



KENAI PENINSULA BOROUGH
Borough Administration Building

IT Server Room AC Replacement Study



AMC Engineers

701 East Tudor Road, Suite 250

Anchorage, Alaska 99503

February 16, 2009

TABLE OF CONTENTS

	PAGE
EXECUTIVE SUMMARY	2
DISCUSSION	3
IT Server Room Mission	3
<u>Existing Server Room AC Unit Deficiencies</u>	3
AC Unit Replacement Construction Schedule Coordination	3
Construction Phasing Considerations	4
RECOMMENDATIONS	5
APPENDIX 1: PRELIMINARY CONSTRUCTION COST ESTIMATE	
APPENDIX 2: PHOTOS	
APPENDIX 3: AC EQUIPMENT TECHNICAL DATA	
APPENDIX 4: SCHEMATIC DRAWINGS	

EXECUTIVE SUMMARY

This study was conducted to address deficiencies with the cooling system for the IT server computer room at the Kenai Borough Administration Building in Soldotna, Alaska. The study included a site visit to the building and meetings with KPB maintenance and IT staff. The study resulted in the following determinations:

1. The IT server room is cooled by a single AC unit that rejects heat to the city water utility. Interruptions in city water utility service result in shutdown of the IT server room cooling system and compromises operation of the computer room.
2. The cooling system equipment was installed in 1984 and has reached the end of its useful life. The AC unit manufacturer no longer exists and replacement parts are increasingly unavailable.
3. The IT server room is a critical computer center that carries 80% of the Kenai Peninsula Borough administrative communications traffic, including Borough wide service to Seward and Homer.

Recommendation:

Replacement of the existing 20 ton AC unit with three new 10 ton AC units and drycoolers mounted exterior to the building is recommended. The new system will provide the full required cooling capacity in the event of a single AC unit failure and provide a self contained heat rejection system independent of the city water utility.

The preliminary construction cost estimate (appendix 1) for replacement of the cooling system is: **\$525,304.**

The construction cost estimate is reflective of a 2009 construction schedule. If the construction schedule is changed then an appropriate escalation factor should be applied.

The project's soft costs need to be added in over and above the construction costs to arrive at a total project cost.

DISCUSSION

IT Server Room Mission

The IT server room computers support 80% of the Kenai Peninsula Borough communication traffic, including Borough services in Seward and Homer. The Borough administrative telephone service uses Voice over Internet Protocol (VoIP) which is supported by the servers in this facility. The public phone communication interface with the Borough administrative offices is also carried by these servers. The IT server room is mission critical to the administrative services provided by the Kenai Peninsula Borough.

Existing Server Room Cooling System Deficiencies

The existing server room AC unit was installed in 1984 and has reached the end of its useful life. It has been rebuilt once but the original manufacturer no longer exists and replacement parts are increasingly unavailable.

The existing AC unit utilizes domestic water from the city utility service for heat rejection. This system is subject to interruptions with the city water service and may be particularly vulnerable to damage to the city utility as a result of seismic activity. The operation of the AC unit ceases when city water service is not available.

The existing AC unit does not employ energy efficiency available with present day computer room AC technology. Newer technology is capable of utilizing cold ambient temperatures to provide cooling without operation of the AC unit compressors. A glycol/water solution is cooled by the drycoolers and circulated in separate cooling coils in the AC unit to provide "free cooling" when ambient temperatures allow.

Photos of the existing AC unit, city water heat exchanger and server room are located in appendix 2 of this study.

AC Unit Replacement Construction Schedule Coordination

The AC unit replacement construction impact on the server room operation is an important consideration. The replacement must be completed without interrupting the KPB administrative communication systems. It is proposed that the existing AC unit be left operational while two of the new AC units and drycooler installation be completed. When the new AC units are proven operational, the existing AC unit would be removed and replaced with the third new AC unit.

Construction Phasing Considerations

The preliminary construction cost estimate of \$525,304 assumes that the entire replacement of the server room cooling system be accomplished as a single contract. Phasing of the construction may be considered to facilitate funding as follows:

1. The existing cooling system is dependent on the city water utility as a source of cooling water for heat rejection. A self contained cooling system independent of the city water utility could be provided with the installation of two drycoolers and pump set exterior to the building. Cooling glycol would be circulated via new piping connections to the existing AC unit city water heat exchanger. The piping connections would be sized to accommodate the total cooling glycol flow rate required for the complete AC replacement project.
2. When funding allows, a 10 ton AC unit and third drycooler could be installed to supplement the existing 20 ton AC unit. This would provide 30 tons of cooling capability in the server room, but only 10 tons capacity if the existing 20 ton AC unit were to fail. Again the entire system would be self contained and independent of the city water utility.
3. As the final phase of project completion, two ten ton AC units could be installed to replace the existing 20 ton AC unit. The existing AC unit heat exchanger would also be removed at this time.

RECOMMENDATIONS

Replace the existing 20 ton AC unit with three new 10 ton AC units, configured for down blast discharge for use with the existing raised computer room floor. Provide units with a free cooling option to provide cooling when outside ambient cold temperatures allow without AC unit refrigeration compressor operation.

Replace the existing city water heat exchanger with three new drycoolers located exterior to the building. Provide a new duplex pump set to circulate cooling glycol from the drycoolers to the new AC units.

Provide a new power distribution panel and power connections to serve the new AC units and drycoolers.

Provide a new concrete equipment pad and chain link fence enclosure for the new drycooler and pump set installation.

Technical data for the new AC units, drycoolers and pump set is included in appendix 3.

Schematic drawings showing the proposed layout and piping diagram for the new system are contained in appendix 4.

KENAI PENINSULA BOROUGH
Borough Administration Building
IT Server Room AC Replacement Study

APPENDIX 1
COST ESTIMATE



**Administration Building IT Server AC Replacement
Kenai Peninsula Borough
Kenai, Alaska**

**Construction Cost Estimate
Concept Submittal
February 9, 2009**

 **ESTIMATIONS**

1225 E. International Airport Road, Suite 205
Anchorage, Alaska 99518
907.561.0790

Prepared for:

AMC Engineers
701 East Tudor Road, Suite 250
Anchorage, Alaska 99503
907.257.9100

Documents

IT Server Room Sketch And Narrative, Dated 26 Jan 09

Notes and Assumptions

- 1 Based on 2009 costs escalated to 2009 construction.
- 2 Labor rates based on Davis Bacon, 50 hours/week.
- 3 Weather, logistics and construction time window has been considered.
- 4 Assumes open competitive bid procurement.
- 5 Materials storage area will be designated near the building.
- 6 Local contractor with limited room and board.

Administration Building IT Server AC Replacement
Kenai Peninsula Borough
Prepared for AMC Engineers by Estimations

Construction Cost Estimate
Concept Submittal
February 9, 2009

Description		Estimated Cost
Basic Bid GENERAL REQUIREMENTS ARCHITECTURAL & STRUCTURAL MECHANICAL ELECTRICAL		\$94,850 \$16,558 \$299,512 \$36,995
Subtotal:		\$447,915 <<<<<
Estimating Contingency: Escalation For Inflation: (2009) 6 Mths	@ 4.0% 15.0% 2.0%	\$67,187 \$10,201
Total Estimated Cost - Basic Bid:		\$525,304 <<<<<

Administration Building IT Server AC Replacement
Kenai Peninsula Borough
Prepared for AMC Engineers by Estimations

Construction Cost Estimate
Concept Submittal
February 9, 2009

Line No.	Description	Qty	UNITS	Material Costs		Labor Hours		Labor Cost	Equip Cost	Total Cost	Total Cost w/ OH & P
				Unit	Total	Units	Totals				
1	GENERAL REQUIREMENTS										
2											
3	Project Management										
4	Project Manager, 16 Hour/Week	5	WEEKS			16.000	80.0	\$6,160		\$6,160	\$6,160
5	Supervisor, 50 Hour/Week	4	WEEKS			50.000	200.0	\$11,000		\$11,000	\$11,000
6	Project Expeditor, 8 Hour/Week	4	WEEKS			8.000	32.0	\$2,182		\$2,182	\$2,182
7											
8	Subsistence										
9	Room & Board - Special Crews	47	MANDAY	\$140.00	\$6,637					\$6,637	\$6,637
10											
11	Travel										
12	Air Fare - Anchorage - Site	1	EA	\$210.00	\$210					\$210	\$210
13											
14	Small Tools & Consumables										
15	Consumables	1	LS	\$600.00	\$600					\$600	\$600
16	Small Tools	1	LS	\$900.00	\$900					\$900	\$900
17											
18	Equipment										
19	Pickup (2 Ea)	4	WEEKS						\$1,867	\$1,867	\$1,867
20	Forklift (1 Ea)	3	WEEKS						\$2,000	\$2,000	\$2,000
21	Flatbed (1 Ea)	3	WEEKS						\$1,500	\$1,500	\$1,500
22											
23	Other Requirements										
24	Project Meetings	2	EA			4.000	8.0	\$308		\$308	\$308
25	Shop Drawings	30	HRS			1.000	30.0	\$1,155		\$1,155	\$1,155
26	Quality Control	1	LS	\$1,000.00	\$1,000	40.000	40.0	\$1,540		\$2,540	\$2,540
27	Test Lab Services	1	LS	\$2,500.00	\$2,500					\$2,500	\$2,500
28											
29	General Contractor Overhead	6%									\$23,557
30	General Contractor Profit (Fee)	5%									\$20,809
31	General Contractor Bond & Insurance	2.5%									\$10,925
32											
33	Subtotal: GENERAL REQUIREMENTS; Cost based on 42,600 SF				\$11,847		390.0	\$22,345	\$5,367	\$39,559	\$94,850
34	Average Unit Price For this division is: \$2.23 per SF										
35											

Administration Building IT Server AC Replacement
Kenai Peninsula Borough
Prepared for AMC Engineers by Estimations

Construction Cost Estimate
Concept Submittal
February 9, 2009

Line No.	Description	Qty	UNITS	Material Costs		Labor Hours		Labor Cost	Equip Cost	Total Cost	Total Cost w/ OH & P
				Unit	Total	Units	Totals				
36	ARCHITECTURAL & STRUCTURAL										
37	Concrete Pad , 8" Thick	400	SF	\$5.55	\$2,220	0.079	31.6	\$2,104	\$300	\$4,624	\$5,549
38	New Chain Link Fence - Subcontract Price	100	LF	\$20.00	\$2,000	0.229	22.9	\$1,672	\$300	\$3,972	\$4,766
39	Cut, Patch And Repair Ext Wall At Pipe Penetrations	1	LS	\$200.00	\$200	6.000	6.0	\$415		\$615	\$615
40	Cut, Patch And Repair Partitions, Structural Members At Pipe Penetrations, Fire Stopping - Allowance	1	LS	\$1,000.00	\$1,000	40.000	40.0	\$2,765		\$3,765	\$3,765
41	Remove & Replace Ceiling, Patch, Repair, Paint To Match Existing	250	SF	\$3.50	\$875	0.057	14.3	\$988		\$1,863	\$1,863
42											
43	Subtotal: ARCHITECTURAL & STRUCTURAL: Cost based on 42,600 SF				\$6,295		114.8	\$7,944	\$600	\$14,839	\$16,558
44	Average Unit Price For this division is: \$0.39 per SF										
45											
46											
47	MECHANICAL										
48											
49	15010 General Conditions										
50	Field Engineering: Submittals, Shop & Record Dwg's, Operating Instructions, O&M Allowance For Phasing. Existing System Must Remain Operational Throughout. 15%	40	HRS	\$5.00	\$200	1.000	40.0	\$1,540		\$1,740	\$1,740
51	Tests, Inspections	1	LS			331.429	331.4	\$22,474		\$22,474	\$29,216
52	Supervision	1	LS	\$100.00	\$100	28.571	28.6	\$1,951		\$2,051	\$2,051
53	Materials Control	5	WEEKS			20.000	100.0	\$5,500	\$313	\$5,813	\$5,813
54	Temporary Connections	5	WEEKS			20.000	100.0	\$2,200	\$344	\$2,544	\$2,544
55	Bond and Insurance (1%)	1	LS	\$1,000.00	\$1,000	40.000	40.0	\$2,728		\$3,728	\$3,728
56	Tools and Equipment (1% of Labor)	1	LS	\$3,000.00	\$3,000				\$800	\$3,000	\$3,000
57	Seismic & Vibration Control	1	LS	\$5,000	\$5,000				\$800	\$5,800	\$5,800
58										\$5,000	\$5,000
59											
60	Demolition										
61	Demo Existing AC Equipment, Assoc Specialties, Pumps, Controls, Piping	1	LS			80.000	80.0	\$5,425		\$5,425	\$7,053
62											
63											

Administration Building IT Server AC Replacement
Kenai Peninsula Borough
Prepared for AMC Engineers by Estimations

Construction Cost Estimate
Concept Submittal
February 9, 2009

Line No.	Description	Qty	UNITS	Material Costs		Labor Hours		Labor Cost	Equip Cost	Total Cost	Total Cost w/ OH & P
				Unit	Total	Units	Totals				
64	15080 Mechanical Insulation										
65	Piping Insulation										
66	Fiberglass Pipe Insulation, 1" Thick W/ ASJ										
67	1-1/4" Pipe, Fittings	150	LF	\$2.23	\$335	0.076	11.4	\$819		\$1,154	\$1,673
68	3" Pipe, Fittings	150	LF	\$3.04	\$456	0.089	13.4	\$962		\$1,418	\$2,056
69	Finishes: Aluminum Covering, .016"	300	SF	\$0.50	\$150	0.080	24.0	\$1,723		\$1,873	\$2,716
70											
71	15181 Hydronic Piping										
72	Pipe & Fittings, Copper Type L										
73	1-1/4" Pipe	150	LF	\$10.67	\$1,601	0.206	30.9	\$2,095		\$3,696	\$4,805
74	3" Pipe	150	LF	\$44.38	\$6,657	0.426	63.9	\$4,333		\$10,990	\$14,287
75	Fittings	1	LS	\$412.90	\$413	28.440	28.4	\$1,926		\$2,339	\$3,041
76											
77	Hydronic Specialties										
78	Allowance For Misc Items Not Included In Package	1	EA	\$1,000.00	\$1,000	16.000	16.0	\$1,085		\$2,085	\$2,711
79											
80	15185 Hydronic Pumps										
81	Included In AC Unit Package Price (2 Ea)										
82											
83	15734 Computer-Room Air-Conditioning Units										
84	Complete Package Vendor Quote Including:	1	LS	\$125,000.00	\$125,000					\$125,000	\$162,500
85	AC Unit, 10 Ton	3	EA			40.000	120.0	\$8,138		\$8,138	\$10,579
86	Dry Cooler	3	EA			40.000	120.0	\$8,138		\$8,138	\$10,579
87	Pumps, 120 GPM, 7.5 HP	2	EA			6.000	12.0	\$814		\$814	\$1,058
88											
89	15900 HVAC Instrumentation and Controls										
90	Interface New AC Units With Existing Control System, Alarms, Notification - Allowance	1	LS	\$10,000.00	\$10,000					\$10,000	\$14,500
91	15950 Testing, Adjusting, and Balancing										
92	Balancing, Adjusting, Commissioning,	1	LS			80.000	80.0	\$5,560		\$5,560	\$8,062
93											
94	Subtotal: MECHANICAL: Cost based on 42,600 SF				\$154,912		1,240.0	\$77,411	\$1,456	\$233,779	\$299,512
95	Average Unit Price For this division is: \$7.03 per SF										
96											

Administration Building IT Server AC Replacement
Kenai Peninsula Borough
Prepared for AMC Engineers by Estimations

Construction Cost Estimate
Concept Submittal
February 9, 2009

Line No.	Description	Qty	UNITS	Material Costs		Labor Hours		Labor Cost	Equip Cost	Total Cost	Total Cost w/ OH & P
				Unit	Total	Units	Totals				
97											
98	ELECTRICAL										
99											
100	16010 Basic Electrical Requirements										
101	Field Engineering: Submittals, Shop & Record										
102	Dwgs, Operating Instructions, O&M Manuals	16	HRS	\$5.00	\$80	1.000	16.0	\$616		\$696	\$696
103	Permits, Tests, Inspections	1	LS	\$100.00	\$100	40.000	40.0	\$2,728		\$2,828	\$2,828
104	Supervision	1	WEEKS			20.000	20.0	\$1,100	\$63	\$1,163	\$1,163
105	Materials Control	1	WEEKS			20.000	20.0	\$440	\$69	\$509	\$509
106	Bond and Insurance	1	LS	\$400.00	\$400					\$400	\$400
107	Tools and Equipment	1	LS						\$100	\$100	\$100
108											
109	16055 Electrical Demolition										
110	Remove Elec To Existing AC Equipment	1	LS			12.000	12.0	\$851		\$851	\$1,149
111											
112	16420 Enclosed Controllers										
113	Starter/Disconnects 5 HP	6	EA	\$740.00	\$4,440	5.000	30.0	\$2,128		\$6,568	\$8,867
114	3/4" EMT, 3#10, 1#10	600	LF	\$2.77	\$1,662	0.094	56.4	\$4,000		\$5,662	\$7,644
115											
116	16442 Panelboards										
117	Panelboards, 480V, 3 Phase, 100A	1	EA	\$3,500.00	\$3,500	16.000	16.0	\$1,135		\$4,635	\$6,257
118	Modify Existing Switchgear, Add Distribution Breaker For New Equipment Panel	1	EA	\$4,000.00	\$4,000	12.000	12.0	\$851		\$4,851	\$6,549
119											
120	16511 Interior Lighting										
121	Remove & Replace Fixtures As Required - Allowance	1	LS	\$50.00	\$50	8.000	8.0	\$567		\$617	\$833
122											
123											
124											
125											
126											
127	Subtotal: ELECTRICAL: Cost based on 42,600 SF				\$14,232		230.4	\$14,416	\$231	\$28,879	\$36,995
128	Average Unit Price For this division is: \$0.87 per SF										
129											

KENAI PENINSULA BOROUGH
Borough Administration Building
IT Server Room AC Replacement Study

APPENDIX 2
PHOTOS



KENAI PENINSULA BOROUGH
Borough Administration Building
IT Server Room AC Replacement Study



Photo 1: Existing IT Server Room AC Unit



Photo 2: IT Server Room

KENAI PENINSULA BOROUGH
Borough Administration Building
IT Server Room AC Replacement Study



Photo 3: Existing IT Server Room AC Unit Heat Exchanger



Photo 4: Proposed Location Next to Building for New Dry Coolers

APPENDIX 3
TECHNICAL DATA



Precision Cooling
For Business-Critical Continuity™

Liebert® DS™

System Design Manual - 28-105kW (8-30 Tons), Downflow/Upflow, 60Hz
Floor Mounted, Air-Cooled, Water/Glycol-Cooled, GLYCOOL, Dual-Cool

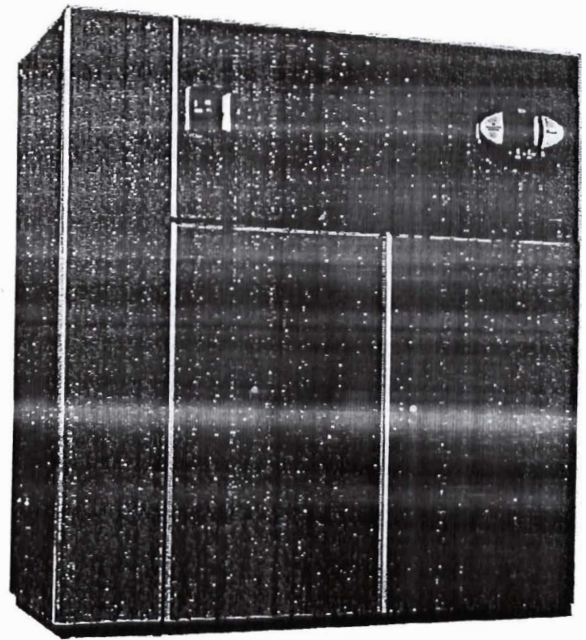
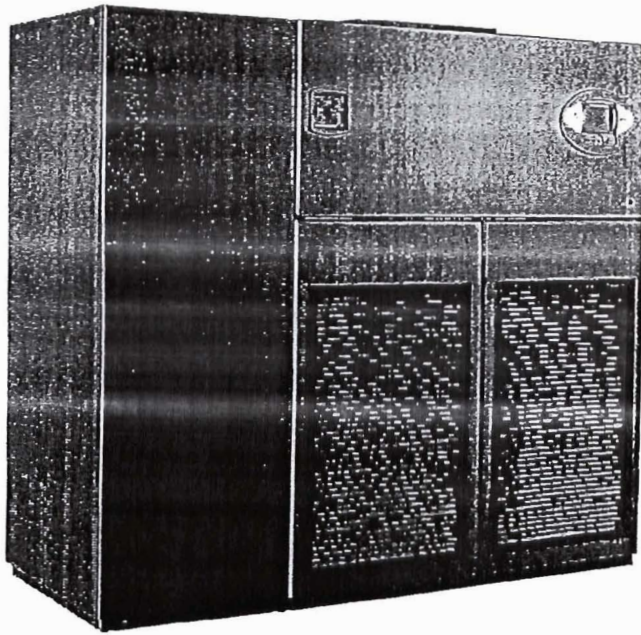


Table 7 Glycol-cooled capacity data, R-407C refrigerant, 40% ethylene glycol

Model Size	028	035	042	053	070	077	105
FOUR-STEP SEMI-HERMETIC COMPRESSOR							
Net Capacity Data kW (BTUH), Standard Air Volume and Evaporator Fan Motor							
75°F DB, 62.5°F WB (23.9°C DB, 16.9°C WB) 50% RH							
Total kW (BTUH)	32.6 (111.1)	32.6 (111.1)	38.4 (131.1)	49.0 (167.3)	59.3 (202.5)	67.4 (230.2)	85.9 (293.1)
Sensible kW (BTUH)	26.5 (90.3)	29.4 (100.4)	34.4 (117.3)	43.8 (149.4)	51.8 (176.8)	58.0 (198.1)	75.5 (257.7)
75°F DB, 61.1°F WB (23.9°C DB, 16.2°C WB) 45% RH							
Total kW (BTUH)	31.7 (108.1)	31.9 (109.0)	37.4 (127.5)	47.8 (163.1)	57.3 (195.5)	64.9 (221.4)	83.0 (283.4)
Sensible kW (BTUH)	28.3 (96.5)	31.9 (109.0)	37.4 (127.5)	47.8 (163.1)	57.3 (195.5)	64.9 (221.4)	83.0 (283.4)
72°F DB, 60°F WB (22.2°C DB, 15.5°C WB) 50% RH							
Total kW (BTUH)	31.2 (106.5)	31.1 (106.2)	36.7 (125.3)	46.8 (159.8)	56.8 (193.8)	64.5 (220.3)	85.9 (293.1)
Sensible kW (BTUH)	26.0 (88.6)	28.7 (98.1)	33.6 (114.6)	42.8 (146.0)	50.7 (173.0)	56.8 (193.9)	75.5 (257.7)
DIGITAL SCROLL COMPRESSOR (std scroll on 077 & 105 models)							
Net Capacity Data kW (BTUH), Standard Air Volume and Evaporator Fan Motor							
75°F DB, 62.5°F WB (23.9°C DB, 16.9°C WB) 50% RH							
Total kW (BTUH)	28.0 (95.5)	31.9 (108.9)	36.6 (124.8)	50.0 (170.8)	61.7 (210.6)	68.1 (232.5)	86.3 (294.5)
Sensible kW (BTUH)	24.6 (84.0)	29.2 (99.5)	33.6 (114.8)	44.2 (150.8)	52.8 (180.1)	58.3 (199.0)	75.7 (258.2)
75°F DB, 61.1°F WB (23.9°C DB, 16.2°C WB) 45% RH							
Total kW (BTUH)	27.4 (93.4)	31.4 (107.0)	35.9 (122.5)	48.8 (166.4)	60.3 (205.7)	66.7 (227.7)	83.7 (285.6)
Sensible kW (BTUH)	27.4 (93.4)	31.4 (107.0)	35.9 (122.5)	48.8 (166.4)	56.8 (193.8)	63.0 (215.0)	83.7 (285.6)
72°F DB, 60°F WB (22.2°C DB, 15.5°C WB) 50% RH							
Total kW (BTUH)	26.8 (91.6)	30.6 (104.5)	35.0 (119.6)	48.0 (163.8)	59.2 (202.2)	65.5 (223.5)	82.9 (283.0)
Sensible kW (BTUH)	24.1 (82.3)	28.5 (97.4)	32.9 (112.2)	43.3 (147.7)	51.7 (176.5)	57.2 (195.2)	74.2 (253.1)

Capacity data is factory-certified to be within 5% tolerance.

Table 8 Glycol-cooled capacity data, R-22 refrigerant, 40% ethylene glycol

Model Size	028	035	042	053	070	077	105
FOUR-STEP SEMI-HERMETIC COMPRESSOR							
Net Capacity Data kW (BTUH), Standard Air Volume and Evaporator Fan Motor							
75°F DB, 62.5°F WB (23.9°C DB, 16.9°C WB) 50% RH							
Total kW (BTUH)	32.6 (111.4)	32.7 (111.6)	38.6 (131.6)	49.0 (167.3)	59.0 (201.5)	67.4 (230.1)	87.2 (297.6)
Sensible kW (BTUH)	27.2 (92.8)	30.0 (102.5)	34.8 (118.8)	44.6 (152.2)	52.2 (178.3)	58.3 (199.1)	76.4 (260.6)
75°F DB, 61.1°F WB (23.9°C DB, 16.2°C WB) 45% RH							
Total kW (BTUH)	31.8 (108.6)	32.1 (109.6)	37.7 (128.8)	48.0 (163.9)	57.4 (196.0)	65.3 (223.0)	84.8 (289.5)
Sensible kW (BTUH)	29.1 (99.3)	32.1 (109.6)	37.7 (128.8)	48.0 (163.9)	57.4 (196.0)	65.3 (223.0)	84.8 (289.5)
72°F DB, 60°F WB (22.2°C DB, 15.5°C WB) 50% RH							
Total kW (BTUH)	31.3 (106.8)	31.4 (107.2)	36.9 (125.9)	47.0 (160.4)	56.5 (192.7)	64.5 (220.2)	83.5 (285.1)
Sensible kW (BTUH)	26.7 (91.0)	29.4 (100.3)	34.0 (116.1)	43.6 (148.9)	51.1 (174.3)	57.1 (194.8)	74.7 (255.0)
DIGITAL SCROLL COMPRESSOR (std scroll on 077 & 105 models)							
Net Capacity Data kW (BTUH), Standard Air Volume and Evaporator Fan Motor							
75°F DB, 62.5°F WB (23.9°C DB, 16.9°C WB) 50% RH							
Total kW (BTUH)	28.0 (95.6)	31.8 (108.6)	37.2 (126.8)	51.0 (174.2)	63.6 (217.2)	69.2 (236.2)	87.5 (298.8)
Sensible kW (BTUH)	25.3 (86.5)	29.7 (101.3)	34.2 (116.8)	45.4 (154.9)	54.1 (184.5)	59.0 (201.5)	76.5 (261.1)
75°F DB, 61.1°F WB (23.9°C DB, 16.2°C WB) 45% RH							
Total kW (BTUH)	27.4 (93.6)	31.4 (107.2)	36.6 (124.9)	49.8 (170.0)	62.0 (211.7)	67.6 (230.6)	85.2 (290.7)
Sensible kW (BTUH)	27.4 (93.6)	31.4 (107.2)	36.6 (124.9)	49.8 (170.0)	58.1 (198.4)	63.7 (217.3)	85.2 (290.7)
72°F DB, 60°F WB (22.2°C DB, 15.5°C WB) 50% RH							
Total kW (BTUH)	27.0 (92.1)	30.4 (103.6)	35.7 (121.7)	49.1 (167.6)	61.1 (208.6)	66.5 (227.0)	84.0 (286.6)
Sensible kW (BTUH)	27.8 (94.8)	30.4 (103.6)	33.5 (114.4)	44.5 (151.9)	53.0 (181.0)	57.9 (197.6)	74.9 (255.7)

Capacity data is factory-certified to be within 5% tolerance.

HEAT REJECTION

CONDENSER AND DRYCOOLER SELECTION

Table 71 Liebert DS air-cooled condenser selection

Refrigerant	Air-Cooled Condenser Selection		Liebert DS Model						
	Condenser Type	Ambient Temperature °F (°C)	028	035	042	053	070	077	105
R-22	Outdoor Condenser	95 (35)	CD*-165	CD*-165	CD*-205	CD*-205	CD*-308	CD*-308	CD*-415
		100 (38)	CD*-165	CD*-205	CD*-205	CD*-308	CD*-415	CD*-415	CD*-510
		105 (41)	CD*-205	CD*-205	CD*-308	CD*-308	CD*-415	CD*-510	CD*-616
	Outdoor Quiet-Line Condenser	95 (35)	CD*-143	CD*-143	CD*-214	CD*-286	CD*-409	CD*-409	CD*-572
		100 (38)	CD*-214	CD*-214	CD*-214	CD*-286	CD*-409	CD*-409	CD*-572
		105 (41)	CD*-214	CD*-286	CD*-286	CD*-409	CD*-477	CD*-572	CD*-572
R-407C	Outdoor Condenser	95 (35)	CD*-205	CD*-205	CD*-205	CD*-251	CD*-308	CD*-308	CD*-415
		100 (38)	CD*-205	CD*-205	CD*-251	CD*-308	CD*-415	CD*-415	CD*-616
		105 (41)	CD*-251	CD*-251	CD*-308	CD*-415	CD*-415	CD*-510	CD*-616
	Outdoor Quiet-Line Condenser	95 (35)	CD*-214	CD*-214	CD*-286	CD*-286	CD*-409	CD*-409	CD*-572
		100 (38)	CD*-214	CD*-214	CD*-286	CD*-409	CD*-477	CD*-572	N/A
		105 (41)	CD*-286	CD*-286	CD*-409	CD*-409	CD*-572	CD*-572	N/A

Table 72 Liebert DS drycooler selection

Drycooler Type	Ambient Temperature °F (°C)	Liebert DS Model						
		028	035	042	053	070	077	105
Outdoor Drycooler	95 (35)	D-174	D-174	D-225-16	D-260	D-310	D-350	D-466
	100 (38)	D-225-16	D-225-16	D-310	D-350	D-419	D-466	D-620-32
	105 (41)	D-310-16	D-350-16	D-419	D-491-32	D-620-32	D-650-40	D-880-52
Outdoor Quiet-Line Drycooler	95 (35)	D-173-16	D-178-16	D-205	DD-248	D-347-32	D-347-32	D-453
	100 (38)	D-205-16	D-205-16	D-347-32	D-347-32	D-453-32	D-453-32	N/A
	105 (41)	D-356-32	D-356-32	D-453-32	D-453-32	D-453-32	N/A	N/A

Table 73 Liebert DS piggyback condenser selection

Refrigerant	Air-Cooled Condenser Selection		Liebert DS Size						
	Condenser Type	Ambient Temp. °F (°C)	028	035	042	053	070	077	105
R-22	Piggyback	95 (35)	PB-675	PB-675	PB-925	PB-925	PB-1100	PB-1350	N/A
		100 (38)	PB-675	PB-675	PB-925	PB-1100	PB-1350	N/A	N/A
		105 (41)	PB-925	PB-925	PB-1350	PB-1350	PB-1350	N/A	N/A
R-407C	Piggyback	95 (35)	PB-925	PB-925	PB-1100	PB-1350	N/A	N/A	N/A
		100 (38)	PB-1100	PB-1100	PB-1350	N/A	N/A	N/A	N/A
		105 (41)	PB-1100	PB-1350	N/A	N/A	N/A	N/A	N/A

Table 74 Liebert piggyback drycooler/DS matchup data

Drycooler Selections		Liebert DS Model					
Drycooler Type	Ambient Temp. °F (°C)	028	035	042	053	070	077
Piggyback Drycooler	95 (35)	PD-133/150	PD-150	PD-223	PD-290	PD-333	PD-333
	100 (38)	PD-223	PD-223	PD-333	N/A	N/A	N/A
	105 (41)	PD-333	PD-333	PD-333	N/A	N/A	N/A

CONDENSER AND DRYCOOLER DIMENSIONAL DATA

Figure 60 Condenser and drycooler dimensions, 2-fan model

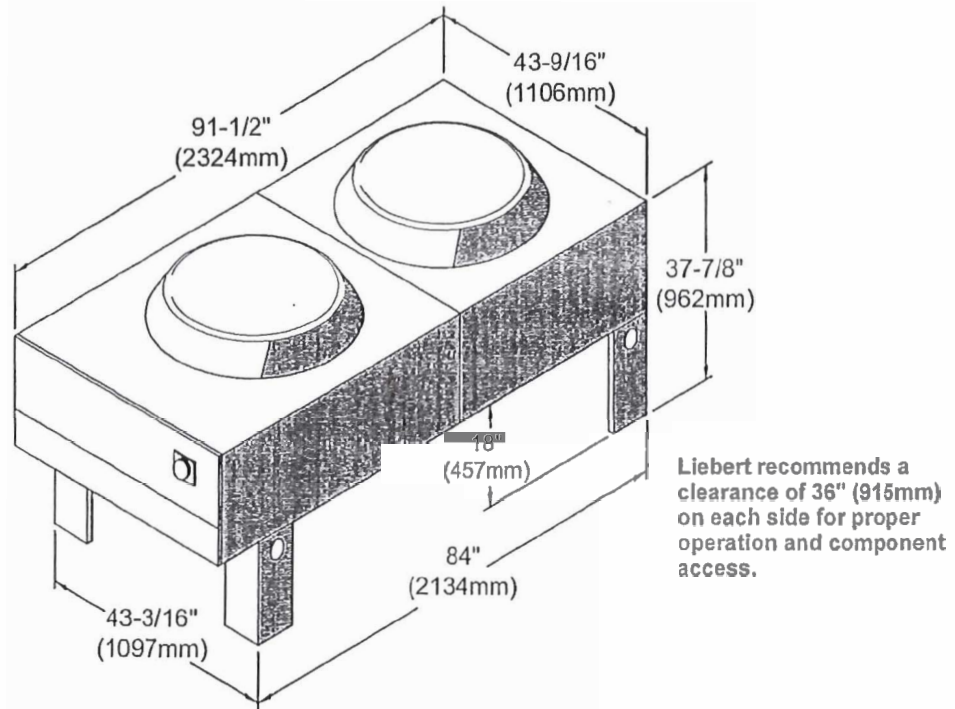
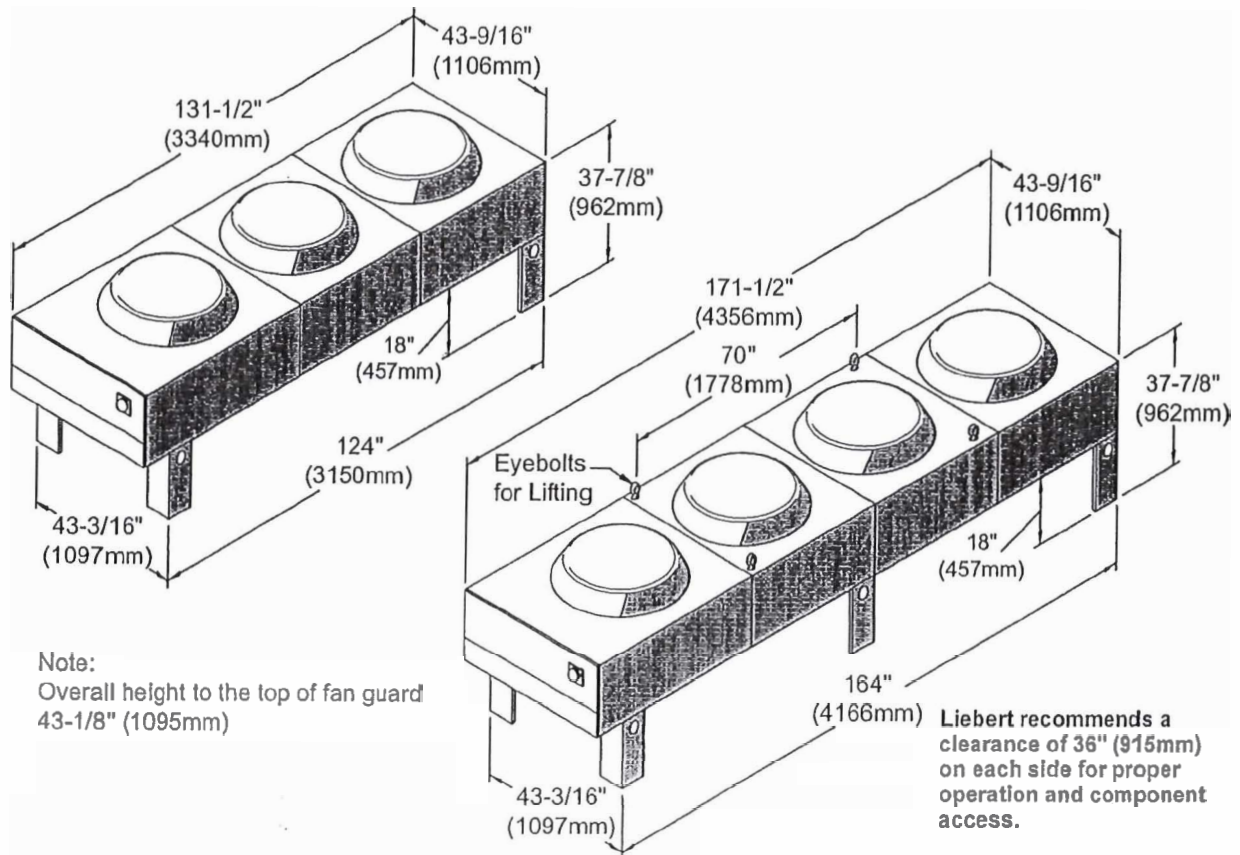


Figure 61 Condenser and drycooler dimensions, 3- and 4-fan models



PUMP PACKAGES & EXPANSION TANK - OPTIONS

Figure 64 Pump package

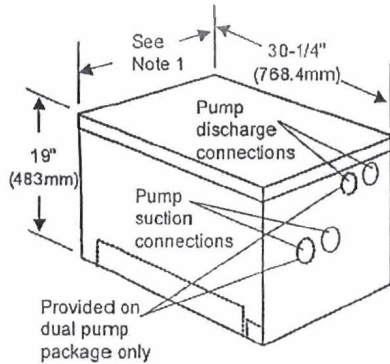
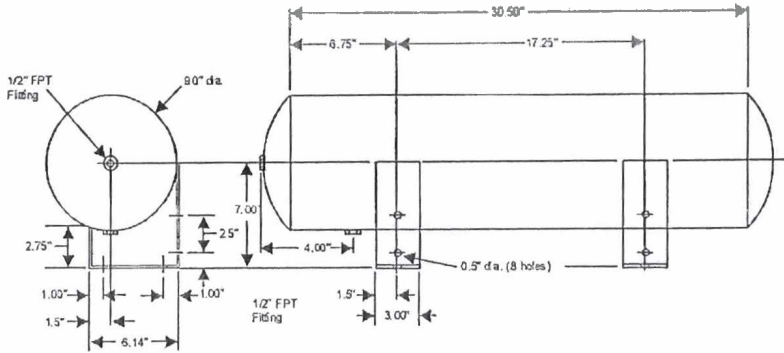


Figure 64 Expansion tank



Expansion Tank (P/N 1C16717P1)

This tank, included in a standard pump package, has an internal volume of 8.8 gal. (33 l) and a maximum pressure of 100 psi (890 kPa).

This tank is sized for a typical "open" system with a fluid volume of less than 75 gal. (280l). When used in a "closed" system, volumes of up to 140 gal. (910l) can be accommodated. The use of a safety relief valve, field-supplied, is recommended for systems "closed" to atmospheric venting. Other piping accessories for filling, venting, or adjusting the fluid in the system, are recommended, but not included.

Figure 65 Pump mounting

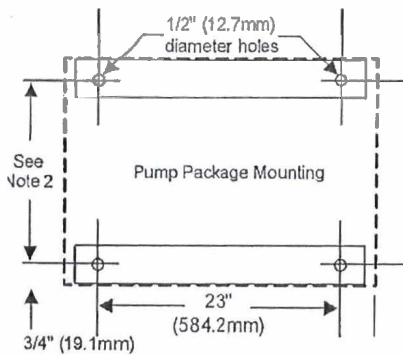


Table 80 Pump data

Pump Model	Connections		hp	ph	Electric @ 60Hz			
	NPT Suction	Female Discharge			208 FLA	230 FLA	460 FLA	575 FLA
3/4	1-1/4"	3/4"	3/4	1	7.6	6.9	N/A	N/A
3/4	1-1/4"	3/4"	3/4	3	3.5	3.2	1.6	1.3
1-1/2	1-1/4"	3/4"	1-1/2	3	6.6	6.0	3.0	2.4
2	1-1/4"	3/4"	2	3	7.5	6.8	3.4	2.7
3	1-1/2"	1"	3	3	10.6	9.8	4.8	3.9
5	1-1/2"	1-1/4"	5	3	16.7	15.2	7.6	6.1
7-1/2	3"	3"	7-1/2	3	24.2	22.0	11.0	9.0

Notes

1. Single pump packages are 17-1/4" (438.2mm) wide. Dual pump packages are 32-1/4" (819.2mm) wide.
2. Mounting holes are 15-11/32" (389.7mm) apart on single pump packages and 30-11/32" (770.7mm) apart on dual pump packages.
3. 7-1/2hp dimensions not shown—Consult local representative.

To Calculate Total Pump and Drycooler Full Load Amps (FLA):

Total FLA = Pump FLA + Drycooler FLA

To Calculate Total Pump and Drycooler Wire Size Amps (WSA):

Total WSA = Largest Motor FLA x 1.25 + Sum of other Motor FLA values

To Calculate Total Pump and Drycooler Maximum Overcurrent Protective Device (OPD):

Total OPD = Largest Motor FLA x 4.0 + Sum of other Motor FLA values

Select standard fuse size (15A, 20A, 25A, 30A, etc.)

Figure 65 Pump curve, 60 Hz

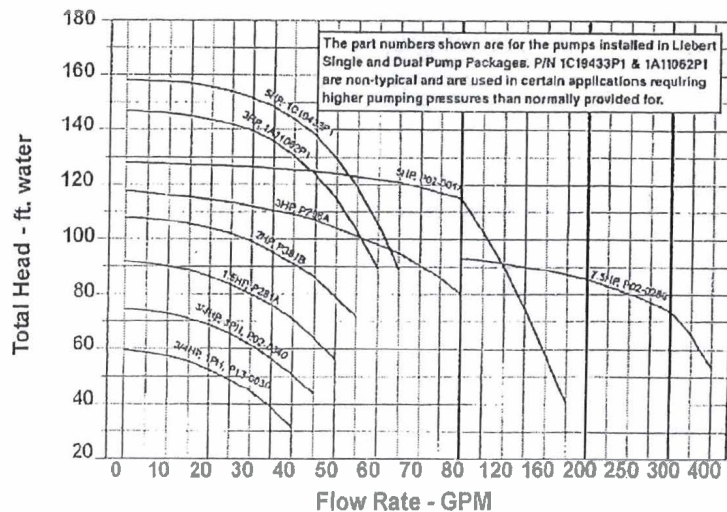


Table 9 Physical data - glycol/GLYCOOL cooled units

Model Size	028	035	042	053	070	077	105
EVAPORATOR COIL- A-Frame - Copper Tube/Aluminum Fin							
Face Area - sq. ft. (sq. m)	17.1 (1.6)	17.1 (1.6)	17.1 (1.6)	24.7 (2.3)	24.7 (2.3)	24.7 (2.3)	32.3 (3.0)
Rows of Coil	3	3	3	3	3	3	3
Face Velocity - FPM (m/s) - STD Air Vol.	251.0 (1.3)	316.0 (1.6)	380.0 (1.9)	319.8 (1.6)	384.6 (1.9)	441.2 (2.2)	453.6 (2.3)
FAN SECTION - Downflow models - Fixed Pitch, Two Belts							
Standard Air Volume - CFM (CMH)	4,400 (7,478)	5,500 (9,345)	6,600 (11,213)	8,000 (13,593)	9,600 (16,311)	11,000 (18,690)	14,600 (25,062)
Standard Fan Motor hp (kW)	2 (1.5)	3 (2.2)	5 (3.7)	3 (2.2)	5 (3.7)	7.5 (5.6)	10.0 (0.75)
Optional Air Volume - CFM (CMH)	5,500 (9,345)	6,600 (11,213)	7,200 (12,233)	9,600 (16,311)	11,000 (18,690)	12,000 (20,390)	15,500 (26,607)
Optional Fan Motor hp	3 (2.2)	5 (3.7)	7.5 (5.6)	5 (3.7)	7.5 (5.6)	10 (7.5)	15 (11.2)
Ext. Static Press - Inches of water (Pa)	0.2 (50)	0.2 (50)	0.2 (50)	0.2 (50)	0.2 (50)	0.2 (50)	0.2 (50)
Quantity of Fans	1	1	1	2	2	2	3
Note: Higher static pressures available, see Table 10 for examples Note: Some options or combinations of options may result in reduced air flow—Consult local representative for recommendations.							
REHEAT SECTION							
Electric Reheat - Three (3) Stage, Stainless Steel Fin Tubular, capacity does not include fan motor heat							
Capacity - kW (KBTUH) - Std Selection	15.0 (51.2)	15.0 (51.2)	15.0 (51.2)	25.0 (85.3)	25.0 (85.3)	25.0 (85.3)	30.0 (102.4)
Capacity - kW (KBTUH) - Opt Selection	10.0 (34.1)	10.0 (34.1)	10.0 (34.1)	15.0 (51.2)	15.0 (51.2)	15.0 (51.2)	20.0 (68.3)
Electric Reheat - SCR Control, Stainless Steel Fin Tubular (optional selection)							
Capacity - kW (KBTUH)	15.0 (51.2)	15.0 (51.2)	15.0 (51.2)	25.0 (85.3)	25.0 (85.3)	25.0 (85.3)	30.0 (102.4)
HUMIDIFIER SECTION							
Infrared Humidifier							
Capacity, lb./hr. (kg/h)	11.0 (5.0)	11.0 (5.0)	11.0 (5.0)	22.0 (10.0)	22.0 (10.0)	22.0 (10.0)	22.0 (10.0)
FILTER SECTION - Disposable Type - Nominal Sizes and Quantities, std MERV 7, optional MERV 11							
Downflow Models							
Nominal Size, inches	25x16	25x16	25x16	25x16	25x16	25x16	25x16
Quantity	5	5	5	7	7	7	9
Upflow Models (Front & Rear return) Filters located in separate filter box on rear return							
Nominal Size, inches	25x20	25x20	25x20	25x20	25x20	25x20	25x20
Quantity	4	4	4	6	6	6	8
Outdoor Drycoolers, std 95°F ambient selection, see table 50 for other selections							
Model (R-22 model)	D-174	D-174	D-225-16	D-260	D-310	D-350	D-466
Number of Fans	2	2	2	3	3	3	4
CONDENSER FLOW REQUIREMENTS							
Glycol Cooled System - Semi-Hermetic Compressors, based on 75°F/50% room conditions							
THR - kBTUH (kW)	164.4 (48.2)	173.2 (50.7)	211.0 (61.8)	230.5 (67.5)	316.0 (92.6)	365.1 (107.0)	489.6 (143.5)
110°F (43.3°C) EGT-GPM (l/m)	34 (129.2)	35 (133.0)	41 (155.8)	52 (197.6)	66 (250.8)	76 (288.8)	90.0 (342.0)
Pressure Drop-ft. of water (kPa), with bypass	7.9 (23.6)	12.3 (36.7)	16.4 (48.9)	16.0 (47.7)	24.9 (74.3)	32.4 (96.7)	44.2 (131.9)
PIPING CONNECTION SIZES -Glycol-Cooled Liebert DS Indoor Unit							
Glycol Supply - O.D. Copper	1-5/8" (41)	1-5/8" (41)	1-5/8" (41)	2-1/8" (54)	2-1/8" (54)	2-1/8" (54)	2-1/8" (54)
Glycol Return - O.D. Copper	1-5/8" (41)	1-5/8" (41)	1-5/8" (41)	2-1/8" (54)	2-1/8" (54)	2-1/8" (54)	2-1/8" (54)
Infrared Humidifier - O.D. Copper	1/4	1/4	1/4	1/4	1/4	1/4	1/4
Condensate Drain - FPT	3/4	3/4	3/4	3/4	3/4	3/4	3/4
Condensate Drain w/opt Condensate Pump - OD	1/2	1/2	1/2	1/2	1/2	1/2	1/2
Hot Water Reheat - O.D. Copper	5/8	5/8	5/8	5/8	5/8	5/8	5/8
Econ-O-Coil Capacity Data (GLYCOOL units), water (40% ethylene glycol), Net Capacity Data kW (KBTUH) (Cu/Ni coil option must be specified when Econ-O-Coil is applied to open water tower)							
75°F DB, 62.57 WB (23.9°C DB, 16.9°C WB) 50% RH, 45°F EWT							
Total Capacity, kW (KBTUH)	28.8 (98.3)	32.8 (112.0)	38.4 (131.0)	47.2 (161.0)	57.1 (195.0)	64.2 (219.0)	86.1 (294.0)
Sensible Capacity, kW (KBTUH)	24.4 (83.3)	28.9 (98.5)	34.0 (116.0)	42.2 (144.0)	50.4 (172.0)	56.5 (193.0)	75.3 (257.0)
Flow Rate - GPM (l/m)	34 (129.2)	35.0 (133.0)	41.0 (155.8)	52 (197.6)	66.0 (250.8)	76.0 (288.8)	90.0 (342.0)
Pressure Drop - ft. (kPa), total unit	38.3 (263.9)	40.5 (279.0)	54.4 (374.8)	39.1 (269.4)	60.8 (418.9)	79.1 (545.0)	79.5 (547.8)
Fluid Volumes							
Unit Volume Without Econ-O-Coil, gal (l)	4 (15.2)	4 (15.2)	4 (15.2)	7 (26.6)	7 (26.6)	7 (26.6)	8 (30.4)
Unit Volume With Econ-O-Coil, gal (l)	9 (34.2)	9 (34.2)	9 (34.2)	14 (53.2)	14 (53.2)	14 (53.2)	17 (64.8)

DOWNFLOW, WATER/GLYCOL/GLYCOOL, 28-42kW (8-12 TON)—ALL COMPRESSORS

Figure 9 Dimensions - downflow, water/glycol/GLYCOOL, 28-42kW (8-12 ton)—all

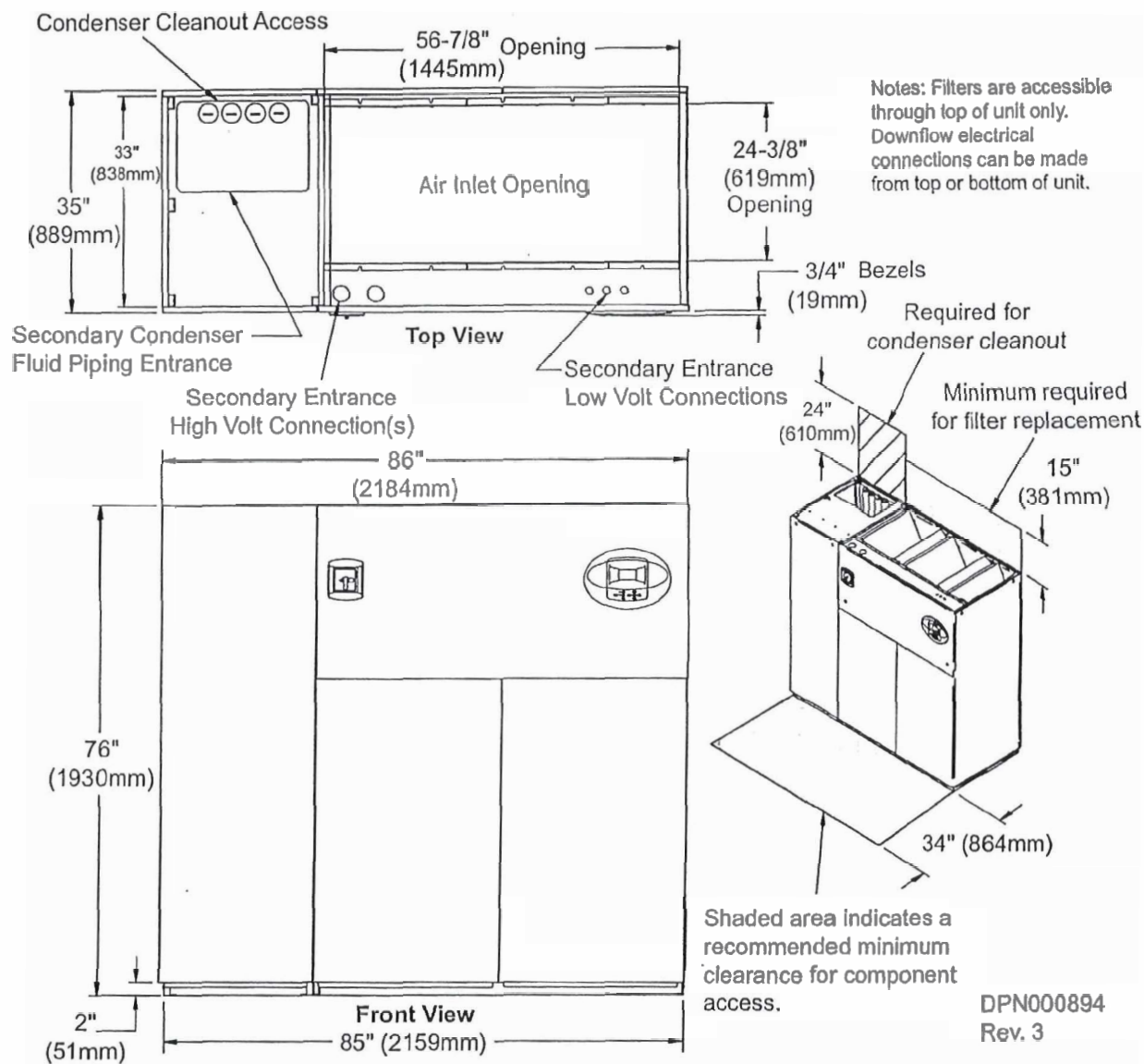
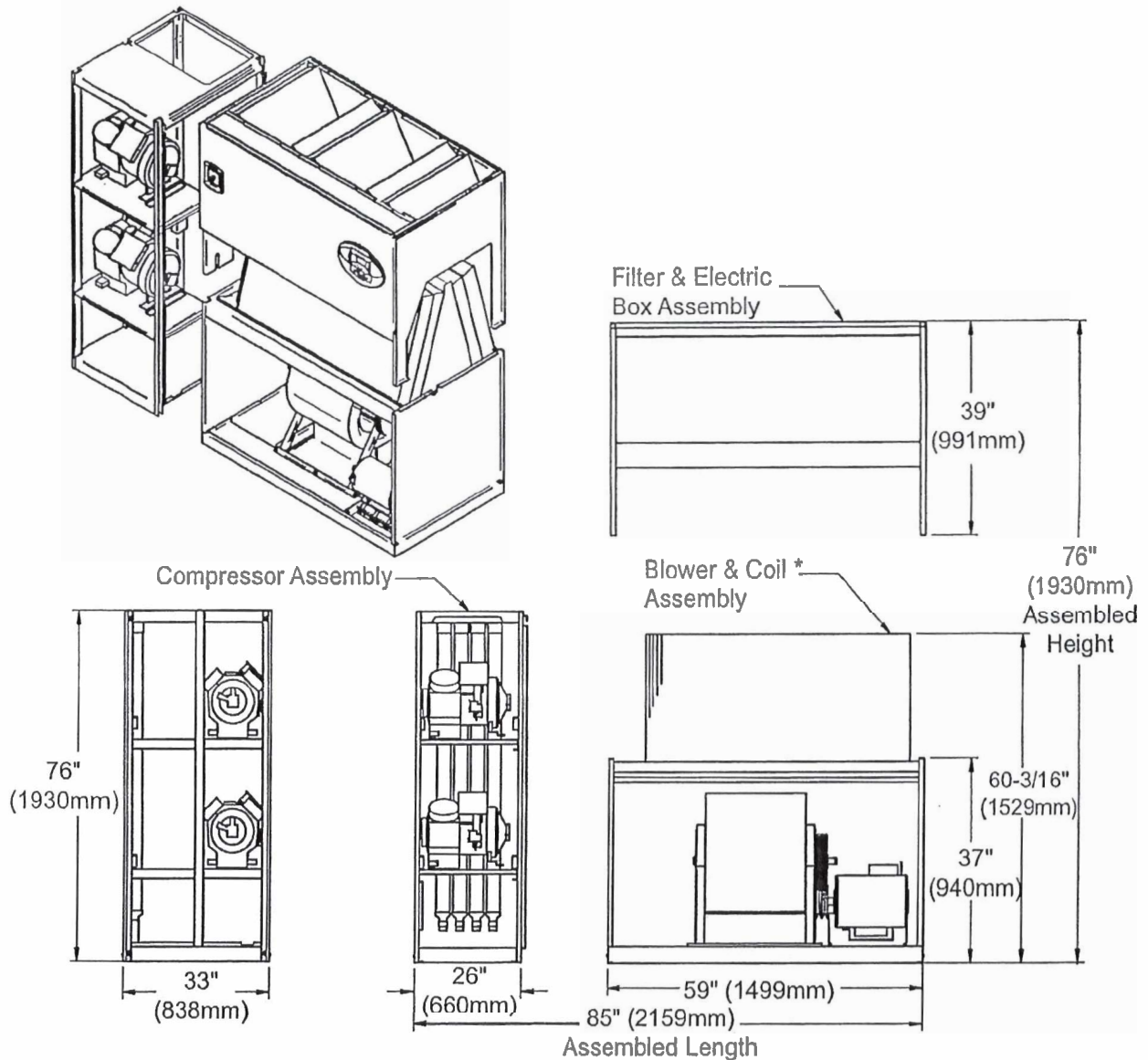


Table 20 Weights - downflow, water/glycol/GLYCOOL, 28-42kW (8-12 ton)—all

Dry Weight, Approximate, lb. (kg)		
Model Type	Model Size: 028-042	
Semi-Hermetic Compressor	Water/Glycol	1930 (877)
	GLYCOOL/Dual-Cool	2080 (945)
Scroll or Digital Scroll Compressor	Water/Glycol	1780 (809)
	GLYCOOL/Dual-Cool	1930 (877)

Figure 11 Disassembly dimensions - downflow, water/glycol/GLYCOOL, 28-42kW (8-12 ton)—all



NOTES: Drawing views are simplified with panels removed to show overall dimensions.

See disassembly and handling instructions in installation manual.

* Coil can be field-removed for further height reduction.

DPN000899

Rev. 1

Table 22 Component weights - downflow, water/glycol/GLYCOOL, 28-42kW (8-12 ton)—all

Dry Weight, Approximate, Including Panels, lb (kg)				
Component	Semi-Hermetic Compressor		Scroll or Digital Scroll Compressor	
	Water/Glycol	GLYCOOL/Dual-Cool	Water/Glycol	GLYCOOL/Dual-Cool
Compressor Assembly	950 (432)	950 (432)	800 (364)	800 (364)
Filter & Electric Box Assembly	210 (96)	210 (96)	210 (96)	210 (96)
Blower & Coil Assembly	770 (350)	920 (418)	770 (350)	920 (418)

Figure 10 Primary connection locations - downflow, water/glycol/GLYCOOL, 28-42kW (8-12 ton)—all

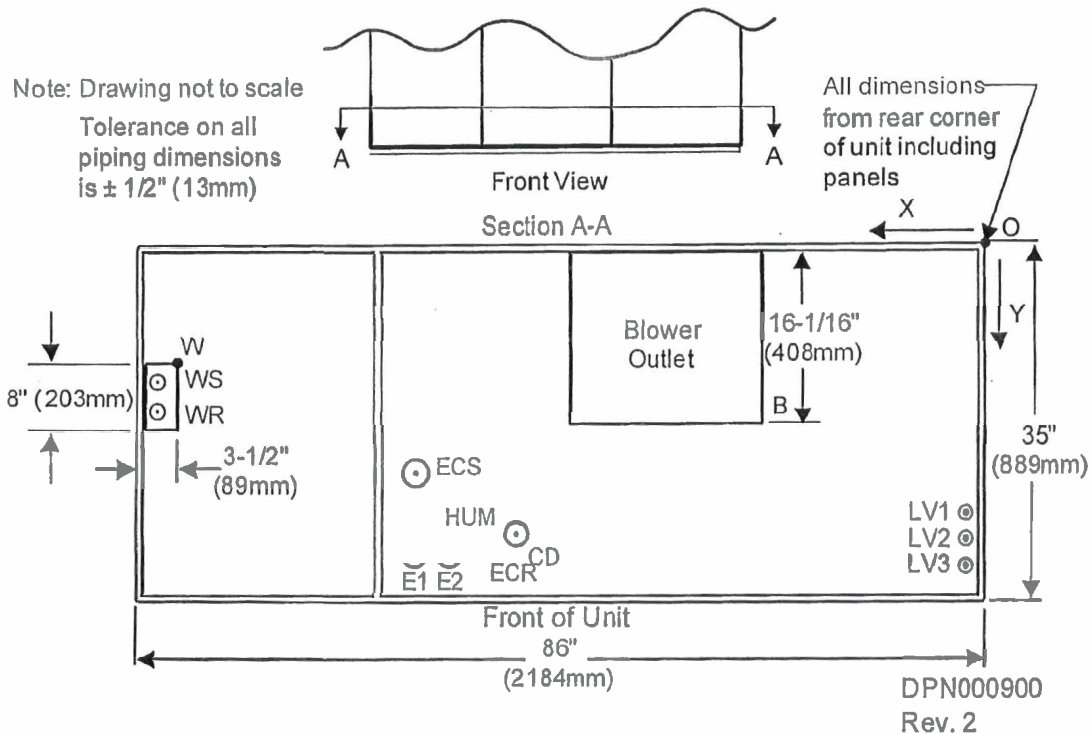


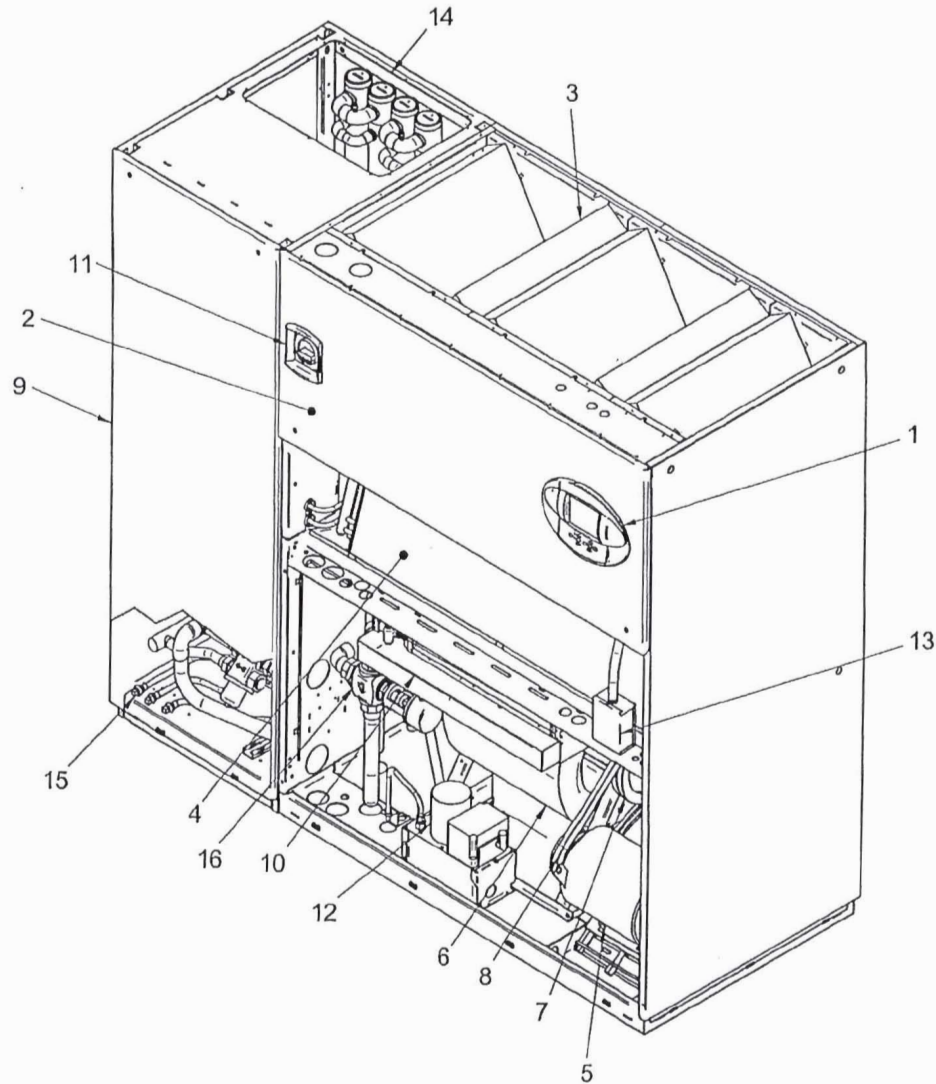
Table 21 Piping data - downflow, water/glycol/GLYCOOL, 28-42kW (8-12 ton)—all

Point	Description	X In. (mm)	Y In. (mm)	Connection Size / Opening In. (mm)
W	Water/Glycol/GLYCOOL Access	79-15/16 (2030)	9-1/16 (230)	3-1/2 x 8 (89 x 203)
WS	Water/Glycol/GLYCOOL Supply	82-15/16 (2107)	10-15/16 (278)	1-5/8" Cu Sweat
WR	Water/Glycol/GLYCOOL Return	82-15/16 (2107)	14-1/16 (357)	1-5/8" Cu Sweat
CD	Condensate Drain *	46 (1168)	29-1/2 (749)	3/4" FPT
	W/ Optional Pump	46 (1168)	29-1/2 (749)	1/2" Cu Sweat
HUM	Humidifier Supply Line	53-1/2 (1359)	29 (737)	1/4" Cu Sweat
ECS	Econ-O-Coil Supply	54-7/8 (1394)	22-9/16 (573)	1-5/8" Cu Sweat
ECR	Econ-O-Coil Return	49-13/16 (1265)	28-1/2 (724)	1-5/8" Cu Sweat
HS	Hot Water Reheat Supply	Consult local representative		
HR	Hot Water Reheat Return	Consult local representative		
E1	Electrical Conn. (High Volt)	55-1/2 (1410)	31-1/4 (794)	2-1/2"
E2	Electrical Conn. (High Volt)	52-7/16 (1332)	31-1/4 (794)	2-1/2"
LV1	Electrical Conn. (Low Volt)	2-1/4 (57)	27 (686)	7/8"
LV2	Electrical Conn. (Low Volt)	2-1/4 (57)	29 (737)	7/8"
LV3	Electrical Conn. (Low Volt)	2-1/4 (57)	31 (787)	7/8"
B	Blower Outlet	21-15/16 (557)	18-1/16 (459)	18-3/4 x 16-1/16 (476 x 408)

* Field pitch condensate drain line a minimum of 1/8" (3.2 mm) per foot (305 mm). All units contain a factory-installed condensate trap. Do not trap external to the unit. Drain line may contain boiling water. Select appropriate drain system materials. The drain line must comply with all local codes.

1.0 LIEBERT DS COMPONENTS AND NOMENCLATURE

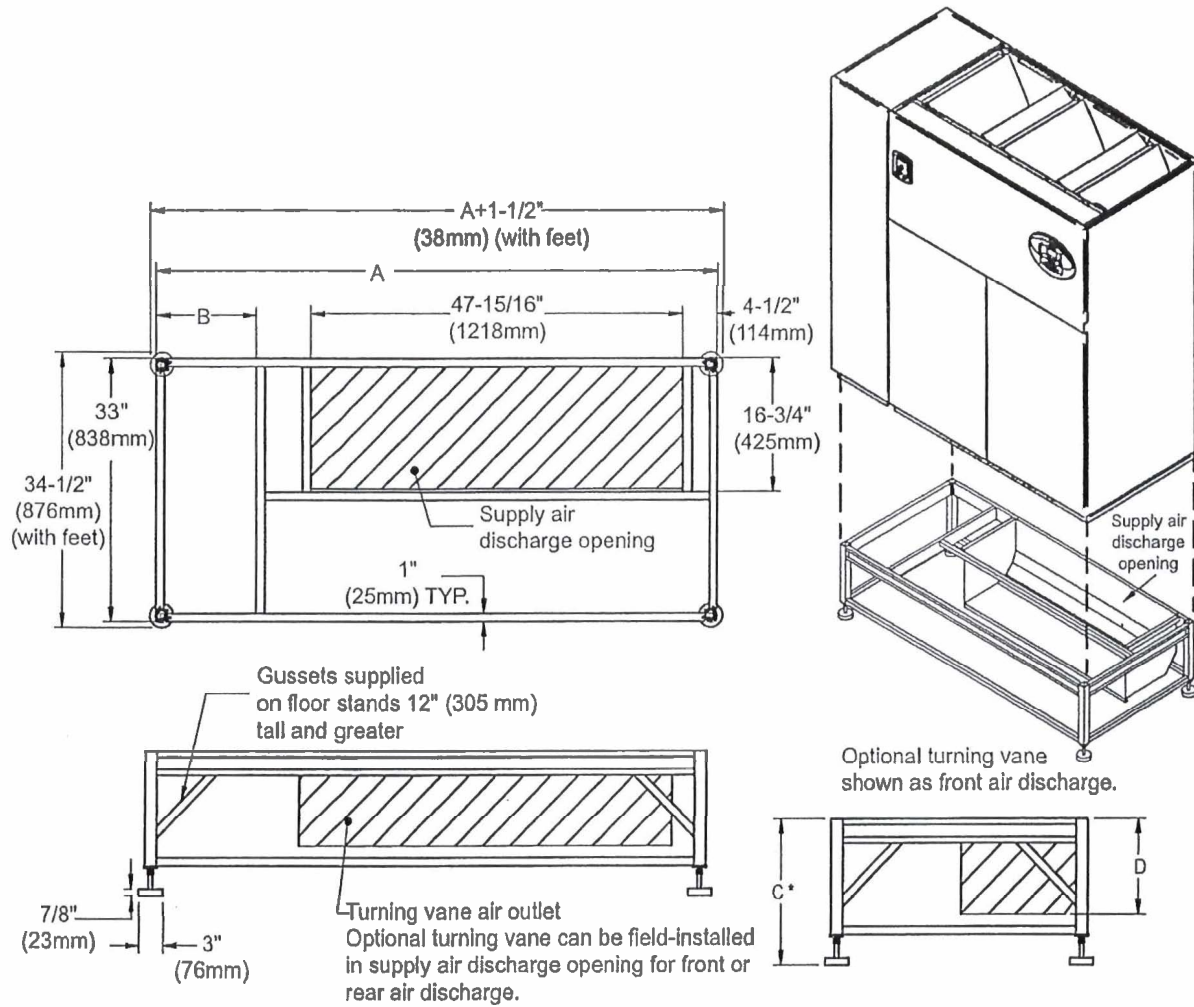
Figure 1 Downflow model component locations



- | | |
|---------------------------|--|
| 1. ICOM Control Display | 10. Infrared Humidifier, optional |
| 2. Electric Box | 11. Disconnect, optional |
| 3. Filters | 12. Condensate Pump, optional |
| 4. Evaporator Coil | 13. Smoke Sensor, optional |
| 5. Motor | 14. Condenser Cleanout Plugs,
fluid-cooled units only |
| 6. Blower | 15. Condenser Drain Plugs,
fluid-cooled units only |
| 7. Fan Pulley | 16. Econ-O-Coil Valve, GLYCOOL/Dual Cooling |
| 8. Motor Sheave and Belts | |
| 9. Compressor Section | |

DPN000958
Rev. 1

Figure 22 Floor stand dimensions—downflow, 28-42kW (8-12 ton) models



NOTE: Right side of paneled unit is flush with right side of floorstand. All other paneled sides overhang floor stand 1" (25mm).
 * Leveling feet are provided with $\pm 1\text{-}1/2"$ (38mm) adjustment from nominal height C.

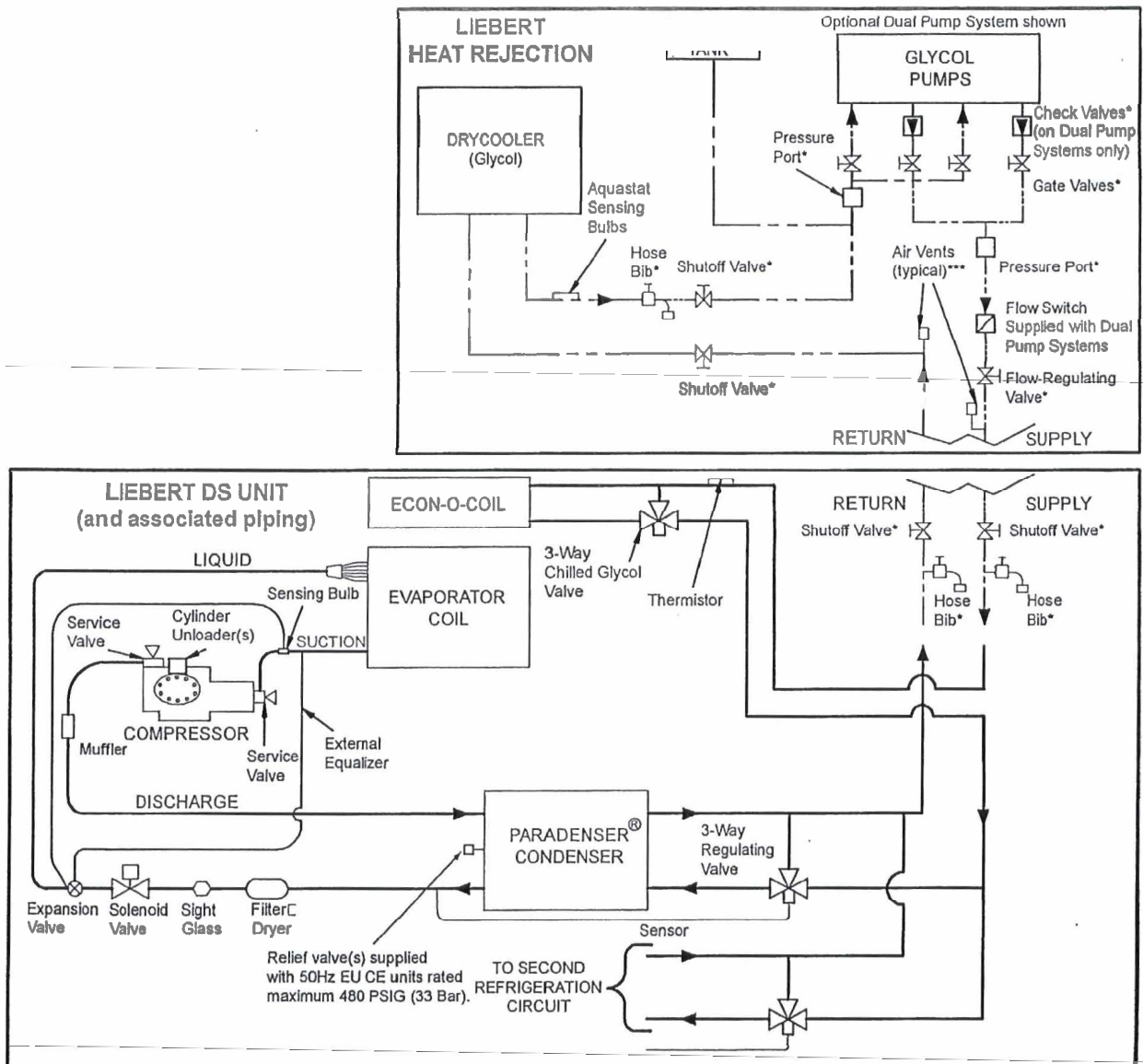
DPN000820
 REV 2

Table 19 Floor stand and floor planning dimensions—downflow, 28-42kW (8-12 ton) models

Dimensions, in. (mm)			Height, in. (mm)	
Model	A	B	C*	D Turning Vane
Air-Cooled Semi-Hermetic Models and All Water/Glycol/GLYCOOL Models	85 (2159)	26 (660)	9 (229)	4 (111)
Air-Cooled Scroll Models and Air-Cooled Digital Scroll Models	72 (1829)	13 (330)	12 (305)	7 (187)
			15 (381)	10 (264)
			18 (457)	13 (340)
			21 (533)	16 (416)
			24 (610)	19 (492)

Figure 61 Piping schematic—GLYCOOL semi-hermetic compressor models

For systems with drycoolers, refer to 12.11.3 - Drycooler Settings.



——— Factory Piping
 - - - Field Piping
 ▽ Service/Schrader (Access) Connection No Valve Core
 ▾ Service/Schrader (Access) Connections With Valve Core

* Components are not supplied by Liebert but are recommended for proper circuit operation and maintenance
 ** Field-installed at highest point in system on return line to pumps
 *** Locate at tops of all risers and any intermediate system high points

Notes: Schematic representation shown. This schematic does not imply or define elevations and component location unless specifically noted.
 Two refrigeration circuits provided. Single refrigeration circuit shown for clarity

DPN000897
 Rev. 02

KENAI PENINSULA BOROUGH
Borough Administration Building
IT Server Room AC Replacement Study

APPENDIX 4
SCHEMATIC DRAWINGS

