Liebert®
Keeping Business in Business®

ENVIRONMENTAL CONTROL

Deluxe System/3® Chilled Water Systems

TECHNICAL DATA MANUAL

50 Hz and 60 Hz

ISO 9000 CERTIFIED COMPANY

EMERSON™
Network Power

Table of Contents

Product Model Information

Model Number Designation

FH	529	C	-	A	A	E	I
FH = Downflow UH = Upflow	Nominal Capacity in Thousand BTU/H	C = Chilled Water	– = Std Drive V = Variable Speed Drive Blower	A = 460/3/60 B = 575/3/60 C = 208/3/60 D = 230/3/60 Z = 380/3/50 F = 380/3/50 G = 415/3/50 H = 230/3/50 J = 200/3/50	A = Advanced Micro-processor G = Advanced Graphics Micro-processor	0 = No Reheat E = Electric Reheat H = Hot Water Reheat T = Steam Reheat	0 = No Humidifier I = Infrared Humidifier G = Steam Grid Humidifer S = Steam Generating Humidifier

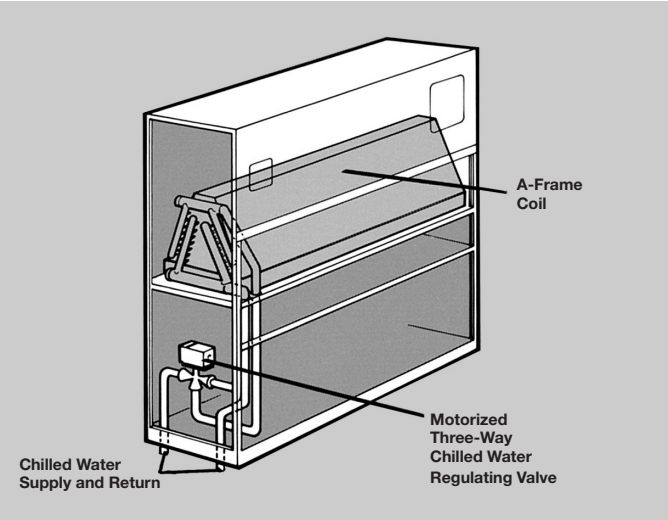
*Not every option is availble on every model

Liebert Technology and Energy Efficiency

Liebert continues its world leadership in precision environmental systems by providing maximum energy efficiency without compromising the precision and reliability demanded by sensitive electronic equipment operations.

Liebert makes no compromise in its approach to environmental control system design. All enhancements to energy efficiency are designed to reduce operating time of key components and increase the Mean Time Between Failure.

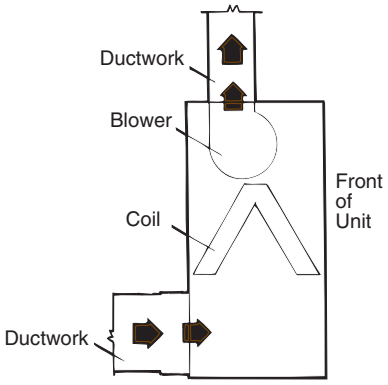
Downflow System



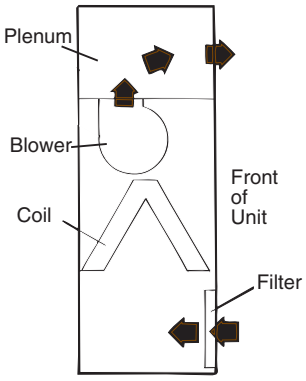
Chilled Water

You can take advantage of an existing chilled water loop if the chilled water is available year-round. The Liebert Deluxe System/3 provides air distribution and microprocessor control and monitoring.

Upflow Systems

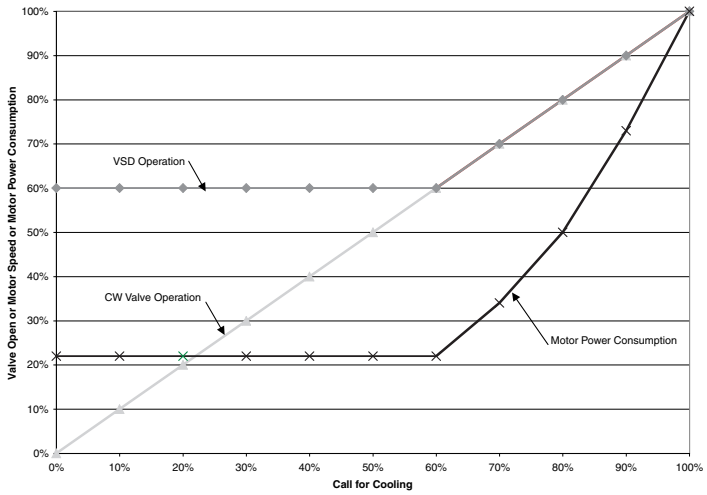


Upflow w/Rear Return and Top Supply—Customer Ducted Supply & Return



Upflow w/Front Return and Top Supply—Optional Plenum w/Front Discharge Grill

ENERGY SAVINGS VSD



Note: The VSD adjusts to 100% speed during reheat and/or humidifier operation.

Energy Saving Option For Our Largest Chilled Water Units:

Models FH/UH600C, FH/UH599C, FH/UH740C & FH/UH739C are available with an optional variable-speed drive on the fan motor, matching the motor speed to the room cooling requirements. This feature allows the unit to use substantially less motor energy to move your room air. Many utility companies offer a rebate for using this energy-efficient feature—check with your local utility company for details.

Dedicated, Precise Environmental Control... Essential for Sensitive Electronics

For sensitive electronics, environmental control is more than simple cooling. "Comfort" air conditioning systems are designed for the comfort of people, and simply cannot provide the kind of environment required by high performance computer or communication equipment.

Temperature Control

The high density heat load in a computer room or other similar application is beyond the capacity of ordinary air conditioning systems. Sensitive electronics are best maintained in a stable environment of 72°F ±2°F (22.2°C ±1°C). As computers generate large quantities of heat in small areas, six to ten times the heat density of normal office space, the air conditioning system must have more than just enough cooling capacity. It must have the precision to react quickly to a drastic change in heat load and prevent wide temperature fluctuations – something a large building system cannot do.

Humidity Control

The electronic equipment must be protected from both internal condensation and static electricity discharges. Maintaining the correct humidity level in the room is just as important as maintaining proper temperature. Too high a humidity level could cause condensation within the electronic equipment and the potential for hardware damage. If humidity is too low, static electricity could disrupt operation or even shut down the electronic system. An ordinary building system cannot normally control the environment within these boundaries.

Air Volume

Computers and other sensitive electronics require greater air volumes than ordinary air conditioning can provide. Typical comfort systems are designed to provide between 300 and 400 CFM (Cubic Feet per Minute), (500–700 CMH) per ton of cooling. Electronic systems require between 500 and 600 CFM (850–1020 CMH) per ton. The high density heat load in a relatively small space requires more changes of air than a less dense "comfort" application. While a normal office space requires only 2 air changes per hour, a room filled with electronic equipment requires up to 30 changes per hour. Without proper air volume, hot spots and temperature fluctuations could develop within the room. Also, greater air volumes provide the higher sensible heat ratios required by electronic computer equipment.

Year Round Operation

Comfort conditioning systems cannot be relied upon 24 hours per day 365 days per year. They are typically designed to operate ten hours per day, from Spring to Autumn. Many "comfort" systems have no provision for winter operation. A precision environmental control system and its supporting equipment are designed for operation at temperatures of up to –30°F (–34.4°C).

Precision

The environmental control system must be able to sense and react to temperature and humidity fluctuations far too small for building HVAC systems to control.

The Deluxe System/3 is capable of control to within ±1°F (°C) and ±1% RH. With Liebert microprocessor technology, it is possible to maintain predictive control over the environment. By analyzing the rate of change in temperature or the moisture content in the environment, the control system anticipates what is going to happen in the room, not simply responding to what has happened.

Reliability

Because electronic system availability is required 24 hours a day, 365 days a year, the environmental control system must meet the same demands.

The Deluxe System/3 is designed with the highest quality components selected for their proven reliability. Microprocessor technology adds automatic sequencing of components to even wear and extend service life. Automatic cleaning cycles can be programmed to match local water conditions. An alarm system and self-diagnostics provide rapid troubleshooting and can prevent a problem before it affects the electronic equipment room environment.

Energy Efficiency

Constant demand for precise environmental control makes energy efficiency all the more important. A well-designed environmental control system makes the most of the energy it uses.

The Deluxe System/3 is designed for maximum energy efficiency. Highly efficient fan motors **pull** air through the coil, providing not only better coil coverage, but reducing fan motor horsepower requirements. A microprocessor control system ties all the key operational components together and responds to changes in the room environment in the most "intelligent" and energy conscious way.

UL Listed

Units are UL listed and CSA (NRTL-C) certified. NRTL-C meets both U.S. and Canadian government safety requirements, providing fast, hassle-free inspection and building code approvals.

Features of a well designed environmental control system

Desirable Feature	Building Systems	Deluxe System/3
Precision	Typically ±5°F(±3°C)	±1°F (±1°C)/1%RH
Humidity Control	Usually None	Humidification and dehumidification
Monitoring	None	Local and remote
Year-Round Reliability	Not designed for winter operation	Yes
Air Filtration	Negligible	20-65% based on ASHRAE 52.1
Factory Tested	No	Yes
In-the-room design	No; centrally located	Yes

POWDER COATED TOUGH™

Standard Features

Cabinet and Frame

The frame, 14 gauge, heliarc welded tubular steel, provides maximum support while steel panels with 1" (25.44mm), 1 1/2 lb. (.68 kg) insulation protect and quiet the system. The captive, 1/4 turn fasteners allow controlled access for service and are positioned to enhance cabinet appearance. The top accent panel may be opened for service or system monitoring without turning off the unit. The frame is coated using the autophoretic® process for corrosion protection. All exterior panels are powder coated for optimum durability. Each panel is available in colors to coordinate with the decor of the space.

Fan Section

The system features quiet, low speed fan assemblies with multiple, double width, double inlet blowers, lifetime lubricated and self-aligning ball bearings and factory-certified dynamic balance. The fan motor features a manual reset line-break overload and is mounted on an industrial quality adjustable slide base. The two-belt variable pitch drive may be field adjusted to match this fan speed to the air flow requirements of the data center. Fans are mounted on a fan-deck weldment which can be removed for service. The draw-through design of the fan section supplies even air distribution across the A-frame coil, controlled bypass-air humidification, static sealing of the filter section and low internal cabinet pressure losses. With the dual belt system, fan operation is assured even if one of the belts breaks.

High Voltage Panel

The high voltage panel contains contactors, transformers, overloads, ground bars, and all other exposed high voltage components. Each individual high voltage system component is protected by a separate overcurrent protective device. The entire high voltage panel is enclosed by a safety lock dead front panel. When the top accent panel is opened by operating personnel, these high voltage components remain enclosed by the dead front panel for operator safety.

Infrared Humidifier

High-intensity quartz lamps over the stainless steel humidifier pan permit clean, particle-free vapor to be added to the air within 5 to 6 seconds of the electronic call from the microprocessor control. The quartz lamps provide radiant energy that evaporates water in a pure state, without solids.

The Infrared Humidifier is equipped with an automatic water supply system that significantly reduces cleaning maintenance. This system has an adjustable water-over-feed to prevent mineral precipitation. A drain valve is provided to easily empty the humidifier pan prior to inspection or servicing. A control valve regulates flow properly at water pressures between 5 and 150 psig (34.5 and 1034 kPa) and includes a Y strainer.

Electric Reheat

The three-stage stainless steel reheat elements are a rigid, fin tubular design that have extended operation life. The reheat has ample capability to maintain room dry-bulb conditions during a system call for dehumidification.

Three equal stages give a more accurate, controlled response to the requirements of the computer room. The low-watt density, electrically enclosed elements are surrounded by the tube and fins, reducing sheath temperatures (420°F/215.5°C) and eliminating ionization. The three stages of reheat create a noticeable lowering of energy use.

Filters

The standard deep-pleated filter with an efficiency of 20% (based on ASHRAE 52.1) can be changed quickly and easily. Removal is through either end of the system or the top of the unit (downflow only). FH/UH599C, FH/UH600C and FH/UH739C, FH/UH740C filters are removable from the front only.

A-Frame Coil

This large face area/low face velocity coil allows precise control of temperature and humidity during the cooling and dehumidification mode, and is designed to optimize fluid velocity and minimize pressure drop. The full face area is active during cooling and dehumidification, resulting in operational energy savings in the data center. A stainless steel corrosion–free condensate pan is provided with the A-frame coil.

Chilled Water Control Valve

The chilled water valve provides proportional control action in response to room temperature and humidity as sensed by the microprocessor control. It includes operating linkage and electronic motor. Unlike other systems of this nature it requires no over–travel linkage or end switches to be adjusted. The valve can be a 3-way or 2-way to meet the appropriate requirements of the installed system.

Local Monitoring Systems

Two levels of microprocessor control systems are available providing precise control and monitoring of the critical space. The Advanced Microprocessor is standard, and the Advanced Microprocessor w/Graphics is optional. The main control fuctions are similar for both controls:

Control

The user must enter a 3-digit password before making changes.

- Temperature Setpoint 65-85°F (18-29°C)
- Temperature Sensitivity +1-10°F (0.6-5.6°C)
- Humidity Setpoint 20-80% R.H.*
- Humidity Sensitivity 1-30% R.H.
- High Temperature Alarm 35-90°F (2-32°C)
- Low Temperature Alarm 35-90°F (2-32°C)
- High Humidity Alarm 15-85% R.H.
- Low Humidity Alarm 15-85% R.H.

* Consult factory if you need to control at either end of this range.

Control Type

Factory set-up for Intelligent Control which uses “fuzzy logic” and “expert systems” methods. Proportional and Tunable PID are user selectable options.

Internal System Control

- System auto restart. The auto restart feature will automatically restart the system after a power failure. Time delay is programmable.
- Sequential Load Activation. On initial start-up or restart after power failure, each operational load is sequenced to minimize total inrush current.
- Hot Water / Econ-o-coil Flush Cycles. Hot water reheat coils are periodically flushed to prevent a build-up of contaminants.
- Temperature/Humidity Sensor Calibration. The sensors may be calibrated from the front monitor panel to insure that all units in the room are similarly calibrated, assuring greater precision.

Monitoring

- Normal display includes present room temperature and humidity, active functions (cooling, heating, dehumidifying), and any alarms.
- Operating status displays each control operation in percent.
- Read analog inputs function. Displays the present values of up to four analog inputs.

Diagnostics

- Input diagnostics. Reviews inputs to the control system.
- Control board diagnostics. Initiates a self-test of the control system.
- Output diagnostics. Tests major components by turning them on and off from the control panel. Includes: main fan, chilled water valve, R-5 relay, reheat, hot water reheat valve, humidifier, humidifier make-up valve, and common alarm.

Advanced Microprocessor (AM) Control System Backlit 4 x 20 LCD

Logging

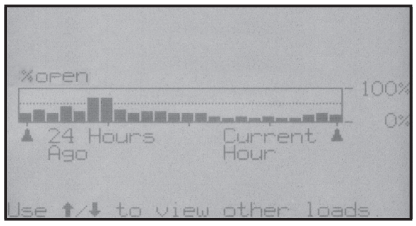
- Alarm history log. The Advanced Microprocessor displays the 10 most recent alarms. The Advanced Microprocessor with Graphics displays the most recent 60 alarms. Both provide a time and date stamp for each event.
- Run time log. Displays run time and hours for major components (also allows reset of run hours) including fan, humidifier, and reheat.

Alarms

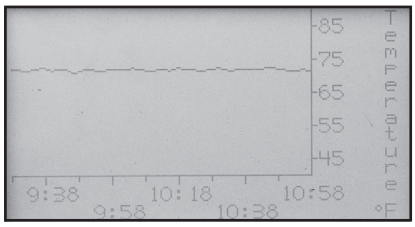
- Humidifier problem
- Change filter
- Loss of air flow
- High temperature
- Low temperature
- High humidity
- Low humidity
- Main fan overload (opt)
- Loss of power
- Custom alarm (choose up to 4)
  - Water under floor
  - Smoke detected
  - Loss of water flow
  - Standby unit on
  - User customized text

Optional Advanced Microprocessor w/Graphics (AG) Control System
Backlit 240 x 128 dot matrix graphics display

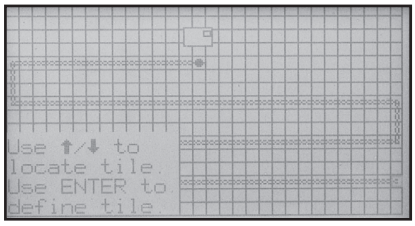
Some of the Optional Views with Advanced Graphics:



The runtime screen provides data in either tabular or easy-to-read graphic formats.



Histograms–historical depictions–of temperature or humidity can be displayed on the screen for analysis. This is especially helpful in tracking the environmental factors of an alarm.



If you have a Liebert water detection system in the room, the display can provide a floorplan for fast location of trouble spots.

Remote Monitoring Systems

In addition to Local Monitoring, the following optional remote monitoring systems are available:

Site Scan

SiteScan is a monitoring solution for critical environments that utilize a facility-view approach. The system enables communications from Liebert environmental and power units -- as well as many other pieces of analog or digital equipment -- to a front end software package which provides monitoring, control and alarm management. SiteScan monitoring gives you decision-making power to effectively manage the equipment that is critical to your business. Designed with flexibility for large, complex systems as well as smaller single-site facilities, the Liebert SiteScan line of products can provide real-time status and alarms.

SiteLink

The microprocessor-based module provides two-way communication between existing building management system and up to 12 Liebert units via MODBUS or BACnet.

OpenComms-NIC

The OpenComms Network Interface Card (NIC) provides Ethernet connectivity for Liebert equipment. Operating status and alarms are communicated via the network to external systems utilizing industry-standard open protocols.

The following protocols are supported:

- SNMP v1, v2c
- HTTP v1.1(web)

OpenComms OC-DO

Interface Card provides 16 discrete outputs, corresponding to status and major alarm conditions. These Form-C contact-closures provide a straightforward means to tie units to BMS Co. (Building Management Systems), I/O or alarm panels, and autodialer devices.

Dry contact monitors—RCM4, RCM8CE

LEDs display customized alarm indication for any dry contact input, including alarms for Liebert environmental, power and UPS systems. RCM4 monitors and displays four dry contact points. The RCM8CE monitors and displays eight dry contacts; it can communicate with Liebert SiteScan, and also has modem dial-up capabilities.

Single unit remote monitoring—MR1

Operating parameters for a single environmental unit are selected with push-buttons and displayed on an LCD screen. This user-friendly system provides remote monitoring and alarm warning, for complete status updates.

Optional Features*

Chilled Water Flow Switch

The flow switch will activate the alarm system and/or shut down the system should the chilled water supply be interrupted. The switch is factory wired and mounted in the chilled water valve compartment.

High Pressure

For special applications, a high pressure, modulating 3-way or 2-way valve can be provided. The valve is designed for 150-400 PSIG (1034 to 2756 kPa) water pressure.

Energy Saving Feature Variable Speed Drive (VSD)

The VSD is available on the FH/UH600C, FH/UH599C, FH/UH740C and FH/UH739C. This drive is controlled by the Advanced Microprocessor Control to match the speed of the blower with the chilled water valve position and consequently the load in the room. This option eliminates excessive energy use due to an oversized design or changing room conditions.

High Efficiency Filters*

Four optional filters are available in lieu of standard package. A 30%, 40-45% or 60-65% filter may be specified. (Efficiency based on ASHRAE 52.1) 25% pre-filters may also be specified.

80-85%, 90-95% filters available on FH/UH600/740C and 599/739C.

High External Static Blower Systems for Upflow Units

(120" unit only)

Various blower/motor combinations are available to provide standard airflow and cooling capacity with up to 3" of external static pressure.

Heavy Gauge Panels

(120" unit only)

16 gauge external panels for use on higher esp systems. Extra 1/4 turn fasteners are provided on end panels.

Leak Detection

Zone detectors with cable, or single point detectors, provide fast and accurate indication of fluid in your critical space. These systems communicate with your Deluxe unit or with a separate monitoring system.

Area leak detection cable with distance measurement and monitoring protects your entire computer room. This system quickly and accurately calculates and displays the location of fluid on the cable, allowing you to promptly find and correct a leak.

Steam Grid Humidifier

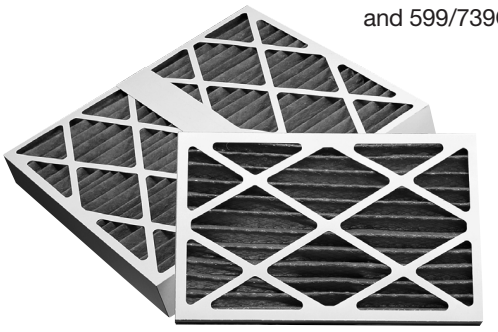
The steam humidifier can be easily adapted into the building's steam system. Contains a stainless steel jacketed manifold to ensure dry steam.

Steam Generating Humidifier

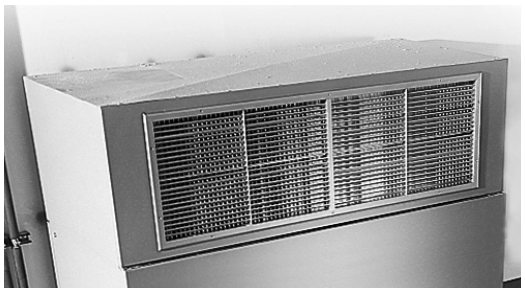
Clean, pure steam is generated in a disposable canister which is complete with supply and drain valves, electronic controls and steam distributor. The humidifier is provided with an automatic flush cycle to lengthen service life. An indicator on the monitor panel is activated when the canister should be changed. Canister life and humidifier operation are functions of water conductivity.

Temperature and Humidity Recorder

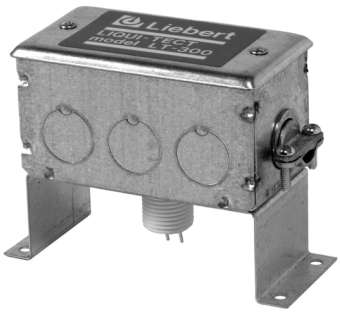
A seven-day temperature and humidity recorder provides a permanent record of the environmental control system's operational efficiency. The system includes 2 pens, 100 recording charts, 1 red and 1 blue bottle of recording ink.



High Efficiency Filters



Plenum with grille



Liqui-Tech Water Detection

Steam Generating Humidifier

* Some options or combination of options may result in reduced air flow. Consult factory for recommendations.

Firestat
The firestat senses return air temperature of the system. Upon sensing high temperatures, the environmental control system is shut down. Required by codes in certain areas.

Floorstand*
Available in heights from 9" to 24" (230 to 610 mm) in 3" (76 mm) increments, adjustable ± 1½" (40mm). Allows for installation and connection of the system prior to the installation of the raised floor. A modular, field installed turning vane may be specified.

Smoke Detector
Upon sensing the presence of smoke in the data center, the smoke detector will activate the alarm system and shut down the environmental control system.

Condensate Pump
The condensate pump is mounted in the bottom of the system and is complete with sump, motor, pump and automatic control. Carries a minimum capacity of 20 feet (58 kPa) of head. (Consult factory for 200V or 230V, 50 Hz.)

Disconnect Switch—Locking
The Locking disconnect switch interlocks with the dead-front panel which cannot be opened until the switch is in the OFF position.

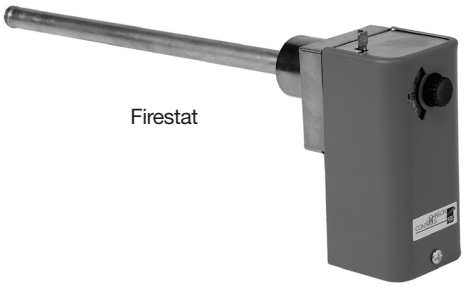
Disconnect Switch—Non-Locking
The disconnect operating handle protrudes through the front of the system for easy access.

Hot Water/ Steam Reheat*
Controlled by a modulating, two-way valve from the microprocessor control panel, these economical reheats have the capacity to maintain dry bulb conditions when the system is calling for dehumidification. The system is completely pre-piped and includes a modulating control valve and Y-strainer. The reheat coil is constructed of copper tubes and aluminum fins.

Plenums for Upflow Units*
Standard heights of 20", 22 3/4" and 34 3/4" (51, 58 and 88cm). They are available with a front discharge grille for air distribution within the installed space, and with a top opening for use as a decorative plenum to conceal ductwork off the blowers.

Auto-Changeover Control
Up to eight environmental units can be automatically and centrally controlled for emergency switching and to balance unit runtime. The AC3 controls two or three units. RAC2-8 controls two through eight units.

Disconnect Switch
(Locking & Non-Locking)


Firestat


Condensate Pump


Floorstand with
turning vane

Data – 50 & 60 Hz Systems

FH= downflow UH= Upflow

	FH/UH147C	FH/UH200C	FH/UH248C	FH/UH302C	FH/UH376C	FH/UH422C	FH/UH529C	FH/UH600C (60 Hz) FH/UH599C (50 Hz)	FH/UH740C (60Hz) FH/UH739C (50 Hz)
CAPACITY DATA BTU/HR (kW) {BASED ON 45°F (7.2°C) ENTERING WATER, 10°F (5.6°C) TEMPERATURE RISE}									
80°F DB, 67°F WB (26.7°C DB, 19.4°C WB) 50% RH									
Total	147,000 (43.1)	199,800 (58.6)	251,900 (73.8)	301,500 (88.4)	381,600 (111.8)	421,100 (123.4)	536,600 (157.3)	599,500 (175.7)	739,000 (216.6)
Sensible	109,600 (32.1)	144,300 (42.3)	168,800 (49.5)	219,600 (64.4)	257,300 (75.4)	302,900 (88.8)	358,900 (105.2)	427,100 (125.2)	492,800 (144.4)
Flow Rate– GPM (*Vs*)	29.4 (1.85)	39.9 (2.52)	50.3 (3.17)	60.3 (3.80)	76.3 (4.81)	84.2 (5.31)	107.2 (6.75)	119.9 (7.5)	147.4 (9.2)
Press. Drop– PSI (kPa)	16.4 (112.8)	13.1 (90.1)	12.4 (85.6)	12.9 (88.9)	9.8 (67.6)	11.2 (77.3)	20.7 (142.7)	16.2 (111.3)	34.2 (235.8)
75°F DB, 62.5°F WB (23.9°C DB, 16.9°C WB) 50% RH									
Total	109,600 (32.1)	148,400 (43.5)	188,400 (55.2)	224,700 (65.9)	285,600 (83.7)	312,600 (91.6)	401,300 (117.6)	444,800 (130.3)	553,600 (162.2)
Sensible	94,900 (27.8)	123,900 (36.3)	143,700 (42.1)	189,100 (55.4)	219,400 (64.3)	259,900 (76.2)	305,500 (89.5)	365,800 (107.2)	419,500 (122.9)
Flow Rate– GPM (*Vs*)	21.9 (1.38)	29.7 (1.87)	37.6 (2.37)	45.0 (2.84)	57.1 (3.60)	62.6 (3.95)	80.1 (5.05)	89.2 (5.6)	110.4 (6.9)
Press. Drop– PSI (kPa)	9.4 (65.1)	7.6 (52.2)	7.4 (51.0)	7.5 (51.9)	5.8 (40.0)	6.5 (44.8)	12.1 (83.4)	9.2 (63.6)	20.1 (138.6)
75°F DB, 61°F WB (23.9°C DB, 16.1°C WB) 45% RH									
Total	99,100 (29.0)	135,000 (39.6)	170,800 (50.0)	199,600 (58.5)	259,100 (75.9)	284,200 (83.3)	363,800 (106.6)	404,100 (118.4)	501,300 (146.9)
Sensible	99,100 (29.0)	127,600 (37.4)	146,000 (42.8)	199,600 (58.5)	223,200 (65.4)	267,500 (78.4)	310,200 (90.9)	376,200 (110.2)	425,200 (124.6)
Flow Rate– GPM (*Vs*)	19.8 (1.25)	27.0 (1.70)	34.1 (2.15)	39.6 (2.5)	51.8 (3.26)	56.8 (3.58)	72.7 (4.58)	80.8 (5.1)	100.1 (6.3)
Press. Drop– PSI (kPa)	7.8 (53.7)	6.3 (43.6)	6.1 (42.1)	6.0 (41.2)	4.8 (33.1)	5.4 (37.3)	10.1 (69.6)	7.7 (53.1)	16.8 (116.0)
72°F DB, 60°F WB (22.2°C DB, 15.5°C WB) 50% RH									
Total	88,200 (25.9)	121,300 (35.6)	154,200 (45.2)	184,000 (53.9)	234,100 (68.6)	255,400 (74.9)	328,400 (96.7)	363,000 (106.4)	452,900 (132.7)
Sensible	88,200 (25.9)	112,200 (32.9)	129,000 (37.8)	171,500 (50.3)	197,300 (57.8)	235,300 (68.8)	274,200 (80.4)	330,900 (96.9)	376,000 (110.2)
Flow Rate– GPM (*Vs*)	17.6 (1.11)	24.3 (1.53)	30.8 (1.94)	36.8 (2.32)	46.8 (2.95)	51.1 (3.22)	65.6 (4.13)	72.6 (4.5)	90.5 (5.7)
Press. Drop– PSI (kPa)	6.3 (43.3)	5.2 (35.8)	5.1 (35.2)	5.2 (36.1)	4.0 (27.6)	4.5 (30.7)	8.4 (57.9)	6.3 (43.2)	13.9 (95.8)
72°F DB, 58.6°F WB (22.2°C DB, 14.8°C WB) 45% RH									
Total	85,300 (25.0)	113,100 (33.1)	139,700 (40.9)	172,300 (50.5)	212,300 (60.0)	237,600 (69.6)	297,300 (87.1)	335,600 (98.3)	408,500 (119.7)
Sensible	85,300 (25.0)	113,100 (33.1)	131,500 (38.5)	172,300 (50.5)	201,500 (59.0)	237,600 (69.6)	279,200 (81.8)	335,600 (98.3)	380,800 (111.6)
Flow Rate– GPM (*Vs*)	17.1 (1.08)	22.6 (1.43)	28.0 (1.77)	34.4 (2.17)	42.5 (2.68)	47.5 (3.00)	59.6 (3.75)	67.0 (4.2)	82.3 (5.1)
Press. Drop– PSI (kPa)	5.9 (40.9)	4.5 (31.3)	4.3 (29.6)	4.6 (31.9)	3.3 (22.8)	3.9 (26.9)	7.0 (48.3)	5.4 (37.3)	11.6 (79.9)
OPTIONAL AIRFLOW CAPACITY DATA									
75°F DB, 62.5°F WB (23.9°C DB, 16.9°C WB) 50% RH									
Total	118,300 (34.7)	152,600 (45.7)	198,500 (58.2)	236,300 (69.3)	307,900 (90.2)	N/A	N/A	N/A	N/A
Sensible	102,900 (30.2)	127,600 (37.4)	151,300 (44.3)	199,600 (58.5)	236,500 (69.3)	N/A	N/A	N/A	N/A
Flow Rate– GPM (*Vs*)	23.7 (1.50)	30.5 (1.92)	39.7 (2.50)	47.3 (2.98)	61.5 (3.87)	N/A	N/A	N/A	N/A
Press. Drop– PSI (kPa)	10.9 (74.9)	8.0 (54.9)	8.1 (55.8)	8.3 (57.0)	6.6 (45.5)	N/A	N/A	N/A	N/A
75°F DB, 61°F WB (23.9°C DB, 16.1°C WB) 45% RH									
Total	107,200 (31.4)	138,800 (40.7)	180,100 (52.8)	209,800 (61.5)	278,500 (81.6)	N/A	N/A	N/A	N/A
Sensible	107,200 (31.4)	131,400 (38.5)	153,800 (45.1)	209,800 (61.5)	239,100 (70.1)	N/A	N/A	N/A	N/A
Flow Rate– GPM (*Vs*)	21.4 (1.35)	27.7 (1.75)	36.0 (2.27)	41.9 (2.64)	56.3 (3.55)	N/A	N/A	N/A	N/A
Press. Drop– PSI (kPa)	9.0 (62.4)	6.7 (46.0)	6.8 (46.9)	6.6 (45.7)	5.6 (38.6)	N/A	N/A	N/A	N/A
72°F DB, 60°F WB (22.2°C DB, 15.5°C WB) 50% RH									
Total	95,300 (27.9)	124,700 (36.5)	162,400 (47.6)	193,500 (56.7)	252,300 (73.9)	N/A	N/A	N/A	N/A
Sensible	95,300 (27.9)	115,500 (33.9)	135,900 (39.8)	181,000 (53.1)	212,700 (62.3)	N/A	N/A	N/A	N/A
Flow Rate– GPM (*Vs*)	19.1 (1.21)	24.9 (1.57)	32.5 (2.05)	38.7 (2.44)	50.4 (3.18)	N/A	N/A	N/A	N/A
Press. Drop– PSI (kPa)	7.3 (50.1)	5.5 (37.6)	5.6 (38.6)	5.7 (39.4)	4.6 (31.7)	N/A	N/A	N/A	N/A
72°F DB, 58.6°F WB (22.2°C DB, 14.8°C WB) 45% RH									
Total	92,200 (27.0)	116,300 (34.1)	147,300 (43.1)	181,600 (53.2)	229,100 (67.1)	N/A	N/A	N/A	N/A
Sensible	92,200 (27.0)	116,300 (34.1)	138,700 (40.6)	181,600 (53.2)	217,600 (63.8)	N/A	N/A	N/A	N/A
Flow Rate– GPM (*Vs*)	18.5 (1.17)	23.2 (1.46)	29.5 (1.86)	36.3 (2.29)	45.8 (2.89)	N/A	N/A	N/A	N/A
Press. Drop– PSI (kPa)	6.8 (47.1)	4.8 (33.1)	4.7 (32.5)	5.1 (34.9)	3.8 (26.2)	N/A	N/A	N/A	N/A

	FH/UH147C	FH/UH200C	FH/UH248C	FH/UH302C	FH/UH376C	FH/UH422C	FH/UH529C	FH/UH600C (60 Hz) FH/UH599C(50 Hz)	FH/UH740C (60 Hz) FH/UH739C(50 Hz)
Fan Section–Variable Pitch, Two (2) Belt Drive Package* (*Some options or combination of options may result in reduced air flow. Consult factory for recommendation.)									
Air Volume C.F.M. (CMH)	5250 (8920)	6050 (10,280)	5900 (10,020)	9300 (15,800)	9100 (15,460)	12,500 (21,240)	12,400 (21,070)	17,100 (29,070)	16,500 (28,050)
Fan Motor H.P. (kW)	2.0 (1.49)	3.0 (2.24)	3.0 (2.24)	5.0 (3.73)	5.0 (3.73)	7.5 (5.59)	7.5 (5.59)	10 (7.57)	10 (7.57)
Optional Air Volume C.F.M. (CMH)	5825 (9,900)	6275 (10,660)	6275 (10,660)	9950 (16,910)	9950 (16,910)	--	--	--	--
Optional Fan Motor H.P. (kW)	3.0 (2.24)	5.0 (3.73)	5.0 (3.73)	7.5 (5.59)	7.5 (5.59)	--	--	--	--
Ext. Static Press. inches of water (Pa)	.3 (75)	.3 (75)	.3 (75)	.3 (75)	.3 (75)	.3 (75)	.3 (75)	.3 (75)	.3 (75)
Quantity of Fans	1	1	1	2	2	2	2	3	3
Chilled Water Coil									
Face Area sq. ft. (m^2)	11.7 (1.08)	11.7 (1.08)	11.7 (1.08)	18.5 (1.72)	18.5 (1.72)	25.0 (2.32)	25.0 (2.32)	36.28 (3.37)	36.28 (3.37)
No. of Rows	3	4	6	4	6	4	6	4	6
Face Velocity FPM (m/s)	431 (2.2)	499 (2.5)	486 (2.4)	482 (2.4)	471 (2.4)	484 (2.5)	480 (2.4)	471 (2.3)	460 (2.3)
Chilled Water Controls (Maximum design water pressure 150 PSI (1034.3 KPa). Higher pressure available as an option. Consult factory)									
Valve Actuator	Modulating	Modulating	Modulating	Modulating	Modulating	Modulating	Modulating	Modulating	Modulating
Sensors	Proportional	Proportional	Proportional	Proportional	Proportional	Proportional	Proportional	Proportional	Proportional
Valve Body	3-Way	3-Way	3-Way	3-Way	3-Way	3-Way	3-Way	3-Way	3-Way
Valve Cv	11.6	11.6	28.9	28.9	46.2	46.2	46.2	46.2	46.2
Valve Size–inches	1	1 1/4	1 1/2	1 1/2	2	2	2	2	2
2-Way Valve (0ptional) Close Off Pressures-PSI (kPa)	150 (1034)	150 (1034	72 (496)	72 (496))	42 (290)	42 (290)	42 (290)	42 (290)	42 (290)
REHEAT SECTION									
Electric Reheat–Three (3) Stage, Fin Tube									
Capacity BTU/HR (kW)*	39,200 (10)	58,800 (15)	58,800 (15)	81,000 (20)	98,100 (25)	121,500 (30)	121,500 (30)	127,900 (30)	127,900 (30)
Steam Reheat–218°F (103.3°C) Steam, 75°F (23.9°C) E.A.T., STD MTR–Modulating Control Valve 2-way**†**									
Capacity BTU/HR (kW)*	84,100 (24.6)	85,800 (25.1)	85,800 (25.1)	93,400 (27.4)	144,500 (42.4)	163,200 (47.8)	163,200 (47.8)	171,7 00 (50.3)	171,700 (50.3)
Hot Water Reheat–Capacity @ 180°F (82.2°C) E.W.T., STD MTR 75°F (23.8°C) E.A.T.–Modulating Control Valvez 2-way**†**									
Capacity BTU/HR (kW)*	47,000 (13.7)	49,500 (14.5)	49,500 (14.5)	89,900 (26.3)	89,900 (26.3)	125,200 (36.7)	125,200 (36.7)	133,700 (39.2)	133,700 (39.2)
Flow Rate–GPM (*l*/s)	5 (.31)	5 (.31)	5 (.31)	8 (.50)	8 (.50)	8 (.50)	8 (.50)	8 (.50)	8 (.50)
Pressure Drop–PSI (kPa)	3.5 (24.1)	3.5 (24.1)	3.5 (24.1)	1.6 (11.0)	1.6 (11.0)	1.6 (11.0)	1.6 (11.0)	1.6 (11.0)	1.6 (11.0)
* Includes Fan Motor ** Optional 3-Way valve available–consult factory *** 25 PSI (172.4 kPa) Max operating pressure–consult factory for higher pressures. † Unit CFM reduced by 300 with std. motor (142 *l*/s) **** 150 PSI (1034.3 kPa) Max operating pressure–consult factory for higher pressures.									
HUMIDIFIER SECTION									
Infrared Humidifier					➢Note: 50 Hz Models are 22.1 lbs/hr. (10.0 kg/h); 9.6 KW.				
Capacity–Lbs. Per Hr. (kg/h)	11.0 (5.0)	11.0 (5.0)	11.0 (5.0)	17.4 (7.9) ➢	17.4 (7.9) ➢	22.1 (10.0)	22.1 (10.0)	22.1 (10.0)	22.1 (10.0)
KW	4.8	4.8	4.8	6.4 ➢	6.4 ➢	9.6	9.6	9.6	9.6
Pan	Stainless	Stainless	Stainless	Stainless	Stainless	Stainless	Stainless	Stainless	Stainless
Steam Generating Humidifier (Water conductivity between 200-500 micromhos is required for ideal operation)									
Capacity–Lbs. Per Hr. (kg/h)	11 (5.0)	11 (5.0)	11.0 (5.0)	22 (10.0)	22 (10.0)	22 (10.0)	22 (10.0)	22 (10.0)	22 (10.0)
Capacity–kW	3.6	3.6	3.6	7.2	7.2	7.2	7.2	7.2	7.2
Steam Grid Humidifier–All Models (Standard Selection, 5 PSIG. (34.5 kPa) Steam 14 lbs./hr. (6.4 kg/h))									
Supply Steam Pressure–PSIG (kPa)	2 (13.8)	4 (27.6)	5 (34.5)	6 (41.4)	8 (55.2)	10 (68.9)			
Capacity, Lbs Per Hr. (kg/h) w/ 5/32* orifice	8 (3.6)	12 (5.4)	14 (6.4)	16 (7.3)	19 (8.6)	21 (9.5)			
FILTER SECTION–DISPOSABLE TYPE—Nominal Sizes and Quantities (See p.9 for efficiencies)									
Downflow Models									
Nominal Size (in)	18x24	18x24	18x24	18x24	18x24	18x24	18x24	24x31	24x31
Quantity	4	4	4	6	6	8	8	5	5
Upflow Models (Front Return)									
Nominal Size (in)	24x24	24x24	24x24	24x24	24x24	24x24	24x24	18x24	18x24
Quantity	2	2	2	3	3	4	4	10	10
Upflow Models (Bottom & Rear Return) Bottom Return not available on UH600/740C									
Nominal Size (in)	18x24	18x24	18x24	18x24	18x24	18x24	18x24	18x24	18x24
Quantity	4	4	4	6	6	8	8	10	10
CONNECTION SIZES									
Chilled Water–O.D. Copper	1 1/8	1 3/8	1 5/8	1 5/8	2 1/8	2 1/8	2 1/8	2 1/8* *	2 5/8
Infrared Humidifier–O.D. Copper	1/4	1/4	1/4	1/4	1/4	1/4	1/4	1/4	1/4
Condensate Drain–FPT	3/4	3/4	3/4	3/4	3/4	3/4	3/4	1 1/4	1 1/4
Steam Reheat–MPT	1/2	1/2	1/2	1/2	3/4	3/4	3/4	3/4	3/4
Hot Water Reheat–O.D. Copper	5/8	5/8	5/8	7/8	7/8	7/8	7/8	7/8	7/8
Steam Humidifier–MPT	1/2	1/2	1/2	1/2	1/2	1/2	1/2	1/2	1/2
WEIGHT–LBS (KG)– Installed	810 (367)	845 (383)	895 (406)	1140 (517)	1210 (549)	1390 (630)	1490 (676)	1950 (885)	2090 (949)

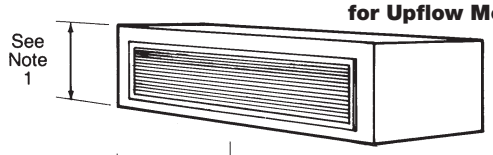
* 2 1/8* on FH600C 2 5/8* on UH600C
FH599C UH599C

Dimensional Data – 50 & 60 Hz Systems
FH/UH147C – FH/UH529C

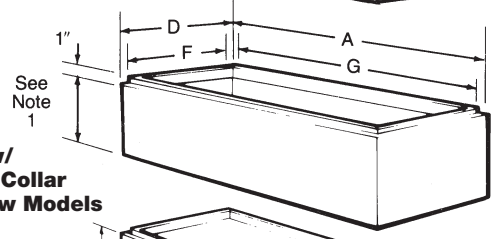
CHILLED WATER	A	B	C*	D	E	F	G	H
FH/UH147C, 200C, 248C	50 (1270)	72 (1829)	35 (889)	34 (864)	33 (838)	32 (813)	46 (1168)	48 (1219)
FH/UH302C	74 (1880)	72 (1829)	35 (889)	34 (864)	33 (838)	32 (813)	70 (1778)	72 (1829)
FH/UH376C	74 (1880)	72 (1829)	35 (889)	34 (864)	33 (838)	32 (813)	70 (1778)	72 (1829)
FH/UH422C	99 (2515)	72 (1829)	35 (889)	34 (864)	33 (838)	32 (813)	95 (2413)	97 (2464)
FH/UH529C	99 (2515)	72 (1829)	35 (889)	34 (864)	33 (838)	32 (813)	95 (2413)	97 (2464)

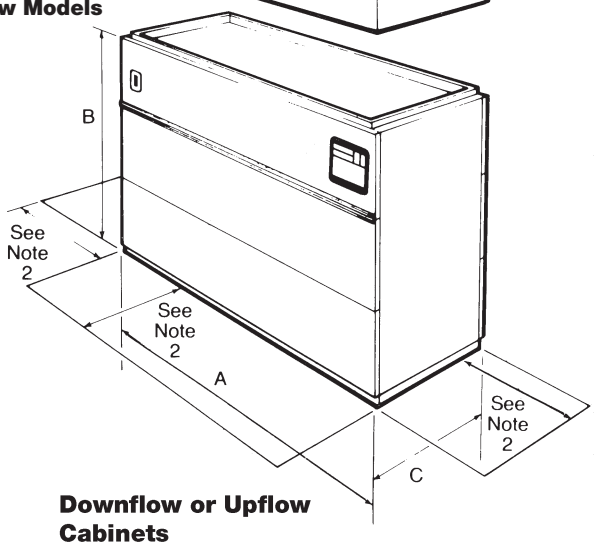
*Projection of bezel 5/8".

Plenum w/Grill for Upflow Models



Plenum w/ Top Duct Collar For Upflow Models





Downflow or Upflow Cabinets

Notes

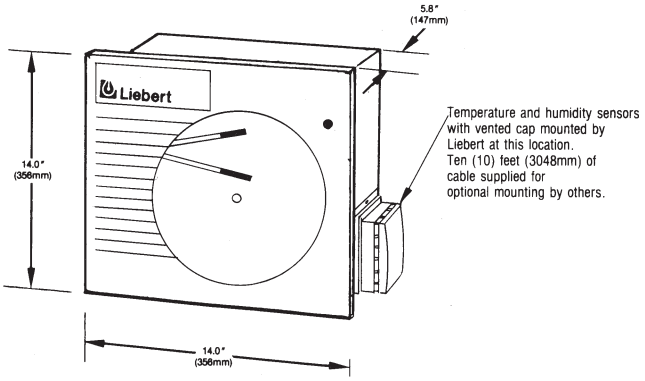
1. Standard nominal plenum heights are 20" (510mm), 22 3/4 (578mm) and 34 3/4 (883mm) 22 3/4 minimum is required for vertical units with steam reheat, hot water reheat, or steam humidifier options.
2. Provide approximately 34" service clearance on the left, right and in front of the unit whenever possible but in tight situations the minimum requirements are listed below.

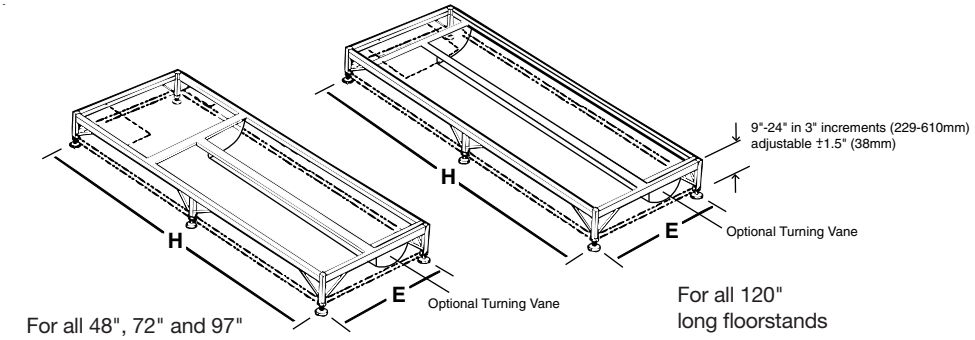
MINIMUM SPACE REQUIRED–IN. (MM)

	DOWNFLOW	UPFLOW
FRONT	**24 (610)**	**24 (610)**
LEFT	**0**	**18 (457)***
RIGHT	**0**	**18 (457)***

This space is necessary to provide for routine service such as: 1) replacing filters, 2) adjusting the fan speed, and 3) cleaning the humidifier. FH/UH600C, FH/UH599C, FH/UH740C, and FH/UH739C, are totally front accessible including any component removal.

Temperature/Humidity Recorder

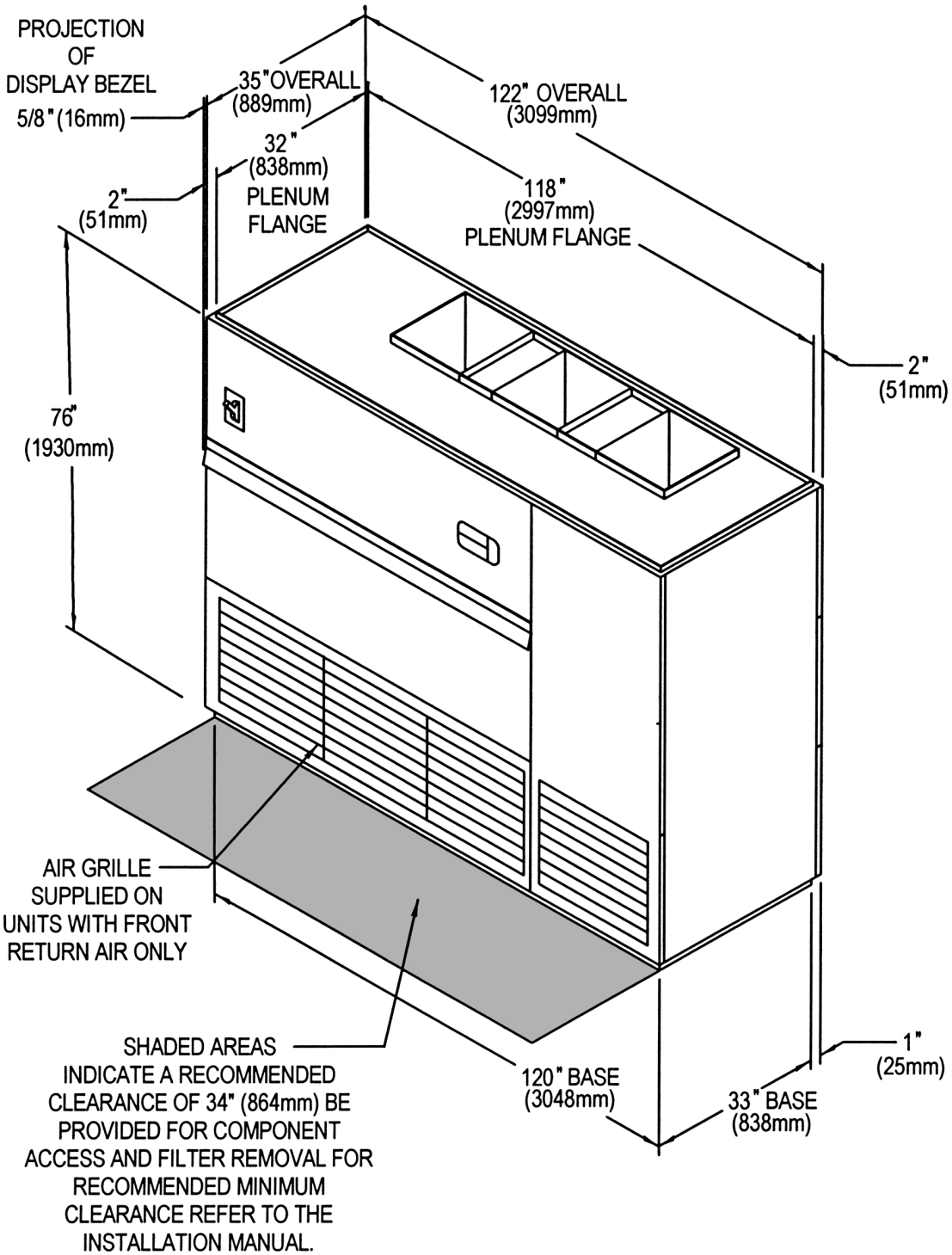




For all 48", 72" and 97" long floorstands

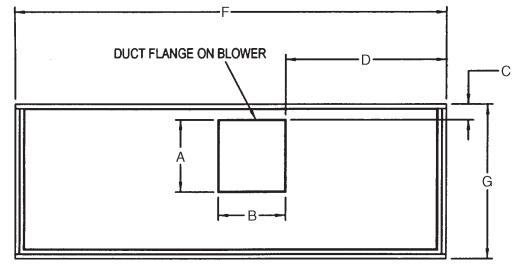
For all 120" long floorstands

Dimensional Data – 50 & 60 Hz Systems
FH/UH599C – FH/UH740C

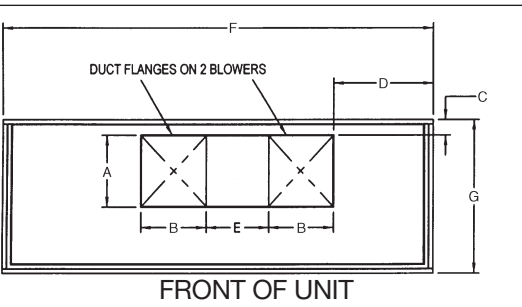


Upflow Duct Connection Data
UH147C – UH529C

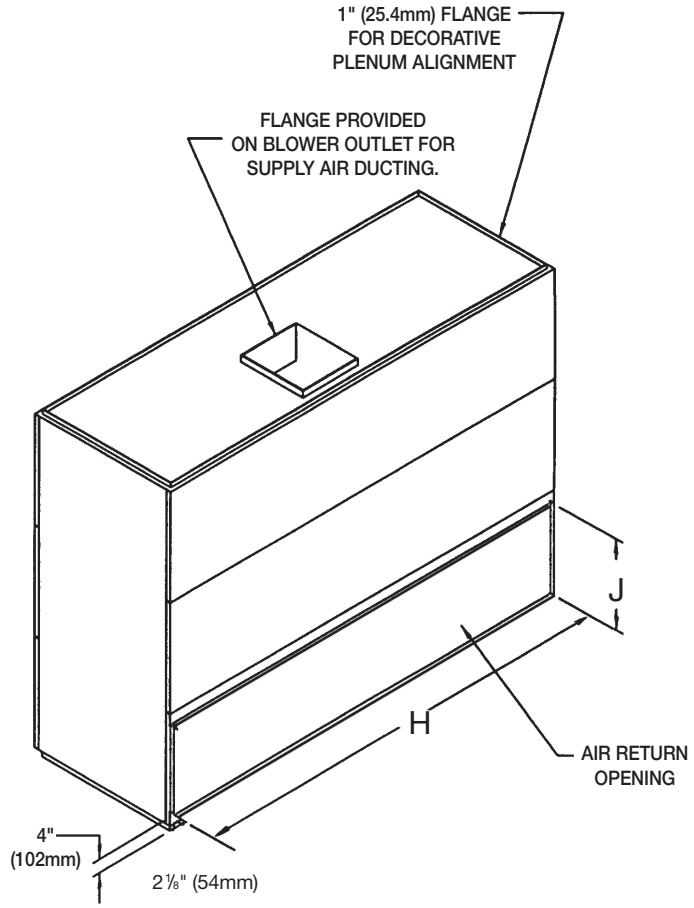
Number of Blowers	Model No. Chilled Water	Dimensional Data—inches (mm)								
		A	B	C	D	E	F	G	H	J
1	UH147C	15 7/8 (403)	18 5/8 (473)	2 3/16 (55)	17 7/8 (454)	-	50 (1270)	35 (889)	44 (1118)	18 (457)
1	UH200C	15 7/8 (403)	18 5/8 (473)	2 3/16 (55)	17 7/8 (454)	-	50 (1270)	35 (889)	44 (1118)	18 (457)
1	UH248C	15 7/8 (403)	18 5/8 (473)	2 3/16 (55)	17 7/8 (454)	-	50 (1270)	35 (889)	44 (1118)	18 (457)
2	UH302C	15 7/8 (403)	14 5/8 (371)	2 3/16 (55)	20 3/8 (517)	11 1/4 (288)	74 (1880)	35 (889)	68 (1727)	20 (508)
2	UH376C	15 7/8 (403)	14 5/8 (371)	2 3/16 (55)	20 3/8 (517)	11 1/4 (288)	74 (1880)	35 (889)	68 (1727)	20 (508)
2	UH422C	15 7/8 (403)	18 5/8 (473)	3 1/4 (82)	20 5/8 (524)	12 5/8 (321)	99 (2515)	35 (889)	86 (2184)	18 (457)
2	UH529C	15 7/8 (403)	18 5/8 (473)	3 1/4 (82)	20 5/8 (524)	12 5/8 (321)	99 (2515)	35 (889)	86 (2184)	18 (457)



BLOWER DUCT FLANGE LOCATION—One Fan



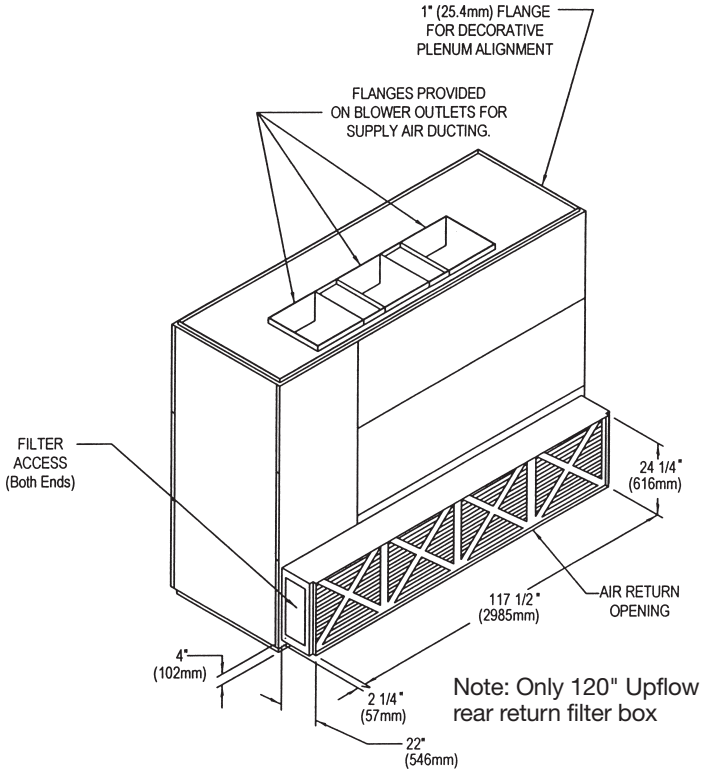
BLOWER DUCT FLANGE LOCATION—Two Fan



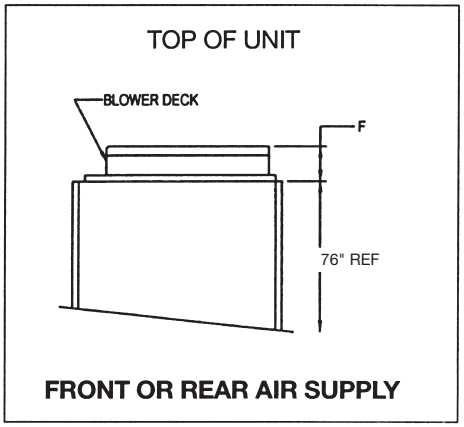
Duct Connection Data
Models with Rear Return

Blower Duct & Deck Dimensional Data
UH599C – UH740C

Model	Blower	Supply	Motor	Dimensional Data					
			HP	A	B	C	D	E	F
UH599C	15X15	TOP FRONT	10-15	27 1/2 (699)	3 1/2 (89)	18 11/16 (475)	16 3/16 (411)	10 (254)	4 1/2 (114)
UH739C									
UH600C		TOP REAR	10-15	27 1/2 (699)	12 5/16 (313)	18 11/16 (475)	16 3/16 (411)	10 (254)	4 1/2 (114)
UH740C									

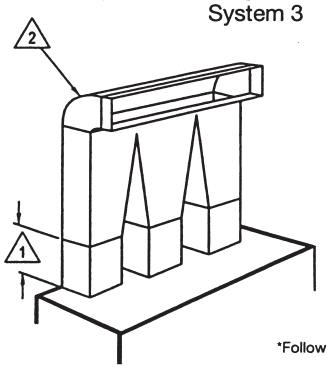


Note: Only 120" Upflow has rear return filter box



FRONT OR REAR AIR SUPPLY

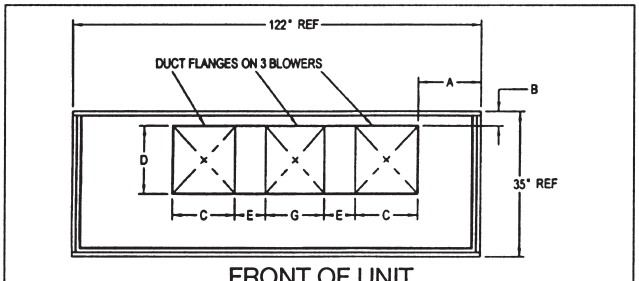
Typical Ducting Configurations
System 3



1 Straight section of duct off of unit to be 1.5 to 2.5 times the longest blower dimension.

2 Typical ducting shown, may run to either side.

*Follow standard practices on all duct work.



FRONT OF UNIT

BLOWER DUCT FLANGE LOCATION—Three Fan

Electrical Specifications – 50 Hz Systems

Chilled Water Models - 50 HZ

Reheat Options			ELECTRIC			None			ELECTRIC			None		
Humidifier Options			IR/SGH			IR/SGH			STM OR NONE			STM OR NONE		
Models / Motor HP		Volts	200	230	380-415	200	230	380-415	200	230	380-415	200	230	380-415
FH/UH147C	2.0 HP	FLA	46.7	43.4	24.3	19.8	17.2	9.9	33.9	32.3	17.9	7.0	6.1	3.5
	3.0 HP	FLA	49.8	46.1	25.9	22.9	19.9	11.5	37.0	35.0	19.5	10.1	8.8	5.1
FH/UH200C	3.0 HP	FLA	62.9	59.0	33.2	22.9	19.9	11.5	50.1	47.9	26.8	10.1	8.8	5.1
	5.0 HP	FLA	68.6	63.9	36.0	28.6	24.8	14.3	55.8	52.8	29.6	15.8	13.7	7.9
FH/UH248C	3.0 HP	FLA	62.9	59.0	33.2	22.9	19.9	11.5	50.1	47.9	26.8	10.1	8.8	5.1
	5.0 HP	FLA	68.6	63.9	36.0	28.6	24.8	14.3	55.8	52.8	29.6	15.8	13.7	7.9
FH/UH302C	5.0 HP	FLA	94.6	88.4	49.6	41.2	35.9	20.7	69.2	66.2	36.8	15.8	13.7	7.9
	7.5 HP	FLA	103.9	96.5	54.2	50.5	44.0	25.3	78.5	74.3	41.4	25.1	21.8	12.5
FH/UH376C	5.0 HP	FLA	107.9	101.4	56.8	41.2	35.9	20.7	82.5	79.2	44.0	15.8	13.7	7.9
	7.5 HP	FLA	117.2	109.5	61.4	50.5	44.0	25.3	91.8	87.3	48.6	25.1	21.8	12.5
FH/UH422C	7.5 HP	FLA	126.6	122.6	68.6	50.5	44.0	25.3	101.2	100.4	55.8	25.1	21.8	12.5
	10.0 HP	FLA	131.7	128.4	71.2	55.6	49.8	27.9	106.3	106.2	58.4	30.2	27.6	15.1
FH/UH529C	7.5 HP	FLA	126.6	122.6	68.6	50.5	44.0	25.3	101.2	100.4	55.8	25.1	21.8	12.5
	10.0 HP	FLA	131.7	128.4	71.2	55.6	49.8	27.9	106.3	106.2	58.4	30.2	27.6	15.1
FH599C	10.0 HP	FLA	131.7	128.4	71.2	55.6	49.8	27.9	106.3	106.2	58.4	30.2	27.6	15.1
	15.0 HP	FLA	147.1	142.4	78.9	71.0	63.8	35.6	121.7	120.2	66.1	45.6	41.6	22.8
	20.0 HP	FLA	161.5	152.8	86.1	85.4	74.2	42.8	136.1	130.6	73.3	60.0	52.0	30.0
FH739C	10.0 HP	FLA	131.7	128.4	71.2	55.6	49.8	27.9	106.3	106.2	58.4	30.2	27.6	15.1
	15.0 HP	FLA	147.1	142.4	78.9	71.0	63.8	35.6	121.7	120.2	66.1	45.6	41.6	22.8
	20.0 HP	FLA	161.5	152.8	86.1	85.4	74.2	42.8	136.1	130.6	73.3	60.0	52.0	30.0

1) FLA = FULL LOAD AMPS
2) Amperage requirements are based on the rated max FLA current of each component in the unit.
   The rated max FLA current of the unit is not the sum
   total of all components, but is the total of the components which operate during maximum electrical load conditions.
3) The values in the chart are for power demand of the FH/UH unit only.
4) Units are 3 phase, 50 cycle.
5) For units with other variations not listed above, consult factory engineering department for electrical requirements.

Indoor Evaporator Fan Motor Electrical Requirements				
	Volts	200	230	380-415
2.0 HP	FLA	7.0	6.1	3.5
3.0 HP	FLA	10.1	8.8	5.1
5.0 HP	FLA	15.8	13.7	7.9
7.5 HP	FLA	25.1	21.8	12.5
10.0 HP	FLA	30.2	27.6	15.1
15.0 HP	FLA	46.2	42.0	24.2
20.0 HP	FLA	NA	NA	30.0

1) Refer to General Data Section for standard fan motor size on units.
2) FLA = FULL LOAD AMPS

Electrical Specifications – 60 Hz Systems

Chilled Water Models - 60 HZ

Reheat Options		Electric				None				Electric				None			
Humidifier Options		Infra-red or Steam Generating				Infra-red or Steam Generating				Steam or None				Steam or None			
Models / Motor HP	Volts	208	230	460	575	208	230	460	575	208	230	460	575	208	230	460	575
FH/UH147C	FLA	48.6	44.1	22.4	20.1	20.8	17.9	9.2	10.1	35.3	33.0	16.6	12.7	7.5	6.8	3.4	2.7
2.0 HP	WSA	60.8	55.1	28.0	25.1	26.0	22.4	11.5	12.6	44.1	41.3	20.8	15.9	9.4	8.5	4.3	3.4
	MFCB	60	50	25	30	30	25	15	15	40	40	20	15	15	15	15	15
	FLA	51.7	46.9	23.8	21.3	23.9	20.7	10.6	11.3	38.4	35.8	18.0	13.9	10.6	9.6	4.8	3.9
3.0 HP	WSA	64.6	58.6	29.8	26.6	29.9	25.9	13.3	14.1	48.0	44.8	22.5	17.4	13.3	12.0	6.0	4.9
	MFCB	60	50	25	30	35	30	15	15	50	45	20	15	20	20	15	15
FH/UH200C	FLA	65.5	59.8	30.3	26.4	23.9	20.7	10.6	11.3	52.2	48.7	24.5	19.0	10.6	9.6	4.8	3.9
3.0 HP	WSA	81.9	74.8	37.9	33.0	29.9	25.9	13.3	14.1	65.3	60.9	30.6	23.8	13.3	12.0	6.0	4.9
	MFCB	90	80	40	35	35	30	15	15	60	70	35	20	20	20	15	15
	FLA	71.6	65.4	33.1	28.6	30.0	26.3	13.4	13.5	58.3	54.3	27.3	21.2	16.7	15.2	7.6	6.1
5.0 HP	WSA	89.5	81.8	41.4	35.8	37.5	32.9	16.8	16.9	72.9	67.9	34.1	26.5	20.9	19.0	9.5	7.6
	MFCB	90	80	40	35	50	45	20	20	70	70	35	25	35	30	15	15
FH/UH248C	FLA	65.5	59.8	30.3	26.4	23.9	20.7	10.6	11.3	52.2	48.7	24.5	19.0	10.6	9.6	4.8	3.9
3.0 HP	WSA	81.9	74.8	37.9	33.0	29.9	25.9	13.3	14.1	65.3	60.9	30.6	23.8	13.3	12.0	6.0	4.9
	MFCB	90	80	40	35	35	30	15	15	60	70	35	20	20	20	15	15
	FLA	71.6	65.4	33.1	28.6	30.0	26.3	13.4	13.5	58.3	54.3	27.3	21.2	16.7	15.2	7.6	6.1
5.0 HP	WSA	89.5	81.8	41.4	35.8	37.5	32.9	16.8	16.9	72.9	67.9	34.1	26.5	20.9	19.0	9.5	7.6
	MFCB	90	80	40	35	50	45	20	20	70	70	35	25	35	30	15	15
FH/UH302C	FLA	98.8	89.9	46.7	39.7	43.3	37.4	20.5	19.6	72.2	67.7	33.8	26.2	16.7	15.2	7.6	6.1
5.0 HP	WSA	123.5	112.4	58.4	49.6	54.1	46.8	25.6	24.5	90.3	84.6	42.3	32.8	20.9	19.0	9.5	7.6
	MFCB	125	110	60	50	60	50	30	25	90	80	40	30	35	30	15	15
	FLA	106.3	96.7	50.1	42.6	50.8	44.2	23.9	22.5	79.7	74.5	37.2	29.1	24.2	22.0	11.0	9.0
7.5 HP	WSA	132.9	120.9	62.6	53.3	63.5	55.3	29.9	28.1	99.6	93.1	46.5	36.4	30.3	27.5	13.8	11.3
	MFCB	125	110	60	50	80	70	35	30	100	100	50	40	50	45	20	20
FH/UH376C	FLA	112.7	102.9	53.2	44.7	43.3	37.4	20.5	19.6	86.1	80.7	40.3	31.2	16.7	15.2	7.6	6.1
5.0 HP	WSA	140.9	128.6	66.5	55.9	54.1	46.8	25.6	24.5	107.6	100.9	50.4	39.0	20.9	19.0	9.5	7.6
	MFCB	150	125	70	60	60	50	30	25	110	110	50	40	35	30	15	15
	FLA	120.2	109.7	56.6	47.6	50.8	44.2	23.9	22.5	93.6	87.5	43.7	34.1	24.2	22.0	11.0	9.0
7.5 HP	WSA	150.3	137.1	70.8	59.5	63.5	55.3	29.9	28.1	117.0	109.4	54.6	42.6	30.3	27.5	13.8	11.3
	MFCB	150	125	80	60	80	70	35	30	110	110	50	45	50	45	20	20
FH/UH422C	FLA	129.9	122.8	61.7	50.7	50.8	44.2	22.6	20.6	103.3	100.6	50.1	39.1	24.2	22.0	11.0	9.0
7.5 HP	WSA	162.4	153.5	77.1	63.4	63.5	55.3	28.3	25.8	129.1	125.8	62.6	48.9	30.3	27.5	13.8	11.3
	MFCB	175	150	80	60	80	70	35	30	125	125	60	50	50	45	20	20
	FLA	136.5	128.8	64.7	52.7	57.4	50.2	25.6	22.6	109.9	106.6	53.1	41.1	30.8	28.0	14.0	11.0
10.0 HP	WSA	170.6	161.0	80.9	65.9	71.8	62.8	32.0	28.3	137.4	133.3	66.4	51.4	38.5	35.0	17.5	13.8
	MFCB	175	150	80	60	90	80	40	35	125	125	70	50	60	60	30	20
FH/UH529C	FLA	129.9	122.8	61.7	50.7	50.8	44.2	22.6	20.6	103.3	100.6	50.1	39.1	24.2	22.0	11.0	9.0
7.5 HP	WSA	162.4	153.5	77.1	63.4	63.5	55.3	28.3	25.8	129.1	125.8	62.6	48.9	30.3	27.5	13.8	11.3
	MFCB	175	150	80	60	80	70	35	30	125	125	60	50	50	45	20	20
	FLA	136.5	128.8	64.7	52.7	57.4	50.2	25.6	22.6	109.9	106.6	53.1	41.1	30.8	28.0	14.0	11.0
10.0 HP	WSA	170.6	161.0	80.9	65.9	71.8	62.8	32.0	28.3	137.4	133.3	66.4	51.4	38.5	35.0	17.5	13.8
	MFCB	175	150	80	60	90	80	40	35	125	125	70	50	60	60	30	20
FH/UH600C	FLA	136.5	128.8	64.7	52.7	57.4	50.2	25.6	22.6	109.9	106.6	53.1	41.1	30.8	28.0	14.0	11.0
10.0 HP	WSA	170.6	161.0	80.9	65.9	71.8	62.8	32.0	28.3	137.4	133.3	66.4	51.4	38.5	35.0	17.5	13.8
	MFCB	175	150	80	60	90	80	40	35	125	125	70	50	60	60	30	20
	FLA	151.9	142.8	71.7	58.7	72.8	64.2	32.6	28.6	125.3	120.6	60.1	47.1	46.2	42.0	21.0	17.0
15.0 HP	WSA	189.9	178.5	89.6	73.4	91.0	80.3	40.8	35.8	156.6	150.8	75.1	58.9	57.8	52.5	26.3	21.3
	MFCB	200	175	90	70	125	110	50	45	175	150	80	60	100	90	45	35
	FLA	165.1	154.8	77.7	63.7	86.0	76.2	38.6	33.6	138.5	132.6	66.1	52.1	59.4	54.0	27.0	22.0
20.0 HP	WSA	206.4	193.5	97.1	79.6	107.5	95.3	48.3	42.0	173.1	165.8	82.6	65.1	74.3	67.5	33.8	27.5
(UH only)	MFCB	225	200	110	90	150	125	70	60	200	200	90	70	125	110	60	45
FH74/UH0C	FLA	136.5	128.8	64.7	52.7	57.4	50.2	25.6	22.6	109.9	106.6	53.1	41.1	30.8	28.0	14.0	11.0
10.0 HP	WSA	170.6	161.0	80.9	65.9	71.8	62.8	32.0	28.3	137.4	133.3	66.4	51.4	38.5	35.0	17.5	13.8
	MFCB	175	150	80	60	90	80	40	35	125	125	70	50	60	60	30	20
	FLA	151.9	142.8	71.7	58.7	72.8	64.2	32.6	28.6	125.3	120.6	60.1	47.1	46.2	42.0	21.0	17.0
15.0 HP	WSA	189.9	178.5	89.6	73.4	91.0	80.3	40.8	35.8	156.6	150.8	75.1	58.9	57.8	52.5	26.3	21.3
	MFCB	200	175	90	70	125	110	50	45	175	150	80	60	100	90	45	35
	FLA	165.1	154.8	77.7	63.7	86.0	76.2	38.6	33.6	138.5	132.6	66.1	52.1	59.4	54.0	27.0	22.0
20.0 HP	WSA	206.4	193.5	97.1	79.6	107.5	95.3	48.3	42.0	173.1	165.8	82.6	65.1	74.3	67.5	33.8	27.5
(UH only)	MFCB	225	200	110	90	150	125	70	60	200	200	90	70	125	110	60	45

Indoor Evaporator Fan Motor Electrical Requirements

	208		230		460		575	
	FLA	LRA	FLA	LRA	FLA	LRA	FLA	LRA
2.0 HP	7.5	46.9	6.8	40.8	3.4	20.4	2.7	16.2
3.0 HP	10.6	66.0	9.6	58.0	4.8	26.8	3.9	23.4
5.0 HP	16.7	105.0	15.2	91.0	7.6	45.6	6.1	36.6
7.5 HP	24.2	152.0	22.0	132.0	11.0	66.0	9.0	54.0
10.0 HP	30.8	193.0	28.0	168.0	14.0	84.0	11.0	66.0
15.0 HP	46.2	290.0	42.0	252.0	21.0	126.0	17.0	102.0
20.0 HP	59.4	321.0	54.0	290.0	72.0	145.0	22.0	116.0

1) Refer to General Data Section for standard fan motor size on units.

1) FLA = FULL LOAD AMPS
WSA = WIRE SIZING AMPS
(Minimum supply circuit ampacity)
MFCB = Maximum Fuse or
Circuit Breaker Size
2) Amperage requirements are based on the rated max FLA current of each component in the unit. The rated max FLA current of the unit is not the sum total of all components, but is the total of the components which operate during maximum electrical load conditions.
3) The values in the chart are for power of the FH/UH unit only.
4) Units are 3 phase, 60 cycle.
5) For units with other variations not listed above, consult factory engineering department for electrical requirements.

1.0 GENERAL

1.1 Summary

These specifications describe requirements for a precision environmental control system. The system shall be designed to maintain temperature and humidity conditions in the rooms containing electronic equipment.

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

1.2 Design Requirements

The precision environmental control system shall be a Liebert self-contained factory assembled unit with (upflow) (down-flow) air delivery. The system shall have a total cooling capacity of ____ BTU/HR, (kW) with a sensible cooling capacity of ____ BTU/HR (kW) based on an entering air temperature of ____ °F (°C) dry bulb and ____ °F (°C) wet bulb. The unit is to be supplied with ____ volt ____ ph ____ Hz electrical service.

1.3 Submittals

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

2.0 PRODUCT

2.1 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 corrosionprotection. The exterior panels shall be insulated with a minimum 1 in. (25.4mm), 1.5 lbs. (.68 kg) density fiber insulation. The main front panel shall have captive 1/4 turn fasteners. The main unit color shall be ____. The accent color shall be ____. The exterior panels shall be powder coated.

2.2 Filter Chamber

The filter chambers shall be an integral part of the system, located within the cabinet serviceable from either end of the unit. The filters shall be rated not less than ____% efficiency (based on ASHRAE 52.1).

For models FH/UH600C, FH/UH599C and FH/UH740C, FH/UH739C the filters shall be serviceable from the front of the unit.

2.3 Fan Section

The fan shall be the centrifugal type, double width double inlet, and shall be statically and dynamically balanced as a completed assembly to a maximum vibration level of two mils in any plane. The shaft shall be heavy duty steel with self-aligning ball bearings with a minimum life span of 100,000 hours. The fan motor shall be ____ hp at 1750 RPM at 60 Hz (1450 RPM at 50 Hz) and mounted on an adjustable slide base. The drive package shall be two-belt, variable speed, sized for 200% of the fan motor horsepower. The fans shall be located to draw air over the A-frame coil to ensure even air distribution and maximum coil performance.

2.4 Infrared Humidifier

The humidifier shall be of the infrared type consisting of high intensity quartz lamps mounted above and out of the water supply. The evaporator pan shall be stainless steel and arranged to be serviceable without disconnecting high voltage electrical connections. The complete humidifier section shall be pre-piped ready for final connection. The infrared humidification system shall use bypass air to prevent overhumidification of the computer room. The humidifier shall have a capacity of ____ lbs./hr. (kg/h). The humidifier shall be equipped with an automatic water supplysystem. The system has an adjustable water-over-feed to prevent mineral precipitation.

2.4 (Optional) Steam Generating Humidifier

The environmental control system shall be equipped with a steam generating humidifier that is controlled by the microprocessor control system. It shall be complete with disposable canister, all supply and drain valves, steam distributor, and electronic controls. The need to change canister shall be annunciated on the microprocessor control panel. The humidifier shall be designed to operate with water conductivity from 200-500 micromhos.

2.4 (Optional) Steam Grid Humidifier

The steam humidifier shall be the “Armstrong” steam separator type with an internal drying chamber and steam jacketed stainless steel distribution manifold. Complete system shall include a pre-piped solenoid control valve, steam trap, and cleanable Y-strainer. All mechanical control components shall be located in a separate compartment, isolated from the air steam. The humidifier shall have a capacity of ____ lbs./hr. (kg/h) at ____ PSIG (kPa) steam supply pressure.

2.5 Electric Reheat

The electric reheat coils shall be low watt density, 304/304 stainless steel fin tubular construction, protected by thermal safety switches, shall be ____ BTU/HR, ____ kW, controlled in three stages.

2.5 (Optional) Steam Reheat

The steam reheat coil shall have copper tubes and aluminum fins with a capacity of ____ BTU/HR (kW) with ____ PSIG (kPa) steam. The system shall be factory pre-piped with a 2-way modulating control valve, Y-strainer, and F & T steam trap.

2.5 (Optional) Hot Water Reheat

The hot water reheat coil shall have copper tubes and aluminum fins with a capacity of ____ BTU/HR (kW) when supplied with ____ °F (°C) entering water temperature at ____ GPM (l/s) flow rate. Maximum pressure drop shall be ____ PSI (kPa). The control system shall be factory pre-piped with a 2-way modulating control valve and cleanable Y-strainer.

2.6 Optional Advanced Control Processor

The Advanced control processor shall be microprocessor based with a front monitor LCD display panel and control keys for user inputs. The controls shall be menu driven with on-screen prompts for easy user operation. The system shall allow user review and programming of temperature and humidity setpoints, alarm parameters, and setup selections including choice of control type. A password shall be required to make system changes. For all user selections, the range of acceptable input (temperature, humidity, or time delay) shall be displayed on the monitor screen. The system shall provide monitoring of room conditions, operational status in % of each function, component run times, date and time, and four analog inputs from sensors provided by others.

Control

The control system shall allow programming of the following room conditions:

- Temperature Setpoint 65-85°F (18-29°C)
- Temperature Sensitivity ±1° to 9.9°F (0.6 to 5.6°C) in 0.1°F (.1°C) increments
- Humidity Setpoint 20-80% R.H.
- Humidity Sensitivity +1% to +30% R.H.

All setpoints shall be adjustable from the individual unit front monitor panel. Temperature and Humidity Sensors shall be capable of being calibrated using the front monitor panel controls to coordinate with other temperature and humidity sensors in the room.

Predictive Humidity Control

The microprocessor shall calculate the moisture content in the room and prevent unnecessary humidification and dehumidification cycles by responding to changes in dewpoint temperature.

In addition the system shall provide the following internal controls:

System Auto-Restart

For start-up after power failure, the system shall provide automatic restart with a programmable (up to 9.9 minutes in 6-second increments) time delay. Programming can be performed either at the unit or from the central site monitoring system.

Sequential Load Activation

During start-up, or after power failure, the microprocessor shall sequence operational load activation to minimize inrush current. Systems allowing multiple loads to start simultaneously are unacceptable.

Front Monitor Display Panel

The microprocessor shall provide a front monitor LCD backlit display panel with 4 rows of 20 characters with adjustable contrast. This display (along with five front mounted control keys) shall be the only operator interface required to obtain all available system information such as room conditions, operational status, alarms, control and alarm setpoints, and all user selections including alarm delays, sensor calibration, DIP switch selections, and diagnostics. All indicators shall be in language form. No symbols or codes shall be acceptable.

Alarms

The microprocessor shall activate an audible and visual alarm in event of any of the following conditions:

- High Temperature
- Low Temperature
- High Humidity
- Low Humidity
- Main Fan Overload (opt)
- Humidifier Problem
- Change Filters
- Loss of Air Flow
- Loss of Power
- Custom Alarm (#1 to #4)

Custom alarms are four customer accessible alarm inputs to be indicated on the front panel. Custom alarms can be identified with prepared (programmed) labels for the following frequently used inputs:

- Leak Under Floor
- Smoke Detected
- Loss of Water Flow
- Standby Unit On

User customized text can be entered for two of the four custom alarms.

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

Audible Alarm

The audible alarm shall annunciate any alarm that is enabled by the operator.

Common Alarm

A programmable common alarm shall be provided to interface user selected alarms with a remote alarm device.

Remote Monitoring

All alarms shall be communicated to the Liebert site monitoring system with the following information: date and time of occurrence, unit number, and present temperature and humidity.

Control Type

The user shall be able to select the type of control the advanced microprocessor will use. Selections available shall be intelligent, proportional, and tunable PID (proportional, integral, and derivative gains).

The intelligent control shall incorporate control logic that uses Artificial Intelligence techniques including “fuzzy logic” and “expert systems” methods to maintain precise, stable control. If tunable PID is selected, the user shall be able to program each of the three gains.

Analog Inputs

The system shall include four customer accessible analog inputs for sensors provided by others. The analog inputs shall accept a 4 to 20 mA signal. The user shall be able to change the input to 0 to 5 vdc or 0 to 10 vdc if desired. The gains for each analog input shall be programmable from the front panel. The analog inputs shall be able to be monitored from the front panel.

Diagnostics

The control system and electronic circuitry shall be provided with self-diagnostics to aid in troubleshooting. The microcontroller board shall be diagnosed and reported as pass/not pass. Control inputs shall be indicated as on or off at the front monitor panel. Control outputs shall be able to be turned on or off from the front monitor panel without using jumpers or a service terminal.

Data Collection

The control system shall maintain accumulative operating hours of compressors, reheats, humdifier, fan motor and econ-o-coil. The ten most recent alarms shall be retained.

Communications

The microprocessor shall be compatible with all Liebert remote monitoring and control devices.

2.6 Advanced Microprocessor Control w/Graphics (Optional)

The optional Advanced control processor shall be microprocessor based with a front monitor dot matrix display panel and control keys for user inputs. The Controls shall be menu driven with on-screen prompts for easy user operation. The system shall allow user review and programming of temperature and humidity setpoints, alarm parameters, and setup selections including choice of control type. A password shall be required to make system changes. For all user selections, the range of acceptable input (temperature, humidity, or time delay) shall be displayed on the monitor screen. The system shall provide monitoring of room conditions, operational status in % of each function, component run times, date and time, and four analog inputs from sensors provided by others.

Control

The control system shall allow programming of the following room conditions:

- Temperature Setpoint 65-85°F (18-29°C)
- Temperature Sensitivity +1° to + 9.9°F (°C) in 0.1°F (°C) increments
- Humidity Setpoint 20-80% R.H.
- Humidity Sensitivity +1% to +30% R.H.

All setpoints shall be adjustable from the individual unit front monitor panel. Temperature and Humidity Sensors shall be capable of being calibrated using the front monitor panel controls to coordinate with other temperature and humidity sensors in the room.

Predictive Humidity Control

The microprocessor shall calculate the moisture content in the room and prevent unnecessary humidification and dehumidification cycles by responding to changes in dewpoint temperature. In addition the system shall provide the following internal controls:

System Auto-Restart

For start-up after power failure, the system shall provide automatic restart with a programmable (up to 9.9 minutes in 6-second increments) time delay. Programming can be performed either at the unit or from the central site monitoring system.

Sequential Load Activation

During start-up, or after power failure, the microprocessor shall sequence operational load activation to minimize inrush current. Systems allowing multiple loads to start simultaneously are unacceptable.

Front Monitor Display Panel

The microprocessor shall provide a front monitor 240 x 128 dot matrix graphics display panel with backlighting. This display (along with five front mounted control keys) shall be the only operator interface required to obtain all available system information such as room conditions, operational status, graphical data, alarms, control and alarm set-points, and all user selections including alarm delays, sensor calibration, DIP switch selections, and diagnostics. All indicators shall be in language form. No symbols or codes shall be acceptable.

Alarms

The microprocessor shall activate an audible and visual alarm in event of any of the following conditions:

- High Temperature
- Low Temperature
- High Humidity
- Low Humidity
- Main Fan Overload (Opt)
- Humidifier Problem
- Change Filters
- Loss of Air Flow
- Loss of Power
- Custom Alarm (#1 to #4)

2.7 Chilled Water Systems

2.7.1 Chilled Water Control Valve

The water circuit shall include a 3-way (2-way) modulating valve. The microprocessor positions the valve in response to room conditions. Cooling capacity will be controlled by bypassing chilled water around the coil. The modulating valve travel for dehumidification shall be proportional.

2.7.1 (Optional) High Pressure Chilled Water Control Valve

The chilled water circuit shall include a 3-way (2-way) high pressure modulating valve. The valve shall be designed for up to 400 PSI (2758 kPa) water pressure.

2.7.2 A-Frame Chilled Water Coil

The cooling coil shall be of A-frame design with a minimum of ____ sq. ft. (sq.m.) face area, ____ rows deep.
The coil shall be controlled by a 3-way modulating control valve. It shall be constructed of copper tubes and aluminum fins and have a maximum face velocity of ____ ft. per minute (m/s) at ____ CFM (CMH).
The water circuit shall be designed to distribute water into the entire coil face area. The coil shall be supplied with ____ °F (°C) entering water temperature, with a ____ °F (°C) temperature rise. The coil shall require ____ GPM (l/s) of chilled water and the pressure drop shall not exceed ____ PSI (kPa). The entire coil assembly shall be mounted in a stainless steel condensate drain pan.

For models FH600C, FH599C and FH740C and FH739C the end sheets shall be aluminum, and the coil can be removed from the front or either side of the unit.

2.7.3 (Optional) Flow Switch

The flow switch shall activate the alarm system should the chilled water supply be interrupted. The switch shall be factory mounted and wired.

2.7.4 (Optional) Variable Speed Drive

A variable speed drive (VSD) is available for models FH/UH600C, FH/UH599C, FH/UH740C, and FH/UH739C to reduce energy consumption. The fan motor speed shall be varied from 100% to 60% of rated speed in response to room conditions. This shall be controlled automatically by the advanced microprocessor control. The variable speed drive option shall be available with an infrared humidifier.

2.8 Optional Specifications

The computer room environmental control system shall be equipped with the following optional components.

Disconnect Switch (Non-Locking Type)

The manual disconnect switch shall be mounted in the high voltage section of the electrical panel. The switch shall be accessible with the door closed.

Disconnect Switch (Locking Type)

The manual disconnect switch shall be mounted in the high voltage section of the electrical panel. The switch shall be accessible from the outside of the unit with the door closed, and prevent access to the high voltage electrical components until switched to the “OFF” position.

Firestat

The firestat shall immediately shut down the environmental control system when activated. The firestat shall be mounted in the electrical panel with the sensing element in the return air.

Condensate Pump

The condensate pump shall have a minimum capacity of 100 GPH at 20 ft. (378 l/hr at 6m) head. (Consult factory for 200V or 230V, 50 Hz applications.) It shall be complete with integral float switch, pump and motor assembly, and reservoir.

Liqui-Tect Sensors (Max. of two per unit)

Provide ____ (quantity) solid state water sensors under the raised floor.

Floor Stand

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

Floor Stand Turning Vane

A factory supplied, field mounted turning vane shall be provided.

Temperature and Humidity Recorder

Provide a 7-day/24 hour temperature and humidity recorder of the full scope, two pen, surface mounted type with 100 recording charts, one red and one blue bottle of recording ink. Recorder shall be a 110 volt, single phase, 60 Hz (50 Hz) power supply.

Smoke Detector

The smoke detector shall immediately shut down the environmental control system and activate the alarm system when activated. The smoke detector shall be mounted in the electrical panel with the sensing element in the return air compartment.

SiteScan Site Monitoring System

Provide a SiteScan monitor system with the Deluxe System/3. The SiteScan shall have the capability to monitor and change (at the user direction) the temperature and humidity setpoints and sensitivities of each unit. The printer shall provide the user with chronological alarm information. It shall also be capable of being programmed to print out environmental conditions or operating modes at each unit.

3.0 EXECUTION

3.1 Installation of Precision Environmental Air Conditioning Units

3.1.1 General

Install precision environmental air conditioning units in accordance with manufacturer’s installation instructions. Install units plumb and level, firmly anchored in locations indicated, and maintain manufacturer’s recommended clearances.

3.1.2 Electrical Wiring

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

3.1.3 Piping Connections

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

3.2 Field Quality Control

Start up mainframe coolant units in accordance with manufacturer’s start up instructions. Test controls and demonstrate compliance with requirements.

Selecting the Critical Space Location

Selection of the Critical Space site requires evaluation and consideration of many factors. These include the proximity of the Critical Space to related operations, security, interior vs. exterior zones of the building and proximity of the packaged environmental control system to the chiller system. In general, the location of the Critical Space should be in an area of the building which is not affected by outside temperatures or relative humidities. If a site is chosen with an outside wall, the area of window glass should be kept to a minimum and double or triple-glazed glass should be used to pre-vent condensation in winter.

Room Preparation

When designing the Critical Space, consideration should be given to accessibility and dimensional requirements for the environmental control equipment as well as the electronic equipment. This includes checking the size of door openings, elevator capacities and, in the case of a raised floor application, selecting a flooring system capable of supporting all the hardware. Consideration should also be given to the type of electrical power distribution and control system to be used in the Critical Space.

Sufficient area for any planned growth of the Critical Space and redundancy in environmental control units should be considered during initial planning.

The room should be well insulated and must have a sealed vapor barrier. The ceiling or ceiling plenum must be sealed as a false ceiling provides no protection from vapor migration. Use a rubber or plastic base paint on concrete walls or floors to prevent moisture migration. Doors should not be undercut or have grilles in them. Light fixtures which require room air to cool them and allow room air to enter the area above the false ceiling should not be used when the false ceiling area is not a part of the site air distribution plan.

Outside air should be kept to an absolute minimum. Fresh air adds to the heating, cooling, humidifying and dehumidifying loads of the site. It is recommended that outside air be kept below 5% of the total air circulated in the space because of the small quantity of people who will be working in the site.

Installation of a Downflow Environmental Control System

The indoor packaged system can be installed on an accessible raised floor system. It may be necessary to furnish additional pedestal support under the unit to ensure maximum structural support. Or a separate floorstand for the unit may be used as support, independent of the raised floor, and installed prior to the flooring system (see Optional Features). The use of the floorstand permits the environmental control system to be installed, piped, wired and inspected prior to the installation of the raised floor. This permits much easier access to all underfloor piping and wiring and would enable the construction to be completed in the least amount of time. The floorstand further provides vibration isolation from the adjacent raised floor and eliminates the need for cutting special openings in the floor panels under the unit. All field piping and electrical enter the unit from the bottom of the unit at the left end.

Provide approximately 34" (86 cm) service clearance on the left, right and in front of the unit whenever possible. The minimum space required for installation is 0" on the left end, 0" on the right end and 24" (61 cm) in front of the unit. This space is necessary to provide for routine maintenance such as replacing filters, adjusting the fan speed and cleaning the humidifier. If filter plenums are used, 25" (63.5 cm) of service clearance is required on the right end.

Air Distribution of Downflow Systems

For underfloor air distribution, observe the following guidelines:

1. Avoid locating units in an alcove or at the extreme end of a room which has a high aspect ration (long narrow room).
2. Avoid locating units too close to each other. Units located relatively close to each other tend to reduce the effectiveness of air distribution.
3. Select the air supply grilles and perforated panels for the raised floor to ensure minimum loss of pressure in the circuit. Air volume dampers on grilles, which extend several inches below the surface of the raised floor, are usually detrimental to air flow. Consideration of the height of the damper on the grille in conjunction with the floor height will determine whether this type of grille may be used.
4. The grilles used in raised floors vary in size, the largest being approximately 18" x 6" (45.7 x 15.2 cm). A larger grille size would be detrimental to the structural capacity of the raised floor panel. An 18" x 6" (45.7 x 15.2 cm) heavy-duty pencil proof type grille typically has 56 square inches (361 cm^2) of free area.
5. Perforated panels are available from various manufacturers of raised floors. These panels are usually 2' x 2' (.61m x .61m) square and have a nominal free area of approximately 108 to 144 square inches (697 to 929 cm^2). Use caution in selecting perforated panels as some manufacturers have only 36 to 40 square inches (232 to 258 cm^2) of free area, requiring four times as many panels.
6. Always check specifications of the floor supplier before specifying the total number of perforated panels and grilles required to handle the air flow. The proper specifications for grilles and perforated panels should indicate the total free area required for air delivery rather than the number of panels and grilles. (See Table for recommended free area required for each Liebert model.) The table below indicates the recommended free area based on having the supply air grilles and perforated panels sized to handle approximately 75% of the total CFM (CMH) of the units at a velocity of 550 to 600 ft/mm. (2.8 to 3.1 *m/s*). The remaining 25% of the air flow in the computer room raised floor passes through cable cutouts, cracks between the panels, and other leakage areas.

RECOMMENDED FREE AREA FT^2 (m^2) FOR GRILLES OR PERFORATED PANELS AT OUTPUT VELOCITIES OF 550 AND 600 F.P.M. (2.8 AND 3.1 m/s)

CHILLED WATER UNITS				
MODEL FH (50 Hz)	550 F.P.M.	2.8 m/s	600 F.P.M.	3.1 m/s
147C	7.2	(0.65)	6.6	(0.60)
200C	8.2	(0.74)	7.6	(0.70)
248C	8.0	(0.73)	7.4	(0.67)
302C	12.7	(1.15)	11.6	(1.05)
376C	12.4	(1.13)	11.4	(1.03)
386C	12.4	(1.1)	11.4	(1.0)
422C	17.0	(1.54)	15.6	(1.42)
529C	16.9	(1.53)	15.5	(1.41)
600C (599C)	23.3	(2.16)	21.4	(1.95)
740C (739C)	22.5	(2.09)	20.6	(1.89)

7. The decision to use a grille or a perforated panel depends on several factors. Perforated panels are generally used in the computer room near the hardware. Grilles with adjustable dampers should be used in areas where “people corn-font” is a prime consideration, such as: keypunch areas, areas around the line printer, or other operator areas. This will allow the personnel to adjust the flow rates for their comfort rather than the equipment loads. Caution should be used when applying dampered grilles or dampered perforated panels around *high* heat gain areas to ensure that the dampers are not closed-off by shuffling of cables, occasional operator discomfort, or carelessness.
8. Avoid low floor elevations (below 7-1/2" / 90.5 mm), loosely installed flooring systems, and below floor obstructions, such as: electrical wiring chases, unusual length of computer system cables, or piping clusters.

Installation of an Upflow Environmental Control System

The indoor packaged system can be installed on an accessible raised floor system as described for a downflow system or on a solid non-raised floor. It can be installed inside the Critical Space or outside the Critical Space. A typical installation within the space can be accomplished without using any ductwork. The packaged system should have a front-return cabinet (or bottom return if on a raised floor) with an optional front discharge plenum which sits on top of the unit. If supply air must be ducted to several locations within the space, duct flanges are provided on the blower discharges to attach the ductwork. A decorative plenum is available in different heights to conceal the ductwork between the unit and ceiling. The packaged system can be installed outside the space and ducted in and out of the space. In this case, the unit should have a rear return with duct connections for the return air. Supply air ductwork should be attached to the blower discharges as described above. All field piping and electrical enter the unit on the lower left corner of the unit’s left end.

Provide approximately (34" 86cm) service clearance on the left, right and in front of the unit whenever possible. The minimum space required for installation is 18" (46cm) on the left end, 18" (46cm) on the right end and 24" (61cm) in front of the unit. This space is necessary to provide for routine maintenance such as replacing filters, adjusting the fan speed and cleaning the humidifier.

Electrical Requirements for the Environmental Control System

Three-phase electrical service is required for all models in 208, 230, 460, or 575 volt 60 hertz (200, 230, 380-415 volt 50 hertz).

Electrical service to the unit should conform with both national and local 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 Amp values in the Electrical Specifications section.

A manual electrical disconnect switch should be installed within 5 ft. (1.5 m) of the unit in accordance with codes or a disconnect switch may be factory supplied, mounted within the unit, accessible from the exterior with a locking or non-locking type of operating handle. (see Optional Equipment/All Systems). For emergency shut-down of each environmental control system through fire detection systems, panic buttons, etc., utilize the low voltage terminal strip located within each unit.

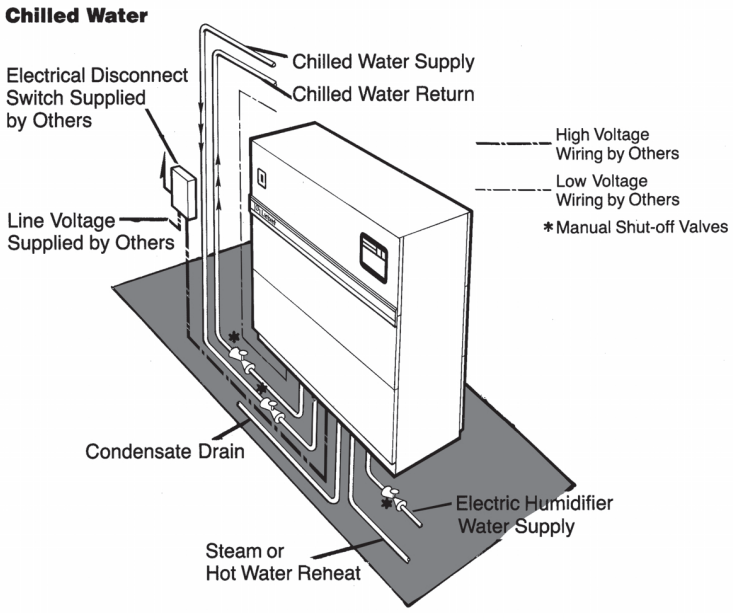
Piping Considerations

It is recommended that manual service shut-off valves be installed at the supply and return line of each 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 chilled water lines.

To provide for the emergency of water leaks and sub-floor flooding, floor drains should be provided with “wet traps” or a free-water detection system such as the Liebert Liqui-Tect alarm should be installed.

For raised floors, all piping below the elevated floor must be located so that it offers the least resistance to air flow discharging from the system. Careful planning of the piping layout under the raised floor is required to prevent the air flow from being blocked from any portion of the room. When installing piping on the sub-floor, it is recommended that pipes be mounted in a horizontal fashion, rather than stacked one above the other on support brackets. Whenever possible, the pipes should be run parallel to the air flow. All condensate and unit drain lines should be trapped and pitched.



Downflow System Shown

Liebert®
Keeping Business in Business®

ENVIRONMENTAL CONTROL

Deluxe System/3® Chilled Water Systems

TECHNICAL DATA MANUAL

The Company Behind the Products

With over a million installations around the globe, Liebert is the world leader in computer protection systems. Since its founding in 1965, Liebert has developed a complete range of support and protection systems for sensitive electronics:

- Environmental systems: close-control air conditioning from 1.5 to 60 tons.
- Power conditioning and UPS with power ranges from 300 VA to more than 1000 kVA.
- Integrated systems that provide both environmental and power protection in a single, flexible package.
- Monitoring and control – for systems of any size or location, on-site or remote.
- Service and support through more than 100 service centers around the world, and a 24/7 Customer Response Center.

While every precaution has been taken to ensure accuracy and completeness of this literature, Liebert Corporation assumes no responsibility and disclaims all liability for damages resulting from use of this information or for any errors or omissions.

SL-18110 (R10/01)

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