Precision Cooling
For *Business-Critical Continuity™*

Liebert VFD Condenser – Model TCDV™

Product Information Manual - 50/60Hz

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1.0 INTRODUCTION

1.1 Description

The Liebert VFD Control Condenser, Model TCDV, is an air cooled direct-drive refrigeration condenser designed to reject the heat from a precision air conditioning unit to the outdoor air. The condenser uses a Variable Frequency Drive (VFD) to control fan speed, which provides positive refrigerant head pressure control for outdoor ambients as low as -20°F (-28.9°C).

Figure 1 Liebert Model TCDV Condenser—2-fan

1.2 Application

The VFD Control Condenser is applied to precision air conditioning units with dual refrigeration circuits, including units with digital scroll compressors.

1.3 Features and Benefits

- Variable Frequency Drive (VFD)—Programmed at the factory to integrate fluctuating head pressure signals created by compressor unloading, including digital scroll compressors, and varying condenser capacity created by lower ambient temperatures.
  - The VFD adjusts fan speed to provide stable fan speeds and condensing temperatures.
  - Provides protection for motor overload and incoming power supply phase loss, undervoltage and overvoltage.
  - Built-in EMC filter—Electromagnetic emission levels comply with EN61800-3 (Second Environment - Light Industrial Applications).
- Inverter duty motor with permanently lubricated ceramic ball bearings for reliability
- Transducers on each circuit sense refrigerant pressures, providing input to the VFD
- Standard TVSS—Transient Voltage Surge Suppression increases condenser reliability by building in a layer of electrical protection against electrical failure caused by transient voltage surges from unconditioned power sources and atmospheric discharges.
- Standard Locking disconnect
- Contacts for monitoring VFD and TVSS alarm conditions
- Available in 2-, 3- or 4-fan, dual-circuit condenser models

Figure 2 Major electrical control components

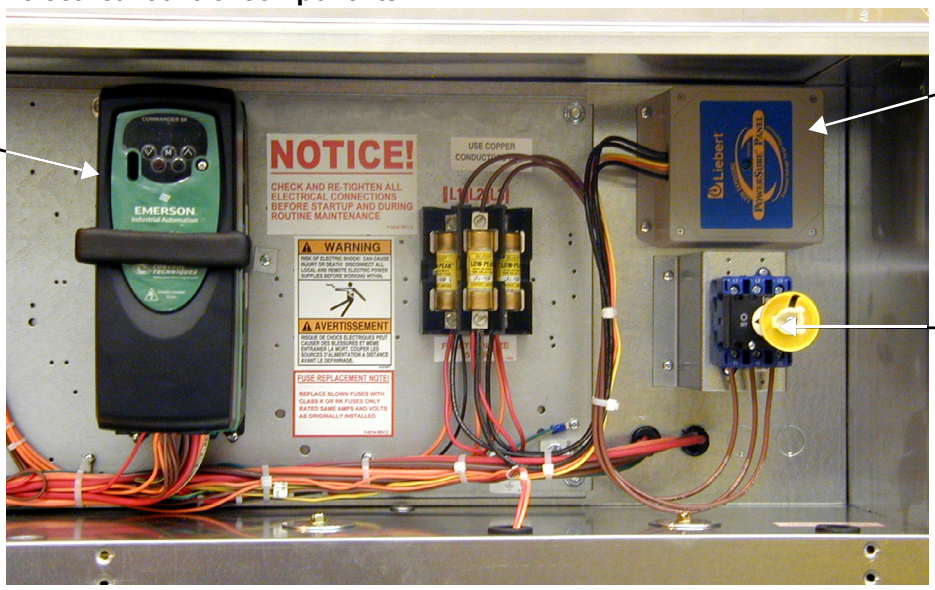


Table 1 Electrical data—50 and 60 Hz

Model #				165, 205			251, 308			415, 510		
Number of Fans				2			3			4		
Input Voltage	Ph	Hz	Motor Hp	FLA	WSA	OPD	FLA	WSA	OPD	FLA	WSA	OPD
208/230	3	60	0.75	7.2	8.1	15	10.7	11.6	15	14.2	15.1	20
460				3.5	4.0	15	5.2	5.7	15	6.9	7.4	15
200/230		50		7.2	*	*	10.7	*	*	14.2	*	*
380/415				3.5	*	*	5.2	*	*	6.9	*	*

FLA = Full Load Amps; WSA = Wire Size Amp; OPD = Maximum Overcurrent Protection Device Rating
* = Follow local electrical code to determine WSA and OPD

Table 2 VFD condensers for indoor units, 50 and 60Hz

	R-22			R-407C		
	Outdoor Design Ambient Temperature					
Indoor Unit	95°F (35°C)	100°F (38°C)	105°F (41°C)	95°F (35°C)	100°F (38°C)	105°F (41°C)
DH/VH75A	N/A	N/A	TCDV165	N/A	N/A	N/A
DH/VH114A	TCDV165	TCDV165	TCDV205	N/A	N/A	N/A
DH/VH125A	TCDV165	TCDV165	TCDV205	N/A	N/A	N/A
DH/VH199A	TCDV205	TCDV308	TCDV308	N/A	N/A	N/A
DH/VH245A	TCDV308	TCDV308	TCDV415	N/A	N/A	N/A
DH/VH290A	TCDV308	TCDV415	TCDV415	N/A	N/A	N/A
DH/VH380A	TCDV415	TCDV510	N/A	N/A	N/A	N/A
DS/VS028A	TCDV165	TCDV165	TCDV205	TCDV205	TCDV205	TCDV251
DS/VS035A	TCDV165	TCDV205	TCDV205	TCDV205	TCDV205	TCDV251
DS/VS042A	TCDV205	TCDV205	TCDV308	TCDV205	TCDV251	TCDV308
DS/VS053A	TCDV205	TCDV308	TCDV308	TCDV251	TCDV308	TCDV415
DS/VS070A	TCDV308	TCDV415	TCDV415	TCDV308	TCDV415	TCDV415
DS/VS077A	TCDV308	TCDV415	TCDV510	TCDV308	TCDV415	TCDV510
DS/VS105A	TCDV415	TCDV510	N/A	TCDV415	N/A	N/A

Table 3 Condenser performance, 60Hz

Model Number	Total Heat Rejection BTU/Hr (kW) Based on TD					CFM (CMH)	Sound dBA	Fan Qty
	30°F TD (16.7°C)	25°F TD (13.9°C)	20°F TD (11.1°C)	15°F TD (8.3C)	1°F TD (0.6°C)			
R-22 Refrigerant								
TCDV165	178,410 (52.2)	148,675 (43.5)	118,940 (34.8)	89,205 (26.1)	5,947 (3.1)	13,300 (22,597)	75.5	2
TCDV205	264,930 (77.6)	220,775 (64.6)	176,620 (51.7)	132,465 (38.8)	8,831 (4.7)	11,200 (19,029)		
TCDV251	298,170 (87.3)	248,475 (72.8)	198,780 (58.2)	149,085 (43.7)	9,939 (5.2)	20,250 (34,405)	77.3	3
TCDV308	384,180 (112.5)	320,150 (93.7)	256,120 (75.0)	192,090 (56.2)	12,806 (6.7)	18,600 (31,602)		
TCDV415	507,690 (148.7)	423,075 (123.9)	338,460 (99.1)	253,845 (74.3)	16,923 (8.9)	24,800 (42,135)	78.5	4
TCDV510	552,240 (161.7)	460,200 (134.8)	368,160 (107.8)	276,120 (80.9)	18,408 (9.7)	19,200 (32,621)		
R-407C Refrigerant								
TCDV165	143,160 (41.9)	119,300 (34.9)	95,440 (27.9)	71,580 (21.0)	4772 (2.5)	13,300 (22,597)	75.5	2
TCDV205	242,100 (70.9)	201,750 (59.1)	161,400 (47.3)	121,050 (35.4)	8070 (4.3)	11,200 (19,029)		
TCDV251	277,380 (81.2)	231,150 (67.7)	184,920 (54.1)	138,690 (40.6)	9246 (4.9)	20,250 (34,405)	77.3	3
TCDV308	337,890 (98.9)	281,575 (82.4)	225,260 (66.0)	168,945 (49.5)	11263 (5.9)	18,600 (31,602)		
TCDV415	472,320 (138.3)	393,600 (115.3)	314,880 (92.2)	236,160 (69.2)	15744 (8.3)	24,800 (42,135)	78.5	4
TCDV510	452,820 (132.6)	377,350 (110.5)	301,880 (88.4)	226,410 (66.3)	15094 (8.0)	19,200 (32,621)		

TD = Difference between Entering Air Temperature and Condensing Temperature

Table 4 Condenser performance, 50Hz

Model Number	Total Heat Rejection BTU/hr (kW) based on TD					CFM (CMH)	Sound dBA	Fan Qty
	30°F TD (16.7°C)	25°F TD (13.9°C)	20°F TD (11.1°C)	15°F TD (8.3°C)	1°F TD (0.6°C)			
R-22 Refrigerant								
TCDV165	162,660 (47.6)	135,550 (39.7)	108,440 (31.8)	81,330 (23.8)	5,422 (2.9)	11,100 (18,859)	71.0	2
TCDV205	233,040 (68.2)	194,200 (56.9)	155,360 (45.5)	116,520 (34.1)	7,768 (4.1)	9,300 (15,801)		
TCDV251	270,150 (79.1)	225,125 (65.9)	180,100 (52.7)	135,075 (39.6)	9,005 (4.7)	16,800 (28,543)	72.8	3
TCDV308	343,080 (100.5)	285,900 (83.7)	228,720 (67.0)	171,540 (50.2)	11,436 (6.0)	15,450 (26,250)		
TCDV415	454,680 (133.1)	378,900 (110.9)	303,120 (88.8)	227,340 (66.6)	15,156 (8.0)	20,600 (35,000)	74.0	4
TCDV510	479,040 (140.3)	399,200 (116.9)	319,360 (93.5)	239,520 (70.1)	15,968 (8.4)	16,000 (27,184)		
R-407C Refrigerant								
TCDV165	129,960 (38.1)	108,300 (31.7)	86640 (25.4)	64,980 (19.0)	4,332 (2.3)	11,100 (18,859)	71.0	2
TCDV205	212,280 (62.2)	176,900 (51.8)	141520 (41.4)	106,140 (31.1)	7,076 (3.7)	9,300 (15,801)		
TCDV251	250,920 (73.5)	209,100 (61.2)	167280 (49.0)	125,460 (36.7)	8,364 (4.4)	16,800 (28,543)	72.8	3
TCDV308	301,950 (88.4)	251,625 (73.7)	201300 (58.9)	150,975 (44.2)	10,065 (5.3)	15,450 (26,250)		
TCDV415	422,400 (123.7)	352,000 (103.1)	281600 (82.5)	211,200 (61.8)	14,080 (7.4)	20,600 (35,000)	74.0	4
TCDV510	391,800 (114.7)	326,500 (95.6)	261200 (76.5)	195,900 (57.4)	13,060 (6.9)	16,000 (27,184)		

TD = Difference between Entering Air Temperature and Condensing Temperature

2.0 DIMENSIONAL AND ELECTRICAL DATA

Figure 3 Cabinet and anchor dimensional data—VFD control condensers, 50 and 60Hz

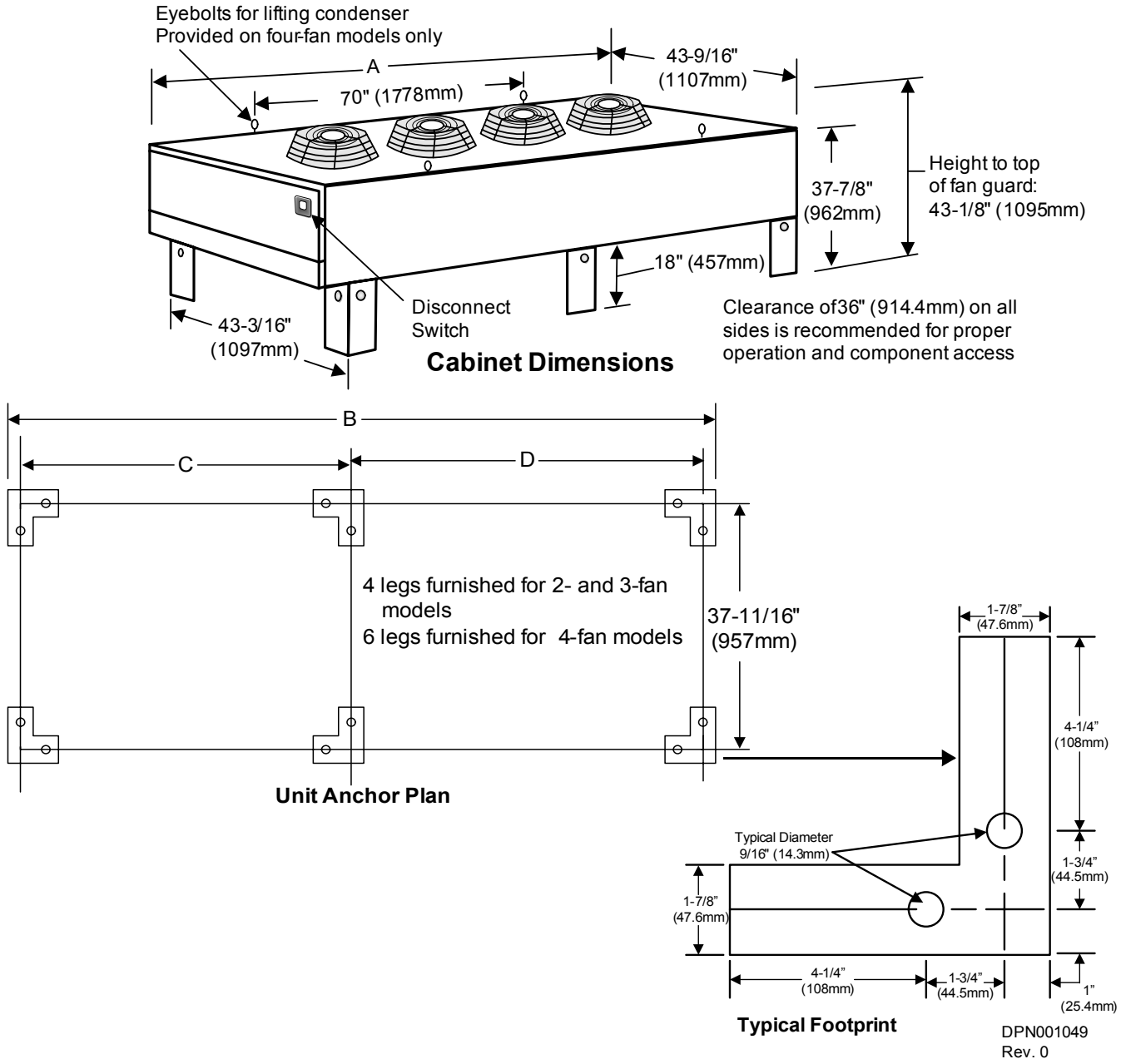
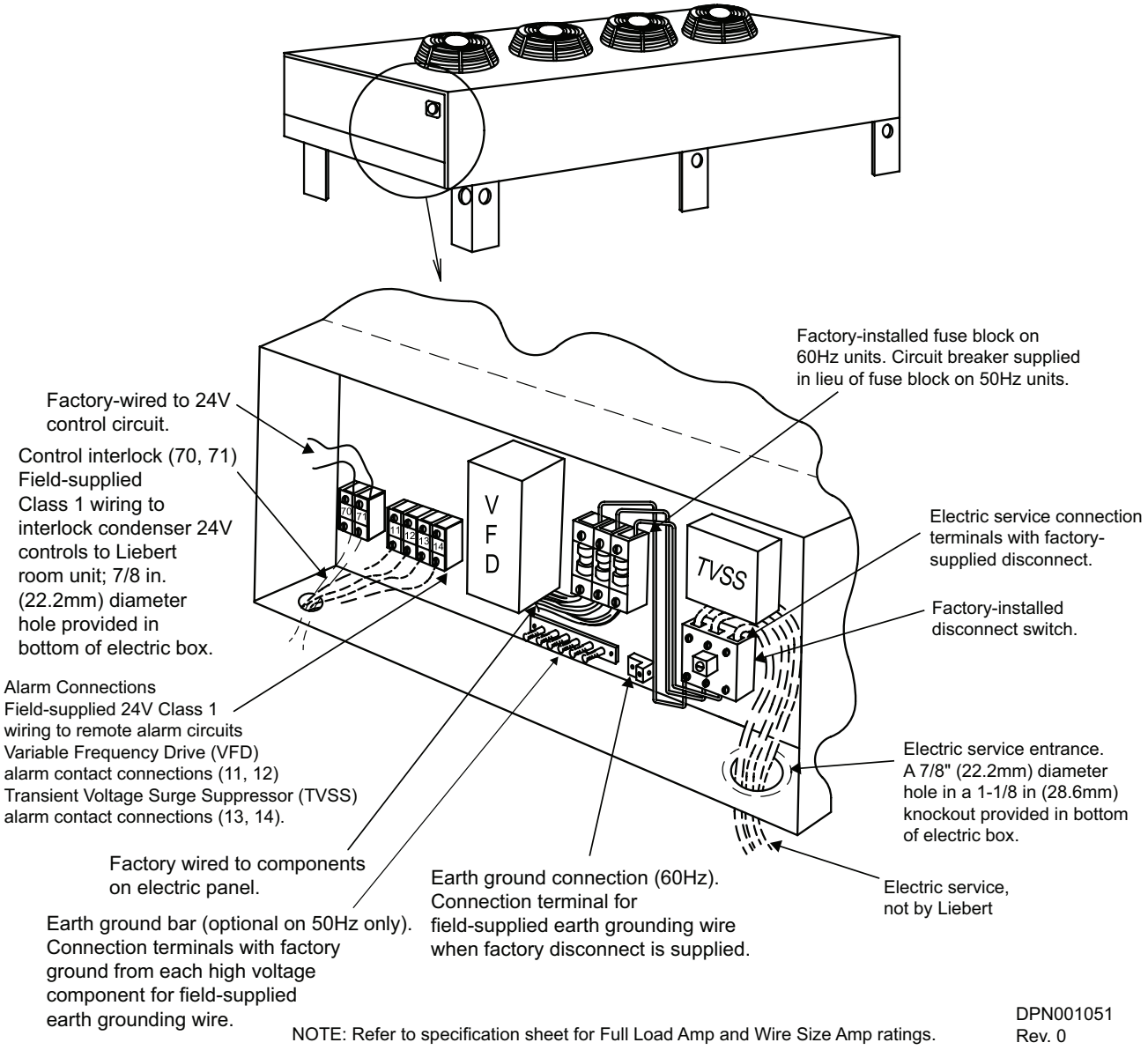


Table 5 Physical data—VFD control condensers, 50 and 60Hz

Model #	Number of Fans	A	B	C	D	Net Weight
		in (mm)	in (mm)	in (mm)	in (mm)	lb (kg)
TCDV165	2	91-1/2 (2324)	84 (2134)	82 (2083)	--	425 (193)
TCDV205	2	91-1/2 (2324)	84 (2134)	82 (2083)	--	495 (225)
TCDV251	3	131-1/2 (3340)	124 (3150)	122 (3099)	--	500 (227)
TCDV308	3	131-1/2 (3340)	124 (3150)	122 (3099)	--	670 (305)
TCDV415	4	171-1/2 (4356)	164 (4166)	82 (2083)	80 (2032)	815 (370)
TCDV510	4	171-1/2 (4356)	164 (4166)	82 (2083)	80 (2032)	1188 (540)

All condenser fan motors are 3/4 hp

Figure 4 Electrical field connections, VFD control condensers



NOTE: Refer to specification sheet for Full Load Amp and Wire Size Amp ratings.

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3.0 GUIDE SPECIFICATIONS

3.1 General

Each condenser shall consist of housing, condenser coil, propeller fans direct-driven by individual fan motors, fan guards, electrical controls and mounting legs. The air-cooled condenser shall have a _____volt, 3-phase, _____ Hz power supply.

3.2 Coil

Liebert manufactured coil shall be constructed of copper tubes in a staggered tube pattern. Tubes are expanded into continuous, corrugated aluminum fins. The fins have full depth fin collars completely covering the copper tubes, which are connected to heavy wall Type "L" headers. Inlet coil connector tubes pass through relieved holes in the tube sheet for maximum resistance to piping strain and vibration. Coils are factory leak-tested at a minimum of 300 psig (2068kPag), dehydrated, then filled with a nitrogen holding charge and sealed for shipment.

3.3 Fans

Fans shall have aluminum blades secured to corrosion protected steel hubs. Fans shall be secured to the fan shaft by means of a heavy-duty keyed hub and dual setscrews. Fan diameter shall be 26" (660mm) or less. Fans shall be factory balanced and run before shipment. Fan guards shall be heavy gauge, close-meshed steel wire with corrosion resistant PVC finish that shall be rated to pass a 675-hour salt spray test.

3.4 Fan Motors

The variable speed fan motor shall be an inverter duty motor with permanently lubricated ceramic bearings. The Liebert variable frequency drive control system shall provide overload protection for the variable speed motor. Each ambient-temperature-controlled fan motor shall have built-in overload protection. All motors shall have rain slingers, permanently lubricated bearings and shall be rigidly mounted on die-formed galvanized steel supports.

3.5 Head Pressure Control

The Liebert VFD Condenser control system shall include a variable frequency drive, inverter duty fan motor operating from 0% to 100% motor RPM based on head pressure, refrigerant pressure transducers, ambient-temperature thermostat(s), motor overload protection and electrical control circuit, factory-wired in the control panel. VFD control shall be furnished on the fan adjacent to the connection end of the condenser, which runs continuously with the compressors. Other condenser fans shall be controlled by ambient thermostats and are either On or Off. This system permits operation at temperatures as low as -20°F (-28.9°C).

3.6 Housing

The condenser housing shall be constructed of bright aluminum sheet and divided into individual fan sections by full width baffles. Structural support members, including coil support frame, motor and drive support, are galvanized steel for strength and corrosion resistance. Aluminum legs are provided with rigging holes for hoisting the unit into position.

3.7 TVSS and Unit Disconnect Switch

Transient Voltage Surge Suppression and locking disconnect shall be factory-installed and wired in the enclosed condenser electrical panel section.

3.8 Alarm Contacts

Normally open, dry contacts shall be provided for indication of VFD and TVSS alarm condition.

3.9 Electrical Controls

All electrical connections and controls shall be provided in a weatherproof enclosure. The enclosure shall be integral with the condenser for pleasing appearance as well as functional protection.

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Technical Support / Service
Web Site
www.liebert.com
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614-888-0246

Locations
United States
1050 Dearborn Drive
P.O. Box 29186
Columbus, OH 43229
Europe
Via Leonardo Da Vinci 8
Zona Industriale Tognana
35028 Piove Di Sacco (PD) Italy
+39 049 9719 111
Fax: +39 049 5841 257
Asia
7/F, Dah Sing Financial Centre
108 Gloucester Road, Wanchai
Hong Kong
852 2572220
Fax: 852 28029250

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