VERTIV.

Liebert®

CW™ Thermal Management System

System Design Catalog

305 kW, 375 kW, 415 kW Capacity, 50/60 Hz

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TABLE OF CONTENTS

1 Nomenclature and Components **1**
1.1 Liebert CW Model-number Nomenclature 1
1.2 Component Location 4
1.3 Blower Configurations 5
2 System Data **9**
2.1 Capacity and Performance Data 9
2.2 Physical Data 15
3 Electrical Requirements **17**
3.1 Electrical Power Requirements 17
3.2 Electrical Field Connections 17
4 Planning Guidelines **19**
4.1 Shipping Dimensions and Unit Weights 19
4.2 Planning Dimensions 19
5 Piping **21**
Appendices **23**
Appendix A: Technical Support and Contacts 23
Appendix B: Submittal Drawings 25
Appendix C: Guide Specifications 27

1 NOMENCLATURE AND COMPONENTS

This section describes the number for Liebert® CW units and components.

1.1 Liebert CW Model-number Nomenclature

The following tables describe each digit of the configuration number. The 14-digit model number consists of the first 10 digits and last 4 digits of the configuration number.

Table 1.1 CW Model Number Example Digits 1 to 10

1	2	3	4	5	6	7	8	9	10
C	W	4	1	5	D	1	3	A	1

Table 1.2 CW Configuration-number Detail Digits 11 to 25 Example

11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
1	2	0	8	1	0	L	0	0	0	P	0	0	0	0

Table 1.3 CW onfiguration-number Detail Digits 26 to 36

26	27	28	29	30	31	32	33	34	35	36
0	0	0	0	0	0	0	0	0	0	0

Table 1.4 CW Model Number Digits 37 to 40 Example

37	38	39	40
#	#	#	A

Table 1.5 CW Model-number Digit Definitions

Digit	Description
Digits 1 and 2 = Unit Family	CW = Liebert® CW floor-mounted, chilled-water unit
Digit 3, 4, 5 = Nominal Cooling Capacity, kW	305 = 305 kW 375 = 375 kW 415 = 415 kW
Digit 6 = Air Distribution	H = Horizontal discharge D =Bottom discharge
Digit 7 = Electric Panel Options	1 =Data hall or Bottom discharge, left electric panel 2 = Data hall or Bottom discharge, right electric panel 3 = Gallery, left electric panel 4 = Gallery, right electric panel

Table 1.5 CW Model-number Digit Definitions (continued)

Digit	Description
Digit 8 = Fan Type	
	3 = Direct-drive + VFD
	T = Direct-drive + VFD + THD
Digit 9 = Voltage	
	A = 460 V - 3 ph - 60 Hz
	B = 575 V - 3 ph - 60 Hz
	2= 380 V - 3 ph - 60 Hz
	M= 380-415 V - 3 ph - 50 Hz
Digit 10 = Valve Type	
	1 = 2-way, fail-in-place, 400 PSI
	4 = 2-way, fail open, 400 PSI
	5 = 2-way, fail closed, 400 PSI
Digit 11 = Agency	
	1 = CSA
Digit 12 = Display/Microprocessor Control	
	2 = iCOM (high-definition)
Digit 13 = Humidification	
	0 = None
Digit 14 = Air Filter	
	8 = 4-in. MERV 8
	9 = 4-in. MERV 11
Digit 15 = Coil	
	2 = Hydrophilic coated evap coil
Digit 16 = Seismic	
	0 = None
Digit 17 = High-voltage Options	
	L = Locking disconnect
	S = Dual locking disconnect with reversing starter + Capacitive buffer
Digit 18 = Option packages	
	0 = None
	L = Low-voltage terminal package
	R = Remote-humidifier contact
	D - Low-voltage terminal package + Remote-humidifier contact

Table 1.5 CW Model-number Digit Definitions (continued)

Digit	Description
Digit 19 = Monitoring B = Base Comms & Connectivity X = Base Comms + Etherernet +RS485 (SFA) R = Base Comms +SiteScan RS485 Expansion (SFA)	
Digit 20 = Sensors 0 = None S = Smoke H = High-temperature F = Smoke and High-temperature	
Digit 21 = Packaging P = Domestic C = Export	
Digit 22, 23, 24, 25 = Placeholder 0 = Placeholder	
Digit 26 = Power Meter 0 = None P = Power Meter	
Digits 27 and 28 = Placeholder 0 = Placeholder	
Digit 29 = Condensate Pump 0 = None C = Condensate pump	
Digit 30 to 36 0 = Placeholder	
Digit 37 to 39 = Factory Configuration Number	
Digit 40 = Configuration Code A = No SFA S = SFA	

1.2 Component Location

The unit component locations are described in the submittal documents included in the Submittal Drawings on page 25.

The following table lists the relevant documents by number and title.

Table 1.6 Component-location Drawings

Document Number	Title
DPN004861	Component Location, Horizontal Discharge
DPN004899	Component Location, Bottom Discharge

1.3 Blower Configurations

Figure 1.1 Downflow, horizontal-discharge blower configurations with EC fans

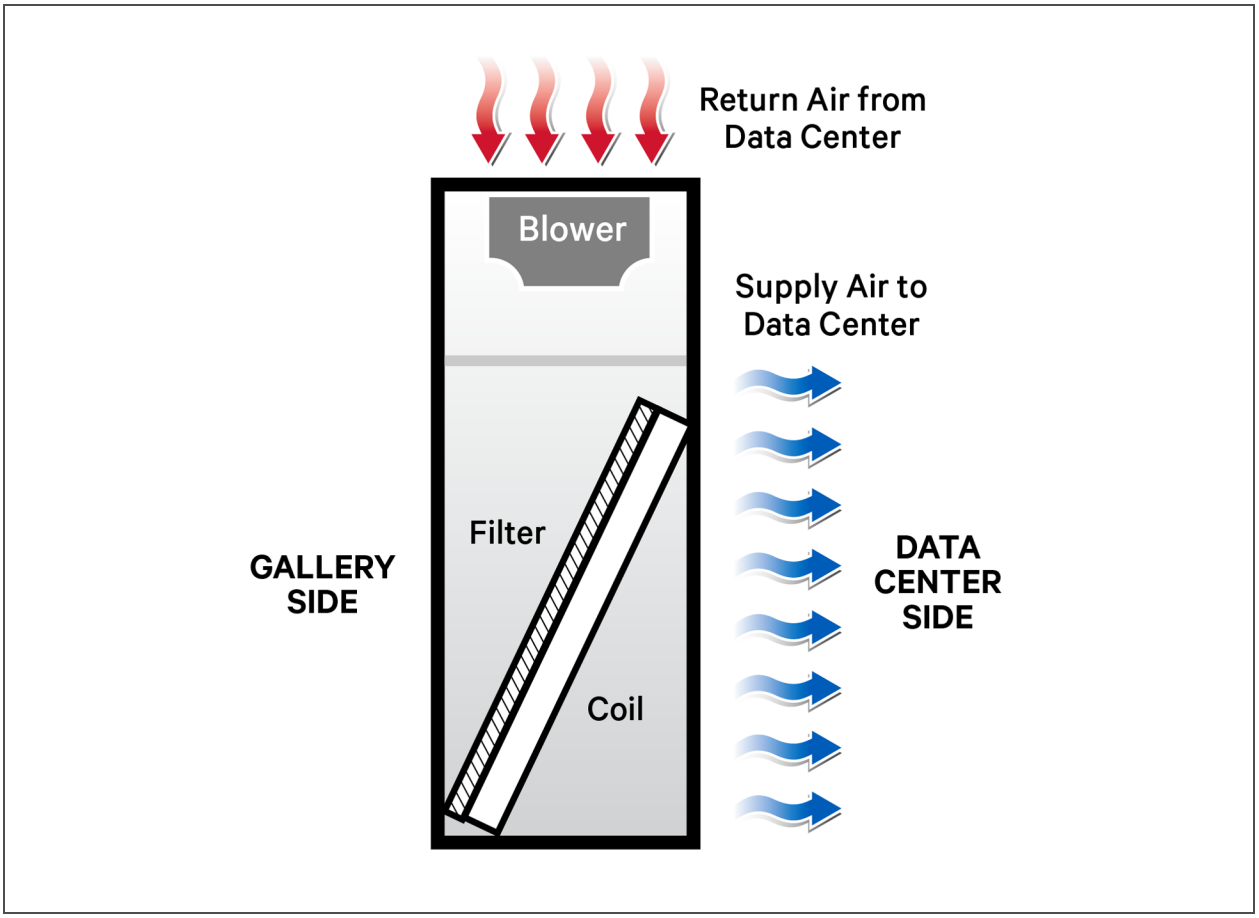


Figure 1.2 Downflow, horizontal-discharge blower configurations with EC fans on a floor stand

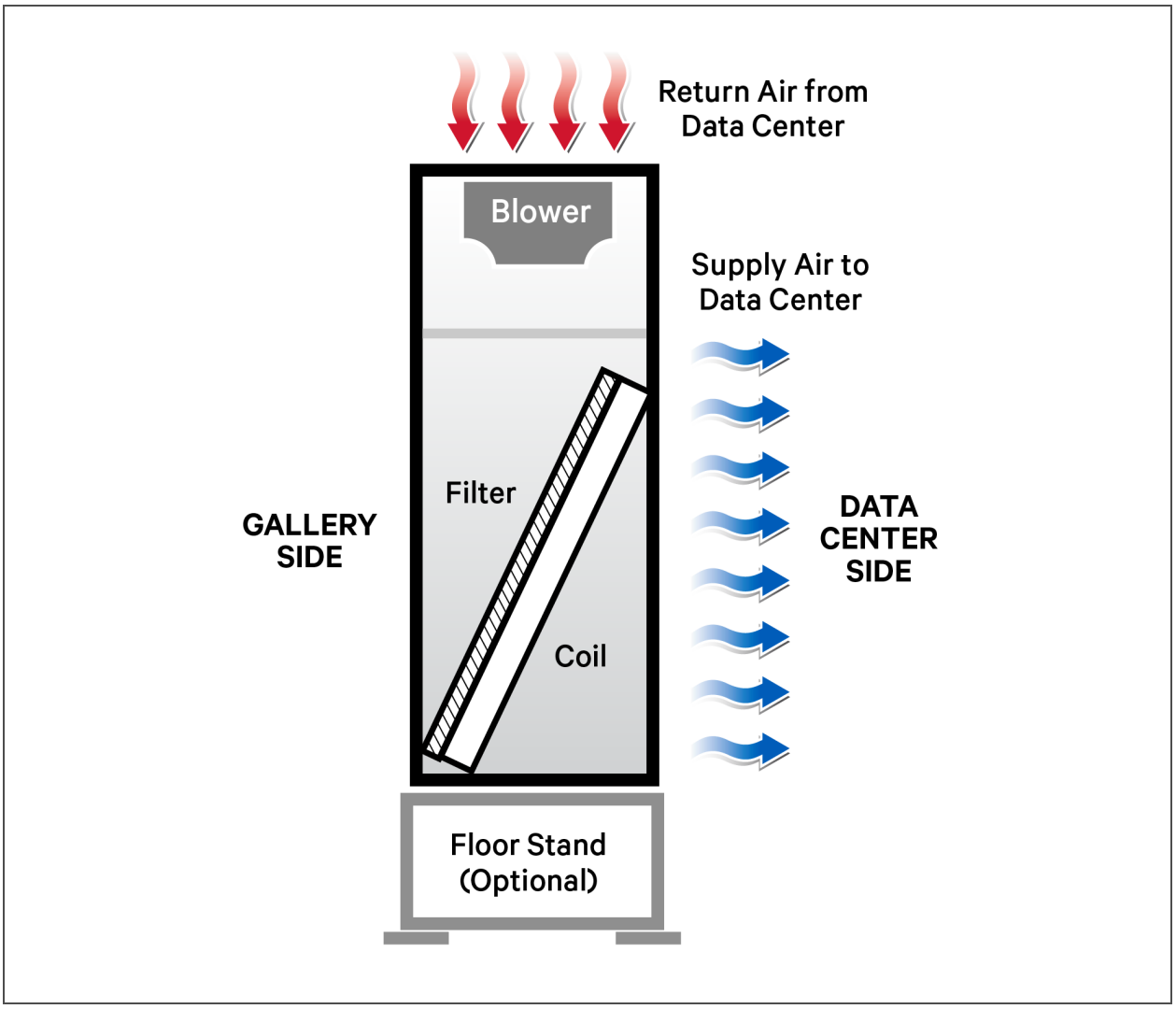
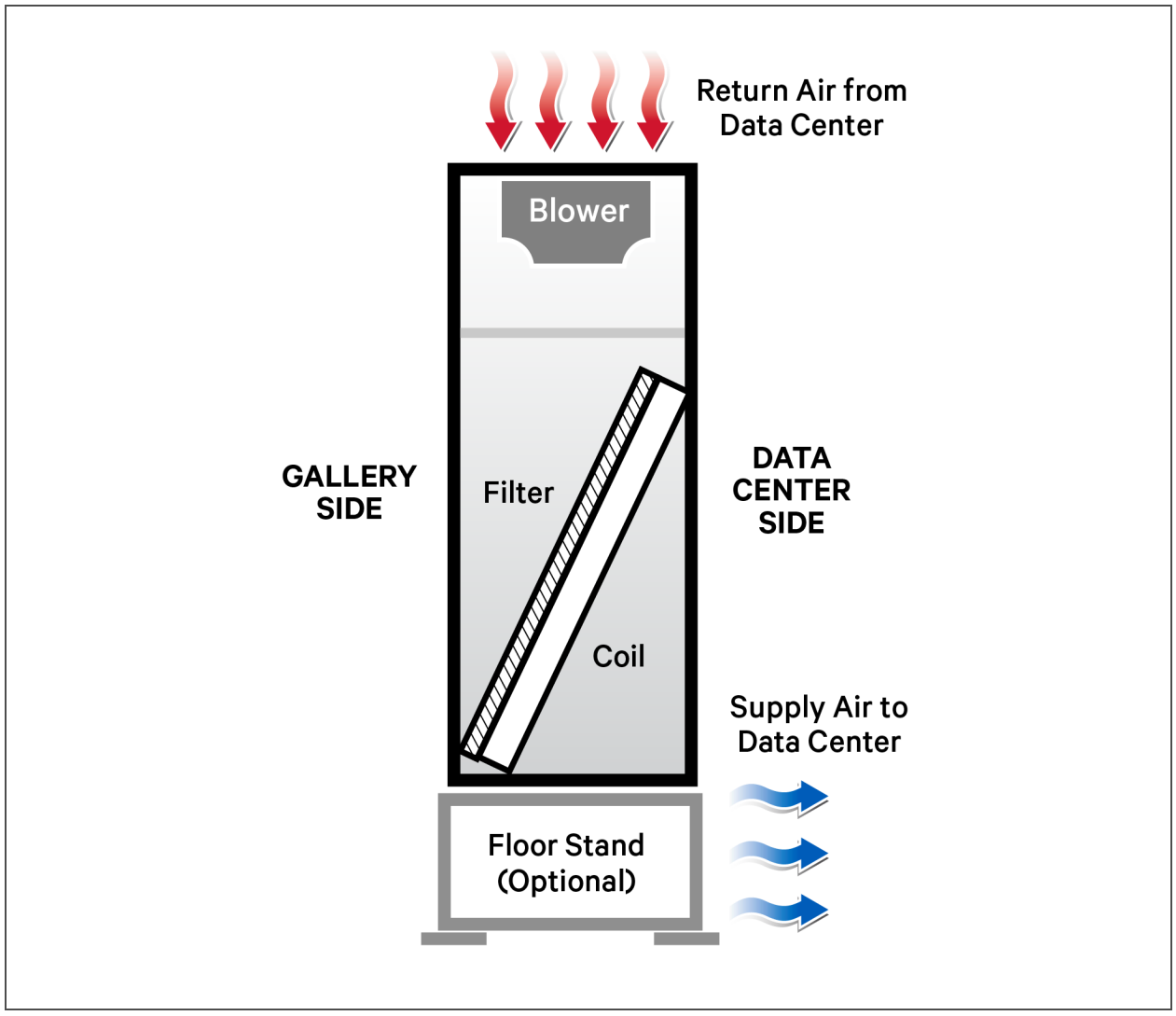


Figure 1.3 Downflow, bottom-discharge blower configurations with EC fans



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2 SYSTEM DATA

2.1 Capacity and Performance Data

Table 2.1 35,000 ACFM Net Capacity Data, kW (kBTUH) Based on 45°F (7.2°C) Entering Water, 10°F (5.5°C) Water Rise, 50/60-Hz Models

Model No.	305	375	415
75°F DB, 61°F WB, 52°F DP, 44% RH (23.9°C DB, 16.1°C WB)			
Total Capacity, kW (kBTUH)	242 (826)	304 (1,037)	343 (1,170)
Sensible Capacity, kW (kBTUH)	228 (778)	267 (911)	288 (983)
Flow Rate, GPM (lps)	175 (11)	219 (13.8)	247 (15.5)
Unit Pressure Drop, ft of Water (kPA)	19 (57)	38 (114)	57 (170)
80°F DB, 62.7°F WB, 52°F DP, 38% RH (26.7°C DB, 17.1°C WB)			
Total Capacity, kW (kBTUH)	291 (993)	358 (1,221)	399 (1,361)
Sensible Capacity, kW (kBTUH)	276 (942)	319 (1,088)	341 (1,163)
Flow Rate, GPM (lps)	208 (13.1)	256 (16.2)	285 (18)
Unit Pressure Drop, ft of Water (kPA)	27 (81)	51 (152)	74 (221)
85°F DB, 64.4°F WB, 52°F DP, 32% RH (29.4°C DB, 18°C WB)			
Total Capacity, kW (kBTUH)	339 (1,157)	411 (1,402)	452 (1,542)
Sensible Capacity, kW (kBTUH)	323 (1,102)	370 (1,262)	394 (1,344)
Flow Rate, GPM (lps)	240 (15.1)	292 (18.4)	321 (20.2)
Unit Pressure Drop, ft of Water (kPA)	35 (105)	64 (191)	92 (275)
Fan Data - EC Fans - Available in Downflow Orientations			
Return Air Volume, ACFM (ACMH)	35,000 (59,465)	35,000 (59,465)	35,000 (59,465)
Fan Motor, Maximum hp (kW), each	15 (11.2)	15 (11.2)	15 (11.2)
Number of Fans	3	3	3
External Static Unit Pressure, in.w.g. (Pa)	0.2 (50)	0.2 (50)	0.2 (50)

1. Some options or combinations of options may result in reduced air flow. Consult factory for recommendations.
2. Net capacity data has fan motor heat factored in for all ratings.
3. Consult factory for alternate performance outputs.

Table 2.2 35,000 ACFM Net Capacity Data, kW (kBTU/H) Based on 45°F (7.2°C) Entering Water, 12°F (6.66°C) Water Rise, 50/60-Hz Models

Model No.	305	375	415
75°F DB, 61°F WB, 52°F DP, 44% RH (23.9°C DB, 16.1°C WB)			
Total Capacity, kW (kBTUH)	217 (740)	286 (976)	325 (1,109)
Sensible Capacity, kW (kBTUH)	214 (730)	258 (880)	279 (952)
Flow Rate, GPM (lps)	132 (8.3)	173 (10.9)	196 (12.4)
Unit Pressure Drop, ft of Water (kPA)	11 (33)	25 (75)	38 (114)
80°F DB, 62.7°F WB, 52°F DP, 38% RH (26.7°C DB, 17.1°C WB)			
Total Capacity, kW (kBTUH)	267 (911)	342 (1,167)	383 (1,307)
Sensible Capacity, kW (kBTUH)	263 (897)	311 (1,061)	334 (1,140)
Flow Rate, GPM (lps)	160 (10.1)	204 (12.8)	228 (14.4)
Unit Pressure Drop, ft of Water (kPA)	16 (48)	33 (99)	50 (149)
85°F DB, 64.4°F WB, 52°F DP, 32% RH (29.4°C DB, 18°C WB)			
Total Capacity, kW (kBTUH)	316 (1,078)	395 (1,348)	439 (1,498)
Sensible Capacity, kW (kBTUH)	311 (1,061)	362 (1,235)	387 (1,320)
Flow Rate, GPM (lps)	188 (11.8)	234 (14.8)	261 (16.4)
Unit Pressure Drop, ft of Water (kPA)	22 (66)	43 (129)	63 (188)
Fan Data - EC Fans - Available in Downflow Orientations			
Return Air Volume, ACFM (ACMH)	35,000 (59,465)	35,000 (59,465)	35,000 (59,465)
Fan Motor, Maximum hp (kW), each	15 (11.2)	15 (11.2)	15 (11.2)
Number of Fans	3	3	3
External Static Unit Pressure, in.w.g. (Pa)	0.2 (50)	0.2 (50)	0.2 (50)

1. Some options or combinations of options may result in reduced air flow. Consult factory for recommendations.
2. Net capacity data has fan motor heat factored in for all ratings.
3. Consult factory for alternate performance outputs.

Table 2.3 36,500 ACFM Net Capacity Data, kW (kBTU/H) Based on 45°F (7.2°C) Entering Water, 10°F (5.5°C) Water Rise, 50/60-Hz Models

Model No.	305	375	415
75°F DB, 61°F WB, 52°F DP, 44% RH (23.9°C DB, 16.1°C WB)			
Total Capacity, kW (kBTUH)	249 (850)	313 (1,068)	355 (1,211)
Sensible Capacity, kW (kBTUH)	235 (802)	276 (942)	299 (1,020)
Flow Rate, GPM (lps)	181 (11.4)	226 (14.3)	258 (16.3)
Unit Pressure Drop, ft of Water (kPA)	20 (60)	40 (120)	62 (185)
80°F DB, 62.7°F WB, 52°F DP, 38% RH (26.7°C DB, 17.1°C WB)			
Total Capacity, kW (kBTUH)	300 (1,024)	370 (1,262)	413 (1,409)
Sensible Capacity, kW (kBTUH)	285 (972)	331 (1,129)	355 (1,211)
Flow Rate, GPM (lps)	215 (13.6)	266 (16.7)	297 (18.7)
Unit Pressure Drop, ft of Water (kPA)	28 (84)	54 (161)	80 (239)
85°F DB, 64.4°F WB, 52°F DP, 32% RH (29.4°C DB, 18°C WB)			
Total Capacity, kW (kBTUH)	349 (1,191)	424 (1,447)	469 (1,600)
Sensible Capacity, kW (kBTUH)	334 (1,140)	384 (1,310)	409 (1,396)
Flow Rate, GPM (lps)	249 (15.7)	302 (19)	336 (21.1)
Unit Pressure Drop, ft of Water (kPA)	37 (111)	68 (203)	100 (299)
Fan Data - EC Fans - Available in Downflow Orientations			
Return Air Volume, ACFM (ACMH)	36,500 (62,013)	36,500 (62,013)	36,500 (62,013)
Fan Motor, Maximum hp (kW), each	15 (11.2)	15 (11.2)	15 (11.2)
Number of Fans	3	3	3
External Static Unit Pressure, in.w.g. (Pa)	0.2 (50)	0.2 (50)	0.2 (50)

1. Some options or combinations of options may result in reduced air flow. Consult factory for recommendations.
2. Net capacity data has fan motor heat factored in for all ratings.
3. Consult factory for alternate performance outputs.

Table 2.4 36,500 ACFM Net Capacity Data, kW (kBTU/H) Based on 45°F (7.2°C) Entering Water, 12°F (6.66°C) Water Rise, 50/60-Hz Models

Model No.	305	375	415
75°F DB, 61°F WB, 52°F DP, 44% RH (23.9°C DB, 16.1°C WB)			
Total Capacity, kW (kBTUH)	222 (757)	296 (1,010)	336 (1,146)
Sensible Capacity, kW (kBTUH)	220 (751)	267 (911)	290 (989)
Flow Rate, GPM (lps)	136 (8.5)	180 (11.3)	204 (12.8)
Unit Pressure Drop, ft of Water (kPA)	12 (36)	27 (81)	40 (120)
80°F DB, 62.7°F WB, 52°F DP, 38% RH (26.7°C DB, 17.1°C WB)			
Total Capacity, kW (kBTUH)	274 (935)	353 (1,204)	397 (1,355)
Sensible Capacity, kW (kBTUH)	271 (925)	322 (1,099)	347 (1,184)
Flow Rate, GPM (lps)	165 (10.4)	212 (13.3)	238 (15)
Unit Pressure Drop, ft of Water (kPA)	17 (51)	36 (108)	54 (161)
85°F DB, 64.4°F WB, 52°F DP, 32% RH (29.4°C DB, 18°C WB)			
Total Capacity, kW (kBTUH)	324 (1,105)	409 (1,396)	455 (1,552)
Sensible Capacity, kW (kBTUH)	321 (1,095)	376 (1,283)	402 (1,372)
Flow Rate, GPM (lps)	194 (12.2)	243 (15.3)	271 (17.1)
Unit Pressure Drop, ft of Water (kPA)	23 (69)	46 (137)	68 (203)
Fan Data - EC Fans - Available in Downflow Orientations			
Return Air Volume, ACFM (ACMH)	36,500 (62,013)	36,500 (62,013)	36,500 (62,013)
Fan Motor, Maximum hp (kW), each	15 (11.2)	15 (11.2)	15 (11.2)
Number of Fans	3	3	3
External Static Unit Pressure, in.w.g. (Pa)	0.2 (50)	0.2 (50)	0.2 (50)

1. Some options or combinations of options may result in reduced air flow. Consult factory for recommendations.
2. Net capacity data has fan motor heat factored in for all ratings.
3. Consult factory for alternate performance outputs.

Table 2.5 42,000 ACFM Net Capacity Data, kW (kBTU/H) Based on 45°F (7.2°C) Entering Water, 10°F (5.5°C) Water Rise, 50/60-Hz Models

Model No.	305	375	415
75°F DB, 61°F WB, 52°F DP, 44% RH (23.9°C DB, 16.1°C WB)			
Total Capacity, kW (kBTUH)	272 (928)	348 (1,187)	400 (1,365)
Sensible Capacity, kW (kBTUH)	260 (887)	311 (1,061)	339 (1,157)
Flow Rate, GPM (lps)	201 (12.7)	256 (16.2)	296 (18.6)
Unit Pressure Drop, ft of Water (kPA)	25 (75)	51 (152)	80 (239)
80°F DB, 62.7°F WB, 52°F DP, 38% RH (26.7°C DB, 17.1°C WB)			
Total Capacity, kW (kBTUH)	327 (1,116)	412 (1,406)	466 (1,590)
Sensible Capacity, kW (kBTUH)	316 (1,078)	373 (1,273)	403 (1,375)
Flow Rate, GPM (lps)	240 (15.1)	300 (18.9)	341 (21.5)
Unit Pressure Drop, ft of Water (kPA)	35 (105)	68 (203)	100 (299)
85°F DB, 64.4°F WB, 52°F DP, 32% RH (29.4°C DB, 18°C WB)			
Total Capacity, kW (kBTUH)	381 (1,300)	474 (1,617)	530 (1,808)
Sensible Capacity, kW (kBTUH)	371 (1,266)	433 (1,477)	465 (1,587)
Flow Rate, GPM (lps)	276 (17.4)	343 (21.6)	383 (24.1)
Unit Pressure Drop, ft of Water (kPA)	45 (135)	86 (257)	130 (389)
Fan Data - EC Fans - Available in Downflow Orientations			
Return Air Volume, ACFM (ACMH)	42,000 (71,358)	42,000 (71,358)	42,000 (71,358)
Fan Motor, Maximum hp (kW), each	15 (11.2)	15 (11.2)	15 (11.2)
Number of Fans	3	3	3
External Static Unit Pressure, in.w.g. (Pa)	0.2 (50)	0.2 (50)	0.2 (50)

1. Some options or combinations of options may result in reduced air flow. Consult factory for recommendations.
2. Net capacity data has fan motor heat factored in for all ratings.
3. Consult factory for alternate performance outputs.

Table 2.6 42,000 ACFM Net Capacity Data, kW (kBTU/H) Based on 45°F (7.2°C) Entering Water, 12°F (6.66°C) Water Rise, 50/60-Hz Models

Model No.	305	375	415
75°F DB, 61°F WB, 52°F DP, 44% RH (23.9°C DB, 16.1°C WB)			
Total Capacity, kW (kBTUH)	244 (833)	329 (1,123)	376 (1,283)
Sensible Capacity, kW (kBTUH)	244 (833)	300 (1,024)	328 (1,119)
Flow Rate, GPM (lps)	153 (9.6)	204 (12.8)	233 (14.7)
Unit Pressure Drop, ft of Water (kPA)	15 (45)	33 (99)	51 (152)
80°F DB, 62.7°F WB, 52°F DP, 38% RH (26.7°C DB, 17.1°C WB)			
Total Capacity, kW (kBTUH)	301 (1,027)	395 (1,348)	444 (1,515)
Sensible Capacity, kW (kBTUH)	301 (1,027)	363 (1,239)	392 (1,338)
Flow Rate, GPM (lps)	185 (11.7)	241 (15.2)	271 (17.1)
Unit Pressure Drop, ft of Water (kPA)	21 (63)	45 (135)	68 (203)
85°F DB, 64.4°F WB, 52°F DP, 32% RH (29.4°C DB, 18°C WB)			
Total Capacity, kW (kBTUH)	356 (1,215)	458 (1,563)	510 (1,740)
Sensible Capacity, kW (kBTUH)	356 (1,215)	424 (1,447)	455 (1,552)
Flow Rate, GPM (lps)	216 (13.6)	276 (17.4)	309 (19.4)
Unit Pressure Drop, ft of Water (kPA)	29 (87)	58 (173)	86 (257)
Fan Data - EC Fans - Available in Downflow Orientations			
Return Air Volume, ACFM (ACMH)	42,000 (71,358)	42,000 (71,358)	42,000 (71,358)
Fan Motor, Maximum hp (kW), each	15 (11.2)	15 (11.2)	15 (11.2)
Number of Fans	3	3	3
External Static Unit Pressure, in.w.g. (Pa)	0.2 (50)	0.2 (50)	0.2 (50)

1. Some options or combinations of options may result in reduced air flow. Consult factory for recommendations.
2. Net capacity data has fan motor heat factored in for all ratings.
3. Consult factory for alternate performance outputs.

2.2 Physical Data

Table 2.7 Physical data for 60/50-Hz models

Model Number:	305	375	415
EVAPORATOR COIL- Copper Tube/Aluminum Fin			
Face Area, sq. ft. (sq. m)	65 (6.04)	65 (6.04)	63.2 (5.87)
Rows of Coil	4	6	8
Face Velocity, FPM (m/s), Std. Air Volume	520 ft/min (2.64 m/s) based on 35,000 CFM (59,465 CMH) 540 ft/min (2.74 m/s) based on 36,500 CFM (62,013 CMH) 622 ft/min (3.15 m/s) based on 42,000 CFM (71,358 CMH)		554 ft/min (2.8 m/s) based on 35,000 CFM (59,465 CMH) 578 ft/min (2.9 m/s) based on 36,500 CFM (62,013 CMH) 665 ft/min (3.4 m/s) based on 42,000 CFM (71,358 CMH)
FILTER SECTION - Disposable Type - Nominal Sizes and Quantities			
Nominal Size, inches	28 x 22 x 4		
Quantity	15		
UNIT PIPING CONNECTION SIZES (not external line sizes)			
Condensate Drain w/opt Condensate Pump, OD	1/2-in. O.D. Cu		
Condensate Drain, FTP	3/4 in.		
Supply and Return, O.D. Cu	4-1/8 in. O.D. Cu		

Table 2.8 Air-flow Calibration Voltage

Air flow* at 0.1 in. (25 Pa) ESP		Air-flow calibration voltage	
CFM	CMH	60 Hz	50 Hz
25,000	42480	4.66	5.57
26,000	44179	4.83	5.78
27,000	45878	5.00	5.98
28,000	47578	5.17	6.19
29,000	49277	5.34	6.39
30,000	50976	5.52	6.60
31,000	52675	5.69	6.81
32,000	54374	5.86	7.01
33,000	56074	6.03	7.22
34,000	57773	6.20	7.42
35,000	59472	6.38	7.63

Table 2.8 Air-flow Calibration Voltage (continued)

Air flow* at 0.1 in. (25 Pa) ESP		Air-flow calibration voltage	
CFM	CMH	60 Hz	50 Hz
36,000	61171	6.55	7.83
37,000	62870	6.72	8.04
38,000	64570	6.89	8.24
39,000	66269	7.06	8.45
40,000	67968	7.23	8.65
41,000	69667	7.41	8.86
42,000	71366	7.58	9.07
43,000	73066	7.75	9.27
44,000	74765	7.92	9.48
*Maximum air-flow calibration voltage must be adjusted based on the required air flow.			

3 ELECTRICAL REQUIREMENTS

3.1 Electrical Power Requirements

Table 3.1 Electrical Data—CW305, 375, 415

	without Condensate Pump			with Condensate Pump		
Voltage	FLA	WSA	OPD	FLA	WSA	OPD
460 V, 60 Hz	63.0	68.3	80	64.2	69.5	90
575 V, 60 Hz	51.0	55.3	70	51.9	56.2	70
380 V, 60 Hz	76.2	82.6	100	77.4	83.8	100
380-415 V, 60 Hz	69.0	74.8	90	70.2	76.0	90
Source: DPN004992 Rev. 0						

3.2 Electrical Field Connections

Three-phase electrical service is required for all models. Electrical service must conform to national and local electrical codes.

The electrical connections are described in the submittal documents included in the Submittal Drawings on page 25.

The following table lists the relevant documents by number and title.

Table 3.2 Electrical Field-connection Drawings

Document Number	Title
DPN004864	Electrical Field Connections, Downflow, CW305, 375, 415
DPN004863	Connection Locations, Data Hall with horizontal-discharge, Front-left facing electrical/piping compartment
DPN004901	Connection Locations, Bottom-discharge, Front-right facing electrical/piping compartment
DPN004923	Connection Locations, Data Hall with horizontal-discharge, Front-right facing electrical/piping compartment
DPN004903	Connection Locations, Bottom-discharge, Front-left facing electrical/piping compartment
DPN004924	Connection Locations, Gallery with horizontal-discharge, Front-right facing electrical/piping compartment
DPN004925	Connection Locations, Gallery with horizontal-discharge, Front-right facing electrical/piping compartment
Unit-to-Unit Networking	
DPN004351	Liebert® iCOM Unit-to-unit Network Connections

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4 PLANNING GUIDELINES

4.1 Shipping Dimensions and Unit Weights

Table 4.1 Downflow unit domestic and export shipping dimensions and weights

Model #	Domestic Packaging		Export Packaging		Dry Weight, lb (kg)
	Ship Weight, lb (kg)	Shipping Dimensions, in. (mm)	Ship Weight, lb (kg)	Shipping Dimensions, in. (mm)	
CW305 CW375 CW415	3890 (1764)	70 x 154 x 96.8 (1778 x 3911 x 2458)	4230 (1919)	70.5 x 154.5 x 99 (1790 x 3924 x 2514)	3300 (1497)
Fan section	3000 (1361)	90 x 128 x 54 (2286 x 3251 x 1372)	3370 (1528)	90.5 x 128.5 x 99 (2299 x 3264 x 2515)	2300 (1043)

4.2 Planning Dimensions

The unit, floor stand, and plenum dimensions are described in the submittal documents included in the Submittal Drawings on page 25.

The following table lists the relevant documents by number and title.

Table 4.2 Dimension Planning Drawings

Document Number	Title
Downflow Units	
DPN004862	Cabinet and Plenum Dimensional Data, Downflow, Horizontal Discharge
DPN004900	Cabinet and Plenum Dimensional Data, Downflow, Bottom Discharge
DPN004870	Installation and Service Clearance Data, Downflow, Horizontal and Bottom Discharge
DPN004869	Floor planning dimensional data for adjacent units
Floor Stands	
DPN004866	Floorstand Dimensional Data,
Airflow Schematic	
DPN004865	Airflow Schematic, Downflow, Horizontal Discharge
DPN004904	Airflow Schematic, Downflow, Bottom Discharge

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5 PIPING

Field-installed piping must be installed in accordance with local code.

The following pipe connections are required:

- A drain line from the unit.
- Supply and return water lines.

The pipe connection locations, piping general arrangement and schematics are described in the submittal documents included in the Submittal Drawings on page 25.

The following tables list the relevant documents by number and title.

Table 5.1 Piping General-arrangment Drawings

Document Number	Title
DPN004952	Piping Schematic, Downflow, CW305, 375, 415

Table 5.2 Piping Connection Drawings

Document Number	Title
DPN004863	Connection Locations, Data Hall with horizontal-discharge, Front-left facing electrical/piping compartment
DPN004923	Connection Locations, Data Hall with horizontal-discharge, Front-right facing electrical/piping compartment
DPN004901	Connection Locations, Bottom-discharge, Front-right facing electrical/piping compartment
DPN004903	Connection Locations, Bottom-discharge, Front-left facing electrical/piping compartment
DPN004924	Connection Locations, Gallery with horizontal-discharge, Front-right facing electrical/piping compartment
DPN004925	Connection Locations, Gallery with horizontal-discharge, Front-right facing electrical/piping compartment

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APPENDICES

Appendix A: Technical Support and Contacts

A.1 Technical Support/Service in the United States

Vertiv™ Group Corporation

24x7 dispatch of technicians for all products.

1-800-543-2378

Liebert® Thermal Management Products

1-800-543-2778

Liebert® Channel Products

1-800-222-5877

Liebert® AC and DC Power Products

1-800-543-2378

A.2 Locations

United States

Vertiv Headquarters

1050 Dearborn Drive

Columbus, OH, 43085, USA

Europe

Via Leonardo Da Vinci 8 Zona Industriale Tognana

35028 Piove Di Sacco (PD) Italy

Asia

7/F, Dah Sing Financial Centre

3108 Gloucester Road

Wanchai, Hong Kong

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Appendix B: Submittal Drawings

The submittal drawings are in the order of document part number (DPN). Table B.1 below, groups the drawings by topic/application.

Table B.1 Submittal-drawings Contents

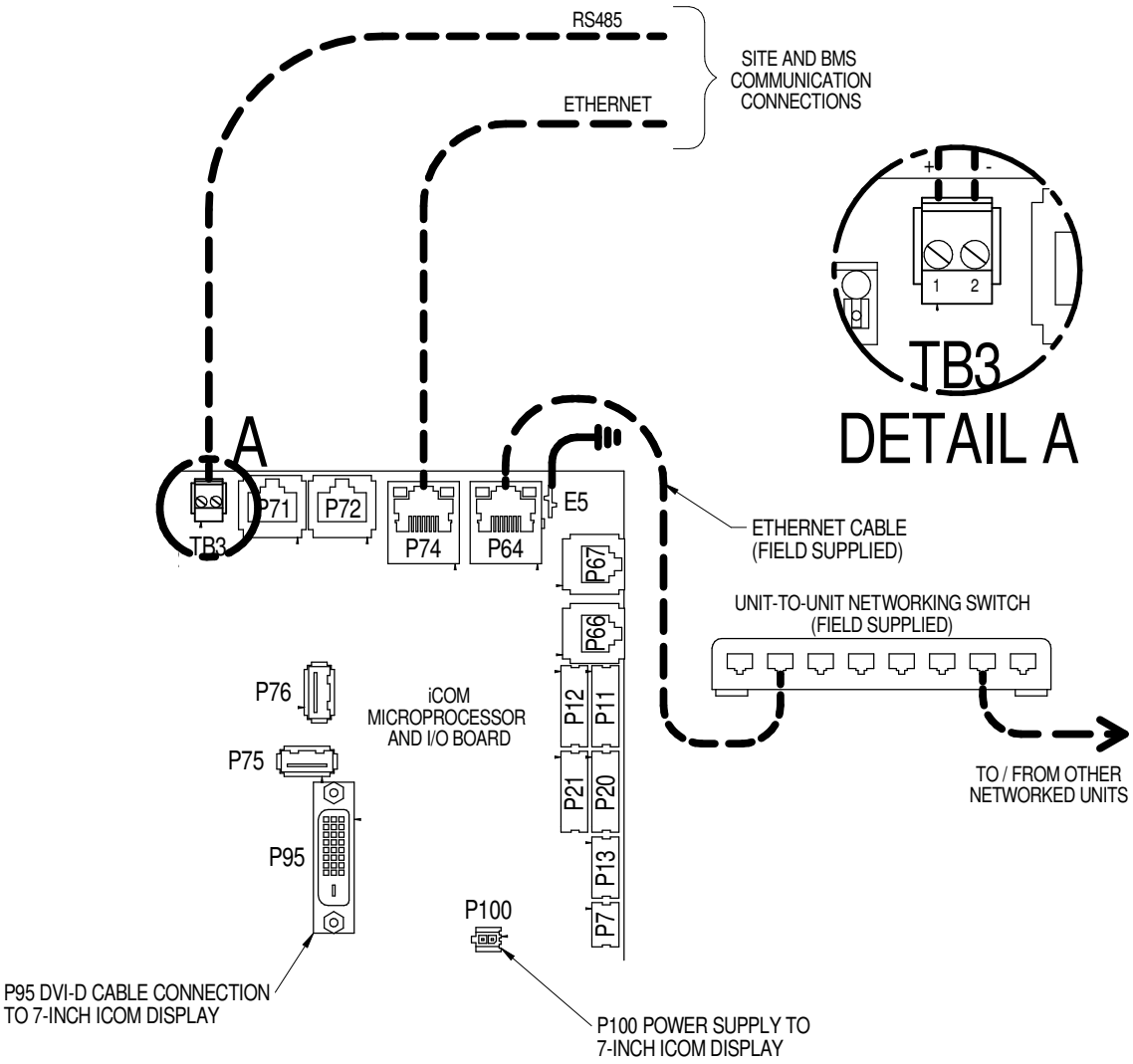
Document Number	Title
Component Location	
DPN004861	Component Location, Horizontal Discharge
DPN004899	Component Location, Bottom Discharge
Planning Dimensions - Downflow Units	
DPN004862	Cabinet and Plenum Dimensional Data, Downflow, Horizontal Discharge
DPN004900	Cabinet and Plenum Dimensional Data, Downflow, Bottom Discharge
DPN004870	Installation and Service Clearance Data, Downflow, Horizontal and Bottom Discharge
DPN004869	Floor planning dimensional data for adjacent units
Planning Dimensions - Floor Stands	
DPN004866	Floorstand Dimensional Data,
Airflow Schematic	
DPN004865	Airflow Schematic, Downflow, Horizontal Discharge
DPN004904	Airflow Schematic, Downflow, Bottom Discharge
Piping Schematics	
DPN004952	Piping Schematic, Downflow, CW305, 375, 415
Piping Connections	
DPN004863	Connection Locations, Data Hall with horizontal-discharge, Front-left facing electrical/piping compartment
DPN004901	Connection Locations, Bottom-discharge, Front-right facing electrical/piping compartment
DPN004923	Connection Locations, Data Hall with horizontal-discharge, Front-right facing electrical/piping compartment
DPN004903	Connection Locations, Bottom-discharge, Front-left facing electrical/piping compartment
DPN004924	Connection Locations, Gallery with horizontal-discharge, Front-right facing electrical/piping compartment
DPN004925	Connection Locations, Gallery with horizontal-discharge, Front-right facing electrical/piping compartment

Table B.1 Submittal-drawings Contents (continued)

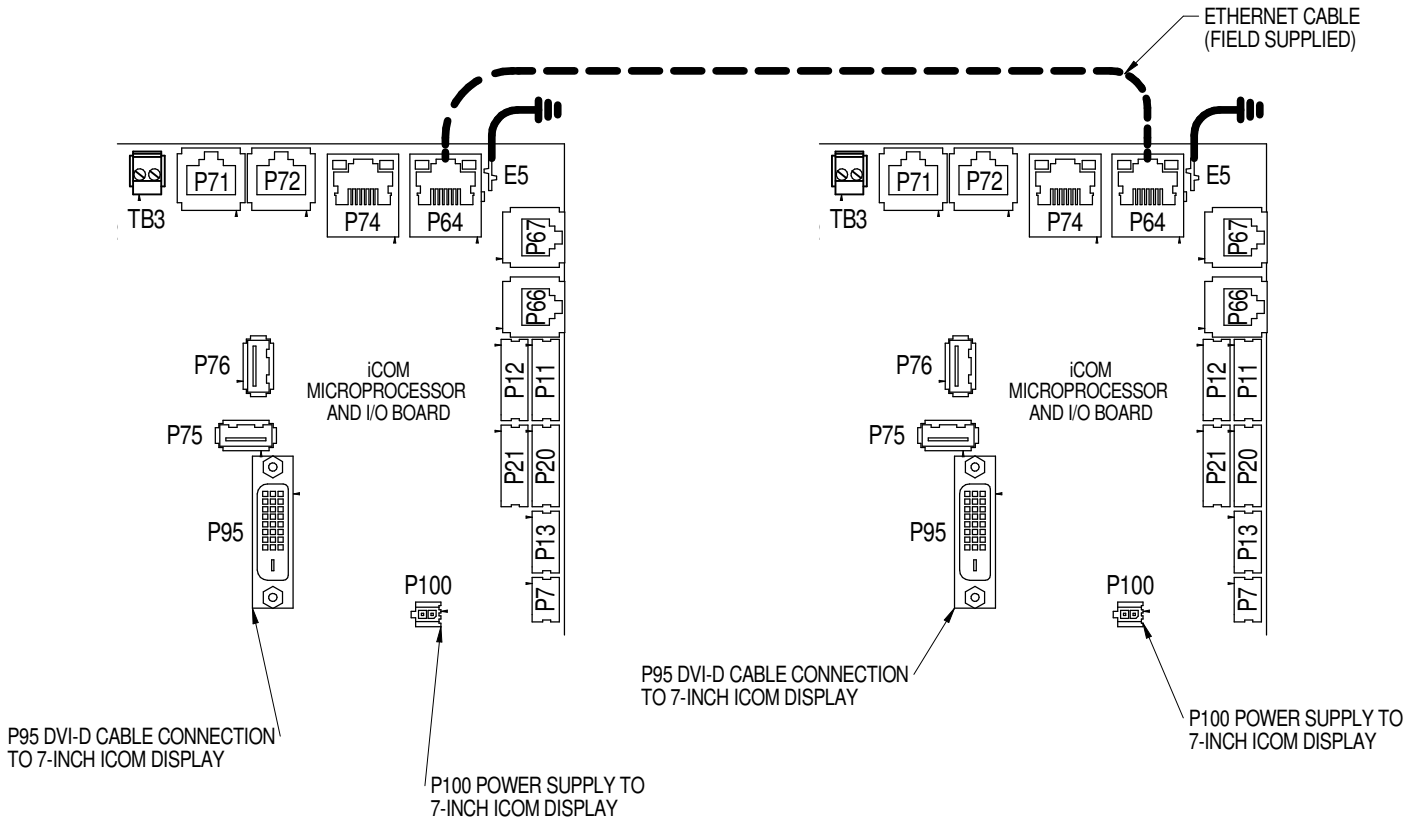
Document Number	Title
Electrical Connections	
DPN004864	Electrical Field Connections, Downflow, CW305, 375, 415
DPN004863	Connection Locations, Data Hall with horizontal-discharge, Front-left facing electrical/piping compartment
DPN004901	Connection Locations, Bottom-discharge, Front-right facing electrical/piping compartment
DPN004923	Connection Locations, Data Hall with horizontal-discharge, Front-right facing electrical/piping compartment
DPN004903	Connection Locations, Bottom-discharge, Front-left facing electrical/piping compartment
DPN004924	Connection Locations, Gallery with horizontal-discharge, Front-right facing electrical/piping compartment
DPN004925	Connection Locations, Gallery with horizontal-discharge, Front-right facing electrical/piping compartment
Unit-to-Unit Networking	
DPN004351	Liebert® iCOM Unit-to-unit Network Connections

LIEBERT DS, DSE, CW, PDX & PCW

UNIT TO UNIT NETWORK CONNECTIONS



UNIT TO UNIT NETWORK CONNECTIONS



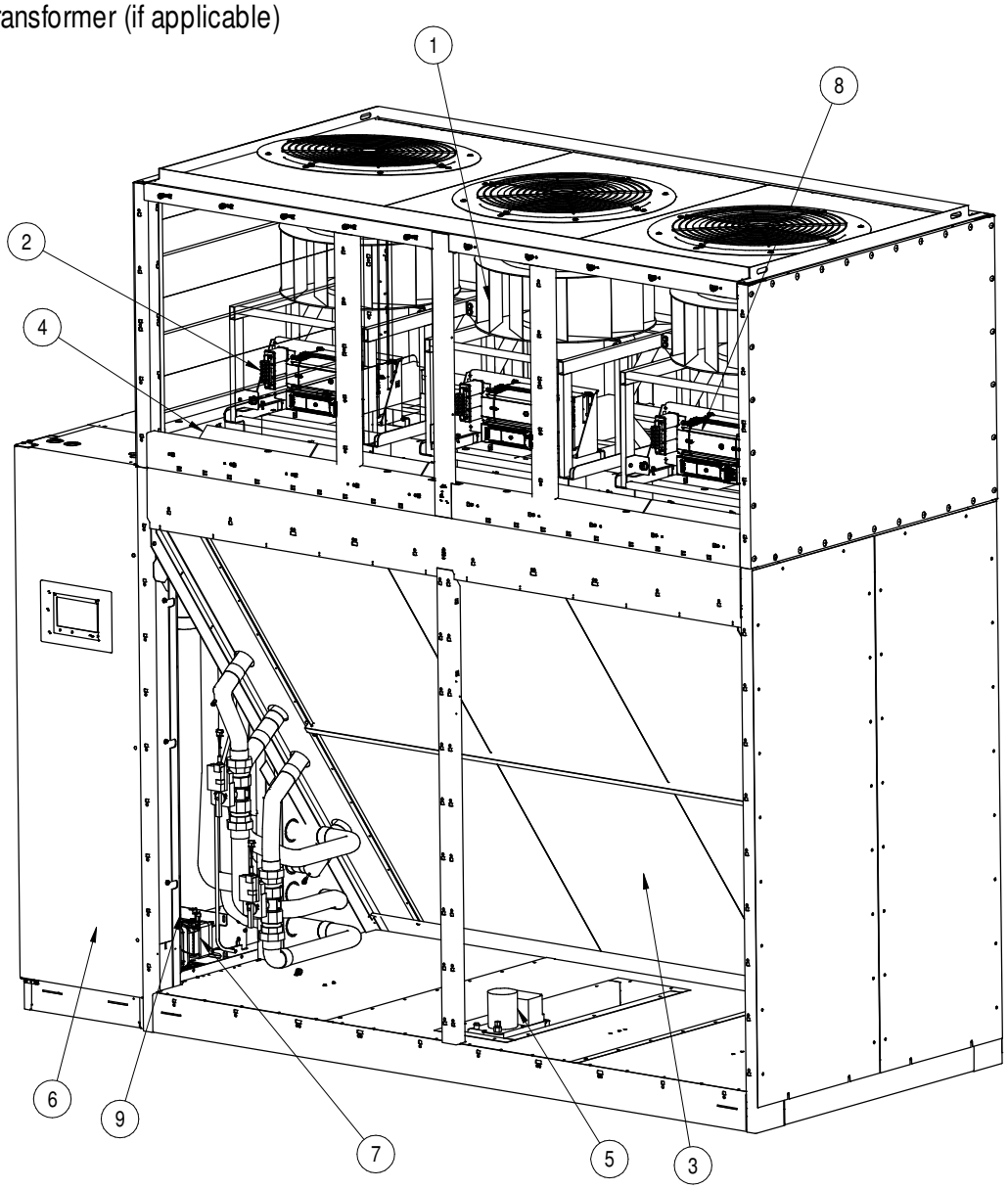
NOTE* For dual-unit network configurations only

COMPONENT LOCATION DIAGRAM

CW305, 375, 415 W/ HORIZONTAL DISCHARGE

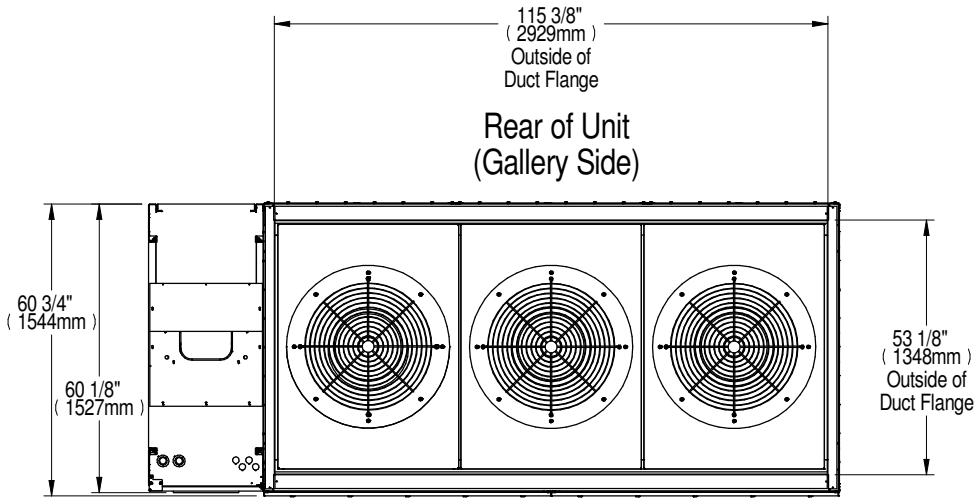
1. Blower/Motor (Typical 3)
2. Line Reactor Transformers (Typical 3)
3. Evaporator Coil
4. Air Filters
5. Condensate Pump (optional)
6. Electric Panel
7. THD Mitigation Device (optional)
8. VFD Assemblies (Typical 3)
9. 575V Transformer (if applicable)

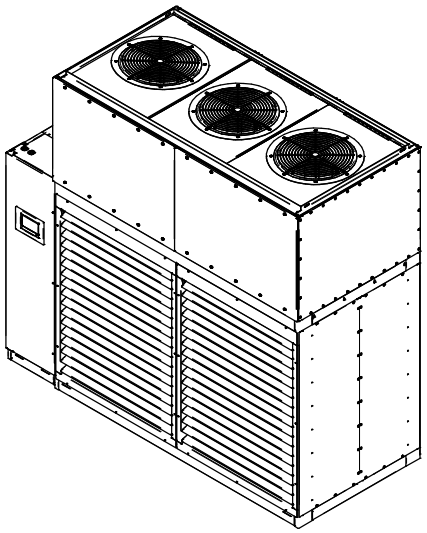
Notes:
1. Electrical Compartment (item #6) shown on left side of unit. Unit may be ordered with Electrical Compartment on either side, or with Electrical Compartment facing into Gallery space.
2. Grills and panels removed for clarity.



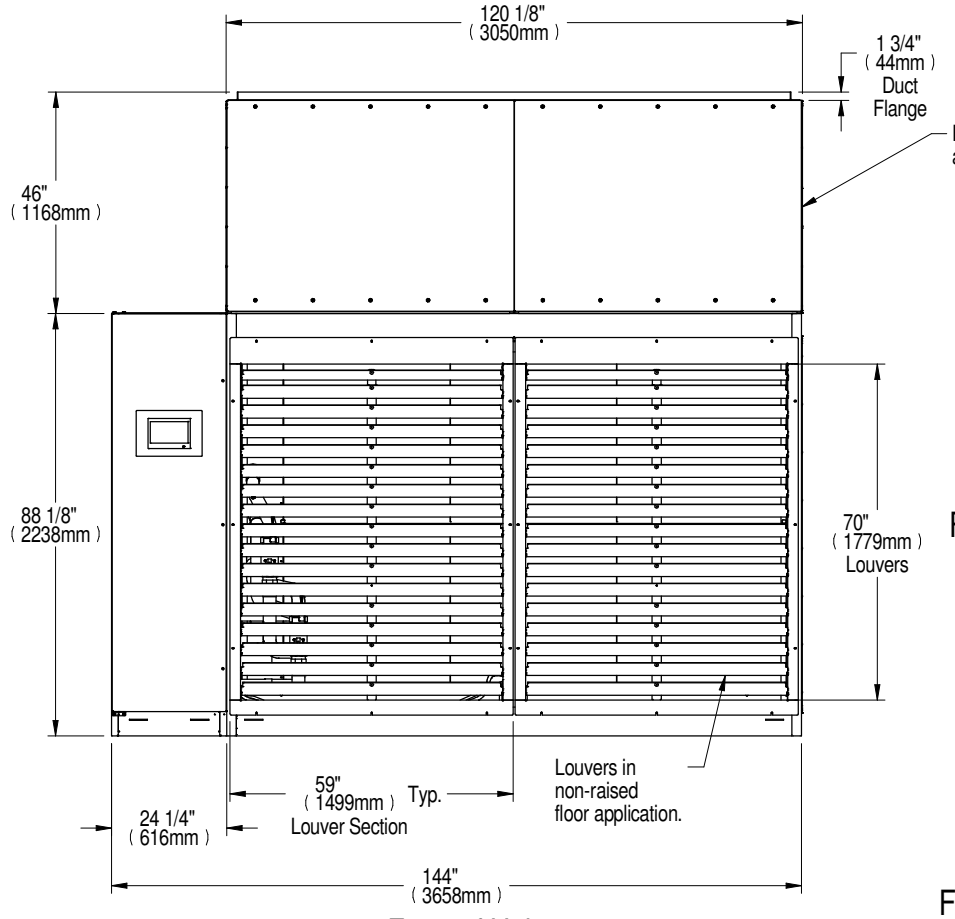
CABINET DIMENSIONAL DATA

CW305, 375, 415 W/ HORIZONTAL DISCHARGE



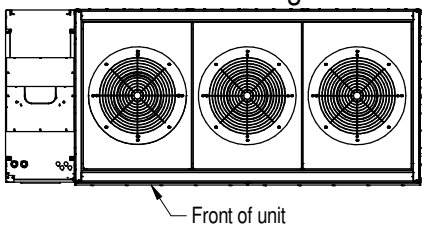


For Unit Disassembly Data
Refer to DPN004868

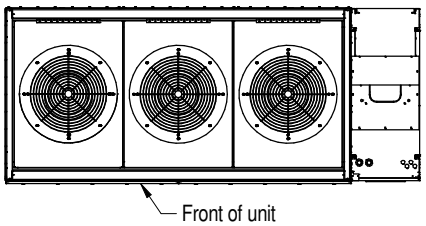


Front of Unit
(Data Hall Side)

Data Hall Unit configuration



Front Left Facing Electrical Compartment
(may be ordered with
Electrical Compartment facing rear)

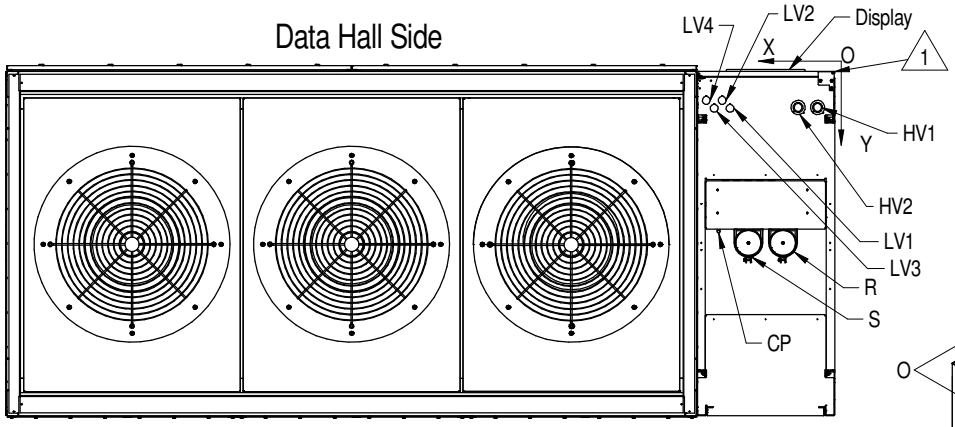


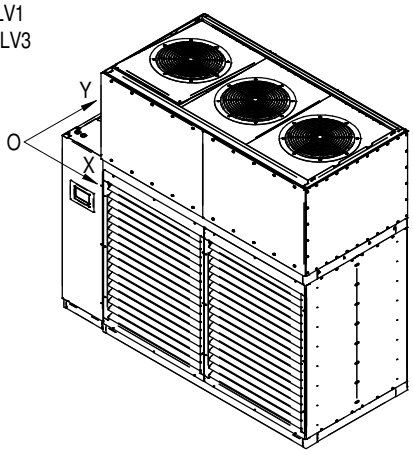
Front Right Facing Electrical Compartment
(may be ordered with
Electrical Compartment facing rear)

LIEBERT CW

PRIMARY CONNECTION LOCATIONS
CW305, 375, 415 DATA HALL W/ HORIZONTAL DISCHARGE
FRONT LEFT FACING ELECTRICAL/PIPING COMPARTMENT

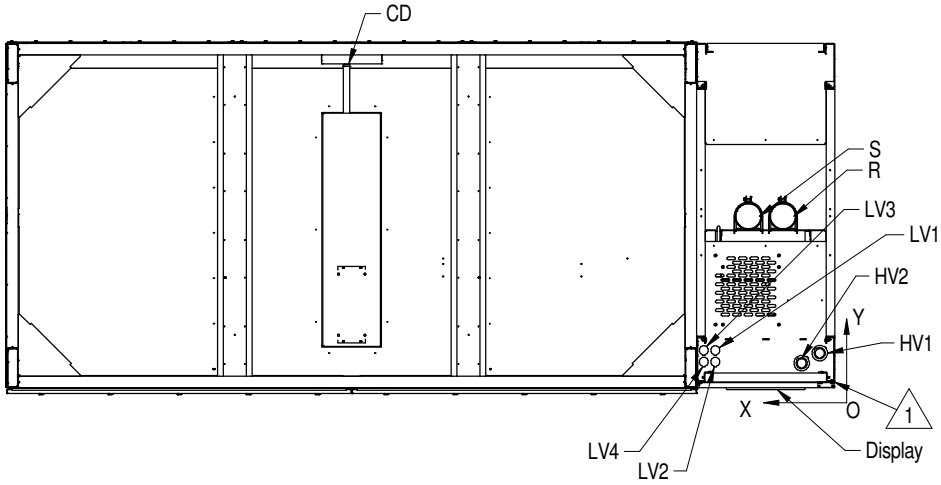
Top View





ISO View showing Display location

Bottom View



POINT	Description	Top View		Bottom View		Connection Size/Opening
		X in. (mm)	Y in. (mm)	X in. (mm)	Y in. (mm)	
HV1	Electrical Conn. (High Volt)	2-7/8 (73)	6-1/4 (160)	2-1/2 (63)	6 (153)	2-1/2"
HV2		6-1/4 (159)		5-5/8 (143)	4-1/4 (108)	
LV1	Electrical Conn. (Low Volt)	18-1/8 (459)	6-3/8 (163)	20-5/8 (524)	6-1/2 (165)	1-1/2"
LV2		19-1/2 (494	5 (129)		4-1/2 (114)	
LV3		20-7/8 (529)	6-3/8 (163)	22-5/8 (575)	6-1/2 (165)	
LV4		22-1/4 (564)	5 (129)		4-1/2 (114)	
CD	Condensate Drain 2	N/A	N/A	84-1/2 (2146)	55-1/2 (1410)	3/4" NPT Female
CP	Condensate Pump	20 (509)	27-7/8 (707)	N/A	N/A	1/2" O.D. Cu
S	Supply Pipe Connection	N/A	N/A	15 (381)	30 (762)	4-1/8" O.D. Cu
R	Return Pipe Connection			9 (229)		

Notes:

1. Drawing not to scale. All dimensions from left corner on service side and have a tolerance of ± 1/2" (13mm).
2. Field pitch Condensate Drain line a minimum of 1/8" (3.2mm) per 12" (305mm). Install an external 5-1/2" (140mm) trap in the drain line (if desired). The factory unit does not contain a trap. Select appropriate drain system materials. The drain must comply with all local codes.
3. Piping connection can be made at the top or bottom of the unit.

ELECTRICAL FIELD CONNECTIONS
CW305, 375, 415 DOWNFLOW MODELS

STANDARD ELECTRICAL CONNECTIONS

1. High voltage entrance - Located in bottom and top of box (quantity 2). Raceway in front left corner of enclosure for routing high voltage wires thru enclosure.
2. Low voltage entrance – Located in bottom and top of box (quantity 4). Raceway in front right corner of enclosure for routing low voltage wires thru enclosure.
3. Three phase electrical service - Terminals are on top of disconnect switch. Three phase service not provided by Liebert.
4. Earth ground - Terminal for field supplied earth grounding wire and component ground terminal strip. Earth grounding required for Liebert units.
5. Unit factory installed disconnect switch and Main Fuses – Access to the high voltage electric panel compartment can be obtained only with the switch in the “off” position. Fused disconnects are provided with a defeater button that allows access to the electrical panel when power is on.
6. Remote unit shutdown - Replace existing jumper between terminals 37 & 38 with field supplied normally closed switch having a minimum 75VA, 24VAC rating. Use field supplied Class 1 wiring.
7. Customer alarm inputs - Terminals for field supplied, normally open contacts, having a minimum 75VA, 24VAC rating, between terminals 24 & 50, 51, 55, 56. Use field supplied Class 1 wiring. Terminal availability varies by unit options.
8. Common alarm - On any alarm, normally open dry contact is closed across terminals 75 & 76 for remote indication. 1 AMP, 24VAC max load. Use Class 1 field supplied wiring.

ELECTRICAL FIELD CONNECTIONS
CW305, 375, 415 DOWNFLOW MODELS

OPTIONAL ELECTRICAL CONNECTIONS

9. Condensate alarm (with condensate pump option) - On pump high water indication, normally open dry contact is closed across terminals 88 & 89 for remote indication. 1 AMP, 24VAC max load. Use Class 1 field supplied wiring.
10. Remote humidifier - On any call for humidification, normally open dry contact is closed across terminals 11 & 12 to signal field supplied remote humidifier. 1 AMP, 24VAC max load. Use Class 1 field supplied wiring
11. Reverse Starter contacts - Normally open dry contact is closed across terminals 102 & 103 for power supply 1 and 106 & 107 for power supply 2 to indicate the active power feed. 1 AMP, 24VAC max load. Use Class 1 field supplied wiring.
12. Smoke sensor alarm - Factory wired dry contacts from smoke sensor are 91-common, 92-NO, and 93-NC. Supervised contacts, 80 & 81, open on sensor trouble indication. 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. 1 AMP, 24VAC max load. Use Class 1 field supplied wiring.
13. Analog inputs- Terminals 41, 42, 43, and 44 are user configurable for 0-10V, 0-5V, or 4-20MA.

OPTIONAL LOW VOLTAGE TERMINAL PACKAGE CONNECTIONS

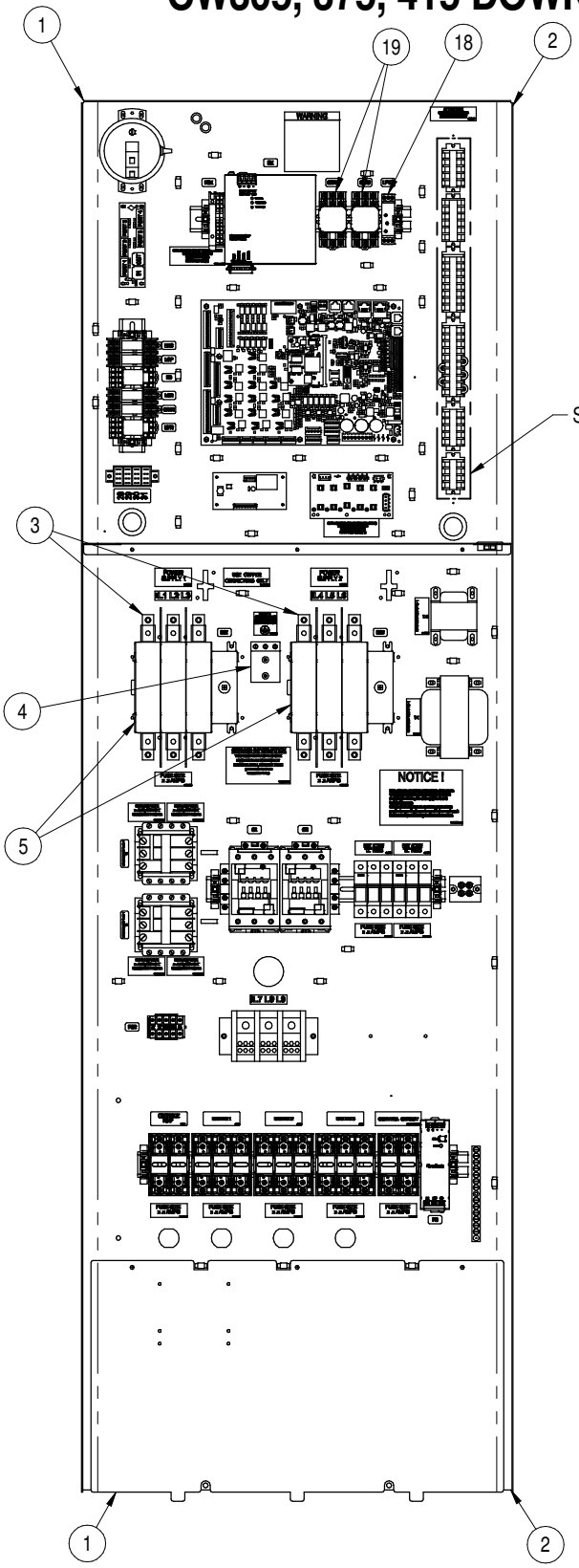
14. Remote unit shutdown - Two additional contact pairs available for unit shutdown (labeled as 37B & 38B, 37C & 38C). Replace jumpers with field supplied normally closed switch having a minimum 75VA, 24VAC rating. Use field supplied Class 1 wiring.
15. Common alarm - On any alarm, two additional normally open dry contacts are closed across terminals 94 & 95 and 96 & 97 for remote indication. 1 AMP, 24VAC max load. Use Class 1 field supplied wiring.
16. Main fan enabled contact - On VFD enable, normally open dry contact is closed across terminals 84 & 85 for remote indication. 1 AMP, 24VAC max load. Use Class 1 field supplied wiring.
17. LiquiTect shutdown and dry contact - On LiquiTect activation, normally open dry contact is closed across terminals 58 & 59 for remote indication (LiquiTect sensor ordered separately). 1 AMP, 24VAC max load. Use Class 1 field supplied wiring.

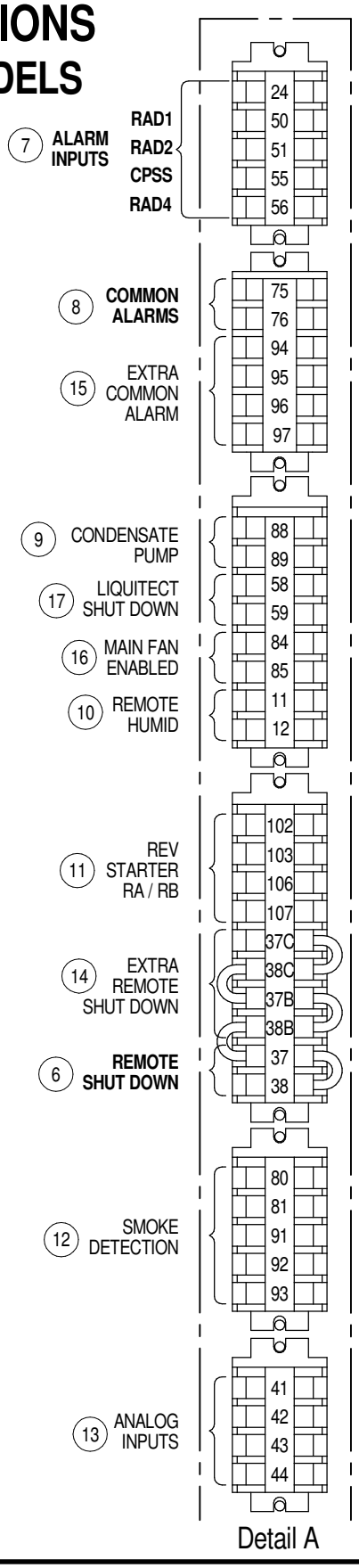
OPTIONAL COMMUNICATION CONNECTIONS

18. Unit-to-Unit – Plug 64 is reserved for U2U communication
19. Site and BMS – Plug 74 and terminal block 3 are reserved for Site and BMS connections. Plug 74 is an eight pin RJ45 for a Cat 5 cable. Terminal block 3 is a two position screw terminal block for use with twisted pair wires.

ELECTRICAL FIELD CONNECTIONS

CW305, 375, 415 DOWNFLOW MODELS



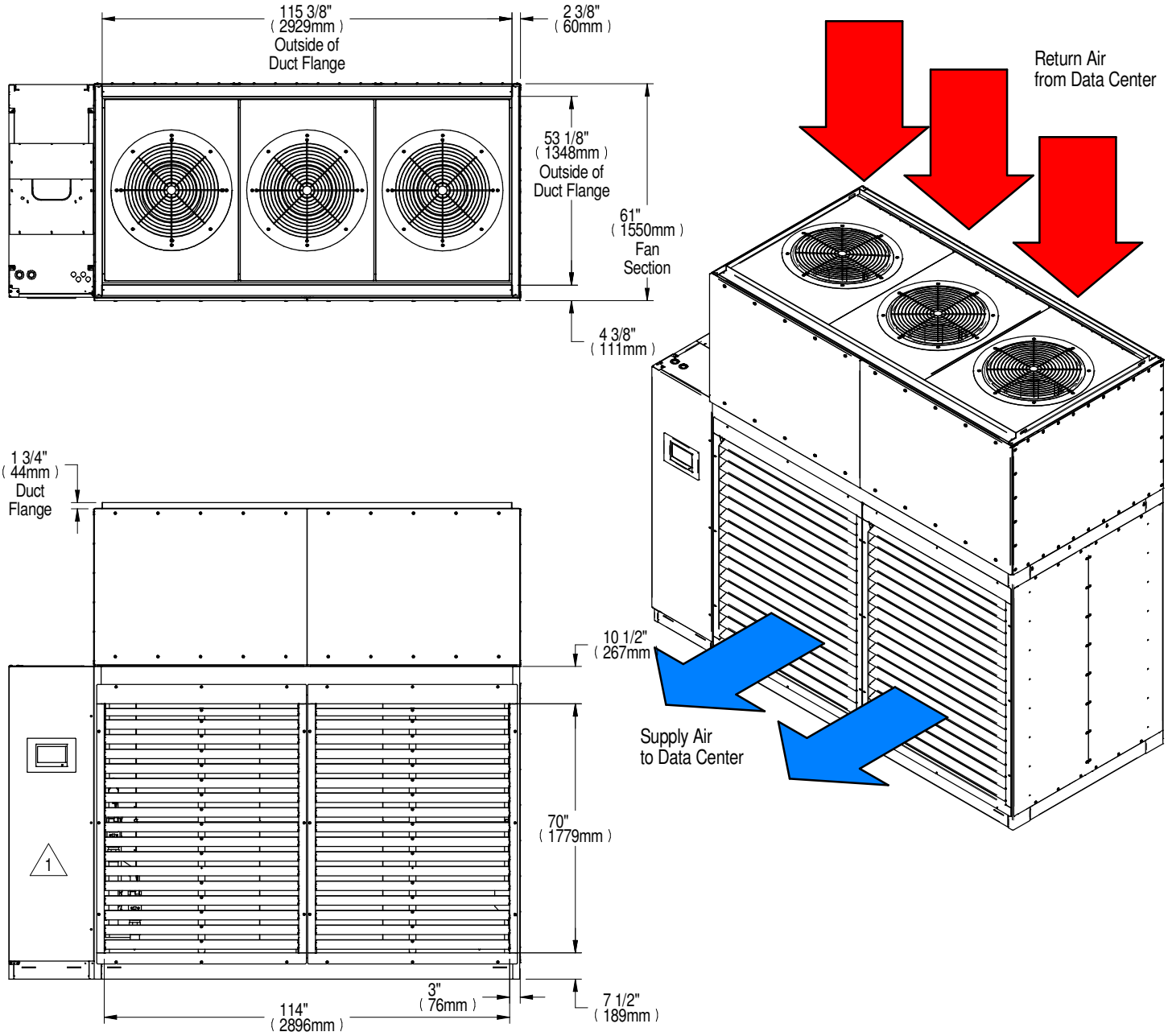


Detail A

LIEBERT CW

AIRFLOW SCHEMATIC

CW305, 375, 415 DOWNFLOW UNIT W/ HORIZONTAL DISCHARGE



Front (Data Hall Side)

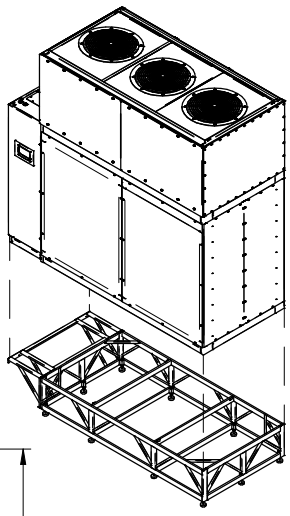
Notes:

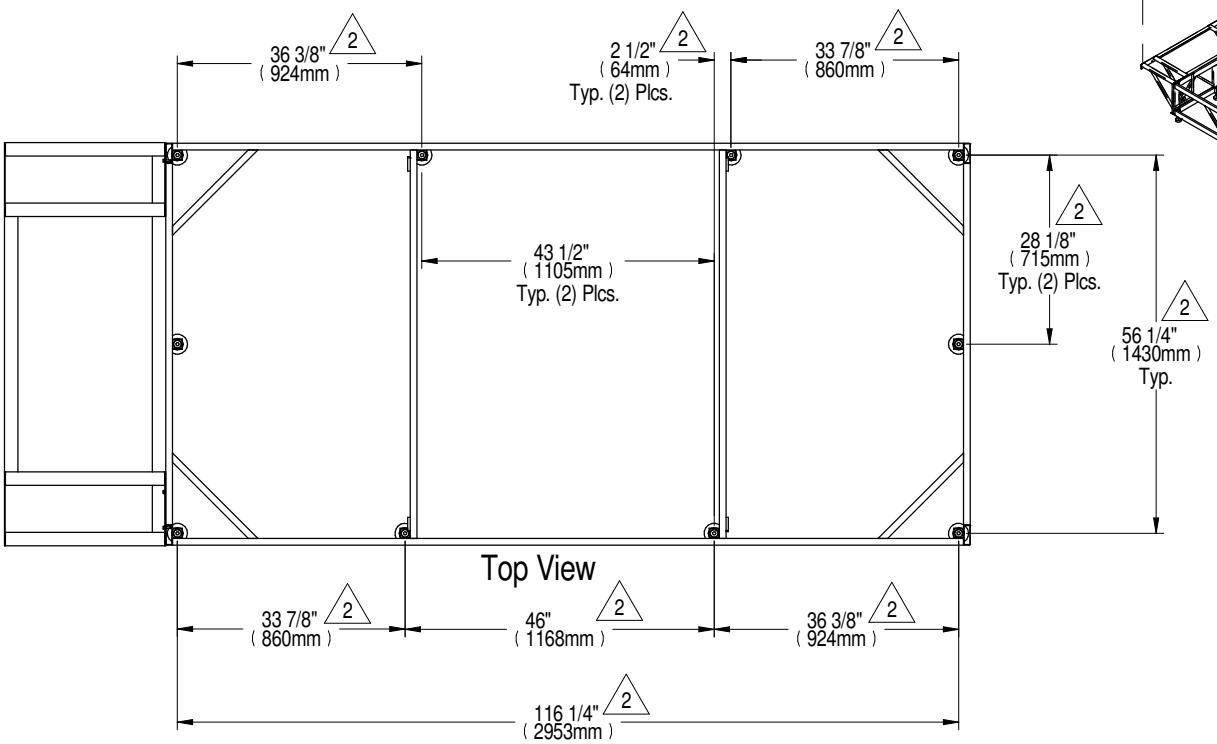
1. Electrical Compartment shown on left side of unit.
   Unit may be ordered with Electrical Compartment on right or left side, or with Electrical Compartment facing into the Gallery space.

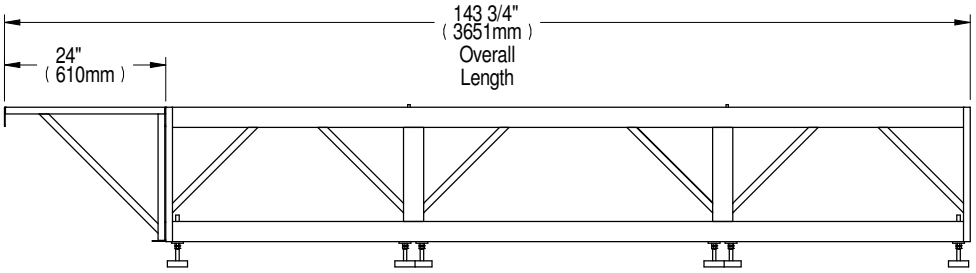
LIEBERT CW

FLOORSTAND DIMENSIONAL DATA

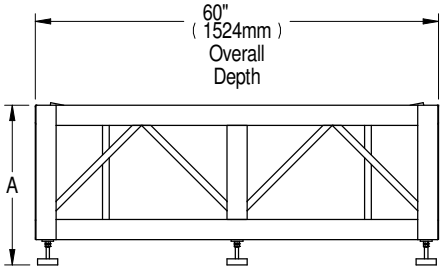
CW305, 375, 415







Front View



Right Side View

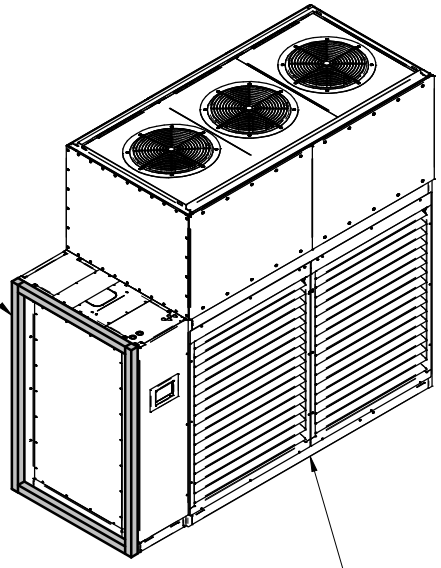
Height in. (mm) A 1
12 (305)
24 (610)
30 (762)
36 (914)
42 (1069)
48 (1219)

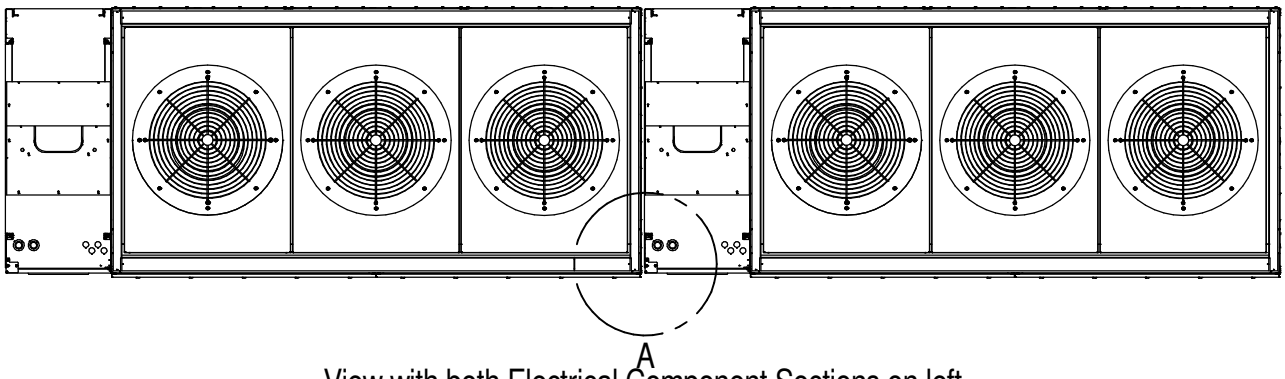
Notes:

1. Leveling feet are provided with ± 1-1/2" (38mm) adjustment from nominal height "A".
2. Dimensions are to center of feet.
3. Floorstand shown in configuration for Electrical Box on the left side of the unit. When unit is ordered with the Electrical Box on the right side of the unit, cantilevered portion of floorstand will appear on the right side.

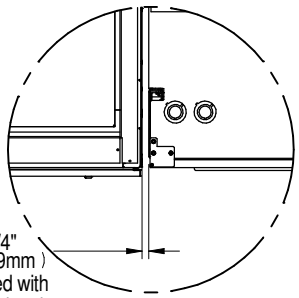
LIEBERT CW

FLOOR PLANNING DIMENSIONAL DATA
FOR ADJACENT CW305, 375, 415 UNITS





View with both Electrical Component Sections on left

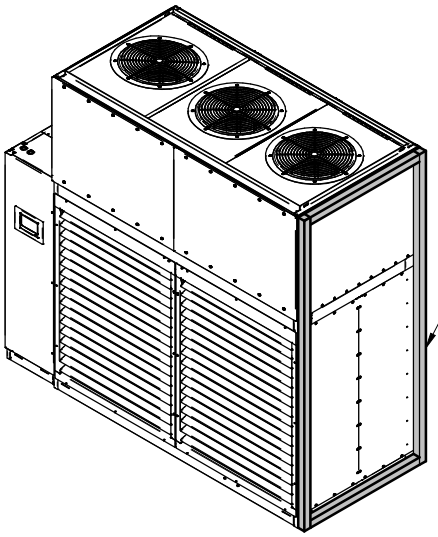


DETAIL A

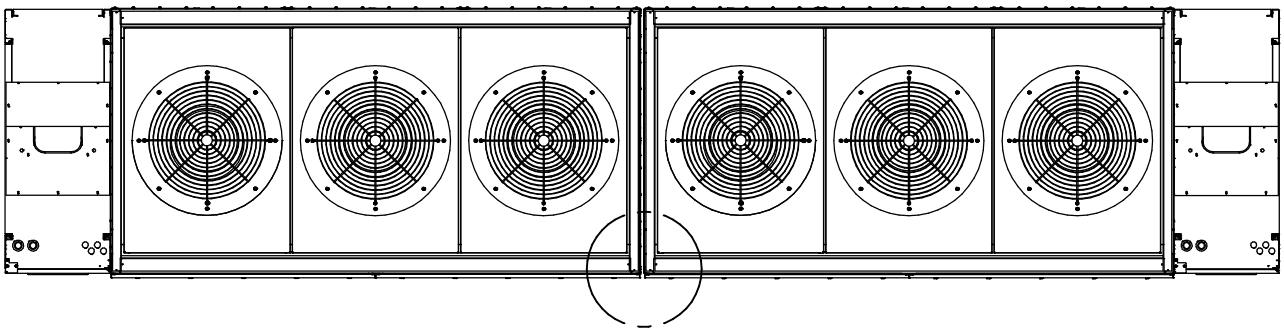
Notes:

1. Gap is measured between frame members of adjacent units.
2. Gasketing required only on shortest section being placed adjacent to another unit.
3. View shows both Electronic Component Sections on the left. The same gasketing instructions apply when both Electronic Component Sections are on the right, or with one on the left and the other on the right.

FLOOR PLANNING DIMENSIONAL DATA
FOR ADJACENT CW305, 375, 415 UNITS

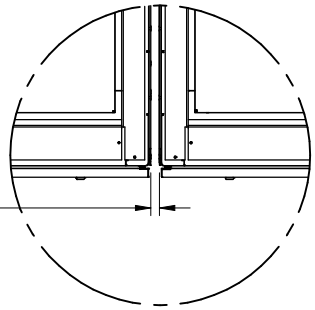


Gasketing shown is for pictorial purposes only to show edges of unit that require gap sealing. Gasketing and method to be provided and applied by others in the field.



B

View with Electrical Component Sections at opposite ends



1 3/4" (19mm)
Minimum gap to be filled with gasketing between each unit

DETAIL B

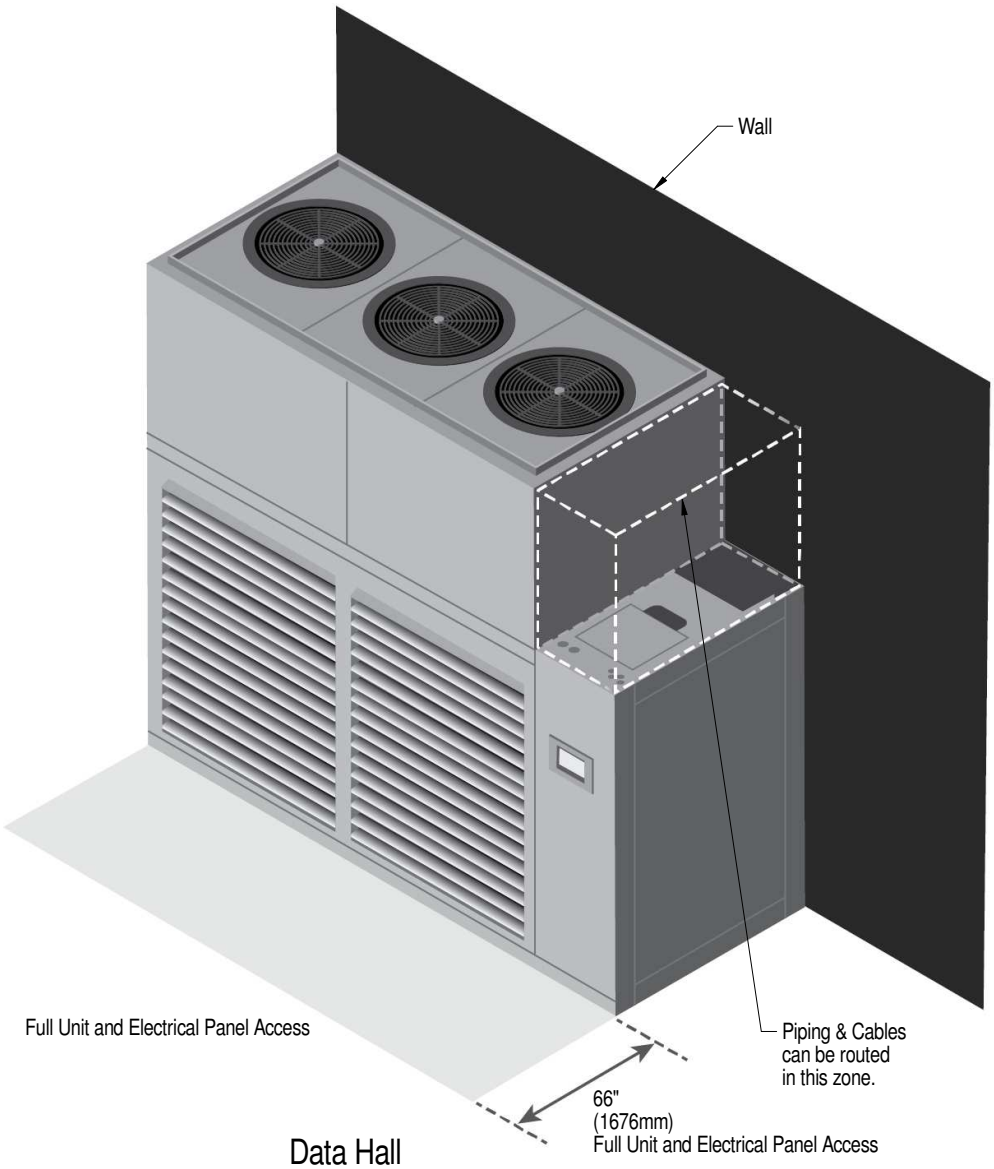
Notes:

1. Gap is measured between frame members of adjacent units.

LIEBERT CW

INSTALLATION & SERVICE CLEARANCE DATA CW305-415

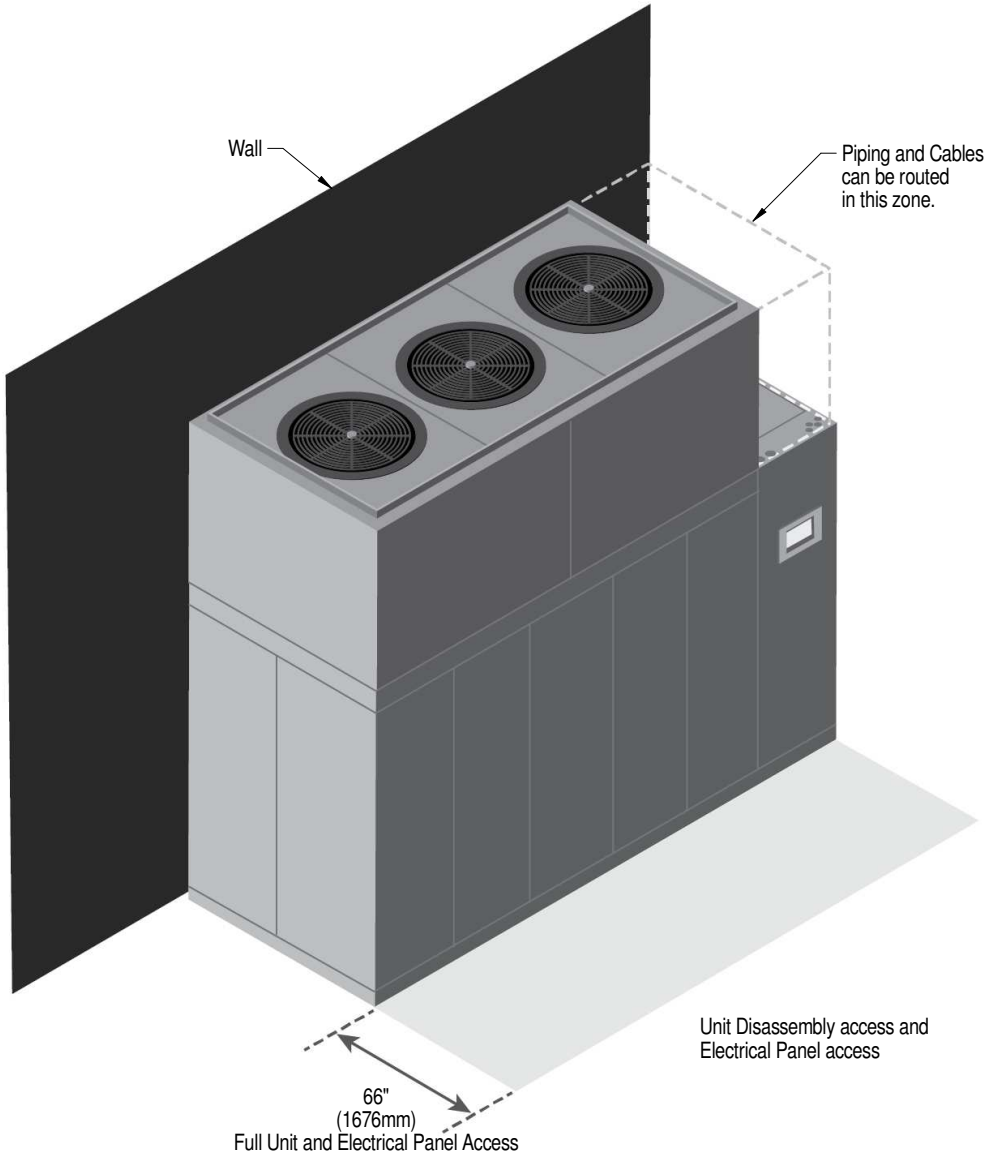
PERIMETER INSTALLATION AND SERVICE CLEARANCE HORIZONTAL DISCHARGE



Notes:
1. Electrical Compartment is shown on the right side of the unit. Unit may be ordered with Electrical Compartment on either side, or with Electrical Compartment facing into Gallery Space.

INSTALLATION & SERVICE CLEARANCE DATA CW305-415

PERIMETER INSTALLATION AND SERVICE CLEARANCE BOTTOM DISCHARGE

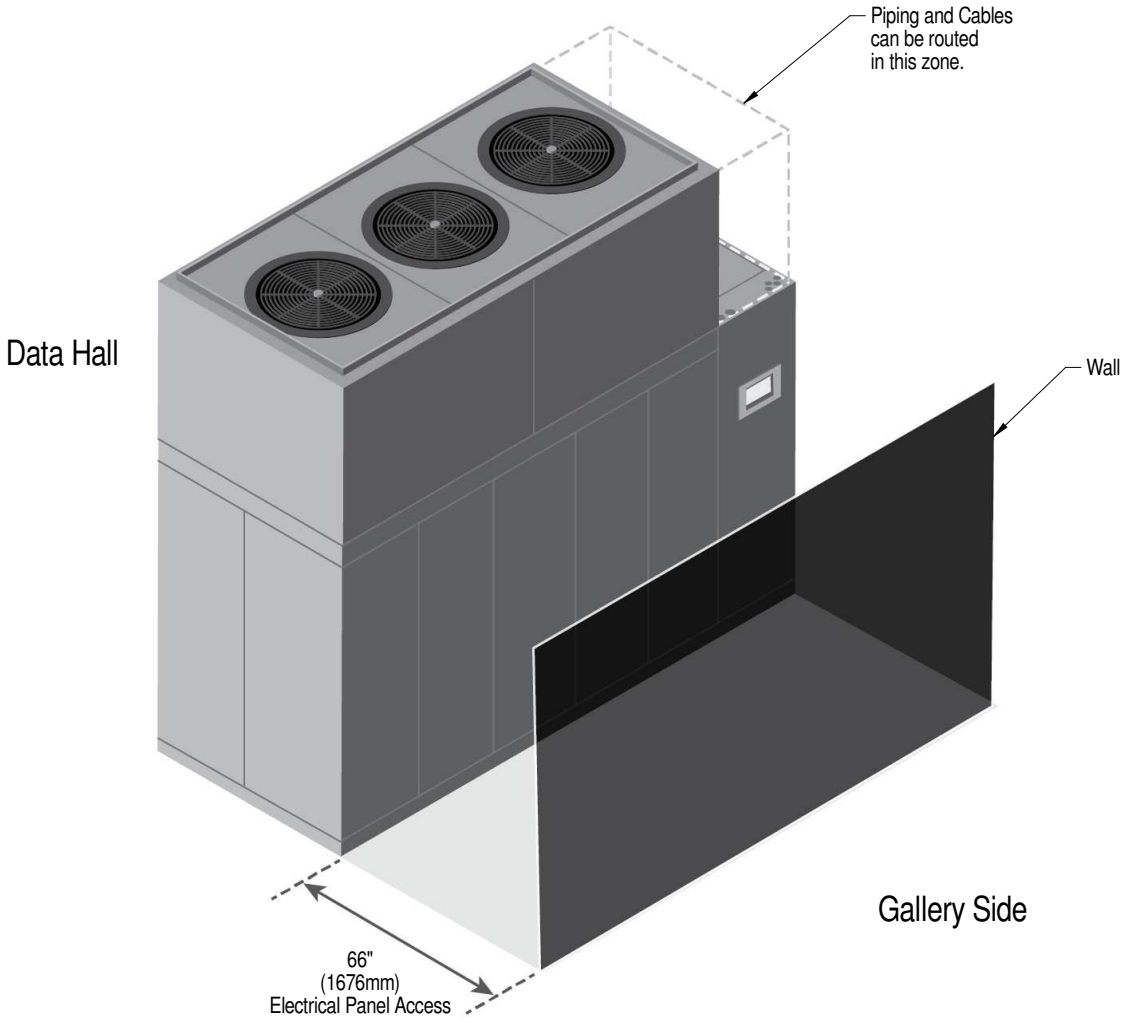


Gallery Side

Notes:
1. Electrical Compartment is shown on the right side of the unit.
   Unit may be ordered with Electrical Compartment on either side,
   or with Electrical Compartment facing into Data Hall.

INSTALLATION & SERVICE CLEARANCE DATA CW305-415

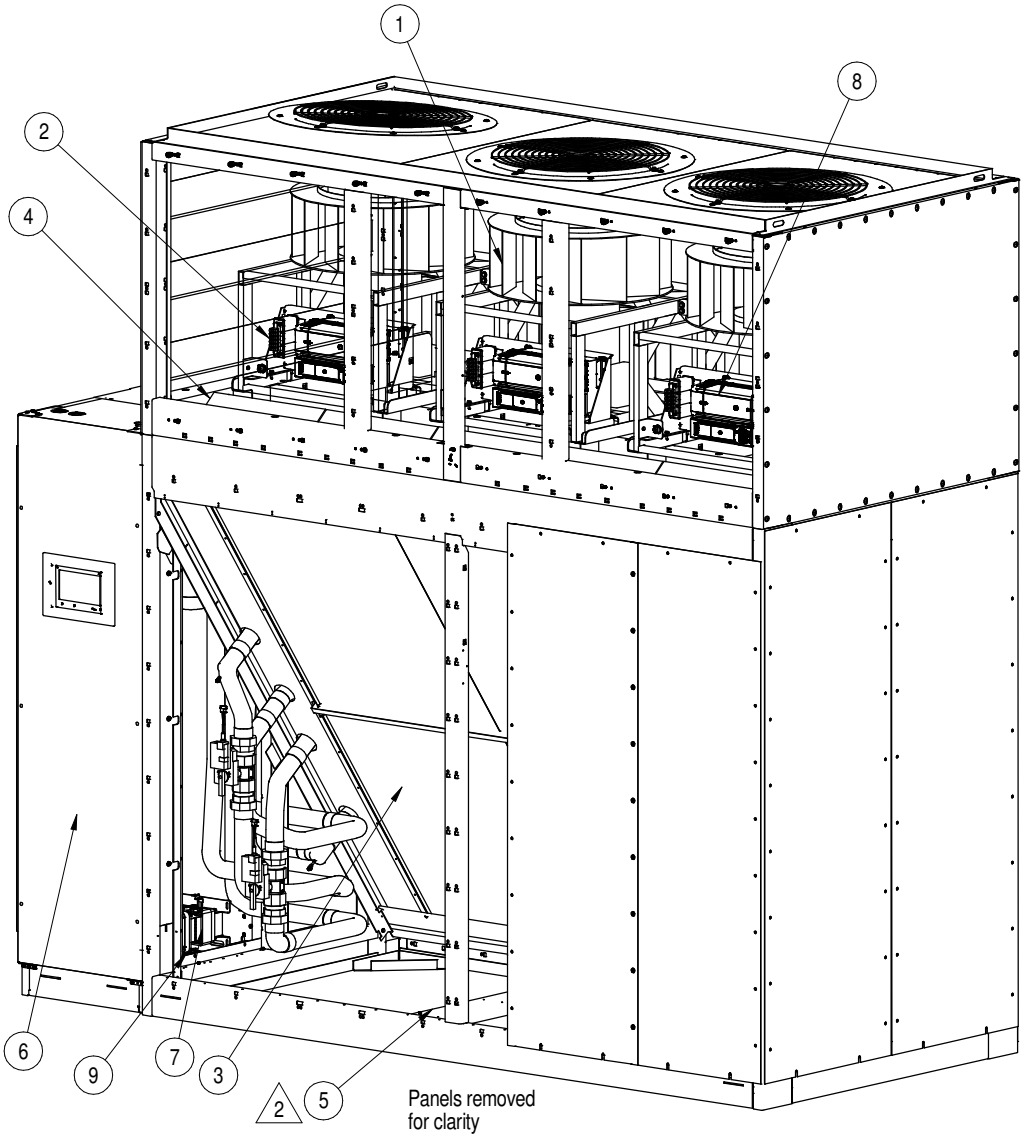
GALLERY INSTALLATION AND SERVICE CLEARANCE



Notes:
1. Electrical Compartment is shown on the left side of the unit.
   Unit may be ordered with Electrical Compartment on either side,
   or with Electrical Compartment facing into Data Hall.

COMPONENT LOCATION DIAGRAM
CW305, 375, 415 W/ BOTTOM DISCHARGE

1. Blower/Motor (Typical 3)
2. Line Reactor Transformers (Typical 3)
3. Evaporator Coil
4. Air Filters
5. Condensate Pump (optional, shipped loose)
6. Electric Panel
7. THD Mitigation Device (optional)
8. VFD Assemblies (Typical 3)
9. 575V Transformer (if applicable)

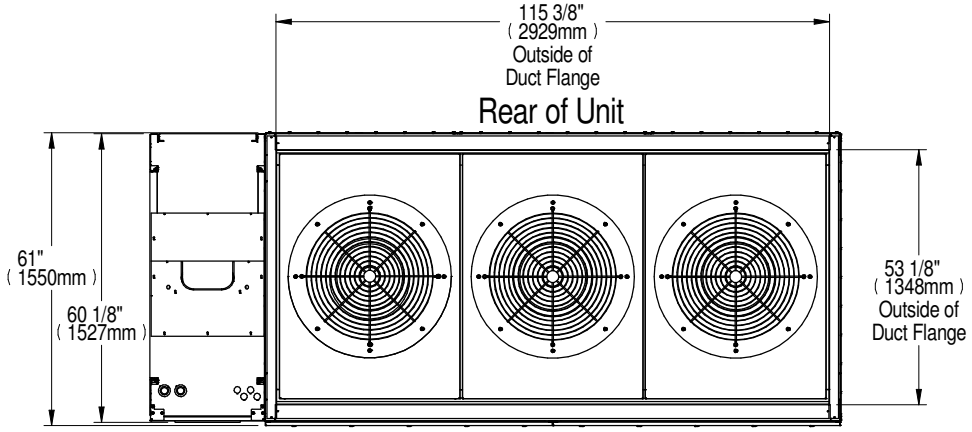


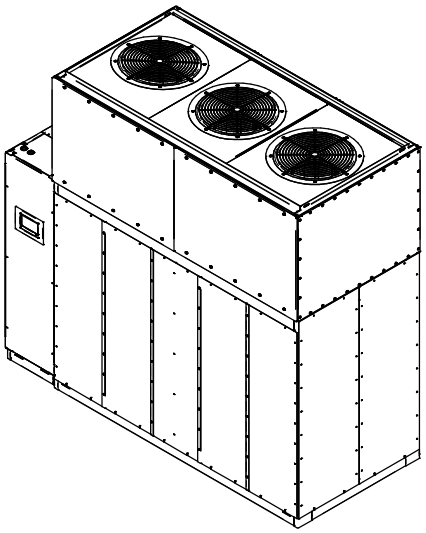
Notes:
1. Electrical Compartment (item #6) shown on left side of unit. Unit may be ordered with Electrical Compartment on either side, or with Electrical Compartment facing into Gallery space.

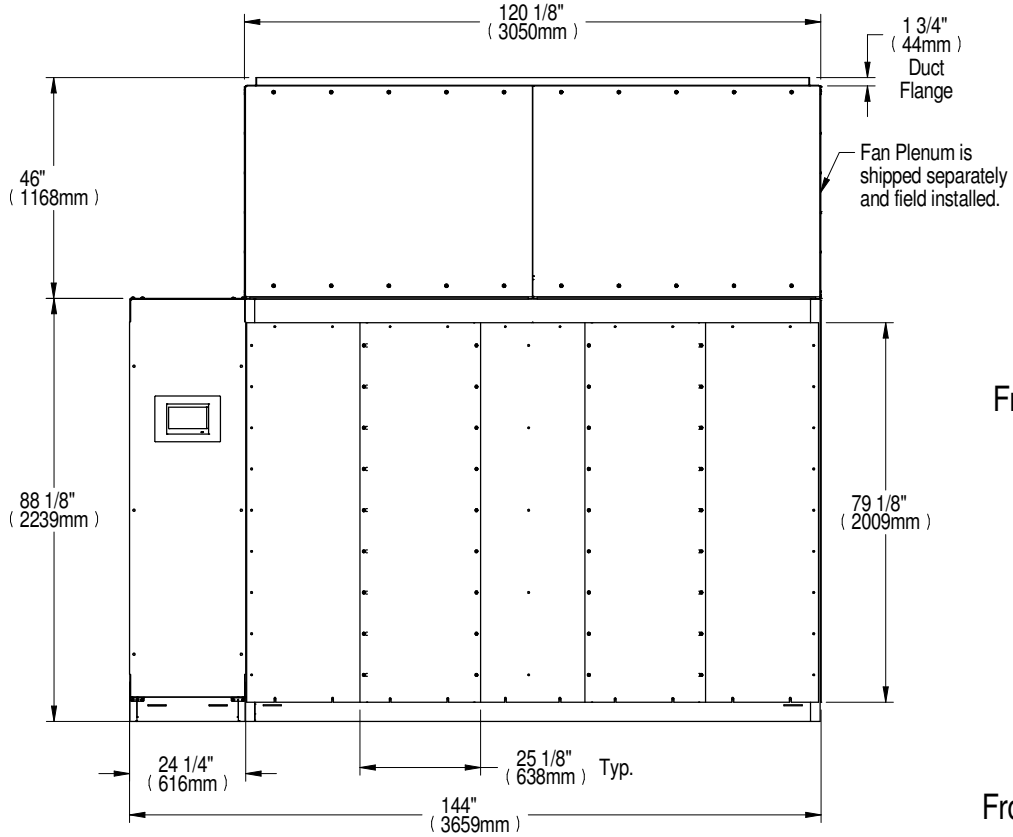
2. Condensate Pump (if ordered) to be shipped loose and attached to this frame member for shipping. Customer to locate and install.

LIEBERT CW

CABINET DIMENSIONAL DATA
CW305, 375, 415 W/ BOTTOM DISCHARGE

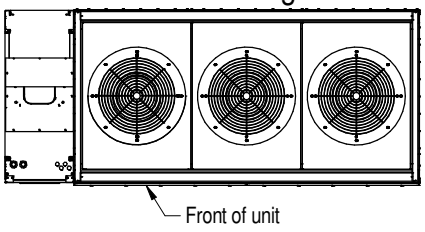




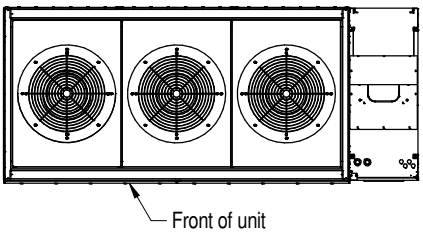


Front of Unit

Data Hall Unit configuration



Front Left Facing Electrical Compartment

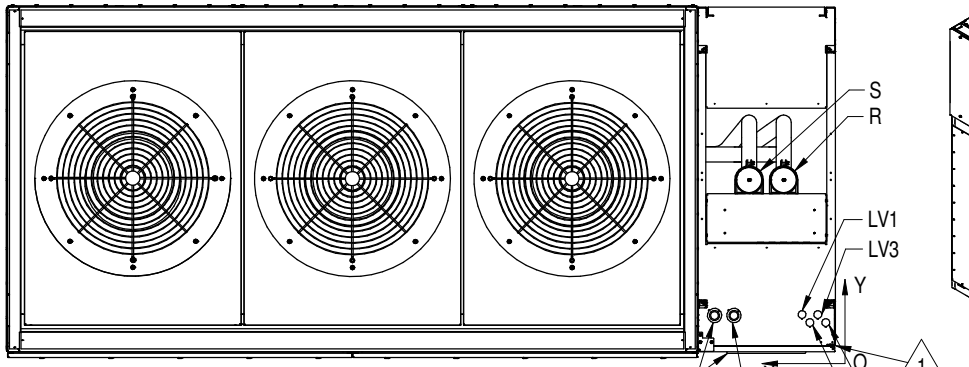


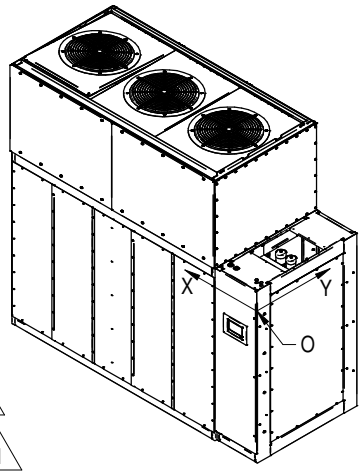
Front Right Facing Electrical Compartment

LIEBERT CW

PRIMARY CONNECTION LOCATIONS
CW305, 375, 415 W/ BOTTOM DISCHARGE
FRONT RIGHT FACING ELECTRICAL/PIPING COMPARTMENT

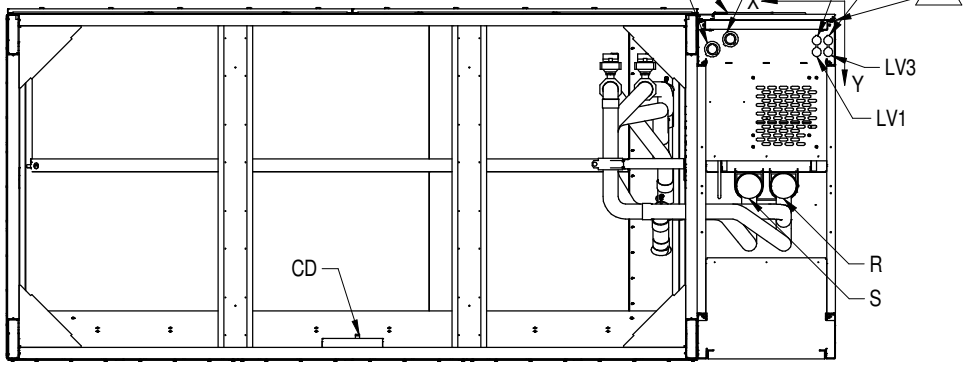
Top View





ISO View showing Display location

Bottom View



POINT	Description	Top View		Bottom View		Connection Size/Opening
		X in. (mm)	Y in. (mm)	X in. (mm)	Y in. (mm)	
HV1	Electrical Conn. (High Volt)	21 (533)	6-1/4 (159)	21-3/8 (543)	5 (127)	2-1/2"
HV2		17-5/8 (448)		18-1/4 (464)	3-1/4 (83)	
LV1	Electrical Conn. (Low Volt)	5-3/4 (148)	6-3/8 (162)	3-1/4 (83)	5-1/2 (140)	1-1/2"
LV2		4-38 (113)	5 (127)	1-1/4 (32)	3-1/2 (89)	
LV3		3 (78)	6-3/8 (162)	3-1/4 (83)	5-1/2 (140)	
LV4		1-5/8 (43)	5 (127)	1-1/4 (32)	3-1/2 (89)	
CD	Condensate Drain △3	N/A	N/A	83 (2108)	54-1/2 (1384)	3/4" NPT Female
CP	Condensate Pump			△2	△2	1/2" O.D. Cu
S	Supply Pipe Connection			15 (381)	28-3/4 (731)	4-1/8 O.D. Cu
R	Return Pipe Connection			9 (229)		

Notes:

△1. Drawing not to scale. All dimensions from right corner on service side and have a tolerance of ± 1/2" (13mm).

△2. Condensate Pump to be field located and installed by customer.

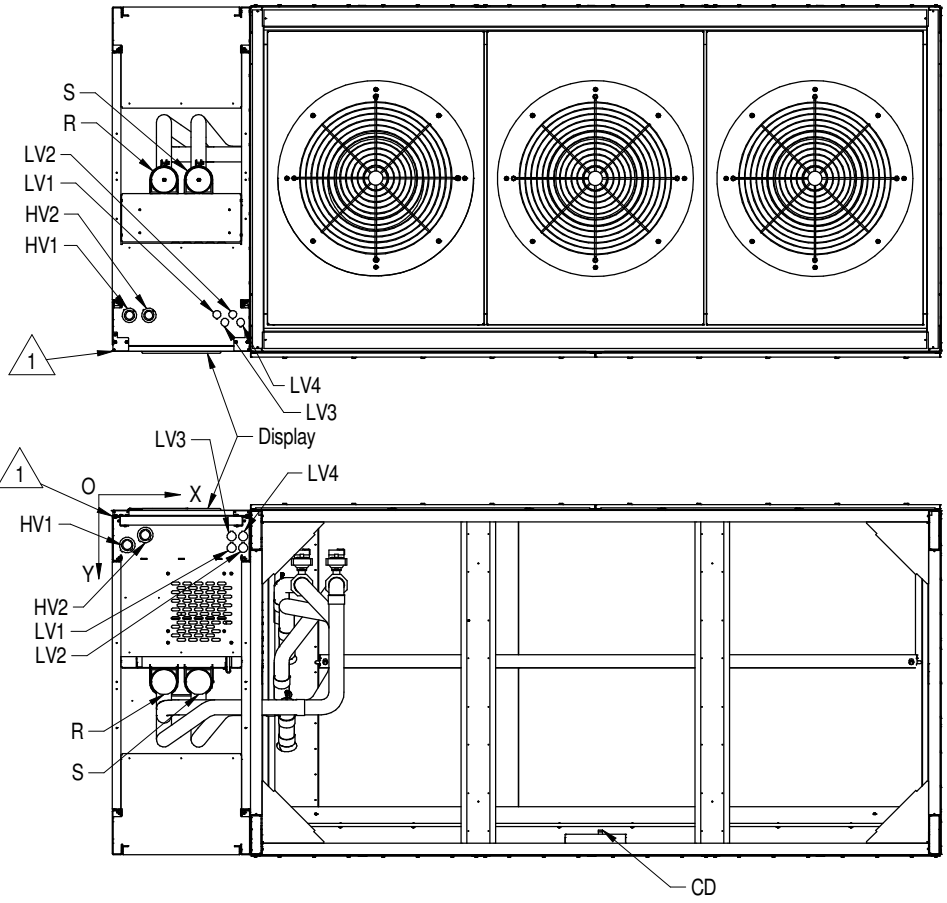
△3. Field pitch Condensate Drain line a minimum of 1/8" (3.2mm) per 12" (305mm).
Install an external 5-1/2" (140mm) trap in the drain line (if desired). The factory unit does not contain a trap. Select appropriate drain system materials.
The drain must comply with all local codes.

4. Piping connection can be made at the top or bottom of the unit.

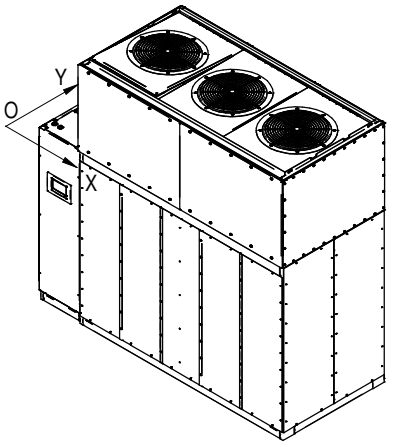
LIEBERT CW

PRIMARY CONNECTION LOCATIONS
CW305, 375, 415 W/ BOTTOM DISCHARGE
FRONT LEFT FACING ELECTRICAL/PIPING COMPARTMENT

Top View



Bottom View



ISO View showing Display location

POINT	Description	Top View		Bottom View		Connection Size/Opening
		X in. (mm)	Y in. (mm)	X in. (mm)	Y in. (mm)	
HV1	Electrical Conn. (High Volt)	2-7/8 (73)	6-1/4 (160)	2-1/2 64)	5 (127)	2-1/2"
HV2		6-1/4 (159)		5-5/8 (143)	3-1/4 (83)	
LV1	Electrical Conn. (Low Volt)	18-1/8 (459)	6-3/8 (163)	20-5/8 (524)	5-1/2 (140)	1-1/2"
LV2		19-1/2 (494	5 (129		3-1/2 (89)	
LV3		20-7/8 (529)	6-3/8 (163)	22-5/8 (575)	5-1/2 (140)	
LV4		22-1/4 (564)	5 (129)		3-1/2 (89)	
CD	Condensate Drain △3	N/A	N/A	84-5/8 (2149)	54-1/2 (1384)	3/4" NPT Female
CP	Condensate Pump △2			△2	△2	1/2" O.D. Cu
S	Supply Pipe Connection			15 (381)	28-3/4 (731)	4-1/8" O.D. Cu
R	Return Pipe Connection			9 (229)		

Notes:

△1. Drawing not to scale. All dimensions from right corner on service side and have a tolerance of ± 1/2" (13mm).

△2. Condensate Pump to be field located and installed by customer.

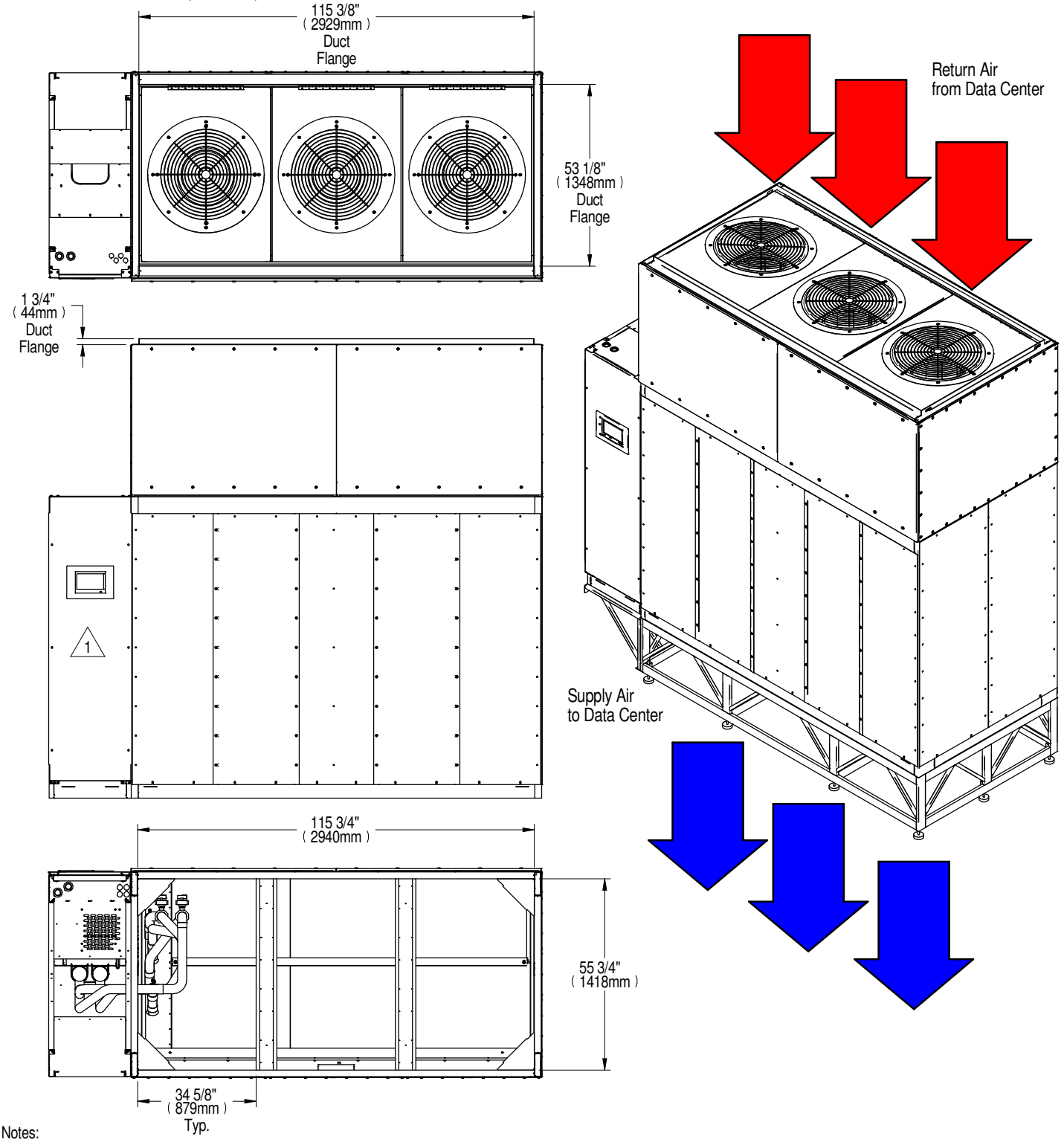
△3. Field pitch Condensate Drain line a minimum of 1/8" (3.2mm) per 12" (305mm).
Install an external 5-1/2" (140mm) trap in the drain line (if desired). The factory unit does not contain a trap. Select appropriate drain system materials.
The drain must comply with all local codes.

4. Piping connection can be made at the top or bottom of the unit.

LIEBERT CW

AIRFLOW SCHEMATIC

CW305, 375, 415 DOWNFLOW UNIT W/ BOTTOM DISCHARGE



Notes:

1. Electrical Compartment shown on left side of unit.
   Unit may be ordered with Electrical Compartment on right or left side of unit.

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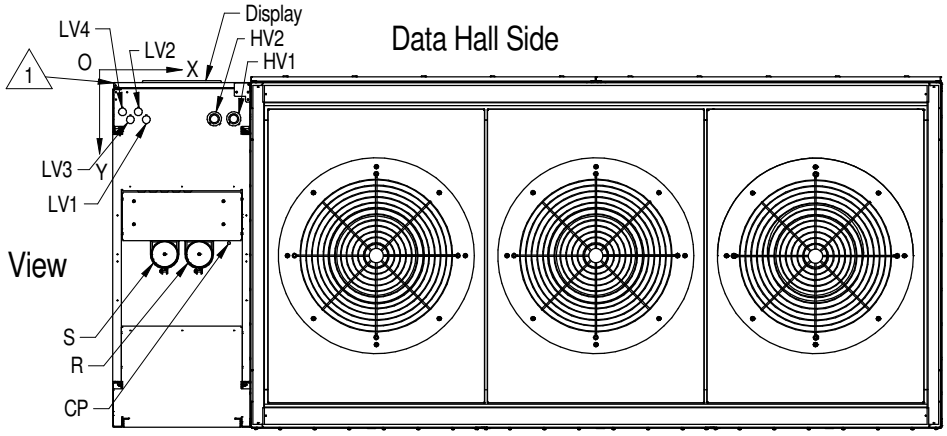
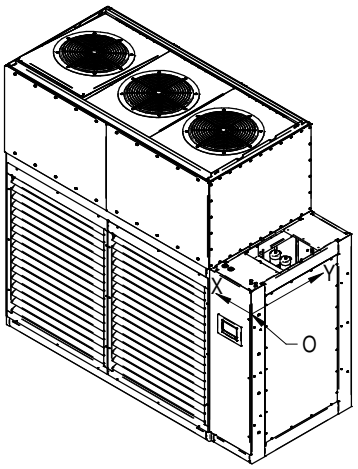
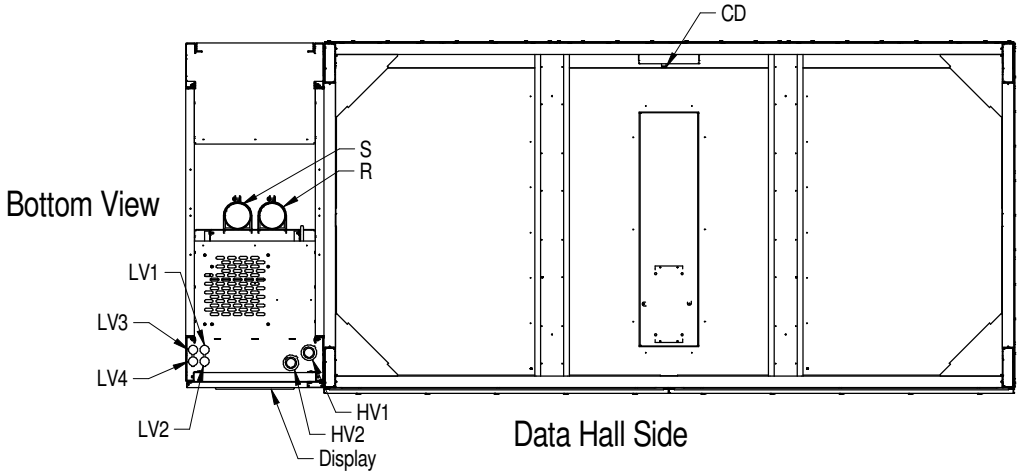
PRIMARY CONNECTION LOCATIONS
CW305, 375, 415 DATA HALL W/ HORIZONTAL DISCHARGE
FRONT RIGHT FACING ELECTRICAL/PIPING COMPARTMENT





ISO View showing Display location



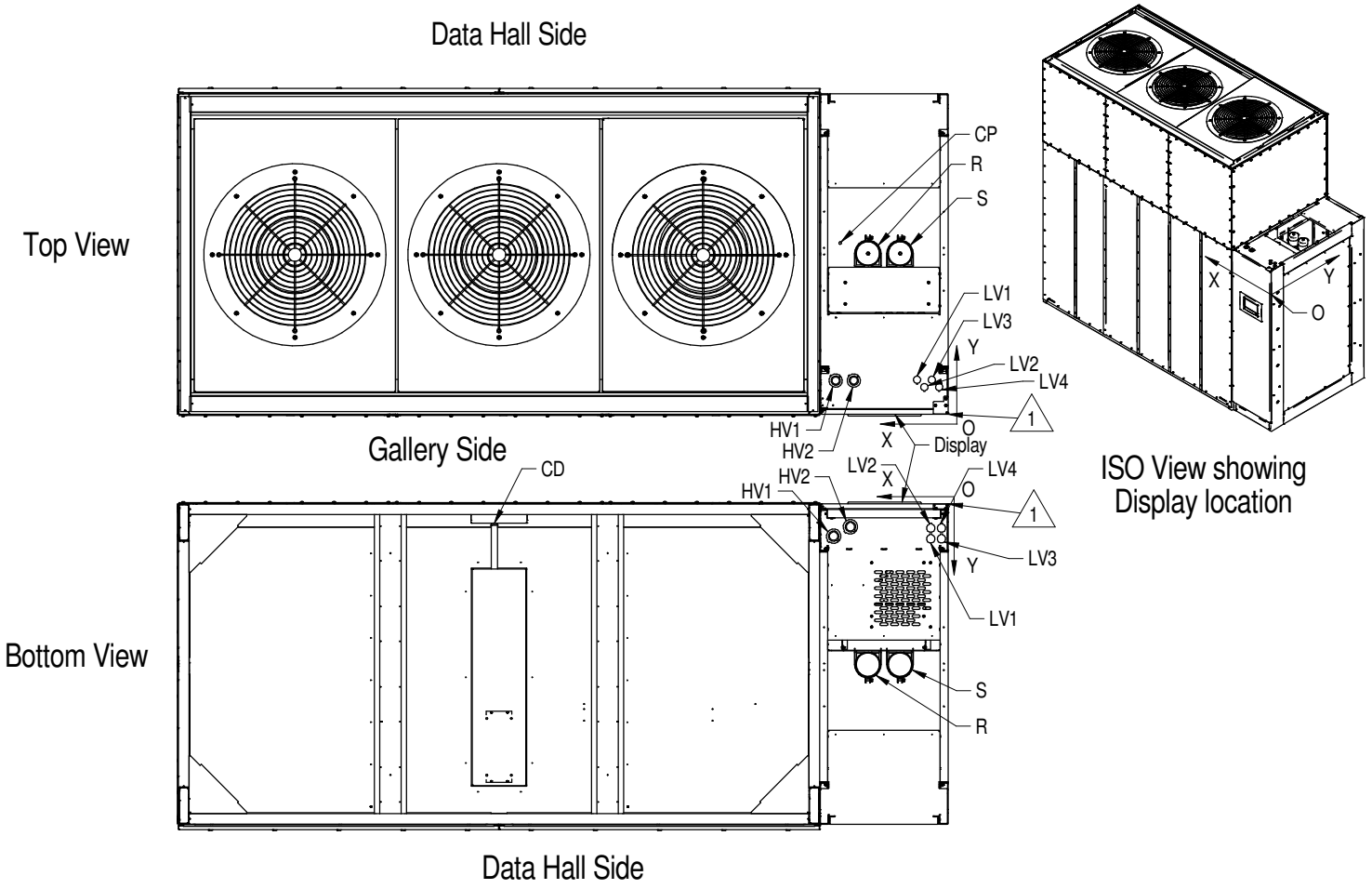
POINT	Description	Top View		Bottom View		Connection Size/Opening
		X in. (mm)	Y in. (mm)	X in. (mm)	Y in. (mm)	
HV1	Electrical Conn. (High Volt)	20-1/8 (513)	6-1/4 (160)	21-1/4 (540)	6 (153)	2-1/2"
HV2		17-1/2 (444)		18-1/8 (460)	4-1/4 (109)	
LV1	Electrical Conn. (Low Volt)	5-5/8 (144)	6-3/8 (163)	3-1/8 (79	6-1/2 (166)	1-1/2"
LV2		4-1/4 (109)	5 (129)		4-1/2 (115)	
LV3		2-7/8 (75)	6-3/8 (163)	1-1/8 (29)	6-1/2 (166)	
LV4		1-1/2 (40)	5 (129)		4-1/2 (115)	
CD	Condensate Drain 2	N/A	N/A	82-7/8 (2105)	55-1/2 (1410)	3/4" NPT Female
CP	Condensate Pump	20 (509)	27-7/8 (707)	N/A	N/A	1/2" O.D. Cu
S	Supply Pipe Connection	N/A	N/A	14-7/8 (378)	30 (762)	4-1/8" O.D. Cu
R	Return Pipe Connection			8-7/8 (225)		

Notes:

1. Drawing not to scale. All dimensions from right corner on service side and have a tolerance of ± 1/2" (13mm).
2. Field pitch Condensate Drain line a minimum of 1/8" (3.2mm) per 12" (305mm). Install an external 5-1/2" (140mm) trap in the drain line (if desired). The factory unit does not contain a trap. Select appropriate drain system materials. The drain must comply with all local codes.
3. Piping connection can be made at the top or bottom of the unit.

LIEBERT CW

PRIMARY CONNECTION LOCATIONS
CW305, 375, 415 GALLERY W/ HORIZONTAL DISCHARGE
FRONT RIGHT FACING ELECTRICAL/PIPING COMPARTMENT



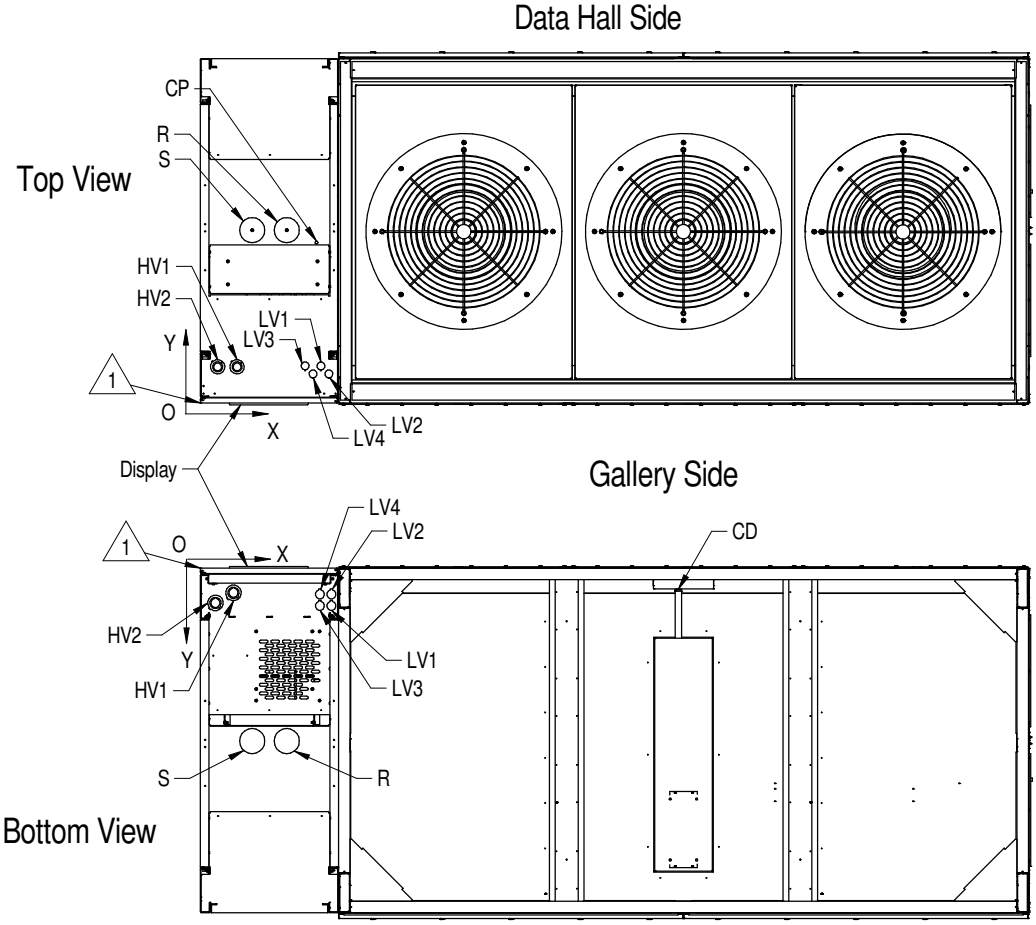
POINT	Description	Top View		Bottom View		Connection Size/Opening
		X in. (mm)	Y in. (mm)	X in. (mm)	Y in. (mm)	
HV1	Electrical Conn. (High Volt)	21 (533)	6-1/4 (160)	21-3/8 (543)	6 (153)	2-1/2"
HV2		17-5/8 (448)		18-1/4 (464)	4-1/4 (109)	
LV1	Electrical Conn. (Low Volt)	5-3/4 (148)	6-1/2 (164	3-1/4 (83)	6-1/2 (166)	1-1/2"
LV2		4-3/8 (113)	5-1/8 (129)		4-1/2 (115)	
LV3		3 (78)	6-1/2 (164)	1-1/4 (32)	6-1/2 (166)	
LV4		1-1/2 (37)	5-1/8 (129)		4-1/2 (115)	
CD	Condensate Drain 2	N/A	N/A	84-3/4 (2153)	3-5/8 (94)	3/4" NPT Female
CP	Condensate Pump	20-1/8 (512)	27-7/8 (708)	N/A	N/A	1/2" O.D. Cu
S	Supply Pipe Connection	N/A	N/A	9 (229)	30 (762)	4-1/8" O.D. Cu
R	Return Pipe Connection			15 (381)		

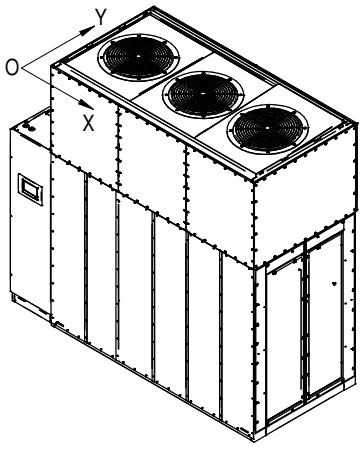
Notes:

1. Drawing not to scale. All dimensions from right corner on service side and have a tolerance of ± 1/2" (13mm).
2. Field pitch Condensate Drain line a minimum of 1/8" (3.2mm) per 12" (305mm). Install an external 5-1/2" (140mm) trap in the drain line (if desired). The factory unit does not contain a trap. Select appropriate drain system materials. The drain must comply with all local codes.
3. Piping connection can be made at the top or bottom of the unit.

LIEBERT CW

PRIMARY CONNECTION LOCATIONS
CW305, 375, 415 GALLERY W/ HORIZONTAL DISCHARGE
FRONT LEFT FACING ELECTRICAL/PIPING COMPARTMENT





ISO View showing Display location

POINT	Description	Top View		Bottom View		Connection Size/Opening
		X in. (mm)	Y in. (mm)	X in. (mm)	Y in. (mm)	
HV1	Electrical Conn. (High Volt)	6-3/8 (162)	6-1/4 (160)	5-3/4 (146)	6 (153)	2-1/2"
HV2		3 (76)		2-5/8 (67)	4-1/4 (109)	
LV1	Electrical Conn. (Low Volt)	21 (532)	6-1/2 (164	22-3/4 (578)	6-1/2 (166)	1-1/2"
LV2		22-3/8 (567)	5-1/8 (129)		4-1/2 (115)	
LV3		18-1/4 (462)	6-1/2 (164)	20-3/4 (527)	6-1/2 (166)	
LV4		19-5/8 (497)	5-1/8 (129)		4-1/2 (115)	
CD	Condensate Drain 2	N/A	N/A	83 (2108)	3-5/8 (94)	3/4" NPT Female
CP	Condensate Pump	20-1/8 (512)	27-7/8 (708)	N/A	N/A	1/2" O.D. Cu
S	Supply Pipe Connection	N/A	N/A	9 (229)	30 (762)	4-1/8" O.D. Cu
R	Return Pipe Connection			15 (381)		

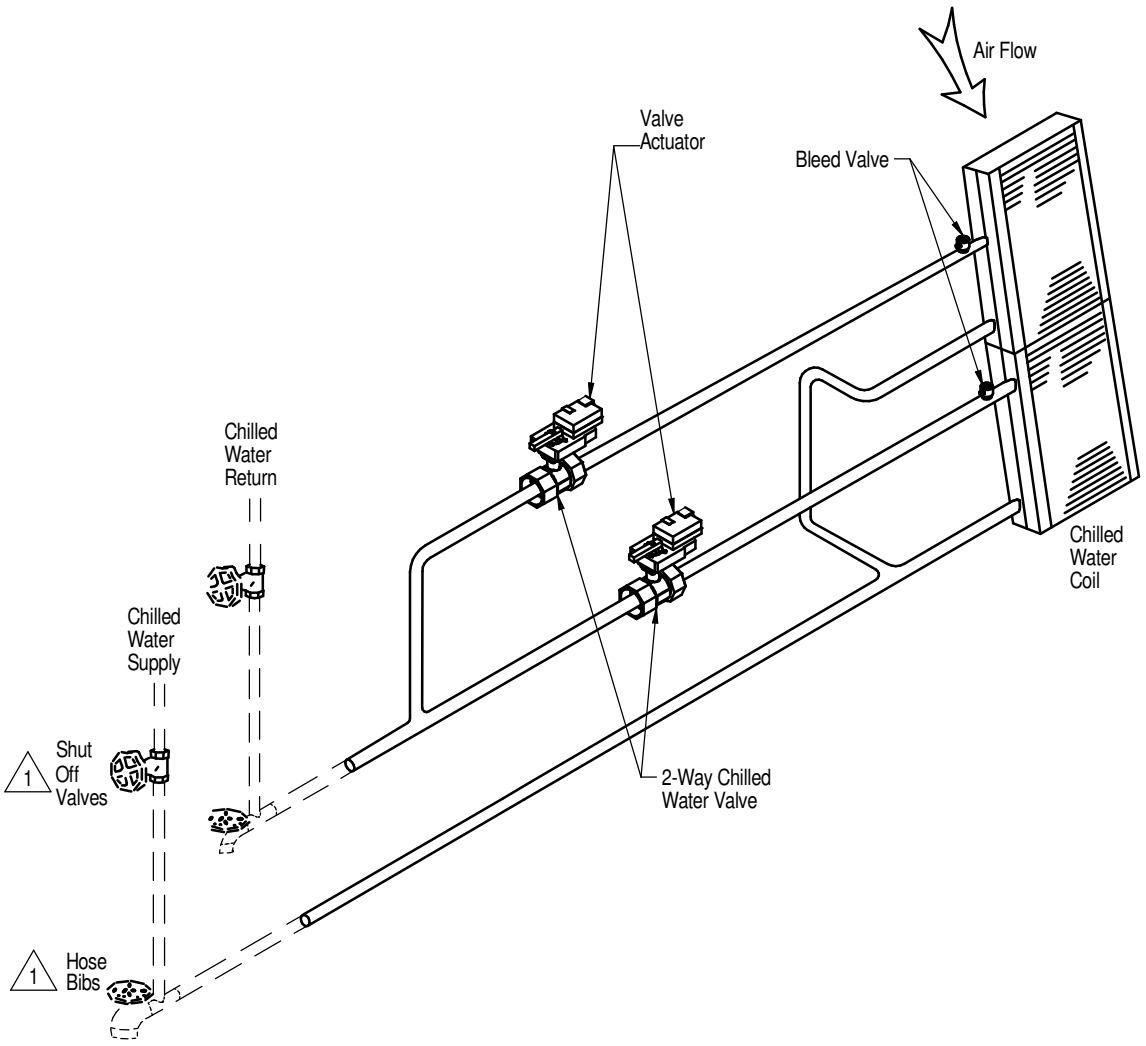
Notes:

1. Drawing not to scale. All dimensions from right corner on service side and have a tolerance of ± 1/2" (13mm).
2. Field pitch Condensate Drain line a minimum of 1/8" (3.2mm) per 12" (305mm). Install an external 5-1/2" (140mm) trap in the drain line (if desired). The factory unit does not contain a trap. Select appropriate drain system materials. The drain must comply with all local codes.
3. Piping connection can be made at the top or bottom of the unit.

LIEBERT CW

GENERAL ARRANGEMENT DIAGRAM

CW305, 375, 415



FACTORY PIPING

FIELD PIPING

Notes:

1. Components are not supplied by Liebert, but are required for proper circuit operation and maintenance.

Appendix C: Guide Specifications

The following are the guide specifications for the Liebert® CW.

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Liebert CW™ Model 305, 375, 415

Guide Specifications

1.0 GENERAL

1.1 SUMMARY

These specifications describe requirements for a Thermal Management system. The system shall be designed to control temperature in rooms containing electronic equipment, with good insulation and vapor barrier. The manufacturer shall design and furnish all equipment to be fully compatible with heat dissipation requirements of the room.

1.2 DESIGN REQUIREMENTS

The Thermal Management system shall be a Liebert self-contained, factory-assembled unit. Standard 60 Hz units shall be CSA-certified to the harmonized U.S. and Canadian product safety standard, "CSA C22.2 No 236/UL 1995 for Heating and Cooling Equipment" and are marked with the CSA c-us logo.

1.3 SUBMITTALS

Submittals shall be provided with the agreement of the proposal and shall include: Single-Line Diagrams; Dimensional, Electrical and Capacity Data; Piping; and Electrical Connection Drawings.

1.4 SERVICEABILITY/ACCESS

The cabinet shall be designed so that all components are easily accessible for service and maintenance through the unit's required service access location. No side access shall be required.

1.5 ACCEPTABLE ALTERNATIVES

Acceptable alternatives shall be permitted with engineer's prior approval only. Contractor to submit a detailed summary form listing all variations to include size deviations, electrical load differences, functional and component changes and savings to end user.

1.6 QUALITY ASSURANCE

The specified system shall be factory-tested before shipment. Testing shall include, but shall not be limited to: Quality Control Checks, “Hi-Pot.” The system shall be designed and manufactured according to world-class quality standards. The manufacturer shall be ISO 9001 certified.

2.0 PRODUCT

2.1 FRAME

The unit frame section and fan plenum frame shall be welded, formed sheet metal. They shall be protected against corrosion using the autophoretic coating process. The unit section and the fan plenum shall be shipped as two separate sections. The fan plenum shall be field mounted on top of the unit frame section.

2.1.1 DOWNFLOW AIR-SUPPLY CONFIGURATIONS

2.1.1.1 Downflow Air Bottom Discharge

The supply air shall exit from the bottom of the unit.

2.1.1.2 Downflow Air Horizontal Discharge

The supply air shall exit from the front (data hall side) of the unit.

2.1.2 Downflow Air Return

The return air shall enter the unit from the top.

2.1.3 Exterior Panels

The exterior panels shall be insulated with a minimum 1 in. (25mm), 1.5 lb. (0.68 kg) density fiber insulation. The main front panel shall have captive quarter-turn fasteners. The main unit color shall be RAL-7021 (black gray). The fan plenum shall be painted to match color of the main unit.

2.1.4 Electrical & Piping Options Panel location

2.1.4.1 Data hall or Bottom discharge, left electric panel

The main unit display and piping connections shall exit from the left hand (Data hall side) of the unit.

2.1.4.2 Data hall or Bottom discharge, right electric panel

The main unit display and piping connections shall exit from the right hand (Data hall side) of the unit.

2.1.4.3 Gallery, left electric panel

The main unit display and piping connections shall exit from the left hand (Gallery side) of the unit.

2.1.4.4 Gallery, right electric panel

The main unit display and piping connections shall exit from the right hand (Gallery side) of the unit.

2.2 FILTERS

The filter chamber shall be located within the evaporator coil cabinet, and filters shall be removable from the designated service side of the unit.

2.2.1 Filters, 4 in. MERV 8 or MERV11

Filters shall be deep-pleated, 4 in. (102 mm) filters with an ASHRAE 52.2-2007 MERV8 or MERV11 rating.

Extra Filter Set

____ extra set(s) of filters shall be provided per system.

2.3 LOCKING DISCONNECT SWITCH

The manual disconnect switch shall be mounted in the high-voltage section of the electrical panel. The switch shall prevent access to the high-voltage electrical components until switched to the "OFF" position.

2.3.1 Dual Locking Disconnect with reversing starter and Capacitive buffer (Optional)

The unit shall be provided with two (2) manual disconnect switches mounted in the high-voltage section of the electrical panel. In addition, the unit shall include reversing starter with ATS (automatic transfer switch) control. In the event of a loss of primary power, the unit will automatically switch over to a secondary power source. Upon return of primary power, the unit will automatically return to the primary power source. Also, the unit shall be equipped with an optional capacitive buffer to provide the Liebert iCOM with a minimum of 3 minutes of ride-through power. The capacitive buffer shall provide power to the Liebert iCOM control w/ embedded Unity functionality for continuous connectivity to Building Management System/Building Automation Systems (where applicable). This functionality is not available with valve configured for spring return closed.

2.4 SHORT-CIRCUIT CURRENT RATING (SCCR)

The electrical panel shall provide at least 65,000A SCCR.

Short-circuit current rating (SCCR) is the maximum short-circuit current a component or assembly can safely withstand when protected by a specific overcurrent protective device(s) or for a specified time.

2.5 FAN SECTION

2.5.1 Backward Curved Direct Fan with Variable Speed Drive

The fans shall be plug/plenum type, single inlet and dynamically balanced. The drive package shall be direct drive, and provided with variable speed drives (3 drives per unit). The fans shall be located in a plenum above the unit and will blow air over the slab coil to ensure even air distribution and maximum coil performance. Fan motors shall be nominal 15hp (11.2 kW) each, with a maximum operating speed of 1800 rpm; quantity 3.

2.5.2 Backward Curved Direct Drive Fan with Variable Speed Drive and Total Harmonic Distortion Device—(Optional)

The fans shall be plug/plenum type, single inlet and dynamically balanced. The drive package shall be direct drive, and provided with variable speed drives (3 drives per unit). The fans shall be located in a plenum above the unit and will blow air over the slab coil to ensure even air distribution and maximum coil performance. Fan motors shall be nominal 15hp (11.2 kW) each, with a maximum operating speed of 1800 rpm; quantity 3. An optional passive filter ,THD Mitigation device is installed behind the unit main electric panel, and wired in series between the main disconnect switch (or reversing starter) and power distribution block.

2.6 EVAPORATOR COIL

The evaporator coil shall be Slab design for downflow units and have _____ sq. ft. (_____ sq. m) face area, _____ rows deep. It shall be constructed of rifled copper tubes and aluminum fins with a maximum face velocity of _____ ft. per minute (_____ m/s) at _____ CFM (_____ CMH). A stainless-steel condensate drain pan shall be provided.

3.0 CONTROLS

3.1 LIEBERT ICOM™ MICROPROCESSOR CONTROL WITH 7 IN. COLOR TOUCHSCREEN

The Liebert iCOM shall be microprocessor-based with a 7-inch, high definition, capacitive, color touchscreen display and shall be mounted in an ergonomic, aesthetically pleasing housing. The display and housing shall be viewable while the front panel is open or closed. The controls shall be menu-driven. The system shall display user menus for active alarms, event log, graphic data, unit view/status overview (including the monitoring of room conditions, operational status in percentage of each function, date and time), total run hours, various sensors, display setup and service contacts. A password shall be required to make system changes. Service menus shall include setpoints, standby settings (lead/lag), timers/sleep mode, alarm setup, sensor calibration, maintenance/wellness settings, options setup, system/network setup, auxiliary boards and diagnostics/service mode. The Liebert iCOM control shall provide Ethernet/RS-485 ports dedicated for BMS connectivity (i.e. Base-Comms).

- Password Protection—The Liebert iCOM shall contain two unique passwords to protect against unauthorized changes. An auto hide/show feature allows the user to see applicable information based on the login used.
- Unit Backup and Restore—The user shall be able to create safe copies of important control parameters. The Liebert iCOM shall have the capacity for the user to automatically backup unit configuration settings to internal memory or USB storage drive. Configuration settings may be transferred to another unit for a more streamlined unit startup.
- Parameter Download—The Liebert iCOM shall enable the user to download a report that lists parameter names, factory default settings and user-programmed settings in .csv format for remote reference.
- Parameter Directory—The Liebert iCOM shall provide a directory that lists all parameters in the control. The list shall provide Line ID numbers, parameter labels, and current parameter values.
- Parameter Search—The Liebert iCOM shall have search fields for efficient navigation and parameter lookup.
- Context-Sensitive Help—The Liebert iCOM shall have an on-board help database. The database shall provide context sensitive help to assist with setup and navigation of the menus.
- Display Setup—The user shall have the ability to configure the Liebert iCOM information based on the specific user's preference. Language, units of measure, screen contrast, home screen layout, back-light timer and the hide/show of certain readouts shall be configurable through the display.
- Additional Readouts—The Liebert iCOM shall permit the user to configure custom widgets on the main screen. Widget options shall include items such as fan speed, call for cooling, call for free-cooling, maintenance status, call for hot water reheat, call for electric reheat, call for dehumidification, call for humidification, airflow, static pressure, fluid flow rate and cooling capacity.
- Status LED’s—The Liebert iCOM shall provide the user with the unit's operating status using an integrated LED. The LED shall indicate if the unit has an active alarm; if the unit has an active alarm that has been acknowledged; or if the unit is On, Off or in standby status.
- Event Log—The Liebert iCOM shall automatically store the last 400 unit-only events (messages, warnings, and alarms).
- Service Contact Information—The Liebert iCOM shall have the ability to store the local service or sales contact information.
- Upgradeable—Liebert iCOM firmware upgrades shall be performed through a USB connection.
- Timers/Sleep Mode—The menu shall allow various customer settings for turning on/off unit.

- Menu Layout—The menus shall be divided into two main menu screens: User and Service. The User screen shall contain the menus to access parameters required for basic unit control and setup. The Service screen shall be designed for service personal and provides access to advanced control setup features and diagnostic information.
- Sensor Calibration—The menus shall allow unit sensors to be calibrated with external sensors.
- Maintenance/Wellness Settings - The menus shall allow reporting of potential component problems before they occur.
- Options Setup—The menus shall provide operation settings for the installed components.
- Auxiliary Boards—The menus shall allow setup of optional expansion boards.
- Various Sensors—The menus shall allow setup and display of optional custom sensors. The control shall include four customer-accessible analog inputs for field-provided sensors. The analog inputs shall accept a 4 to 20mA signal. The user shall be able to change the input to 0 to 5VDC or 0 to 10VDC. The gains for each analog input shall be programmable from the front display. The analog inputs shall be able to be monitored from the front display.
- Diagnostics/Service Mode—The Liebert iCOM® shall be provided with self-diagnostics to aid in troubleshooting. The microcontroller board shall be diagnosed and reported as pass/not pass. Control inputs shall be indicated as On or Off at the front display. Control outputs shall be able to be turned On or Off from the front display without using jumpers or a service terminal. Each control output shall be indicated by an LED on a circuit board.
- Base-Comms for BMS Connectivity – The Liebert iCOM controller shall provide one Ethernet Port and RS-485 Port dedicated for BMS Connectivity. Provides ground fault isolated RS-485 Modbus, BACnet IP & Modbus IP network connectivity to Building Management Systems for unit monitoring and management. Also, provides ground fault isolated 10/100 baseT Ethernet connectivity for unit monitoring and management. The supported management interfaces include: SNMP for Network Management Systems, HTTP for web page viewing, SMTP for email, and SMS for mobile messaging. The iCOM controller can support dual IP on a single network and one 485 protocol simultaneously.

3.2 ALARMS

All unit alarms shall be annunciated through both audio and visual cues, clearly displayed on the screen, automatically recorded in the event log and communicated to the customer's Building Management System/Building Automation System. The Liebert iCOM shall activate an audible and visual alarm in the event of any of the following conditions:

- High Temperature
- Low Temperature
- High Humidity
- Low Humidity
- Fan Fault
- Change Filters
- Loss of Air Flow
- Loss of Power
- Custom Alarms

Custom alarm inputs shall be provided to indicate facility-specific events. Custom alarms can be identified with programmable labels. Frequently used alarm inputs shall include:

- Leak Under Floor
- Smoke Detected
- Standby Unit On

Each alarm (unit and custom) shall be separately enabled or disabled, selected to activate the common alarm and programmed for a delay of 0 to 255 seconds.

3.3 LIEBERT ICOM™ CONTROL METHODS AND OPTIONS

The Liebert iCOM shall be factory-set to allow precise monitoring and control of the condition of the air entering and leaving the unit. This control shall include predictive methods to control air flow and cooling capacity based control sensors installed. Proportional and Tunable PID shall also be user-selectable options.

3.3.1 Controlling Sensor Options

The Liebert iCOM shall be flexible in the sense that it shall allow controlling the capacity and fan from multiple different sensor selections. The sensor selections shall be:

Cooling Capacity

- Supply
- Remote
- Return

Fan Speed

- Supply
- Remote
- Return
- Manual (for diagnostics or to receive a signal from the BMS through Liebert remote monitoring devices or analog input)
- Static Pressure

3.3.2 Temperature Compensation

The Liebert iCOM™ shall have the ability to adjust the capacity output based on supply and return temperature conditions to meet SLA guidelines while operating to highest efficiency.

3.4 MULTI-UNIT COORDINATION

Liebert iCOM teamwork shall save energy by preventing multiple units in an area from operating in opposing modes. Teamwork allows the control to optimize a group of connected equipped with Liebert iCOM using the U2U (Unit-to-Unit) network. There shall be three modes of teamwork operation:

- Teamwork Mode 1 (Parallel): Is best in small rooms with balanced heat loads. The controlling temperature and humidity sensor readings of all units in operation (fan On) are collected to be used for an average or worst case sensor reading (user selectable). The master unit shall send the operating requirements to all operating units in the group. The control band (temperature, fan and humidity) is derived and shared among the units in the group. Each unit will receive instructions on how to operate from the Master unit based on how far the system deviates from the setpoints. Evaporator fans and cooling capacity are ramped in parallel.
- Teamwork Mode 2 (Independent): The Liebert iCOM calculates the worse-case demand for heating, cooling humidification and dehumidification. Based on the greatest demand within the group, each unit operates independently, meaning that the unit may respond to the thermal load and humidity conditions based on the units controlling sensors. All sensor readings are shared.
- Teamwork Mode 3 - Optimized Aisle (Optimized Aisle): May be applied in large and small rooms with varying heat loads. Optimized Aisle is the most efficient teamwork mode that allows the unit to match cooling capacity with heat load. In the Optimized Aisle mode, the fans operate in parallel. Fans can be controlled exclusively by remote temperature or using static pressure with a secondary remote temperature sensor(s) as an override to ensure that the inlet rack temperature is being met. Cooling (Compressors, Economizer or EconoPhase) is controlled off unit supply air conditions. The Liebert iCOM calculates the average or worst-case sensor reading (user-selectable) for heating, cooling humidification and dehumidification. Based on the demand within the group, units will be allowed to operate within that mode until room conditions are satisfied. This is the best form of control for a room with an unbalanced load.

3.5 STANDBY/LEAD-LAG

The Liebert iCOM shall allow planned rotation to keep equal run time on units and provide automated emergency rotation of operating and standby units.

3.6 STANDBY UNIT CASCADING

The Liebert iCOM cascade option shall allow the units to turn On and Off based on heat load when utilizing Teamwork Mode 3–Optimized Aisle mode with remote temperature sensors. In Teamwork Mode 3, Cascade mode will stage units On based on the temperature and humidity readings and their deviation from setpoint. Cascade mode coordinates the fan speed dynamically to save energy and to meet cooling demands. For instance, with a Liebert iCOM group of six units and only 50% of the heat load, the Liebert iCOM shall operate only four units at 80% fan speed and leave the other two units in standby. As the heat load increases, the Liebert iCOM shall automatically respond to the new load and bring on another unit, increasing the units in operation to five. As the heat load shifts up or down, the control shall meet the needs by cascading units On or putting them back into standby.

3.7 VIRTUAL MASTER

As part of the robust architecture of the Liebert iCOM control, it shall allow for a virtual master that coordinates operation. The Virtual Master function shall provide smooth control operation if the group's communication is compromised. When the lead unit, which is in charge of component staging in teamwork, unit staging and standby rotation, becomes disconnected from the network, the Liebert iCOM automatically assigns a virtual master. The virtual master shall assume the same responsibilities as the master until communication is restored.

3.8 VIRTUAL BACK-DRAFT DAMPER

The Liebert iCOM shall allow the use of a virtual back-draft damper, eliminating the need for a mechanical damper. This shall allow the fans of a stand-by unit to spin in reverse at a low speed (15% or less) to act as a damper.

3.9 WIRED SUPPLY SENSOR

Each Liebert iCOM shall have one factory-supplied and connected supply air sensor that may be used as a controlling sensor or reference. When multiple sensors are applied for control purposes, the user shall be able to control based on a maximum or average temperature reading.

3.10 SYSTEM AUTO RESTART

The auto restart feature shall automatically restart the system after a power failure. Time delay shall be programmable. An optional capacitive buffer may be provided for continuous control operation through a power outage.

3.11 SEQUENTIAL LOAD ACTIVATION

On initial startup or restart after power failure, each operational load shall be sequenced with a minimum of one second delay to minimize total inrush current.

4.0 MISCELLANEOUS OPTIONS

4.1 SMOKE SENSOR—OPTIONAL

The smoke sensor shall immediately shut down the Thermal Management system and activate the alarm system when activated. The smoke sensor shall be mounted in the electrical panel with the sensing element in the return air compartment. The smoke sensor is not intended to function as or replace any room smoke detection system that may be required by local or national codes. The smoke sensor shall include a supervision contact closure.

4.2 CONDENSATE PUMP, DUAL FLOAT—OPTIONAL

The pump shall have a capacity of _____ GPM (_____ l/m) at _____ ft head (_____ kPa). It shall be complete with integral dual-float switches, pump-and-motor assembly and reservoir. The secondary float shall send a signal to the local alarm and shut down the unit upon high water condition.

4.3 LOW VOLTAGE TERMINAL PACKAGE—OPTIONAL

Factory-installed and factory-wired terminals shall be provided.

- Remote Shutdown Terminals - 2 additional pairs of terminals provide the customer with additional locations to remotely shut-down the unit by field-installed devices or controls.
- Extra Common-Alarm Contacts - 2 additional pairs of terminals provide the customer with normally-open contacts for remote indication of unit alarms.
- Main-Fan Auxiliary Switch - 1 set of normally-open contacts wired to the EC-fan motor contactor will close when EC-fan operation is required. This set of dry contacts could also be used to initiate air economizer operation. Air economizer and associated devices by others.
- Liqui-tect Shutdown - 1 pair of dry contacts for the Liqui-tect sensor signal will provide unit shut down. (Liqui-tect sensor is not included.)

4.4 REMOTE HUMIDIFIER CONTACT—OPTIONAL

A pair of N/O contacts provided for connection to a remote humidifier that allow the unit's humidity controller to control a humidifier outside the unit. Power to operate the remote humidifier does not come from the unit.

4.5 FAN OVERLOAD

The fan fault alarm is standard on all models.

4.6 WIRED REMOTE SENSOR(S)—OPTIONAL

Each Liebert iCOM™ can have up to ten 2T sensors (20 sensor readings total) for control or reference. As part of the U2U network, those sensors shall be shared and used to control the cooling units and provide greater flexibility, visibility and control to respond to changes in the conditioned space. When the sensors are used for control, the user may set the control to be based off a maximum or average of a selected highest temperature reading.

4.7 LIEBERT LIQUI-TECT™ SENSORS (MAXIMUM OF 2 PER UNIT)—OPTIONAL

____ (quantity) solid state water sensors shall be provided for installation under the raised floor.

4.8 FLOOR STAND—OPTIONAL FOR RAISED-FLOOR APPLICATIONS

The floor stand shall be constructed of a welded steel frame. The floor stand shall have adjustable legs with vibration isolation pads. The floor stand shall be ____ in. (_____mm) high.

4.9 LIEBERT vNSA™ NETWORK SWITCH—OPTIONAL

The Liebert vNSA network switch is designed for networking multiple iCOM unit-level controllers together. There shall be two different styles of the vNSA14 panel available:

- vNSA14 – enclosure with network switches only
- vNSA14-iCOM-H – enclosure with network switches and 9” iCOM color touchscreen display

Each offering shall be housed inside a steel enclosure secured with a key lock and contain two network switches, providing a total of 14 Ethernet ports available for iCOM controller unit-to-unit networking. The Liebert vNSA requires field supplied, hard wiring, 16AWG, 100-240VAC universal (12V, 1.5A) single-phase input power supply for 120V or 230V operation with factory supplied power connector.

4.10 POWER MONITORING—OPTIONAL

The unit shall be equipped with factory-programmed/installed power meters to monitor power characteristics for either individual component or total unit. These meters allow the user to monitor meter connection status, input under voltage, input RMS voltage leg-to-leg and leg-to ground, input current for each phase, energy consumption in kilowatt hours and instantaneous power in watts. In multi-unit applications, a phase loss protection routine shall place a unit into standby mode in the event that phase loss is detected.

5.0 EXECUTION

5.1 INSTALLATION OF THERMAL MANAGEMENT UNITS

The customer or the customer's representative shall be responsible for the following:

5.1.1 General

Install Thermal Management units in accordance with the manufacturer's installation instructions. Install units plumb and level, firmly anchored in locations indicated and maintain the manufacturer's recommended clearances.

5.1.2 Electrical Wiring

Install and connect electrical devices furnished by the manufacturer but not specified to be factory-mounted. Furnish copy of the manufacturer's electrical connection diagram submittal to electrical contractor.

5.2 PIPING CONNECTIONS

Install and connect devices furnished by manufacturer but not specified to be factory-mounted. Furnish copy of the manufacturer's piping connection diagram submittal to piping contractor.

5.2.1 Supply, Return, and Drain Water Piping

Connect water-supply, water-return, and drains to air-conditioning unit. Provide pitch and trap as manufacturer's instructions and local codes require.

5.3 FIELD QUALITY CONTROL

Start cooling units in accordance with the manufacturer's startup instructions. Test controls and demonstrate compliance with requirements. These specifications describe requirements for a computer room environmental control system. The system shall be designed to maintain temperature and humidity conditions in the rooms containing electronic equipment.

The manufacturer shall design and furnish all equipment to be fully compatible with heat dissipation requirements.

5.4 WARRANTY START-UP AND CONTROL PROGRAMMING

Install the indoor unit in accordance with manufacturer's installation instructions provided with seismic option. Firmly anchor maintaining manufacturer's recommended clearances. Mounting requirement details such as anchor brand, type, embedment depth, edge spacing, anchor-to-anchor spacing, concrete strength, special inspection and attachment to non-building structures must be outlined and approved by the Engineer of Record for the projection or building. Electrical, pipe and duct connections must permit movement in three dimensions and isolate the unit from field connections. Electrical conduit shall be flexible, having at least one bend between the rigid connection at the unit cabinet and the connection to rigid conduit or foundation. The piping flexible connection or loop must be suitable for the operation pressure and temperature of the system. Furnish copy of manufacturer's piping connection diagram submittal to piping contractor.

Engage manufacturer's field service technician to provide warranty start-up supervision and assist in programming of unit(s) controls and ancillary panels supplied by them.


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