Liebert
Keeping Business In Business

DISCONTINUED PRODUCT

HEAT REMOVAL/ENVIRONMENTAL CONTROL

CSU 3000™

TECHNICAL DATA MANUAL

Mainframe Cooling Systems
60 Hz

EMERSON™
Network Power

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DEDICATED, FULLY REDUNDANT PROCESSOR COOLING

Water-cooled mainframe computers rely on a continuous supply of liquid coolant to maintain processor temperature below a specified limit. Coolant specifications typically are 16°C (60°F) or below. Exceeding temperature specification can result in imminent shutdown, interruption of computer operations, and possible hardware damage resulting in costly repairs at the user's expense. Re-starts following such a shutdown can be time consuming.

Liebert CSU3000 Series chillers are application matched to the temperature control and heat rejection requirements of water cooled processors, and provide 100% backup in the unlikely event of failure. Both coolant flow and temperature are precisely regulated to keep processor cooling within specification.

Unlike building chillers, every critical element is duplicated for dependability. **No single component failure will interrupt operation.** A monitoring system alerts personnel to alarm conditions instead of allowing temperature shutdown, and in case of malfunction, switch-over to the stand-by module is automatic.

The 3000's close-coupled, closed loop system also supplies cleaner cool ant to the processor heat exchanger, reducing the fouling factor. Use of the CSU3000 is also more efficient. Cooling requirements can be met during periods of low outside temperature without the extra expense of operating a large facility chiller.

Installation is simple. Liebert chillers can be supplied with plug-in hose connections and pre-charged refrigeration circuits. And, in case of expansion, the CSU3000 has the capability to be easily upgraded to increase cooling capacity. The CSU3000 is available in both dual and triple capacity models, allowing precise cooling over a wide range of heat loads.

The advantages of Liebert 3000 Series chillers make them a clear choice for meeting the cooling requirements of mainframes.

Table 1 CSU3000 features and installation ease

Desirable Feature	Packaged System	Building Chiller
Full redundancy	Yes - Total with automatic switchover	No.
Easy install	Yes - Flexible plug-compatible hose connections to the CDU.	Doubtful - Piping, pumping and control may require special design.
Efficiency	Yes - Many energy saving features. Highest EER in the industry.	Usually not - Chiller capacity probably is far in excess of computer needs, making operation of the chiller inefficient during some periods.
Monitoring	Yes - Local and remote.	Not available.
Proven design	Yes - Factory assembled and tested.	Tapping into building chillers with needed controls and is typically a "first time" approach.
Easy expansion	Yes - Dual and triple capacities increase cooling capability at the touch of a button.	Difficult - Redesign and resizing of pumping equipment.
Precise control of flow and temperature.	Yes - Integral control system.	More difficult - Piping length and fittings can introduce transport lag.

FEATURES FOR RELIABLE COOLING

Built-In Dependability

Liebert CSU3000 chillers contain dual or triple, totally independent, complete cooling units. Compressors, pumps, condensers and control electronics are all duplicated to prevent single component failure from taking down the system. Energy efficiency.

The CSU3000 is designed exclusively with semi-hermetic compressors which are more efficient than conventional hermetic compressors. An optional GLYCOOL model automatically switches to an ambient-cooled liquid source during periods of low outside temperature.

Application Flexibility

Liebert chillers are available in a variety of sizes and configurations to meet application needs. Sizes range from 2.5 to 37 ton capacities. Dual and triple capacity units, GLYCOOL versions and alternate water source models are available. Microprocessor compatibility.

Operation is directed by a proven control system that can be integrated with Liebert microprocessor monitoring and control systems. Flow rates, compressor operation and coolant temperature are precisely controlled to maintain cooling to specified limits:

Monitoring

Liebert 3000 chillers are equipped with built-in monitoring to alert personnel to out-of-spec or alarm conditions. Pressure, water temperature, flow and power are monitored and alarmed if they exceed specifications.

Applications Flexibility

Liebert CSU3000 chillers are available in a variety of configurations to meet application requirements. Sizes range from 2.5 to 37 tons in air, water and glycol cooled systems. Regardless of geographic location, ambient temperature or facility considerations, the CSU3000 offers models to enhance energy efficiency and to make use of existing water sources.

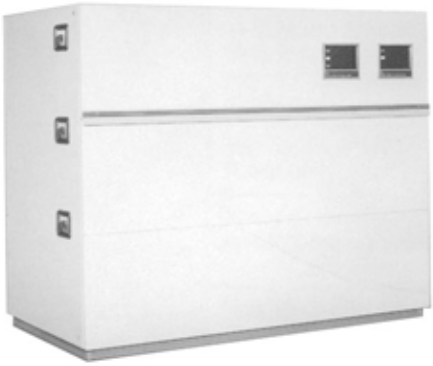
Figure 1 Model DS/DD, 2.5/5 ton air/water/glycol cooled, compressorized

Compact model requiring only 11 sq. ft. of floor space. Dual capacity is standard. A backup coolant tank and UPS pump electrical connection can be provided. A two- or four-hose connection kit quickly couples to the CDU.

Figure 2 Model CS/CD 7.5, 10, 12, and 15 ton, air/water/glycol cooled, compressorized

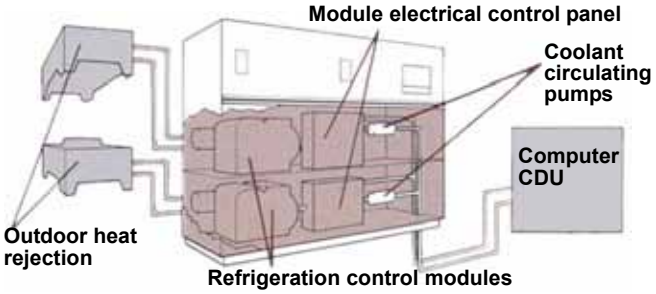
Full size model with capacities to 200,800 BTUH. Dual and triple capacity optional. Glycol option and Alternate Water Source systems available. Two-, four- and eight-hose connection kits can be supplied.

Figure 3 Model CT 20,30 and 37 ton, air/water/glycol cooled, compressorized

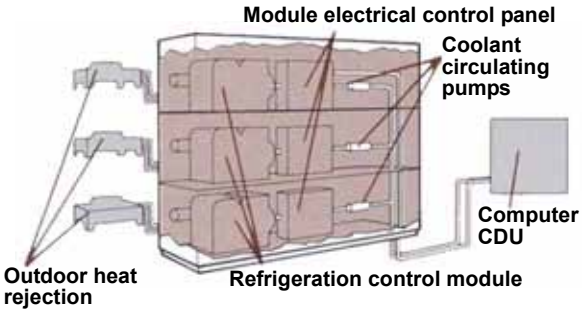


Three-module systems with capacities to 485,000 BTUH. Triple capacity optional on certain models. Four- and eight- hose connection kits can be provided.

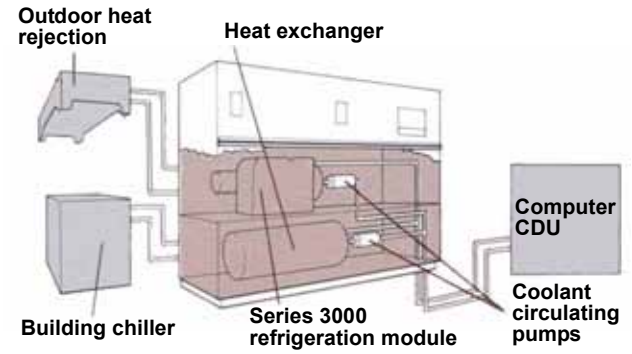
CSU3000 Model	GLYCOOL	AWS3000 Alternate Water Source	Separate Pump Power Connection	Backup Coolant Tank	Dual Capacity Refrigeration Control	Triple Capacity Refrigeration Control
DS/DD	Not Available	Not Available	Optional	Optional	Standard	Not Available
CS/CD	Optional 7, 10, 12 Ton	Optional 7, 10, 12 Ton	Optional	Consult Factory	Optional	Optional 10, 12 & 15 Ton
CT	Not Available	Not Available	Optional	Consult Factory	Optional (not available for 37 ton)	Optional (not available for 37 ton)



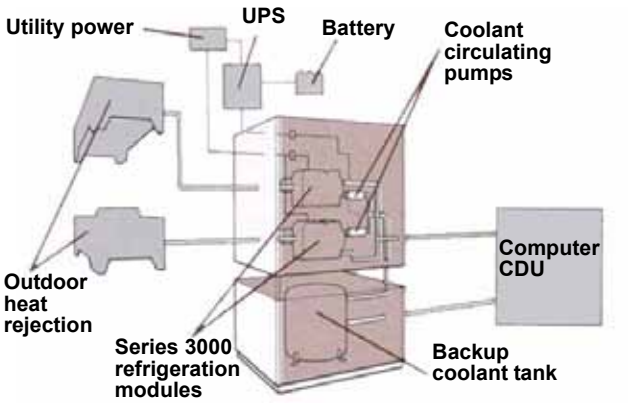
Standard CSU3000 provides two refrigeration modules with every component duplicated for 100% redundancy. Flexible hose kits provide easy connection to CDU.



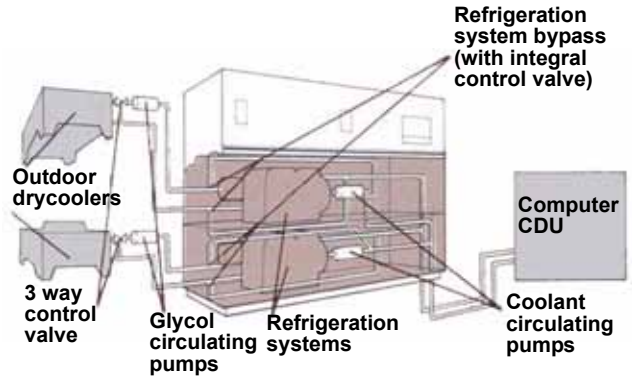
20, 30 & 37 ton models use a 3-module configuration. Two modules provide full capacity; the third is standby.



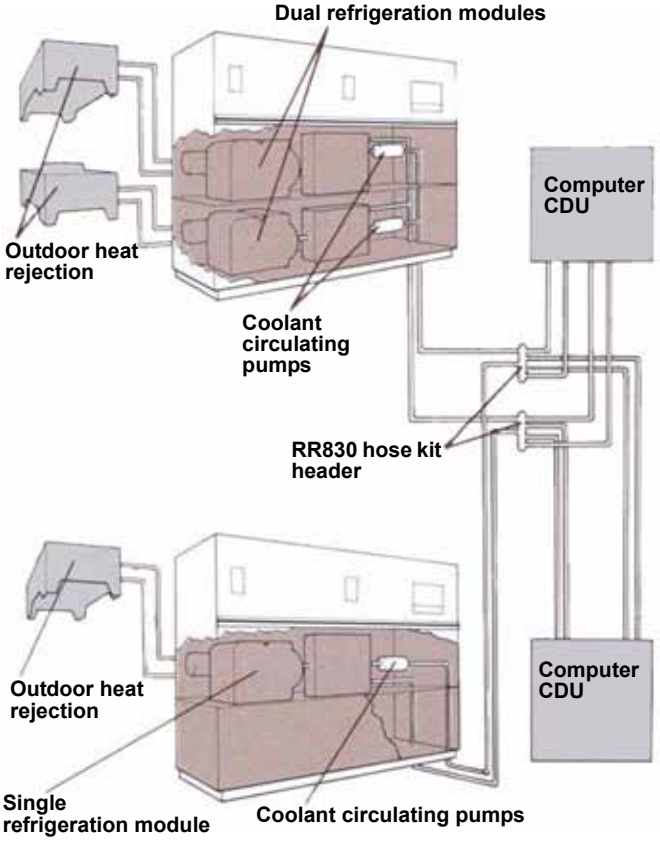
An AWS3000 utilizes an existing chilled water loop. The CDU is isolated from the contaminants and possible high pressure of the building chiller loop and adds monitoring and redundancy. A stand-by refrigeration module is automatically activated should failure or shutdown of the building system occur.



A backup coolant tank and separate pump power connection can be specified. The circulating pumps, powered by the computer room's UPS system, maintain coolant flow after a power outage.



A GLYCOOL system takes advantage of low outdoor temperatures by circuiting the cold glycol directly to the CDU, eliminating compressor operation. Proper flow rate and temperature is maintained by 3-way mixing valve.



A three-module system provides coolant flow to two CDUs while providing a single backup system. A header kit is available, and all control circuitry is integrated for reliable operation.

MONITORING SYSTEM

PCR3000

The PCR3000 is a solid-state control system that continuously monitors the operation of the coolant supply unit. A backlighted readout panel displays both operation mode and any alarm condition. It features a manual start/stop switch for each module and a silence switch that will quiet the audible alarm. The PCR3000 also provides connection points for the entire control system that eliminates "hand-wired" connections and assures greater reliability.

The exclusive Sentinel 3000 is a solid state alarm module that maintains a constant watch over the system and warns operation personnel audibly and visually of any alarm condition. Should a malfunction occur, the Sentinel 3000 will automatically deactivate the primary chiller module and energize the stand-by module continuing the flow of coolant to the mainframe. The audible alarm may be silenced, but the visual indicator remains lit until the problem is corrected. To aid in troubleshooting, the nature of the malfunction is described on the readout panel, and that the stand-by module is operating.

Operation Mode	Alarm Conditions
Pump ON Cooling Start/Stop	No water flow High water temperature Low water temperature Power failure Standby ON High compressor head pressure Water under floor

In addition to the specific alarm message, a common alarm message such as CALL SERVICE may be specified.

SiteScan

SiteScan is an on-line site management center for monitoring and controlling all support systems in a large data processing installation. SiteScan provides early warning alarms and total site management data. A software-based system using a microcomputer as the central processing center, SiteScan is programmable, menu-driven, and upgradeable. Four primary site management programs are built into the SiteScan system.

Alarm functions provide instant warning of potential problems. A seven level selection of options for response to each alarm offers total flexibility in designing a custom-tailored alarm system.

Control functions allow critical setpoints and sensitivities to be adjusted by remote control for dynamic, single-point site management. Password access preserves site security.

Status functions provide complete information on all computer support systems, including real-time status of all monitored parameters and any existing alarm conditions.

History functions offer database management capabilities. These functions track, store and graphically display crucial data and trends for site management activities such as capacity analysis, growth predictions and energy management.

SiteScan makes full use of all features of its personal computer-based central processor, including RS-232 communications and other output ports and unlimited expansion via multiplexers. For critical data processing facilities, the SiteScan system offers total site management capability in a virtually obsolescence-proof configuration.

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STANDARD FEATURES—ALL SYSTEMS

Individual Electrical Systems

Each cooling module in the CSU3000 chiller includes dedicated electrical components. Contactors, starters, relays and transformers required for operation are contained in each module. Electrical circuitry is protected by dual element fuses. A dedicated disconnect switch for each module is accessible from the outside to allow shutdown of any cooling module prior to opening.

Individual Pumps

A close coupled, dedicated coolant circulating pump is also included in each module. Pump motors are ball bearing, bronze fitted construction with 316 stainless steel shafts for dependable operation.

Solid-State Control

Temperature and flow are precisely controlled by advanced solid-state control circuits. Each control circuit includes its own temperature control thermostats and a flow switch for coolant. Should coolant temperatures exceed pre-set limits, the module is deactivated and the standby module is energized.

Monitoring and Alarms

Critical variables are continuously monitored. In the event of failure or out-of-spec condition, both audible and visual alarms are activated to alert personnel to potential danger.

Automatic Switchover

Should a malfunction occur, the CSU3000 will automatically sound the alarm, deactivate the module in operation and start the backup unit without interruption of coolant flow to the processor.

Easy Shutdown

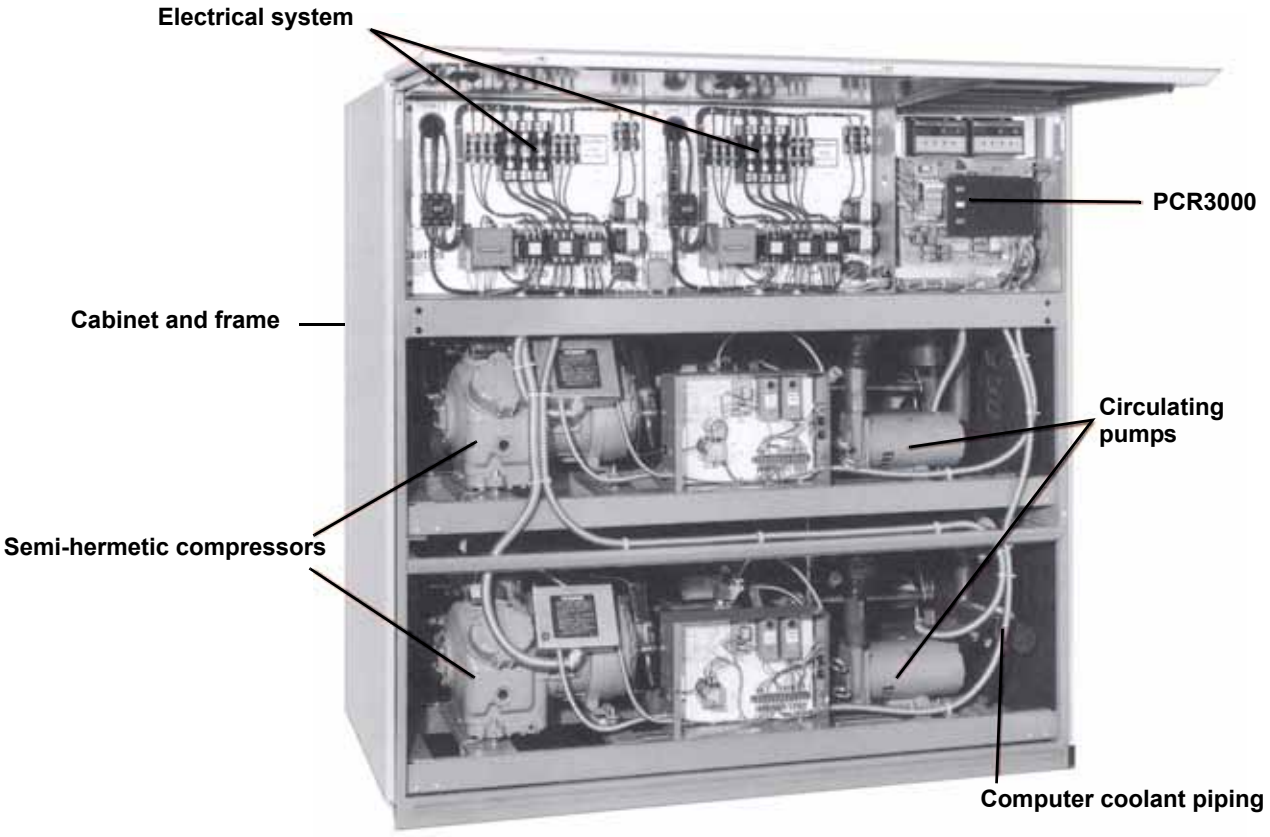
Front accessible switching allows interruption of coolant flow to meet the typical computer manufacturer requirement of no cooling when the processor is out of service for more than 30 minutes.

In-the-Computer-Room Design

Liebert processor cooling units are designed for use in the computer room. Noise levels are low, the result of insulated steel panels. A welded tubular steel frame supports both components and exterior panels which can be ordered to match computer room color schemes. All panels are easily removed for service access.

Insulated Piping

Internal coolant piping is insulated to prevent condensation and improve energy efficiency. Header connections to the processor cooling unit may be either hard-piped or connected with optional hose kits.



STANDARD FEATURES—COMPRESSORIZED SYSTEMS

Compressorized/Air Cooled

Semi-Hermetic Compressors

High efficiency semi-hermetic compressors are standard equipment. Built-in sight glasses allow fast determination of refrigerant and oil levels. Overload protection, suction line strainers, reversible oil pumps for forced feed lubrication and pump down control are provided. They are mounted on vibration-isolating springs and, running at only 1750 RPM, are quiet in operation.

Dual Capacity Control

DS/DD models are provided with dual capacity control. The capacity of the refrigeration system may be increased or decreased by the use of capacity control valves on one head of the compressor. A selector switch is provided in each module. A crankcase heater is standard to prevent refrigerant migration.

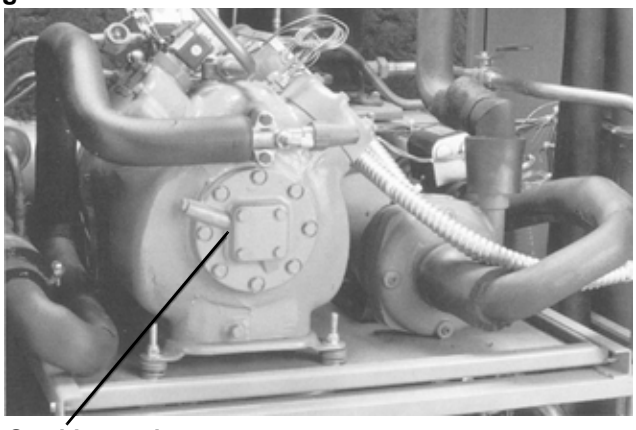
Refrigerator Dehydrator

An in-line desiccant absorbs moisture contamination in the refrigerant for longer compressor life and trouble free service.

Expansion Valve

An externally equalized thermostatic expansion valve smoothly controls refrigerant flow and provides precise control of superheat.

Figure 4 DS/DD model



Semi-hermetic compressor

Nominal Ton System	Compressor EER*
7-1/2 ton	11.7
10 ton	11.7
12 ton	11.7
15 ton	11.7
20 ton	11.7
30 ton	11.0
37 ton	11.8

*Based on ARI rated conditions 130°F SCT, 45°F SST, 15°F subcooling

Pressure Limiting

Both compressors have high low pressure switches. To prevent compressor cycling at high pressure, the high pressure switch must be manually reset after high pressure cut-out.

Condenser

A Liebert manufactured, low profile, direct-drive, propeller fan air cooled condenser operates quietly and efficiently. Copper tubing with aluminum fins provides effective heat-exchange. Condenser is housed in a corrosion resistant aluminum cabinet.

Lee-Temp Winter Control

The Lee-Temp winter control system utilizes heated receivers to permit startup with positive head pressure at ambient temperatures as low as -30°F (-34°C). Lee-Temp includes an insulated receiver, pressure relief valve, three-way head pressure control valves, and roto-lock valve.

Compressorized/Water & Glycol Cooled

Condenser

Water cooled condensers are heavy-duty, shell and tube, counter-flow design with removable heads. The shell side of the condenser acts as a receiver and holds refrigerant charge during pump-down. Heads are rugged cast iron, tubing is copper. Cleaning can be accomplished from either side.

Regulating Devices

Two-way, head pressure operated valves accurately control the condensing temperature, maintaining system capacity for varying entry flow rates and temperatures. On glycol models, the regulating valves have a parallel bypass valve. Glycol cooled systems include a heavy duty pump for moving the fluid. Pumps are mounted in vented, weather tight enclosures. The drycooler is designed and manufactured by Liebert to match glycol operational requirements. A low profile design features multiple direct-drive fans, balanced to the heat rejection load. The copper-tube, aluminum-fin coil provides efficient heat rejection. The drycooler is contained in a corrosion-resistant cabinet. An integral control panel contains necessary circuitry and components for control of both the pump and drycooler fan(s).

OPTIONAL CONFIGURATIONS—GLYCOOL SYSTEMS

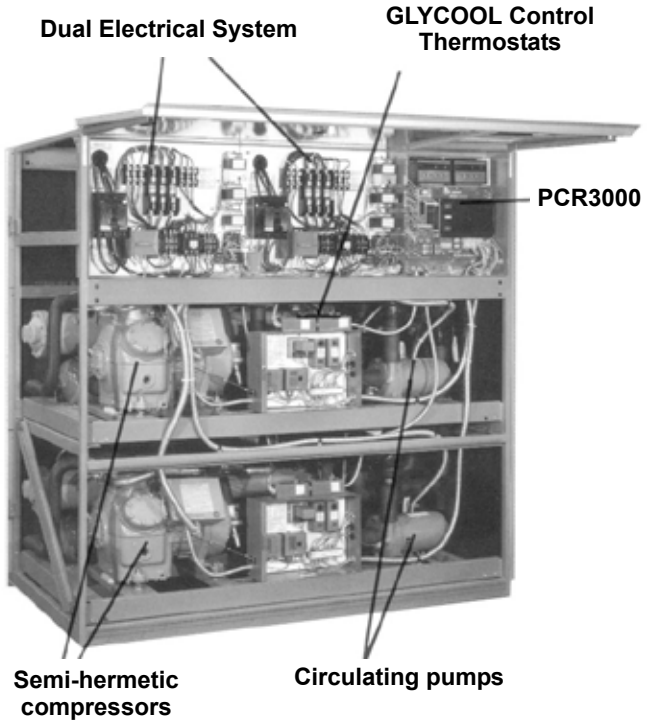
Alternate Water Source

The Liebert CSU3000 GLYCOOL model is a patented energy efficient system which reduces chiller operating costs during periods of low outdoor temperatures. It is available for 7-1/2, 10, and 12 ton models.

When the outdoor ambient temperature is low enough to cool the glycol solution to 50°F (10°C), a closed loop is used for heat transfer from the CDU processor to the outdoor drycooler. This provides the same cooling capacity as the compressor circuit but with significant energy savings since only pumps are operating.

A glycol temperature sensor at the entry line activates change-over when temperature reaches the GLYCOOL operation setpoint. Switching to GLYCOOL is automatic. A 3-way valve diverts solution flow directly to the processor heat exchanger, and compressor operation is discontinued.

Since a compressor accounts for up to 70% of the energy used in a chiller, energy savings can be substantial.



When ambient temperatures go above the GLYCOOL setpoint, the system automatically switches to compressor operation.

Another energy saving configuration is one which makes use of an existing source of chilled for primary processor cooling, backed by the Liebert CSU3000. Available for 7-1/2, 10, and 12 ton models, this system isolates the processor heat exchanger from the building source and controls flow rate to maintain proper temperature by means of a motor-driven throttling valve. Flow is regulated to meet processor cooling requirements. Valve design eliminates backlash and adjustments are unnecessary.

In the event of alternate source failure, the system automatically switches to compressor operation to prevent temperature shutdown. Built-in monitoring alerts personnel to failures and alarm conditions.

Table 2 Alternate water source data†

7-1/2,10,12 ton module - External water source flow requirements						
Capacity rating = 100,000 BTU/hr (25200 kcal/h) 24 gpm (5448 l/h) to computer						
Entering chilled water temp*	**Leaving coolant temp (to computer) °F (°C)**					
	52 (11.1)	**54 (12.2)**	**56 (13.3)**			
45°F (7.2°C)	47.9 (10873)	37.0 (8399)	31.0 (7037)	External water source flow rate US gpm (l/h)		
44°F (6.6°C)	42.0 (9534)	34.0 (7718)	29.0 (6583)			
43°F (6.1°C)	38.0 (8626)	31.6 (7173)	27.0 (6129)			
42°F (5.5°C)	34.5 (7832)	29.5 (6696)	25.3 (5743)			
41°F (5.0°C)	31.0 (7037)	27.5 (6242)	23.9 (5425)			
40°F (4.4°C)	29.5 (6696)	25.8 (5856)	23.0 (5221)			

7-1/2,10,12 ton module - External water source pressure drop							
Flow rate US gpm (l/h)	10 (2270)	20 (4540)	30 (6810)	40 (9080)	50 (11350)	60 (13620)	70 (15890)
Pressure drop WPD-ft. wg.(kPa)	1.0 (2.98)	3.8 (11.3)	8.6 (25.6)	15.3 (45.6)	23.9 (71.2)	34.4 (102.5)	46.9 (139.7)

*External Water Source
†Consult factory for operating points not listed.

OPTIONAL FEATURES

Options—Air Cooled/Compressorized Systems

Heat Recovery

The Series HR adds a second source of heat rejection to an air cooled system equipped with a conventional air cooled condenser. Usable wherever a source of heated water is needed, the HR shell-in-tube condenser permits a water circuit to absorb the heat of rejection. Complete engineering data is covered in the Series HR brochure SL-11330.

High-Rise Building Systems

A line of PB condensers is available for installations where roof top condenser mounting is impractical. Series PB condensers can be located indoors, adjacent to the CSU3000 or in a remote location with ducted condenser air. Complete engineering data are covered in the Series PB brochure SL-11340.

Figure 5 High-rise building systems

Options—Water and Glycol Cooled Compressorized Systems

Regulating Valves

Two regulating valve options are available:

** A two-way with bypass control condensing temperature. Valve pressure drop is reduced by the bypass with gate valve shut-off.

** A three-way valve accurately control condensing temperature, maintaining constant system capacity while keeping condenser water flow constant.

High Pressure Components

For installations where multiple stories and increased hydrostatic pressures are encountered, a high pressure option including two-way pressure regulating valve and a 300 PSIG condenser is available.

Options—All Systems

Backup Coolant Tank (2.5/5 Ton Models)

A reserve coolant tank provides up to 20 minutes of processor cooling in the event of a power failure. Requires the coolant pump to be supplied with uninterruptible power.

Locking Disconnect Switch

A locking disconnect switch in the electrical panel, interlocked mechanically to a front panel safety lock prevents panel opening unless the disconnect is in the off position. This option may be needed to comply with local and NEC codes.

Figure 6 Locking disconnect switch

Hose Kits

Optional hose kits allow fast coupling of coolant lines to the processor heat exchanger. Kits are available in 30- and 60-foot (9 and 18 meters) lengths:

- RR230/430 Kit—2 or 4, flexible insulated, 30 ft. hoses eliminate the cost of rigid piping and reduces installation cost. Couplings are Hansen ML-6-H31 (Parker Hannifin SS-H6-62) quick connect.
- RR260/460 Kit—2- or 4-hose kit same as above with 60 ft. length.

RR4.75 Single Unit Headers

Required on any 7.5 ton or larger chiller when an RR hose kit is to be used. Two headers are included. Each header has four 3/4" FPT connections for RR hose kits.

Under-Floor Header (RR830)

Manifold for connection of two CSU3000s and two processors, including an isolation valve and four 3/4" FPT connections. Used with RR hose kits.

ES9000 Hose Kits

- ES230/430 Kit includes two or four 30 ft. (9.1m), 1.5" (3.8cm) ID insulated hoses with barbed adapters and clamps. Each hose has one 2" FPT connection and one 2" MPT connection. An ES9000 coupling pair is required to attach hoses to mainframe CDU. Two are required for 430 hose kits.
- ES260/460 Kit is the same as ES230/430, except 60 ft. (18.2m) long hoses.

ES9000 Single Unit Headers

Required on any 7-1/2 ton or larger chiller when an ES hose kit is to be used. Two headers are included. Each header has two (2), 2" MPT connection for ES hose kits or ES9000 Coupling Pair.

ES9000 Coupling Pair

Includes the IBM specific connections for two hoses to mainframe CDU. The male connection includes a 2" ball valve, 1/4" drain valve and 2" male adaptor The female connection includes a 2" ball valve, 1/4" drain valve and 2" female coupler with bleed-off safety catch. These assemblies may attach directly to ES Hose Kits, ES Single Unit Headers or field supplied piping.

Adjustable Floor Stands

Available in heights from 7-1/2" to 25-1/2" (19 to 65cm) in 3" increments. Adjustable within a 3-inch (7.6 cm) range. Allows complete installation of chiller prior to installing raised floor. Liqui-Tect is a solid state water sensor for instantaneous detection of water in critical areas. Sensor operates on conductivity through platinum coated titanium electrodes. Sensor connections are hermetically sealed and potted to prevent contamination. Unaffected by dirt or vibration. Water detected is displayed on Liqui-Tector monitoring panel.

Figure 7 Floor stand

Capacity Control Valves (CS/CD/CT Models)

Capacity control valves, mounted on each semi-hermetic compressor can increase or decrease the capacity of the refrigeration system with a press of a button. The valve, when activated, reduces the cooling capacity of the system by approximately one-half, 10,12 and 15 ton CS/CD models and 20 and 30 ton CT models can be supplied with triple capacity control, allowing even more expansion range. Compressors are equipped with two capacity control valves for easy switching to any one of three capacities. Capacity information for both dual and triple configurations is located in the data tables.

Liqui-Tect Sensor/Liqui-Tector Panel

The Liqui-Tector panel monitors up to 20 sensors. Display maps sensed area with individual lighted indicators for pinpointing location of liquid. When activated by a Liqui-Tect sensor, the indicator is accompanied by an audible alarm. Alarm can be silenced, but the lighted indicator remains on until the problem is corrected.

Figure 8 Liqui-Tect components

DIMENSIONAL DATA

Figure 9 CS/CD chiller dimensions

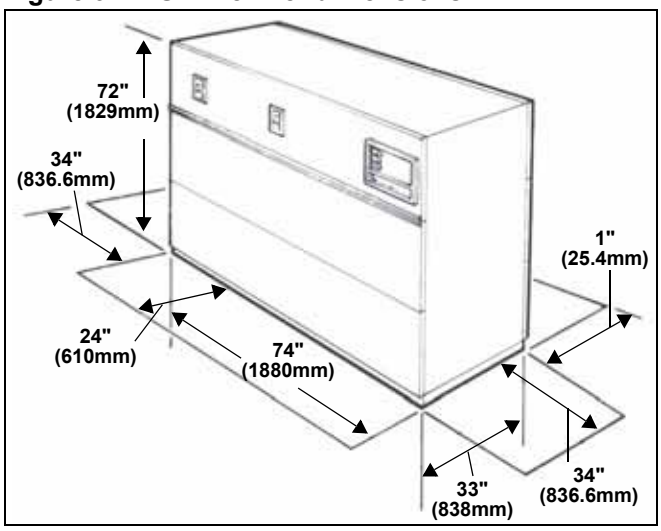


Figure 10 CT chiller dimensions

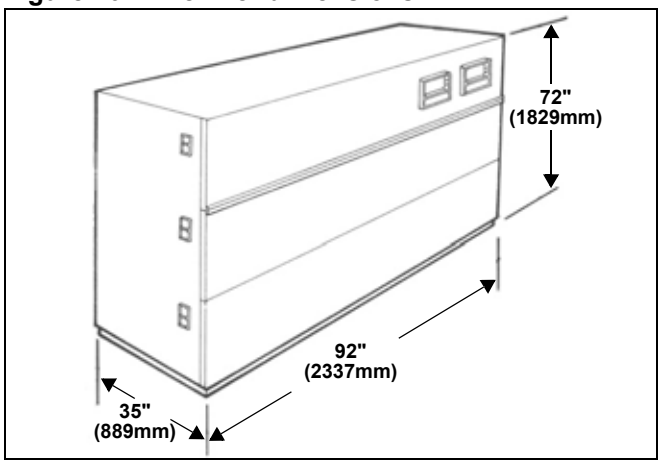


Figure 11 Drycooler/air cooled condenser dimensions

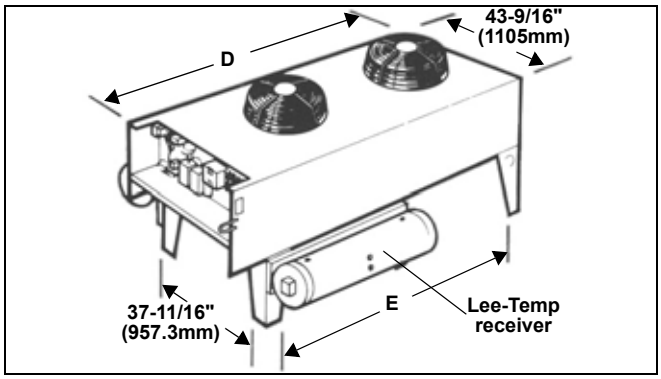


Table 3 Drycooler/air cooled condenser dimensions

No. of Fans	"D" inches (mm)	"E" inches (mm)
1	51-7/16 (1307.5)	42 (1066.8)
2	91-7/16 (2323.5)	82 (2082.8)
3	131-7/16 (3339.5)	122 (3098.8)
4	171-7/16 (4354.5)	162 (3606.8)

Figure 12 Floor stand dimensions

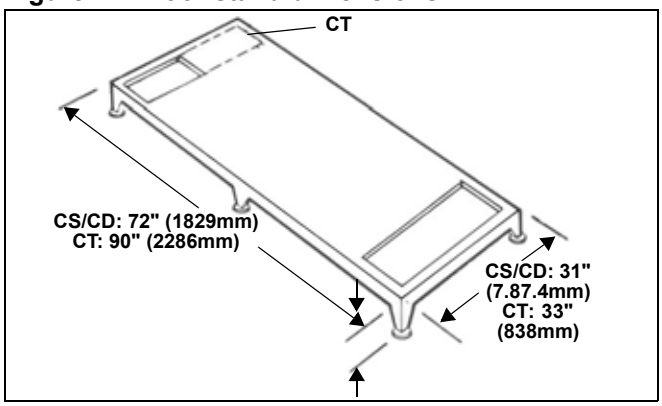


Figure 13 DS/DD chiller dimensions

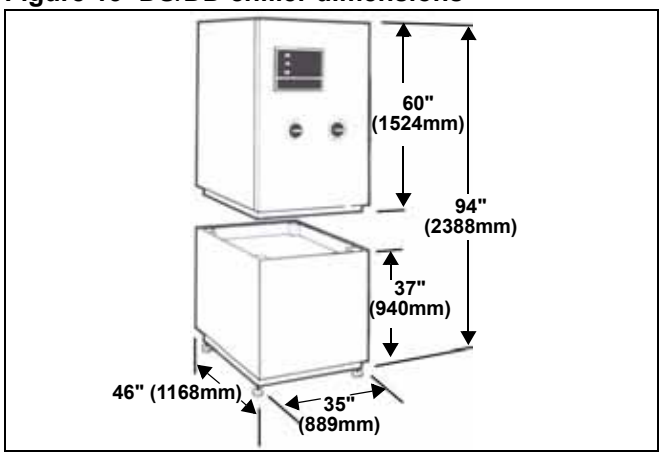


Figure 14 Glycol pump package dimensions

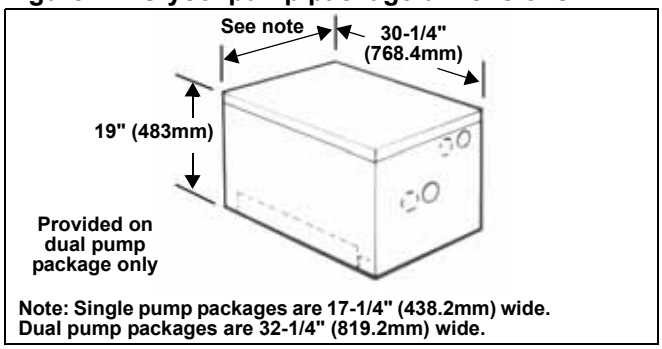


Figure 15 Liqui-Tector panels dimensions

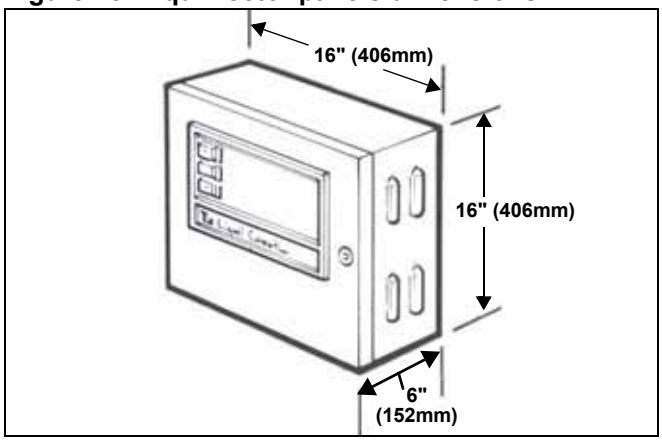


Table 4 Dimensions of single, dual, and triple module systems

Single Module Systems		Dual and Triple Module Systems							
Air Cooled	**Weight lbs (kg)**	**Air Cooled**	**Weight lbs (kg)**	**Hot Gas at CSU3000**	**Liquid Line at CSU3000**	**Hot Gas at Condenser**	**Liquid Line at Condenser**	**Coolant Supply & Return**	**Module Drain Pan**
DS-065-A	1105 (501)	DD-130-A	1705 (773)	578	1/2	1-1/8	5/8	3/4	1/2 OD CU
CD-091-A	1106 (502)	CD-182-A	1810 (821)	7/8	1/2	1-1/8	5/8	2-1/8	3/4 FPT
CS-109-A	1250 (567)	CD-218-A	1910 (866)	1-1/8	5/8	1-1/8	7/8	2-1/8	3/4 FPT
CS-135-A	1300 (590)	CD-270-A	1960 (889)	1-1/8	5/8	1-1/8	7/8	2-1/8	3/4 FPT
CS-181-A	1400 (635)	CD-362-A	2060 (934)	1-1/8	5/8	1-1/8	7/8	2-1/8	3/4 FPT
		CT-327-A	2570 (1166)	1-1/8	5/8	1-1/8	7/8	2-1/8	3/4 FPT
		CT-543-A	2720 (1234)	1-1/8	5/8	1-1/8	7/8	2-1/8	3/4 FPT
		CT-663-A	3160 (1433)	1-1/8	7/8	1-5/8	1-1/8	2-1/8	3/4 FPT
Water Cooled		**Water Cooled**		**Water Cooled Condensers**	**Coolant Supply & Return**	**Module Drain Pan**			
DS-072-W	1220 (553)	DD-144-W	1940 (880)	1-1/8	3/4	1/2 OD CU			
CS-101-W	1295 (587)	CD-202-W	2090 (948)	2-1/8	2-1/8	3/4 FPT			
CS-121-W	1385 (628)	CD-242-W	2250 (1021)	2-1/8	2-1/8	3/4 FPT			
CS-151-W	1400 (635)	CD-302-W	2300 (1043)	2-1/8	2-1/8	3/4 FPT			
CS-200-W	1500 (680)	CD-400-W	2400 (1089)	2-1/8	2-1/8	3/4 FPT			
		CT-363-W	3115 (1413)	2-1/8	2-1/8	3/4 FPT			
		CT-600-W	3300 (1497)	2-1/8	2-1/8	3/4 FPT			
		CT-702-W	3740 (1696)	2-1/8	2-1/8	3/4 FPT			
Glycol Cooled		**Glycol Cooled**		**Drycooler Connection**	**Condenser Connection**	**Glycol Pump Inlet**	**Glycol Pump Discharge**	**Expansion Tank**	**Coolant Supply & Return**
DS-057-G	1220 (553)	DD-114-G	1940 (880)	1-1/4	1-1/8	1-1/4	3/4	1/2	3/4
CS-085-G	1295 (587)	CD-170-G	2029 (920)	2	1-3/8	1-1/4	3/4	1/2	2-1/8
CS-102-G	1375 (624)	CD-204-G	2250 (1021)	2	1-3/8	1-1/4	3/4	1/2	2-1/8
CS-126-G	1400 (635)	CD-252-G	2300 (1043)	2	1-3/8	1-1/4	3/4	1/2	2-1/8
CS-168-G	1500 (680)	CD-336-G	2400 (1089)	2	1-3/8	1-1/4	3/4	3/4	2-1/8
		CT-306-G	3115 (1413)	2	1-3/8	1-1/4	3/4	1/2	2-1/8
		CT-504-G	3300 (1497)	2	1-3/8	1-1/4	3/4	3/4	2-1/8
		CT-621-G	3740 (1696)	2	1-3/8	1-1/4	3/4	3/4	2-1/8
		GLYCOOL Systems							
		CD-170-L	2079 (943)	2	1-3/8	1-1/4	3/4	1/2	2-1/8
		CD-204-L	2300 (1043)	2	1-3/8	1-1/4	3/4	1/2	2-1/8
		CD-252-L	2350 (1066)	2	1-3/8	1-1/4	3/4	1/2	2-1/8

Table 5 Dimensions of alternate water source systems

System	Weight lbs (kg)	External Chilled Water Source	Coolant Supply and Return	Module Drain Pan
Air Cooled				
AS-181-A	1715 (778)	2-1/8	3/4	3/4 FPT
AS-217-A	1785 (810)	2-1/8	3/4	3/4 FPT
AS-269-A	1860 (844)	2-1/8	3/4	3/4 FPT
Water Cooled				
AS-201-W	1990 (903)	2-1/8	3/4	3/4 FPT
AS-241-W	2125 (964)	2-1/8	3/4	3/4 FPT
AS-301-W	2175 (987)	2-1/8	3/4	3/4 FPT
Glycol Cooled				
AS-169-G	1990 (903)	2-1/8	3/4	3/4 FPT
AS-203-G	2125 (964)	2-1/8	3/4	3/4 FPT
AS-251-G	2175 (987)	2-1/8	3/4	3/4 FPT

ELECTRICAL SPECIFICATIONS FOR ALL SYSTEMS

Table 6 Single module systems—one power supply; *Dual module systems—two power supplies

Model Number		208V/230V			460V			575V		
		FLA	WSA	OPD	FLA	WSA	OPD	FLA	WSA	OPD
Air Cooled										
DS-065-A	*DD-130-A	36.7	43.8	70.0	18.2	21.7	35.0	14.3	17.1	25.0
CS-091-A	*CD-182-A	39.3	46.2	70.0	19.4	22.9	35.0	15.3	18.1	25.0
CS-109-A	*CD-218-A	50.7	59.0	90.0	25.1	29.6	45.0	19.6	23.2	35.0
CS-135-A	*CD-270-A	54.8	64.7	100.0	27.2	32.2	50.0	21.4	25.4	40.0
CS-181-A	*CD-362-A	74.0	88.3	125.0	33.7	40.2	60.0	26.5	31.6	50.0
Water Cooled										
DS-072-W	*DD-144-W	31.3	38.4	60.0	15.5	19.0	30.0	12.4	15.2	25.0
CS-101-W	*CD-202-W	33.9	41.0	60.0	16.7	20.2	30.0	13.4	16.2	25.0
CS-121-W	*CD-242-W	41.3	50.2	80.0	20.4	24.9	40.0	16.3	19.9	30.0
CS-151-W	*CD-302-W	45.4	55.3	90.0	22.5	27.5	45.0	18.1	22.1	35.0
CS-200-W	*CS-400-W	64.6	78.9	125.0	29.0	35.4	60.0	23.2	28.3	45.0
Glycol Cooled										
DS-057-G	*DD-114-G	41.0	48.1	70.0	20.1	23.7	35.0	15.9	18.7	30.0
CS-085-G	*CD-170-G	43.6	50.7	70.0	21.3	24.8	35.0	16.9	19.7	30.0
CS-102-G	*CD-204-G	53.9	63.9	90.0	26.6	31.5	45.0	20.9	24.8	35.0
CS-126-G	*CD-252-G	60.9	70.8	110.0	29.9	34.9	50.0	23.6	27.9	40.0
CS-168-G	*CD-336-G	82.6	96.9	150.0	37.8	44.2	60.0	29.3	34.4	50.0

Each condenser/drycooler is powered from the CSU3000 unit by separate power feeds.
*Values reflect 1 coolant pump, 1 compressor, 1 control circuit and 1 heat rejection package for each supply.

Table 7 Dual and triple module systems—one power supply

Model Number	208V/230V			460V			575V		
	FLA	WSA	OPD	FLA	WSA	OPD	FLA	WSA	OPD
Air Cooled									
DD-130-A	73.4	80.5	100	36.3	39.8	50	28.6	31.4	40
CD-182-A	78.6	85.7	110	38.8	42.3	50	30.6	33.4	40
CD-218-A	101.4	110.3	125	50.2	54.7	70	39.2	42.8	50
CD-270-A	109.6	119.5	150	54.4	59.4	70	42.8	46.8	60
CD-362-A	148.0	162.3	200	67.4	74.0	90	53.0	58.1	70
CT-327-A	152.1	161.0	175	75.3	79.8	90	58.8	62.4	70
CT-543-A	222.0	236.3	250	101.1	107.5	125	79.5	84.6	100
CT-663-A	249.0	263.9	300	123.0	130.5	150	91.8	97.4	110
Water Cooled									
DD-144-W	62.6	69.7	90	31.0	34.5	45	24.8	27.6	35
CD-202-W	67.8	74.9	100	33.4	36.9	50	26.8	29.6	40
CD-242-W	82.6	91.5	125	40.8	45.3	60	32.6	36.2	50
CD-302-W	90.8	100.7	125	45.0	50.0	60	36.2	39.9	50
CD-400-W	129.2	143.5	200	58.0	64.4	90	46.4	51.6	70
CT-363-W	123.9	132.8	150	61.2	65.7	80	48.9	54.0	60
CT-600-W	193.8	208.1	250	87.0	93.4	110	69.6	74.7	90
CT-702-W	210.9	225.8	300	104.1	111.6	125	78.3	83.9	100
Glycol Cooled									
DD-114-G	82.0	89.1	110	40.2	43.7	50	31.8	34.6	45
CD-170-G	87.2	94.3	110	42.6	46.1	50	33.8	36.5	45
CD-204-G	107.8	116.7	150	53.2	57.7	70	41.8	45.4	50
CD-252-G	121.8	131.7	150	59.8	64.8	80	47.2	51.2	60
CD-336-G	165.2	179.5	225	75.6	82.1	100	58.6	63.5	80
CT-306-G	161.7	173.9	200	79.8	85.5	100	62.7	67.8	80
CT-504-G	247.8	263.9	300	113.4	119.8	125	87.9	94.8	110
CT-621-G	297.0	311.9	350	144.9	152.4	175	109.2	114.8	125

Each condenser/drycooler is powered from the CSU3000 unit by separate power feeds.
DD/CD = 2 coolant pumps, 2 compressors, 2 control circuits, and 2 heat rejection packages, powered from a single source.
CT = 3 coolant pumps, 3 compressors, 3 control circuits, and 3 heat packages, powered from a single source.

Table 8 Dual GLYCOOL module—one power supply

Model Number	208V/230V			460V			575V		
	FLA	WSA	OPD	FLA	WSA	OPD	FLA	WSA	OPD
CD-170-L	90.8	97.9	125	44.2	47.7	60	35.0	37.8	45
CD-204-L	113.6	122.5	150	55.6	60.1	70	43.6	47.2	60
CD-252-L	128.0	137.9	175	62.6	67.6	80	49.2	53.2	60

Each condenser/drycooler is powered from the CSU3000 by separate power feeds.
FLA = Full Load Amps; OPD = Overcurrent Protection Device (max. supply circuit fuse size)
WSA = Wire Sizing Amps (min. supply circuit ampacity)

Table 9 Dual GLYCOOL module—two power supplies

Model Number	208V/230V			460V			575V		
	FLA	WSA	OPD	FLA	WSA	OPD	FLA	WSA	OPD
CD-170-L (each module)	45.4	52.5	80	22.1	25.6	35	17.5	20.3	30
CD-204-L (each module)	56.8	65.7	100	27.8	32.3	50	21.8	25.4	35
CD-252-L (each module)	64.0	73.9	110	31.3	36.3	50	24.8	28.8	40

Table 10 Alternate water source systems—one power supply

Model Number	208V/230V			460V			575V		
	FLA	WSA	OPD	FLA	WSA	OPD	FLA	WSA	OPD
One air cooled module; one AWS3000 module									
AS-181-A	45.0	52.1	80	22.0	25.6	35	17.4	20.2	30
AS-217-A	56.4	62.2	90	27.7	32.2	50	21.7	26.3	35
AS-269-A	60.5	70.4	110	29.8	34.8	50	23.5	27.5	40
One water cooled module; one AWS3000 module									
AS-201-W	39.6	46.7	70	19.3	22.8	35	15.5	18.3	25
AS-241-W	47.0	55.9	90	23.0	27.9	45	18.4	22.0	35
AS-301-W	51.1	61.0	100	25.1	30.1	50	20.2	24.2	40
One glycol cooled module; one AWS3000 module									
AS-169-G	49.3	56.4	80	23.9	27.4	40	19.0	21.8	30
AS-203-G	60.7	69.6	100	29.6	34.1	50	23.3	26.9	40
AS-251-G	66.6	76.5	110	32.5	37.5	50	25.7	29.7	45

Table 11 Alternate water source systems—two power supplies

Model Number		208V/230V			460V			575V		
		FLA	WSA	OPD	FLA	WSA	OPD	FLA	WSA	OPD
One air cooled module; one AWS3000 module										
AS-181-A	Chiller	39.3	46.2	70	19.4	22.9	35	15.3	18.1	25
	AWS3000	5.7	7.1	20	2.6	3.3	15	2.1	2.6	15
AS-217-A	Chiller	50.7	59.6	90	25.1	29.6	45	19.6	23.2	35
	AWS3000	5.7	7.1	20	2.6	3.3	15	2.1	2.6	15
AS-269-A	Chiller	54.8	64.7	100	27.2	32.2	50	21.4	25.4	40
	AWS3000	5.7	7.1	20	2.6	3.3	15	2.1	2.6	15
One water cooled module; one AWS3000 module										
AS-201-W	Chiller	33.9	41.0	60	16.7	20.2	30	13.4	16.2	25
	AWS3000	5.7	7.1	20	2.6	3.3	15	2.1	2.6	15
AS-241-W	Chiller	41.3	50.2	80	20.4	24.9	40	16.3	19.9	30
	AWS3000	5.7	7.1	20	2.6	3.3	15	2.1	2.6	15
AS-301-W	Chiller	45.4	55.3	90	22.5	27.5	45	18.1	22.1	35
	AWS3000	5.7	7.1	20	2.6	3.3	15	2.1	2.6	15
One glycol cooled module; one AWS3000 module										
AS-169-G	Chiller	43.6	50.7	70	21.3	24.8	35	16.9	19.7	30
	AWS3000	5.7	7.1	20	2.6	3.3	15	2.1	2.6	15
AS-203-G	Chiller	53.9	63.9	90	26.6	31.5	45	20.9	24.8	35
	AWS3000	5.7	7.1	20	2.6	3.3	15	2.1	2.6	15
AS-251-G	Chiller	60.9	70.8	110	29.9	34.9	50	23.6	27.6	40
	AWS3000	5.7	7.1	20	2.6	3.3	15	2.1	2.6	15

Table 12 Separate pump power connection—two or three refrigeration modules

Model Number		208V/230V			460V			575V		
		FLA	WSA	OPD	FLA	WSA	OPD	FLA	WSA	OPD
Air Cooled										
DD-130-	UTIL	67.2	74.3	100	33.5	37.0	50	26.4	29.2	40
	UPS	6.2	6.9	15	2.8	3.0	15	2.2	2.5	15
CD-182-	UTIL	65.8	72.9	100	32.9	36.4	50	26.0	28.8	40
	UPS	11.4	12.8	25	5.2	5.9	15	4.2	4.7	15
CD-218-	UTIL	90.0	98.9	125	45.0	49.5	60	35.0	38.6	50
	UPS	11.4	12.8	25	5.2	5.9	15	4.2	4.7	15
CD-270-	UTIL	98.2	108.1	125	49.2	54.2	70	38.6	42.6	50
	UPS	11.4	12.8	25	5.2	5.9	15	4.2	4.7	15
CD-362-	UTIL	133.0	147.3	200	60.6	67.0	90	47.6	52.7	70
	UPS	15.0	16.8	35	6.8	7.7	15	5.4	6.1	15
CT-327-	UTIL	135.0	143.9	175	67.5	72.0	80	52.5	56.1	70
	UPS	17.1	18.5	30	7.8	8.5	15	6.3	6.9	15
CT-543-	UTIL	199.5	213.8	250	90.9	97.3	110	71.4	76.5	90
	UPS	22.5	24.4	45	10.2	11.1	20	8.1	8.8	15
CT-663-	UTIL	217.2	232.1	250	108.6	116.1	125	80.1	85.7	100
	UPS	31.8	34.5	60	14.4	15.6	25	11.7	12.7	20
Water Cooled										
DD-144-	UTIL	56.4	63.5	90	28.2		45	22.6	25.4	35
	UPS	6.2	6.9	15	2.8	15	2.2	2.5	15	
CD-202-	UTIL	56.4	63.5	90	28.2		45	22.6	25.4	35
	UPS	11.4	12.8	25	5.2	15	4.2	4.7	15	
CD-242-	UTIL	71.2	80.1	110	35.6	40.1	50	28.4	32.0	45
	UPS	11.4	12.8	25	5.2	5.9	15	4.2	4.7	15
CD-302-	UTIL	79.4	89.3	125	39.8	44.8	60	32.0	36.0	50
	UPS	11.4	12.8	25	5.2	5.9	15	4.2	4.7	15,
CD-400-	UTIL	114.2	128.5	175	51.2	57.6	80	41.0	46.1	60
	UPS	15.0	16.8	35	6.8	7.7	15	5.4	6.4	15
CT-363-	UTIL	106.8	115.7	150	53.4	57.9	70	42.6	46.2	60
	UPS	17.1	18.5	30	7.8	8.5	15	6.3	6.9	15
CT-600-	UTIL	171.3	185.6	225	76.8	83.2	100	61.5	66.6	80
	UPS	22.5	24.4	45	10.2	11.1	20	8.1	8.8	15
CT-702-	UTIL	179.1	194.0	250	89.7	97.2	125	66.6	72.2	90
	UPS	31.8	34.5	60	14.4	15.6	25	11.7	12.7	20
Glycol Cooled										
DD-114-	UTIL	75.8	82.9	110	37.4	40.9	50	29.6	32.4	40
	UPS	6.2	6.9	15	2.8	3.2	15	2.2	2.5	15
CD-170-	UTIL	75.8	82.9	110	37.4	40.9	50	29.6	32.4	40
	UPS	11.4	12.8	25	5.2	5.9	15	4.2	4.7	15
CD-204-	UTIL	98.6	107.5	125	48.8	53.3	70	38.2	41.8	50
	UPS	11.4	12.8	25	5.2	5.9	15	4.2	4.7	15
CD-252-	UTIL	110.4	120.3	150	54.6	59.6	70	43.0	47.0	60
	UPS	11.4	12.8	25	5.2	5.9	15	4.2	4.7	15
CD-336-	UTIL	151.4	165.7	200	68.8	75.2	100	27.8	58.5	80
	UPS	15.0	16.8	35	6.8	7.7	15	5.4	6.1	15
CT-306-	UTIL	147.9	156.8	175	73.2	77.7	90	57.3	60.9	70
	UPS	17.1	18.5	30	7.8	8.5	15	6.3	6.9	15
CT-504-	UTIL	227.1	241.4	250	103.2	109.0	125	81.6	86.7	100
	UPS	22.5	24.4	45	10.2	11.1	20	8.1	8.8	15
CT-621-	UTIL	265.2	280.1	300	130.5	138.0	150	97.5	103.1	125
	UPS	31.8	34.5	60	14.4	15.6	25	11.7	12.7	20

Table 13 Dual pump power connection—two GLYCOOL modules

Model Number		208V/230V			460V			575V		
		FLA	WSA	OPD	FLA	WSA	OPD	FLA	WSA	OPD
Air Cooled										
CD-170-L	UTIL	79.4	86.5	110	39.0	42.5	50	30.8	33.6	40
	UPS	11.4	12.8	25	5.2	5.9	15	4.2	4.7	15
CD-204-L	UTIL	102.2	110.9	125	50.4	54.9	70	39.8	43.7	50
	UPS	11.4	12.8	25	5.2	5.9	15	4.2	4.7	15
CD-252-L	UTIL	116.6	126.5	150	57.4	62.4	80	45.4	49.4	60
	UPS	11.4	12.8	25	5.2	5.9	15	4.2	4.7	151

Table 14 Dual pump power connection—alternate water source systems

Model Number		208/230V			460V			575V		
		FLA	WSA	OPD	FLA	WSA	OPD	FLA	WSA	OPD
One air cooled module; one AWS3000 module										
AS-181-A	UTIL	33.6	40.7	60	16.8	20.3	30	13.2	16.0	25
	UPS	11.4	12.8	25	5.2	5.9	15	4.2	4.7	15
AS-217-A	UTIL	45.0	53.9	80	22.5	27.0	40	17.5	21.1	35
	UPS	11.4	12.8	25	5.2	5.9	15	4.2	4.7	15
AS-269-A	UTIL	49.1	59.0	90	24.6	29.6	45	19.3	23.3	35
	UPS	11.4	12.8	25	5.2	5.9	15	4.2	4.7	15
One water cooled module; one AWS3000 module										
AS-201-W	UTIL	28.2	35.3	60	14.1	17.6	30	11.3	14.1	25
	UPS	11.4	12.8	25	5.2	5.9	15	4.2	4.7	15
AS-241-W	UTIL	35.6	44.5	80	17.8	22.3	40	14.2	17.8	30
	UPS	11.4	12.8	25	5.2	5.9	15	4.2	4.7	15
AS-301-W	UTIL	39.7	49.6	80	19.9	24.9	40	16.0	20.0	35
	UPS	11.4	12.8	25	5.2	539	15	4.2	4.7	15
One glycol cooled module; one AWS3000 module										
AS-169-G	UTIL	37.9	45.0	70	18.7	22.2	35	14.8	17.6	25
	UPS	11.4	12.8	25	5.2	5.9	15	4.2	4.7	15
AS-203-G	UTIL	49.3	58.2	90	24.4	28.9	45	19.1	22.7	35
	UPS	11.4	12.8	25	5.2	5.9	15	4.2	4.7	15
AS-251-G	UTIL	55.2	65.1	100	27.3	32.3	50	21.5	25.5	40
	UPS	11.4	12.8	25	5.2	5.9	15	4.2	4.7	15

Table 15 Lee-Temp condenser amperage, 3 ph.

Model No.	208/230V		460V		575V	
	FLA	WSA	FLA	WSA	FLA	WSA
CSC-104L	4.0	5.0	2.0	2.5	1.4	1.8
CSC-107C	4.0	5.0	2.0	2.5	1.4	1.8
CSC-165L	8.0	9.0	4.0	4.5	2.8	3.2
CSC-217C	8.0	9.0	4.0	4.5	2.8	3.2
CSC-308L	12.0	13.0	6.0	6.5	4.2	4.5

Table 16 Glycol cooled pump and drycooler, 3 ph.

Drycooler Model No.	Pump Model No.	208/230V		460V		575V	
		FLA	WSA	FLA	WSA	FLA	WSA
DSO-092	S1.5	9.7	11.1	4.6	5.3	3.5	4
DSO-112	S1.5	9.7	11.1	4.6	5.3	3.5	4
DSO-139	S1.5	13.7	15.1	6.6	7.3	4.9	7.3
DSO-174	S2	15.5	17.4	7.4	8.3	5.5	6.2
DSO-225	S3/CS3	18.6	21.3	8.8	10.0	6.7	8.0
DSO-260	S5/CS5	28.7	32.9	13.6	15.5	10.3	11.8

Table 17 GLYCOOL pump and drycooler, 3 ph.

Drycooler Model No.	Model No.	208/230V		460V		575V	
		FLA	WSA	FLA	WSA	FLA	WSA
DSG-112	CSL2	11.5	13.4	5.4	6.3	4.1	4.8
DSG-139	CSL2	15.5	17.4	7.4	8.3	5.5	6.2
DSG-174	CSL3	18.6	21.3	8.8	10.0	6.7	7.7

Table 18 Glycol pump electrical data, 3 ph.

Model No.	Hp	208/230V	460V	575V
		FLA	FLA	FLA
S1.5	1-1/2	5.7	2.6	2.1
S2	2	7.5	3.4	2.7
S3/CS3	3	10.6	4.8	3.9
S5/CS5	5	16.7	7.6	6.1

Table 19 Lee-Temp receiver heater pads

All Air Cooled Models	
Volts	230
Watts/Pad	150
Total Amps	.65
WSA	.89
OPD	15

PUMP PERFORMANCE AND SPECIFICATIONS

Table 20 Air cooled data

	5 Ton	7-1/2 Ton	10 Ton	12 Ton	15 Ton	20 Ton	30 Ton	37 Ton
Model Numbers								
Single Module	DS 065A	CS 091A	CS 109A	CS 135A	CS 181A	--	--	-
Dual Module	DD 130A	CD 182A	CD 218A	CD 270A	CD 362A	--	--	
Triple Module	--	--	--	--	--	CT 327A	CT 543A	CT 663A
Cooling Capacity k Btuh (kW) - Per Module								
Full Capacity						(**)	(**)	(**)
52°F (11.1°C) LWT	66.0 (19.3)	88.7 (26.0)	114.8 (33.6)	131.9 (38.7)	182.0 (53.3)	229.6 (67.3)	363.9 (106.7)	447.6 (131.1)
54°F (12.2°C) LWT	67.8 (19.9)	92.0 (27.0)	119.2 (34.9)	136.7 (40.1)	188.4 (55.2)	238.3 (69.8)	376.8 (110.4)	463.0 (135.7)
56°F (13.3°C) LWT	69.8 (20.5)	95.3 (27.9)	123.6 (36.2)	141.7 (41.5)	195.0 (57.2)	247.1 (72.4)	390.0 (114.3)	478.7 (140.3)
Medium Capacity								
52°F (11.1°C) LWT	--	--	84.0 (24.6)	90.5 (26.5)	130.3 (38.2)	167.9 (49.2)	260.7 (76.4)	-
54°F (12.2°C) LWT	--	--	87.4 (25.6)	93.4 (27.4)	135.3 (39.7)	174.7 (51.2)	270.5 (79.3)	-
56°F (13.3°C) LWT	--	--	90.7 (26.6)	96.6 (28.3)	140.3 (41.1)	181.4 (53.2)	280.6 (82.2)	-
Low Capacity								
52°F (11.1°C) LWT	35.6 (10.4)	50.1 (14.7)	45.9 (13.5)	53.3 (15.6)	72.9 (21.4)	91.8 (26.9)	145.7 (42.7)	-
54°F (12.2°C) LWT	36.6 (10.7)	52.0 (15.2)	47.8 (14.0)	55.4 (16.2)	75.7 (22.2)	95.7 (28.0)	151.4 (44.4)	-
56°F (13.3°C) LWT	37.8 (11.1)	53.9 (15.8)	49.7 (14.6)	57.5 (16.9)	78.6 (23.0)	99.3 (29.1)	157.3 (46.1)	-
Coolant Flow Rate - GPM (l/s) for all above cooling capacities	9 (0.56)	24 (1.51)	24 (1.51)	24 (1.51)	24 (1.51)	48 (3.02)	48 (3.02)	64 (4.03)
Standard Coolant Pump								
Hp (kW)	3/4 (0.56)	1-1/2 (1.10)	1-1/2 (1.10)	1-1/2 (1.10)	2 (1.50)	2@1-1/2(1.1)/ea	2@2(1.5)/ea	2@3(2.2)/ea
Flow Rate - GPM (l/s)	9 (0.56)	24 (1.51)	24 (1.51)	24 (1.51)	24 (1.51)	48 (3.02)	48 (3.02)	64 (4.03)
Total Head - ft. of water (kPa)	70 (209)	83 (247)	83(247)	83 (247)	99 (295)	83 (247)	99 (295)	136 (406)
Module Pressure Drop ft. of water (kPa)	23.2 (69)	27.1 (81)	27.1 (81)	27.1 (81)	21.1 (63)	27.1 (81)	21.1 (63)	39.6 (118)
***RR Hose Kit Pressure Drop - ft. of water (kPa)**								
Thirty Feet	6.7 (20.0)	11.4 (34.0)	11.4 (34.0)	11.4 (34.0)	3.2 (9.5)	11.4 (34.0)	11.4 (34.0)	19.4 (58.0)
Sixty Feet	10.5 (31.3)	18.0 (53.6)	18.0 (53.6)	18.0 (53.6)	5.0 (14.9)	18.0 (53.6)	18.0 (53.6)	30.7 (92.0)
*Qty. of supply & return hoses	2	4	4	4	8	8	8	8
***ES9000 Hose Kit Pressure Drop - ft. of water (kPa)**								
Thirty Feet	--	3.4 (10.1)	3.4 (10.1)	3.4 (10.1)	1.0 (3.0)	3.4 (10.1)	3.4 (10.1)	5.8 (17.3)
Sixty Feet	--	6.8 (20.3)	6.8 (20.3)	6.8 (20.3)	2.0 (6.0)	6.8 (20.3)	6.8 (20.3)	11.2 (33.4)
*Qty. of Supply & Return Hoses	--	2	2	2	4	4	4	4
Optional Coolant Pump								
Hp (kW)	--	2 (1.5)	2 (1.5)	2 (1.5)	3 (2.2)	2@2(1.5)/ea	2@3(2.2)/ea	2@5(3.7)/ea
Flow Rate - GPM (l/s)	--	30 (1.89)	30 (1.89)	30 (1.89)	40 (2.52)	56 (3.53)	64 (4.03)	82 (5.16)
Total Head - ft. of water (kPa)	--	96 (286)	96 (286)	96 (286)	130 (389)	97 (290)	136 (406)	143 (427)
Module Pressure Drop ft. of water (kPa)	--	40.8 (122)	40.8 (122)	40.8 (122)	53.9 (161)	35.9 (107)	35.8 (107)	63.5 (189)
***RR Hose Kit Pressure Drop - ft. of water (kPa)**								
Thirty Feet	--	17.2 (51.3)	17.2 (51.3)	17.2 (51.3)	8.1 (24.1)	15.1 (45.0)	19.4 (58.0)	30.7 (92.0)
Sixty Feet	--	27.2 (81.0)	27.2 (81.0)	27.2 (81.0)	12.8 (38.1)	23.8 (71.0)	30.7 (92.0)	48.4 (144.0)
*Qty. of supply & return hoses	--	4	4	4	8	8	8	8
*ES9000 Hose Kit Pressure Drop - ft. of water (kPa)								
Thirty Feet	--	5.0 (14.9)	5.0 (14.9)	5.0 (14.9)	2.4 (7.2)	4.6 (13.7)	5.8 (17.3)	9.0 (26.8)
Sixty Feet	--	10.1 (30.1)	10.1 (30.1)	10.1 (30.1)	4.8 (14.3)	9.2 (27.4)	11.2 (33.4)	17.7 (52.8)
*Qty, of supply & return hoses	--	2	2	2	4	4	4	4
Air Cooled Condenser - Standard 95°F (35°C) Ambient Temperature								
Model Number***	CSC-104L	CSC-107C	CSC-165L	CSC-165L	CSC-217C	CSC-165L	CSC-217C	CSC-308L
Number of Fans	1	1	2	2	2	2	2	3
Condenser (only) net weight lbs (kg)	315 (143)	335 (152)	425 (193)	425 (193)	515 (234)	425 (193)	515 (234)	670 (30)
Lee-Temp Receiver net weight lbs (kg)	80 (36)	105 (48)	105 (48)	105 (48)	125 (57)	105 (48)	125 (57)	125 (57)

*Pressure drops are based on quantity of hoses shown

**Capacities are for two (2) modules during normal operation

***One (1) condenser required per module

Table 21 Water cooled data

	5 Ton	7-1/2 Ton	10 Ton	12 Ton	15 Ton	20 Ton	30 Ton	37 Ton
Model Numbers								
Single Module	DS 072W	CS 101W	CS 121W	CS 151W	CS 200W	--	--	--
Dual Module	DD 144W	CD 202W	CD 242W	CD 302W	CD 400W	--	--	--
Triple Module	--	--	--	--	--	CT 363W	CT 600W	CT 702W
Cooling Capacity k Btuh (kW) - Per Module								
Full Capacity						(**)	(**)	(**)
52°F (11.1°C) LWT	72.7 (21.3)	99.0 (29.0)	125.8 (36.9)	147.4 (43.2)	201.4 (59.0)	251.5 (73.7)	402.7 (118.0)	495.4 (145.2)
54°F (12.2°C) LWT	75.0 (22.0)	103.0 (30.2)	131.1 (38.4)	153.7 (45.0)	209.5 (61.4)	262.3 (76.9)	419.0 (122.8)	514.7 (150.9)
56°F (13.3°C) LWT	77.4 (22.7)	107.2 (31.4)	136.8 (40.1)	159.9 (46.9)	217.8 (63.8)	273.5 (802)	435.7 (127.7)	534.0 (156.5)
Medium Capacity								
52°F (11.1°C) LWT	--	--	87.8 (25.7)	93.8 (27.5)	137.1 (40.2)	175.7 (51.5)	274.3 (80.4)	--
54°F (12.2°C) LWT	--	--	91.7 (26.9)	97.2 (28.5)	142.8 (41.9)	183.4 (53.8)	285.7 (83.7)	--
56°F (13.3°C) LWT	--	--	95.8 (28.1)	100.7 (29.5)	148.5 (43.5)	191.7 (56.2)	296.9 (87.0)	--
Low Capacity								
52°F (11.1°C) LWT	38.5 (11.3)	51.5 (15.1)	45.5 (13.3)	53.3 (15.6)	72.9 (21.4)	91.5 (26.8)	145.7 (42.7)	--
54°F (12.2°C) LWT	39.7 (11.6)	53.6 (15.7)	47.5 (13.9)	55.5 (16.3)	75.9 (22.2)	95.5 (28.0)	151.8 (44.5)	--
56°F (13.3°C) LWT	41.1 (12.0)	55.8 (16.4)	49.5 (14.5)	57.7 (16.9)	78.8 (23.1)	99.5 (29.2)	157.6 (46.2)	--
Coolant Flow Rate - GPM (l/s) for all above cooling capacities	9 (0.56)	24 (1.51)	24 (1.51)	24 (1.51)	24 (1.51)	48 (3.02)	48 (3.02)	64 (4.03)
Standard Coolant Pump								
Hp (kW)	3/4 (0.56)	1-1/2 (1.10)	1-1/2 (1.10)	1-1/2 (1.10)	2 (1.50)	2@1-1/2(1.1)/ea	2@2(1.5)/ea	2@3(2.2)/ea
Flow Rate - GPM (l/s)	9 (0.56)	24 (1.51)	24 (1.51)	24 (1.51)	24 (1.51)	48 (3.02)	48 (3.02)	64 (4.03)
Total Head - ft. of water (kPa)	70 (209)	83 (247)	83 (247)	83 (247)	99 (295)	83 (247)	99 (295)	136 (406)
Module Pressure Drop ft. of water (kPa)	23.2 (69)	27.1 (80.9)	27.1 (80.9)	27.1 (80.9)	21.1 (63.0)	27.1 (80.9)	21.1 (63.0)	39.6 (118)
***RR Hose Kit Pressure Drop - ft. of water (kPa)**								
Thirty Feet	6.7 (20.0)	11.4 (34.0)	11.4 (34.0)	11.4 (34.0)	3.2 (9.5)	11.4 (34.0)	11.4 (34.0)	19.4 (58)
Sixty Feet	10.5 (31.3)	18.0 (53.6)	18.0 (53.6)	18.0 (53.6)	5.0 (14.9)	18.0 (53.6)	18.0 (53.6)	30.7 (92)
*Qty. of supply & return hoses	2	4	4	4	8	8	8	8
***ES9000 Hose Kit Pressure Drop - ft. of water (kPa)**								
Thirty Feet	--	3.4 (10.1)	3.4 (10.1)	3.4 (10.1)	1.0 (3.0)	3.4 (10.1)	3.4 (10.1)	5.8 (17.3)
Sixty Feet	--	6.8 (20.3)	6.8 (20.3)	6.8 (20.3)	2.0 (6.0)	6.8 (20.3)	6.8 (20.3)	11.2 (33.4)
'Qty. of supply and return hoses	--	2	2	2	4	4	4	4
Hp (kW)	--	2 (1.5)	2 (1.5)	2 (1.5)	3 (2.2)	2@2(1.5)/ea	2@3(2.2)/ea	2@5(3.7)/ea
Flow Rate - GPM (l/s)	--	30 (1.89)	30 (1.89)	30 (1.89)	40 (2.52)	56 (3.53)	64 (4.03)	82 (5.16)
Total Head - ft. of water (kPa)	--	96 (286)	96 (286)	96 (286)	130 (389)	97 (290)	136 (406)	143 (427)
Module Pressure Drop ft. of water (kPa)	--	40.8 (122)	40.8 (122)	40.8 (122)	53.9 (161)	35.9 (107)	35.8 (107)	63.5 (189)
***RR Hose Kit Pressure Drop - ft. of water (kPa)**								
Thirty Feet	--	17.2 (51.3)	17.2 (51.3)	17.2 (51.3)	8.1 (24.1)	15.1 (45.0)	19.4 (58.0)	30.7 (92)
Sixty Feet	--	27.2 (81.0)	27.2 (81.0)	27.2 (81.0)	12.8 (38.1)	23.8 (71.0)	30.7 (92.0)	48.4 (144)
*Qty. of supply & return hoses	--	4	4	4	8	8	8	8
***ES9000 Hose Kit Pressure Drop - ft. of Water (kPa)**								
Thirty Feet	--	5.0 (14.9)	5.0 (14.9)	5.0 (14.9)	2.4 (7.2)	4.6 (13.7)	5.8 (17.3)	9.0 (26.8)
Sixty Feet	--	10.1 (30.1)	10.1 (30.1)	10.1 (30.1)	4.8 (14.3)	9.2 (27.4)	11.2 (33.4)	17.7 (52.8)
*Qty. of Supply & Return Hoses	--	2	2	2	4	4	4	4
Water Regulating Valve - Single-seated, Head Pressure Controlled								
Valve Size - inches (mm)	3/4 (19.1)	1 (25.4)	1-1/4 (31.8)	1-1/4 (31.8)	1-1/4 (31.8)	1-1/4 (31.8)	1-1/4 (31.8)	1-1/4 (31.8)
Water Requirements for Condenser - Per Module* **								
THR - KBTU/HR (kW) @ 52° LWT & Std coolant flow per module	88.8 (26.0)	119.5 (35.0)	152.3 (44.6)	179.1 (52.4)	247.1 (72.4)	152.3 (44.6)	247.1 (72.4)	297.4 (87.1)
65°F (18.3°C) EWT								
Flow Rate - GPM (l/s)	8.0 (0.5)	6.6 (0.4)	10.4 (0.7)	10.4 (0.7)	14.7 (0.9)	10.4 (0.7)	14.7 (0.9)	18.6 (1.2)
Pressure Drop - ft. of water (kPa)	12.7 (37.9)	1.7 (5.1)	3.9 (11.6)	3.9 (11.6)	7.6 (22.7)	3.9 (11.6)	7.6 (22.7)	11.7 (34.9)
75°F (23.9°C) EWT								
Flow Rate - GPM (l/s)	12.2 (0.8)	11.2 (0.7)	17.1 (1.1)	15.6 (1.0)	21.2 (1.3)	17.1 (1.1)	21.2 (1.3)	27.3 (1.7)
Pressure Drop - ft. of water (kPa)	27.7 (82.7)	4.6 (13.7)	10.1 (30.1)	8.5 (25.4)	15.1 (45.1)	10.1 (30.1)	15.1 (45.1)	24.4 (72.8)
85°F (29.4°C) EWT								
Flow Rate - GPM (l/s)	16.2 (1.0)	14.9 (0.9)	22.7 (1.4)	19.9 (1.3)	26.5 (1.7)	22.7 (1.4)	26.5 (1.7)	35.4 (2.3)
Pressure Drop - ft. of water (kPa)	30.3 (90.3)	5.1 (15.2)	10.9 (32.5)	8.6 (25.7)	14.4 (43.0)	10.9 (32.5)	14.4 (43.0)	24.3 (72.5)
85° EWT, PD ratings based on 110° SCT & 2-way valve with bypass								

* Pressure drops are based on quantity of hoses shown
**Capacities are for two (2) modules during normal operation
***When 3-way Water Regulating Valves are used, condenser water pump must be sized for total of all installed modules.
§ Note flows are per condenser, two are required for standard operation for rated capacities, with one as standby.

Table 22 Glycol cooled data

	5 Ton	7-1/2 Ton	10 Ton	12 Ton	15 Ton	20 Ton	30 Ton	37 Ton
Model Numbers								
Single Module	DS 057G	CS 085G	CS 102G	CS 126G	CS 168G	--	--	--
Dual Module	DD 114G	CD 170G	CD 204G	CD 252G	CD 336G	--	--	--
Triple Module	--	--	--	--	--	CT 306G	CT 504G	CT 621G
Cooling Capacity k Btuh kW - Per Module								
Full Capacity						(**)	(**)	(**)
52°F (11.1°C) LWT	61.0 (17.9)	83.8 (24.6)	99.6 (29.2)	124 (36.3)	172 (50.4)	199.3 (58.4)	344.3 (100.9)	411.1 (120.5)
54°F (12.2°C) LWT	62.8 (18.4)	87.1 (25.5)	105 (30.8)	128 (37.4)	179 (52.4)	210.5 (61.7)	357.5 (104.8)	422.9 (124.0)
56°F (13.3°C) LWT	64.7 (19.0)	90.4 (26.5)	109 (32.0)	132 (38.5)	184 (54.0)	218.6 (64.1)	368.2 (107.9)	434.9 (127.5)
Medium Capacity								
52°F (11.1°C) LWT	--	--	77 (22.6)	87.7 (25.7)	125 (36.7)	153.9 (45.1)	250.3 (73.4)	--
54°F (12.2°C) LWT	--	--	79.5 (23.3)	90.0 (26.4)	130 (38.1)	159.1 (46.6)	259.8 (76.1)	--
56°F (13.3°C) LWT	--	--	83.4 (24.4)	93.4 (27.4)	135 (39.5)	168.8 (48.9)	269.2 (78.9)	--
Low Capacity								
52°F (11.1°C) LWT	32.0 (9.4)	48.8 (14.3)	43.1 (12.6)	52.4 (15.4)	71.3 (20.9)	86.3 (25.3)	142.6 (41.8)	--
54°F (12.2°C) LWT	33.2 (9.7)	49.6 (14.5)	45.5 (13.3)	53.8 (15.8)	74.0 (21.7)	91.1 (26.7)	147.9 (43.3)	--
56°F (13.3°C) LWT	34.4 (10.1)	52.5 (15.4)	47.3 (13.9)	56.2 (16.5)	75.5 (22.1)	94.6 (27.7)	151.0 (44.3)	--
Coolant Flow Rate - GPM (l/s) for all above cooling capacities		24 (1.51)	24 (1.51)	24 (1.51)	24 (1.51)	48 (3.02)	48 (3.02)	64 (4.03)
Standard Coolant Pump								
Hp (kW)	3/4 (0.56)	1-1/2 (1.10)	1-1/2 (1.10)	1-1/2 (1.10)	2 (1.50)	2@1-1/2(1.1)/ea	2@2(1.5)/ea	2@3(2.2)/ea
Flow Rate- GPM (l/s)	9 (0.56)	24 (1.51)	24 (1.51)	24 (1.51)	24 (1.51)	48 (3.02)	48 (3.02)	64 (4.03)
Total Head - ft. of water (kPa)	70 (209)	83 (247)	83 (247)	83 (247)	99 (295)	83 (247)	99 (295)	136 (406)
Module Pressure Drop - ft. of water (kPa)	23.2 (69)	27.1 (81)	27.1 (81)	27.1 (81)	21.1 (63)	27.1 (81)	21.1 (63)	39.6 (118)
***RR Hose Kit Pressure Drop - ft. of water (kPa)**								
Thirty Feet	6.7 (20.0)	11.4 (34.0)	11.4 (34.0)	11.4 (34.0)	3.2 (9.5)	11.4 (34.0)	11.4 (34.0)	19.4 (58)
Sixty Feet	10.5 (31.3)	18.0 (53.6)	18.0 (53.6)	18.0 (53.6)	5.0 (14.9)	18.0 (53.6)	18.0 (53.6)	30.7 (92)
*Qty. of supply & return hoses	2	4	4	4	8	8	8	8
***ES9000 Hose Kit Pressure Drop - ft. of water (kPa)**								
Thirty Feet	--	3.4 (10.1)	3.4 (10.1)	3.4 (10.1)	1.0 (3.0)	3.4 (10.1)	3.4 (10.1)	5.8 (17.3)
Sixty Feet	--	6.8 (20.3)	6.8 (20.3)	6.8 (20.3)	2.0 (6.0)	6.8 (20.3)	6.8 (20.3)	11.2 (33.4)
*Qty. of supply and return hoses	--	2	2	2	4	4	4	4
Optional Coolant Pump								
Hp (kW)	--	2 (1.5)	2 (1.5)	2 (1.5)	3 (2.2)	2@2(1.5)/ea	2@3(2.2)/ea	2@5(3.7)/ea
Flow Rate - GPM (l/s)	--	30 (1.89)	30 (1.89)	30 (1.89)	40 (2.52)	56 (3.53)	64 (4.03)	82 (5.16)
Total Head - ft. of water (kPa)	--	96 (286)	96 (286)	96 (286)	130 (389)	97 (290)	136 (406)	143 (427)
Module Pressure Drop - ft. of water (kPa)	--	40.8 (122)	40.8 (122)	40.8 (122)	53.9 (161)	35.9 (107)	35.8 (107)	63.5 (189)
***RR Hose Kit Pressure Drop - ft. of water (kPa)**								
Thirty Feet	--	17.2 (51.3)	17.2 (51.3)	17.2 (51.3)	8.1 (24.1)	15.1 (45.0)	19.4 (58.0)	30.7 (92)
Sixty Feet	--	27.2 (81.0)	27.2 (81.0)	27.2 (81.0)	12.8 (38.1)	23.8 (71.0)	30.7 (92.0)	48.4 (144)
*Qty. of supply and return hoses	--	4	4	4	8	8	8	8
***ES9000 Hose Kit Pressure Drop - ft. of water (kPa)**								
Thirty Feet	--	5.0 (14.9)	5.0 (14.9)	5.0 (14.9)	2.4 (7.2)	4.6 (13.7)	5.8 (17.3)	9.0 (26.8)
Sixty Feet	--	10.1 (30.1)	10.1 (30.1)	10.1 (30.1)	4.8 (14.3)	9.2 (27.4)	11.2 (33.4)	17.7 (52.8)
'Qty. of supply and return hoses	--	2	2	2	4	4	4	4
Glycol Reg. Valve - Head Press. Controlled, Single-Seated w/Bypass, 150PSI (1034kPa) Working Pressure								
Valve Size - in. (mm)	3/4 (19.1)	1-1/4 (31.8)	1-1/4 (31.8)	1-1/4 (31.8)	1-1/4 (31.8)	1-1/4 (31.8)	1-1/4 (31.8)	1-1/4 (31.8)
Glycol Pump - One per Module - Standard Selection								
Hp (kW)	1.5 (1.1)	1.5 (1.1)	1.5 (1.1)	2 (1.5)	3 (2.2)	1.5 (1.1)	3 (2.2)	5 (3.7)
Model Number	S1.5	S1.5	S1.5	S2	CS3	S1.5	CS3	CS5
Rated Flow - GPM (l/s) - for 40% Glycol	22.0 (1.4)	26.0 (1.6)	26.0 (1.6)	34.0 (2.1)	48.0 (3.0)	26.0 (1.6)	48.0 (3.0)	48.0 (3.0)
Total Head - ft. of water (kPa)	85.0 (253.0)	83.0 (247.0)	83.0 (247.0)	95.0 (283.0)	115.0 (342.0)	83.0 (247.0)	115.0 (342.0)	134.0 (400.0)
Module Pressure Drop - ft. of water (kPa)	45.7 (136.0)	19.6 (58.5)	19.6 (58.5)	32.0 (95.5)	56.5 (168.6)	18.8 (56.1)	58.8 (175.5)	56.5 (168.6)
Drycooler Pressure Drop - ft. of water (kPa)	5.8 (17.3)	5.8 (17.3)	4.2 (12.5)	10.0 (29.8)	7.8 (23.3)	4.2 (12.5)	7.8 (23.3)	8.8 (29.3)
Avail. Field Pressure Drop - ft. of water (kPa)	33.5 (100.0)	57.6 (172.0)	59.2 (176.7)	53.0 (158.2)	50.7 (151.3)	60.0 (179.0)	48.4 (144.4)	68.7 (205.0)
Drycooler - Standard 95°F (35°C) Ambient Temperature Selection								
Model Number**	DSO-092	DSO-112	DSO-139	DSO-174	DSO-225	DSO-139	DSO-225	DSO-260
Number of Fans	1	1	2	2	2	2	2	3
Approx. Weight lbs (kg)	410 (186)	470 (213)	565 (256)	605 (274)	685 (311)	565 (256)	685 (311)	826 (375)
Internal Volumes - U.S. gal. (liters)								
Drycooler	3.7 (14)	5.8 (22)	4.8 (18)	6.9 (26)	11.1 (42)	4.8 (18)	4.8 (18)	10.0 (38)
Chiller Module (Dual & Triple)	6.3 (23)	7.6 (28)	7.6 (28)	7.6 (28)	8.7 (32)	10.6 (39)	12.3 (46)	12.3 (46)
Expansion Tank	8.8 (33)	8.8 (33)	8.8 (33)	8.8 (33)	15 (57)	8.8 (33)	15 (57)	15 (57)

*Pressure drops are based on quantity of hoses shown
**Capacities are for two (2) modules during normal operation
***One (1) drycooler required per module

Table 23 GLYCOOL systems

	7-1/2 TON	10 TON	12 TON
Model Numbers			
Single Module	--	--	--
Dual Module	CD 170L	CD 204L	CD 252L
Triple Module	--	--	
Cooling Capacity k Btuh (kW) - Per Module			
Full Capacity			
52°F (11.1°C) LWT	81.7 (23.9)	98 (28.7)	118.9 (34.8)
54°F (12.2°C) LWT	84.6 (24.8)	100.1 (29.3)	123.5 (36.2)
56°F (13.3°C) LWT	86.4 (25.3)	105.7 (31.0)	127.4 (37.3)
Medium Capacity			
52°F (11.1°C) LWT	--	73.2 (21.5)	85.2 (25.0)
54°F (12.2°C) LWT	--	77.5 (22.7)	88.1 (25.8)
56°F (13.3°C) LWT	--	80.9 (23.7)	91.0 (26.7)
Low Capacity			
52°F (11.1°C) LWT	47.4 (13.9)	42.8 (12.5)	50.7 (14.9)
54°F (12.2°C) LWT	49.4 (14.5)	43.8 (12.8)	53.3 (15.6)
56°F (13.3°C) LWT	50.6 (14.8)	46.6 (13.7)	55.1 (16.1)
Coolant Flow Rate - GPM (l/s) for all above cooling capacities	24 (1.51)	24 (1.51)	24 (1.51)
Standard Coolant Pump			
Horsepower (kW)	1-1/2 (1.10)	1-1/2 (1.10)	1-1/2 (1.10)
Flow Rate - GPM (l/s)	24 (1.51)	24 (1.51)	24 (1.51)
Total Head - ft. of water (kPa)	83 (247)	83 (247)	83 (247)
Module Pressure Drop - ft. of water (kPa)	35.7 (107)	35.7 (107)	35.7 (107)
***RR Hose Kit Pressure Drop - ft. of water (kPa) (based on 40% glycol solution)**			
Thirty Feet	13.9 (41.0)	13.9 (41.0)	13.9 (41.0)
Sixty Feet	21.9 (65.0)	21.9 (65.0)	21.9 (65.0)
*Qty. of supply and return hoses	4	4	4
***ES9000 Hose Kit Pressure Drop - ft. of water (kPa) (based on 40% glycol solution)**			
Thirty Feet	4.2 (12.5)	4.2 (12.5)	4.2 (12.5)
Sixty Feet	8.3 (24.7)	8.3 (24.7)	8.3 (24.7)
*Qty. of supply and return hoses	2	2	2
Optional Coolant Pump			
Horsepower (kW)	2 (1.5)	2 (1.5)	2 (1.5)
Flow Rate - GPM (l/s)	30 (1.89)	30 (1.89)	30 (1.89)
Total Head - ft. of water (kPa)	96 (286)	96 (286)	96 (286)
Module Pressure Drop - ft. of water (kPa)	53.0 (158)	53.0 (158)	53.0 (158)
***RR Hose Kit Pressure Drop - ft. of water (kPa) (based on 40% glycol solution)**			
Thirty Feet	21.0 (63.0)	21.0 (63.0)	21.0 (63.0)
Sixty Feet	33.1 (99.0)	33.1 (99.0)	33.1 (99.0)
*Qty. of supply and return hoses	4	4	4
***ES9000 Hose Kit Pressure Drop - ft. of water (kPa) (based on 40% glycol solution)**			
Thirty Feet	5.0 (14.9)	5.0 (14.9)	5.0 (14.9)
Sixty Feet	10.1 (30.1)	10.1 (30.1)	10.1 (30.1)
*Qty. of supply and return hoses	2	2	2
Glycol Reg. Valve - Head Press. Controlled, Single-Seated w/Bypass, 150PSI (1034kPa) Working Pressure			
Valve Size - inches (mm)	1-1/4 (31.8)	1-1/4 (31.8)	1-1/4 (31.8)
Glycol Pump - One per Module - Standard & Optional Selections (For 40% Glycol Solution)			
	Std / Opt	Std / Opt	Std / Opt
Horsepower (CSL type)	2 / 3	2 / 3	3 / 5
Rated Flow Rate - GPM (l/s)	26 (1.6) / 26 (1.6)	26 (1.6) / 26 (1.6)	34 (2.1) / 34 (2.1)
Total Head - ft. of water (kPa)	98 (292) / 139 (414)	98 (292) / 139 (414)	134 (399) / 146 (435)
Module Pressure Drop - ft. of water (kPa)	19.6 (58.5) / 19.6 (58.5)	19.6 (58.5) / 19.6 (58.5)	32 (95.5) / 32 (95.5)
Drycooler Pressure Drop - ft. of water (kPa)	6.8 (17.3) / 6.8 (17.3)	4.2 (12.6) / 4.2 (12.6)	10.0 (29.9) / 10.0 (29.9)
Avail. Field Pressure Drop - ft. of water (kPa)	71.6 (213.7) / 112.6 (336.0)	74.2 (221.4) / 115.2 (343.8)	92.0 (274.5) / 104.0 (310.3)
Drycooler - Standard 95°F (35°C) Ambient Temperature Selection			
Model Number**	DSG-112	DSG-139	DSG-174
Number of Fans	1	2	2
Approx. Weight lbs (kg)	470 (213)	565 (256)	605 (274)
Internal Volumes - U.S. Gallons (liters)			
Drycooler	5.8 (22)	4.8 (18)	6.9 (26)
Chiller Module (Dual & Triple)	2.7 (10)	2.7 (10)	2.7 (10)
Expansion Tank	15 (57)	15 (57)	15 (57)

*Pressure drops are based on quantity of hoses shown
**Capacities are for two (2) modules during normal operation
***One (1) drycooler required per module

DS/DD GUIDE SPECIFICATIONS

DS/DD Models

The mainframe coolant supply unit shall be a Liebert Model _____, self-contained, factory assembled, dual capacity system. Provide unit(s) with matching, dual refrigeration systems to provide both primary and redundant sources of chilled water to the mainframe computer system. This system shall be provided such that each chiller module can cool the mainframe computer; the second chiller module serves as a standby module. The packaged coolant supply unit shall have the following built in components:

Standard Features - All Systems

Cabinet and Frame Construction

The frame shall be constructed of heliarc-welded tubular steel. It shall be painted using the autophoretic coating process for maximum corrosion protection. The exterior panels shall be insulated with a minimum of 1", 1-1/2 lb. density fiber insulation. All panels shall have captive, 1/4 turn fasteners and shall be removable for service access.

The main unit color shall be _____. The exterior panels shall be powder coated.

Coolant Piping

The internal coolant piping shall include: isolating valves for each module; an expansion tank with fill connection, pressurization connection and liquid-level sight glass; a circulating pump which shall provide GPM at _____ feet of water total head; and a discharge check valve to prevent back flow.

The supply and return headers shall be equipped with four, 3/4" FPT piping connections for RR series quick connect hose kits.

High Voltage Electric Panel

Each chiller module shall have a separate, self-contained high voltage electric panel. Each shall include a non-automatic, molded case circuit breaker that can be operated with the panel cover closed. The disconnect shall include a decorative trim to match the exterior trim of the unit. Each electric panel shall include starters, contractors, relays, transformers and dual-element fuses that protect each high-voltage circuit in the system. The electric panel shall be wired with one common electrical line connection.

Solid-State Control System

The solid-state control system shall be powered from two independent, non-interconnecting 24 volt power sources. Each chiller module control system shall include the following: Start/Stop button; Silence Button for the audible alarm; Manual reset circuit breakers; Backlighted monitor panel (no message is visible until lit).

The monitor panel shall display operating modes (Pump On, Cooling On) in white and alarm conditions in red. Alarm messages remain lit until the malfunction is corrected but the audible alarm may be silenced. If a second alarm condition occurs, the audible alarm shall sound again. The alarm panel shall activate with the following conditions: No Water Flow; Low Water Temperature; High Water Temperature; High Compressor Head Pressure; Loss of Power. The control system shall automatically energize the stand-by chiller module whenever any of the alert conditions exist and energize the “Stand-by-On Other Failed” message on the monitor panel.

The solid-state plug-in alarm module shall include a Push-to-Test circuit for testing all operating and alarm mode messages as well as the audible alarm. An individual Push-to-Test button shall be provided to test each alarm condition. This will verify the function of the audible alarm, the lights and the switchover to the stand-by module. A reset button shall reset a module after the malfunction has been corrected.

The control system shall also include a set of non-powered, normally open contacts for a remote customer alarm and two custom alarm inputs and visual messages to be customer specified.

Semi-Hermetic Compressors

The compressor shall be semi-hermetic with a suction-gas cooled motor, vibration isolators, thermal overloads, oil sight glass, manual reset high pressure switch, pump-down low pressure switch, suction line strainer, reversible oil pumps for forced feed lubrication and a maximum operating speed of 1750 RPM. The minimum EER for the compressor shall be at ARI rated conditions (130°F SCT, 45°F SST, 15°F subcooling). Compressors shall be suitable for capacity modulation in addition to hot gas bypass systems.

The semi-hermetic compressor shall be equipped with a capacity control valve that shall reduce compressor capacity by unloading one bank of compressor cylinders when manually activated.

Refrigeration System

Each refrigeration system shall be direct expansion with separate, fully insulated shell and tube evaporator. The refrigeration circuit shall include a hot gas muffler, liquid line filter drier, refrigerant sight glass and moisture indicator, and adjustable, externally equalized thermostatic expansion valve, liquid line solenoid valve, hot gas bypass solenoid and valve to control compressor capacity at reduced load. All components of the system shall be factory connected with type “L” refrigeration copper tubing.

Standard Features - Individual Systems

Air Cooled

Condenser

Each chiller module shall be provided with a Liebert manufactured, air cooled condenser. The low-profile, propeller fan condenser shall be designed for vertical air flow and include an integral electrical panel. The condenser shall balance the heat rejection requirements of each module at _____ °F. The copper-tube, aluminum fin coil shall be housed in a corrosion-resistant aluminum cabinet.

Lee-Temp Winter Control System

The Lee-Temp winter control system shall allow startup and provide positive head-pressure control at ambient temperatures as low as -30°F. The Lee-Temp package include factory insulated receivers, refrigerant sight glasses, pressure relief valves, 3-way head-pressure control valves and roto-lock valve for isolating the refrigerant charge. All necessary electrical components shall be factory installed, connected, and calibrated. Any components required to be installed by the installing contractor shall be done at no additional cost to the owner.

Water Cooled

Condenser

The water cooled condensers shall be cleanable, shell-and-tube, counterflow with removable heads. Condensers shall be ASME stamped for a maximum refrigerant pressure of 400 psi at 200°F. The unit shall require _____GPM of ____°F water and have a maximum pressure drop of _____PSI.

Water Regulating Valves

The water-cooled condenser shall be factory piped with a head-pressure actuated water regulating valve (2-way) and a hand operated isolation valve.

Glycol Cooled

Condenser

The glycol cooled condenser shall be counterflow, shell-and-tube. It shall be cleanable, with removable heads. The condensers shall be ASME stamped for a maximum refrigerant pressure of 400 PSI at 200°F. The unit shall require _____GPM of _____°F water and have a maximum pressure drop of _____ feet of water.

Glycol Regulating Valve

The glycol-cooled condenser shall be factory piped with a head-pressure actuated water regulating valve (2-way with bypass) and a hand-operated isolated valve.

Drycooler

Each chiller module shall be provided with a Liebert manufactured, drycooler. The low-profile, propeller fan drycooler shall be designed for vertical air flow and include an integral electrical panel that contains all the necessary electrical components for both drycooler fans and glycol circulating pump. The condenser shall be designed for an outdoor ambient temperature of _____°F. The copper-tube, aluminum-fin coil shall be housed in a corrosion-resistant aluminum cabinet.

Glycol Pump Package

Each module shall be provided with a centrifugal pump mounted in a weatherproof, vented enclosure that matches the finish of the drycooler.

Optional Equipment - Individual Systems

Air Cooled

Series HR Heat Recovery Module

Refer to Series HR Technical Data Manual for model specification and selection.

Series PB Indoor Condenser

Refer to Series PB Technical Data Manual for model specification and selection.

Water Cooled

High Pressure Water Cooled Condensers

The water cooled condensers shall be cleanable, shell-and-tube, counterflow with removable heads.

The condenser shall be ASME stamped for a maximum refrigerant pressure of 400 PSI at 200°F, and a maximum water pressure of 300 PSI. The unit shall require _____GPM of _____°F water and have a maximum pressure drop of ____PSI.

Water Regulating Valves

The water-cooled condenser circuit shall be pre-piped with head pressure activated (3-way) (2-way with bypass) regulating valve with a maximum water pressure of (150) (300) psi.

Glycol Cooled

3-Way Glycol Regulating Valve

The condenser circuit of each module shall be prepiped with a head-pressure actuated three-way regulating valve.

CS/CD/CT GUIDE SPECIFICATIONS

CS/CD Models

The mainframe coolant supply unit shall be a Liebert Model_____, self-contained, factory assembled system. Provide unit(s) with matching, dual refrigeration systems to provide both primary and redundant sources of chilled water to the mainframe computer system. This system shall be provided such that each chiller module can cool the mainframe computer; the second chiller module serves as a stand-by module. The packaged coolant supply unit shall have the following built in components:

CT Models

The mainframe coolant supply unit shall be a Liebert model _____, self-contained, factory assembled system. Provide unit(s) with matching, dual refrigeration units to provide primary source of chilled water to the mainframe computer system. A third refrigeration module shall be provided to provide redundant cooling capacity. The packaged coolant supply unit shall have the following built-in components:

Standard Features - All Systems

Cabinet and Frame Construction

The frame shall be constructed of heliarc-welded tubular steel. It shall be painted using the autophoretic coating process for maximum corrosion protection. The exterior panels shall be insulated with a minimum of 1", 1-1/2 lb. density fiber insulation. All panels shall have captive, 1/4 turn fasteners and shall be removable for service access.

The main unit color shall be _____, and the accent panel color shall be _____. The exterior panels shall be powder coated.

Coolant Piping

The internal coolant piping shall include: isolating valves for each module; an expansion tank, water fill connection, pressurization connection and liquid-level sight glass; a circulating pump which shall provide _____GPM at _____feet of water total head; and a discharge check valve to prevent back flow.

The supply and return connections shall be 2-1/8" OD copper for connection to RR or ES header assemblies.

High Voltage Electric Panel

Each chiller module shall have a separate, self-contained high voltage electric panel. Each shall include a non-automatic, molded case circuit breaker that can be operated with the panel cover closed. The disconnect shall include a decorative trim to match the exterior trim of the unit. Each electric panel shall include starters, contactors, relays, transformers and dual-element fuses that protect each high-voltage circuit in the system. The electric panel shall be wired with one common electrical line connection.

Solid-State Control System

Each of the solid state control systems shall be powered from separate, non interconnecting 24 volt power sources. Each chiller module control system shall include the following: Start/Stop button; Silence Button for the audible alarm; manual reset circuit breakers; back-lighted monitor panel (no message is visible until lit).

The monitor panel shall display operating modes (Pump On, Cooling On) in white and alarm conditions in red. Alarm messages remain lit until the malfunction is corrected but the audible alarm may be silenced. If a second alarm condition occurs, the audible alarm shall sound again. The alarm panel shall activate with the following conditions: No Water Flow; Low Water Temperature; High Water Temperature; High Compressor Head Pressure; Loss of Power. The control system shall automatically energize the stand-by chiller module whenever any of the alert conditions exist and energize the “Stand-by—On Other Failed” message on the monitor panel.

The solid-state plug-in alarm module shall include a Push-to-Test circuit for testing all operating and alarm mode messages as well as the audible alarm. An individual Push-to-Test button shall be provided to test each alarm condition. This will verify the function of the audible alarm, the lights and the switchover to the stand-by module. A reset button shall reset a module after the malfunction has been corrected.

The control system shall also include a set of non-powered, normally open contacts for a remote customer alarm and two custom alarm inputs and visual messages to be customer specified.

Semi-Hermetic Compressors

The compressor shall be semi-hermetic with a suction-gas cooled motor, vibration isolators, thermal overloads, oil sight glass, manual reset high pressure switch, pump-down low pressure switch, suction line strainer, reversible oil pumps for forced feed lubrication and a maximum operating speed of 1750 RPM. The minimum EER for the compressor shall be at ARI rated conditions (130°F SCT, 45°F SST, 15°F subcooling). Compressors may be suitable for capacity modulation in addition to hot gas bypass systems.

Refrigeration System

Each refrigeration system shall be direct expansion with separate, fully insulated shell and tube evaporator. The refrigeration circuit shall include a hot gas muffler, liquid line filter drier, refrigerant sight glass and moisture indicator, and adjustable, externally equalized thermostatic expansion valve, liquid line solenoid valve, hot gas bypass solenoid and valve to control compressor capacity at reduced load. All components of the system shall be factory connected with type “L” refrigeration copper tubing.

Standard Features - Individual Systems

Air Cooled

Condenser

Each chiller module shall be provided with a Liebert manufactured, air cooled condenser. The low-profile, propeller fan condenser shall be designed for vertical air flow and include an integral electrical panel. The condenser shall balance the heat rejection requirements of each module at _____°F. The copper-tube, aluminum fin coil shall be housed in a corrosion-resistant aluminum cabinet.

Lee-Temp Winter Control System

The LEE-TEMP winter control system shall allow startup and provide positive head-pressure control at ambient temperatures as low as -30°F. The Lee-Temp package includes factory insulated receivers, refrigerant sight glasses, pressure relief valves, 3-way head-pressure control valves and roto-lock valve for isolating the refrigerant charge. All necessary electrical components shall be factory installed, connected, and calibrated. Any components required to be installed by the installing contractor shall be done at no additional cost to the owner.

Water Cooled

Condenser

The water cooled condensers shall be cleanable, counterflow shell and tube with removable heads. Condensers shall be ASME stamped for maximum refrigerant pressure of 400 psi at 300°F. The unit shall require _____ GPM of ____°F water and have a maximum pressure drop of _____ psi.

Water Regulating Valve

The water-cooled condenser shall be factory-piped with a head-pressure actuated water regulating valve (2-way) and a hand-operated isolation valve.

Glycol Cooled Condenser

The glycol-cooled condensers shall be cleanable, counterflow shell and tube with removable heads. Condensers shall be ASME stamped for maximum refrigerant pressure of 400 psi at 300°F. The unit shall require _____ GPM of _____°F 40% glycol and have a maximum pressure drop of ____ feet of water.

Glycol Regulating Valve

The glycol-cooled condenser shall be factory piped with a head-pressure actuated water regulating valve (2-way with bypass) and a hand-operated isolation valve.

Drycooler

Each chiller module shall be provided with a Liebert manufactured drycooler. The low-profile, propeller fan drycooler shall be designed for vertical air flow and include an integral electrical panel that contains all the necessary electrical components for both drycooler fans and glycol circulating pump. The condenser shall be designed for an outdoor ambient temperature of _____°F. The copper-tube, aluminum-fin coil shall be housed in a corrosion-resistant aluminum cabinet.

Glycol Pump Package

Each module shall be provided with a centrifugal pump mounted in a weatherproof, vented enclosure that matches the finish of the drycooler.

OPTIONAL SPECIFICATIONS

Optional Equipment - DS/DD Models

Backup Coolant Supply

The dual capacity CSU3000 shall be equipped with a backup coolant supply system that will provide continued coolant flow to the mainframe during power outages when the circulating pump is connected to an uninterruptible power supply. See **Separate Pump Power Connection**.

GLYCOOL Systems - CS/CD Modules Only

GLYCOOL Module

The GLYCOOL system shall be a basic glycol cooled system plus the necessary components to eliminate compressor operation during low ambient temperature conditions automatically. The GLYCOOL system shall include a fully proportional 3-way mixing valve, and a solenoid valve to control glycol flow. All the control circuitry necessary to operate the system shall be factory installed, connected and calibrated.

Alternate Water Source - CS/CD Models Only

AWS3000 Module

The AWS3000 module shall provide a cooling capacity of _____BTU/HR when cooling _____GPM of coolant water to _____°F. A chilled water source of_____ GPM at _____°F entering water temperature shall be required at a pressure drop of ____feet of water. The module shall contain a circulating pump having a rating of _____GPM at _____ ft. of water total head and a fully proportional 3-way mixing valve to maintain a constant leaving water temperature. The shell and tube heat exchanger and piping shall be factory insulated. The system shall utilize a separate electrical panel and be integrated with the matching compressorized module.

Optional Equipment - CS/CD/CT Models

Capacity Control Valves

The semi-hermetic compressor shall be equipped with a capacity control valve that shall reduce compressor capacity by unloading on bank of compressor cylinders when activated by the capacity selector switch (except 37 ton unit). All control circuitry shall be factory installed and connected.

Optional Equipment - All Systems

Liqui-Tect Sensors (Maximum 2 Per Unit)

Provide _____ (quantity) solid-state water sensors under the raised floor. The field installed sensor shall activate a red “water under floor” indicator and the audible alarm.

Liqui-Tector Panel

Provide a Liqui-Tector panel to be centrally located in the computer room. It shall be capable of monitoring up to 20 remote Liqui-Tect sensors and other system related functions.

Locking Disconnect Switch

The non-automatic molded case circuit breaker shall be mounted in the high voltage section of each electric panel. The switch shall be accessible from the outside of the unit with the accent panel closed and prevent access to the high voltage electrical components until switched to the OFF position.

Dual Power Supply

The CSU3000 shall be provided with dual power supplies to enable the two modules to be separately powered. (Not available on CT Models)

Floor Stand

The floor stand shall be constructed of a heliarc welded tubular steel frame. It shall have adjustable legs with vibration isolating pads. The floor stand shall be _____ inches high.

Header Kit

The CSU3000 shall be provided with a field-installed (RR) (ES) header kit for connection of (RR) (ES) hoses.

Quick-Connect Hose Kits

Provide with the CSU3000 system a complete hose kit capable of connecting the system to the CDU of the computer mainframe. The hose kit shall consist of _____flexible hoses, each _____feet in length, insulated with Armaflex type FR insulation or equal. The hose kit shall contain barbed fittings for connections at the supply and return headers of the chiller and factory made connections on the other end with the proper male and female fittings to connect directly to the Coolant Distribution Unit.

Information Gathering Module

Provide an Information Gathering Module for CSU3000 that permits communication with a Liebert Sitemaster Model 200 or a Liebert SiteScan. Three-module systems shall be equipped with interconnecting cable.

Separate Pump Power Connection

Provide one 3-phase power connection for all pumps and controls, and one 3-phase power connection for all other loads. Two locking disconnects shall be provided with this option on single module units. Four locking disconnects shall be provided on dual module units; six on triple module units.

Crankcase Heater

A crankcase heater shall be provided to prevent the migration of refrigerant to the compressor during off cycles.

INSTALLATION/APPLICATION GUIDELINES

Refer to the installation manual for complete installation information.

Installing the CSU3000

The CSU3000 can sit on top of an accessible, elevated flooring system. It may be necessary to furnish additional pedestal support for the floor below the unit to ensure maximum structural support. Or, a separate floor stand for the unit may be used as support, independent of the elevated floor, and installed prior to the flooring system. The use of the floor stand permits the chiller to be installed, prepiped, wired and checked out prior to installation of the raised floor. This permits much easier access to all under-floor piping, wiring, etc., during installation. This would enable the construction to be completed in the least amount of time. The floor stand further provides vibration isolation from the adjacent raised floor and eliminates the need for cutting special openings in the floor panels below the unit.

Provide approximately 34" service clearance on the left, right and in front of the unit. This space is necessary to provide for routine maintenance.

Electrical Requirements for the CSU3000

Three-phase electrical service is required for all CSU3000 models in 208, 230, 460, and 575 volt, 60 Hz. Electrical Service to the Series 3000 unit should conform with both local and National Electrical Codes. Select the proper wire size for minimum allowable voltage drops to assure dependable operation during periods of peak power usage when brownouts may occur. See wire size amperage values.

For emergency shutdown of each CSU3000 unit, through fire detection systems, panic buttons, etc., utilize the low voltage auxiliary contacts located within the CSU3000 unit.

Liebert Air Cooled CSU3000

The Liebert CSU3000 is shipped with separate air cooled condenser. The refrigerant piping must be connected in the field and then dehydrated and charged. Other services required to make it operational are: 1) electrical supply to the Series 3000 units; 2) electrical interconnection to the air cooled condenser; 3) condensate drain lines and; 4) piping to the computer.

Installing the Air Cooled Condenser

The air cooled condenser should be located for maximum security and maintenance accessibility. Avoid ground level sites with public access to heavy snow or ice accumulations.

Utilize centrifugal fan condensers whenever interior building locations must be used or where heat recovery is required from the condenser air.

Air Cooled Condenser Electrical Requirements

All Series 3000 air cooled condensers are powered from the Series 3000 unit. For electrical characteristics of the standard matching voltage condensers, see Wire Sizing Amps (WSA) for your unit.

An electrical control panel is standard on all Liebert manufactured condensers. The panel contains all the electrical components (contactors, fuses, controls) ready for field connections.

Piping Considerations

All refrigeration piping should be installed with high temperature brazed joints. Prevailing good refrigeration practices should be employed for piping supports, leak testing, dehydration and charging of the refrigeration circuits. The refrigeration piping should be isolated from the building by the use of vibration isolating supports.

Traps should be installed in the hot gas lines whenever vertical risers exceed 40 feet in elevation. These traps will collect condensed refrigerant and refrigerant oil during the off cycle of the unit and ensure flow of refrigerant oil during operation.

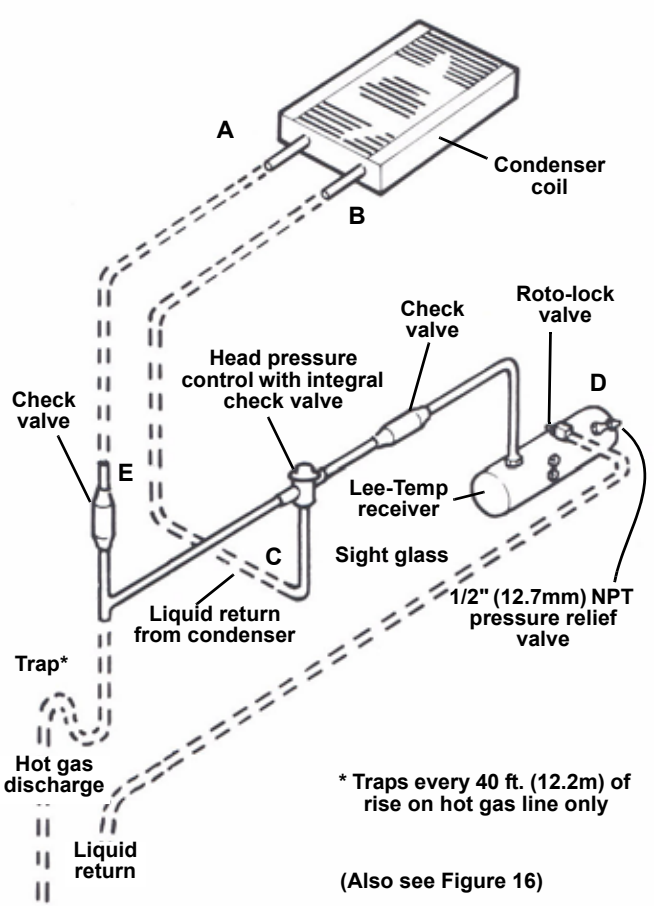


Table 24 Connection sizes

Condenser Model	CSC 104L	CSC 107L	CSC 165L	CSC 217C	CSC 308L
LT Model	W-0040	W-0050	W-0050	W-0050	W-0060
A	1-1/8	1-1/8	1-1/8	1-1/8	1-5/8
B	5/8	5/8	7/8	7/8	1-1/8
C	7/8	7/8	7/8	7/8	7/8
D	5/8	7/8	7/8	7/8	7/8
E	7/8	1-1/8	1-1/8	1-1/8	1-1/8
F	1-1/8	1-3/8	1-3/8	1-3/8	1-3/8

Factory approval is required whenever a refrigerant piping run exceeds 200 feet equivalent length or when condensers must be located more than 30 feet below the level of the cooling coil.

To provide for the emergency of water leaks and the consequences of subfloor flooding, floor drains should be provided with "wet traps," or a free water detection system, such as Liebert Liqui-Tect alarm, should be installed below the elevated floor. All piping below the elevated floor must be located so that it offers the least resistance to air flow from the room environmental control system. When installing piping on the sub-floor, it is recommended that the pipes be mounted in a horizontal fashion on the same elevation plane, rather than stacked one above the other on support brackets. This will provide minimum resistance to air flow under the raised floor. Wherever possible, the pipes should be run parallel to the air flow. All condensate and unit drain lines should be trapped and pitched.

Liebert Water Cooled CSU3000

The Liebert CSU3000 is shipped as a complete prepackaged system. The refrigeration circuit is complete and factory charged and sealed with an operating charge ready for operation.

Other services required to make it operational are: 1) electrical supply to the Series 3000 units; 2) condensate drain lines; 3) piping to the computer; and 4) water source for the condensers.

Piping Considerations

The CSU3000 unit contains a water cooled condenser for each refrigeration circuit. The supply and return lines to the water cooled condensers are manifolded together inside of the CSU3000 to provide one (1) supply and one (1) return customer connection.

It is recommended that manual service shutoff valves be installed at the supply and return line to each unit. This will provide for routine service or emergency isolation of the unit.

When the water source of the condenser is of poor quality, it is good practice to provide cleanable filters in the supply line. These filters will trap the particles in the water supply and extend the service life of the water cooled condenser by extending the periodic cleaning cycle time. When required, the water cooled condenser may be cleaned by removing the heads, and rodding the tubes of the water cooled condensers. The condensers may also be acid cleaned, however, acid cleaning is not generally permitted in computer room locations. Consideration of the minimum water temperature to be supplied from the cooling tower or other water source will be determined if the need exists to insulate the water cooled condenser supply and return lines. Insulation will prevent condensation on the water supply lines to the condenser.

Figure 16 Air cooled

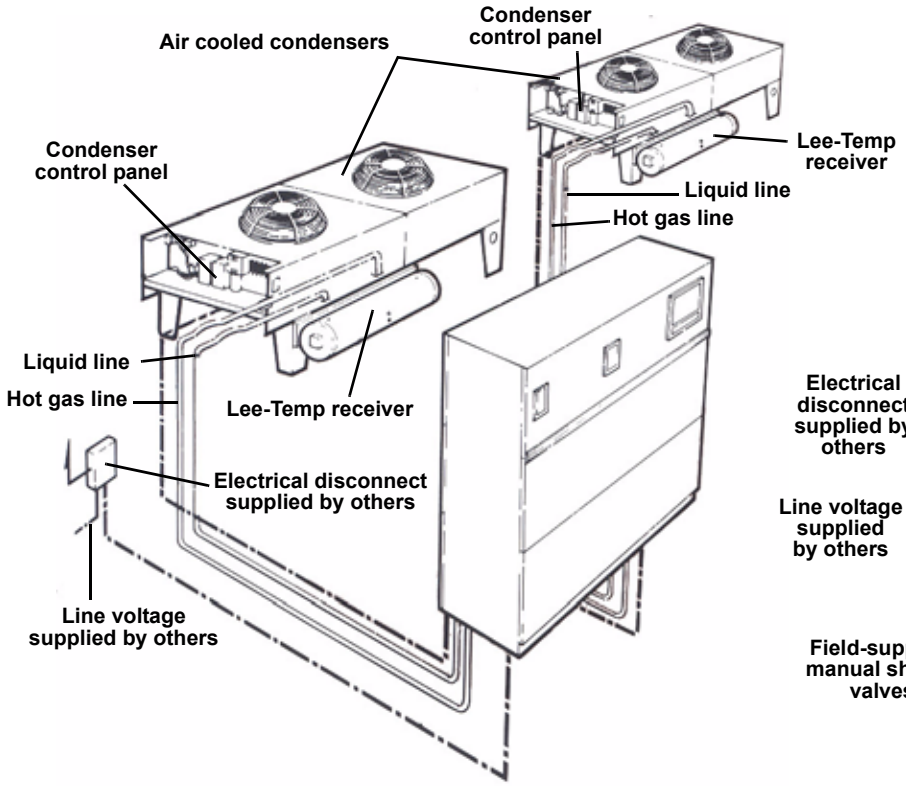
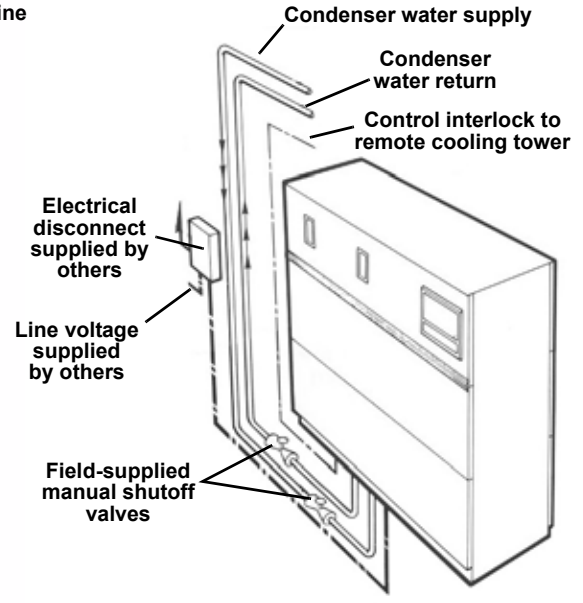


Figure 17 Water cooled



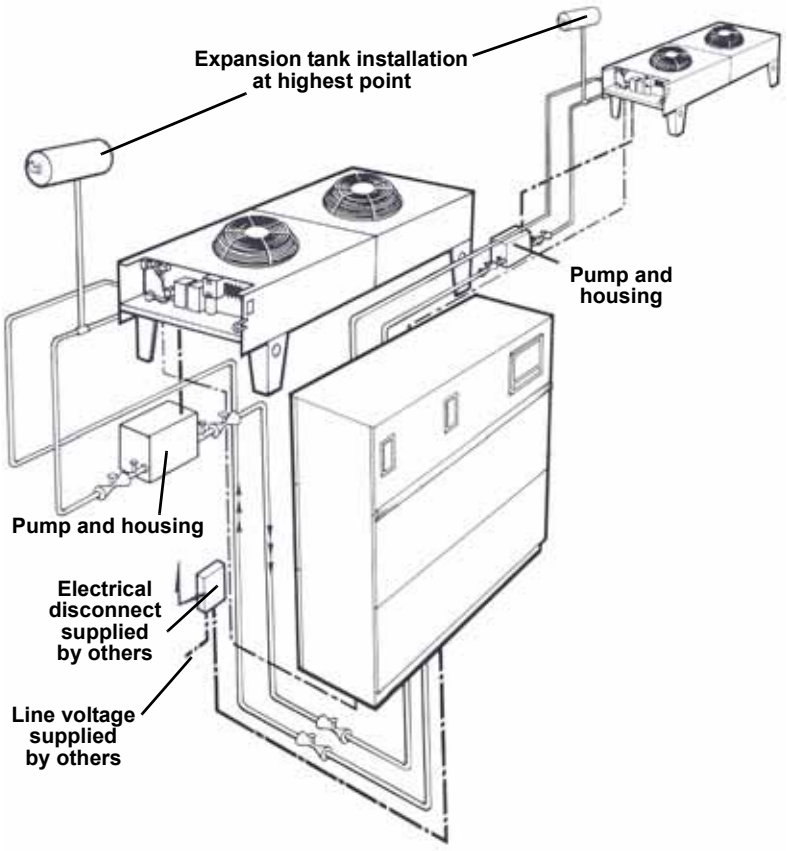
To provide for the emergency of water leaks and the consequences of sub-floor flooding, floor drains should be provided with “wet traps,” or a free water detection system, such as Liebert Liqui-Tect alarm, should be installed below the elevated floor. All piping below the elevated floor must be located so that it offers the least resistance to air flow. When installing piping on the subfloor, it is recommended that the pipes be mounted in a horizontal fashion on the same elevation plane, rather than stacked one above the other on support brackets. This will provide minimum resistance to air flow under the raised floor. Wherever possible, the pipes should be run parallel to the air flow. All condensate and unit drain lines should be trapped and pitched.

Liebert Glycol Cooled CSU3000

The Liebert CSU3000 is shipped as a complete, prepackaged system. The refrigeration circuit is complete and factory charged and sealed with an operating charge ready for operation.

Other services required to make it operational are: 1) electrical supply to the Series 3000 units; 2) condensate drain lines; 3) piping to the computer; 4) glycol piping to the drycooler; and 5) electrical interconnection to the drycooler and pump package.

Figure 18 Glycol cooled



Piping Considerations

The Series 3000 unit contains a glycol cooled condenser for each refrigeration circuit.

It is recommended that manual service shutoff valves be installed at the supply and return line to each unit. This will provide for routine service or emergency isolation of the unit.

When required, the glycol cooled condenser may be cleaned by removing the heads and rodding the tubes of the glycol cooled condensers. The condensers may also be acid cleaned, however, acid cleaning is not generally permitted in computer room locations. Consideration of the minimum glycol temperature to be supplied from the drycooler or other water source will determine if the need exists to insulate the glycol cooled condenser supply and return lines. Insulation will prevent condensation on the glycol supply lines to the condenser in low ambient temperature conditions.

To provide for the emergency of water leaks and the consequences of sub-floor flooding, floor drains should be provided with “wet traps,” or a free water detection system, such as Liebert Liqui-Tect alarm, which should be installed below the elevated floor. All piping below the elevated floor must be located so that it offers the least resistance to air flow. When installing piping on the subfloor, it is recommended that the pipes be mounted in a horizontal fashion on the same elevation plane, rather than stacked one above the other on support brackets. This will provide minimum resistance to air flow under the raised floor. Whenever possible, the pipes should be run parallel to the air flow. All condensate and unit drain lines should be trapped and pitched.

Installation—Drycoolers

Locate the drycoolers for maximum effective security as well as best access for maintenance. Avoid site locations with public access or areas which will contribute to heavy snow or ice accumulations. Locate the pump near the drycooler. The expansion tank should be installed at the highest point in the system. An electrical control panel and disconnect switch is standard on all Liebert manufactured drycoolers. This panel contains all the electrical components (contactors, fuses, controls) for the pump and drycooler ready for field connection. Utilize drycoolers with centrifugal fans whenever interior building locations must be used.

Drycooler Electrical Requirements

All Series 3000 drycoolers are powered from the Series 3000 unit. For electrical characteristics of the standard matching voltage drycoolers see Wire Sizing Amps (WSA) for your unit.

All drycoolers feature integral control panel. This control box includes all the electrical components (contactors, fuses and controls) for the drycooler and glycol pump ready for field connections.

Alternate Water Source CSU3000

The Alternate Water Source module utilizes an existing chilled water source. The module is shipped from the factory with all the controls, including valves, installed.

Other services required to make it operational are: 1) electrical supply to the Series 3000 units; 2) condensate drain lines; 3) piping to the computer; and 4) chilled water source.

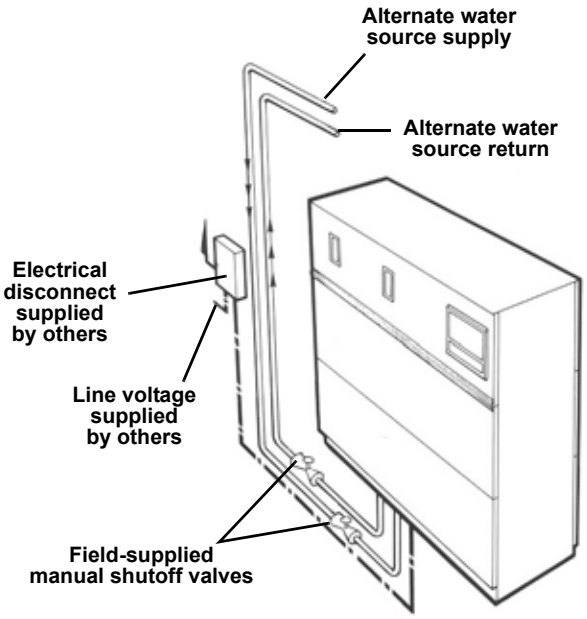
Piping Considerations

It is recommended that manual service shutoff valves be installed at the supply and return line to each unit. This will provide for routine service or emergency isolation of the unit.

Consideration of the minimum water temperature to be supplied from the chiller will determine that the need exists to insulate supply and return lines. Insulation will prevent condensation on the water supply and return lines to the unit. To provide for the emergency of water leaks and the consequences of subfloor flooding, floor drains should be provided with "wet traps," or a free water detection system, such as Liebert Liqui-Tect alarm, should be installed below the elevated floor. All piping below the elevated floor must be located so that it offers the least resistance to air flow.

When installing piping on the subfloor, it is recommended that the pipes be mounted in a horizontal fashion on the same elevation plane, rather than stacked one above the other on support brackets. This will provide minimum resistance to air flow under the raised floor. Wherever possible, the pipes should be run parallel to the air flow. All condensate and unit drain lines should be trapped and pitched.

Figure 19 Alternate water source



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