PENNSYLVANIA TREASURY DEPARTMENT
INVITATION FOR BID
FOR
COMPUTER ROOM CHILLER

ISSUING OFFICE:

PA Treasury Department
Bureau of Support Services
3TA Finance Building

613 NORTH STREET
HARRISBURG, PA 17120

IFB # 21-001

ORIGINAL RELEASE DATE: Wednesday, March 23, 2022
REISSUED CLARIFICATION: Monday, July 18, 2022
BID OPENING DATE: Tuesday, August 30, 2022
INTRODUCTION-------------------------------------------------------------------------------------------------------------------

The Pennsylvania Treasury Department ("Treasury") is pursuing a vendor to replace the current chiller and air handling unit (AHU), located in the Bureau of Information Technology main computer room. The chiller is used as a backup chilled water source when the central chilled water plant, provided by the Department of General Services, cannot supply chilled water. The chilled water is used in three computer room down flow AHUs. The chiller would also energize if the central chiller plant experiences a malfunction that prevents it from supplying chilled water to the server room AHUs.

Currently the internal equipment loads in the computer room are a maximum load for servers of 30 kw/h (103,000 BTUH). This number is from the two UPS units, plus 36,000 BTUH from the printers and 12,000 BTUH from personnel and lighting. The total is 151,000 BTUH or 12.58 tons.

Treasury will continue to utilize the central plant for chilled water and a new chiller sized 25 ton for redundancy and emergency back-up.

CLARIFICATION AND STANDARDIZED SCOPE ----------------------------------------------------------

The following standards must be met in order for the proposal to be considered:

1. Replace the existing chiller with a 25-ton air cooled chiller placed on the same pad. The current system readings are 112 GPM with a 3.5 to 4.5 delta T°F. Remove the associated refrigeration lines and external electric as shown on sketch. Johnson (York) Model YCAL-25T - https://www.johnsoncontrols.com/es_south_america/-/media/jci/be/united-states/hvac-equipment/chillers/files/be_eng_guide_-_ycal_scroll-chillers-style-e-50-and-60-hz-111417.pdf See Attachment A – NO SUBSTITUTIONS

2. To schedule an onsite visit to survey the existing site to understand the space limitations, piping and electrical routing paths, existing controls and the current connection points please email IFB21-001@patreasury.gov.

3. Contractor’s professional engineer will be the engineer of record. Proposal shall provide rough layout, proposed equipment list, control options and expected duration of project. The two sketches show the proposed scope of work. See Attachment C

4. If the removal of the existing and placement of the new chiller requires a crane located on North Street for a day, two-week notice required. There will be no fees associated with street blockage. A preferred time for crane work would be off hours.
5. Replace the three existing water cooled CRAC units with three 10-ton water cooled CRAC units and associated controls. Liebert CW 26-181kW
See Attachment E – NO SUBSTITUTIONS

6. Existing chilled water from the central plant is a variable flow system, therefore, two-way valves are preferred on the CRAC units.

7. Remove and replace the four 3” shut off valves that isolate the chiller plant supply and returns from the air-cooled chiller supply and return piping. The 4 new 3” valves shall be modulating two position valves that will follow the suggested sequence of operations.

8. Remove the existing refrigeration lines, piping, electrical and mechanical equipment as shown on sketch for the “G” level.

9. Two new chilled water pumps shall have VFD drives to adjust flow to keep a constant pressure in the new loop. Thermostats and pressure gauges shall be on the supply and return lines of the new pumps.

10. The grounds and interior conditions shall be maintained and match the pre-construction conditions at the end of the project.

11. Provide engineering and/or documentation of secured permits; including but not limited to L&I.

12. Provide rigid conduit to liquid tight flexible metal conduit, max 18” length from new disconnect to chiller.

13. Test and balance the system

14. Provide training and warranty information.

Any questions regarding the bid should be directed to IFB21-001@patreasury.gov.
Project Lead Time

Project Cost $________________

Warranty Term Length:
- Product
- Installation

Annual Maintenance agreement after warranty expiration:
- 2nd year cost $________________
- 3rd year cost $________________
- 4th year cost $________________

---------------------------------------------------------------------------------------------------------------------

Company Name _______________________________________________________

Contact Person _________________________ Phone Number (   ) _____________

Address ______________________________________________________________
______________________________________________________________________

County _________________________ Federal ID # _________________________

Vendor Signature ______________________________________________________

(Vendor agrees that this cost proposal will remain valid for a minimum of 120 days from date of bid opening.)

PLEASE NOTE THAT THE COMMONWEALTH IS EXEMPT FROM STATE TAX.

Please complete this bid form and electronically submit your bid to IFB21-001@patreasury.gov. This bid form and all required submissions must be received no later than close of business Monday, August 29, 2022.
MODEL YCAL
AIR-COOLED SCROLL CHILLERS WITH
BRAZED PLATE HEAT EXCHANGERS
STYLE E

15 – 85 TON
53 – 218 kW
50 and 60 Hz
R-410A

YORK
INSTALL CONFIDENCE
### Design Conditions Datasheet

<table>
<thead>
<tr>
<th>Unit Tag</th>
<th>Qty</th>
<th>Model No</th>
<th>Nominal Cooling Capacity (ton-R)</th>
<th>Nominal Voltage</th>
<th>Refrigerant Type</th>
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<td></td>
<td></td>
<td>YCAL003EE-40XEBSD1X</td>
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<td>460-3-60.0</td>
<td>R410A</td>
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<table>
<thead>
<tr>
<th>Evaporator Data</th>
<th>Condenser Data</th>
<th>Performance Data</th>
</tr>
</thead>
<tbody>
<tr>
<td>EWT (°F)</td>
<td>61.42</td>
<td>Min. Flow Rate (USGPM)</td>
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<tr>
<td>LWT (°F)</td>
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<td>Max. Flow Rate (USGPM)</td>
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<td>Fluid</td>
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<td>Fouling Factor (h.lf. ft/Btu)</td>
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<td>Fluid Volume (USGAL)</td>
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<td>Compressor RLA</td>
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<tr>
<td>Fan QTY/RLA (each)</td>
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<td>High LRA Current</td>
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<td>Max. Inverse Time CB Rating</td>
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<td>Max. Dual Element Fuse Size (A)</td>
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<tr>
<td>Wires Per Phase</td>
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<td>Compressor kW</td>
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<tr>
<td>Wire Range (Lug Size)</td>
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<td>Total Fan kW</td>
</tr>
<tr>
<td>Starter Type</td>
<td>Across The Line</td>
<td>Total kW</td>
</tr>
</tbody>
</table>

**Notes:**

Within the scope of AHRI Air-Cooled Water-Chilling Packages Using Vapor Compression Cycle Certification Program, AHRI Certified performance may be obtained from the manufacturer’s representative.


MLP Effective Date: 11/15/2021
Generated on 2021-12-13
Unit Folder: CH-1
DGS Finance Bldg Chiller
Datasheet Spec
Software Version: YW21.04a
Page 1 of 2
# Design Conditions Datasheet

## Part Load Rating Data

<table>
<thead>
<tr>
<th>Load %</th>
<th>Ambient (°F)</th>
<th>Capacity (ton.R)</th>
<th>Total kW</th>
<th>Unit Efficiency (Btu/W-h)</th>
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<tbody>
<tr>
<td>100</td>
<td>95.0</td>
<td>28.37</td>
<td>32.59</td>
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<td>109</td>
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<td>30.92</td>
<td>32.92</td>
<td>13.16</td>
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<td>15.51</td>
<td>13.75</td>
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<td>12.21</td>
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<td>69</td>
<td>66.1</td>
<td>16.72</td>
<td>12.21</td>
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<td>56</td>
<td>55.0</td>
<td>17.37</td>
<td>11.37</td>
<td>18.33</td>
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<tr>
<td>56</td>
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<td>17.37</td>
<td>11.37</td>
<td>18.33</td>
</tr>
</tbody>
</table>

## Sound Power Levels in Accordance with AHRI-370

<table>
<thead>
<tr>
<th>Load %</th>
<th>Ambient (°F)</th>
<th>63 Hz (dB)</th>
<th>125 Hz (dB)</th>
<th>250 Hz (dB)</th>
<th>500 Hz (dB)</th>
<th>1 kHz (dB)</th>
<th>2 kHz (dB)</th>
<th>4 kHz (dB)</th>
<th>8 kHz (dB)</th>
<th>LWA</th>
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<tbody>
<tr>
<td>100</td>
<td>55.0</td>
<td>65</td>
<td>90</td>
<td>93</td>
<td>92</td>
<td>88</td>
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<td>89</td>
<td>83</td>
<td>79</td>
<td>74</td>
<td>89</td>
</tr>
</tbody>
</table>

Note: Unit is equipped with Low Sound Fans. Measurement of sound pressure used to obtain the sound power data presented is based on AHRI-370.

For an air-cooled chiller, sound pressure calculated from sound power varies depending on how the chiller is assumed to behave, i.e. the radiation model. In other words, determining sound pressure from sound power requires making assumptions that result in different answers at a given distance from the chiller. The environment also influences sound pressure in the field installation. Sound pressure estimation radiation models pertaining to air-cooled chillers include the 'traditional' hemispherical model, parallelepiped model and equivalent hemispherical model.

Regarding sound power, Johnson Controls references tolerance limits based on ASHRAE guidelines. These are +/- 5dB in the 63-Hz octave band, +/- 4dB in all other octave bands and +/- 3dB for the overall cBA.

Tolerance limits are based on uncertainties associated with:
1. Measurement Test Procedure
2. Repeatability
3. Production / Manufacturing Variability

Standard deviation associated with air-cooled chiller sound data is a measure of spread i.e. it indicates the range of probability of sound levels. Note that for operating conditions other than AHRI's Standard Rating Condition, higher levels of uncertainty can be expected.

Lead times for factory performance testing depend on test laboratory availability. Please confirm with Johnson Controls Customer Service.

## Evaporator Data

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>EWT (°F)</td>
<td>54.00</td>
</tr>
<tr>
<td>LWT (°F)</td>
<td>44.00</td>
</tr>
<tr>
<td>Flow Rate (USGPM)</td>
<td>88.34</td>
</tr>
<tr>
<td>Pressure Drop (H2O)</td>
<td>11.0</td>
</tr>
<tr>
<td>Fluid</td>
<td>Water</td>
</tr>
<tr>
<td>Fouling Factor (hr°F/ft²)</td>
<td>0.000100</td>
</tr>
<tr>
<td>Fluid Volume (USGAL)</td>
<td>1.189</td>
</tr>
</tbody>
</table>

Note: Unit rated at design condition capacity.

## Condenser Data

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ambient Temp. (°F)</td>
<td>85.0</td>
</tr>
<tr>
<td>Altitude (ft)</td>
<td>0.000</td>
</tr>
<tr>
<td>EER (Btu/W-h)</td>
<td>10.50</td>
</tr>
<tr>
<td>IPLV (Btu/W-h)</td>
<td>15.22</td>
</tr>
<tr>
<td>Net Cooling Capacity (ton.R)</td>
<td>28.56</td>
</tr>
</tbody>
</table>

Note: Unit rated at design condition capacity.
A Chilled Water Precision System That Handles The Most Demanding Conditions

Based on the historically reliable design of the Liebert® Deluxe System/3, the Liebert CW™ continues this reputation for dependability, and improves upon the design with energy saving upgrades. The Liebert CW chilled water based precision cooling system is specifically designed to handle the high heat loads generated by computers and other electronic equipment, using an existing building chiller as a source of chilled water cooling.

Built to the highest specifications in the industry with proven components and design, the Liebert CW is ideal for critical applications including:

- Data centers
- Telecommunications central switching offices
- Industrial process control centers
- Laboratories
- Medical facilities

THE INDUSTRY’S PREMIER CHILLED WATER SYSTEM

Flexibility

- Provides complete environmental control package.
- Built-in redundant control and power supplies.
- Both upflow and downflow configurations are available to cover raised floor and non-raised applications.
- Liebert iCOM control system brings high-level supervision to multiple units, allowing them to work together as a single system to optimize room performance.

Higher Availability

- Designed with the highest quality components selected for their proven reliability and performance.
- Provides around-the-clock operation to protect critical installations.
- Operates with a high sensible heat ratio, assuring that proper humidity levels will be maintained.
- Liebert iCOM control system adds automatic sequencing of components to even wear and extend service life.

Lowest Total Cost of Ownership

- Uses existing building chilled water systems to provide cooling.
- Higher efficiency fan options include EC Plug Fan on larger downflow models and variable speed drive centrifugal fans available on all models.

Service Solutions

Liebert Services capabilities can increase the availability of your precision cooling equipment by reducing downtime due to component failure. This is especially valuable to companies who do not have a dedicated technician on-site to troubleshoot equipment. Field service is provided by a nationwide network of locally-based, factory-trained technicians for installation, support and maintenance of Liebert precision environmental products. Liebert Services offerings include warranty service, emergency coverage and preventive maintenance. We also offer an environmental equipment site management program that creates a customized solution for your site by offering a single point of contact for your service needs.
A Choice Of Configurations

More Configurations to Fit More Applications

High performance, sensitive electronic equipment requires precise, reliable control of room temperature, humidity and airflow for proper operation. Liebert® CW™ meets these needs for environmental control in computer dependent operations. It is available in sizes from 26-187kW, and in airflow configurations to meet unique applications.

Downflow Supply
Designed for raised-floor applications, the downflow air supply configuration is commonly found in data centers and other similar facilities housing sensitive electronic equipment.

EC Plug Fans — Under Floor Configuration
With EC Plug Fans below unit in raised floor space, the system is 30 percent more energy efficient than centrifugal blowers, while providing more efficient airflow.

EC Plug Fans — In-Line Configuration
Designed for applications requiring greater airflow requirements, the in-line configuration provides a high degree of flexibility.

Centrifugal Fans With Variable Speed Drives
Centrifugal fans are also available with Liebert® CW™. These fans can be controlled by a variable speed drive to adjust airflow as required.

Top Front Supply With Plenum & Grille And Front Return
In-the-space applications without ductwork, such as Telecommunications, Networks and Switching Centers, benefit from this economical configuration. Optional high filtration may be desirable.

Top Front Supply And Front Return
Engineered for in-the-space applications utilizing duct work, this airflow design is commonly used for Telecommunications or Industrial applications. High static pressure and filtering options may be selected.

Top Rear Supply And Rear Return
Designed for use in out-of-space applications, this configuration is typical for Industrial Processes such as Control Rooms, and Labs. Many of these sites will select a higher static pressure and optional high efficiency filters. (Customer ducted supply and return)

Top Front Supply With Plenum & Grille And Bottom Return
Specifically designed for use in raised floor, in-the-room applications, this configuration takes advantage of typical computer room construction. Additional filtering may be requested to protect sensitive computers and peripherals.
Economical Chilled Water Systems

By taking advantage of your existing central air conditioning chiller, the Liebert® CW™ provides economical, durable cooling and humidity control around the clock, throughout the year.

The Liebert CW chilled water system offers rugged, yet affordable cooling and humidity control where a central water chiller is available as a year-round cooling source. In these applications, a single chiller can be used for multiple air conditioning units, providing savings on additional heat rejection components.

The full line of Liebert chilled water systems use Liebert iCOM microprocessor-based controls to maintain precise temperature and humidity levels, while the cooling hardware is designed and built for continuous, trouble-free operation.

More Cooling Capacities

Available in ten cooling capacities, with either upflow or downflow configurations.

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 control uses "intelligent logic" to eliminate valve hunting, thus greatly increasing the life of the valve. The valve can be a 3-way or 4-way to meet the appropriate requirements of the installed system.
Every Feature Contributes To Absolute Reliability

When the demand is for around the clock operation, you simply can't take shortcuts. Liebert® CW™ is designed with robust components that operate reliably under the most demanding conditions, ensuring uptime for sensitive electronics in critical applications.

Fans And Motors

Clean, even air distribution is supplied by large capacity fans, which are balanced to minimize vibration. The fans draw filtered air through the system. An EC Plug Fan option is available for Liebert CW downflow models.

Draw-Through Airflow

The fans draw air evenly and at low velocity through the cooling coil, reheat and humidification systems. The result is flat, less turbulence with superior efficiencies in heat transfer. Clean air at the right temperature and humidity is fed positively and evenly into the room.

A-Frame Coil

This Liebert designed and manufactured A-Frame coil features a large face area/low face velocity design for maximum cooling and even air distribution.

Infrared Humidifier

The infrared humidifier design consists of quartz lamps mounted above a stainless steel water reservoir. The lamps never come in contact with the water. When humidification of room air is required, infrared rays generate water vapor—without impurities or odor, within seconds.
Liebert® iCOM™

Optimizing Cooling System Performance For Efficiency And Energy Savings

The Liebert iCOM control system offers a variety of advantages:

* Saves energy using predictive humidity control.
* Built-in lead/lag functions for enhanced system reliability.
* Wellness calculation alerts service personnel before problems occur.
* Unit-to-unit communications allow team work settings to keep multiple units working together to optimize energy efficiency.

Liebert iCOM At A Glance

The Status menu shows setpoints, environmental conditions, operational status, alarm conditions and system health.

* Graphical view
* Simple view
* Display icons
* Access icons—user, service, advanced
* Help menu layout
* Temperature and humidity graphs
* Online help menus

Small Graphic Display Model

The Liebert iCOM with small display has a 128 x 64 dot matrix screen that simultaneously shows two menu icons, along with descriptive text. This display is capable of controlling only the unit it is directly connected to. Views include:

* Event log
* Temperature and humidity graphs
* Standby/load/seg
* Unit wellness
* Service contact information

Large Graphic Display Model

The Liebert iCOM with large display has a 320 x 240 dot matrix screen that shows up to 18 menu icons at a time, as well as descriptive text. This display can be used to control a single cooling unit or any cooling unit on a network, regardless of how it is connected—either integrated into a cooling unit or simply connected to the network and mounted remotely. It provides the same information as the small display plus these additional views:

* Spare parts list
* Unit diary
* View status of all cooling units
* Control any cooling unit on network
* View system averages of entire cooling unit network

The optional VNSA with iCOM combines a Wall Mounted Large Graphic Display along with a network switch to facilitate U2U wiring in one convenient cabinet.
A Choice Of Fans To Fit Every Application Requirement

Our downflow floormount Liebert CW models are now available with energy efficient EC Plug Fans.

These energy efficient fans add to the superior efficiency already achieved by the use of a traditional variable speed drive system. In fact, many utility companies offer a rebate for using these energy efficient options—check with your local utility for details.

The Liebert CW with EC Plug Fan delivers energy efficiency gains via the fan system. These electrically commutated fans are a backward curved motorized impeller powered by a direct drive DC Motor with integrated AC-DC conversion.

This design uses less energy than standard centrifugal blowers by lowering motor kW. The EC Plug Fan uses 10-30% less energy on average than standard AC motors.

The EC Plug Fan is located in the area beneath the raised floor or within the unit. Superior energy savings can be realized with the fans located beneath the raised floor. Placing the fan in the raised floor space, is 30 percent more energy efficient than centrifugal blowers. The EC Plug Fan also provides greater energy savings than variable speed drives.

Real World Energy Savings

![Graph showing energy savings](image)

The energy saving capabilities of the Liebert CW with EC Plug Fans or variable speed drive fans result in a quick payback through lower electricity costs.

Optional Energy Saving Variable Speed Drive Fan Motor

All Liebert CW models are also available with an optional variable speed drive on the fan motor used to drive centrifugal blowers, matching the motor speed to the room cooling requirements. This feature allows the unit to use far less motor energy to move room air.

This drive is controlled by the Liebert ICOM control system 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.

Example shows Liebert CW106 @10/kWh.
## Liebert CW Chilled Water System Specifications

### Deluxe CW Capacity Data 50 Hz and 60 Hz Chilled Water Systems

<table>
<thead>
<tr>
<th>Model</th>
<th>75°F DB, 62.5°F WB (23.9°C DB, 19.2°C WB)</th>
<th>75°F DB, 61°F WB (23.9°C DB, 18.3°C WB)</th>
<th>72°F DB, 60°F WB (22.2°C DB, 15.6°C WB)</th>
<th>72°F DB, w/88.6°F WB (22.2°C DB, 31.5°C WB)</th>
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<tr>
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<td>50% RH</td>
<td>46% RH</td>
<td>50% RH</td>
<td>46% RH</td>
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<tr>
<td>CW024</td>
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<td>CW072</td>
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<td>596 (195.0)</td>
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Capacity data is certified to ASHRAE 12-2007 standard. Fan motor heats have been extracted, resulting in "net" capacity.

*Available with Centrifugal or downflow EC Plug Fan. Centrifugal Fan capacity shown.

** Only available in downflow configuration with EC Plug Fan.
1.1 SUMMARY
These specifications describe requirements for a Thermal Management system. The system shall be designed to control temperature and humidity conditions in rooms containing electronic equipment, with good insulation and vapor barrier. The manufacturer shall design and furnish all equipment to be fully compatible with heat-dissipation requirements of the room.

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

The Liebert CW system performance shall be AHRI Certified™, the trusted mark of performance assurance for heating, ventilation, air conditioning and commercial refrigeration equipment, using AHRI Standard 1360.

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.

1.4 SERVICEABILITY/ACCESS
The cabinet shall be designed so that all components are easily accessible for service and maintenance through the unit's side and front [CW038-084], front [CW106-181].

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

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

2.1 FRAME

The frame shall be constructed of welded tubular steel. It shall be painted using the autophoretic coating process for maximum corrosion protection.

2.1.1 Downflow Air Flow Configurations

2.1.1.1 Downflow Air Supply
The supply air shall exit from the bottom of the unit.

2.1.1.2 Downflow Air, EC Fans Lowered into Floor Stand
The supply air shall exit from all sides of the floor stand.

2.1.1.3 Downflow Air, Front Discharge
The supply air shall exit from the front of the unit.

2.1.1.4 Downflow Air, Rear Discharge
The supply air shall exit from the rear of the unit.

2.1.1.5 Downflow Air Return
The return air shall enter the unit from the top.

2.1.2 Upflow Air Flow Configurations

2.1.2.1 Upflow Top Air Supply, Front Throw
The supply air shall exit from the top of the cabinet (or plenum) with the air throw toward the front.

2.1.2.2 Upflow Top Air Supply, Rear Throw
The supply air shall exit from the top of the cabinet (or plenum) with the air throw toward the back.

2.1.2.3 Upflow Rear Air Supply
The supply air shall exit from the back of the cabinet.

2.1.2.4 Upflow Air Return, Front
The return air shall enter the unit from the front of the cabinet through factory-installed grilles. Grilles shall be painted black.

2.1.2.5 Upflow Air Return, Rear
The return air shall enter the unit from the back of the cabinet.

2.1.2.6 Upflow Air Return, Bottom
The return air shall enter the unit from the bottom of the cabinet.
2.1.3 Exterior Panels

The exterior panels shall be insulated with a minimum 1 in. (25 mm), 1.5 lb. (0.68 kg) density fiber insulation. The main front panel shall have captive quarter-turn fasteners. The main unit color shall be _______. The accent color shall be _______.

2.2 FILTERS

The filter chambers for CW038-084 filters are located within the cabinet and serviceable from either end of the unit.

The filter chambers for CW106 and CW114 are located within the cabinet and serviceable from the front of the unit.

The filter chambers for CW146 and CW181 are field mounted on the top of the cooling unit. The filters are located in an 18-in. (457-mm) plenum, which is serviceable from the front of the unit.

For CW038-084 units with rear-return filter boxes, the filter chambers shall be field-mounted on the rear of the cooling unit and are serviceable from either end of the unit.

2.2.1 Filters, 4-in. MERV8 and MERV11

Filters shall be deep-pleated 4-in. filters with an ASHRAE 52.2-2007 MERV8 or ASHRAE 52.2-2007 MERV11.

2.2.2 Filters, 2-in. Pre-filter with 4-in. Filter MERV8 and MERV11

Filters shall be 2-in. ASHRAE 52.2-2007 MERV8 pre-filter, with 4-in. ASHRAE 52.2-2007 MERV8 or MERV11 efficiency filter.

2.2.3 Extra Filter Set

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

2.3 LOCKING DISCONNECT SWITCH

The manual disconnect switch shall be mounted in the high-voltage section of the electrical panel. The switch shall 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.

2.4 SHORT-CIRCUIT CURRENT RATING (SCCR)

The electrical panel shall provide at least 65,000A SCCR (60hz).

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

2.5.1 Electronically Commutated (EC) Fans

The fans shall be plug/plenum type, single-inlet and shall be dynamically balanced. The drive package shall be direct drive, electronically commutated and variable speed. The fans shall be located to draw air over the A-frame coil to ensure even air distribution and maximum coil performance. EC fans shall be available on downflow models, and fans may be lowered into a raised floor with a minimum height of 24 in. (610 mm). EC fans may operate within the Liebert CW cabinet, instead of under the floor.

EC fans shall be available on upflow models and fans shall operate outside the unit in a factory-provided plenum.

- Upflow CW038–114: The fan motor(s) shall be 4.0 hp (3.0 kW) with maximum speed of 1520 rpm; quantity 1 for CW038–41; 2 for CW051–084; 3 for CW106–114.
- Downflow CW038–CW041: The fan motor shall be 4.0 hp (3.0 kW) with a maximum operating speed of 1520 rpm; quantity 1.
- Downflow CW051 and CW060: The fan motors shall be 3.4 hp (2.5 kW) with a maximum operating speed of 1700 rpm; quantity 2. (Power rating for 380–480V. For 200–240V, power is 3.6 hp [2.7 kW]).
- Downflow CW076–CW084: The fan motors shall be 4.0 hp (3.0 kW) with a maximum operating speed of 1520 rpm; quantity 2.
- Downflow CW106–CW114: The fan motors shall be 4.0 hp (3.0 kW) with a maximum operating speed of 1520 rpm; quantity 3.
- CW146: The fan motors shall be 3.7 hp (2.8 kW) with a maximum operating speed of 1230 rpm; quantity 3.
- CW181: The fan motors shall be 4.9 hp (3.7 kW) with a maximum operating speed of 1370 rpm; quantity 3.

2.5.2 Forward Curved Blower—Optional

The blower section shall be designed for ____ CFM (____ CMH) at an external static pressure of ____ in. wg. (Pa). The fan shall be the centrifugal type, double-width, double-inlet, and shall be factory-balanced as a completed assembly. The shaft shall be heavy-duty steel with self-aligning ball bearings with a minimum lifespan of 100,000 hours.

The fans shall be located to draw air over the A-frame coil to ensure even air distribution and maximum coil performance. The fan motor shall be ____ hp at 1750 rpm at 60 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.

2.6 CHILLED WATER CONTROL VALVE

The water circuit shall include a 2-way (modulating) valve. The valve shall be designed for up to 400 PSI (2758 kPa) water pressure. The Liebert iCOM shall position the valve in response to room conditions.
2.7 CHILLED WATER COIL

The evaporator coil shall be A-frame design for downflow and upflow units and have ___ ft\(^2\) (m\(^2\)) face area, ____ rows deep.

It shall be constructed of copper tubes and aluminum fins and have a maximum face velocity of 2.50 ft per minute (m/s) at ____ CFM (m\(^3\)).

The water circuit shall be designed to distribute water into the entire coil face area. The coil shall be supplied with ___ \(\Delta T\) \(^\circ\)F \(^\circ\)C) entering water temperature, with a \(\Delta T\) \(^\circ\)F \(^\circ\)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.

2.8 HUMIDIFIER

2.8.1 Infrared Humidifier—OPTIONAL

A humidifier shall be factory-installed inside the unit. The humidifier shall be of the infrared type, consisting of high-intensity quartz lamps mounted above and out of the water supply. The humidifier pan shall be stainless steel and arranged to be serviceable without disconnecting water-supply lines, drain lines or electrical connections. The complete humidifier section shall be pre-piped ready for final connection. The infrared humidification system shall use by-pass air to prevent over-humidification of the controlled space. The auto-flush system shall automatically flush deposits from the humidifier pan. The system shall be field adjustable to change the cycle time to suit local water conditions.

A minimum 1-in. (25-mm) air gap within the humidifier piping assembly, in compliance with ASME A112.1.2 section 2.4.2 (backsiphonage testing), shall prevent back-flow of the humidifier supply water.

2.9 REHEAT

2.9.1 Electric Reheat—OPTIONAL

The Thermal Management unit shall include a factory-installed reheat to control temperature during dehumidification. The low-watt density, 304/304, stainless-steel, finned-tubular electric reheat coils. The reheat section shall include UL/CSA recognized safety switches to protect the system from overheating.

2.9.2 Hot Water Reheat—OPTIONAL

The hot water reheat coil shall have copper tubes and aluminum fins. The control system shall be factory pre-piped with a 2-way motorized control valve. A cleanable Y-strainer is factory-installed on hot-water supply line. Upflow model requires a 22 \(\frac{3}{4}\)-in. (58-cm) high plenum with grille.
3.0 CONTROLS

3.1 LIEBERT iCOM™
MICROPROCESSOR CONTROL WITH 7-IN. COLOR TOUCHSCREEN

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

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

• Sensor Calibration – The menus shall allow unit sensors to be calibrated with external sensors.

• Maintenance/Wellness Settings - The menus shall allow reporting of potential component problems before they occur.

• Options Setup - The menus shall provide operation settings for the installed components.

• Auxiliary Boards - The menus shall allow setup of optional expansion boards.

• Various Sensors - The menus shall allow setup and display of optional custom sensors. The control shall include four customer-accessible analog inputs for sensors provided by others. The analog inputs shall accept a 4 to 20mA signal. The user shall be able to change the input to 0 to 5VDC or 0 to 10VDC. The gains for each analog input shall be programmable from the front display. The analog inputs shall be able to be monitored from the front display.

• Diagnostics/Service Mode - The Liebert iCOM control shall be provided with self-diagnostics to aid in troubleshooting. The microcontroller board shall be diagnosed and reported as pass/not pass. Control inputs shall be indicated as On or Off at the front display. Control outputs shall be able to be turned On or Off from the front display without using jumpers or a service terminal. Each control output shall be indicated by an LED on a circuit board.

• Base-Comms for BMS Connectivity – The Liebert iCOM controller shall provide one Ethernet Port and RS-485 Port dedicated for BMS Connectivity. Provides ground fault isolated RS-485 Modbus, BACnet IP & Modbus IP network connectivity to Building Management Systems for unit monitoring and management. Also, provides ground fault isolated 10/100 baseT Ethernet connectivity for unit monitoring and management. The supported management interfaces include SNMP for Network Management Systems, HTTP for web page viewing, SMTP for email, and SMS for mobile messaging. The iCOM controller can support dual IP on a single network and one 485 protocol simultaneously.

3.2 ALARMS

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

• High Temperature
• Low Temperature
• High Humidity
• Low Humidity
• EC Fan Fault
• Change Filters
• Loss of Air Flow
• Loss of Power
• Custom Alarms
Custom alarm inputs shall be provided to indicate facility-specific events. Custom alarms can be identified with programmable labels. Frequently used alarm inputs include:

- Leak Under Floor
- Smoke Detected
- Standby Unit On

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

3.3 LIEBERT ICOM™ CONTROL METHODS AND OPTIONS

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

3.3.1 Controlling Sensor Options

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

3.3.1.1 Cooling Capacity

- Supply
- Remote
- Return

3.3.1.2 Fan Speed

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

3.3.2 Temperature Compensation

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

3.3.3 Humidity Control

Dew point and relative humidity control methods shall be available (based on user preference) for humidity control within the space.
3.4 **MULTI-UNIT COORDINATION**

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

- **Teamwork Mode 1 (Parallel):** Is best in small rooms with balanced heat loads. The controlling temperature and humidity sensor readings of all units in operation (fan on) are collected to be used for an average or worst-case sensor reading (user selectable). The master unit shall send the operating requirements to all operating units in the group. The control band (temperature, fan and humidity) is divided and shared among the units in the group. Each unit will receive instructions on how to operate from the Master unit based on how far the system deviates from the setpoints. Evaporator fans and cooling capacity are ramped in parallel.

- **Teamwork Mode 2 (Independent):** Is best applied in large rooms with unbalanced heat loads. The Liebert iCOM calculates the worse-case demand for heating, cooling humidification and dehumidification. Based on the greatest demand within the group, each unit operates independently, meaning that the unit may respond to the thermal load and humidity conditions based on the unit’s controlling sensors. All sensor readings are shared.

- **Teamwork Mode 3 (Optimized Aisle):** May be employed in large and small rooms with varying heat loads. Optimized Aisle is the most efficient teamwork mode that allows the unit to match cooling capacity with heat load. In the Optimized Aisle mode, the fans operate in parallel. Fans can be controlled exclusively by remote temperature or using static pressure with a secondary remote temperature sensor(s) as an override to ensure the inlet rack temperature is being met. Cooling (Chilled Water Valve or Economizer) is controlled through unit supply air conditions. The Liebert iCOM calculates the average or worst-case sensor reading (user-selectable) for heating, cooling humidification and dehumidification. Based on the demand within the group, units will be allowed to operate within that mode until room conditions are satisfied. This is the best form of control for a room with an unbalanced load.

3.5 **STANDBY LEAD-LAG**

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

3.6 **STANDBY UNIT CASCADING**

The Liebert iCOM cascade option shall allow the units to turn On and Off based on heat load when utilizing Teamwork Mode 1, Independent mode or Teamwork Mode 3, Optimized Aisle mode with remote temperature sensors. In Teamwork Mode 1, Cascade mode will stage units on based on the temperature and humidity readings and their deviation from setpoint. In Teamwork 3 Mode, Cascade mode dynamically coordinates the fan speed to save energy and to meet the cooling demands. For instance, with a Liebert iCOM group of six units and only 50% of the heat load, the Liebert iCOM shall operate only four units at 80% fan speed and leave the other two units in standby. As the heat load increases, the Liebert iCOM shall automatically respond to the new load and bring on another unit, increasing the units in operation to five. As the heat load shifts up or down, the control shall meet the need by cascading units On or putting them into standby.

3.7 **VIRTUAL MASTER**

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

Liebert iCOM™ shall allow the use of a virtual back-draft damper, eliminating the need for a mechanical damper. This shall allow the fans to spin slowly (15% or less) to act as a damper.

3.9 SYSTEM AUTO RESTART

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

3.10 WIRED SUPPLY SENSOR

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

3.11 SEQUENTIAL LOAD ACTIVATION

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

3.12 CW QUICK START

Each Liebert iCOM controller shall have the option to enable Chilled Water Quick-Start. After a loss of power, iCOM application normally requires approximately 60 seconds to reboot prior to the unit providing airflow and cooling output. With CW Quick-Start enabled, the end-user may configure a specific airflow output percentage and cooling capacity output percentage as desired. The unit shall operate at these configured values within approximately 10 seconds after a power restoration all while the iCOM application is rebooting. After iCOM has fully booted, the unit will continue normal operation.

3.13 ADAPTIVE PID CW AUTO-TUNING

iCOM shall support the use of Liebert’s auto-tuning feature called Adaptive PID. Adaptive PID may be used for fan speed control or cooling capacity control. With Adaptive PID selected, iCOM shall automatically recognize oscillations across multiple sub-systems relating to the PI tuning associated with either mode of control or correct those oscillations with zero human intervention. This feature allows for better overall system operation and responds well to increasing/decreasing system loads.

3.14 SUPPLY SENSOR AGGREGATION

Each Liebert iCOM controller shall support the Supply Sensor Aggregation feature. Supply Sensor Aggregation allows for the use of additional remote 2T temperature sensors that are used to calculate an aggregated supply air temperature value which may be used for cooling capacity control. Each iCOM controller can support up to five additional remote 2T sensors for supply sensor aggregation.
4.0 MISCELLANEOUS OPTIONS

4.1 FLOW SWITCH—OPTIONAL

The flow switch shall activate the alarm system should the chilled water supply be interrupted. The switch shall be designed for up to 400 PSI (2758 kPa) water pressure and shipped loose for field installation.

4.2 VARIABLE SPEED DRIVE—OPTIONAL

A variable speed drive (VSD) is available for models CW106 and CW114 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 Liebert iCOM™ control. The variable-speed-drive option shall be available with an infrared humidifier.

4.3 WIRED REMOTE SENSOR(S)—OPTIONAL

Each Liebert iCOM shall have up to 10 2T sensors (20 sensor readings total) for control or reference. As part of the U2U network, these sensors shall be shared and used to control the cooling units and provide greater flexibility, visibility and control, using that to respond to changes in the conditioned space. When the sensors are used for control, the user may set the control to be based on a maximum or average of a selected highest temperature reading.

4.4 DUAL CHILLED WATER VALVE STAGING—OPTIONAL

The control shall provide special staging options on dual chilled water valve applications. The chilled-water valves may be staged in parallel, cascade or alternate lead operation.

Parallel control shall allow both chilled-water valves to operate at the same time, following the same open/close command as the room conditions deviate from the setpoint.

Cascade control shall allow the valves to operate in stages. Only 1 circuit shall be operated to maintain the conditioned space temperature. If the room condition is not held with 1 circuit in operation, the control will automatically stage a second valve on to maintain room conditions. An automatic timer may be used to alternate the lead valve to keep equal component run time.

Alternate operation shall allow 1 circuit to work as lead and the second circuit to act as backup. The lead valve will rotate based on valve run time, or the user can alternate the lead valve using a customer input connection.

4.5 HIGH TEMPERATURE SENSOR—OPTIONAL

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

4.6 CONDENSATE PUMP, DUAL FLOAT—OPTIONAL

The pump shall have a capacity of _____ GPM (_____ l/m) at _____ ft head (_____ kPa). The pump shall be complete with integral dual-float switch, pump, motor assembly and reservoir. The secondary float shall send a signal to the local alarm and shut-down the unit upon a high-water condition. The pump shall be shipped loose for field installation on Chilled Water units that are upflow with bottom return. They are also shipped loose for under-floor field installation on CW038-CW060 units with EC fans.

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

Provide ____ (quantity) solid-state water sensors under the raised floor.
4.8 **SMOKE SENSOR—OPTIONAL**

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

4.9 **LIEBERT SITESCAN™ SITE MONITORING SYSTEM—OPTIONAL**

Provide a Liebert SiteScan monitoring system with the Liebert CW. The Liebert SiteScan shall have the capability of monitoring and changing (at the user’s direction) the temperature 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.

4.10 **LOW-VOLTAGE TERMINAL PACKAGE INCLUDES—OPTIONAL**

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

4.11 **REHEAT & HUMIDIFIER LOCKOUT—OPTIONAL**

The reheat and humidifier lockout includes the necessary relays to disable the reheat and humidifier from an external customer supplied 24-V signal while on emergency power.

4.12 **REMOTE HUMIDIFIER CONTACT—OPTIONAL**

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

4.13 **LIEBERT vNSA™ NETWORK SWITCH—OPTIONAL**

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

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

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

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 ____ in. (mm) high.

4.14.1 EC-fan Lowering Jack—Optional

An EC-fan lowering jack shall be supplied to assist the lowering of EC fans from downflow unit into the floor stand. Only available with downflow units with EC fans and “Under-the-floor” options when floor stands are selected. Ships with floor stand.

4.14.2 Seismic-rated Floor Stand—Optional

The floor stand shall be seismic-rated and shall be bolted to the unit frame.

4.15 RETURN-AIR PLENUM FOR DOWNFLOW UNITS—OPTIONAL

The air plenum shall be constructed of 20-gauge steel, powder coated to match unit color. A door shall be included in the front of the plenum to enable front filter access. Air shall enter the plenum from the top.

4.16 DISCHARGE AIR PLENUM FOR UPFLOW UNITS, WITH DISCHARGE GRILLE(S)—OPTIONAL

The air plenum shall be constructed of 20-gauge steel, powder coated to match unit color. Discharge air grilles shall be painted black and shall be included on the (front), (rear), (left side) or (right side) of the plenum.

4.17 DISCHARGE AIR PLENUM FOR UPFLOW UNITS, WITHOUT DISCHARGE GRILLE(S)—OPTIONAL

The air plenum shall be constructed of 20-gauge steel, powder coated to match unit color. Air shall discharge from the top of the plenum.
5.0 EXECUTION

5.1 INSTALLATION OF THERMAL MANAGEMENT UNITS

5.1.1 General
The user shall install Thermal Management units in accordance with manufacturer's installation instructions. The units shall be installed plumb and level, firmly anchored in locations indicated and shall maintain manufacturer's recommended clearances.

5.1.2 Electrical Wiring
The user shall install and connect electrical devices furnished by the manufacturer but not specified to be factory mounted. The manufacturer shall furnish a copy of manufacturer's electrical connection diagram submittal to electrical contractor.

5.2 PIPING CONNECTIONS
The user shall install and connect devices furnished by the manufacturer but not specified to be factory-mounted. The manufacturer shall furnish a copy of piping connection diagram submittal(s) to the piping contractor.

5.2.1 Supply and Drain Water Piping
The user shall startup Thermal Management units in accordance with the manufacturer's startup instructions. The manufacturer shall test controls and demonstrate compliance with requirements.

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

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

5.4 WARRANTY START-UP AND CONTROL PROGRAMMING
Install the indoor unit in accordance with manufacturer's installation instructions provided with seismic option. Firmly anchor maintaining manufacturer's recommended clearances. Mounting requirement details such as anchor brand, type, embedment depth, edge spacing, anchor-to-anchor spacing, concrete strength, special inspection and attachment to non-building structures must be outlined and approved by the Engineer of Record for the projection or building. Electrical, pipe and duct connections must permit movement in three dimensions and isolate the unit from field connections. Electrical conduit shall be flexible, having at least one bend between the rigid connection at the unit cabinet and the connection to rigid conduit or foundation. The piping flexible connection or loop must be suitable for the operation pressure and temperature of the system. Furnish copy of manufacturer's piping connection diagram submittal to piping contractor.
1. Single Air-Cooled Chiller (typical of 1)

**System Enable – Run Conditions:**

- Central Plant Flow Has Failed (Flow Switch)
- And/or Central Plant Chilled water is above 54°F (adj.).

**Isolation Valve Operation:**

The Isolation valves will remain in the closed state until there is a System enable command. Then the Isolation valves will switch to the open state.

**Chilled Water Pump Lead/Standby Operation:**

The **Lead/designated** Chilled water pumps will run anytime the System Enable is Present and the Isolation valves are proven open.

The Lead/designated pump will start prior to the chiller being enabled and will stop only after the chiller is disabled. The Pump(s) will therefore have:

- A User adjustable delay on start
- And a User adjustable delay on stop

The Delay times will be set appropriately to allow for orderly Isolation valve movement and chilled water pump start-up, shutdown and sequencing.

The two pumps will operate in a Lead/standby fashion.

- The lead/designated Pump will run first
- On Failure of the lead pump, the standby pump will run, and the lead pump will turn off.

The designated lead pump will rotate upon one of the following conditions (user selectable):

- Manually through a software switch
- If pump runtime (adj.) has exceeded
Alarms will be provided as follows:

**Chilled water pump 1**
- Failure: Commanded on, but the status is off
- Running in hand: Commanded off, but the status is on.
- Runtime Exceeded: Status runtime exceeds a user definable limit.

**Chilled water pump 2**
- Failure: Commanded on, but the status is off
- Running in hand: Commanded off, but the status is on.
- Runtime Exceeded: Status runtime exceeds a user definable limit.

**Isolation Valves**
- Held Open: Commanded closed, but the status is open
- Held Closed: Commanded Open, but the status is closed

**Central Plant Failure**
- Central Plant Failure: Central plant flow switch showing open status

**Chiller Failure**
- Failure: Commanded on, but the status is off
- Running in hand: Commanded off, but the status is on

**Chilled water temperatures**
- High chilled water supply temperature: If the Chiller command is on for (adj) amount of time and temperature is greater than 55°F (adj.).
- Low chilled water supply temperature: If the Chiller command is on and the temperature is lower than 40°F (adj.).
Chiller:
The chiller will be enabled once Isolation valves are proven open and flow is proven with pump status. The chiller will therefore have a user adjustable delay on start.

The chiller will run subject to its own internal safeties and controls

Chiller monitoring points: “Provided by integration card on chiller” (Connect via MSTP trunk)

- Chiller status
- KW
- Evaporator pressure
- Condenser Pressure
- Tonnage
- Blank
- Blank

Chiller Chilled water supply setpoint:
The chiller will maintain a chilled water supply temperature setpoint as determined by its own internal controls (provided by others)

Chilled Water Temperature Monitoring:
The following temperatures will be monitored:

- Chilled water supply.
- Chilled water return.
<table>
<thead>
<tr>
<th>Point Name</th>
<th>Hardware Points</th>
<th>Software Points</th>
</tr>
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<tbody>
<tr>
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<td>AI  AO  BI  BO</td>
<td>AV  BV  Loop  Sched  Trend  Alarm  Show On Graphic</td>
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<td>Chilled Water Return Temp</td>
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<tr>
<td>Chilled Water Supply Temp</td>
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