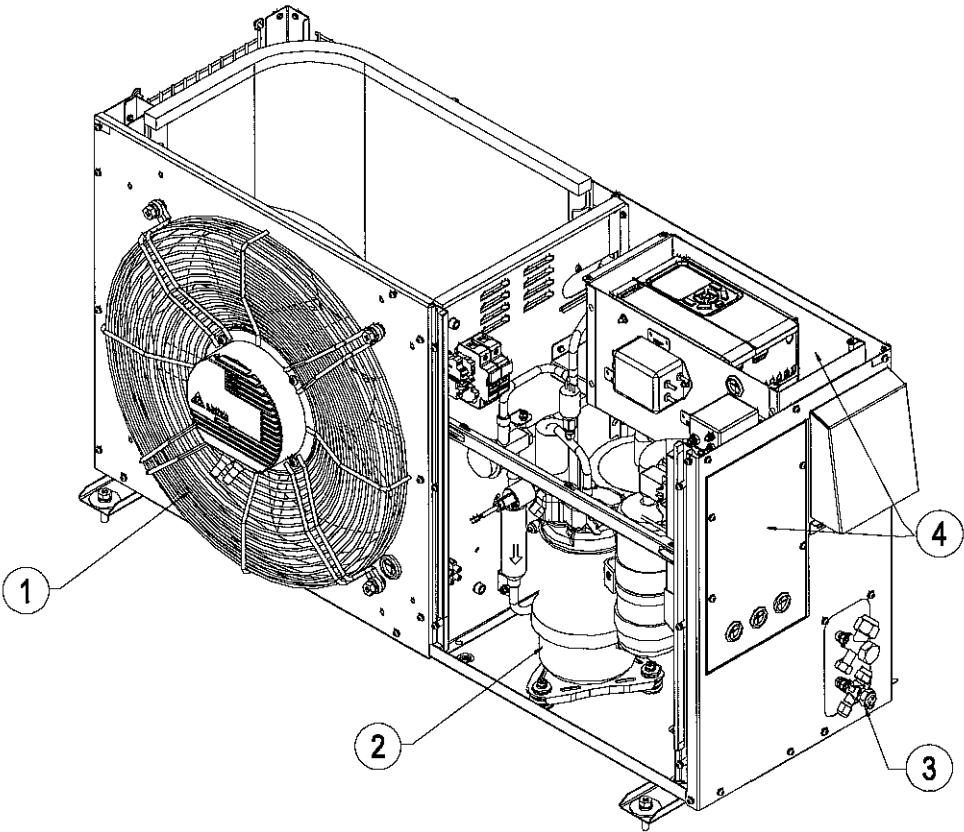




Vertiv CoolPhase Condensing Unit

COMPONENT LOCATION

CONDENSER UNIT 3.5 & 7.0 & 11KW

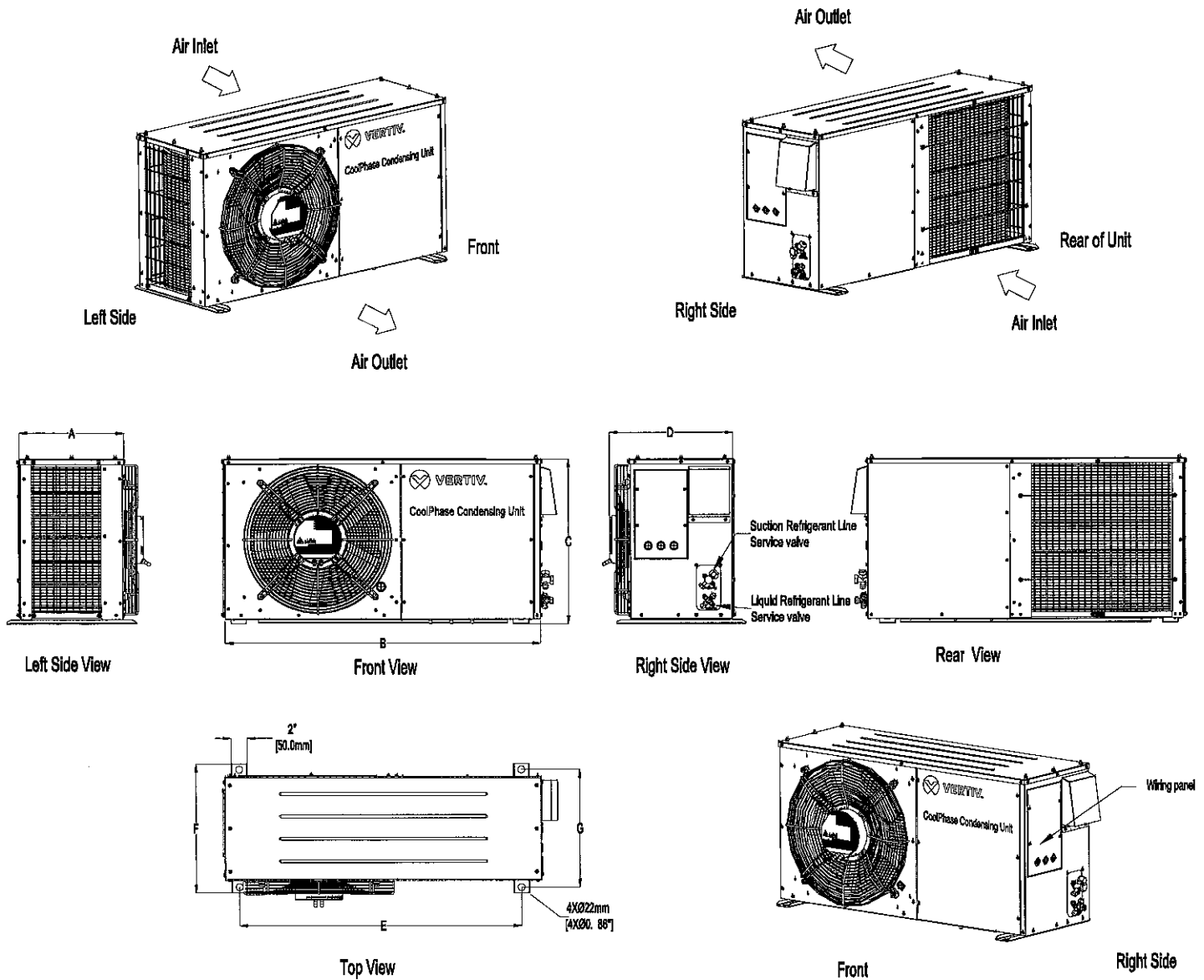


	A	B
1	ITEM	DESCRIPTION
2	1	CONDENSER FAN
3	2	COMPRESSOR
4	3	SERVICE VALVES
5	4	ELECTRICAL BOXES



Vertiv CoolPhase Condensing Unit

DIMENSIONAL DATA



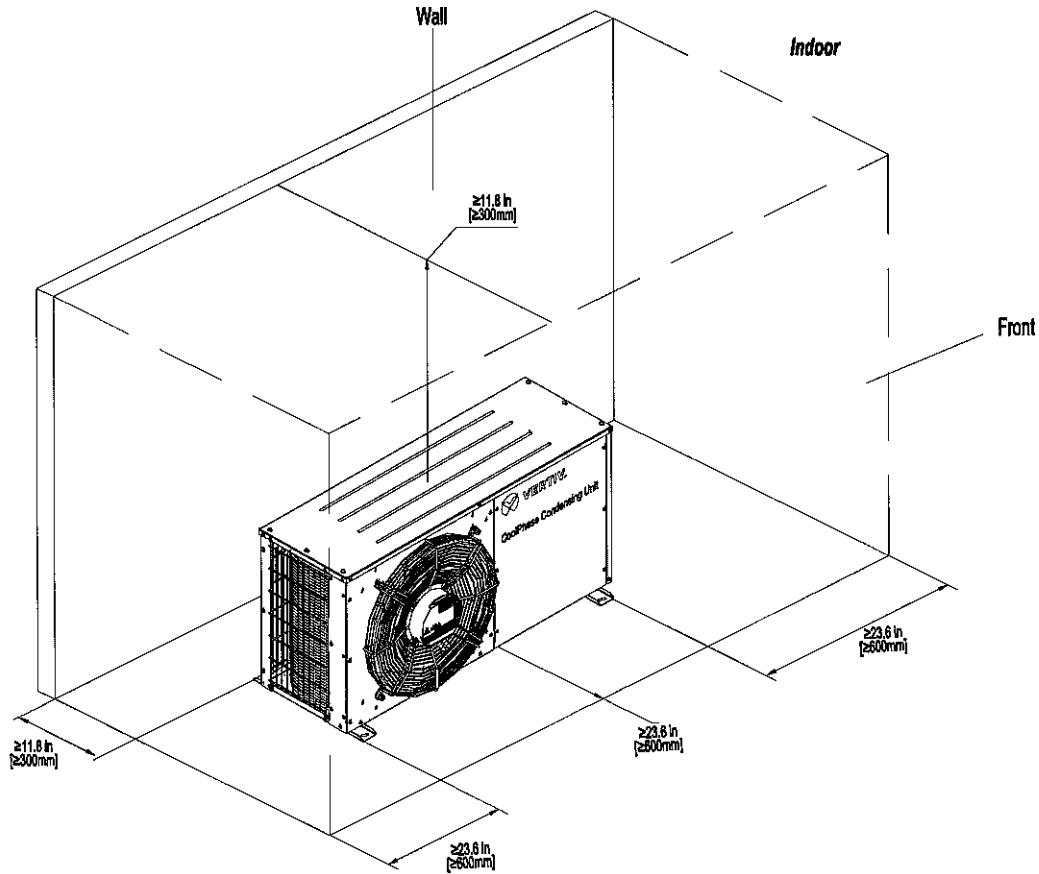
MODEL #	DIMENSIONAL DATA in. (mm).							NET WEIGHT lb (kg)		Shipping Dimensions(WxDxH) in.(mm).		SHIPPING WEIGHT lb (kg)	
	A	B	C	D	E	F	G	CUD	CUL	I		CUD	CUL
CUD050-E000A CUL050-E000A	12.6 (319)	38.8 (985)	20.3 (516)	15.2 (385)	34.7 (881)	15.9 (404)	14.5 (368)	110.2 (50)	116.8 (53)	45.2 x 22 x 28.8 (1149 x 559 x 732)		169.8 (77)	176.4 (80)
CUD070-E000A CUL070-E000A	16.5 (419)	44.4 (1128)		19.1 (485)	40.1 (1018)	19.8 (504)	18.4 (468)	118 (53.5)	130 (59)	50.7 x 26 x 28.8 (1289 x 659 x 732)		188.5 (85.5)	200.6 (91)
CUD111-E000A CUL111-E000A	20.5 (520)	51.3 (1303)	22.8 (580)	23.4 (595)	48.4 (1179)	23.8 (604)	22.4 (568)	175.3 (79.5)	184.1 (83.5)	57.6 x 30.1 x 31.3 (1464 x 764 x 795)		259 (117.5)	272.3 (123.5)
CUD115-E000A CUL115-E000A								174.17 (79)	183 (83)			257.9 (117)	271.2 (123)



Vertiv CoolPhase Condensing Unit

CLEARANCE SPACE

Standard Condensing Unit Install indoor



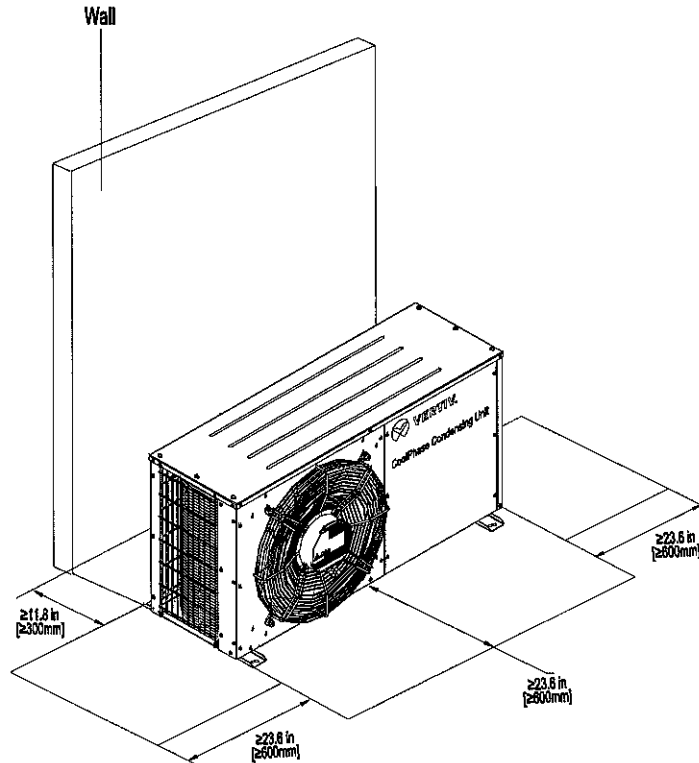
NOTES: When Standard Condensing Unit is installed in indoor environment, it is not necessary to install the wind baffle.



Vertiv CoolPhase Condensing Unit

CLEARANCE SPACE

Standard Condensing Unit Install outdoor





Vertiv CoolPhase Condensing Unit

PRIMARY CONNECTION LOCATIONS

Field-installed piping must comply with all applicable local codes.

The vertical riser pipe size must be reduced according to the following trade sizes: (1-1/8 to 7/8, 7/8 to 3/4, 3/4 to 5/8, 5/8 to 1/2.)

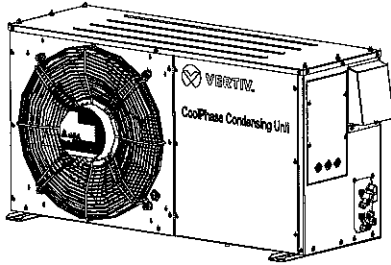


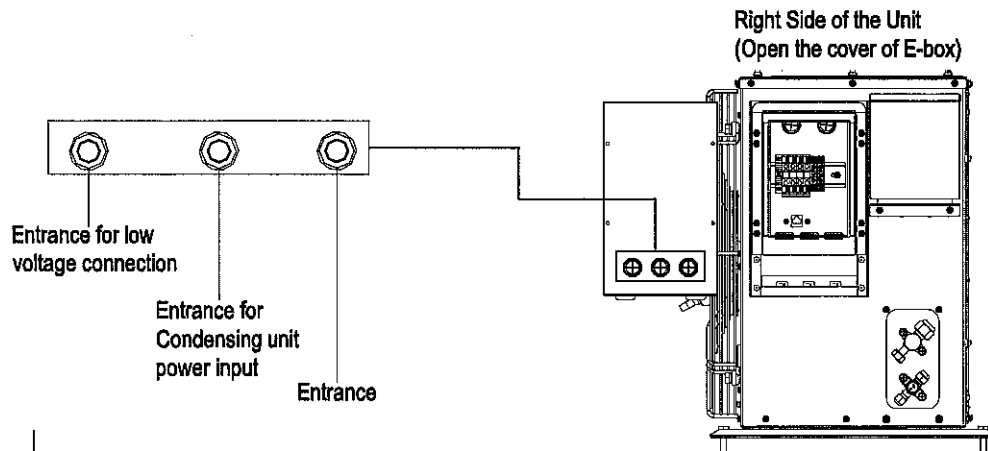
Table 1. Vertiv Coolphase Condensing Unit recommended refrigerant line size of standard units and low ambient units

	A	B	C	D	E	F
1	Outdoor Model	Refrigerant line length ft(m)	Liquid line diameter ANSI(mm)	Suction line diameter ANSI(mm)	"LIQUID LINE SERVICE VALVE"	"SUCTION LINE SERVICE VALVE"
2	CUD030-E000A	$L \leq (33)10$	1/4"(6.35)	1/2"(12.7)	7/16"-20UNF	3/4"-16UNF
3	CUL030-E000A	$33(10) < L \leq 197(60)$	3/8"(9.52)	1/2"(12.7)	7/16"-20UNF	3/4"-16UNF
4	CUD070-E000A	$L \leq (33)10$	3/8"(9.52)	1/2"(12.7)	5/8"-18UNF	3/4"-16UNF
5	CUL070-E000A	$33(10) < L \leq 115(35)$	3/8"(9.52)	5/8"(16)	5/8"-18UNF	3/4"-16UNF
6		$115(35) < L \leq 197(60)$	1/2"(12.7)	5/8"(16)	5/8"-18UNF	3/4"-16UNF
7	CUD111-E000A	$L \leq 66(20)$	3/8"(9.52)	5/8"(16)	5/8"-18UNF	7/8"-14UNF
8	CUL111-E000A	$66(20) < L \leq 148(45)$	1/2"(12.7)	3/4"(19.05)	5/8"-18UNF	7/8"-14UNF
9	CUD115-E000A CUL115-E000A	$148(45) < L \leq 197(60)$	1/2"(12.7)	7/8"(22.23)	5/8"-18UNF	7/8"-14UNF



Vertiv CoolPhase Condensing Unit

ELECTRICAL FIELD CONNECTIONS



Electric control box layout and power supply system

CUD030-E000A, CUL030-E000A CUD070-E000A, CUL070-E000A	CUD111-E000A, CUL111-E000A	CUD115-E000A, CUL115-E000A
L1 L2/N PE RJ45-low voltage connector	L1 L2 L3 PE RJ45-low voltage connector	L1 L2 L3 N PE RJ45-low voltage connector
208/230V/1Ph/50/60Hz	208/230V/3Ph/50/60Hz	400V/3Ph+N/50/60Hz

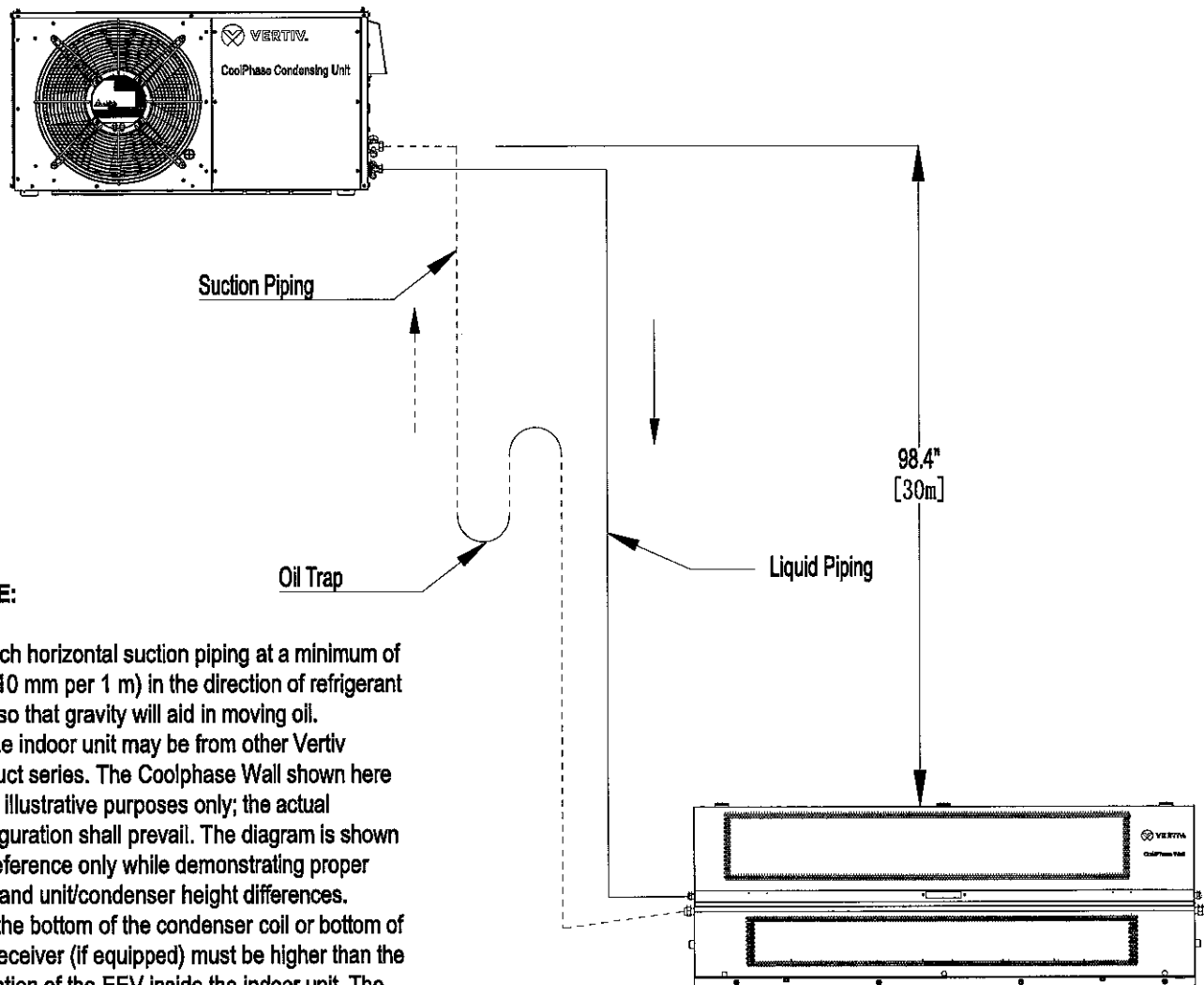
NOTE: After wiring is completed, secure the excess cables with wire ties. The Wire Saddles are at the bottom of the electrical box.



Vertiv CoolPhase Condensing Unit

PIPING SCHEMATIC

CONDENSER UNIT ABOVE INDOOR UNIT 3.5 & 7.0 & 11KW



NOTE:

1. Pitch horizontal suction piping at a minimum of 1% (10 mm per 1 m) in the direction of refrigerant flow so that gravity will aid in moving oil.
2. The indoor unit may be from other Vertiv product series. The Coolphase Wall shown here is for illustrative purposes only; the actual configuration shall prevail. The diagram is shown for reference only while demonstrating proper pipe and unit/condenser height differences.
3. If the bottom of the condenser coil or bottom of the receiver (if equipped) must be higher than the elevation of the EEV inside the indoor unit. The vertical height must not exceed 98.4 feet (30m).
4. Install an oil trap every 24.6 feet (7.5m) of the vertical suction/gas pipe.



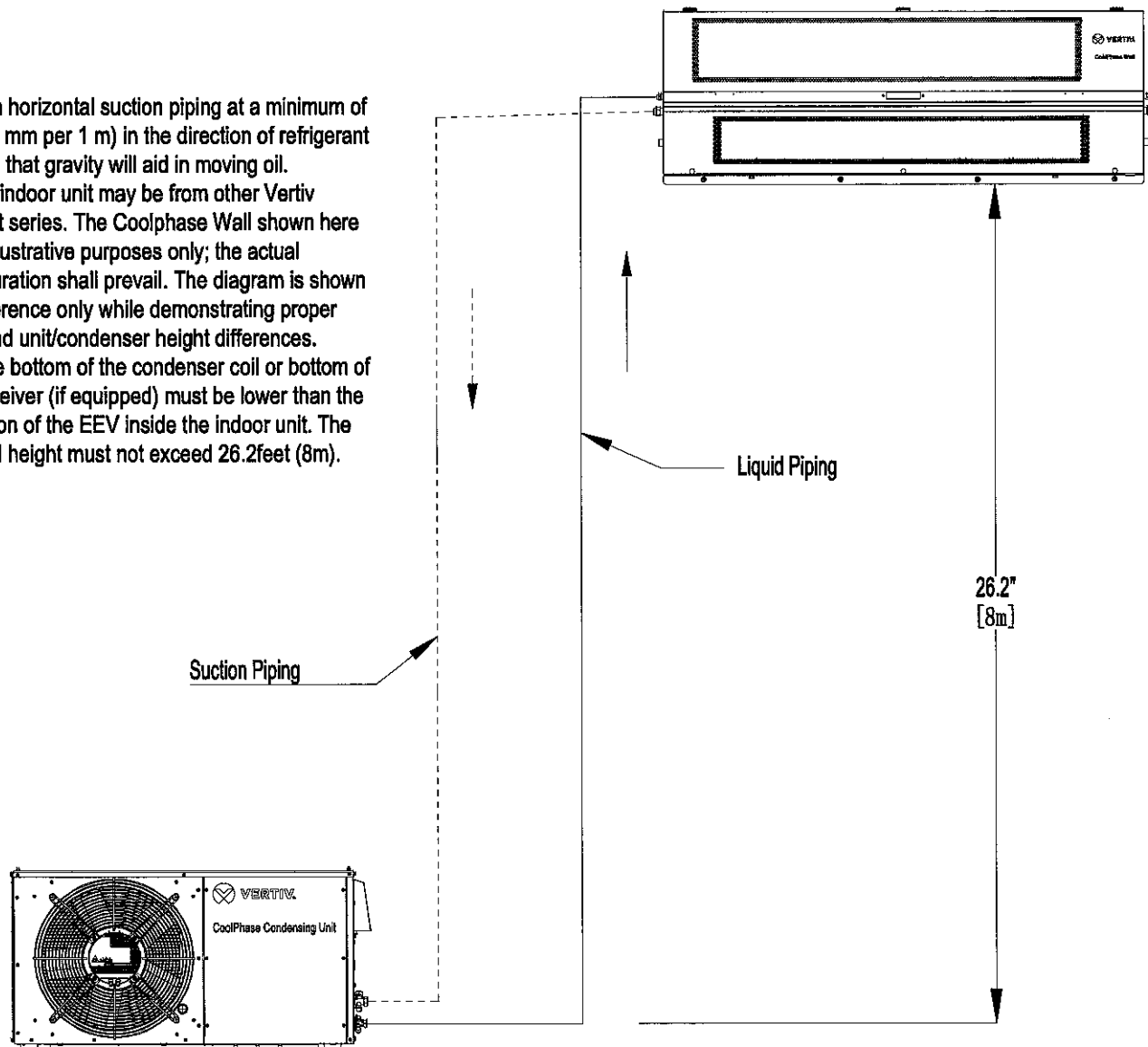
Vertiv CoolPhase Condensing Unit

PIPING SCHEMATIC

CONDENSER UNIT BELOW INDOOR UNIT 3.5 & 7.0 & 11KW

NOTE:

1. Pitch horizontal suction piping at a minimum of 1% (10 mm per 1 m) in the direction of refrigerant flow so that gravity will aid in moving oil.
2. The indoor unit may be from other Vertiv product series. The Coolphase Wall shown here is for illustrative purposes only; the actual configuration shall prevail. The diagram is shown for reference only while demonstrating proper pipe and unit/condenser height differences.
3. If the bottom of the condenser coil or bottom of the receiver (if equipped) must be lower than the elevation of the EEV inside the indoor unit. The vertical height must not exceed 26.2feet (8m).




VERTIV™

DX PRODUCTS WITH R32

A2L REFRIGERANT DISPERSAL VOLUME CALCULATION R32

Engineer of record to determine the Refrigerant Charge m_c and required minimum Effective Dispersal Volume V_{ED} of the space to which the appliance can be utilized for the cooling of ITE AREAS.

The required minimum EFFECTIVE DISPERSAL VOLUME V_{ED} is a function of the refrigerant charge, m_c and is represented by the following equation:

$$V_{ED} = m_c / 0.5 \times \text{LFL}$$

V_{ED} = the minimum Effective Dispersal Volume in ft^3 (m^3)

m_c = the refrigerant charge of the largest single circuit of a unit in lbs (kg)

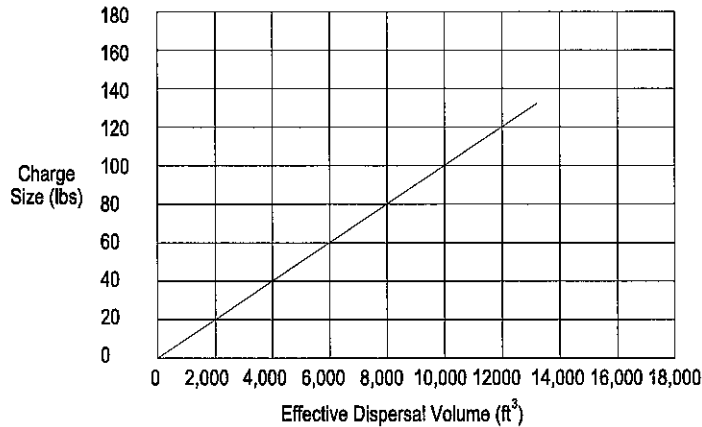
0.5 = the concentration factor

LFL = the Lower Flammability Limit in $\text{lbs}/1000 \text{ ft}^3$ (kg/m^3)

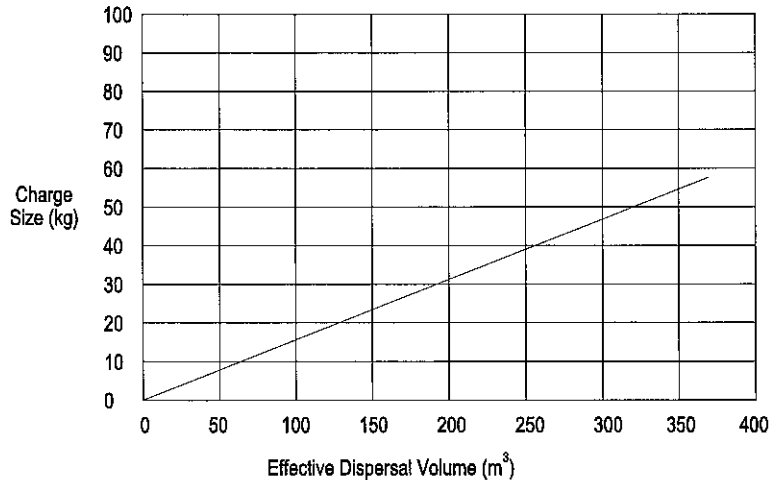
Note: The LFL of R32 is $19.2 \text{ lbs}/1000 \text{ ft}^3$ ($307.0 \text{ g}/\text{m}^3$) according to ASHRAE 34-2022.

Minimum Effective Dispersal Volume V_{ED} of the space shall be based on altitude of the installation location. For locations above sea level, the engineer of record will need to adjust the value of LFL in accordance with ANSI/ASHRAE 34 before applying it to the equation for determining the required minimum Effective Dispersal Volume V_{ED} .

Charge Size vs. Effective Dispersal Volume



Charge Size vs. Effective Dispersal Volume





VERTIV COOLPHASE CEILING

STANDARD & OPTIONAL FEATURES

EVAPORATOR UNIT, 1-8TON

STANDARD FEATURES

EVAPORATOR COIL Constructed of soft copper tubes in a staggered tube pattern. Tubes are expanded into continuous high efficiency aluminum lance type fins. Coil is set in condensate drain pan, with float switch for unit shutdown. The evaporator drain is internally trapped.

REFRIGERATION SYSTEM Single refrigeration circuit, includes a liquid line filter drier, externally equalized expansion valve, and a suction pressure transducer. The module is pre-charged with nitrogen and sealed. R-32 refrigerant must be field supplied and field charged by others.

FAN ASSEMBLY Fan is plug type, with integral direct drive with backward curved blades and Electronically Commutated (EC) motor. The fan speed shall be variable and automatically regulated by the Liebert® iCOM™ control through all modes of operation. The impeller shall be made of aluminum and is dynamically balanced. The fan shall be located to draw air through the coil to ensure even air distribution and maximum coil performance.

LIEBERT® iCOM™ CONTROL SYSTEM The Liebert® iCOM™ controls the Liebert® CoolPhase Ceiling and enables Unit-to-Unit communication with other Liebert® CoolPhase Ceiling units.

BASE-COMMS FOR BMS CONNECTIVITY The Liebert® iCOM™ controller shall provide four ethernet ports dedicated for:

- 1) Unit-to-Unit A
- 2) Unit-to-Unit B
- 3) BMS Connectivity
- 4) Indoor-Outdoor Communication

TOUCH SCREEN DISPLAY The standard user interface is a remote wall mountable 9 inch color touch screen which presents system information and allows all parameters to be viewed and adjusted. The touch screen display comes in a plastic housing for mounting on the wall and is shipped loose with the unit

CABINET AND CHASSIS Constructed of galvanized steel for strength and corrosion resistance with thermal/acoustical insulation to reduce sound levels and prevent condensation. Removable panels allow access to the electric panel or refrigeration components for service or maintenance. Hanging brackets are integral to the chassis with vibration isolators and hardware provided for field supplied 3/8" threaded suspension rods.

UNIT PROTECTIONS AND CONTACTS include a filter clog switch, common alarm contact and remote shutdown contacts.

- Filter clog switch is provided to activate a Liebert® iCOM™ alarm when the pressure drop across the filter exceeds the customer adjustable level. Switch is adjustable outside the cabinet.
- Common Alarm Contact is one set of normally open contacts which close for remote indication of alarms.
- Remote Shutdown Contact allows unit shutdown based on external input

HIGH TEMPERATURE SENSOR senses the return air temperature, shuts down the unit if temperature reaches 125F (52C) and is a manual reset device not meant to replace any fire detection system that may be required by local or national codes.

TEMPERATURE AND HUMIDITY SENSORS are mounted in unit on the return air stream and wired to the Liebert® iCOM™ Control board.



VERTIV COOLPHASE CEILING

STANDARD & OPTIONAL FEATURES

EVAPORATOR UNIT, 1-8TON

OPTIONAL FEATURES

→ **LOCKING UNIT DISCONNECT SWITCH** includes a "Locking-Type" factory-mounted fused disconnect switch providing unit with a 5,000 Amp or 65,000 Amp short-circuit current rating (SCCR). Disconnect switch is mounted internally with locking and lockable handle operational from outside the unit. Access to high voltage electric panel can only be obtained with the switch in the "off" position, and the handle is lockable to support lockout/tagout safety programs.

ELECTRIC REHEAT Electric low watt density 304 stainless steel fin tubular reheat element provides one stage of reheat to maintain room dry bulb temperature during dehumidification and is protected by one automatic reset temperature switch and one manual reset temperature safety switch.

STEAM GENERATING CANISTER HUMIDIFIER is housed in a steel enclosure and includes a replaceable canister with all supply and drain valves, 1" (25mm) air gap on fill line, inlet strainer, steam distributor and electronic controls, including high water indicator. System automatically fills and drains and maintains the required water level based on conductivity. Humidifier Problem Alarm annunciates touchscreen display.

SMOKE SENSOR samples the return air, shuts down the unit upon detection, and sends visual and audible alarm. This smoke sensor is not intended to function as or replace any room smoke detection system that may be required by local or national codes. Smoke sensor trouble connections are available for external monitoring

FREE COOLING Air cooled coil, for alternate Water/Glycol Source, Constructed of soft copper tubes in a staggered tube pattern and Header tubes for inled and outlet. Tubes are expanded into continuous high efficiency aluminum lance type fins. Coil is set in condensate drain pan, with float switch for unit shutdown.



VERTIV COOLPHASE CEILING

STANDARD & OPTIONAL FEATURES

EVAPORATOR UNIT, 1-8TON

SHIP LOOSE OPTIONS

- **FILTER BOX** is constructed of galvanized steel, supplied with quantity of two nominal 20" (508mm) x 20" (508 mm) x 4" (102 mm) deep pleated MERV 8 filters (based on ASHRAE 52.2-2007). The box is provided with a 1" (25 mm) duct flange. The filters are accessible via a hinged access door, without shutting the unit down. The filter box option also includes a 1" (25 mm) discharge air duct collar.

DUCT FLANGES 1" (25mm) duct flanges for easy duct integration.

BOTTOM DISCHARGE GRILLE (1, 2 and 3 Ton models only) is a 3-way louvered air grille, painted white, added to a T-bar grid assembly for air discharge directly into room from bottom of unit. Kit includes air baffle and rear discharge block-off plates. Use separate filter box kit for filtration and connection to field provided room air return grille and ductwork.

DISTRIBUTION PLENUM (1, 2 and 3 Ton models only) Easily installed, self-contained air distribution plenum provides air discharge in three directions. The plenum is supplied with a nominal 16" (406mm) x 25" (535mm) x 4" (102mm) deep pleated MERV 8 filter (based on ASHRAE 52.2-2007).

- **CONDENSATE PUMP** has a capacity of 7.5 GPM (28.4 l/m) at 10 ft feet of head for 460/575V units, and 5.1 GPM (19.3 l/m) for 208/230 volt units at 10 ft. of head. Pump assembly is complete with pump, motor assembly, reservoir, integral float switch, and auxiliary safety float switch to shut unit off in event of pump failure. Pump assembly is designed to mount on the side of the evaporator (indoor) module, or other suitable means to allow condensate drainage into the reservoir. The condensate pump is field-mounted on the outside of the cabinet, and is field-wired to the evaporator/fan-coil electric panel for both power supply and float switch interlock. Separate power feed is not necessary.
- **TEMPERATURE AND HUMIDITY SENSORS** are mounted in an attractive case with 30 ft. (9m) of cable, it is shipped loose and ready to be field mounted on the room wall or in unit return air stream and field wired to the Liebert® iCOM™ Control board.



Vertiv CoolPhase Condensing Unit

STANDARD FEATURES AND OPTIONS

STANDARD FEATURES

CABINET is IPX4 rated, made of galvanized sheet metal with powder-coated exterior panels and is equipped with an IPX4-rated waterproof electrical control box.

ROTARY COMPRESSOR is inverter-duty, driven by an inverter, with capacity adjustment range from 20 to 100%.

CONDENSER COIL is an aluminum microchannel heat exchanger, with TCP coating to protect the coil from corrosion.

FAN ASSEMBLY includes an axial EC fan, driven by an Electronically Commutated (EC) motor with speed control from 10% to 100%.

REFRIGERATION SYSTEM is a single-circuit design that includes a compressor, microchannel condenser coil, discharge temperature sensor, high-pressure switch, and check valve. It is designed for field-supplied and charged R32 refrigerant. The standard ambient condenser is capable of operating in temperatures ranging from 23°F to 118°F (-5°C to 48°C). With the addition of the wind baffle assembly (Optional), the unit can operate within a temperature range of -4°F to 118°F (-20°C to 48°C).

HIGH PRESSURE SWITCH is mounted on the compressor discharge line and is set at 595 psi (41 bar) with tolerance of ± 14.5 psi (1 bar). The switch will open when the high pressure exceeds 595 psi (41 bar) and close when the pressure drops below 479 psi (33 bar). If the switch is open, the compressor will be shut down.

DISCHARGE TEMPERATURE SENSOR is installed on the compressor discharge line. If the temperature reaches the limit of 239°F (115°C), the iCOM Edge controller will shut down the compressor.

THE HIGH-PRESSURE TRANSDUCER is installed on the compressor discharge line. If the discharge pressure reaches 565 psi (39 bar), the iCOM Edge controller will shut down the compressor.

CHECK VALVE is mounted on the compressor discharge line to prevent refrigerant migration from the condenser or receiver when the unit is stopped for a long time.

LOW-AMBIENT CONDENSER model includes head pressure valve, liquid receiver, heating belts, relief valve, and low-pressure switch based on the standard units. The condensing unit can operate between -31 to 118°F (-35 to 48°C). The relief valve is installed on the liquid receiver of the low ambient condenser. It features threaded connections for routing refrigerant discharge to the outside. The valve is factory-set to open at 595 psi (45 bar). The check valve is installed on the inlet line of the liquid receiver.

SHIP-LOOSE FEATURE (Optional- FIELD INSTALLED)

DUCT KIT is field attached to the condensing unit to enable ductwork to be connected to the condensing unit. When using the duct kit, please pay attention to the allowable static pressure conditions.

	A	B	C	D	E	F	G	H	I
1		CUD030-E000A	CUL030-E000A	CUD070-E000A	CUL070-E000A	CUD111-E000A	CUL111-E000A	CUD115-E000A	CUL115-E000A
2	Unit Static pressure, (Psi/Pa)	0.2psi(50Pa)	0.2psi(50Pa)	0.12psi(30Pa)	0.12psi(30Pa)	0.12psi(30Pa)	0.12psi(30Pa)	0.12psi(30Pa)	0.12psi(30Pa)

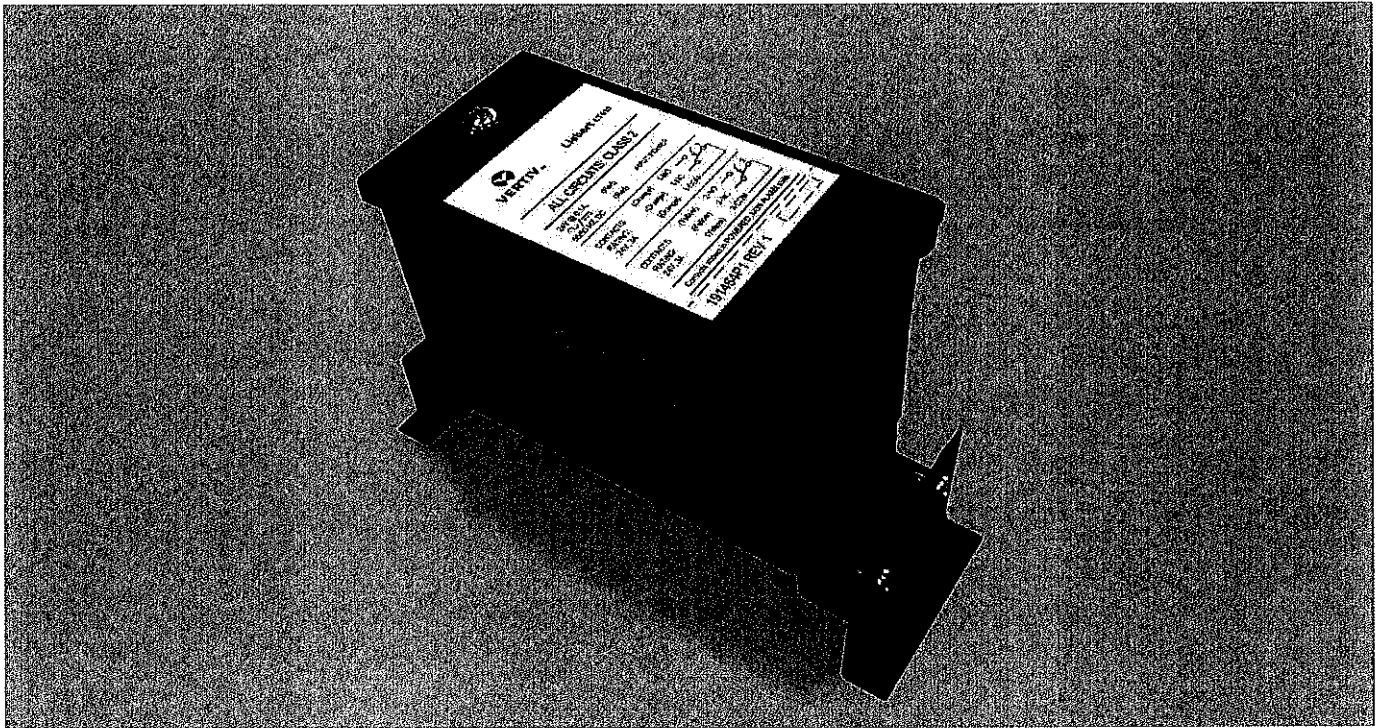
HAILGUARD KIT protects the condensing coil from hail strikes.

→ **WIND BAFFLE** helps shield the condenser from cold wind, enabling the system to operate down to -4°F (-20°C) with standard version unit.

LIEBERT® LIQUI-TECT™ 410

POINT LEAK DETECTION SENSOR

Product Specification/Installation Guide



The Liebert® Liqui-Tect™ 410 (LT410) provides single-point detection of leaks. The point-detection sensor has two gold-plated sensing probes to prevent corrosion and to provide accurate readings. The LT410 constantly monitors for leaks, internal faults, and power failures and warns of any abnormal conditions. Mounting brackets allow for sensor height adjustment and leveling.

The LT410 is the ideal solution for sensing leaks under a raised computer floor or air conditioning drip pans. Two independent outputs provide added flexibility with the capacity to signal both a local alarm panel, Liebert cooling unit and a remote building management system or external equipment, such as motorized water shutoff valves.

LT410 APPLICATIONS

The LT410 is ideally suited for:

- Glycol and chilled water cooling,
- Humidification supply water piping,
- Condensate pumps and drains,
- Unit and ceiling auxiliary drip pans,
- Overhead piping troughs.

LOCATIONS/PLACEMENT

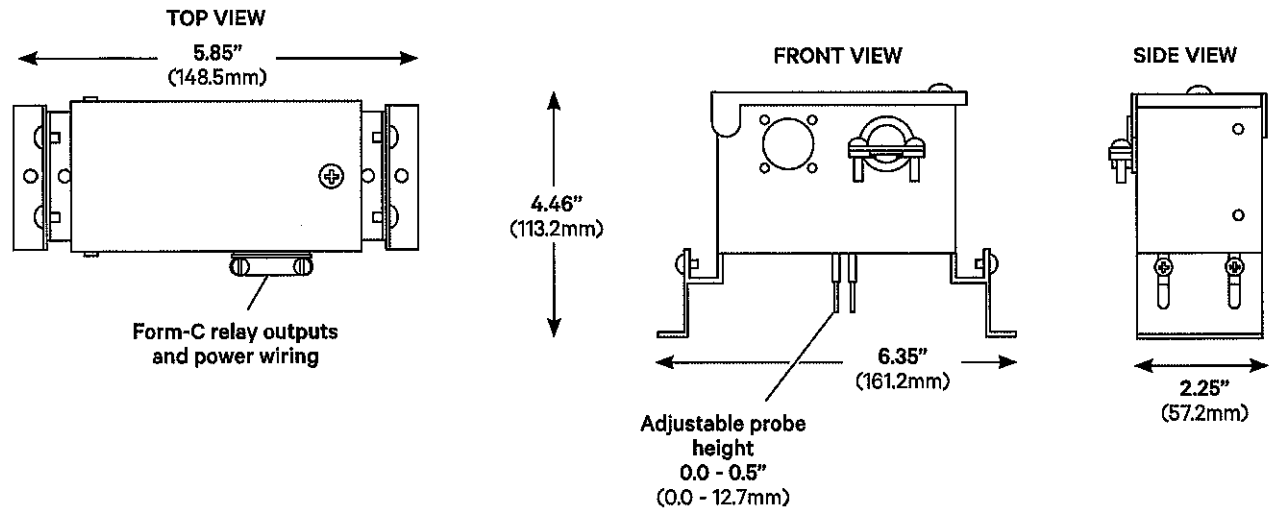
The LT410 is an excellent choice for:

- Large scale network control centers,
- Data centers,
- Server rooms and closets,
- Unattended, remote shelters,
- Mechanical equipment rooms,
- Sensitive areas with overhead piping,
- Industrial process control rooms.

COMPONENTS OF THE LIQUI-TECT™ 410 MODULE

The LT410 consists of a metal enclosure with a hinged top door that provides access to the internal wiring termination. It includes side access through a box connector for installation of the power and contact wiring. The mounting brackets attach to the enclosure with adjustable slots to allow custom setting of the height of the sensing probes.

**DIMENSIONS -
TOP, FRONT AND SIDE**



SPECIFICATIONS

Power Requirements	24 VAC 100 mA, 50/60 Hz, 3 VA (max.)
Dimensions, W x D x H	6.35 in. x 2.25 in. x 4.46 in. (161.2 mm x 57.2 mm x 113.2 mm)
Weight (assembled)	2.0 lb. (0.9 kg)
Metal Enclosure	NEMA 1, IP 30

ENVIRONMENTAL CONDITIONS

Operating Temperature	50°F to 104°F (10°C to 40°C)
Operating Humidity	10% to 95% relative humidity (non-condensing)
Operating Altitude	0 to 10,000 ft. (0 to 3,048 m)
Output Relay Contact Rating	2 Form-C, 3 A rating at 24 VAC

AGENCY LISTINGS

UL	UL916
C-UL	C22.2, No. 205-M1983
CE	Yes
FCC Compliance	47 CFR, Part 15



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LIEBERT COOLPHASE CEILING DX CEILING-SUSPENDED PRECISION COOLING SYSTEM

Job Name	Highland's Oncology Group - Pinnacle
Equipment Tags	LU-4
Spec. Section	238125 – Computer Room Air Conditioners – Ceiling Mounted
Model	Liebert CoolPhase Ceiling - 4-Ton
Description	4-Ton Ceiling Suspended DX Precision Cooling Systems
Quantity	1
Date	June 25, 2026
Submitted By	Sam White

Submittal Note:

This project was initially designed around the legacy Liebert MiniMate2 and MiniMate3 DX systems with R407 and R410A refrigerants. These systems are currently in End of Production phase and have been replaced by the Liebert CoolPhase Ceiling DX systems with Low GWP refrigerant (R32). EPA has mandated all Computer Room Air Conditioning systems installed after 1/1/2027 must comply with Low GWP refrigerant requirements. Submitting on the new Liebert CoolPhase Ceiling DX systems.

Liebert CoolPhase Ceiling Ceiling Suspended Precision Cooling System 4-Ton DX Air-Cooled

One (1) 4-Ton Liebert CoolPhase Ceiling Precision Cooling Split System – Indoor Unit

- Model Number: MMI48E04A004J
- Nominal Cooling Capacity: 4-tons (15kW)
- Air Volume: 2,710 CFM; Fans: 1 (.95hp)
- Electrical: 460V-3ph, 60 Hz; OPD: 20A
- Refrigerant: R32 (field supplied and charged)
- Evaporator type: copper tubes – aluminum fins with hydrophilic coating
- Variable speed EC fan – (1) fan per system
- Modulating electric reheat: 10.0 kW (34.12 kBTUh)
- No humidifier
- Filter clog and high temperature sensors
- Liebert iCOM microprocessor control with embedded Unity
- Wall-mounted 7" color touchscreen display (field mounted and wired)
- Room Temperature/humidity sensor (field mounted and wired)
- Locking disconnect switch, factory mounted and wired, with short-circuit current rating (SCCR) of 65,000 amps
- IS-UNITY-DP network communications card (SNMP, BACnet and Modbus protocols)

One (1) Liebert Outdoor Air Cooled Condensing Unit – Outdoor Unit

- Model Number: CUD154-0000A
- Outdoor Design Ambient : -4°F - 118°F
- Electrical: 460V-3ph, 60 Hz; OPD: 20A
- Inverter, variable capacity compressor (R32)
- High head pressure switch
- Nitrogen holding charge (System field charged, with field-supplied R32 refrigerant)

Ship-Loose Accessories (field installed)

- One (1) condensate pump kit per system
- One (1) return air filter box kit per system
- One (1) set of remote temp/humidity sensors per system
- One (1) LT410 spot leak detector per system

Services Include:

- Startup/Warranty Inspection – 8x5
 - Final connections, leak checking, evacuation and refrigerant **not included**
- Assistance with communications and controls setup; Owner Training
- Standard one (1) year parts and limited labor warranty
 - Extended compressor warranty through year 5

AHRI Certified Performance Data*Unit Information - Indoor**

Cooling Type	DX Indoor	Unit Model	MMI48E04R0000A0000
Configuration	Air Cooled	Power Supply	460V/3ph/60Hz
Operation Mode	DX Mode	Airflow Configuration	Frontal Air
Refrigerating Circuits No	1	Compressor 1 - Circuit 1	Variable Speed Scroll
Refrigerant	R32	Fan Type	Axial Fan
Product Line	CoolPhase Ceiling	Fan Quantity	1
Product Family	MM	Filter Class	Merv8

Options

External Filter	Not selected	Electric Reheat	Selected
Humidifier	Not selected	Damper	Not selected

Unit Information - Outdoor

Product Line	CoolPhase Condensing Unit	Fan Module	Standard
Product Family	Condensing Unit	Fan Type	Axial Fan
Unit Model	CUD154-0000A0000	Fan Quantity	2
Unit Power Supply	460V/3ph/60Hz		

Design Conditions -Data Input

Calculation Mode	Return Airflow + Compressor Modulation	Compressor Modulation	100.0 %
Indoor Return Air Temperature	75.0 °F	Outdoor Air Temp	95.0 °F
Indoor Return Air RH	45.0 %	Outdoor Airflow	5116 cfm
Altitude Sea Level	0.0 ft	Subcooling	16.6 R
Atmospheric Pressure	14.7 psi	Outdoor ESP	0.000 in-H2O
Indoor ESP	0.200 in-H2O	Fan Speed Control	On
Indoor Return Airflow	2706.0 cfm		

General Performance at Design Conditions

Gross Total Capacity	14.8 kW	Supply Air RH	52.0 %
Gross Sensible Capacity	14.8 kW	Supply Air DP	52.3 °F
nSHR	1	Return Airflow	2706 cfm
Net Total Capacity	13.6 kW	Indoor Fan Modulation	69.7 %
Net Sensible Capacity	13.6 kW	Actual Room SPL @2m f.f.	62.0 dBA
Compressor Modulation	100.0 %	System Net Sens nSCOP	2.90

General Performance at Design Conditions

System Power Input	4.69 kW	Outdoor Airflow	5116 cfm
Supply Air DB	70.7 °F	Outdoor Fan Modulation	100.0 %
Supply Air WB	59.6 °F	Outdoor Actual SPL @5m f.f.	50.0 dBA

2 System Data

2.1 Air Cooled System Performance and Physical Data

Table 2.1 Vertiv™ CoolPhase Ceiling technical specifications

Models		1 Ton	2 Ton	3 Ton	4 Ton	5 Ton	8 Ton
		MMI12	MMI24	MMI36	MMI48	MMI60	MMI96
Region		NAM					
Certification marks		cCSAus					
Piping Connections		Flare Connection					
Condenser Fan		EC Motor					
External Static Pressure		0.20 inH ₂ O (50 Pa)					
Sensible Cooling Capacity (kW) @26.7 °C (80 °F) RAT, 38% Rh, 35 °C (95 °F) outdoor temp		1 (3.5)	2 (7)	3 (11)	4 (15)	6 (21)	8 (28)
Power Supply Evaporator		208/230 V, 1-Ph, 50/60 Hz		208/230 V, 1-Ph, 50/60 Hz 208/230 V, 3-Ph, 60 Hz 460 V, 3-Ph, 60 Hz	208/230 V, 3-Ph, 60 Hz 460 V, 3-Ph, 60 Hz		
Controls		Vertiv™ ICOM™					
Refrigerant (Field supplied/field charged. Not factory charged)		R-32					
Max Equivalent Length of Pipe between Indoor Unit and Condensing Unit		196.85 ft (60 m)			295.27 ft (90 m)		
Height between Indoor and Condensing Unit	Condensing unit placed higher than indoor unit	98.43 ft (30 m)			60 ft (18.3 m)	98.43 ft (30 m)	
	Condensing unit placed lower than indoor unit	-26.25 ft (-8 m)			-15 ft (4.6 m)	-26.25 ft (-8 m)	

1. Certified in accordance with the AHRI Datacom Cooling Certification Program at AHRI Standard 1360 (I-P) Standard Rating Conditions. Certified units may be found in the AHRI Directory at www.ahridirectory.org.
2. Some options or combinations of options may result in reduced air flow. Consult factory for recommendations.
3. Data rated at 100% fan speed and with Standard Feature filter.
4. Net capacity data has fan motor heat factored in for all ratings.
5. Performance data generated in GRS (Global Rating System).

Table 2.3 CoolPhase Condensing Unit technical specifications for 15 kW units

Models	CUD151 / CUL151	CUD154 / CUL154
Certification marks	cCSAus (UL 60335-2-40 and CSA C22.2 No. 60335-2-40)	
Piping Connections	Flare Connection	
Operating Temperature range	Low ambient condensing unit: -31 °F (-35 °C) ~118 °F (48 °C) Standard ambient condensing Unit with wind baffle: -4 °F (-20 °C) ~118 °F (48 °C) Standard ambient condensing unit without wind baffle 23 °F (-5 °C) ~118 °F (48 °C)	

Table 2.3 CoolPhase Condensing Unit technical specifications for 15 kW units (continued)

Models	CUD151 / CUL151	CUD154 / CUL154
Compressor	Variable speed Inverter-driven	
Condenser Fan	EC Motor	
Noise Data	72 dB	
Noise Data of night mode	64 dB	
Power Supply	208/230 V, 3-Ph, 50/60 Hz (±10%)	460 V, 3-Ph, 50/60 Hz (±10%)
Refrigerant	R-32	
Max Equivalent Length of Pipe between Indoor Unit and Condensing Unit	295.27 ft (90 m)	
Height between Indoor and Condensing Unit	Condensing unit placed higher than Indoor unit	98.4 ft (30 m)
	Condensing unit placed lower than Indoor unit	26.3 ft (8 m)

NOTE: When the ambient temperature is below -4 °F (-20 °C) up to -31 °F (-35 °C), the low-ambient version must be used. Low Ambient versions of the units do not require a Wind Baffle accessory.

NOTE: All CUD15 and CUL15 Condensing Unit models on the table above are not plenum-rated.

Table 2.5 Air Cooled Data, 60 Hz

Evaporator Model		MMI12	MMI24	MMI36	MMI48	MMI60	MMI96
Condensing Unit Type		Outdoor	Outdoor	Outdoor	Outdoor	Outdoor	Outdoor
DX Evaporator- Net Capacity Data - kW (kBTU/h) @ High-Speed CFM							
80 °F DB, 62.8 °F WB (26.7 °C DB, 17.1 °C WB) 38% Rh	Total	3.4 (11.6)	6.7 (22.8)	9.2 (31.3)	14.7 (51.0)	19.1 (65.2)	26.7 (91.1)
	Sensible	3.4 (11.6)	6.7 (22.8)	9.2 (31.3)	14.7 (51.0)	19.0 (64.8)	24.2 (82.6)
75 °F DB, 61 °F WB (23.9 °C DB, 16.1 °C WB) 45% Rh	Total	3.1 (11.6)	6.2 (21.1)	8.6 (29.3)	13.5 (46.1)	18.2 (62.1)	25.5 (87.0)
	Sensible	3.1 (11.6)	6.2 (21.1)	8.5 (29.1)	13.5 (46.1)	17.1 (58.4)	20.5 (70.0)
72 °F DB, 60 °F WB (22.2 °C DB, 15.5 °C WB) 50% Rh	Total	3.0 (10.1)	5.9 (20.0)	8.3 (28.4)	12.9 (44.0)	17.8 (59.7)	24.9 (85.0)
	Sensible	2.9 (10.0)	5.5 (18.8)	7.9 (26.8)	12.8 (43.7)	15.7 (53.6)	18.7 (63.8)
Fan Data - Evaporator							
CFM (CMH)		816 (1,386)	1,451 (2,465)	1,533 (2,605)	2,710 (4,607)	2,746 (4,665)	3,759 (6,387)
Fan Motor, HP (W)		0.16 (0.12)	0.37 (0.28)	0.56 (0.42)	0.95 (0.71)	1.10 (0.82)	1.60 (1.19)
External Static Pressure, in (mm) water gauge		0.2 (5.1)					
Evaporator Coil - Copper Tube/Aluminum Fin							
Face Area, ft2 (m2)		2.5 (0.23)	3.0 (0.28)	3.0 (0.28)	5.56 (0.52)	5.56 (0.52)	7.64 (71)
Coil Rows		3	5	5	6	6	6
Max Face Velocity, fpm (m/s)		500 (2.54)					
Unit Refrigerant Charge, lb (kg)		0.5 (0.2)	1.0 (0.5)	1.8 (0.8)	2.8 (1.3)	3.3 (1.5)	3.7 (1.7)
Unit Operating Weight DX, lb (kg)		269 (122.2)	295 (134.0)	299 (136.0)	416 (187.5)	484 (219.5)	673 (305.4)
Unit Operating Weight DX+FC, lb (kg)		292 (132.6)	325 (147.6)	329 (149.6)	484 (219.5)	504 (228.5)	752 (341.4)
Electric Reheat Capacity, kW (kBTU/h)		SSR (Solid State Relay)					
Input Voltage 230-1-60		4.5 (15.35)	4.7 (16.04)	4.0 (13.65)	—	—	—
Input Voltage 230-3-60		—	—	7.0 (23.89)	10.0 (34.12)	15.0 (51.18)	10.0 (34.12)
Input Voltage 460-3-60		—	—	4.0 (13.65)	10.0 (34.12)	10.0 (34.12)	10.0 (34.12)
Humidifier Data - Steam Generator Type							
Steam capacity, lb/h (kg/h)		5 (2.27)			12 (5.44)		
Electrical Input Power 230-1-60, kW		10.6	14.4	17.4	N/A	N/A	N/A
Electrical Input Power 230-3-60, kW		N/A	N/A	18.1	20.7	20.7	24.8
Electrical Input Power 460-3-60, kW		N/A	N/A	8.4	10.8	10.8	14.4
Evaporator Connection Sizes							
Liquid line Diameter, in O.D. Cu		3/8	3/8	3/8	5/8	5/8	5/8
Suction Line Diameter, in O.D. Cu		1/2	1/2	1/2	7/8	7/8	7/8

Table 2.5 Air Cooled Data, 60 Hz (continued)

Evaporator Model	MMI12	MMI24	MMI36	MMI48	MMI60	MMI96
Humidifier Supply	¼ in OD Copper Compression Fitting					
Evaporator/Condensate Drain	¾ in NPT-Female					
MERV 8 Filter						
External Filter Box, Nom. Size WxHxD, in (mm)	Qty. 1 20x16x4 (508x406x102)		Qty. 2 20x20x4 (508x508x102)		Qty. 2 25x20x4 (635x508x102)	
Air Distribution Plenum, Nom. Size WxHxD, in (mm)	Qty. 1 16x25x4 (406x635x102)			N/A		
Return Grille, Nom. Size WxHxD, in (mm)	Qty. 1 20x20x1 (508x508x25)			N/A		
Condensing Unit Model Number	CUD/L03	CUD/L07	CUD/L11	CUD/L15	CUD/L21	CUD/L28
Condensing Unit Rating Conditions	95 °F (35 °C) Ambient					
Coil Face Area ft2 (m2)	3.3 (0.31)	4.82 (0.45)	7.06 (0.66)	10.11 (0.94)	24.37 (2.3)	24.37 (2.3)
Type of Coil	Microchannel					
CFM (CMH)	2,222 (3,778)	2,714 (4,612)	3,892 (6,613)	5,113 (8,688)	8,839 (15,023)	8,447 (14,352)
Motor Hp (KW)	0.36 (0.27)	0.40 (0.3)	0.55 (0.41)	0.36 (0.27)	0.75 (0.57)	1.25 (0.93)
External Static Pressure, in (mm) water gauge	N/A					
STD Unit Refrigerant Charge, lb (kg)	1.3 (0.6)	1.5 (0.7)	1.8 (0.8)	2.9 (1.3)	3.0 (1.4)	5.0 (2.3)
LAK Unit Refrigerant Charge, lb (kg)	2.4 (1.1)	2.9 (1.3)	5.3 (2.4)	5.7 (2.6)	10.1 (4.6)	17.2 (7.8)
STD Unit Operating Weight, lb (kg)	110 (50)	118 (53.5)	175 (79.5)	268 (121.37)	425 (193)	425 (193)
LAK Unit Operating Weight, lb (kg)	117 (53)	130 (59)	184 (83.5)	277 (125.32)	458 (208)	458 (208)
Condensing Unit Connection Sizes						
Liquid line Diameter, in O.D. Cu	1/4	3/8	3/8	1/2	5/8	5/8
Suction Line Diameter, in O.D. Cu	1/2	1/2	5/8	3/4	7/8	7/8

2.1.1 Operating Limits for Air Cooled Systems

The Vertiv™ CoolPhase Ceiling operates within the working ranges as shown in the table below. These limits refer to new units and those that have been correctly installed and serviced.

Table 2.6 Operating limits—Air Cooled Systems

Parameter		Design Condition	
		Minimum	Maximum
Unit Entering Air Conditions	Temperature	64.4 °F (18 °C)	113 °F (45 °C)
	Relative Humidity	17%	60%
Storage Conditions	Temperature	-4 °F (-20 °C)	118 °F (48 °C)
		NOTE: Unit remains operational up to 125.6 °F (52 °C) with reduced capacity.	
Power Supply Tolerances		Voltage ± 10%, Frequency ±2 Hz	

For working ranges of the Condensing units, refer to tables below.

Table 2.7 Operating limits—Condensing Units from 3 kW to 15 kW

Models	CUD030	CUD070	CUD111	CUD114	CUD151	CUD154
	CUL030	CUL070	CUL111	CUL114	CUL151	CUL154
Operating Temperature range	Low ambient Condensing Unit: -31 °F (-35 °C) ~118 °F (48 °C)					
	Standard Ambient Condensing Unit with Wind Baffle Accessory: -4 °F (-20 °C) ~118 °F (48 °C)					
	Standard Ambient Condensing Unit without Wind Baffle Accessory: 23 °F (-5 °C) ~118 °F (48 °C)					

NOTE: When the ambient temperature is between -4 °F (-20 °C) and -31 °F (-35 °C), the Low Ambient version must be used. Low Ambient versions of units do not require a Wind Baffle accessory.

NOTE: The Low Ambient version of the Condensing Unit cannot be installed in plenum areas; only the standard version is plenum rated.

NOTE: All CUD15 and CUL15 Condensing Unit models on the table above are not plenum-rated.

Table 4.1 CoolPhase Ceiling Electrical Data (continued)

Model	Power Supply	Feature	FLA (A)	MCA (A)	MOP (A)
MMI36	230 V / 1-Ph	Reheat	39.2	48.9	50
		Reheat + Humidifier	39.2	48.9	50
		Humidifier	17.4	22.0	25
		Air Cooling	10.3	12.0	15
	230 V / 3-Ph	Reheat	30.5	38.0	35
		Reheat + Humidifier	30.5	47.0	50
		Humidifier	18.1	23.0	25
		Air Cooling	11.0	13.0	20
	460 V / 3-Ph	Reheat	15.0	21.0	20
		Reheat + Humidifier	15.0	19.0	20
		Humidifier	8.4	10.0	15
		Air Cooling	6.2	7.0	15
MMI48	230 V / 3-Ph	Reheat	38.6	48.0	50
		Reheat + Humidifier	38.6	61.0	70
		Humidifier	20.7	26.0	25
		Air Cooling	10.9	13.0	15
	→ 460 V / 3-Ph	Reheat	18.4	23.0	20
		Reheat + Humidifier	18.4	29.0	30
		Humidifier	10.8	13.0	15
		Air Cooling	5.8	7.0	15
MMI60	230 V / 3-Ph	Reheat	52.5	66.0	70
		Reheat + Humidifier	52.5	78.0	80
		Humidifier	20.7	26.0	25
		Air Cooling	10.9	13.0	15
	460 V / 3-Ph	Reheat	18.4	29.0	30
		Reheat + Humidifier	18.4	23.0	20
		Humidifier	10.8	13.0	15
		Air Cooling	5.8	7.0	15

Table 4.2 Vertiv™ CoolPhase Condensing unit electrical data

Models	Nom. Tons	Volts / Phases	Compressor Qty.	Compressor Inverter (A)	Crank Case + Heating belt (A)	FLA (A)	MCA (A)	MOP (A)
CUD03 / CUL03	1	208/230 1-Ph	1	14	0/0.4	17	21	35
CUD07 / CUL07	2	208/230 1-Ph	1	20	0/0.4	23	28	50
CUD111 / CUL111	3	208/230 3-Ph	1	17	0/0.4	21	25	40
CUD114 / CUL114	3	460 3-Ph	1	11	0/0.4	15	18	30
CUD151	4	208/230 3-Ph	1	14	0/32.2	20	23	35
CUL151	4	460 3-Ph	1	14	0.5/32.2	20	24	35
CUD154	4	208/230 3-Ph	1	9	0/21.9	11	13	20
CUL154	4	460 3-Ph	1	9	0.25/21.9	11	13	20
CUD211	6	208/230 3-Ph	1	22	0/41.3	31	36	50
CUL211	6	460 3-Ph	1	22	0.5/41.3	31	37	50
CUD214	6	208/230 3-Ph	1	19	0/32.9	22	27	45
CUL214	6	460 3-Ph	1	19	0.25/32.9	23	27	45
CUD281	8	208/230 3-Ph	1	40	0/51.3	49	58	90
CUL281	8	460 3-Ph	1	40	0.5/51.3	49	59	90
CUD284	8	208/230 3-Ph	1	30	0/39.7	33	40	70
CUL284	8	460 3-Ph	1	30	0.25/39.7	33	41	70

FLA = Full Load Amps; MCA = Minimum Circuit Ampacity; MOP = Maximum Overcurrent Protection Device.

5.5 Connecting Gas Pipe and Liquid Pipe

Table 5.3 Vertiv™ CoolPhase Ceiling recommended refrigerant line sizes, O.D. CU for Vertiv™ CoolPhase Condensing Unit

CoolPhase Ceiling	Total Equivalent Length ft (m)	Suction Line, in (mm)	Liquid Line in (mm)
MMI12 (1 Ton) + CU03A	0 to 32.80 (0 to 10)	½ (12.70)	¼ (6.35)
	32.80 to 196.90 (10 to 60)	½ (12.70)	5/16 (7.93)
MMI24 (2 Ton) + CU07A	0 to 16.40 (0 to 5)	½ (12.70)	3/8 (9.52)
	16.40 to 65.60 (5 to 20)	5/8 (15.87)	3/8 (9.52)
	65.60 to 196.85 (20 to 60)	¾ (19.05)	3/8 (9.52)
MMI3 (36 Ton) + CU11A	0 to 16.40 (0 to 5)	½ (12.70)	3/8 (9.52)
	16.40 to 49.20 (5 to 15)	5/8 (15.87)	3/8 (9.52)
	49.20 to 65.60 (15 to 20)	5/8 (15.87)	½ (12.70)
	65.60 to 131.20 (20 to 40)	¾ (19.05)	½ (12.70)
	131.20 to 196.85 (40 to 60)	7/8 (22.22)	½ (12.70)
MMI48 (4 Ton) + CU15A	0 to 32.80 (0 to 10)	¾ (19.05)	½ (12.70)
	32.80 to 295.30 (10 to 90)	7/8 (22.22)	½ (12.70)
MMI60 (6 Ton) + CU21A	0 to 49.20 (0 to 15)	7/8 (22.22)	5/8 (15.87)
	49.20 to 295.30 (15 to 90)	1-1/8 (28.58)	5/8 (15.87)
MMI96 (8 Ton) + CU28A	0 to 16.40 (0 to 5)	7/8 (22.22)	5/8 (15.87)
	16.40 to 98.40 (5 to 30)	1-1/8 (28.58)	5/8 (15.87)
	98.40 to 295.30 (30 to 90)	1-3/8 (34.93)	¾ (19.05)

NOTE: Must downsize vertical riser one trade size (1-1/8" to 7/8", 7/8" to 3/4", 3/4" to 5/8", 5/8" to 1/2").

NOTE: If the condensing unit is installed indoors, the total system refrigerant charge (Indoor unit + Condensing unit + Piping) can't exceed 4 lbs.

NOTE: Contact your representative for line sizing for runs longer than 295.30 ft (90 m) equivalent length.

Table 5.4 Equivalent Length of Components

Liquid Pipe, External Diameter in (mm)	Equivalent Length ft (m)			
	90° Bend	45° Bend	T Type Three-Way	90° Bend 45° Bend T Type Three-Way
½ (12.70)		1.31 (0.40)	0.65 (0.20)	2.49 (0.76)
5/8 (15.87)		1.80 (0.55)	0.88 (0.27)	2.49 (0.76)
¾ (19.05)		1.96 (0.60)	0.98 (0.30)	2.49 (0.76)
7/8 (22.22)		2.29 (0.70)	1.14 (0.35)	3.60 (1.10)

Table 5.4 Equivalent Length of Components (continued)

Liquid Pipe, External Diameter in (mm)	Equivalent Length ft (m)			
	90° Bend 45° Bend T Type Three- Way	90° Bend 45° Bend T Type Three- Way	90° Bend 45° Bend T Type Three- Way	90° Bend 45° Bend T Type Three- Way
1 1/8 (28.58)	2.85 (0.87)	1.44 (0.44)		4.60 (1.04)
1 3/8 (34.93)	3.45 (1.05)	1.72 (0.53)		5.30 (1.60)
1-5/8 (41.00)	4.10 (1.25)	2.05 (0.63)		5.30 (1.60)

NOTE: Suitable piping thickness must be used to support the pressure of the CoolPhase Ceiling Units

Installing Pipelines

1. Release the pre-charged nitrogen. Open all the Schrader valves in the system to release nitrogen.
2. Cut the liquid pipe and gas pipe connectors on the evaporator and condenser.
3. Lay the pipes between the evaporator and condenser.
4. Connect a nitrogen cylinder to the Schrader valve. Purge the pipe with nitrogen to flow through the pipe while welding the pipe.

Table 5.5 Pipe length and condensing unit elevation relative to evaporator

Model	Maximum Condensing Unit Level Above Evaporator, ft (m)	Maximum Condensing Unit Level Below Evaporator, ft (m)
MMI12	49.2 (15)	16.4 (5)
MMI24	49.2 (15)	16.4 (5)
MMI36	49.2 (15)	16.4 (5)
MMI48	49.2 (15)	16.4 (5)
MMI60	98.4 (30)	26.2 (8)
MMI96	98.4 (30)	26.2 (8)

Table 5.5 Pipe length and condensing unit elevation relative to evaporator

Model	Maximum Condensing Unit Level Above Evaporator, ft (m)	Maximum Condensing Unit Level Below Evaporator, ft (m)
MMI12	49.2 (15)	16.4 (5)
MMI24	49.2 (15)	16.4 (5)
MMI36	49.2 (15)	16.4 (5)
MMI48	49.2 (15)	16.4 (5)
MMI60	98.4 (30)	26.2 (8)
MMI96	98.4 (30)	26.2 (8)

Table 5.8 Outdoor condenser approximate R-32 refrigerant charge for standard units

Model	Refrigerant charge lb (kg)
CUD03	13 (0.6)
CUD07	15 (0.7)
CUD11	18 (0.8)
CUD15	29 (1.3)
CUD21	30 (1.4)
CUD28	50 (2.3)

Table 5.11 Interconnecting piping refrigerant charge for R-32 for type L Tube

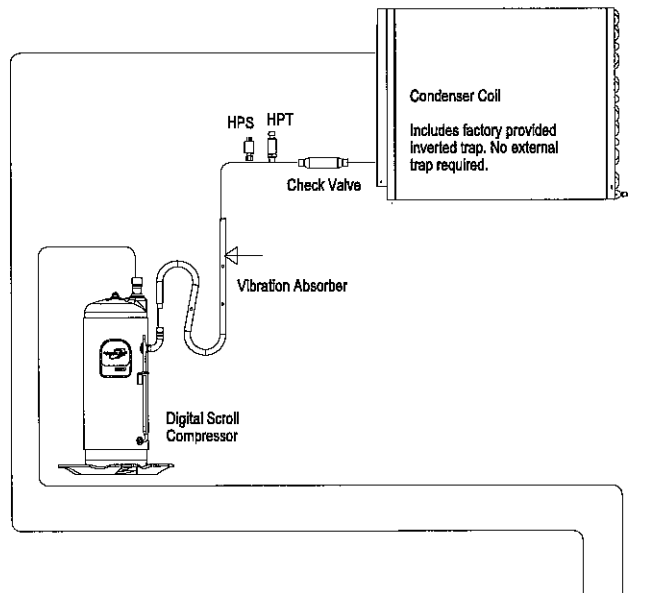
Line Size O.D.	Liquid Line, lb/100 ft (kg/30 m)	Suction Line, lb/100 ft (kg/30 m)
3/8	2.9 (1.3)	0.15 (0.07)
1/2	5.5 (2.5)	0.2 (0.1)
5/8	9.0 (4.0)	0.4 (0.2)
3/4	13.5 (6.0)	0.7 (0.3)
7/8	18.5 (8.4)	1.1 (0.5)
1 1/8	31.7 (14.4)	1.8 (0.8)
1 3/8	48.3 (21.9)	2.6 (1.2)

VERTIV COOLPHASE CEILING

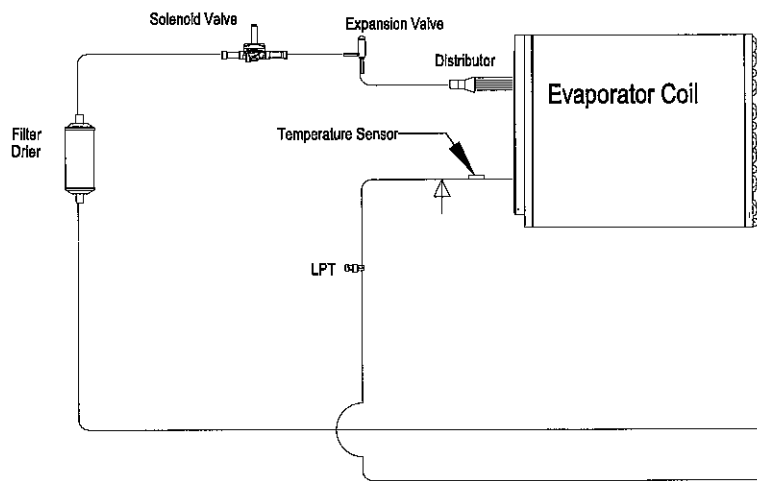
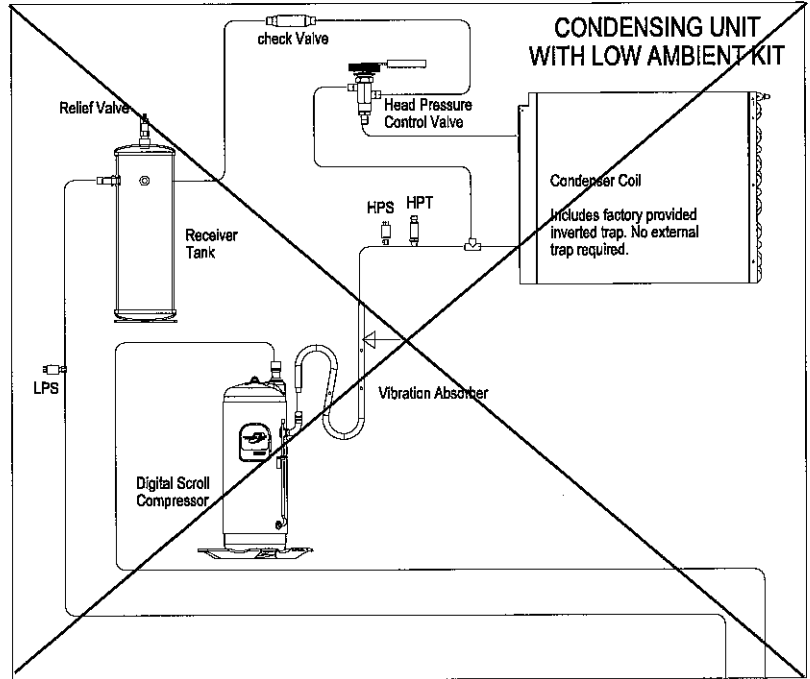
GENERAL ARRANGEMENT

3-8 TON DIRECT EXPANSION AIR COOLED

CONDENSING UNIT



CONDENSING UNIT WITH LOW AMBIENT KIT



Interconnecting Piping

For rises over 25ft (7.6m), trap every 20ft (6m) or evenly divided

Trap at base of risers over 5ft. (1.5m)

FACTORY REFRIGERANT PIPING

FIELD PIPING

▽ SERVICE / SCHRADER (ACCESS) CONNECTION NO VALVE CORE

▽ SERVICE / SCHRADER (ACCESS) CONNECTION WITH VALVE CORE

Notes:

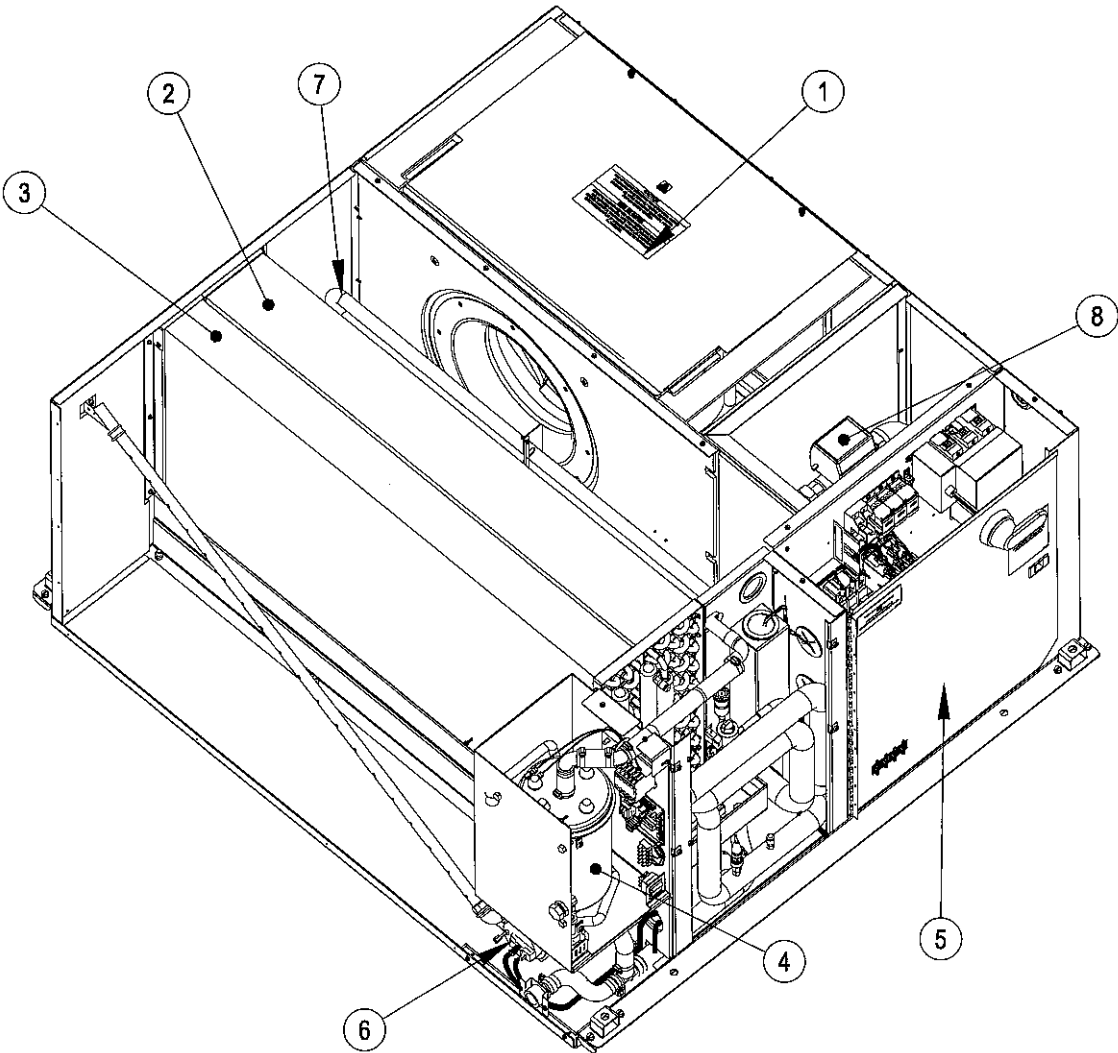
1. Schematic representation shown. Do not use for specific connection location. Filter Drier and Solenoid Valve could be in different order in the liquid line depending on the model.
2. Interconnecting piping is not supplied by Vertiv™, but is required for proper circuit operation and maintenance.
3. Do not isolate any refrigerant circuit from over pressurization protection.
4. Traps must be installed and horizontal lines pitched to ensure proper oil return and to reduce liquid floodback to compressor. Pitch horizontal hot gas piping at a minimum of 1/2" per 10 feet (42mm per 10m) so that gravity will aid in moving oil in the direction of the refrigeration flow.



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COMPONENT LOCATION EVAPORATOR UNIT, 4 & 5 TON



(PANELS REMOVED FOR CLARITY)

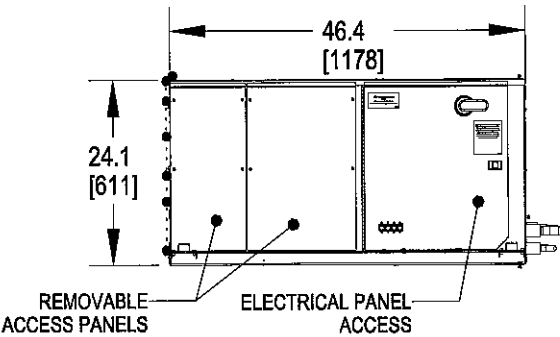
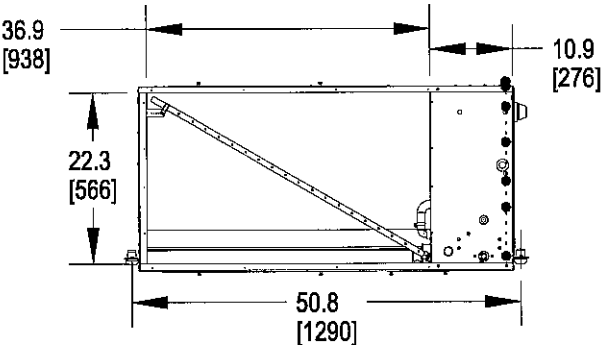
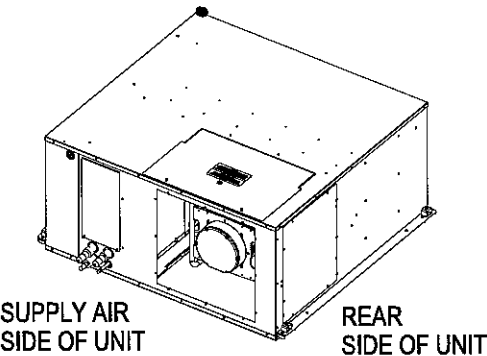
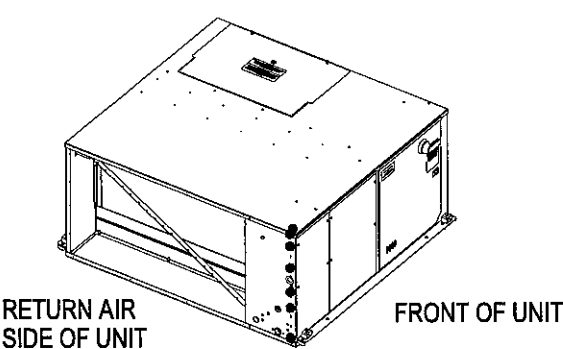
ITEM	DESCRIPTION
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2	EVAPORATOR COIL DX
~~3~~	~~EVAPORATOR COIL FREE COOLING (OPTIONAL)~~
~~4~~	~~HUMIDIFIER (OPTIONAL)~~
5	ELECTRICAL BOX
~~6~~	~~SMOKE SENSOR (OPTIONAL)~~
7	ELECTRICAL REHEAT (OPTIONAL)
~~8~~	~~3-WAY VALVE (ONLY IN FREE COOLING OPTION)~~



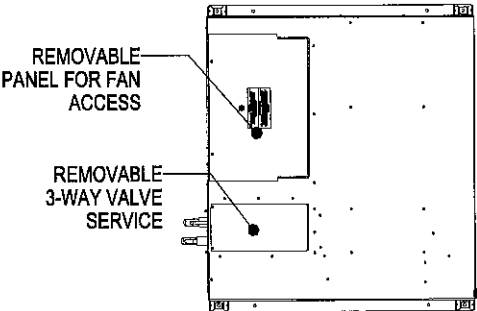
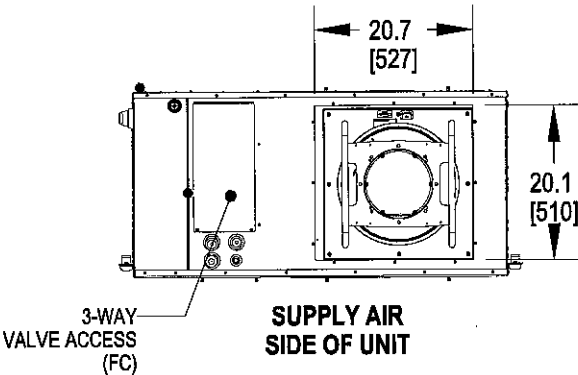
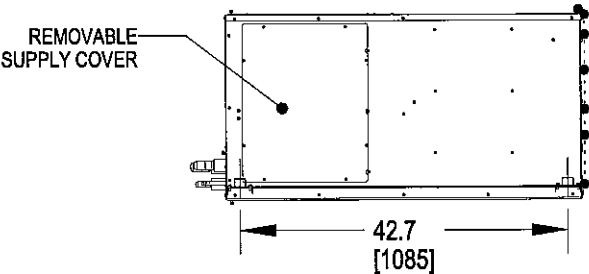
VERTIV™

VERTIV COOLPHASE CEILING

DIMENSIONAL DATA CABINET DIMENSIONS, 4 & 5 TON



RETURN
AIR SIDE OF UNIT



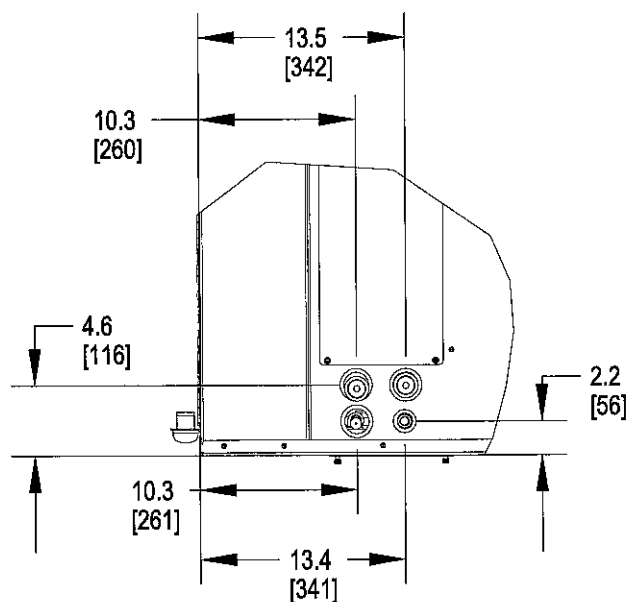
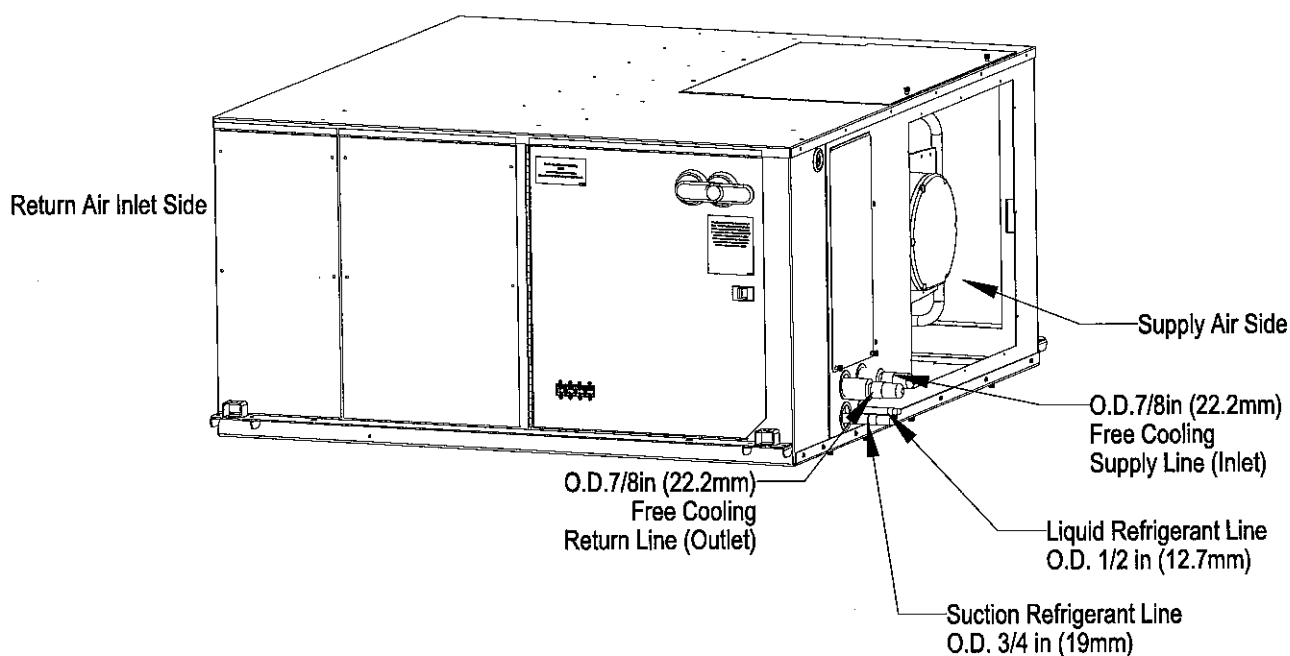
BOTTOM OF UNIT

	EVAPORATOR COIL	UNIT NET WEIGHT LBS. (KG)
MMI48 (4 TON) MODEL	→ DX	355.8 (161.4)
	DX + FC	426.3 (193.4)
MMI60 (5 TON) MODEL	DX	375.66 (170.4)
	DX + FC	446.2 (202.4)



VERTIV COOLPHASE CEILING

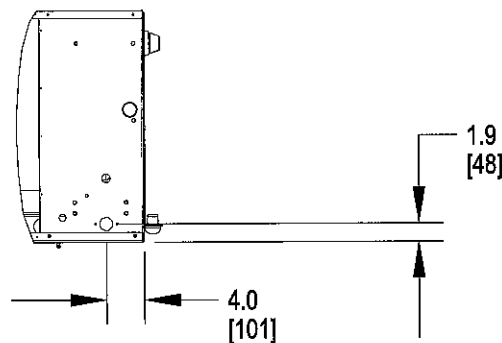
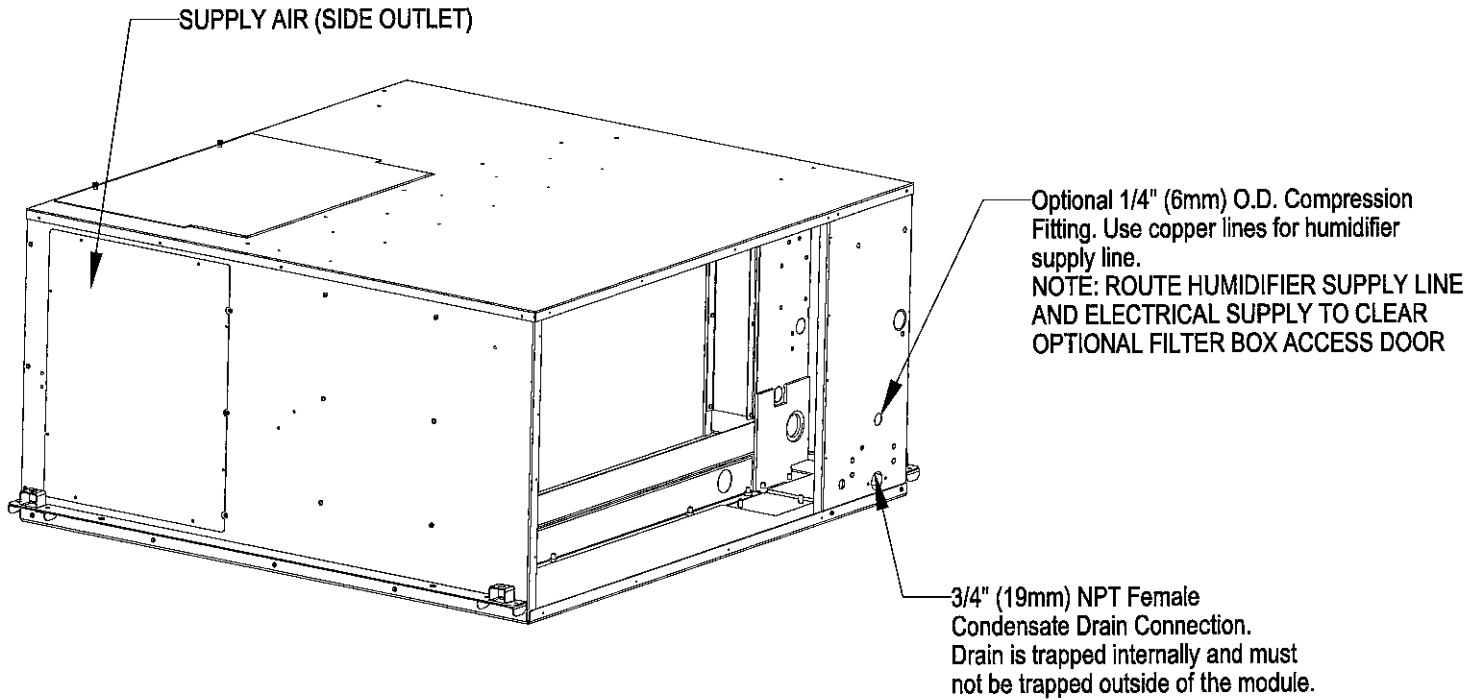
PRIMARY CONNECTION LOCATIONS 4 & 5 TON DIRECT EXPANSION & FREE COOLING





VERTIV COOLPHASE CEILING

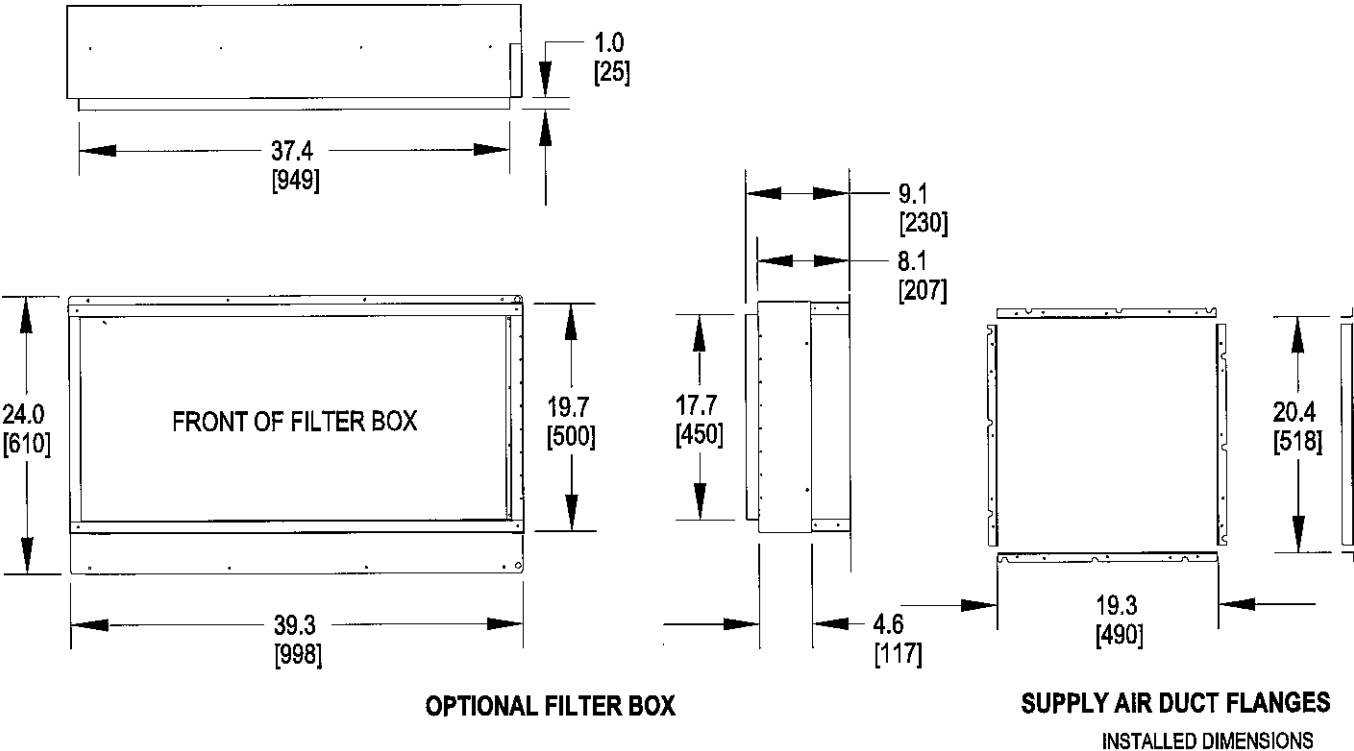
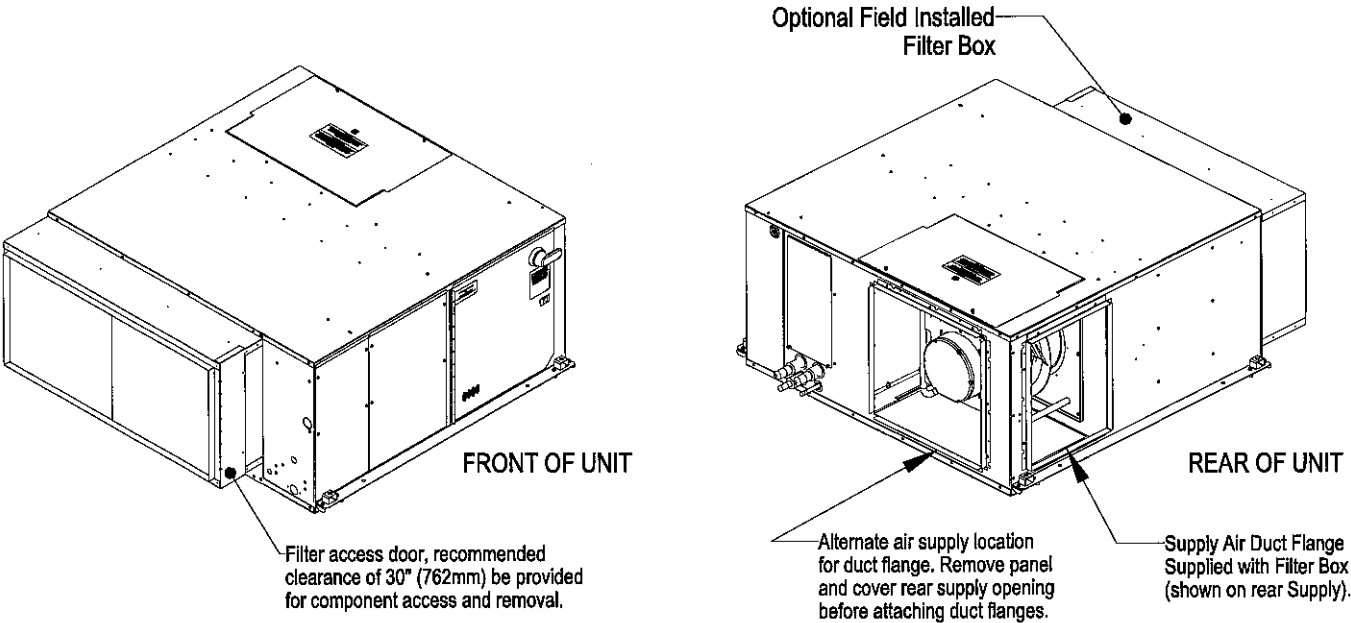
PRIMARY CONNECTION LOCATIONS 4 & 5 TON DIRECT EXPANSION & FREE COOLING





VERTIV™ VERTIV COOLPHASE CEILING

DIMENSIONAL DATA FILTER BOX 4 & 5 TON

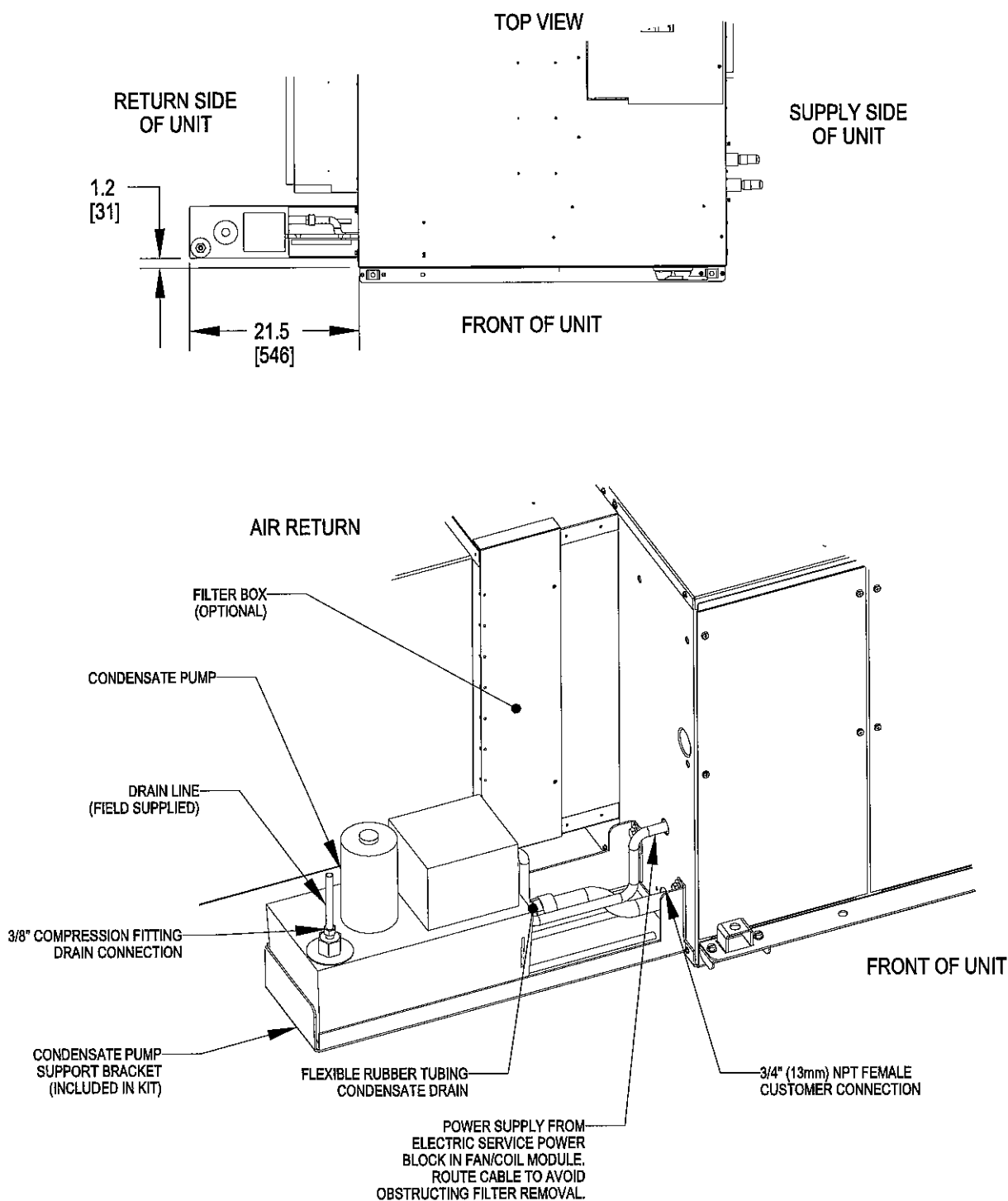



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VERTIV COOLPHASE CEILING

PIPING CONNECTIONS

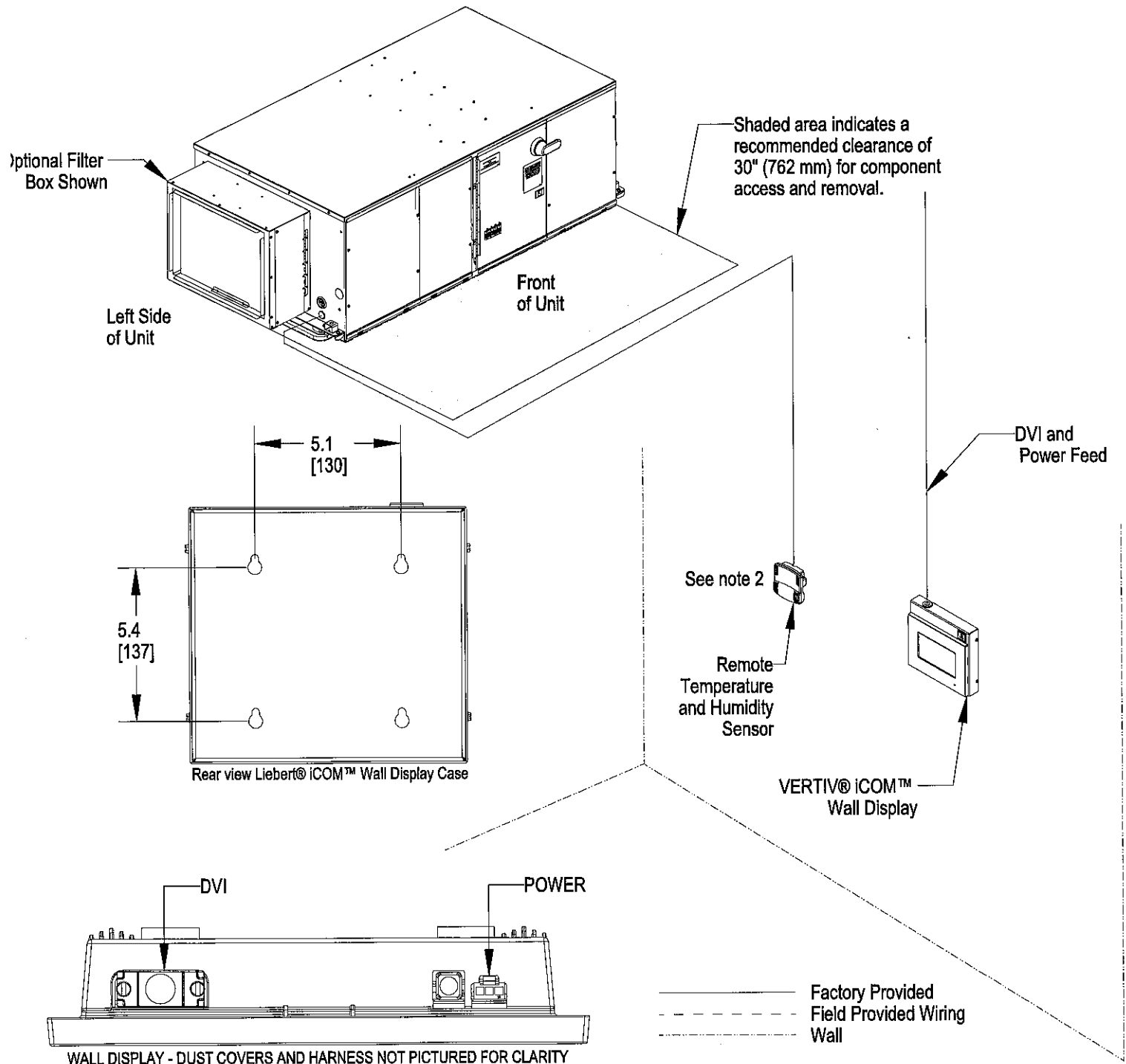
CONDENSATE PUMP CONNECTION LOCATIONS, 4 & 5 TON



**VERTIV™****VERTIV COOLPHASE CEILING**

GENERAL ARRANGEMENT, DIMENSIONAL DATA & FIELD CONNECTIONS

VERTIV® ICOM™ WALLMOUNT DISPLAY

**Notes:**

1. Refer to 20000913 for connection points on Vertiv™ CoolPhase Ceiling Unit.
2. CANbus cable connection wired form P66 / P67 on the rear of the Remote Temperature / Humidity sensor.
Connection routed to secondary port on rear of Return T/H sensor inside unit or available CANbus port on internal control board (P66 / P67).



VERTIV COOLPHASE CEILING

ELECTRICAL FIELD CONNECTIONS

4 & 5 TON DX & FC

STANDARD ELECTRICAL CONNECTIONS

1) High Voltage connection through the right side of the Ceiling Panel - 1.37" (35mm) diameter concentric knockout

2) Communication connection on the front of the Ceiling Panel
Connect according diagram in the corresponding ethernet port.

3) Electrical service (hard wired) - refer to serial tag information for unit electrical service requirement

- Three Phase - 208-230V 60HZ / 460 60HZ

- Single Phase - 208-230V 60HZ

Connect to terminals on disconnect switch. Electrical service not by Vertiv. Use copper conductors only, wire per local codes. Refer to specification sheet for total unit full load amps, wire size amps and max over current protection device size.

4) Communication Bracket

-P64A: U2U-A Unit-to-Unit Communication

-P64B: U2U-B Unit-to-Unit Communication

-VFD: Condenser Modbus (RS485) Communication

-P74: BMS Connectivity / Embedded Unity

5) Terminal Blocks Control Distribution Voltage / Power Voltage Terminals / Communication RS485

- TBK Terminal Ground

- TBK 24M Control Distribution Voltage 24VAC

- TBK 24-24AS Control Distribution Voltage 24VAC Insulated Voltage from Transformer 1:1

6) Fans Terminal Blocks

- MR relay is the power source for MF (Main Fan Relay)

- Main control signal from ICOM 4. (0-10V Distribution)

Reference models showed in this document are 300MM units. All connections, terminal block locations and communication ports also apply for 600MM units.



VERTIV COOLPHASE CEILING

ELECTRICAL FIELD CONNECTIONS

4 & 5 TON DX & FC

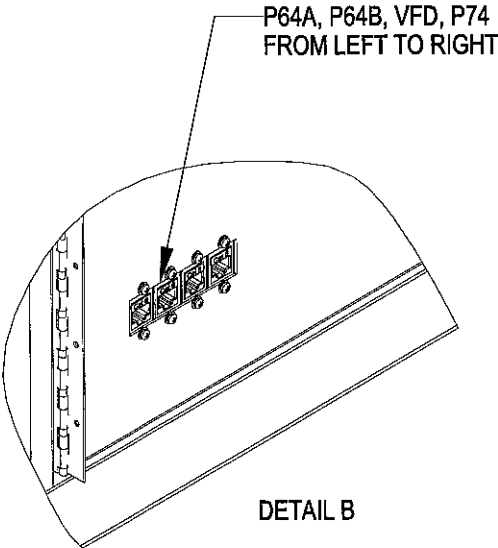
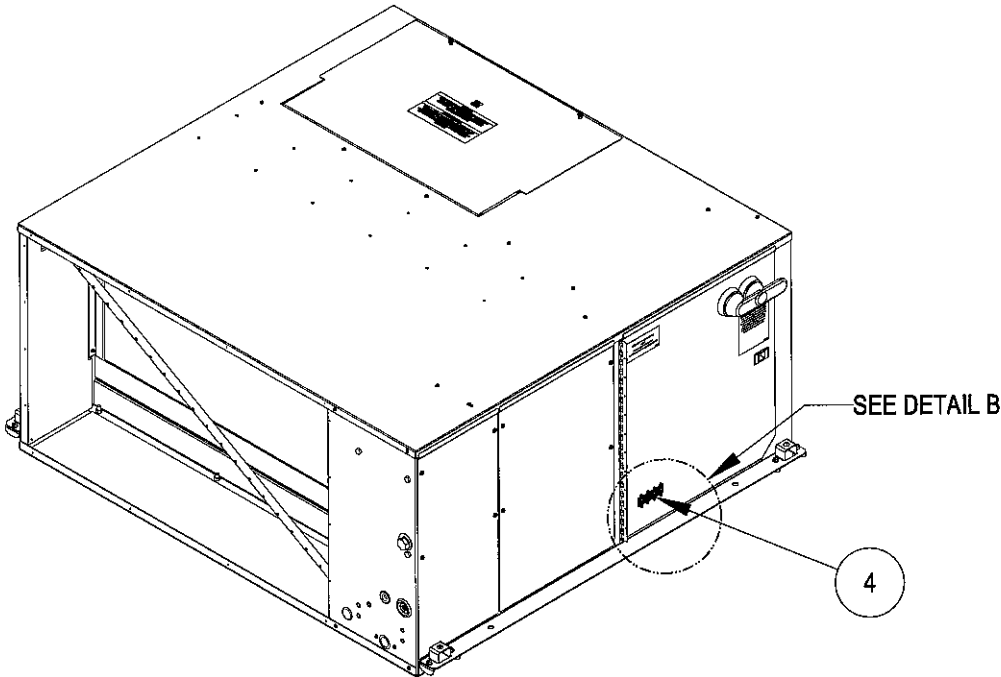
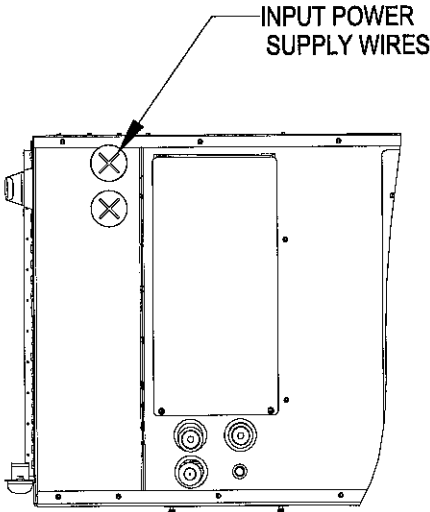


TABLE "A"	
PIN OUT	DESCRIPTION
VFD1 / VFD8	MODBUS A/B
VFD3 / VFD4	24VAC L/N



(RIGHT SIDE)

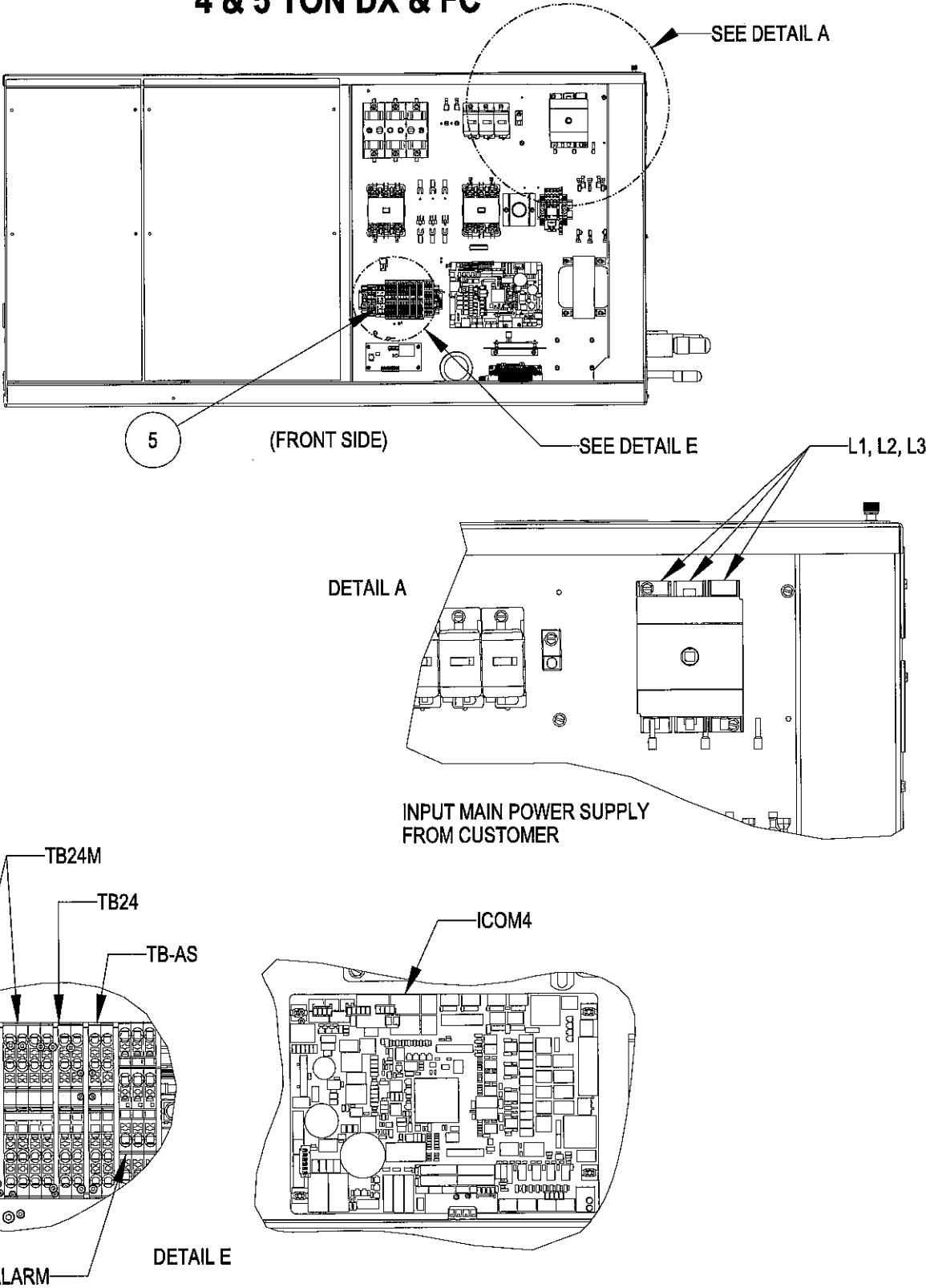
ETHERNET CABLE CONFIGURATION MUST BE STRAIGHT CONFIGURATION.
VFD PIN OUT(INDOOR - OUTDOOR COMMUNICATION) SEE TABLE "A"



VERTIV COOLPHASE CEILING

ELECTRICAL FIELD CONNECTIONS

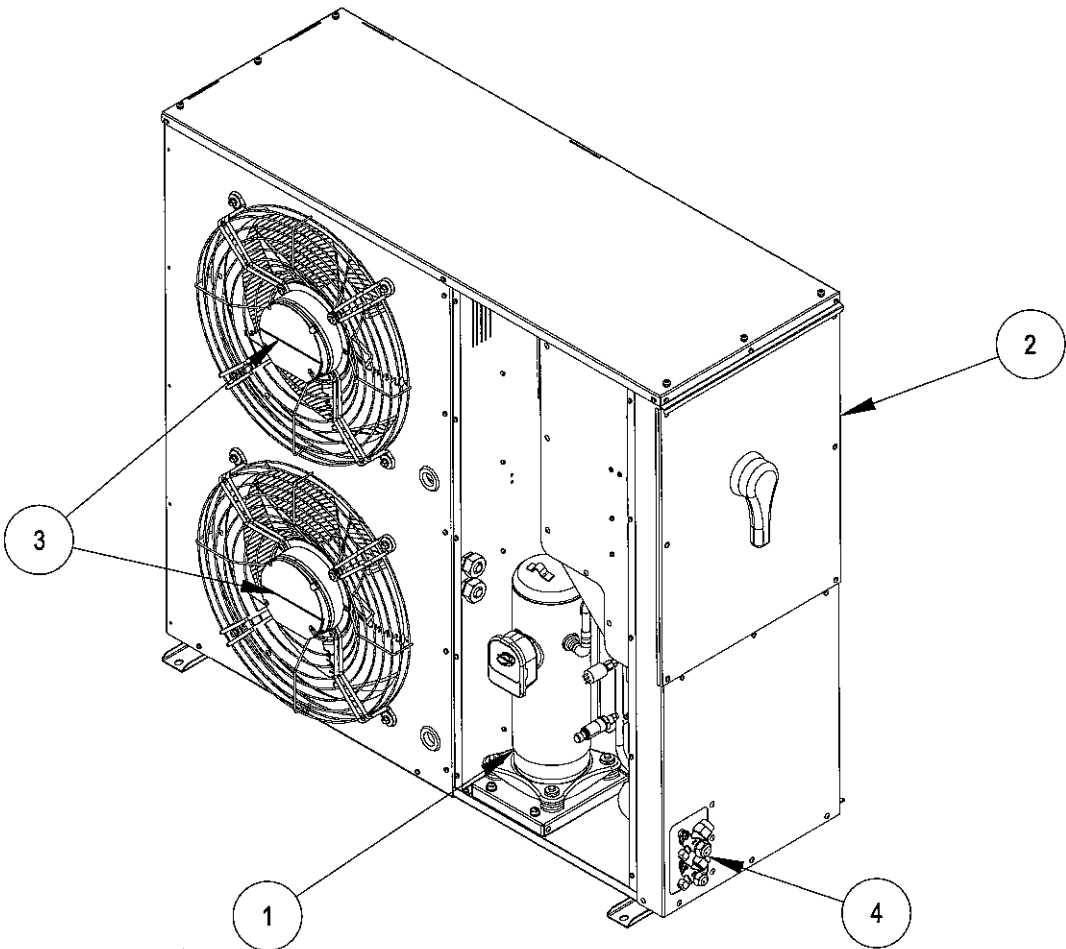
4 & 5 TON DX & FC





VERTIV™ VERTIV COOLPHASE CONDENSING UNIT

COMPONENT LOCATION CONDENSER UNIT 15KW

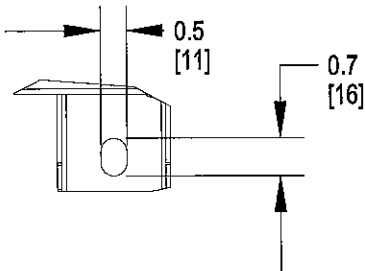
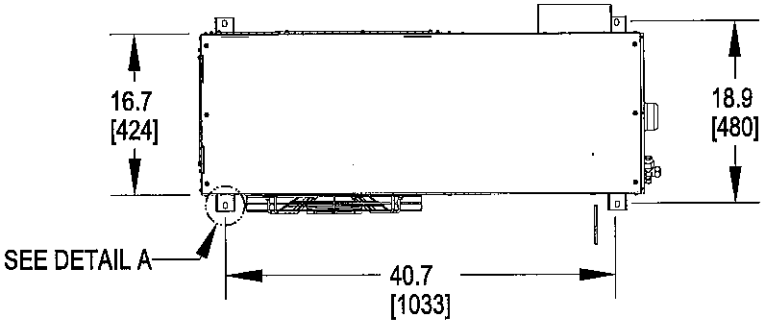
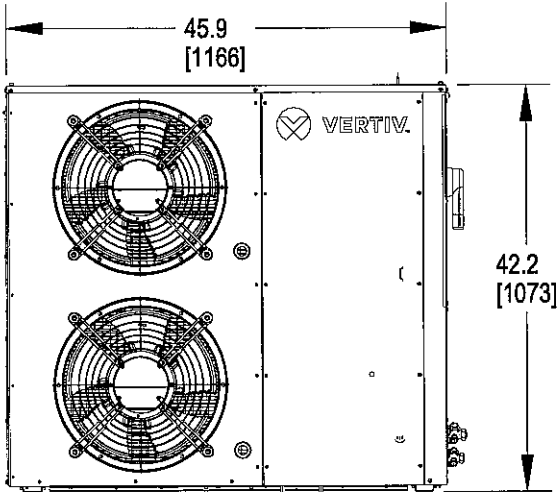
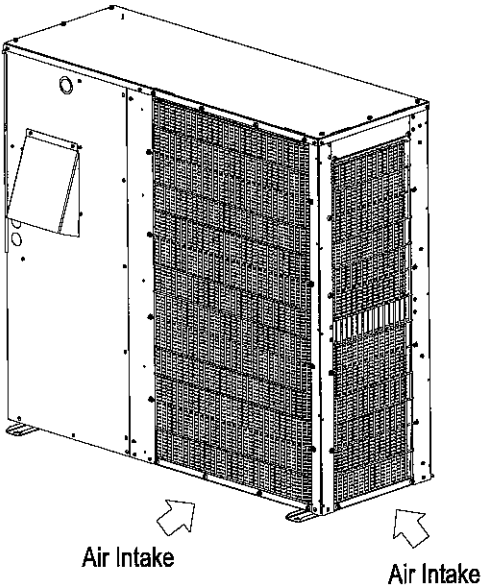
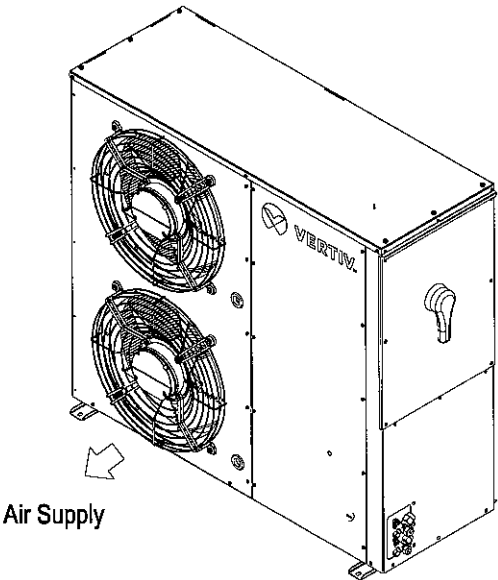


ITEM	DESCRIPTION
1	COMPRESSOR
2	ELECTRICAL BOX
3	CONDENSER FANS
4	SERVICE VALVES



VERTIV VERTIV COOLPHASE CONDENSING UNIT

DIMENSIONAL DATA CONDENSER UNIT 15kW



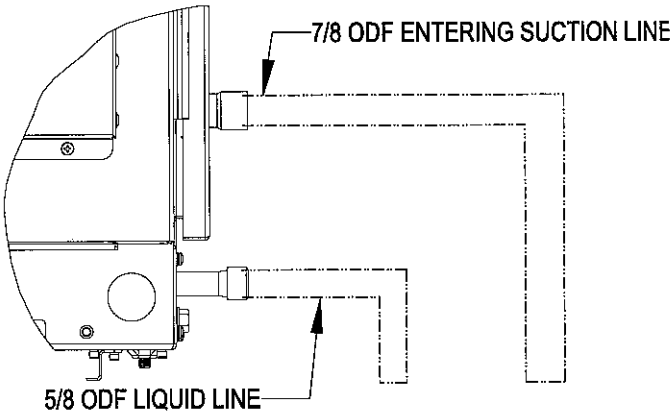
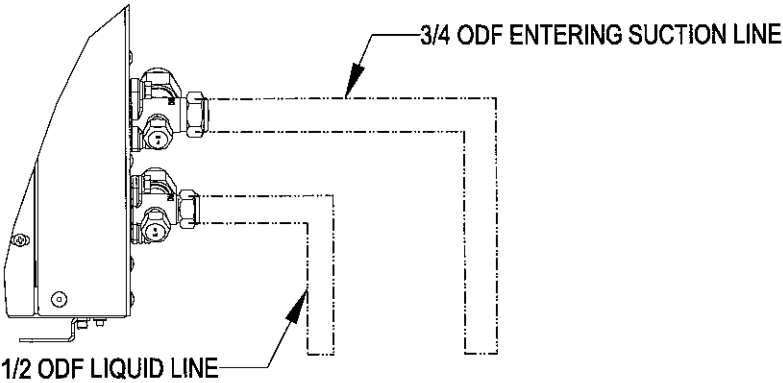
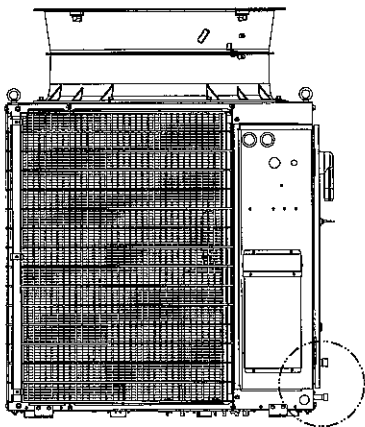
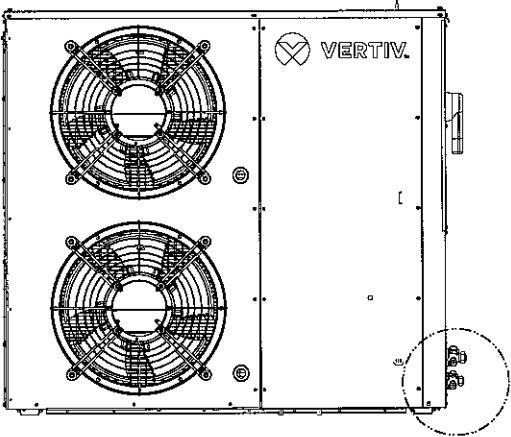
Unit	Net Weight Kg (lb)	Shipping Weight Kg (lb)
Standard 15kW	121.37 (267.57)	147.46 (325.09)
Low ambient 15kW	125.32 (276.56)	151.42 (333.83)

SINGLE POWER SUPPLY UNIT SHOWN*



VERTIV VERTIV COOLPHASE CONDENSING UNIT

PIPING DIMENSIONAL DATA CONDENSER UNITS 15 kW & 21kW



Model / Capacity	Length (mts)	Length (ft)	Liquid Line Diameter (mm)	Liquid Line Diameter (ANSI)	Suction Line Diameter (mm)	Suction Line Diameter (ANSI)
CU15 kW	5	16	12.7	1/2	19.05	3/4
	10	33	12.7	1/2	19.05	3/4
	15	49	12.7	1/2	22.23	7/8
	20	66	12.7	1/2	22.23	7/8
	25	82	12.7	1/2	22.23	7/8
	30	98	15.88	5/8	28.58	1 1/8
	35	115	15.88	5/8	28.58	1 1/8
	40	131	15.88	5/8	28.58	1 1/8
	45	148	15.88	5/8	28.58	1 1/8
	50	164	15.88	5/8	28.58	1 1/8
	55	180	15.88	5/8	28.58	1 1/8
	60	197	15.88	5/8	28.58	1 1/8
	65	213	15.88	5/8	28.58	1 1/8
	70	230	15.88	5/8	28.58	1 1/8
	75	246	15.88	5/8	28.58	1 1/8
	80	262	15.88	5/8	28.58	1 1/8
	85	279	15.88	5/8	28.58	1 1/8
	90	295	15.88	5/8	28.58	1 1/8

Model / Capacity	Length (mts)	Length (ft)	Liquid Line Diameter (mm)	Liquid Line Diameter (ANSI)	Suction Line Diameter (mm)	Suction Line Diameter (ANSI)
CU21 kW	5	16	12.7	1/2	19.05	3/4
	10	33	12.7	1/2	22.23	7/8
	15	49	12.7	1/2	22.23	7/8
	20	66	15.88	5/8	28.58	1 1/8
	25	82	15.88	5/8	28.58	1 1/8
	30	98	15.88	5/8	28.58	1 1/8
	35	115	15.88	5/8	28.58	1 1/8
	40	131	15.88	5/8	28.58	1 1/8
	45	148	15.88	5/8	28.58	1 1/8
	50	164	15.88	5/8	28.58	1 1/8
	55	180	15.88	5/8	28.58	1 1/8
	60	197	19.05	3/4	34.93	1 3/8
	65	213	19.05	3/4	34.93	1 3/8
	70	230	19.05	3/4	34.93	1 3/8
	75	246	19.05	3/4	34.93	1 3/8
	80	262	19.05	3/4	34.93	1 3/8
	85	279	19.05	3/4	34.93	1 3/8
	90	295	19.05	3/4	34.93	1 3/8
	95	312	19.05	3/4	34.93	1 3/8
	100	328	19.05	3/4	34.93	1 3/8
	105	344	19.05	3/4	34.93	1 3/8
	110	361	19.05	3/4	34.93	1 3/8
	115	377	19.05	3/4	34.93	1 3/8
	120	394	19.05	3/4	34.93	1 3/8

2.4.2 Wind Baffle

The wind baffle allows cooling-mode operation at lower outdoor ambient temperatures.

NOTE: The Wind Baffle should be installed when the standard condensing unit is installed outdoors, and the temperature is 23°F (-5°C) or below. The Wind Baffle can help ensure the stability and reliability of the standard condensing unit running in a low-temperature environment.

NOTE: When equipped with the wind baffle kit, the maximum ambient air temperature is 118.4°F (48°C); however, cooling capacity will be reduced by approximately 1.5% in high ambient temperatures.

NOTE: If both the hail guard and wind baffle kit are installed, the maximum ambient air temperature is 118.4°F (48°C); however, the cooling capacity will decrease by approximately 3.5% in high ambient temperatures.

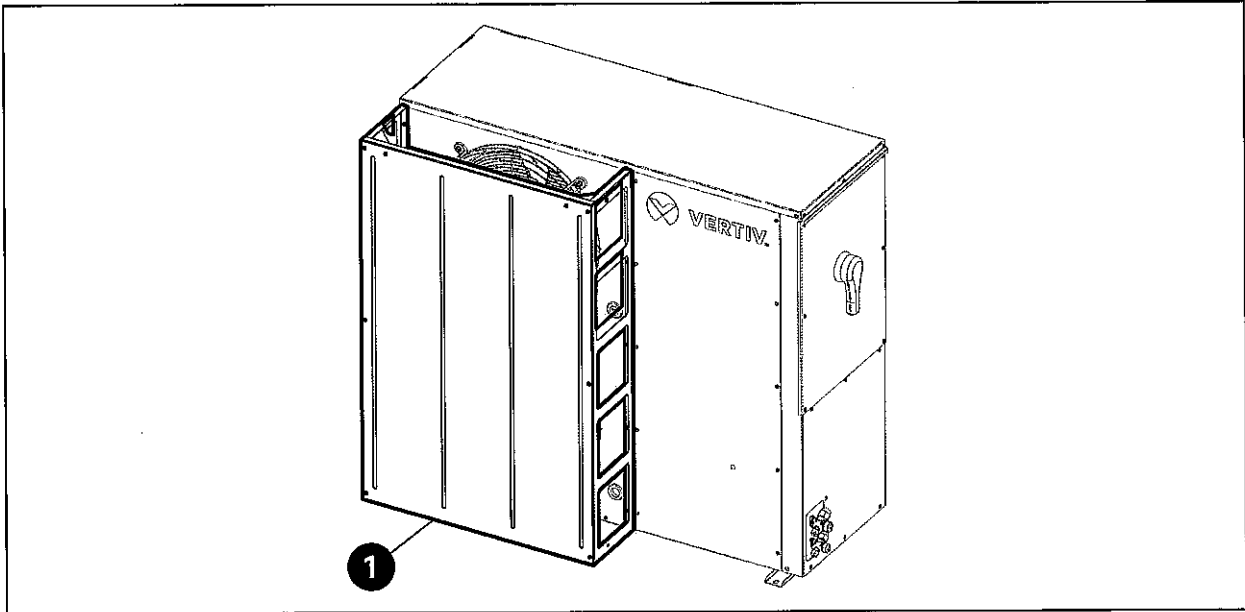
NOTE: When the ambient temperature is lower than -4°F (-20 °C) up to -31°F (-35°C), the low ambient version must be used.

NOTE: Low Ambient versions of the units do not require a Wind Baffle accessory.

Table 2.9 Wind Baffle SKUs.

SKU	Item Description	Applicable Models
CUWINDKIT-03	Wind Baffle for 3.5 kW Standard Ambient Condensing Units	CUD03
CUWINDKIT-07	Wind Baffle for 7 kW Standard Ambient Condensing Units	CUD07
CUWINDKIT-11	Wind Baffle for 11 kW Standard Ambient Condensing Units	CUD11
→ CUWINDKIT-15	Wind Baffle for 15 kW Standard Ambient Condensing Units	CUD15

Figure 2.16 Wind Baffle (CUWINDKIT-15) mounted on the 15-kW unit.



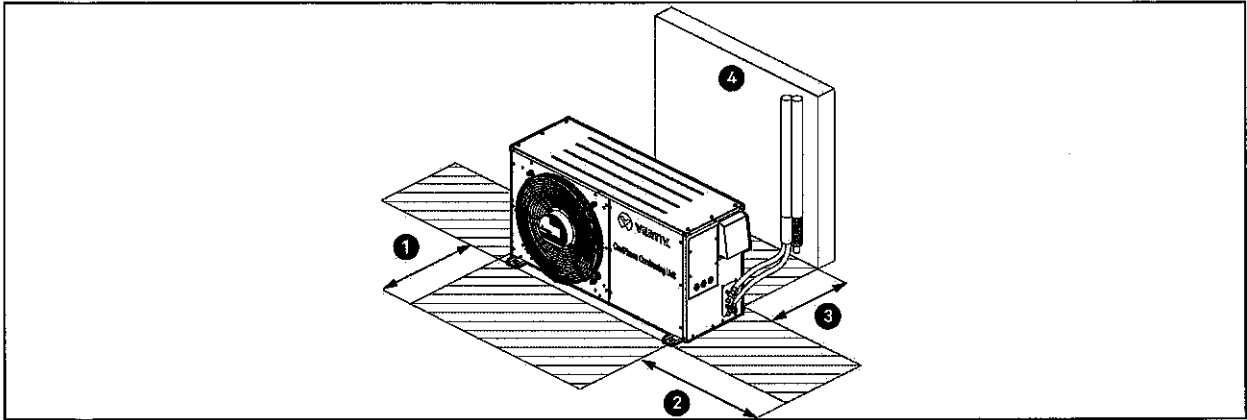
Item	Description
1	Wind Baffle for Condensing Unit

4.3 Clearance Requirements

4.3.1 Condensing Units of 3.5 to 15 kW

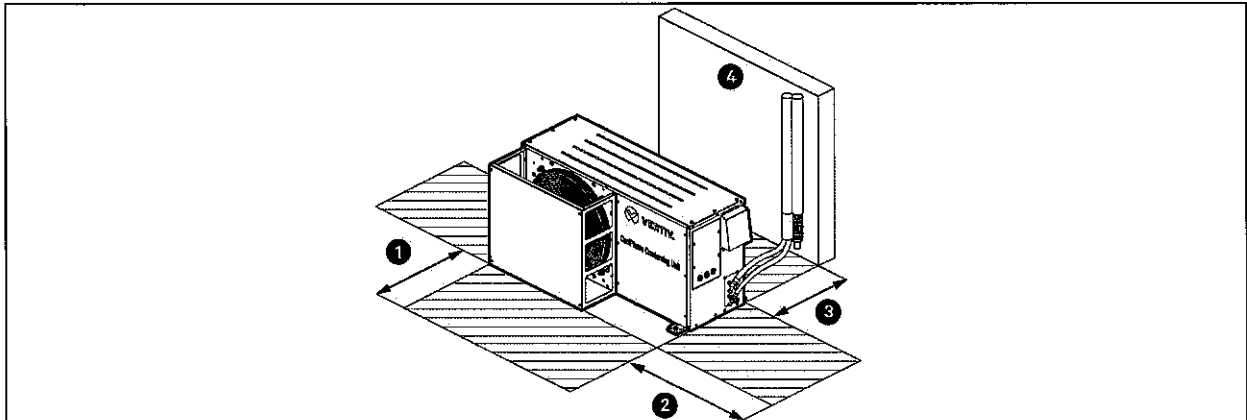
Proper airflow through the Condensing unit coil is critical for correct unit operation. When installing, consider service, inlet, outlet, and minimum allowable space requirements as illustrated below.

Figure 4.1 Condensing unit clearances



Item	Description	Item	Description
1	23.6 in (600 mm) Minimum distance	3	11.8 in (300 mm) Minimum distance
2	23.6 in (600 mm) Minimum distance	4	Wall

→ Figure 4.2 Condensing unit clearances with Wind Baffle installed.



Item	Description	Item	Description
1	23.6 in (600 mm) Minimum distance	3	11.8 in (300 mm) Maximum distance
2	23.6 in (600 mm) Minimum distance	4	Wall

NOTE: When installing the wind baffle, there must be a wall behind the unit, and the maximum clearance is 11.8 in (300 mm)



VERTIV™ VERTIV COOLPHASE CONDENSING UNIT

ELECTRICAL FIELD CONNECTIONS CONDENSER UNIT 15kW

Condenser-rated voltage should be verified with available power supply before installation. Refer to the unit's electrical schematic and serial tag for specific electrical requirements. Line voltage electrical service is required for all condensers at the location of the condenser. The voltage supply to the condenser may not be the same voltage supply as required by the indoor unit. Consider using UPS equipment on both data center cooling units and Liebert MC condensers to maintain uninterrupted cooling capability. Refer to the unit's serial tag for specific condenser electrical requirements. A unit disconnect is standard. However, a site disconnect may be required per local code to isolate the unit for maintenance. Route the supply power to the site disconnect switch and then to the unit. Route the conduit to the knockout provided in the top right end of the electrical control enclosure. Connect the earth ground wire leads to the marked earth ground connection terminal provided near the factory-installed disconnect switch.

KEY ELECTRICAL POWER SUPPLY DETAILS:

- 1) **Three phase electrical service (primary source)** - The connection terminals are on top of fused switch. Three phase service not by Vertiv. See note 4.
- 2) **Earth ground (primary source)** - Field lug terminal for earth ground connection.
- 3) **Three phase electrical service (secondary source)** - The connection terminals are on top of fused switch, the fused switch is located at the top and right side of the E-box. Three phase service not by Vertiv. See note 4.
- 4) **Earth ground (secondary source)** - Terminal for field-supplied earth grounding wire.
- 5) **Modbus terminal connections (RS-485) from the interior unit** - The connection terminals are located in TB-A. See DETAIL B on page 3.
 RS485+ terminal is the input terminal for RS485 signal (positive).
 RS485- terminal is the input terminal for RS485 signal (negative).
 CGND terminal is the input terminal for signal reference ground.
- 6) **24V terminal connections from the interior unit** - The connection terminals are located in TB-A. See DETAIL B on page 3.
 24V terminal is the input terminal for the hot wire used for leak detection mitigation on the indoor unit.
 COM terminal is the input terminal for the common wire used for leak detection mitigation on the indoor unit.
- 7) **Three phase electrical service entrance (primary source)** - One 1.875in (47.63mm) diameter knockout located at the top and left side of the E-Box.
- 8) **Three phase electrical service entrance (secondary source)** - One 1.875in (47.63mm) diameter knockout located at the top and left side of the E-Box.
- 9) **Modbus terminal connections (RS-485) from the interior unit** - Field connections for Modbus cable connection: One - 0.70" (18mm) diameter knockout located at the middle and left side of the E-Box.

NOTES:

1. Refer to specification sheet for unit voltage rating, full load amp, minimum circuit ampacity and maximum circuit protection.
2. The modbus (RS485) wiring is field supplied and must be (See drawing on page 3 for wire configuration):
 STP straight through wire type.
 22-18AWG stranded tinned copper.
 Twisted pair (minimum 4 twist per foot).
 Low Capacitance (15pF/FT or less).
 Must be rated to meet local codes and conditions.
3. Do not run in same conduit, raceway, or chase as high voltage wiring.
4. All wiring must be sized and selected for insulation case per NEC and other local codes.
5. Do not bend cables to less than four times the diameter of the cable.
6. UL approved temperature rated to 75°C.
7. UV - and moisture-resistance for exterior and if it is not provided in conduits.
8. Do not deform cables when securing in bundles or when hanging them.
9. Avoid running the cables by devices that may introduce noise, such as machines, fluorescent lights, and electronics.
10. Avoid stretching cables.



VERTIV™ VERTIV COOLPHASE CONDENSING UNIT

ELECTRICAL FIELD CONNECTIONS CONDENSER UNIT 15kW

NOTICE

RISK OF IMPROPER INPUT POWER CAN CAUSE EQUIPMENT DAMAGE.

The electronically commutated motors included in the COOLPHASE CONDENSING UNITS are suitable for connection to an electrical service providing input power to the unit with 300V or less line -to-ground potential only.

Acceptable unit input electrical service for 208V(230V) nominal units:
208V wye with solidly grounded neutral and 120V line-to-ground.

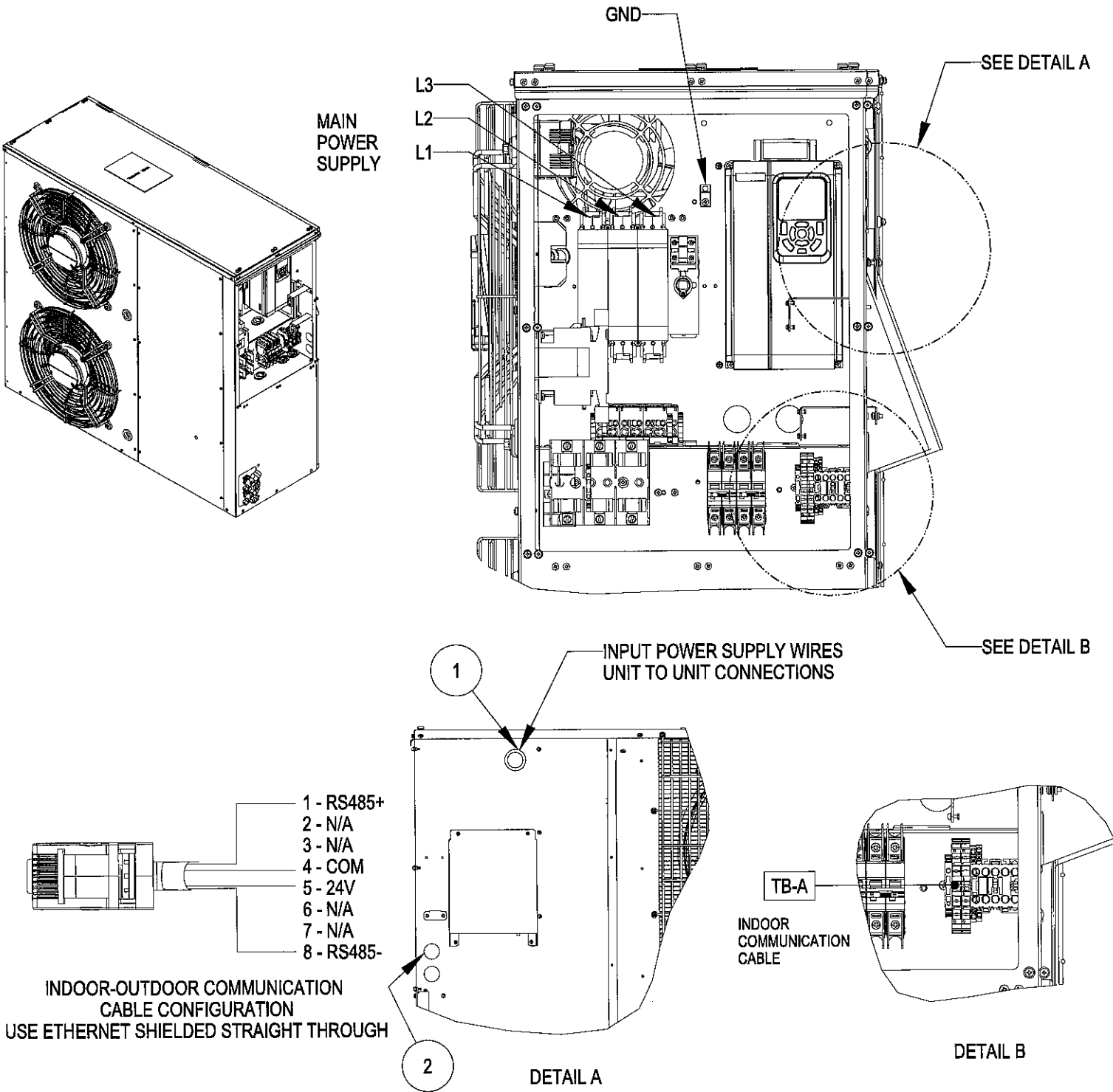
Acceptable unit input electrical service for 460V(480V) nominal units:
480V wye with solidly grounded neutral and 277V line-to-ground.

Unacceptable unit input electrical service for 208V to 460V (480V) nominal units:
Wye with high resistance (or impedance) ground
Delta without ground or with floating ground
Delta with corner ground
Delta with grounded center tap



VERTIV VERTIV COOLPHASE CONDENSING UNIT

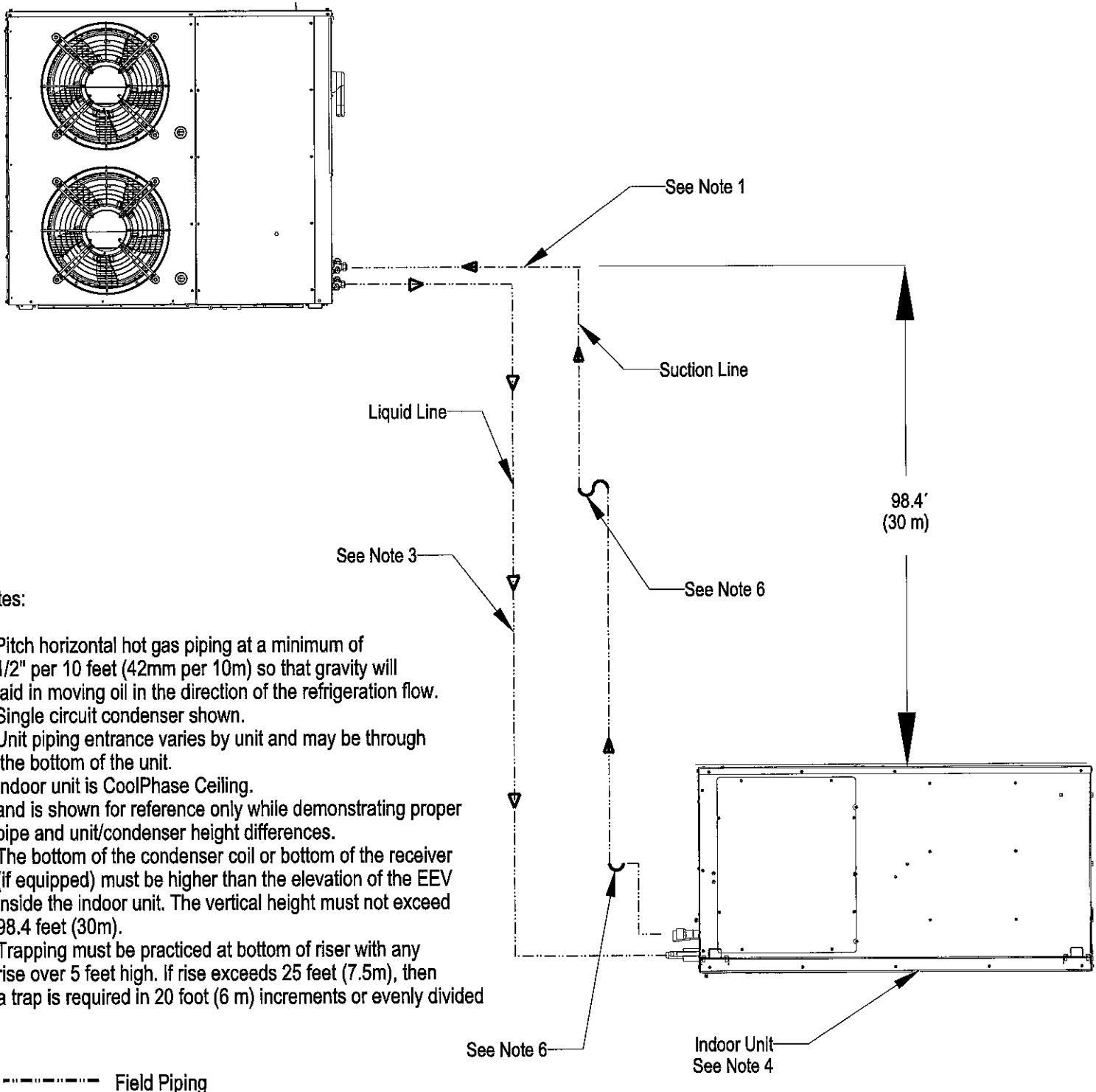
ELECTRICAL FIELD CONNECTIONS CONDENSER UNIT 15kW





VERTIV VERTIV COOLPHASE CONDENSING UNIT

PIPING SCHEMATIC CONDENSING UNIT ABOVE INDOOR UNIT 15 kW



Notes:

1. Pitch horizontal hot gas piping at a minimum of 1/2" per 10 feet (42mm per 10m) so that gravity will aid in moving oil in the direction of the refrigeration flow.
2. Single circuit condenser shown.
3. Unit piping entrance varies by unit and may be through the bottom of the unit.
4. Indoor unit is CoolPhase Ceiling and is shown for reference only while demonstrating proper pipe and unit/condenser height differences.
5. The bottom of the condenser coil or bottom of the receiver (if equipped) must be higher than the elevation of the EEV inside the indoor unit. The vertical height must not exceed 98.4 feet (30m).
6. Trapping must be practiced at bottom of riser with any rise over 5 feet high. If rise exceeds 25 feet (7.5m), then a trap is required in 20 foot (6 m) increments or evenly divided

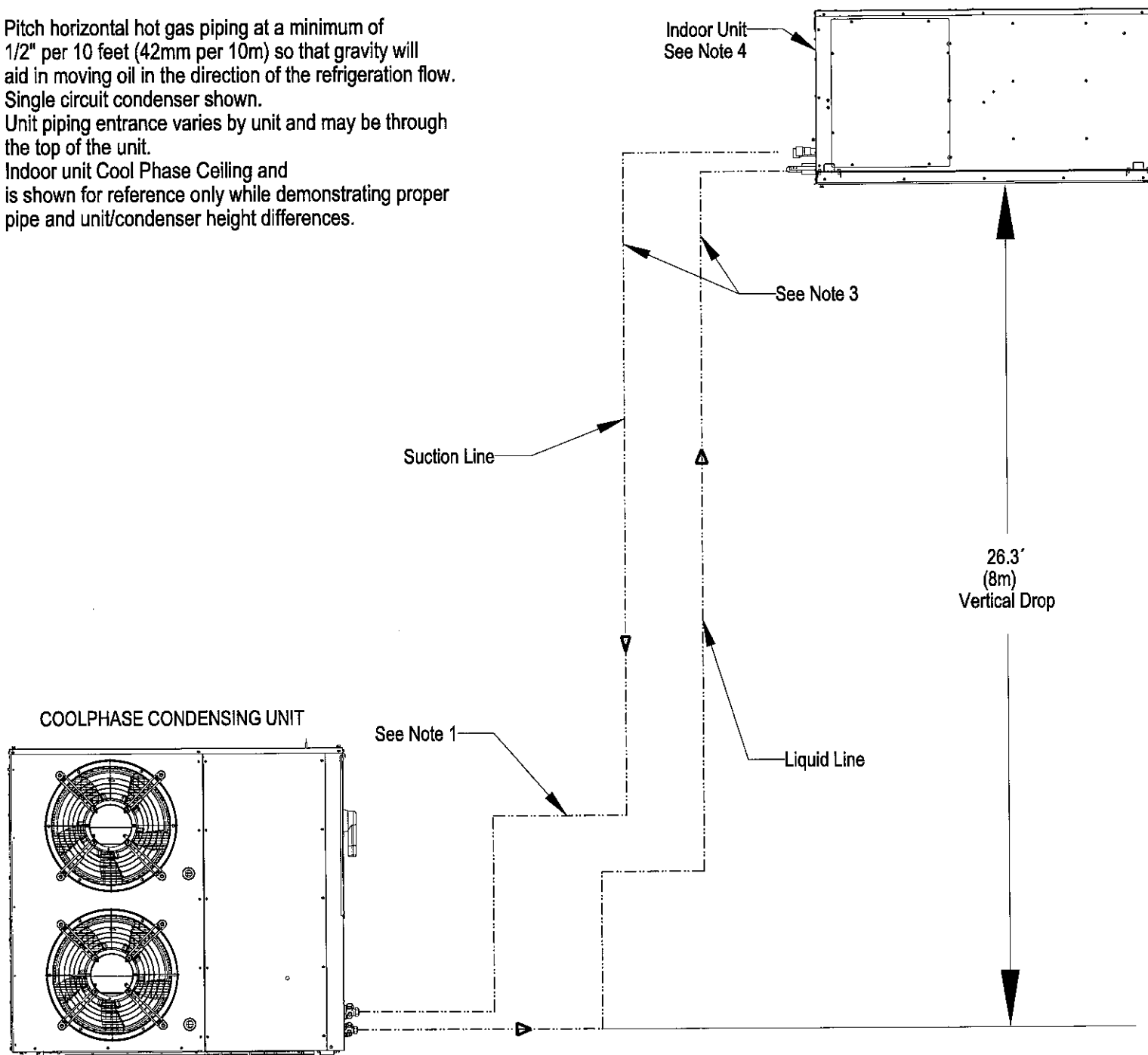


VERTIV VERTIV COOLPHASE CONDENSING UNIT

PIPING SCHEMATIC CONDENSING UNIT BELOW INDOOR UNIT 15kW

Notes:

1. Pitch horizontal hot gas piping at a minimum of 1/2" per 10 feet (42mm per 10m) so that gravity will aid in moving oil in the direction of the refrigeration flow.
2. Single circuit condenser shown.
3. Unit piping entrance varies by unit and may be through the top of the unit.
4. Indoor unit Cool Phase Ceiling and is shown for reference only while demonstrating proper pipe and unit/condenser height differences.





DX PRODUCTS WITH R32

A2L REFRIGERANT DISPERSAL VOLUME CALCULATION R32

Engineer of record to determine the Refrigerant Charge m_c and required minimum Effective Dispersal Volume V_{ED} of the space to which the appliance can be utilized for the cooling of ITE AREAS.

The required minimum EFFECTIVE DISPERSAL VOLUME V_{ED} is a function of the refrigerant charge, m_c and is represented by the following equation:

$$V_{ED} = m_c / 0.5 \times \text{LFL}$$

V_{ED} = the minimum Effective Dispersal Volume in ft^3 (m^3)

m_c = the refrigerant charge of the largest single circuit of a unit in lbs (kg)

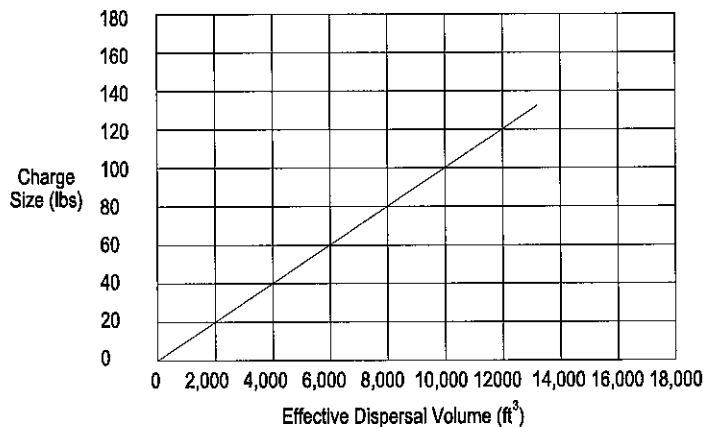
0.5 = the concentration factor

LFL = the Lower Flammability Limit in lbs/1000 ft^3 (kg/ m^3)

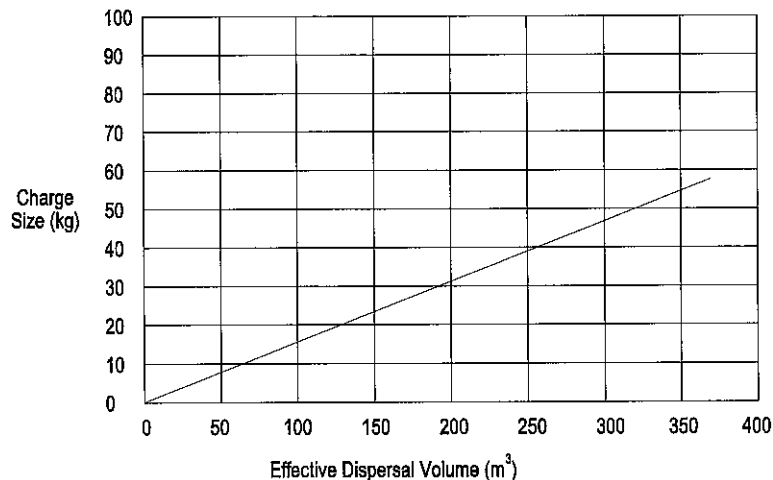
Note: The LFL of R32 is 19.2 lbs/1000 ft^3 (307.0 g/ m^3) according to ASHRAE 34-2022.

Minimum Effective Dispersal Volume V_{ED} of the space shall be based on altitude of the installation location. For locations above sea level, the engineer of record will need to adjust the value of LFL in accordance with ANSI/ASHRAE 34 before applying it to the equation for determining the required minimum Effective Dispersal Volume V_{ED} .

Charge Size vs. Effective Dispersal Volume



Charge Size vs. Effective Dispersal Volume





DX PRODUCTS WITH R32

A2L REFRIGERANT DISPERSAL VOLUME CALCULATION R32

How to Determine the Effective Dispersal Volume of an ITE Area

Volume Calculations shall be based on the overall volume of space available to which the refrigerant disperses within the CIRCULATION AIRFLOW in the event of a refrigerant leak. This overall volume shall be modified with the appropriate deductions. For the purposes of determining the EFFECTIVE DISPERSAL VOLUME of an ITE AREA the following shall apply:

- a) The EFFECTIVE DISPERSAL VOLUME shall only include the circulated airflow of the system.
- b) The EFFECTIVE DISPERSAL VOLUME shall initially include the ITE AREA enclosed by the floor, walls, and ceiling of that space.
- c) When the CIRCULATION AIRFLOW includes underfloor spaces, suspended ceiling spaces, or other partitioned spaces, such as equipment galleries, the volume of those spaces may be included.

In general, the volume of equipment, piping, wiring, or other apparatus that consume space within and are isolated from the CIRCULATION AIRFLOW shall be deducted from the EFFECTIVE DISPERSAL VOLUME. The following deductions shall be applied:

- a) When the CIRCULATION AIRFLOW has been fully contained on both hot and cold sides of the aisle, via ducts or other apparatus, any room volume outside of that containment shall not be included when calculating the EFFECTIVE DISPERSAL VOLUME.
- b) When the overall volume of space available, or a partitioned portion of that volume includes ducted openings from partially ducted systems, some volume of that space may require a deduction. No volume greater than 4 feet away in height from the upper most supply or return duct opening in the space may be included when calculating the EFFECTIVE DISPERSAL VOLUME, unless an analysis of the airflow has been conducted to show that the volume of air has effective movement for the mixing of a leaked refrigerant.
- c) Obstructions of tubing, piping, wiring, etc., consuming more than 0.0071 m^3 (0.25 ft^3) of space shall be included in the deductions from the overall volume.
- d) The ITE within the circulated airflow shall be evaluated for their deduction from the EFFECTIVE DISPERSAL VOLUME. The deducted volume of the ITE shall be based on the designed maximum capacity or fill of the servers.
- e) As a maximum value, no more than 75 % of the ITE's volume shall be included as circulating air space in the EFFECTIVE DISPERSAL VOLUME. The total volume of the ITE shall be defined by the overall dimensions of its ITE ENCLOSURE. Small gaps in between individual server racks shall not be included in the EFFECTIVE DISPERSAL VOLUME.
- f) Any other volume within the circulation airflow that is otherwise enclosed or partitioned off from the airflow shall be deducted in the calculation of the EFFECTIVE DISPERSAL VOLUME.



VERTIV COOLPHASE CEILING

STANDARD & OPTIONAL FEATURES

EVAPORATOR UNIT, 1-8TON

STANDARD FEATURES

EVAPORATOR COIL Constructed of soft copper tubes in a staggered tube pattern. Tubes are expanded into continuous high efficiency aluminum lance type fins. Coil is set in condensate drain pan, with float switch for unit shutdown. The evaporator drain is internally trapped.

REFRIGERATION SYSTEM Single refrigeration circuit, includes a liquid line filter drier, externally equalized expansion valve, and a suction pressure transducer. The module is pre-charged with nitrogen and sealed. R-32 refrigerant must be field supplied and field charged by others.

FAN ASSEMBLY Fan is plug type, with integral direct drive with backward curved blades and Electronically Commutated (EC) motor. The fan speed shall be variable and automatically regulated by the Liebert® iCOM™ control through all modes of operation. The impeller shall be made of aluminum and is dynamically balanced. The fan shall be located to draw air through the coil to ensure even air distribution and maximum coil performance.

LIEBERT® iCOM™ CONTROL SYSTEM The Liebert® iCOM™ controls the Liebert® CoolPhase Ceiling and enables Unit-to-Unit communication with other Liebert® CoolPhase Ceiling units.

BASE-COMMS FOR BMS CONNECTIVITY The Liebert® iCOM™ controller shall provide four ethernet ports dedicated for:

- 1) Unit-to-Unit A
- 2) Unit-to-Unit B
- 3) BMS Connectivity
- 4) Indoor-Outdoor Communication

TOUCH SCREEN DISPLAY The standard user interface is a remote wall mountable 9 inch color touch screen which presents system information and allows all parameters to be viewed and adjusted. The touch screen display comes in a plastic housing for mounting on the wall and is shipped loose with the unit

CABINET AND CHASSIS Constructed of galvanized steel for strength and corrosion resistance with thermal/acoustical insulation to reduce sound levels and prevent condensation. Removable panels allow access to the electric panel or refrigeration components for service or maintenance. Hanging brackets are integral to the chassis with vibration isolators and hardware provided for field supplied 3/8" threaded suspension rods.

UNIT PROTECTIONS AND CONTACTS include a filter clog switch, common alarm contact and remote shutdown contacts.

- Filter clog switch is provided to activate a Liebert® iCOM™ alarm when the pressure drop across the filter exceeds the customer adjustable level. Switch is adjustable outside the cabinet.
- Common Alarm Contact is one set of normally open contacts which close for remote indication of alarms.
- Remote Shutdown Contact allows unit shutdown based on external input

HIGH TEMPERATURE SENSOR senses the return air temperature, shuts down the unit if temperature reaches 125F (52C) and is a manual reset device not meant to replace any fire detection system that may be required by local or national codes.

TEMPERATURE AND HUMIDITY SENSORS are mounted in unit on the return air stream and wired to the Liebert® iCOM™ Control board.



VERTIV COOLPHASE CEILING

STANDARD & OPTIONAL FEATURES

EVAPORATOR UNIT, 1-8TON

OPTIONAL FEATURES

→ **LOCKING UNIT DISCONNECT SWITCH** includes a "Locking-Type" factory-mounted fused disconnect switch providing unit with a 5,000 Amp or 65,000 Amp short-circuit current rating (SCCR). Disconnect switch is mounted internally with locking and lockable handle operational from outside the unit. Access to high voltage electric panel can only be obtained with the switch in the "off" position, and the handle is lockable to support lockout/tagout safety programs.

→ **ELECTRIC REHEAT** Electric low watt density 304 stainless steel fin tubular reheat element provides one stage of reheat to maintain room dry bulb temperature during dehumidification and is protected by one automatic reset temperature switch and one manual reset temperature safety switch.

STEAM GENERATING CANISTER HUMIDIFIER is housed in a steel enclosure and includes a replaceable canister with all supply and drain valves, 1" (25mm) air gap on fill line, inlet strainer, steam distributor and electronic controls, including high water indicator. System automatically fills and drains and maintains the required water level based on conductivity. Humidifier Problem Alarm annunciates touchscreen display.

SMOKE SENSOR samples the return air, shuts down the unit upon detection, and sends visual and audible alarm. This smoke sensor is not intended to function as or replace any room smoke detection system that may be required by local or national codes. Smoke sensor trouble connections are available for external monitoring

FREE COOLING Air cooled coil, for alternate Water/Glycol Source, Constructed of soft copper tubes in a staggered tube pattern and Header tubes for inled and outlet. Tubes are expanded into continuous high efficiency aluminum lance type fins. Coil is set in condensate drain pan, with float switch for unit shutdown.



VERTIV COOLPHASE CEILING

STANDARD & OPTIONAL FEATURES

EVAPORATOR UNIT, 1-8TON

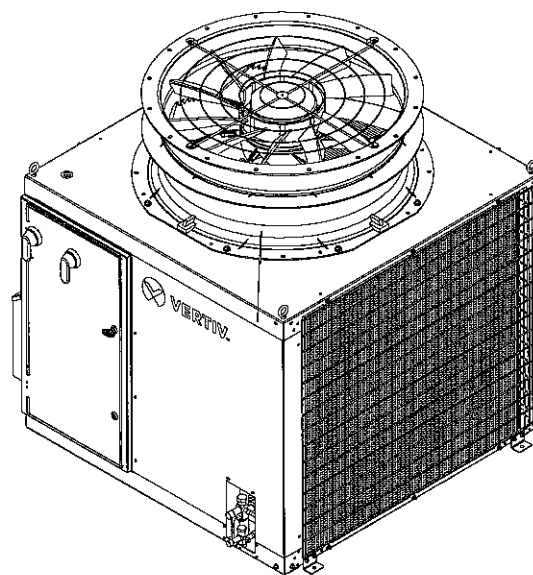
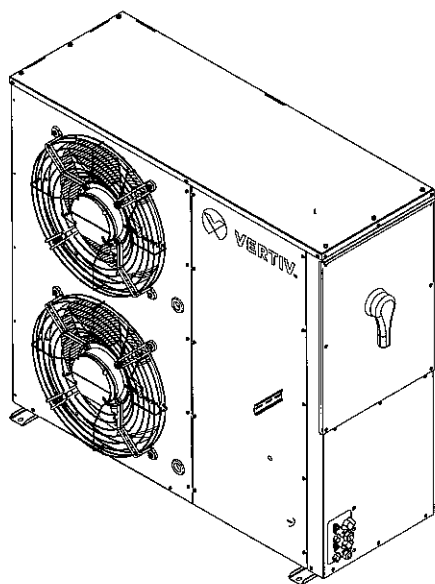
SHIP LOOSE OPTIONS

- **FILTER BOX** is constructed of galvanized steel, supplied with quantity of two nominal 20" (508mm) x 20" (508 mm) x 4" (102 mm) deep pleated MERV 8 filters (based on ASHRAE 52.2-2007). The box is provided with a 1" (25 mm) duct flange. The filters are accessible via a hinged access door, without shutting the unit down. The filter box option also includes a 1" (25 mm) discharge air duct collar.
- DUCT FLANGES** 1" (25mm) duct flanges for easy duct integration.
- BOTTOM DISCHARGE GRILLE** (1, 2 and 3 Ton models only) is a 3-way louvered air grille, painted white, added to a T-bar grid assembly for air discharge directly into room from bottom of unit. Kit includes air baffle and rear discharge block-off plates. Use separate filter box kit for filtration and connection to field provided room air return grille and ductwork.
- DISTRIBUTION PLENUM** (1, 2 and 3 Ton models only) Easily installed, self-contained air distribution plenum provides air discharge in three directions. The plenum is supplied with a nominal 16" (406mm) x 25" (535mm) x 4" (102mm) deep pleated MERV 8 filter (based on ASHRAE 52.2-2007).
- **CONDENSATE PUMP** has a capacity of 7.5 GPM (28.4 l/m) at 10 ft feet of head for 460/575V units, and 5.1 GPM (19.3 l/m) for 208/230 volt units at 10 ft. of head. Pump assembly is complete with pump, motor assembly, reservoir, integral float switch, and auxiliary safety float switch to shut unit off in event of pump failure. Pump assembly is designed to mount on the side of the evaporator (indoor) module, or other suitable means to allow condensate drainage into the reservoir. The condensate pump is field-mounted on the outside of the cabinet, and is field-wired to the evaporator/fan-coil electric panel for both power supply and float switch interlock. Separate power feed is not necessary.
- **TEMPERATURE AND HUMIDITY SENSORS** are mounted in an attractive case with 30 ft. (9m) of cable, it is shipped loose and ready to be field mounted on the room wall or in unit return air stream and field wired to the Liebert® iCOM™ Control board.



VERTIV VERTIV COOLPHASE CONDENSING UNIT

STANDARD & OPTIONAL FEATURES CONDENSER UNIT 15, 21 & 28kW



STANDARD FEATURES

COIL. Vertiv CoolPhase® Condensing Unit is an aluminum construction. Tubes are created by extruding small parallel refrigerant flow paths into aluminum. Full-depth louvered aluminum fins fill spaces between the tubes. Tubes, fins and aluminum headers are oven-brazed to form a complete refrigerant-to-air heat exchange coil. Baffles are used in the headers to separate one coil slab into multiple passes as needed. Coils are factory leak tested at a minimum of 300 PSIG and dehydrated. Copper stub pipes are electric resistance welded to aluminum coils and joints are protected with polyolefin to seal joint from environmental corrosive elements. Hot gas and liquid lines are brazed to the stub pipes with spun closed ends for customer piping connections. Coil pipe assemblies are filled and sealed with a nitrogen holding charge for shipment. One coil is used per fan assembly.

FAN/MOTOR ASSEMBLY The fan/motor assembly is complete with external rotor motor, fan blades and fan/finger guard. Fan blades are constructed of stamped aluminum or steel extrusion coated with PP plastic. Fan guards are heavy gauge, close meshed, steel wire, coated with a black corrosion resistant finish. Fan terminal blocks located on the top of the fan guard with IP54 protection class. Fans are factory balanced and tested before shipment.

FAN MOTORS Fan motors are specifically designed for variable speed and have ball bearings. The EC fans provide internal overload protection through the built-in electronics. Each EC fan motor has built-in controller and communication module, linked via RS485 communication wire to each fan and the Premium Control Board. This allows each fan to receive and respond to precise fan speed inputs from the Premium control board.

COMPRESSOR. The compressor uses environmentally friendly R-32 refrigerant with Asymmetric Oval Scroll Technology, High Efficiency Low Noise Motor with solenoid valve unloads the compressor to provide variable capacity operation. The compressor has a suction gas cooled motor, vibration isolators, internal thermal overloads, low pressure and high pressure transducer, crankcase heater, internal centrifugal oil pump, and an operating speed of 3600 RPM @ 60Hz.

PREMIUM EFFICIENCY FAN CONTROL The premium efficiency condenser control system is complete with control board, EC fan motor(s), refrigerant-pressure transducer(s), refrigerant-temperature thermistor(s), ambient-temperature thermistor, and motor overload protection in the factory wired control panel. The control board maintains EC fans on the same circuit to the same speed in order to maintain refrigerant head pressure. The control board receives a run signal from the compressor of the indoor unit via field-supplied low voltage interlock wires and field-supplied CANbus communication wires from the indoor unit Liebert® ICOM™. The control system provides refrigerant head pressure and system starting for outdoor ambient temperature as low as -30° F (-35° C), provided the total temperature design range (from minimum to maximum) is 125° F (70° C) or less.

HOUSING The condenser housing is constructed of bright aluminum sheet and divided into individual fan sections by full width baffles. Internal structural support members, including coil support frame, are galvanized steel for strength and corrosion resistance. Panel doors are provided on two sides of each coil/fan section to provide for coil cleaning. Aluminum legs are provided with rigging holes for hoisting the unit into position.



VERTIV™ VERTIV COOLPHASE CONDENSING UNIT

STANDARD & OPTIONAL FEATURES CONDENSER UNIT 15, 21 & 28kW

COMMUNICATION The Premium Efficiency Control communicates with the Liebert® iCOM™ control of the indoor Liebert unit using field supplied CANbus wires. The communication link allows for condenser alarm condition communication to Liebert® iCOM™, communication of other measurable items on the condenser, and fan control features to improve efficiency, sound and wintertime operation based on Liebert® iCOM™ programming.

UNIT DISCONNECT SWITCH Locking unit disconnect switch is factory installed and wired in attached condenser control section.

OPTIONAL FEATURES

VERTIV COOLPHASE CONDENSING UNIT TEMP LOW AMBIENT CONTROL receiver kits can be added to achieve head pressure control down to minimum ambient temperatures of -30 °F (-34 °C). The premium efficiency fan control when used with the Temp receiver kits runs the fan(s) at lower speeds during cold temperatures saving fan energy.

E-COAT COIL PROTECTION The aluminum microchannel coil is epoxy-coated for extended coil life in corrosive environments, such as coastal areas. Factory-applied E-coat using immersion and baking process provides a flexible epoxy-coating to all coil surfaces and ensures complete coil encapsulation. Coil color is black and a factory-applied UV topcoat protects the E-coat from solar UV ray degradation.



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LIEBERT COOLPHASE CEILING DX CEILING-SUSPENDED PRECISION COOLING SYSTEM

Job Name	Highland's Oncology Group - Pinnacle
Equipment Tags	LU-5
Spec. Section	238125 – Computer Room Air Conditioners – Ceiling Mounted
Model	Liebert CoolPhase Ceiling - 4-Ton
Description	4-Ton Ceiling Suspended DX Precision Cooling Systems
Quantity	1
Date	June 25, 2026
Submitted By	Sam White

Submittal Note:

This project was initially designed around the legacy Liebert MiniMate2 and MiniMate3 DX systems with R407 and R410A refrigerants. These systems are currently in End of Production phase and have been replaced by the Liebert CoolPhase Ceiling DX systems with Low GWP refrigerant (R32). EPA has mandated all Computer Room Air Conditioning systems installed after 1/1/2027 must comply with Low GWP refrigerant requirements. Submitting on the new Liebert CoolPhase Ceiling DX systems.

Liebert CoolPhase Ceiling Ceiling Suspended Precision Cooling System 4-Ton DX Air-Cooled

One (1) 4-Ton Liebert CoolPhase Ceiling Precision Cooling Split System – Indoor Unit

- Model Number: MMI48E04A004J
- Nominal Cooling Capacity: 4-tons (15kW)
- Air Volume: 2,710 CFM; Fans: 1 (.95hp)
- Electrical: 460V-3ph, 60 Hz; OPD: 15A
- Refrigerant: R32 (field supplied and charged)
- Evaporator type: copper tubes – aluminum fins with hydrophilic coating
- Variable speed EC fan – (1) fan per system
- Cooling only – No reheat / humidifier
- Filter clog and high temperature sensors
- Liebert iCOM microprocessor control with embedded Unity
- Wall-mounted 7" color touchscreen display (field mounted and wired)
- Room Temperature/humidity sensor (field mounted and wired)
- Locking disconnect switch, factory mounted and wired, with short-circuit current rating (SCCR) of 65,000 amps
- IS-UNITY-DP network communications card (SNMP, BACnet and Modbus protocols)

One (1) Liebert Outdoor Air Cooled Condensing Unit – Outdoor Unit

- Model Number: CUD154-0000A
- Outdoor Design Ambient : -4°F - 118°F
- Electrical: 460V-3ph, 60 Hz; OPD: 20A
- Inverter, variable capacity compressor (R32)
- High head pressure switch
- Nitrogen holding charge (System field charged, with field-supplied R32 refrigerant)

Ship-Loose Accessories (field installed)

- One (1) condensate pump kit per system
- One (1) return air filter box kit per system
- One (1) set of remote temp/humidity sensors per system
- One (1) LT410 spot leak detector per system

Services Include:

- Startup/Warranty Inspection – 8x5
 - Final connections, leak checking, evacuation and refrigerant not included
- Assistance with communications and controls setup; Owner Training
- Standard one (1) year parts and limited labor warranty
 - Extended compressor warranty through year 5

AHRI Certified Performance Data*Unit Information - Indoor**

Cooling Type	DX Indoor	Unit Model	MMI48E04R0000A0000
Configuration	Air Cooled	Power Supply	460V/3ph/60Hz
Operation Mode	DX Mode	Airflow Configuration	Frontal Air
Refrigerating Circuits No	1	Compressor 1 - Circuit 1	Variable Speed Scroll
Refrigerant	R32	Fan Type	Axial Fan
Product Line	CoolPhase Ceiling	Fan Quantity	1
Product Family	MM	Filter Class	Merv8

Options

External Filter	Not selected	Electric Reheat	Not selected
Humidifier	Not selected	Damper	Not selected

Unit Information - Outdoor

Product Line	CoolPhase Condensing Unit	Fan Module	Standard
Product Family	Condensing Unit	Fan Type	Axial Fan
Unit Model	CUD154-0000A0000	Fan Quantity	2
Unit Power Supply	460V/3ph/60Hz		

Design Conditions -Data Input

Calculation Mode	Return Airflow + Compressor Modulation	Compressor Modulation	100.0 %
Indoor Return Air Temperature	75.0 °F	Outdoor Air Temp	95.0 °F
Indoor Return Air RH	45.0 %	Outdoor Airflow	5116 cfm
Altitude Sea Level	0.0 ft	Subcooling	16.6 R
Atmospheric Pressure	14.7 psi	Outdoor ESP	0.000 In-H2O
Indoor ESP	0.200 in-H2O	Fan Speed Control	On
Indoor Return Airflow	2706.0 cfm		

General Performance at Design Conditions

Gross Total Capacity	14.8 kW	Supply Air RH	78.6 %
Gross Sensible Capacity	14.8 kW	Supply Air DP	52.3 °F
nSHR	1	Return Airflow	2706 cfm
Net Total Capacity	13.7 kW	Indoor Fan Modulation	68.5 %
Net Sensible Capacity	13.7 kW	Actual Room SPL @2m f.f.	61.5 dBA
Compressor Modulation	100.0 %	System Net Sens nSCOP	2.93

General Performance at Design Conditions

System Power Input	4.66 kW	Outdoor Airflow	5116 cfm
Supply Air DB	58.9 °F	Outdoor Fan Modulation	100.0 %
Supply Air WB	55.0 °F	Outdoor Actual SPL @5m f.f.	50.0 dBA

2 System Data

2.1 Air Cooled System Performance and Physical Data

Table 2.1 Vertiv™ CoolPhase Ceiling technical specifications

Models		1 Ton	2 Ton	3 Ton	4 Ton	5 Ton	8 Ton
		MMI12	MMI24	MMI36	MMI48	MMI60	MMI96
Region		NAM					
Certification marks		cCSAus					
Piping Connections		Flare Connection					
Condenser Fan		EC Motor					
External Static Pressure		0.20 inH ₂ O (50 Pa)					
Sensible Cooling Capacity (kW) @26.7 °C (80 °F) RAT, 38% Rh, 35 °C (95 °F) outdoor temp		1 (3.5)	2 (7)	3 (11)	4 (15)	6 (21)	8 (28)
Power Supply Evaporator		208/230 V, 1-Ph, 50/60 Hz		208/230 V, 1-Ph, 50/60 Hz 208/230 V, 3-Ph, 60 Hz 460 V, 3-Ph, 60 Hz	208/230 V, 3-Ph, 60 Hz 460 V, 3-Ph, 60 Hz		
Controls		Vertiv™ ICOM™					
Refrigerant (Field supplied/field charged. Not factory charged)		R-32					
Max Equivalent Length of Pipe between Indoor Unit and Condensing Unit		196.85 ft (60 m)			295.27 ft (90 m)		
Height between Indoor and Condensing Unit	Condensing unit placed higher than indoor unit	98.43 ft (30 m)			60 ft (18.3 m)	98.43 ft (30 m)	
	Condensing unit placed lower than indoor unit	-26.25 ft (-8 m)			-15 ft (4.6 m)	-26.25 ft (-8 m)	

1. Certified in accordance with the AHRI Datacom Cooling Certification Program at AHRI Standard 1360 (I-P) Standard Rating Conditions. Certified units may be found in the AHRI Directory at www.ahridirectory.org.
2. Some options or combinations of options may result in reduced air flow. Consult factory for recommendations.
3. Data rated at 100% fan speed and with Standard Feature filter.
4. Net capacity data has fan motor heat factored in for all ratings.
5. Performance data generated in GRS (Global Rating System).

Table 2.3 CoolPhase Condensing Unit technical specifications for 15 kW units

Models	CUD151 / CUL151	CUD154 / CUL154
Certification marks	cCSAus (UL 60335-2-40 and CSA C22.2 No. 60335-2-40)	
Piping Connections	Flare Connection	
Operating Temperature range	Low ambient condensing unit: -31 °F (-35 °C) ~118 °F (48 °C) Standard ambient condensing Unit with wind baffle: -4 °F (-20 °C) ~118 °F (48 °C) Standard ambient condensing unit without wind baffle 23 °F (-5 °C) ~118 °F (48 °C)	

Table 2.3 CoolPhase Condensing Unit technical specifications for 15 kW units (continued)

Models	CUD151 / CUL151	CUD154 / CUL154
Compressor	Variable speed Inverter-driven	
Condenser Fan	EC Motor	
Noise Data	72 dB	
Noise Data of night mode	64 dB	
Power Supply	208/230 V, 3-Ph, 50/60 Hz (±10%)	460 V, 3-Ph, 50/60 Hz (±10%)
Refrigerant	R-32	
Max Equivalent Length of Pipe between Indoor Unit and Condensing Unit	295.27 ft (90 m)	
Height between Indoor and Condensing Unit	Condensing unit placed higher than indoor unit	98.4 ft (30 m)
	Condensing unit placed lower than indoor unit	26.3 ft (8 m)

NOTE: When the ambient temperature is below -4 °F (-20 °C) up to -31 °F (-35 °C), the low-ambient version must be used. Low Ambient versions of the units do not require a Wind Baffle accessory.

NOTE: All CUD15 and CUL15 Condensing Unit models on the table above are not plenum-rated.

Table 2.5 Air Cooled Data, 60 Hz

Evaporator Model		MMI12	MMI24	MMI36	MMI48	MMI60	MMI96
Condensing Unit Type		Outdoor	Outdoor	Outdoor	Outdoor	Outdoor	Outdoor
DX Evaporator- Net Capacity Data - kW (kBTU/h) @ High-Speed CFM							
80 °F DB, 62.8 °F WB (26.7 °C DB, 17.1 °C WB) 38% Rh	Total	3.4 (11.6)	6.7 (22.8)	9.2 (31.3)	14.7 (51.0)	19.1 (65.2)	26.7 (91.1)
	Sensible	3.4 (11.6)	6.7 (22.8)	9.2 (31.3)	14.7 (51.0)	19.0 (64.8)	24.2 (82.6)
75 °F DB, 61 °F WB (23.9 °C DB, 16.1 °C WB) 45% Rh	Total	3.1 (11.6)	6.2 (21.1)	8.6 (29.3)	13.5 (46.1)	18.2 (62.1)	25.5 (87.0)
	Sensible	3.1 (11.6)	6.2 (21.1)	8.5 (29.1)	13.5 (46.1)	17.1 (58.4)	20.5 (70.0)
72 °F DB, 60 °F WB (22.2 °C DB, 15.5 °C WB) 50% Rh	Total	3.0 (10.1)	5.9 (20.0)	8.3 (28.4)	12.9 (44.0)	17.8 (59.7)	24.9 (85.0)
	Sensible	2.9 (10.0)	5.5 (18.8)	7.9 (26.8)	12.8 (43.7)	15.7 (53.6)	18.7 (63.8)
Fan Data - Evaporator							
CFM (CMH)		816 (1,386)	1,451 (2,465)	1,533 (2,605)	2,710 (4,607)	2,746 (4,665)	3,759 (6,387)
Fan Motor, HP (W)		0.16 (0.12)	0.37 (0.28)	0.56 (0.42)	0.95 (0.71)	1.10 (0.82)	1.60 (1.19)
External Static Pressure, in (mm) water gauge		0.2 (5.1)					
Evaporator Coil - Copper Tube/Aluminum Fin							
Face Area, ft2 (m2)		2.5 (0.23)	3.0 (0.28)	3.0 (0.28)	5.56 (0.52)	5.56 (0.52)	7.64 (71)
Coil Rows		3	5	5	6	6	6
Max Face Velocity, fpm (m/s)		500 (2.54)					
Unit Refrigerant Charge, lb (kg)		0.5 (0.2)	1.0 (0.5)	1.8 (0.8)	2.8 (1.3)	3.3 (1.5)	3.7 (1.7)
Unit Operating Weight DX, lb (kg)		269 (122.2)	295 (134.0)	299 (136.0)	416 (187.5)	484 (219.5)	673 (305.4)
Unit Operating Weight DX+FC, lb (kg)		292 (132.6)	325 (147.6)	329 (149.6)	484 (219.5)	504 (228.5)	752 (341.4)
~~Electric Reheat Capacity, kW (kBTU/h)~~		SSR (Solid State Relay)					
Input Voltage 230-1-60		4.5 (15.35)	4.7 (16.04)	4.0 (13.65)	—	—	—
Input Voltage 230-3-60		—	—	7.0 (23.89)	10.0 (34.12)	15.0 (51.18)	10.0 (34.12)
Input Voltage 460-3-60		—	—	4.0 (13.65)	10.0 (34.12)	10.0 (34.12)	10.0 (34.12)
~~Humidifier Data - Steam Generator Type~~							
Steam capacity, lb/h (kg/h)		5 (2.27)			12 (5.44)		
Electrical Input Power 230-1-60, kW		10.6	14.4	17.4	N/A	N/A	N/A
Electrical Input Power 230-3-60, kW		N/A	N/A	18.1	20.7	20.7	24.8
Electrical Input Power 460-3-60, kW		N/A	N/A	8.4	10.8	10.8	14.4
Evaporator Connection Sizes							
Liquid line Diameter, in O.D. Cu		3/8	3/8	3/8	5/8	5/8	5/8
Suction Line Diameter, in O.D. Cu		1/2	1/2	1/2	7/8	7/8	7/8

Table 2.5 Air Cooled Data, 60 Hz (continued)

Evaporator Model	MMI12	MMI24	MMI36	MMI48	MMI60	MMI96
Humidifier Supply	¾ in OD Copper Compression Fitting					
Evaporator/Condensate Drain	¾ in NPT-Female					
MERV 8 Filter						
External Filter Box, Nom. Size WxHxD, in (mm)	Qty. 1 20x16x4 (508x406x102)	Qty. 2 20x20x4 (508x508x102)		Qty. 2 25x20x4 (635x508x102)		
Air Distribution Plenum, Nom. Size WxHxD, in (mm)	Qty. 1 16x25x4 (406x635x102)		N/A			
Return Grille, Nom. Size WxHxD, in (mm)	Qty. 1 20x20x1 (508x508x25)		N/A			
Condensing Unit Model Number	CUD/L03	CUD/L07	CUD/L11	CUD/L15	CUD/L21	CUD/L28
Condensing Unit Rating Conditions	95 °F (35 °C) Ambient					
Coil Face Area ft2 (m2)	3.3 (0.31)	4.82 (0.45)	7.06 (0.66)	10.11 (0.94)	24.37 (2.3)	24.37 (2.3)
Type of Coil	Microchannel					
CFM (CMH)	2,222 (3,778)	2,714 (4,612)	3,892 (6,613)	5,113 (8,688)	8,839 (15,023)	8,447 (14,352)
Motor Hp (KW)	0.36 (0.27)	0.40 (0.3)	0.55 (0.41)	0.36 (0.27)	0.75 (0.57)	1.25 (0.93)
External Static Pressure, in (mm) water gauge	N/A					
STD Unit Refrigerant Charge, lb (kg)	1.3 (0.6)	1.5 (0.7)	1.8 (0.8)	2.9 (1.3)	3.0 (1.4)	5.0 (2.3)
LAK Unit Refrigerant Charge, lb (kg)	2.4 (1.1)	2.9 (1.3)	5.3 (2.4)	5.7 (2.6)	10.1 (4.6)	17.2 (7.8)
STD Unit Operating Weight, lb (kg)	110 (50)	118 (53.5)	175 (79.5)	268 (121.37)	425 (193)	425 (193)
LAK Unit Operating Weight, lb (kg)	117 (53)	130 (59)	184 (83.5)	277 (125.32)	458 (208)	458 (208)
Condensing Unit Connection Sizes						
Liquid line Diameter, in O.D. Cu	1/4	3/8	3/8	1/2	5/8	5/8
Suction Line Diameter, in O.D. Cu	1/2	1/2	5/8	3/4	7/8	7/8

2.1.1 Operating Limits for Air Cooled Systems

The Vertiv™ CoolPhase Ceiling operates within the working ranges as shown in the table below. These limits refer to new units and those that have been correctly installed and serviced.

Table 2.6 Operating limits—Air Cooled Systems

Parameter		Design Condition	
		Minimum	Maximum
Unit Entering Air Conditions	Temperature	64.4 °F (18 °C)	113 °F (45 °C)
	Relative Humidity	17%	60%
Storage Conditions	Temperature	-4 °F (-20 °C)	118 °F (48 °C)
		NOTE: Unit remains operational up to 125.6 °F (52 °C) with reduced capacity.	
Power Supply Tolerances		Voltage ± 10%, Frequency ±2 Hz	

For working ranges of the Condensing units, refer to tables below.

Table 2.7 Operating limits—Condensing Units from 3 kW to 15 kW

Models	CUD030	CUD070	CUD111	CUD114	CUD151	CUD154
	CUL030	CUL070	CUL111	CUL114	CUL151	CUL154
Operating Temperature range	Low ambient Condensing Unit: -31 °F (-35 °C) ~118 °F (48 °C)					
	Standard Ambient Condensing Unit with Wind Baffle Accessory: -4 °F (-20 °C) ~118 °F (48 °C)					
	Standard Ambient Condensing Unit without Wind Baffle Accessory: 23 °F (-5 °C) ~118 °F (48 °C)					

NOTE: When the ambient temperature is between -4 °F (-20 °C) and -31 °F (-35 °C), the Low Ambient version must be used. Low Ambient versions of units do not require a Wind Baffle accessory.

NOTE: The Low Ambient version of the Condensing Unit cannot be installed in plenum areas; only the standard version is plenum rated.

NOTE: All CUD15 and CUL15 Condensing Unit models on the table above are not plenum-rated.

Table 4.1 CoolPhase Ceiling Electrical Data (continued)

Model	Power Supply	Feature	FLA (A)	MCA (A)	MOP (A)
MMI36	230 V / 1-Ph	Reheat	39.2	48.9	50
		Reheat + Humidifier	39.2	48.9	50
		Humidifier	17.4	22.0	25
		Air Cooling	10.3	12.0	15
	230 V / 3-Ph	Reheat	30.5	38.0	35
		Reheat + Humidifier	30.5	47.0	50
		Humidifier	18.1	23.0	25
		Air Cooling	11.0	13.0	20
	460 V / 3-Ph	Reheat	15.0	21.0	20
		Reheat + Humidifier	15.0	19.0	20
		Humidifier	8.4	10.0	15
		Air Cooling	6.2	7.0	15
MMI48	230 V / 3-Ph	Reheat	38.6	48.0	50
		Reheat + Humidifier	38.6	61.0	70
		Humidifier	20.7	26.0	25
		Air Cooling	10.9	13.0	15
	→ 460 V / 3-Ph	Reheat	18.4	23.0	20
		Reheat + Humidifier	18.4	29.0	30
		Humidifier	10.8	13.0	15
		Air Cooling	5.8	7.0	15
MMI60	230 V / 3-Ph	Reheat	52.5	66.0	70
		Reheat + Humidifier	52.5	78.0	80
		Humidifier	20.7	26.0	25
		Air Cooling	10.9	13.0	15
	460 V / 3-Ph	Reheat	18.4	29.0	30
		Reheat + Humidifier	18.4	23.0	20
		Humidifier	10.8	13.0	15
		Air Cooling	5.8	7.0	15

Table 4.2 Vertiv™ CoolPhase Condensing unit electrical data

Models	Nom. Tons	Volts / Phases	Compressor Qty.	Compressor Inverter (A)	Crank Case + Heating belt (A)	FLA (A)	MCA (A)	MOP (A)
CUD03 / CUL03	1	208/230 1-Ph	1	14	0/0.4	17	21	35
CUD07 / CUL07	2	208/230 1-Ph	1	20	0/0.4	23	28	50
CUD111 / CUL111	3	208/230 3-Ph	1	17	0/0.4	21	25	40
CUD114 / CUL114	3	460 3-Ph	1	11	0/0.4	15	18	30
CUD151	4	208/230 3-Ph	1	14	0/32.2	20	23	35
CUL151	4	460 3-Ph	1	14	0.5/32.2	20	24	35
CUD154	4	208/230 3-Ph	1	9	0/21.9	11	13	20
CUL154	4	460 3-Ph	1	9	0.25/21.9	11	13	20
CUD211	6	208/230 3-Ph	1	22	0/41.3	31	36	50
CUL211	6	460 3-Ph	1	22	0.5/41.3	31	37	50
CUD214	6	208/230 3-Ph	1	19	0/32.9	22	27	45
CUL214	6	460 3-Ph	1	19	0.25/32.9	23	27	45
CUD281	8	208/230 3-Ph	1	40	0/51.3	49	58	90
CUL281	8	460 3-Ph	1	40	0.5/51.3	49	59	90
CUD284	8	208/230 3-Ph	1	30	0/39.7	33	40	70
CUL284	8	460 3-Ph	1	30	0.25/39.7	33	41	70

FLA = Full Load Amps; MCA = Minimum Circuit Ampacity; MOP = Maximum Overcurrent Protection Device.

5.5 Connecting Gas Pipe and Liquid Pipe

Table 5.3 Vertiv™ CoolPhase Ceiling recommended refrigerant line sizes, O.D. CU for Vertiv™ CoolPhase Condensing Unit

CoolPhase Ceiling	Total Equivalent Length ft (m)	Suction Line, in (mm)	Liquid Line in. (mm)
MMI12 (1 Ton) + CU03A	0 to 32.80 (0 to 10)	½ (12.70)	¼ (6.35)
	32.80 to 196.90 (10 to 60)	½ (12.70)	5/16 (7.93)
MMI24 (2 Ton) + CU07A	0 to 16.40 (0 to 5)	½ (12.70)	3/8 (9.52)
	16.40 to 65.60 (5 to 20)	5/8 (15.87)	3/8 (9.52)
	65.60 to 196.85 (20 to 60)	¾ (19.05)	3/8 (9.52)
MMI36 (36 Ton) + CU11A	0 to 16.40 (0 to 5)	½ (12.70)	3/8 (9.52)
	16.40 to 49.20 (5 to 15)	5/8 (15.87)	3/8 (9.52)
	49.20 to 65.60 (15 to 20)	5/8 (15.87)	½ (12.70)
	65.60 to 131.20 (20 to 40)	¾ (19.05)	½ (12.70)
	131.20 to 196.85 (40 to 60)	7/8 (22.22)	½ (12.70)
MMI48 (4 Ton) + CU15A	0 to 32.80 (0 to 10)	¾ (19.05)	½ (12.70)
	32.80 to 295.30 (10 to 90)	7/8 (22.22)	½ (12.70)
MMI60 (6 Ton) + CU21A	0 to 49.20 (0 to 15)	7/8 (22.22)	5/8 (15.87)
	49.20 to 295.30 (15 to 90)	1-1/8 (28.58)	5/8 (15.87)
MMI96 (8 Ton) + CU28A	0 to 16.40 (0 to 5)	7/8 (22.22)	5/8 (15.87)
	16.40 to 98.40 (5 to 30)	1-1/8 (28.58)	5/8 (15.87)
	98.40 to 295.30 (30 to 90)	1-3/8 (34.93)	¾ (19.05)

NOTE: Must downsize vertical riser one trade size (1-1/8" to 7/8", 7/8" to 3/4", 3/4" to 5/8", 5/8" to 1/2").

NOTE: If the condensing unit is installed indoors, the total system refrigerant charge (Indoor unit+ Condensing unit + Piping) can't exceed 4 lbs.

NOTE: Contact your representative for line sizing for runs longer than 295.30 ft (90 m) equivalent length.

Table 5.4 Equivalent Length of Components

Liquid Pipe, External Diameter in (mm)	Equivalent Length ft (m)			
	90° Bend Way	45° Bend Way	T Type Way	Three-Way Way
½ (12.70)	1.31 (0.40)	0.65 (0.20)		2.49 (0.76)
5/8 (15.87)	1.80 (0.55)	0.88 (0.27)		2.49 (0.76)
¾ (19.05)	1.96 (0.60)	0.98 (0.30)		2.49 (0.76)
7/8 (22.22)	2.29 (0.70)	1.14 (0.35)		3.60 (1.10)

Table 5.4 Equivalent Length of Components (continued)

Liquid Pipe, External Diameter in (mm)	Equivalent Length ft (m)		
	90° Bend 45° Bend T Type Three- Way	90° Bend 45° Bend T Type Three- Way	90° Bend 45° Bend T Type Three- Way
1 1/8 (28.58)	2.85 (0.87)	1.44 (0.44)	4.60 (1.04)
1 3/8 (34.93)	3.45 (1.05)	1.72 (0.53)	5.30 (1.60)
1-5/8 (41.00)	4.10 (1.25)	2.05 (0.63)	5.30 (1.60)

NOTE: Suitable piping thickness must be used to support the pressure of the CoolPhase Ceiling Units

Installing Pipelines

1. Release the pre-charged nitrogen. Open all the Schrader valves in the system to release nitrogen.
2. Cut the liquid pipe and gas pipe connectors on the evaporator and condenser.
3. Lay the pipes between the evaporator and condenser.
4. Connect a nitrogen cylinder to the Schrader valve. Purge the pipe with nitrogen to flow through the pipe while welding the pipe.

Table 5.5 Pipe length and condensing unit elevation relative to evaporator

Model	Maximum Condensing Unit Level Above Evaporator, ft (m)	Maximum Condensing Unit Level Below Evaporator, ft (m)
MMI12	49.2 (15)	16.4 (5)
MMI24	49.2 (15)	16.4 (5)
MMI36	49.2 (15)	16.4 (5)
MMI48	49.2 (15)	16.4 (5)
MMI60	98.4 (30)	26.2 (8)
MMI96	98.4 (30)	26.2 (8)

Table 5.5 Pipe length and condensing unit elevation relative to evaporator

Model	Maximum Condensing Unit Level Above Evaporator, ft (m)	Maximum Condensing Unit Level Below Evaporator, ft (m)
MMI12	49.2 (15)	16.4 (5)
MMI24	49.2 (15)	16.4 (5)
MMI36	49.2 (15)	16.4 (5)
MMI48	49.2 (15)	16.4 (5)
MMI60	98.4 (30)	26.2 (8)
MMI96	98.4 (30)	26.2 (8)

Table 5.8 Outdoor condenser approximate R-32 refrigerant charge for standard units

Model	Refrigerant charge lb (kg)
CUD03	1.3 (0.6)
CUD07	1.5 (0.7)
CUD11	1.8 (0.8)
CUD15	2.9 (1.3)
CUD21	3.0 (1.4)
CUD28	5.0 (2.3)

Table 5.11 Interconnecting piping refrigerant charge for R-32 for type L Tube

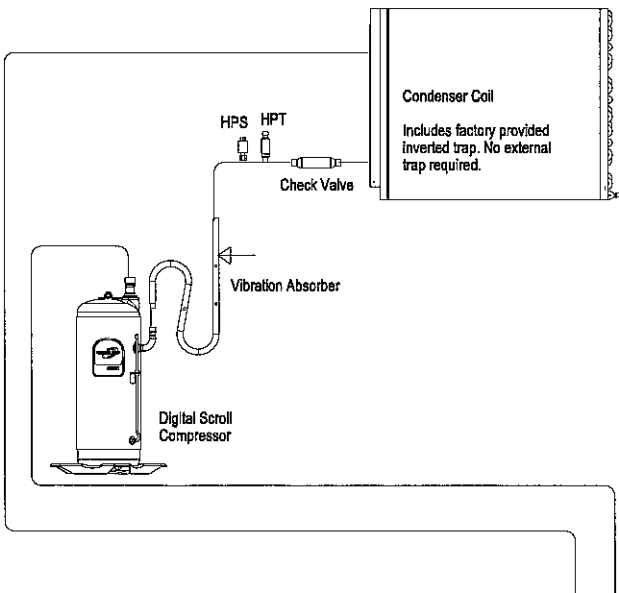
Line Size O.D.	Liquid Line, lb/100 ft (kg/30 m)	Suction Line, lb/100 ft (kg/30 m)
3/8	2.9 (1.3)	0.15 (0.07)
1/2	5.5 (2.5)	0.2 (0.1)
5/8	9.0 (4.0)	0.4 (0.2)
3/4	13.5 (6.0)	0.7 (0.3)
7/8	18.5 (8.4)	1.1 (0.5)
1 1/8	31.7 (14.4)	1.8 (0.8)
1 3/8	48.3 (21.9)	2.6 (1.2)

VERTIV COOLPHASE CEILING

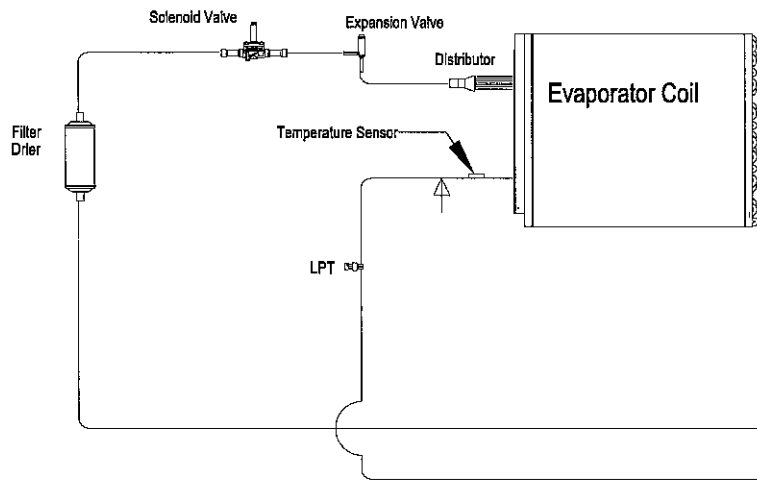
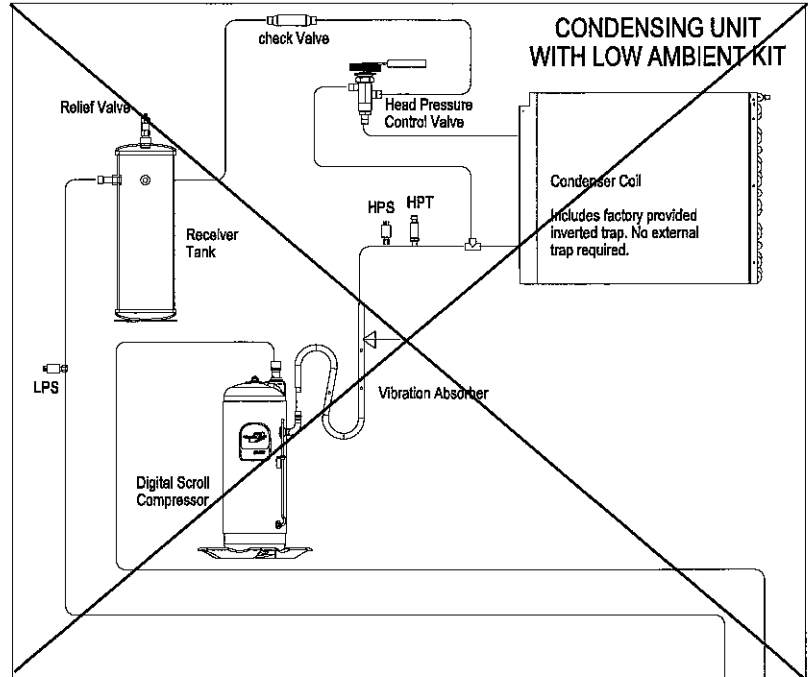
GENERAL ARRANGEMENT

3-8 TON DIRECT EXPANSION AIR COOLED

CONDENSING UNIT



CONDENSING UNIT WITH LOW AMBIENT KIT



Interconnecting Piping

For rises over 25ft (7.6m), trap every 20ft (6m) or evenly divided

Trap at base of risers over 5ft. (1.5m)

FACTORY REFRIGERANT PIPING

FIELD PIPING

▽ SERVICE / SCHRADER (ACCESS) CONNECTION NO VALVE CORE

⬇ SERVICE / SCHRADER (ACCESS) CONNECTION WITH VALVE CORE

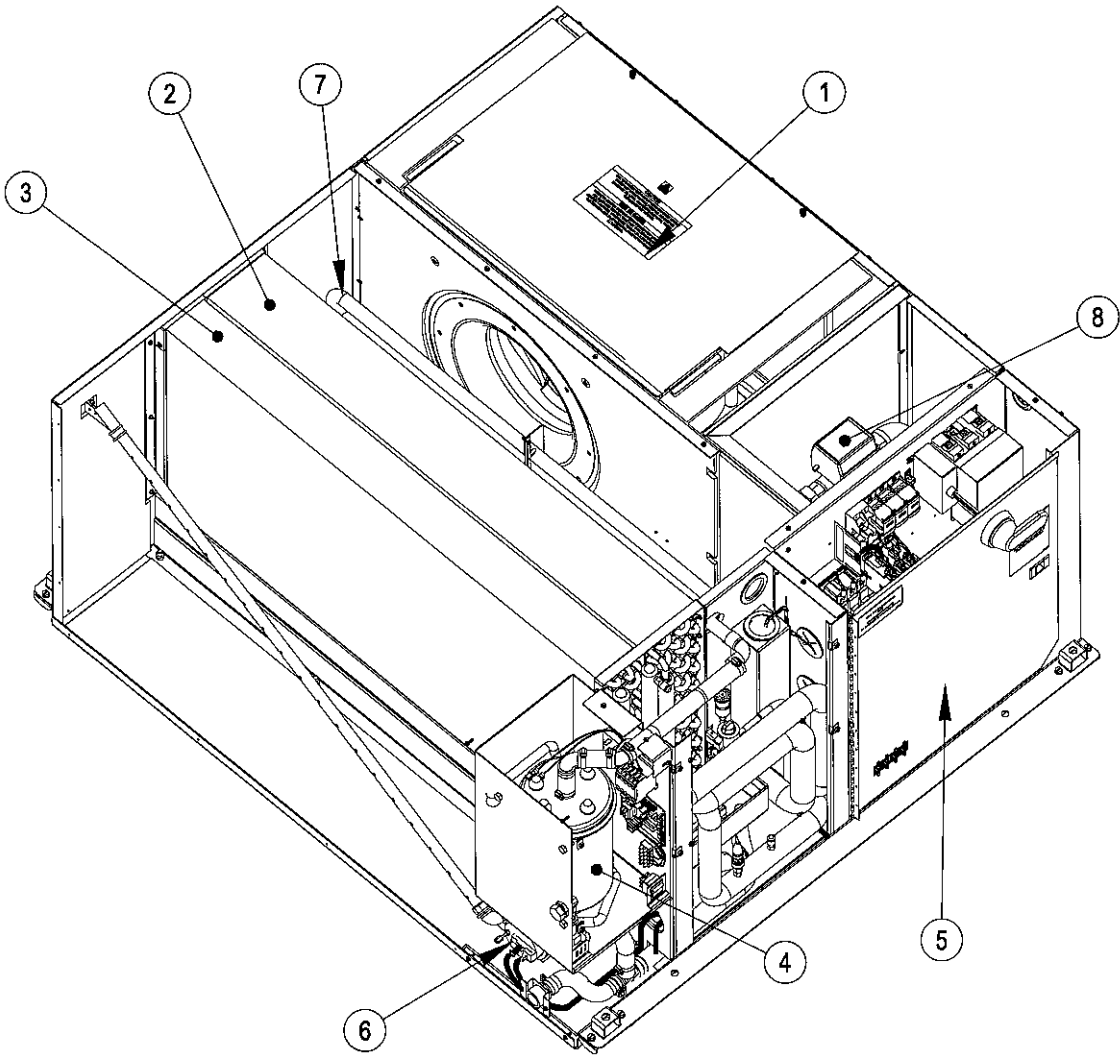
Notes:

1. Schematic representation shown. Do not use for specific connection location. Filter Drier and Solenoid Valve could be in different order in the liquid line depending on the model.
2. Interconnecting piping is not supplied by Vertiv™, but is required for proper circuit operation and maintenance.
3. Do not isolate any refrigerant circuit from over pressurization protection.
4. Traps must be installed and horizontal lines pitched to ensure proper oil return and to reduce liquid floodback to compressor. Pitch horizontal hot gas piping at a minimum of 1/2" per 10 feet (42mm per 10m) so that gravity will aid in moving oil in the direction of the refrigeration flow.



VERTIV COOLPHASE CEILING

COMPONENT LOCATION EVAPORATOR UNIT, 4 & 5 TON



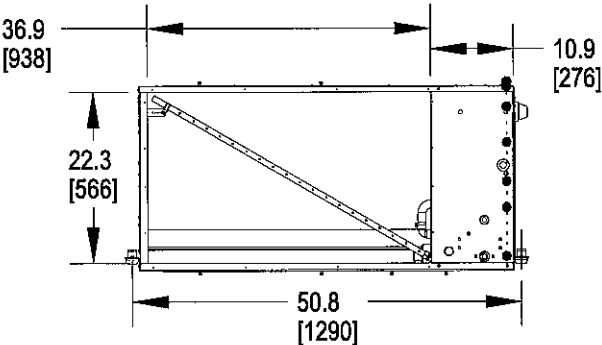
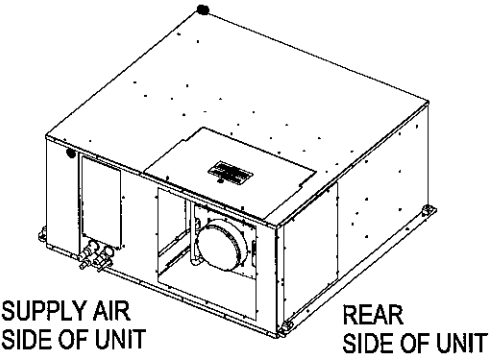
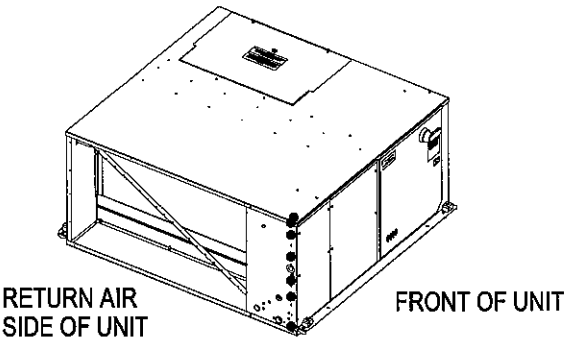
(PANELS REMOVED FOR CLARITY)

ITEM	DESCRIPTION
1	DIRECT DRIVE FAN WITH VARIABLE SPEED EC MOTOR
2	EVAPORATOR COIL DX
~~3~~	~~EVAPORATOR COIL FREE COOLING (OPTIONAL)~~
~~4~~	~~HUMIDIFIER (OPTIONAL)~~
5	ELECTRICAL BOX
~~6~~	~~SMOKE SENSOR (OPTIONAL)~~
~~7~~	~~ELECTRICAL REHEAT (OPTIONAL)~~
~~8~~	~~3-WAY VALVE (ONLY IN FREE COOLING OPTION)~~

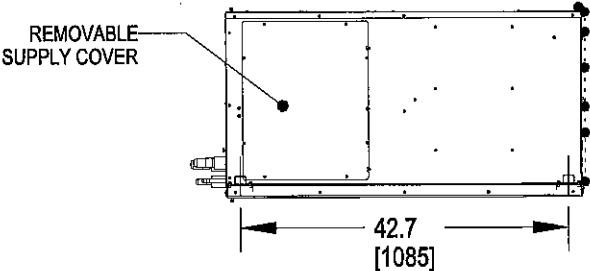
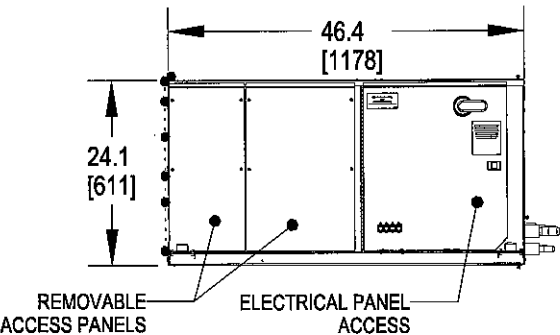


VERTIV™ VERTIV COOLPHASE CEILING

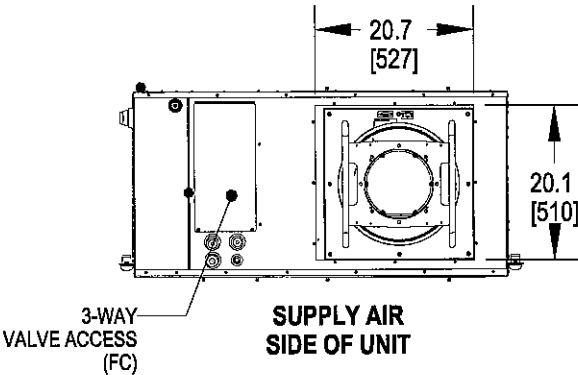
DIMENSIONAL DATA CABINET DIMENSIONS, 4 & 5 TON



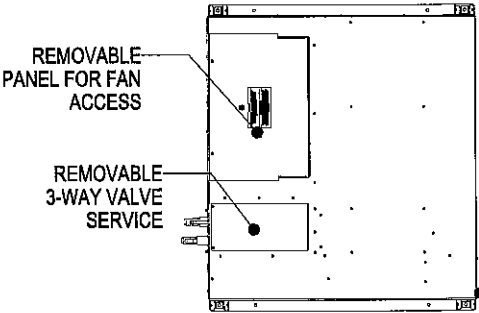
RETURN
AIR SIDE OF UNIT



REAR
SIDE OF UNIT



SUPPLY AIR
SIDE OF UNIT



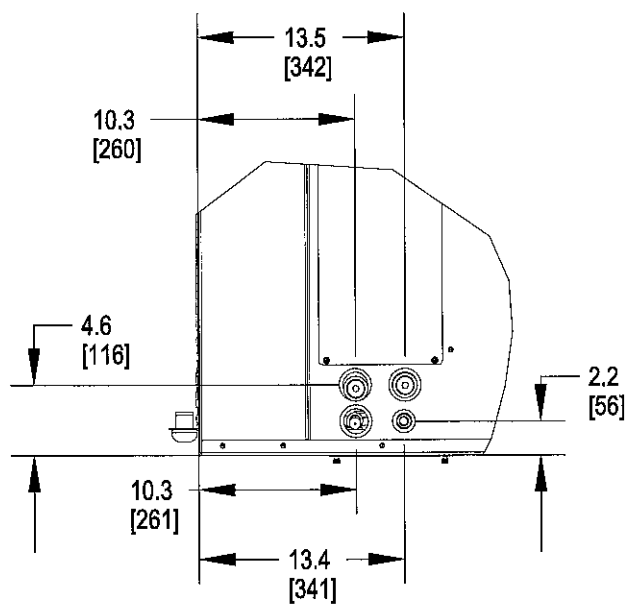
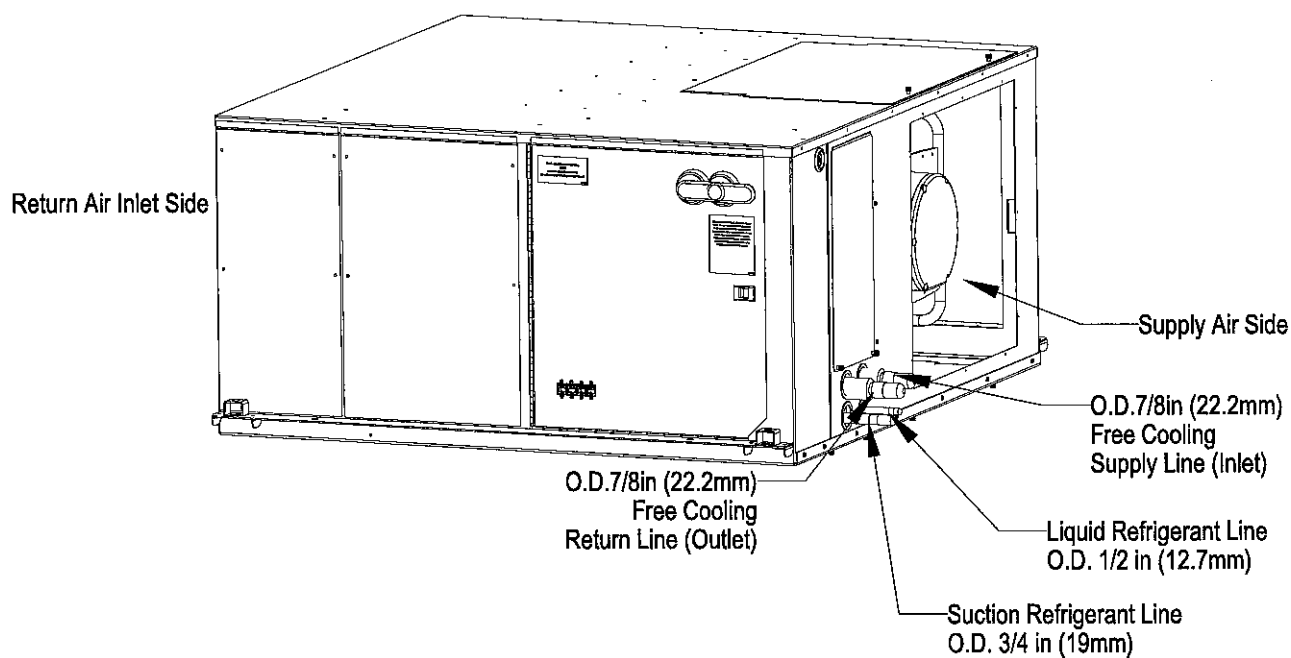
BOTTOM OF UNIT

	EVAPORATOR COIL	UNIT NET WEIGHT LBS. (KG)
MMI48 (4 TON) MODEL	→ DX	355.8 (161.4)
	DX + FC	426.3 (193.4)
MMI60 (5 TON) MODEL	DX	375.66 (170.4)
	DX + FC	446.2 (202.4)



VERTIV COOLPHASE CEILING

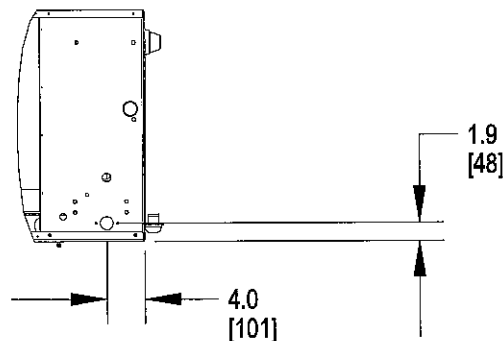
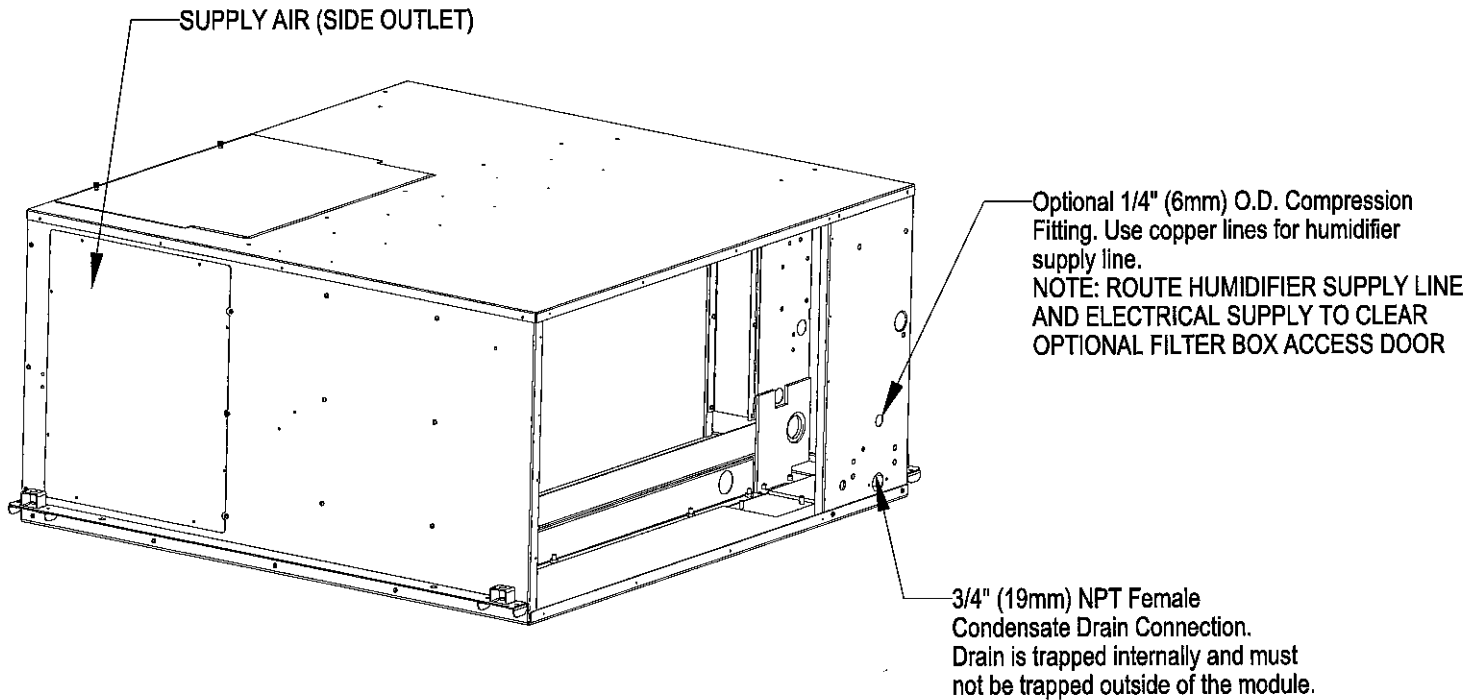
PRIMARY CONNECTION LOCATIONS 4 & 5 TON DIRECT EXPANSION & FREE COOLING





VERTIV COOLPHASE CEILING

PRIMARY CONNECTION LOCATIONS 4 & 5 TON DIRECT EXPANSION & FREE COOLING

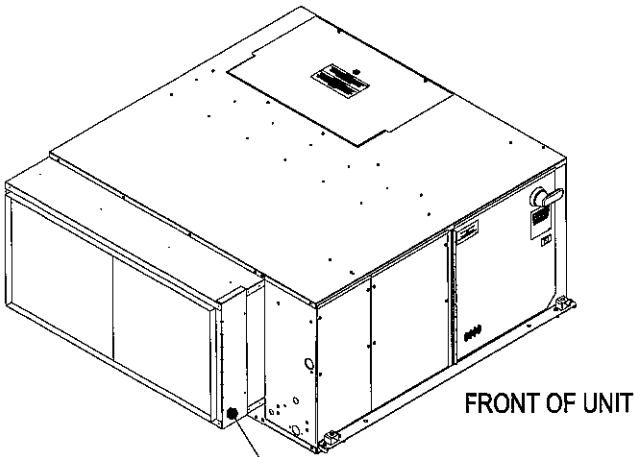




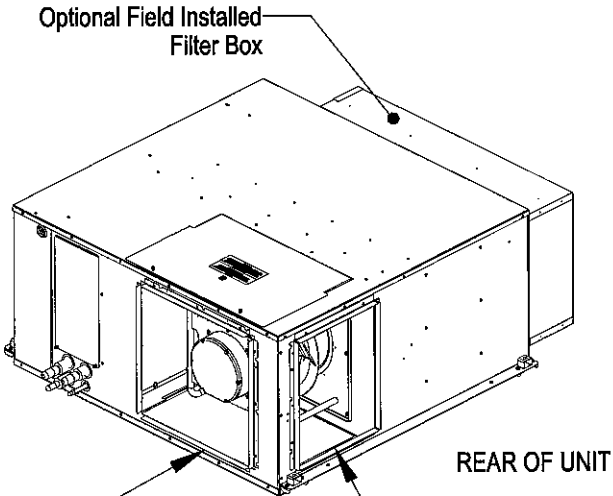
VERTIV™

VERTIV COOLPHASE CEILING

DIMENSIONAL DATA FILTER BOX 4 & 5 TON

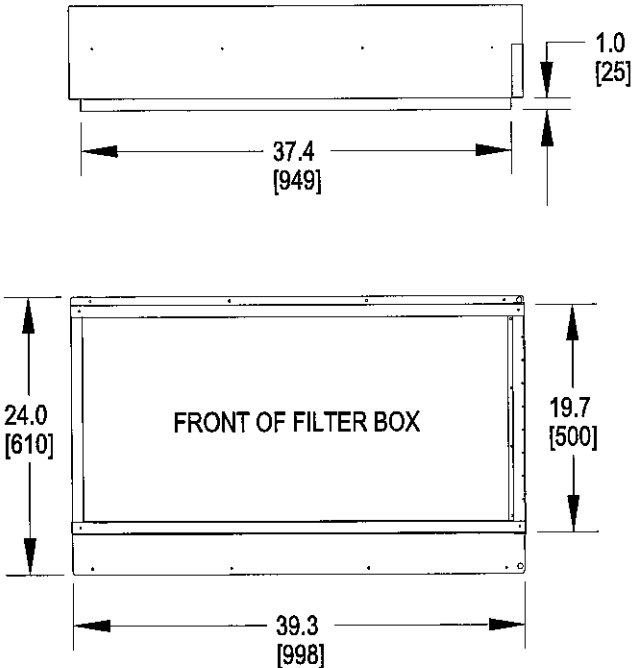


Filter access door, recommended clearance of 30" (762mm) be provided for component access and removal.

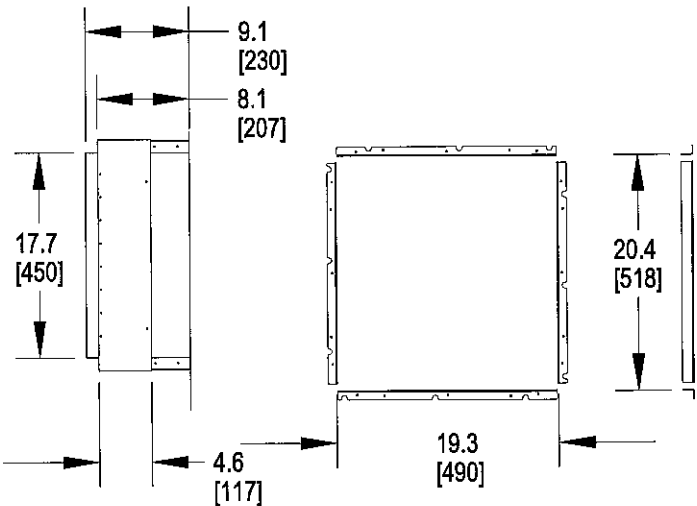


Alternate air supply location for duct flange. Remove panel and cover rear supply opening before attaching duct flanges.

Supply Air Duct Flange Supplied with Filter Box (shown on rear Supply).



OPTIONAL FILTER BOX

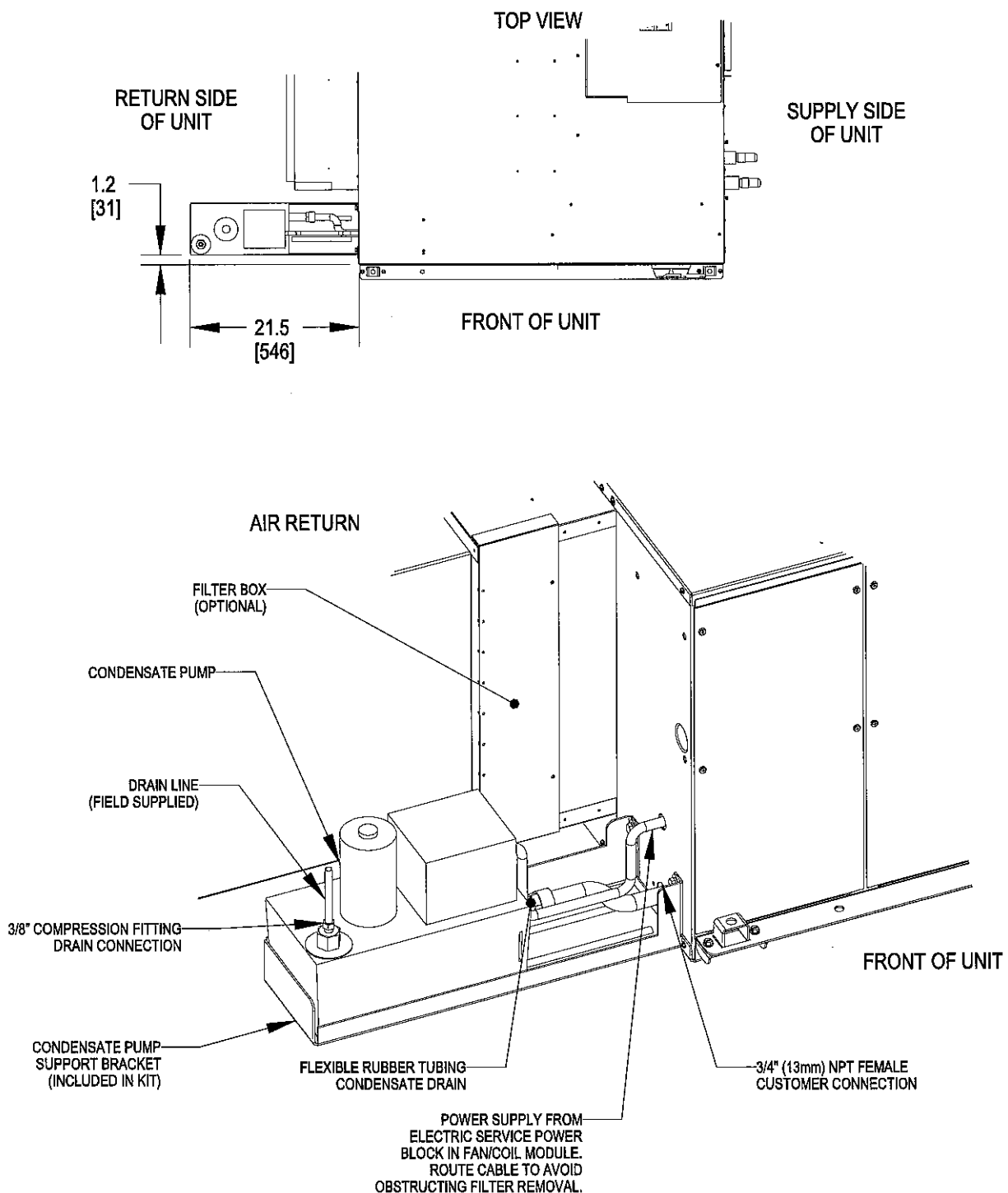


SUPPLY AIR DUCT FLANGES
INSTALLED DIMENSIONS



VERTIV COOLPHASE CEILING

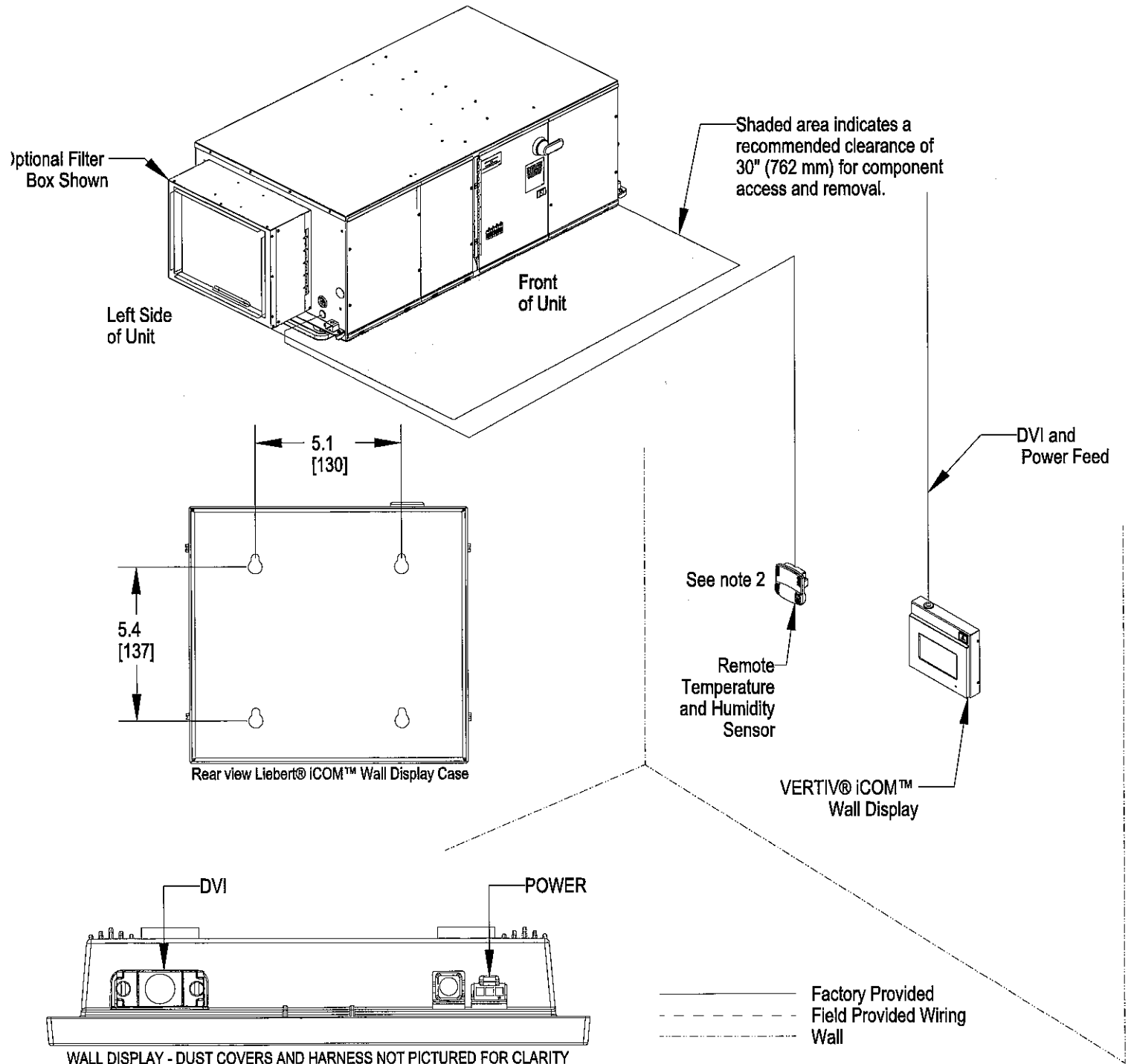
PIPING CONNECTIONS CONDENSATE PUMP CONNECTION LOCATIONS, 4 & 5 TON





VERTIV COOLPHASE CEILING

GENERAL ARRANGEMENT, DIMENSIONAL DATA & FIELD CONNECTIONS VERTIV® ICOM™ WALLMOUNT DISPLAY



Notes:

1. Refer to 20000913 for connection points on Vertiv™ CoolPhase Ceiling Unit.
2. CANbus cable connection wired form P66 / P67 on the rear of the Remote Temperature / Humidity sensor.
Connection routed to secondary port on rear of Return T/H sensor inside unit or available CANbus port on internal control board (P66 / P67).



VERTIV COOLPHASE CEILING

ELECTRICAL FIELD CONNECTIONS 4 & 5 TON DX & FC

STANDARD ELECTRICAL CONNECTIONS

1) High Voltage connection through the right side of the Ceiling Panel - 1.37" (35mm) diameter concentric knockout

2) Communication connection on the front of the Ceiling Panel
Connect according diagram in the corresponding ethernet port.

3) Electrical service (hard wired) - refer to serial tag information for unit electrical service requirement

- Three Phase - 208-230V 60HZ / 460 60HZ

- Single Phase - 208-230V 60HZ

Connect to terminals on disconnect switch. Electrical service not by Vertiv. Use copper conductors only, wire per local codes. Refer to specification sheet for total unit full load amps, wire size amps and max over current protection device size.

4) Communication Bracket

-P64A: U2U-A Unit-to-Unit Communication

-P64B: U2U-B Unit-to-Unit Communication

-VFD: Condenser Modbus (RS485) Communication

-P74: BMS Connectivity / Embedded Unity

5) Terminal Blocks Control Distribution Voltage / Power Voltage Terminals / Communication RS485

- TBK Terminal Ground

- TBK 24M Control Distribution Voltage 24VAC

- TBK 24-24AS Control Distribution Voltage 24VAC Insulated Voltage from Transformer 1:1

6) Fans Terminal Blocks

- MR relay is the power source for MF (Main Fan Relay)

- Main control signal from ICOM 4. (0-10V Distribution)

Reference models showed in this document are 300MM units. All connections, terminal block locations and communication ports also apply for 600MM units.



VERTIV COOLPHASE CEILING

ELECTRICAL FIELD CONNECTIONS

4 & 5 TON DX & FC

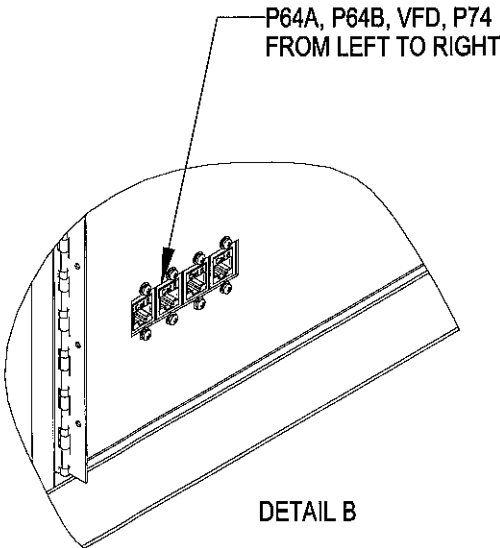
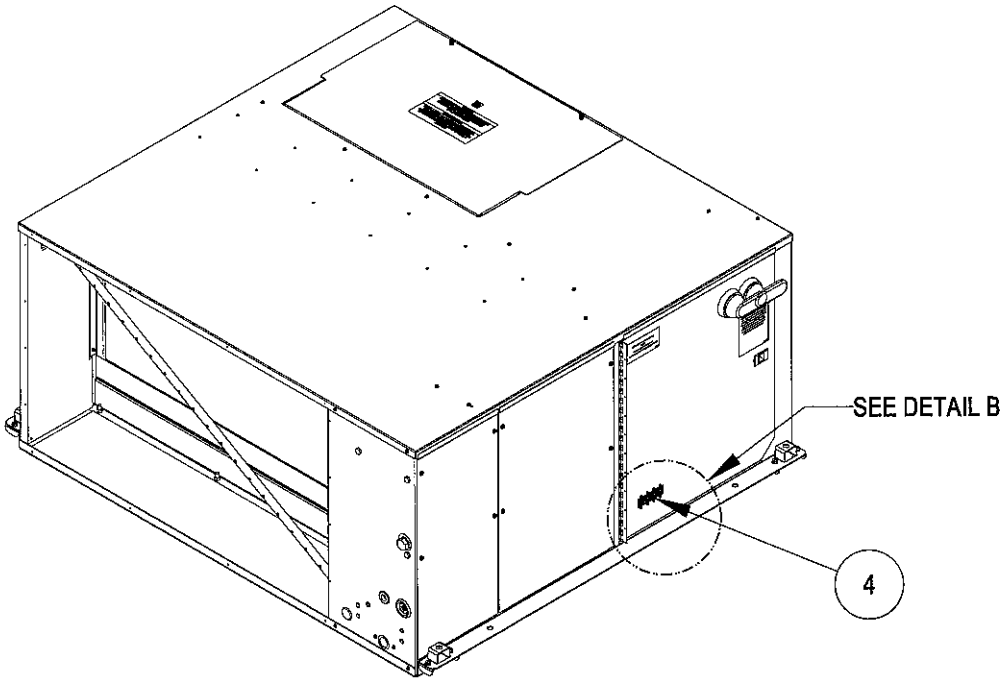
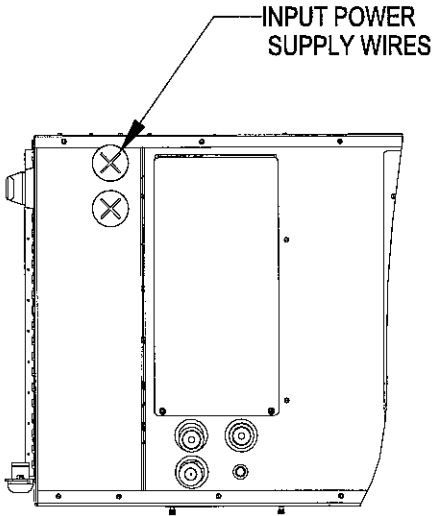


TABLE "A"	
PIN OUT	DESCRIPTION
VFD1 / VFD8	MODBUS A/B
VFD3 / VFD4	24VAC L/N



(RIGHT SIDE)

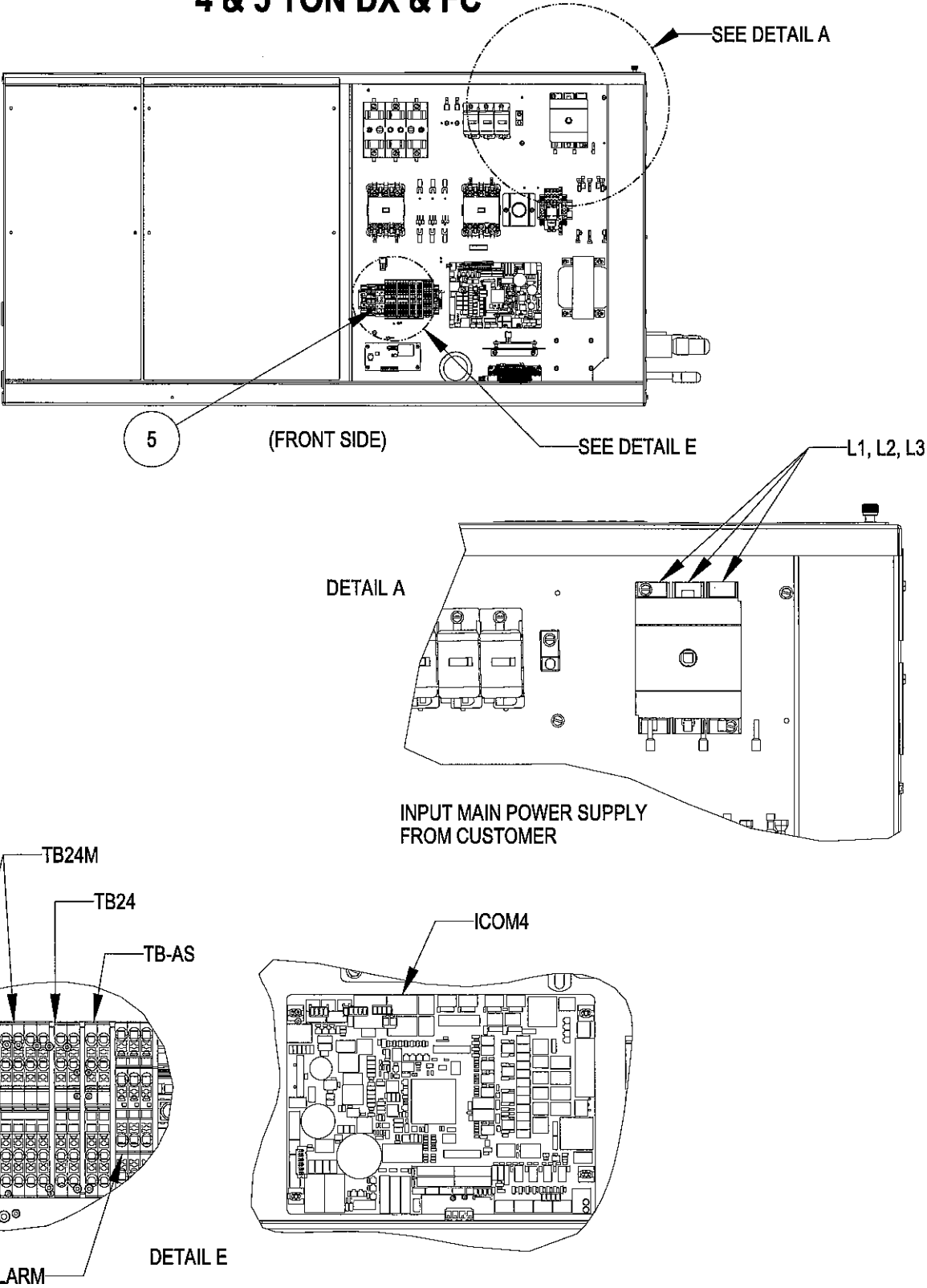
ETHERNET CABLE CONFIGURATION MUST BE STRAIGHT CONFIGURATION.
VFD PIN OUT(INDOOR - OUTDOOR COMMUNICATION) SEE TABLE "A"



VERTIV COOLPHASE CEILING

ELECTRICAL FIELD CONNECTIONS

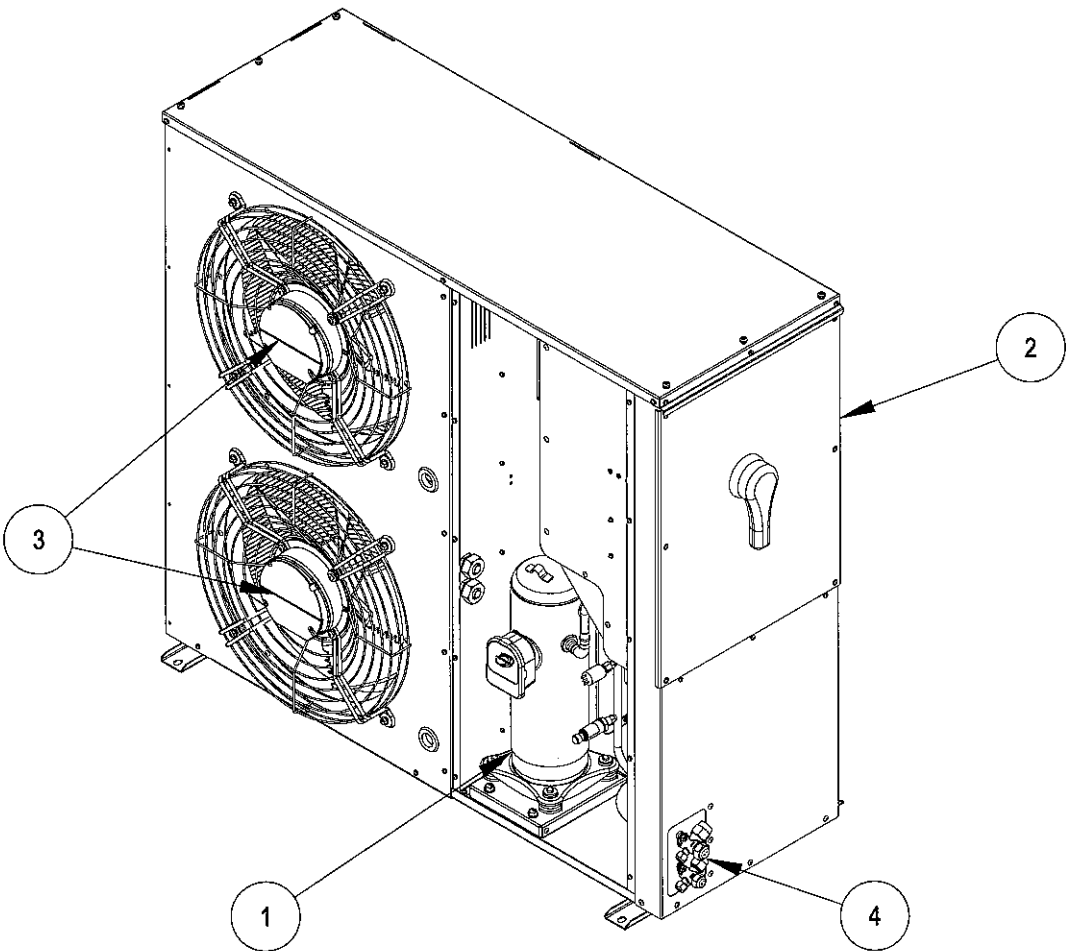
4 & 5 TON DX & FC





VERTIV. VERTIV COOLPHASE CONDENSING UNIT

COMPONENT LOCATION CONDENSER UNIT 15KW

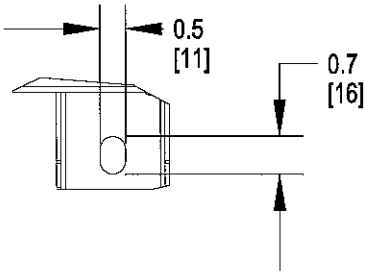
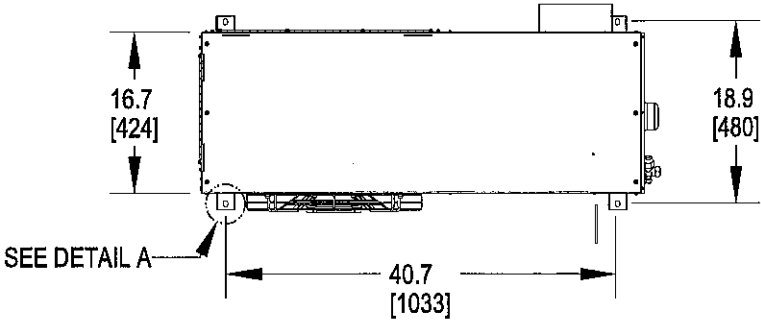
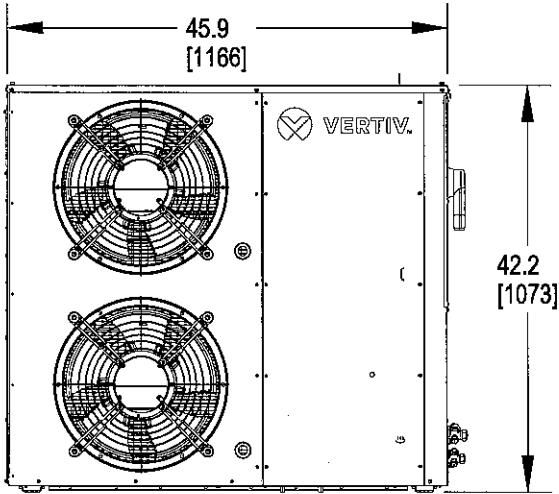
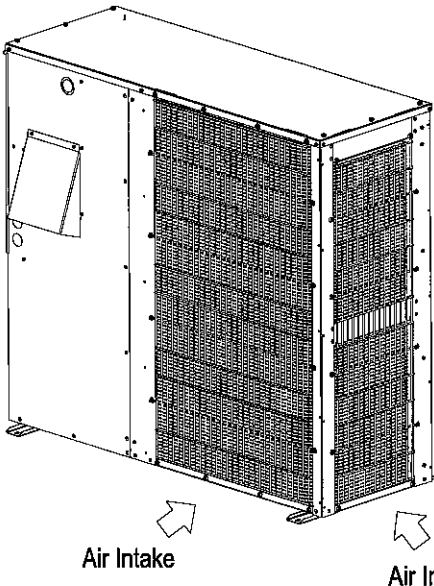
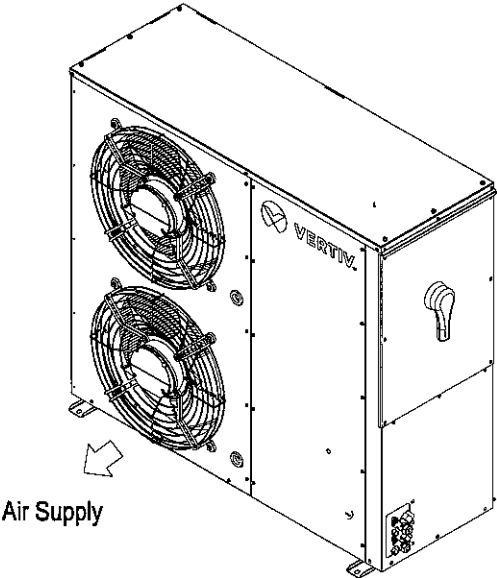


ITEM	DESCRIPTION
1	COMPRESSOR
2	ELECTRICAL BOX
3	CONDENSER FANS
4	SERVICE VALVES



VERTIV™ VERTIV COOLPHASE CONDENSING UNIT

**DIMENSIONAL DATA
CONDENSER UNIT 15kW**



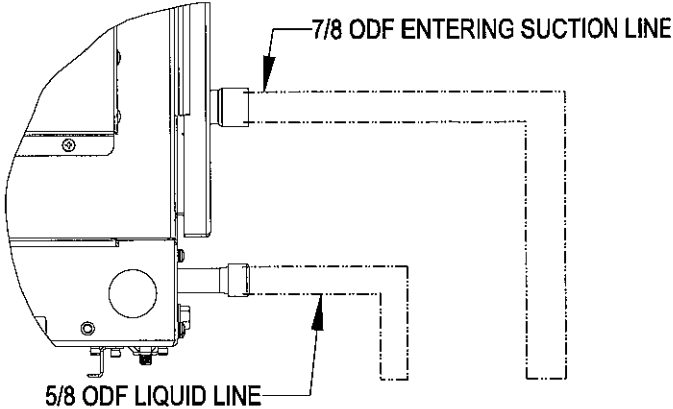
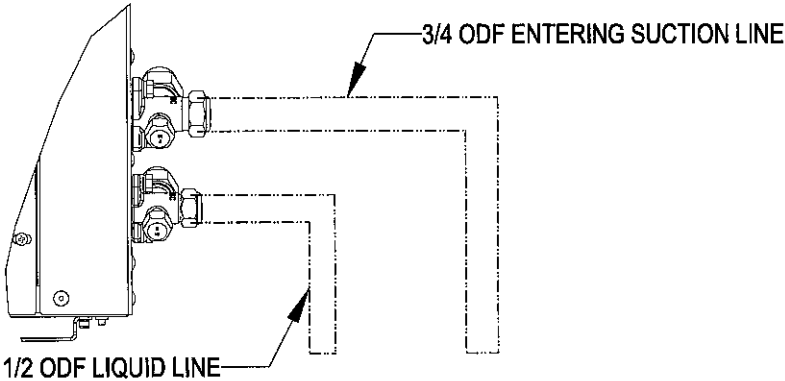
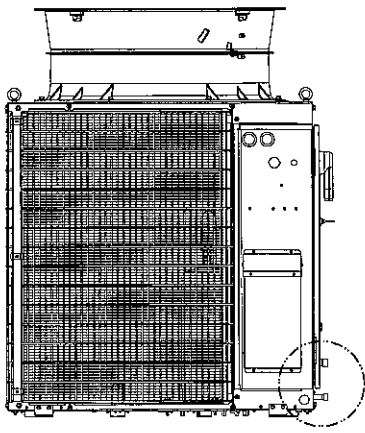
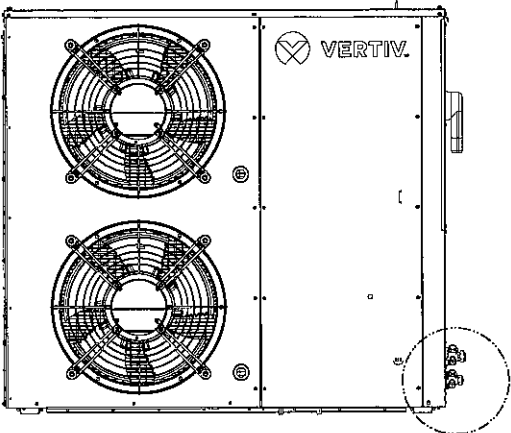
Unit	Net Weight Kg (lb)	Shipping Weight Kg (lb)
Standard 15kW	121.37 (267.57)	147.46 (325.09)
Low ambient 15kW	125.32 (276.56)	151.42 (333.83)

SINGLE POWER SUPPLY UNIT SHOWN*



VERTIV™ VERTIV COOLPHASE CONDENSING UNIT

PIPING DIMENSIONAL DATA
CONDENSER UNITS 15 kW & 21kW



Model / Capacity	Length (mts)	Length (ft)	Liquid Line Diameter (mm)	Liquid Line Diameter (ANSI)	Suction Line Diameter (mm)	Suction Line Diameter (ANSI)
CU15 kW	5	16	12.7	1/2	19.05	3/4
	10	33	12.7	1/2	19.05	3/4
	15	49	12.7	1/2	22.23	7/8
	20	66	12.7	1/2	22.23	7/8
	25	82	12.7	1/2	22.23	7/8
	30	98	15.88	5/8	28.58	1 1/8
	35	115	15.88	5/8	28.58	1 1/8
	40	131	15.88	5/8	28.58	1 1/8
	45	148	15.88	5/8	28.58	1 1/8
	50	164	15.88	5/8	28.58	1 1/8
	55	180	15.88	5/8	28.58	1 1/8
	60	197	15.88	5/8	28.58	1 1/8
	65	213	15.88	5/8	28.58	1 1/8
	70	230	15.88	5/8	28.58	1 1/8
	75	246	15.88	5/8	28.58	1 1/8
	80	262	15.88	5/8	28.58	1 1/8
	85	279	15.88	5/8	28.58	1 1/8
	90	295	15.88	5/8	28.58	1 1/8

Model / Capacity	Length (mts)	Length (ft)	Liquid Line Diameter (mm)	Liquid Line Diameter (ANSI)	Suction Line Diameter (mm)	Suction Line Diameter (ANSI)
CU21 kW	5	16	12.7	1/2	19.05	3/4
	10	33	12.7	1/2	22.23	7/8
	15	49	12.7	1/2	22.23	7/8
	20	66	15.88	5/8	28.58	1 1/8
	25	82	15.88	5/8	28.58	1 1/8
	30	98	15.88	5/8	28.58	1 1/8
	35	115	15.88	5/8	28.58	1 1/8
	40	131	15.88	5/8	28.58	1 1/8
	45	148	15.88	5/8	28.58	1 1/8
	50	164	15.88	5/8	28.58	1 1/8
	55	180	15.88	5/8	28.58	1 1/8
	60	197	19.05	3/4	34.93	1 3/8
	65	213	19.05	3/4	34.93	1 3/8
	70	230	19.05	3/4	34.93	1 3/8
	75	246	19.05	3/4	34.93	1 3/8
	80	262	19.05	3/4	34.93	1 3/8
	85	279	19.05	3/4	34.93	1 3/8
	90	295	19.05	3/4	34.93	1 3/8
	95	312	19.05	3/4	34.93	1 3/8
	100	328	19.05	3/4	34.93	1 3/8
	105	344	19.05	3/4	34.93	1 3/8
	110	361	19.05	3/4	34.93	1 3/8
	115	377	19.05	3/4	34.93	1 3/8
	120	394	19.05	3/4	34.93	1 3/8

2.4.2 Wind Baffle

The wind baffle allows cooling-mode operation at lower outdoor ambient temperatures.

NOTE: The Wind Baffle should be installed when the standard condensing unit is installed outdoors, and the temperature is 23°F (-5°C) or below. The Wind Baffle can help ensure the stability and reliability of the standard condensing unit running in a low-temperature environment.

NOTE: When equipped with the wind baffle kit, the maximum ambient air temperature is 118.4°F (48°C); however, cooling capacity will be reduced by approximately 1.5% in high ambient temperatures.

NOTE: If both the hail guard and wind baffle kit are installed, the maximum ambient air temperature is 118.4°F (48°C); however, the cooling capacity will decrease by approximately 3.5% in high ambient temperatures.

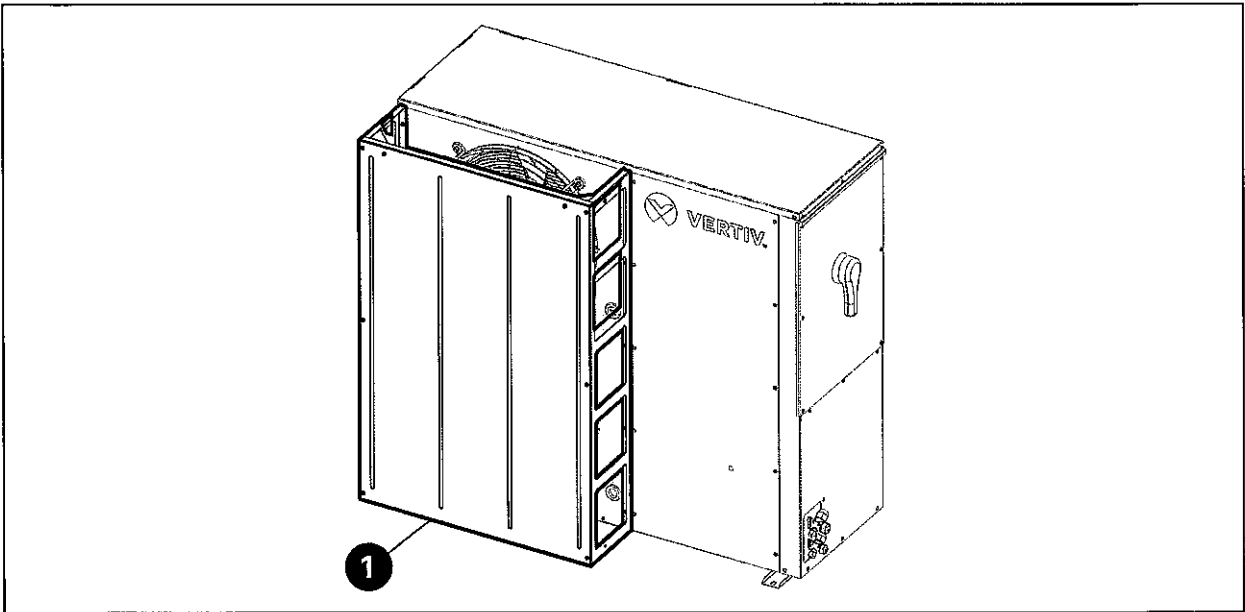
NOTE: When the ambient temperature is lower than -4°F (-20 °C) up to -31°F (-35°C), the low ambient version must be used.

NOTE: Low Ambient versions of the units do not require a Wind Baffle accessory.

Table 2.9 Wind Baffle SKUs.

SKU	Item Description	Applicable Models
CUWINDKIT-03	Wind Baffle for 3.5 kW Standard Ambient Condensing Units	CUD03
CUWINDKIT-07	Wind Baffle for 7 kW Standard Ambient Condensing Units	CUD07
CUWINDKIT-11	Wind Baffle for 11 kW Standard Ambient Condensing Units	CUD11
→ CUWINDKIT-15	Wind Baffle for 15 kW Standard Ambient Condensing Units	CUD15

Figure 2.16 Wind Baffle (CUWINDKIT-15) mounted on the 15-kW unit.



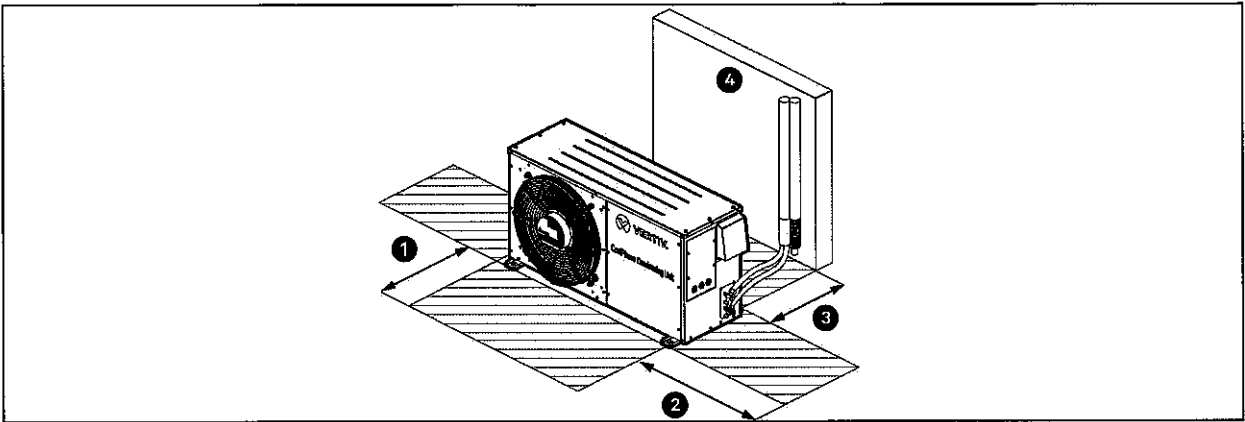
Item	Description
1	Wind Baffle for Condensing Unit

4.3 Clearance Requirements

4.3.1 Condensing Units of 3.5 to 15 kW

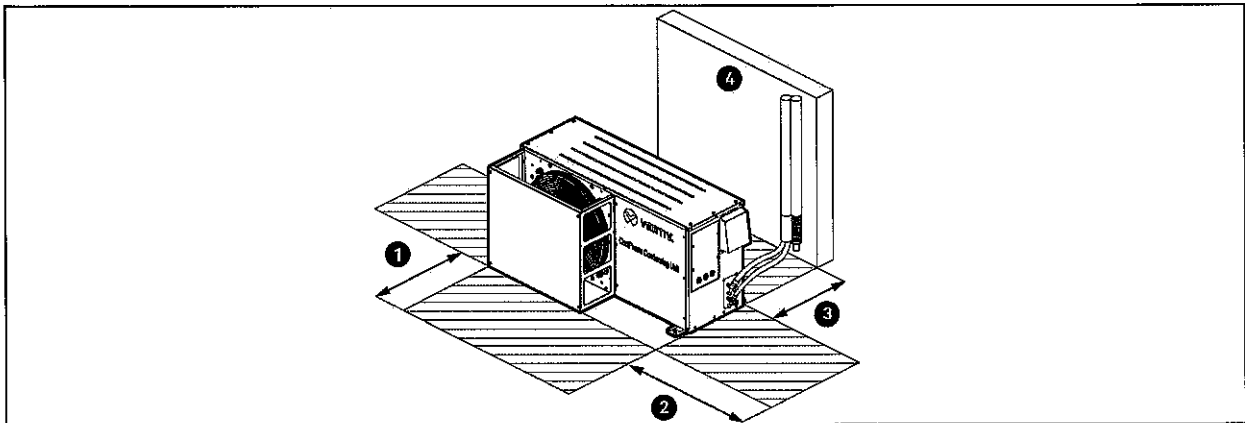
Proper airflow through the Condensing unit coil is critical for correct unit operation. When installing, consider service, inlet, outlet, and minimum allowable space requirements as illustrated below.

Figure 4.1 Condensing unit clearances



Item	Description	Item	Description
1	23.6 in (600 mm) Minimum distance	3	11.8 in (300 mm) Minimum distance
2	23.6 in (600 mm) Minimum distance	4	Wall

→ Figure 4.2 Condensing unit clearances with Wind Baffle installed.



Item	Description	Item	Description
1	23.6 in (600 mm) Minimum distance	3	11.8 in (300 mm) Maximum distance
2	23.6 in (600 mm) Minimum distance	4	Wall

NOTE: When installing the wind baffle, there must be a wall behind the unit, and the maximum clearance is 11.8 in (300 mm)



VERTIV™ VERTIV COOLPHASE CONDENSING UNIT

ELECTRICAL FIELD CONNECTIONS CONDENSER UNIT 15kW

Condenser-rated voltage should be verified with available power supply before installation. Refer to the unit's electrical schematic and serial tag for specific electrical requirements. Line voltage electrical service is required for all condensers at the location of the condenser. The voltage supply to the condenser may not be the same voltage supply as required by the indoor unit. Consider using UPS equipment on both data center cooling units and Liebert MC condensers to maintain uninterrupted cooling capability. Refer to the unit's serial tag for specific condenser electrical requirements. A unit disconnect is standard. However, a site disconnect may be required per local code to isolate the unit for maintenance. Route the supply power to the site disconnect switch and then to the unit. Route the conduit to the knockout provided in the top right end of the electrical control enclosure. Connect the earth ground wire leads to the marked earth ground connection terminal provided near the factory-installed disconnect switch.

KEY ELECTRICAL POWER SUPPLY DETAILS:

- 1) **Three phase electrical service (primary source)** - The connection terminals are on top of fused switch. Three phase service not by Vertiv. See note 4.
- 2) **Earth ground (primary source)** - Field lug terminal for earth ground connection.
- 3) **Three phase electrical service (secondary source)** - The connection terminals are on top of fused switch, the fused switch is located at the top and right side of the E-box. Three phase service not by Vertiv. See note 4.
- 4) **Earth ground (secondary source)** - Terminal for field-supplied earth grounding wire.
- 5) **Modbus terminal connections (RS-485) from the interior unit** - The connection terminals are located in TB-A. See DETAIL B on page 3.
 RS485+ terminal is the input terminal for RS485 signal (positive).
 RS485- terminal is the input terminal for RS485 signal (negative).
 CGND terminal is the input terminal for signal reference ground.
- 6) **24V terminal connections from the interior unit** - The connection terminals are located in TB-A. See DETAIL B on page 3.
 24V terminal is the input terminal for the hot wire used for leak detection mitigation on the indoor unit.
 COM terminal is the input terminal for the common wire used for leak detection mitigation on the indoor unit.
- 7) **Three phase electrical service entrance (primary source)** - One 1.875in (47.63mm) diameter knockout located at the top and left side of the E-Box.
- 8) **Three phase electrical service entrance (secondary source)** - One 1.875in (47.63mm) diameter knockout located at the top and left side of the E-Box.
- 9) **Modbus terminal connections (RS-485) from the interior unit** - Field connections for Modbus cable connection: One - 0.70" (18mm) diameter knockout located at the middle and left side of the E-Box.

NOTES:

1. Refer to specification sheet for unit voltage rating, full load amp, minimum circuit ampacity and maximum circuit protection.
2. The modbus (RS485) wiring is field supplied and must be (See drawing on page 3 for wire configuration):
 STP straight through wire type.
 22-18AWG stranded tinned copper.
 Twisted pair (minimum 4 twist per foot).
 Low Capacitance (15pF/FT or less).
 Must be rated to meet local codes and conditions.
3. Do not run in same conduit, raceway, or chase as high voltage wiring.
4. All wiring must be sized and selected for insulation case per NEC and other local codes.
5. Do not bend cables to less than four times the diameter of the cable.
6. UL approved temperature rated to 75°C.
7. UV - and moisture-resistance for exterior and if it is not provided in conduits.
8. Do not deform cables when securing in bundles or when hanging them.
9. Avoid running the cables by devices that may introduce noise, such as machines, fluorescent lights, and electronics.
10. Avoid stretching cables.



VERTIV™ VERTIV COOLPHASE CONDENSING UNIT

ELECTRICAL FIELD CONNECTIONS CONDENSER UNIT 15kW

NOTICE

RISK OF IMPROPER INPUT POWER CAN CAUSE EQUIPMENT DAMAGE.

The electronically commutated motors included in the COOLPHASE CONDENSING UNITS are suitable for connection to an electrical service providing input power to the unit with 300V or less line -to-ground potential only.

Acceptable unit input electrical service for 208V(230V) nominal units:
208V wye with solidly grounded neutral and 120V line-to-ground.

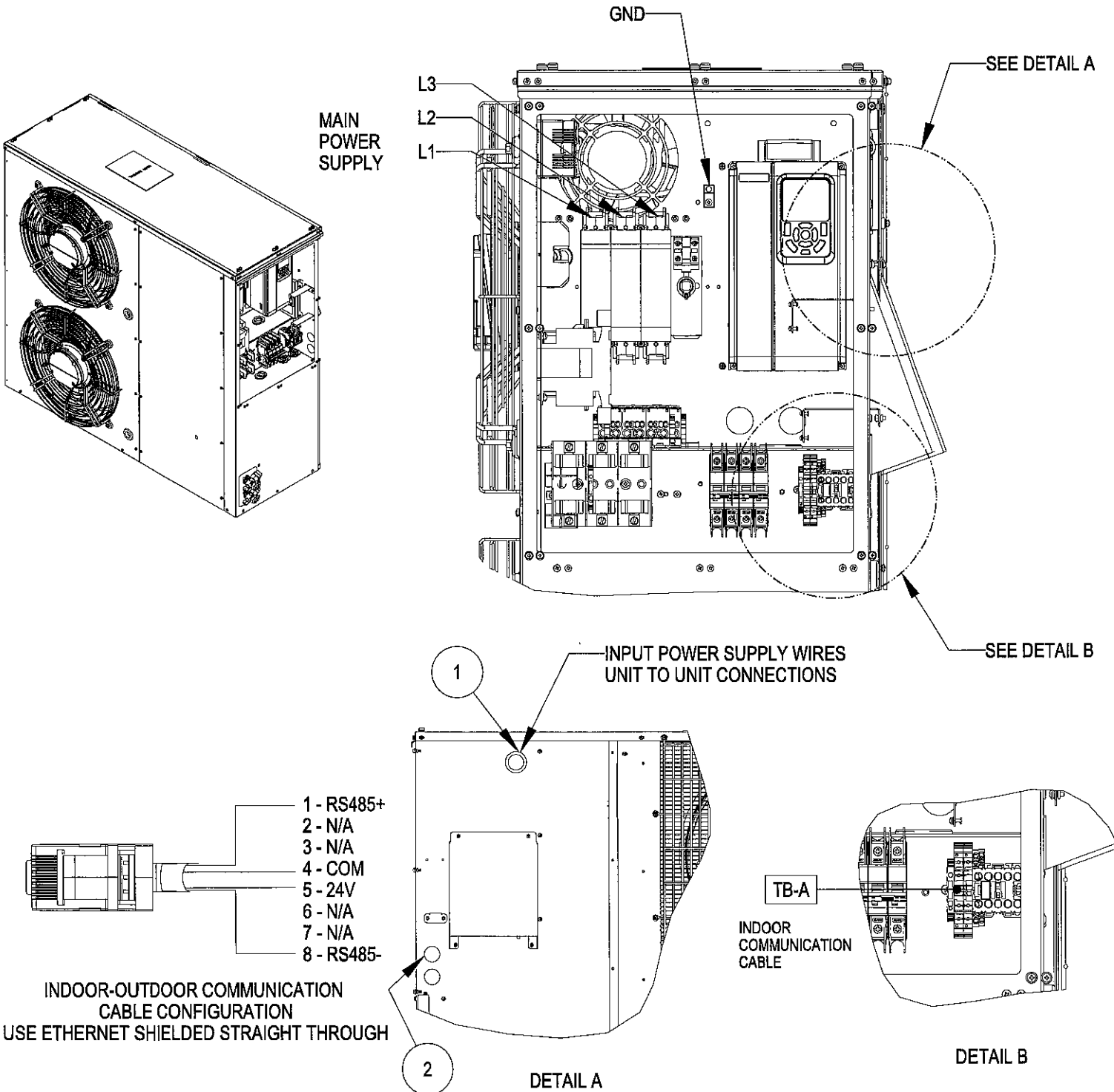
Acceptable unit input electrical service for 460V(480V) nominal units:
480V wye with solidly grounded neutral and 277V line-to-ground.

Unacceptable unit input electrical service for 208V to 460V (480V) nominal units:
Wye with high resistance (or impedance) ground
Delta without ground or with floating ground
Delta with corner ground
Delta with grounded center tap



VERTIV VERTIV COOLPHASE CONDENSING UNIT

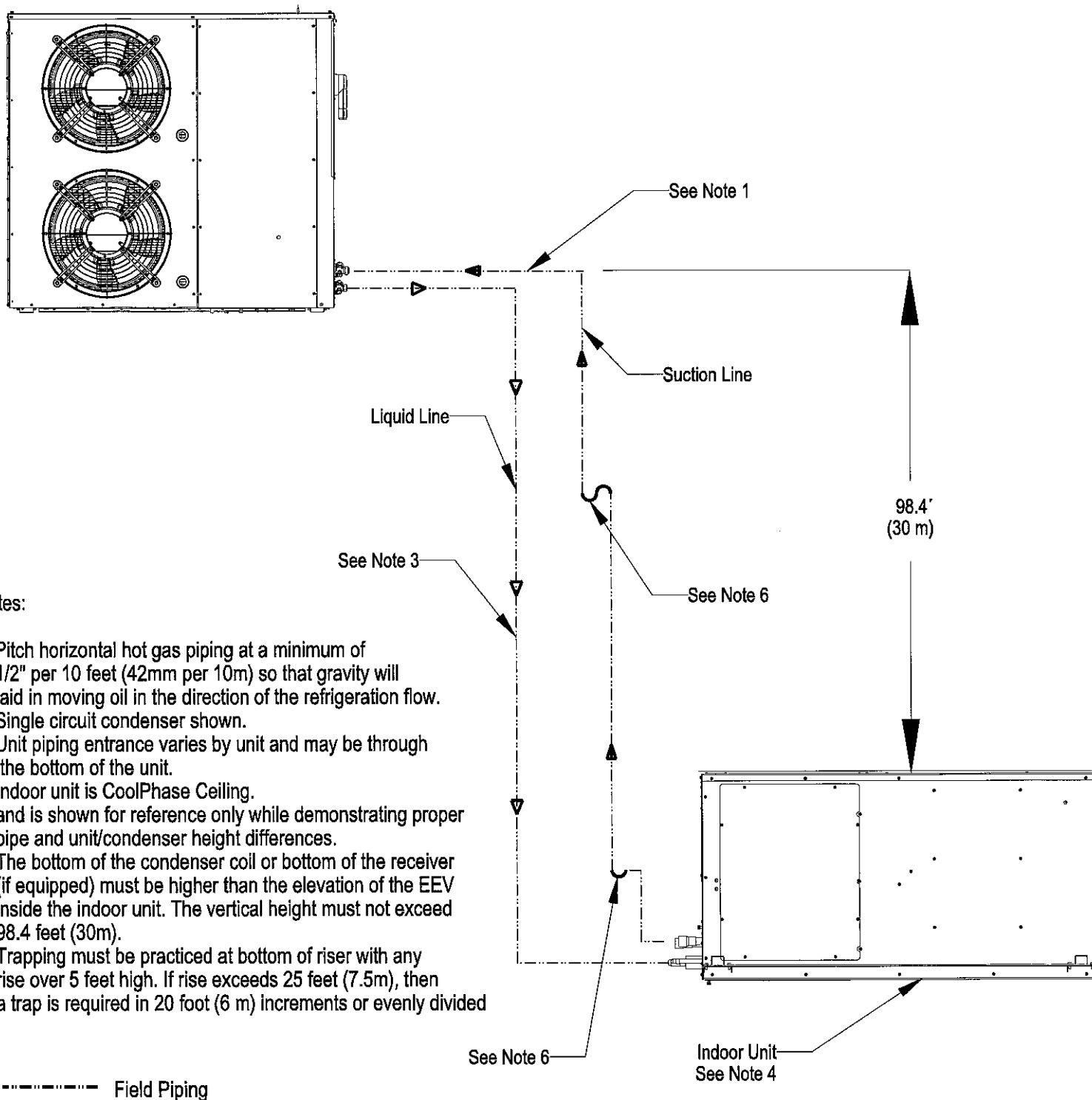
ELECTRICAL FIELD CONNECTIONS CONDENSER UNIT 15kW





VERTIV VERTIV COOLPHASE CONDENSING UNIT

PIPING SCHEMATIC CONDENSING UNIT ABOVE INDOOR UNIT 15 kW



Notes:

1. Pitch horizontal hot gas piping at a minimum of 1/2" per 10 feet (42mm per 10m) so that gravity will aid in moving oil in the direction of the refrigeration flow.
2. Single circuit condenser shown.
3. Unit piping entrance varies by unit and may be through the bottom of the unit.
4. Indoor unit is CoolPhase Ceiling and is shown for reference only while demonstrating proper pipe and unit/condenser height differences.
5. The bottom of the condenser coil or bottom of the receiver (if equipped) must be higher than the elevation of the EEV inside the indoor unit. The vertical height must not exceed 98.4 feet (30m).
6. Trapping must be practiced at bottom of riser with any rise over 5 feet high. If rise exceeds 25 feet (7.5m), then a trap is required in 20 foot (6 m) increments or evenly divided

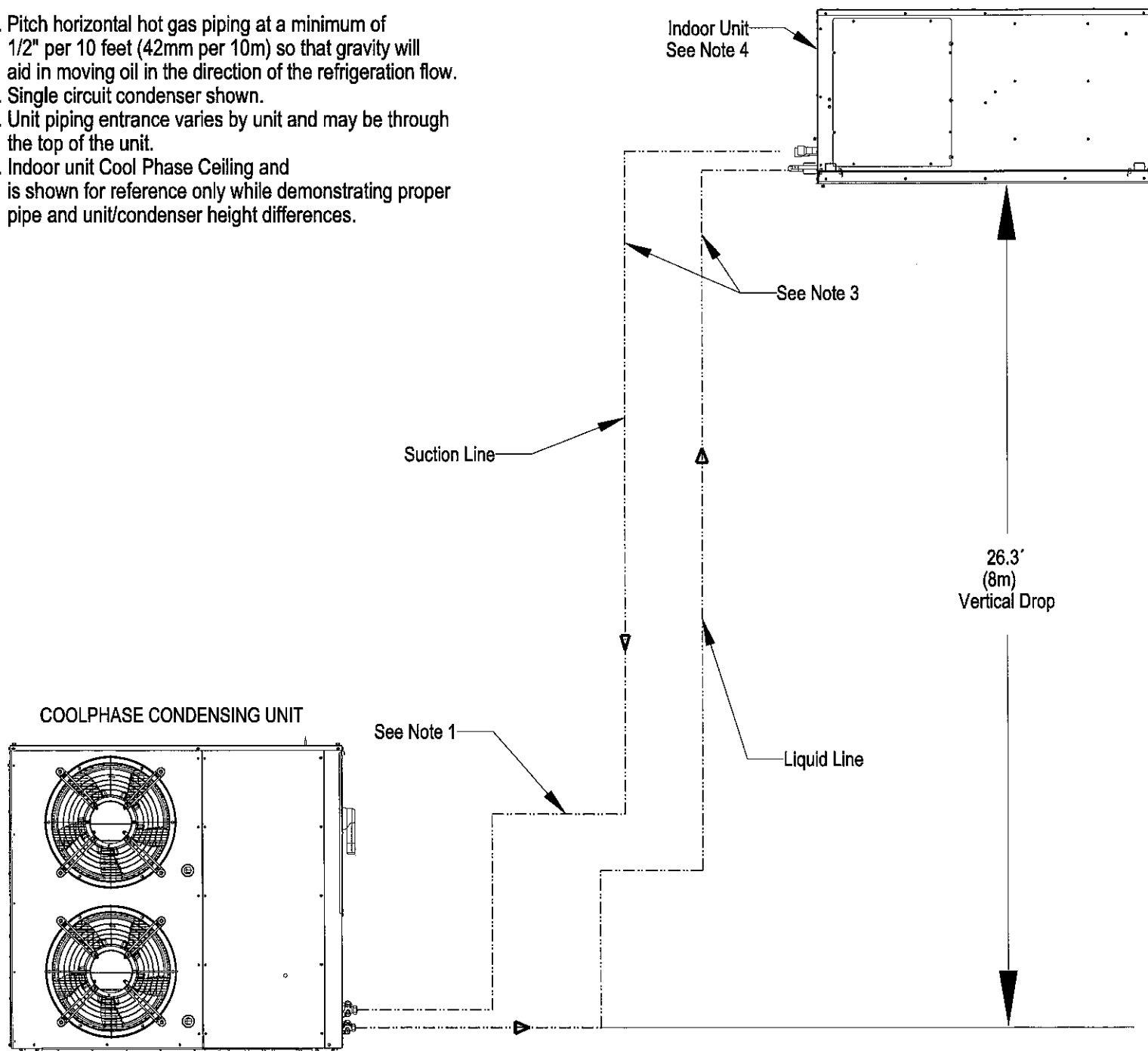


VERTIV VERTIV COOLPHASE CONDENSING UNIT

PIPING SCHEMATIC CONDENSING UNIT BELOW INDOOR UNIT 15kW

Notes:

1. Pitch horizontal hot gas piping at a minimum of 1/2" per 10 feet (42mm per 10m) so that gravity will aid in moving oil in the direction of the refrigeration flow.
2. Single circuit condenser shown.
3. Unit piping entrance varies by unit and may be through the top of the unit.
4. Indoor unit Cool Phase Ceiling and is shown for reference only while demonstrating proper pipe and unit/condenser height differences.





DX PRODUCTS WITH R32

A2L REFRIGERANT DISPERSAL VOLUME CALCULATION R32

Engineer of record to determine the Refrigerant Charge m_c and required minimum Effective Dispersal Volume V_{ED} of the space to which the appliance can be utilized for the cooling of ITE AREAS.

The required minimum EFFECTIVE DISPERSAL VOLUME V_{ED} is a function of the refrigerant charge, m_c and is represented by the following equation:

$$V_{ED} = m_c / 0.5 \times \text{LFL}$$

V_{ED} = the minimum Effective Dispersal Volume in ft^3 (m^3)

m_c = the refrigerant charge of the largest single circuit of a unit in lbs (kg)

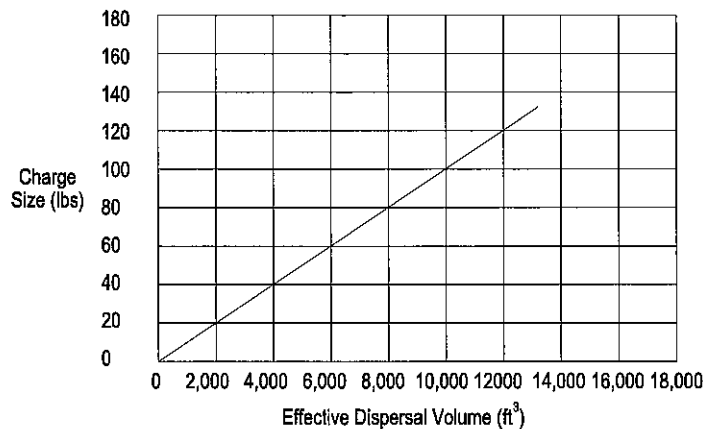
0.5 = the concentration factor

LFL = the Lower Flammability Limit in lbs/1000 ft^3 (kg/ m^3)

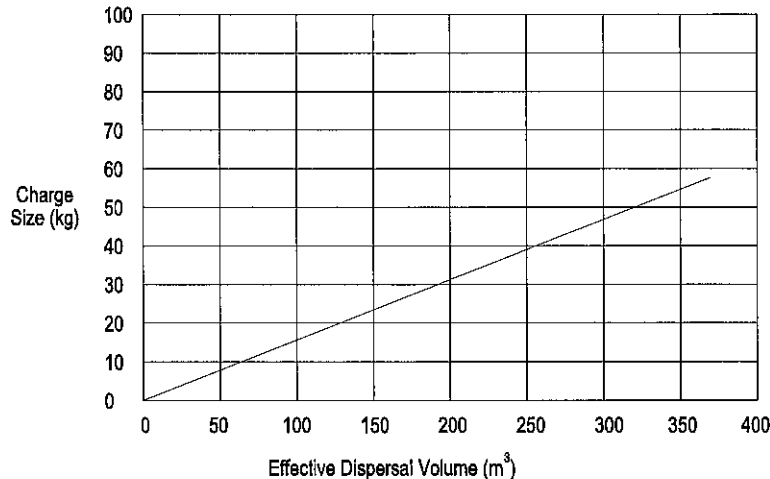
Note: The LFL of R32 is 19.2 lbs/1000 ft^3 (307.0 g/ m^3) according to ASHRAE 34-2022.

Minimum Effective Dispersal Volume V_{ED} of the space shall be based on altitude of the installation location. For locations above sea level, the engineer of record will need to adjust the value of LFL in accordance with ANSI/ASHRAE 34 before applying it to the equation for determining the required minimum Effective Dispersal Volume V_{ED} .

Charge Size vs. Effective Dispersal Volume



Charge Size vs. Effective Dispersal Volume





DX PRODUCTS WITH R32

A2L REFRIGERANT DISPERSAL VOLUME CALCULATION R32

How to Determine the Effective Dispersal Volume of an ITE Area

Volume Calculations shall be based on the overall volume of space available to which the refrigerant disperses within the CIRCULATION AIRFLOW in the event of a refrigerant leak. This overall volume shall be modified with the appropriate deductions. For the purposes of determining the EFFECTIVE DISPERSAL VOLUME of an ITE AREA the following shall apply:

- a) The EFFECTIVE DISPERSAL VOLUME shall only include the circulated airflow of the system.
- b) The EFFECTIVE DISPERSAL VOLUME shall initially include the ITE AREA enclosed by the floor, walls, and ceiling of that space.
- c) When the CIRCULATION AIRFLOW includes underfloor spaces, suspended ceiling spaces, or other partitioned spaces, such as equipment galleries, the volume of those spaces may be included.

In general, the volume of equipment, piping, wiring, or other apparatus that consume space within and are isolated from the CIRCULATION AIRFLOW shall be deducted from the EFFECTIVE DISPERSAL VOLUME. The following deductions shall be applied:

- a) When the CIRCULATION AIRFLOW has been fully contained on both hot and cold sides of the aisle, via ducts or other apparatus, any room volume outside of that containment shall not be included when calculating the EFFECTIVE DISPERSAL VOLUME.
- b) When the overall volume of space available, or a partitioned portion of that volume includes ducted openings from partially ducted systems, some volume of that space may require a deduction. No volume greater than 4 feet away in height from the upper most supply or return duct opening in the space may be included when calculating the EFFECTIVE DISPERSAL VOLUME, unless an analysis of the airflow has been conducted to show that the volume of air has effective movement for the mixing of a leaked refrigerant.
- c) Obstructions of tubing, piping, wiring, etc., consuming more than 0.0071 m^3 (0.25 ft^3) of space shall be included in the deductions from the overall volume.
- d) The ITE within the circulated airflow shall be evaluated for their deduction from the EFFECTIVE DISPERSAL VOLUME. The deducted volume of the ITE shall be based on the designed maximum capacity or fill of the servers.
- e) As a maximum value, no more than 75 % of the ITE's volume shall be included as circulating air space in the EFFECTIVE DISPERSAL VOLUME. The total volume of the ITE shall be defined by the overall dimensions of its ITE ENCLOSURE. Small gaps in between individual server racks shall not be included in the EFFECTIVE DISPERSAL VOLUME.
- f) Any other volume within the circulation airflow that is otherwise enclosed or partitioned off from the airflow shall be deducted in the calculation of the EFFECTIVE DISPERSAL VOLUME.



VERTIV COOLPHASE CEILING

STANDARD & OPTIONAL FEATURES

EVAPORATOR UNIT, 1-8TON

STANDARD FEATURES

EVAPORATOR COIL Constructed of soft copper tubes in a staggered tube pattern. Tubes are expanded into continuous high efficiency aluminum lance type fins. Coil is set in condensate drain pan, with float switch for unit shutdown. The evaporator drain is internally trapped.

REFRIGERATION SYSTEM Single refrigeration circuit, includes a liquid line filter drier, externally equalized expansion valve, and a suction pressure transducer. The module is pre-charged with nitrogen and sealed. R-32 refrigerant must be field supplied and field charged by others.

FAN ASSEMBLY Fan is plug type, with integral direct drive with backward curved blades and Electronically Commutated (EC) motor. The fan speed shall be variable and automatically regulated by the Liebert® iCOM™ control through all modes of operation. The impeller shall be made of aluminum and is dynamically balanced. The fan shall be located to draw air through the coil to ensure even air distribution and maximum coil performance.

LIEBERT® iCOM™ CONTROL SYSTEM The Liebert® iCOM™ controls the Liebert® CoolPhase Ceiling and enables Unit-to-Unit communication with other Liebert® CoolPhase Ceiling units.

BASE-COMMS FOR BMS CONNECTIVITY The Liebert® iCOM™ controller shall provide four ethernet ports dedicated for:

- 1) Unit-to-Unit A
- 2) Unit-to-Unit B
- 3) BMS Connectivity
- 4) Indoor-Outdoor Communication

TOUCH SCREEN DISPLAY The standard user interface is a remote wall mountable 9 inch color touch screen which presents system information and allows all parameters to be viewed and adjusted. The touch screen display comes in a plastic housing for mounting on the wall and is shipped loose with the unit

CABINET AND CHASSIS Constructed of galvanized steel for strength and corrosion resistance with thermal/acoustical insulation to reduce sound levels and prevent condensation. Removable panels allow access to the electric panel or refrigeration components for service or maintenance. Hanging brackets are integral to the chassis with vibration isolators and hardware provided for field supplied 3/8" threaded suspension rods.

UNIT PROTECTIONS AND CONTACTS include a filter clog switch, common alarm contact and remote shutdown contacts.

- Filter clog switch is provided to activate a Liebert® iCOM™ alarm when the pressure drop across the filter exceeds the customer adjustable level. Switch is adjustable outside the cabinet.
- Common Alarm Contact is one set of normally open contacts which close for remote indication of alarms.
- Remote Shutdown Contact allows unit shutdown based on external input

HIGH TEMPERATURE SENSOR senses the return air temperature, shuts down the unit if temperature reaches 125F (52C) and is a manual reset device not meant to replace any fire detection system that may be required by local or national codes.

TEMPERATURE AND HUMIDITY SENSORS are mounted in unit on the return air stream and wired to the Liebert® iCOM™ Control board.



VERTIV COOLPHASE CEILING

STANDARD & OPTIONAL FEATURES

EVAPORATOR UNIT, 1-8TON

OPTIONAL FEATURES

→ **LOCKING UNIT DISCONNECT SWITCH** includes a "Locking-Type" factory-mounted fused disconnect switch providing unit with a 5,000 Amp or 65,000 Amp short-circuit current rating (SCCR). Disconnect switch is mounted internally with locking and lockable handle operational from outside the unit. Access to high voltage electric panel can only be obtained with the switch in the "off" position, and the handle is lockable to support lockout/tagout safety programs.

→ **ELECTRIC REHEAT** Electric low watt density 304 stainless steel fin tubular reheat element provides one stage of reheat to maintain room dry bulb temperature during dehumidification and is protected by one automatic reset temperature switch and one manual reset temperature safety switch.

STEAM GENERATING CANISTER HUMIDIFIER is housed in a steel enclosure and includes a replaceable canister with all supply and drain valves, 1" (25mm) air gap on fill line, inlet strainer, steam distributor and electronic controls, including high water indicator. System automatically fills and drains and maintains the required water level based on conductivity. Humidifier Problem Alarm annunciates touchscreen display.

SMOKE SENSOR samples the return air, shuts down the unit upon detection, and sends visual and audible alarm. This smoke sensor is not intended to function as or replace any room smoke detection system that may be required by local or national codes. Smoke sensor trouble connections are available for external monitoring

FREE COOLING Air cooled coil, for alternate Water/Glycol Source, Constructed of soft copper tubes in a staggered tube pattern and Header tubes for inled and outlet. Tubes are expanded into continuous high efficiency aluminum lance type fins. Coil is set in condensate drain pan, with float switch for unit shutdown.



VERTIV COOLPHASE CEILING

STANDARD & OPTIONAL FEATURES

EVAPORATOR UNIT, 1-8TON

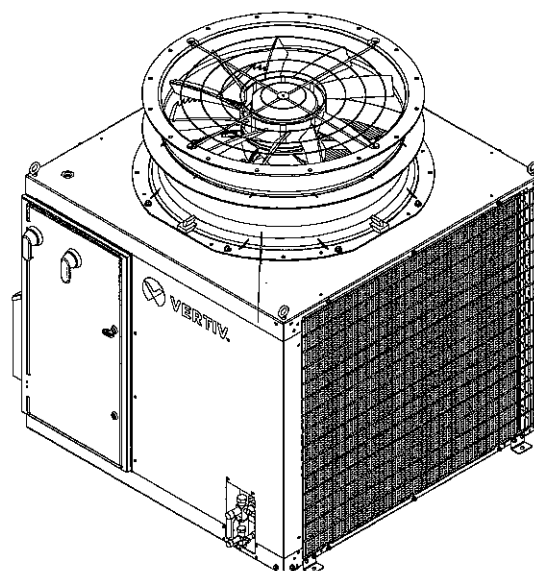
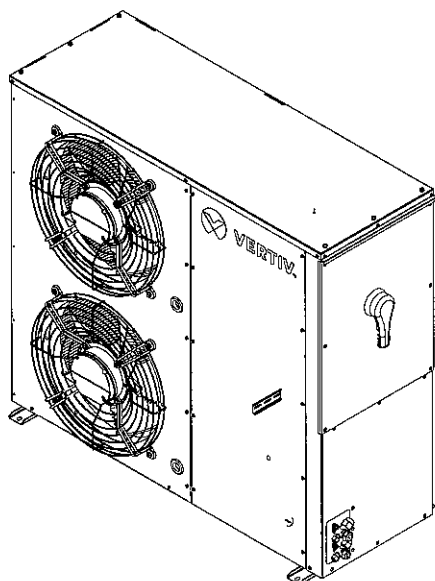
SHIP LOOSE OPTIONS

- **FILTER BOX** is constructed of galvanized steel, supplied with quantity of two nominal 20" (508mm) x 20" (508 mm) x 4" (102 mm) deep pleated MERV 8 filters (based on ASHRAE 52.2-2007). The box is provided with a 1" (25 mm) duct flange. The filters are accessible via a hinged access door, without shutting the unit down. The filter box option also includes a 1" (25 mm) discharge air duct collar.
- DUCT FLANGES** 1" (25mm) duct flanges for easy duct integration.
- BOTTOM DISCHARGE GRILLE** (1, 2 and 3 Ton models only) is a 3-way louvered air grille, painted white, added to a T-bar grid assembly for air discharge directly into room from bottom of unit. Kit includes air baffle and rear discharge block-off plates. Use separate filter box kit for filtration and connection to field provided room air return grille and ductwork.
- DISTRIBUTION PLENUM** (1, 2 and 3 Ton models only) Easily installed, self-contained air distribution plenum provides air discharge in three directions. The plenum is supplied with a nominal 16" (406mm) x 25" (535mm) x 4" (102mm) deep pleated MERV 8 filter (based on ASHRAE 52.2-2007).
- **CONDENSATE PUMP** has a capacity of 7.5 GPM (28.4 l/m) at 10 ft feet of head for 460/575V units, and 5.1 GPM (19.3 l/m) for 208/230 volt units at 10 ft. of head. Pump assembly is complete with pump, motor assembly, reservoir, integral float switch, and auxiliary safety float switch to shut unit off in event of pump failure. Pump assembly is designed to mount on the side of the evaporator (indoor) module, or other suitable means to allow condensate drainage into the reservoir. The condensate pump is field-mounted on the outside of the cabinet, and is field-wired to the evaporator/fan-coil electric panel for both power supply and float switch interlock. Separate power feed is not necessary.
- **TEMPERATURE AND HUMIDITY SENSORS** are mounted in an attractive case with 30 ft. (9m) of cable, it is shipped loose and ready to be field mounted on the room wall or in unit return air stream and field wired to the Liebert® ICOM™ Control board.



VERTIV™ VERTIV COOLPHASE CONDENSING UNIT

STANDARD & OPTIONAL FEATURES CONDENSER UNIT 15, 21 & 28kW



STANDARD FEATURES

COIL. Vertiv CoolPhase® Condensing Unit is an aluminum construction. Tubes are created by extruding small parallel refrigerant flow paths into aluminum. Full-depth louvered aluminum fins fill spaces between the tubes. Tubes, fins and aluminum headers are oven-brazed to form a complete refrigerant-to-air heat exchange coil. Baffles are used in the headers to separate one coil slab into multiple passes as needed. Coils are factory leak tested at a minimum of 300 PSIG and dehydrated. Copper stub pipes are electric resistance welded to aluminum coils and joints are protected with polyolefin to seal joint from environmental corrosive elements. Hot gas and liquid lines are brazed to the stub pipes with spun closed ends for customer piping connections. Coil pipe assemblies are filled and sealed with a nitrogen holding charge for shipment. One coil is used per fan assembly.

FAN/MOTOR ASSEMBLY The fan/motor assembly is complete with external rotor motor, fan blades and fan/finger guard. Fan blades are constructed of stamped aluminum or steel extrusion coated with PP plastic. Fan guards are heavy gauge, close meshed, steel wire, coated with a black corrosion resistant finish. Fan terminal blocks located on the top of the fan guard with IP54 protection class. Fans are factory balanced and tested before shipment.

FAN MOTORS Fan motors are specifically designed for variable speed and have ball bearings. The EC fans provide internal overload protection through the built-in electronics. Each EC fan motor has built-in controller and communication module, linked via RS485 communication wire to each fan and the Premium Control Board. This allows each fan to receive and respond to precise fan speed inputs from the Premium control board.

COMPRESSOR. The compressor uses environmentally friendly R-32 refrigerant with Asymmetric Oval Scroll Technology, High Efficiency Low Noise Motor with solenoid valve unloads the compressor to provide variable capacity operation. The compressor has a suction gas cooled motor, vibration isolators, internal thermal overloads, low pressure and high pressure transducer, crankcase heater, internal centrifugal oil pump, and an operating speed of 3600 RPM @ 60Hz.

PREMIUM EFFICIENCY FAN CONTROL The premium efficiency condenser control system is complete with control board, EC fan motor(s), refrigerant-pressure transducer(s), refrigerant-temperature thermistor(s), ambient-temperature thermistor, and motor overload protection in the factory wired control panel. The control board maintains EC fans on the same circuit to the same speed in order to maintain refrigerant head pressure. The control board receives a run signal from the compressor of the indoor unit via field-supplied low voltage interlock wires and field-supplied CANbus communication wires from the indoor unit Liebert® iCOM™. The control system provides refrigerant head pressure and system starting for outdoor ambient temperature as low as -30° F (-35° C), provided the total temperature design range (from minimum to maximum) is 125° F (70° C) or less.

HOUSING The condenser housing is constructed of bright aluminum sheet and divided into individual fan sections by full width baffles. Internal structural support members, including coil support frame, are galvanized steel for strength and corrosion resistance. Panel doors are provided on two sides of each coil/fan section to provide for coil cleaning. Aluminum legs are provided with rigging holes for hoisting the unit into position.



VERTIV™ VERTIV COOLPHASE CONDENSING UNIT

STANDARD & OPTIONAL FEATURES CONDENSER UNIT 15, 21 & 28kW

COMMUNICATION The Premium Efficiency Control communicates with the Liebert® iCOM™ control of the indoor Liebert unit using field supplied CANbus wires. The communication link allows for condenser alarm condition communication to Liebert® iCOM™, communication of other measurable items on the condenser, and fan control features to improve efficiency, sound and wintertime operation based on Liebert® iCOM™ programming.

UNIT DISCONNECT SWITCH Locking unit disconnect switch is factory installed and wired in attached condenser control section.

OPTIONAL FEATURES

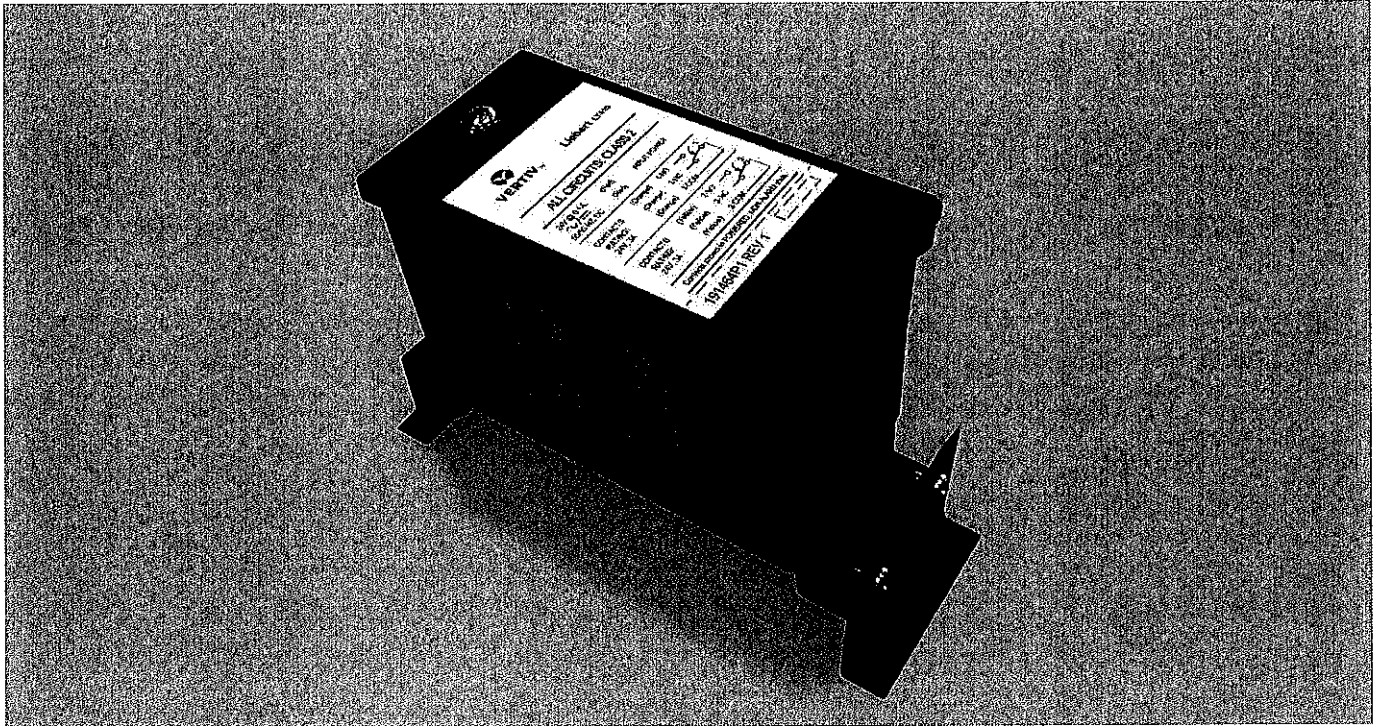
VERTIV COOLPHASE CONDENSING UNIT TEMP LOW AMBIENT CONTROL receiver kits can be added to achieve head pressure control down to minimum ambient temperatures of -30 °F (-34 °C). The premium efficiency fan control when used with the Temp receiver kits runs the fan(s) at lower speeds during cold temperatures saving fan energy.

E-COAT COIL PROTECTION The aluminum microchannel coil is epoxy-coated for extended coil life in corrosive environments, such as coastal areas. Factory-applied E-coat using immersion and baking process provides a flexible epoxy-coating to all coil surfaces and ensures complete coil encapsulation. Coil color is black and a factory-applied UV topcoat protects the E-coat from solar UV ray degradation.

LIEBERT® LIQUI-TECT™ 410

POINT LEAK DETECTION SENSOR

Product Specification/Installation Guide



The Liebert® Liqui-Tect™ 410 (LT410) provides single-point detection of leaks. The point-detection sensor has two gold-plated sensing probes to prevent corrosion and to provide accurate readings. The LT410 constantly monitors for leaks, internal faults, and power failures and warns of any abnormal conditions. Mounting brackets allow for sensor height adjustment and leveling.

The LT410 is the ideal solution for sensing leaks under a raised computer floor or air conditioning drip pans. Two independent outputs provide added flexibility with the capacity to signal both a local alarm panel, Liebert cooling unit and a remote building management system or external equipment, such as motorized water shutoff valves.

LT410 APPLICATIONS

The LT410 is ideally suited for:

- Glycol and chilled water cooling,
- Humidification supply water piping,
- Condensate pumps and drains,
- Unit and ceiling auxiliary drip pans,
- Overhead piping troughs.

LOCATIONS/PLACEMENT

The LT410 is an excellent choice for:

- Large scale network control centers,
- Data centers,
- Server rooms and closets,
- Unattended, remote shelters,
- Mechanical equipment rooms,
- Sensitive areas with overhead piping,
- Industrial process control rooms.

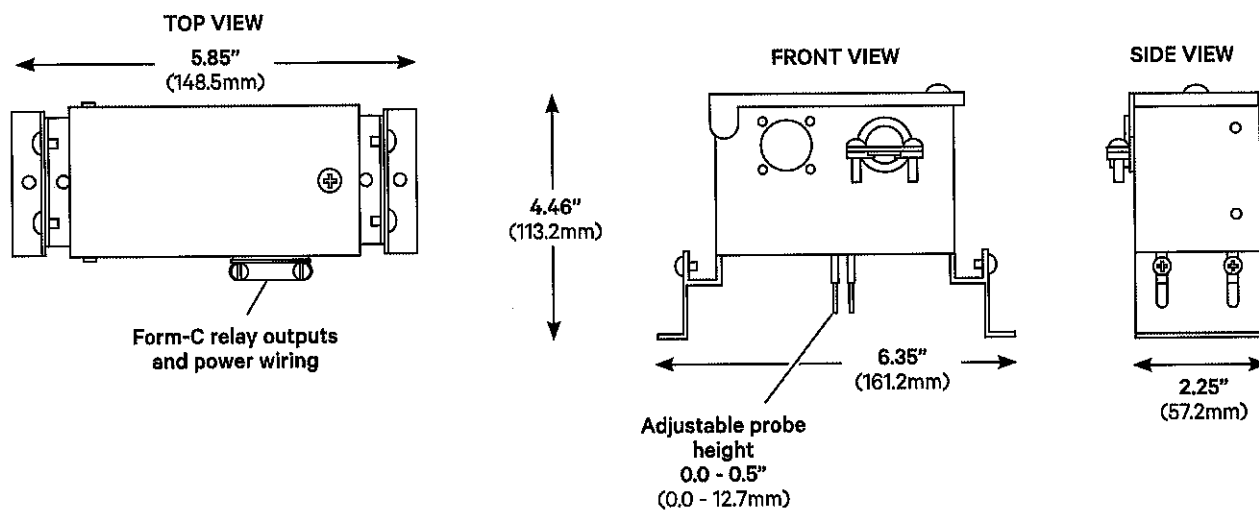
COMPONENTS OF THE LIQUI-TECT™ 410 MODULE

The LT410 consists of a metal enclosure with a hinged top door that provides access to the internal wiring termination. It includes side access through a box connector for installation of the power and contact wiring. The mounting brackets attach to the enclosure with adjustable slots to allow custom setting of the height of the sensing probes.

LIEBERT® LIQUI-TECT™ 410 POINT LEAK DETECTION SENSOR
Product Specification/Installation Guide



**DIMENSIONS -
TOP, FRONT AND SIDE**



SPECIFICATIONS

Power Requirements	24 VAC 100 mA, 50/60 Hz, 3 VA (max.)
Dimensions, W x D x H	6.35 in. x 2.25 in. x 4.46 in. (161.2 mm x 57.2 mm x 113.2 mm)
Weight (assembled)	2.0 lb. (0.9 kg)
Metal Enclosure	NEMA 1, IP 30

ENVIRONMENTAL CONDITIONS

Operating Temperature	50°F to 104°F (10°C to 40°C)
Operating Humidity	10% to 95% relative humidity (non-condensing)
Operating Altitude	0 to 10,000 ft. (0 to 3,048 m)
Output Relay Contact Rating	2 Form-C; 3 A rating at 24 VAC

AGENCY LISTINGS

UL	UL916
C-UL	C22.2, No. 205-M1983
CE	Yes
FCC Compliance	47 CFR, Part 15