Liebert®
DSE™ Thermal Management System

System Design and User Manual
Downflow, 250 kW (71 ton) Capacity, 50 and 60 Hz
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**Technical Support Site**

If you encounter any installation or operational issues with your product, check the pertinent section of this manual to see if the issue can be resolved by following outlined procedures. Visit [https://www.VertivCo.com/en-us/support/](https://www.VertivCo.com/en-us/support/) for additional assistance.
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1 IMPORTANT SAFETY INSTRUCTIONS

SAVE THESE INSTRUCTIONS

This manual contains important safety instructions that should be followed during the installation and maintenance of the Liebert® DSE. Read this manual thoroughly before attempting to install or operate this unit.

Only qualified personnel should move, install or service this equipment. Adhere to all warnings, cautions, notices and installation, operating and safety instructions on the unit and in this manual. Follow all installation, operation and maintenance instructions and all applicable national and local building, electrical and plumbing codes.

WARNING! Arc flash and electric shock hazard. Open all local and remote electric power-supply disconnect switches, verify with a voltmeter that power is Off and wear appropriate, OSHA-approved personal protective equipment (PPE) per NFPA 70E before working within the electric control enclosure. Failure to comply can cause serious injury or death. Customer must provide earth ground to unit, per NEC, CEC and local codes, as applicable. Before proceeding with installation, read all instructions, verify that all the parts are included and check the nameplate to be sure the voltage matches available utility power. The Liebert® controller does not isolate power from the unit, even in the “Unit Off” mode. Some internal components require and receive power even during the “Unit Off” mode of the controller. The factory-supplied disconnect switch is inside the unit. The line side of this switch contains live high-voltage. The only way to ensure that there is NO voltage inside the unit is to install and open a remote disconnect switch. Refer to unit electrical schematic. Follow all local codes.

WARNING! Risk of electric shock. Can cause serious injury or death. Open all local and remote electric power supply disconnect switches and verify with a voltmeter that power is off before working within the component electric-connection enclosures. Fan-motor controls can maintain an electric charge for 10 minutes after power is disconnected. Wait 10 minutes after power is verified as off before working within the VFD electric control/connection enclosures.

WARNING! Risk of over-pressurization of the refrigeration system. Can cause explosive discharge of high-pressure refrigerant, loss of refrigerant, environmental pollution, equipment damage, injury, or death. This unit contains fluids and gases under high pressure. Use extreme caution when charging the refrigerant system. Do not pressurize the system higher than the design pressure marked on the unit’s nameplate. For systems requiring EU CE compliance (50 Hz), the system installer must provide and install a pressure relief valve in the high side refrigerant circuit that is rated same as the refrigerant high side “Max Allowable Pressure” rating that is marked on the unit serial tag. Do not install a shutoff valve between the compressor and the field installed relief valve. The pressure relief valve must be CE-certified to the EU Pressure Equipment Directive by an EU “Notified Body.”

WARNING! Risk of very heavy 125-lb (56.7-kg) fan modules dropping downward suddenly. Can cause injury or death. Support fan modules before removing mounting hardware. Use caution to keep body parts out of the fan modules pathway during repositioning. Only properly trained and qualified personnel should work on this equipment.
WARNING! Risk of improper moving. Can cause equipment damage, injury or death. Use only lifting equipment that is rated for the unit weight by an OSHA-certified rating organization. The center of gravity varies depending on the unit size and selected options. The slings must be equally spaced on either side of the center of gravity indicator. Unit weights are listed in Shipping Dimensions and Unit Weights on page 21. Use the center of gravity indicators on the unit to determine the position of the slings.

WARNING! Risk of contact with high-speed rotating fan blades. Can cause serious injury or death. Open all local and remote electric power-supply disconnect switches, verify with a voltmeter that power is off, and verify that all fan blades have stopped rotating before working in the unit cabinet or on the fan assembly. If control voltage is applied, the fan motor can restart without warning after a power failure.

WARNING! Risk of improper wiring, piping, moving, lifting and handling. Can cause equipment damage, serious injury or death. Installation and service of this equipment should be done only by qualified personnel who have been specially-trained in the installation of air-conditioning equipment and who are wearing appropriate, OSHA-approved PPE.

WARNING! Risk of improper wire sizing/rating and loose electrical connections. Can cause overheated wire and electrical connection terminals resulting in smoke, fire, equipment and building damage, injury or death. Use correctly sized copper wire only and verify that all electrical connections are tight before turning power On. Check all electrical connections periodically and tighten as necessary.

CAUTION: Risk of contact with sharp edges, splinters, and exposed fasteners. Can cause injury. Only properly trained and qualified personnel wearing appropriate, OSHA-approved PPE should attempt to move, lift, remove packaging from or prepare the unit for installation.

CAUTION: Risk of contact with hot surfaces. Can cause injury. The compressor, refrigerant discharge lines, fan motor, and some electrical components are extremely hot during unit operation. Allow sufficient time for them to cool to a touch-safe temperature before working within the unit cabinet. Use extreme caution and wear appropriate, OSHA-approved PPE when working on or near hot components.

CAUTION: Risk of handling heavy and lengthy parts. Can cause personal injury and equipment damage. Cabinet panels can exceed 5 ft. (1.5 m) in length and weigh more than 35 lb. (15.9 kg). Follow relevant OSHA lifting recommendations and consider using a two-person lift for safe and comfortable removal and installation of cabinet panels. Only properly trained and qualified personnel wearing appropriate, OSHA-approved PPE should attempt to remove or install cabinet panels.
CAUTION: Risk of improper moving, lifting and handling. Can cause equipment damage or injury. Only properly trained and qualified personnel should work on this equipment. Use proper lifting techniques and wear appropriate, OSHA-approved PPE to avoid injury and dropping the fan module during removal. Equipment used in handling/lifting, and/or installing the fan assembly must meet OSHA requirements. Use handling/lifting equipment rated for the weight of the fan assembly. Use ladders rated for the weight of the fan assembly and technicians if used during installation. Refer to handling/lifting, and/or installation equipment operating manual for manufacturer’s safety requirements and operating procedures.

CAUTION: Risk of exposure to harmful noise levels. Can cause hearing injury or loss. Depending on the installation and operating conditions, a sound pressure level greater than 70 dB(A) may arise. Take appropriate technical safety measures. Operating personnel must wear appropriate, OSHA-approved PPE and observe all appropriate hearing-protection safety requirements.

NOTICE
Risk of improper power-supply connection. Can cause equipment damage and loss of warranty coverage.

Prior to connecting any equipment to a main or alternate power source (for example: back-up generator systems) for start-up, commissioning, testing, or normal operation, ensure that these sources are correctly adjusted to the nameplate voltage and frequency of all equipment to be connected. In general, power-source voltages should be stabilized and regulated to within ±10% of the load nameplate nominal voltage. Also, ensure that no three-phase sources are single-phased at any time.

NOTICE
Risk of oil contamination with water. Can cause equipment damage.

Liebert® DSE systems require the use of POE (polyolester) oil. POE oil absorbs water at a much faster rate when exposed to air than previously used oils. Because water is the enemy of a reliable refrigeration system, extreme care must be used when opening systems during installation or service. If water is absorbed into the POE oil, it will not be easily removed and will not be removed through the normal evacuation process. If the oil is too wet, it may require an oil change. POE oils also have a property that makes them act as a solvent in a refrigeration system. Maintaining system cleanliness is extremely important because the oil will tend to bring any foreign matter back to the compressor.

NOTICE
Risk of improper refrigerant charging. Can cause equipment damage.

Refrigerant charge must be weighed into air-cooled compressorized systems before they are started. Starting digital scroll compressors without proper refrigerant charging can cause the compressors to operate at less than 5°F (–15°C) evaporator temperature and at less than 52 psig (358 kPa). Operation for extended periods at less than 52 psig (358 kPa) can cause premature compressor failure.
NOTICE

Risk of clogged or leaking drain lines and leaking water-supply lines. Can cause equipment and building damage.

This unit requires a water drain connection. Drain lines must be inspected at start-up and periodically, and maintenance must be performed to ensure that drain water runs freely through the drain system and that lines are clear and free of obstructions and in good condition with no visible sign of damage or leaks. This unit may also require an external water supply to operate.

Improper installation, application and service practices can result in water leakage from the unit. Water leakage can result in catastrophic and expensive building and equipment damage and loss of critical data center equipment.

Do not locate unit directly above any equipment that could sustain water damage.

We recommend installing a monitored fluid-detection system to immediately discover and report coolant-fluid system and condensate drain-line leaks.

NOTICE

Do not install an external trap in the drain line. This line already has a factory-installed trap inside the cabinet. Installation of a second trap will prevent drain-water flow and will cause the water to overflow the drain pan. Sagging condensate drain lines may inadvertently cause an external trap.

NOTICE

Risk of doorway/hallway interference. Can cause unit and/or structure damage. The unit may be too large to fit through a doorway or hallway while on the skid. Measure the unit and passageway dimensions, and refer to the installation plans prior to moving the unit to verify clearances.

NOTICE

Risk of damage from forklift. Can cause unit damage. Keep tines of the forklift level and at a height suitable to fit below the skid and/or unit to prevent exterior and/or underside damage.

NOTICE

Risk of improper storage. Can cause unit damage.

Keep the unit upright, indoors and protected from dampness, freezing temperatures and contact damage.

NOTE: The Liebert® indoor cooling unit has a factory-installed, high-pressure safety switch in the high-side refrigerant circuit. Each refrigerant receiver contains a fusible plug for fire-safety purposes. Consult your local building code to determine whether the refrigerant piping will require additional, field-provided pressure-relief devices.
NOTICE TO EUROPEAN UNION CUSTOMERS: DISPOSAL OF OLD APPLIANCES—This product uses components that are dangerous for the environment, such as electronic cards and other electronic components. Any component that is removed must be take to specialized collection and disposal centers. If this unit must be dismantled, this must be done by a specialized center for collection and disposal of electric and electrical appliances or other dangerous substances.

This product has been supplied from an environmentally aware manufacturer that complies with the Waste Electrical and Electronic Equipment (WEEE) Directive 2012/19/CE.

The “crossed-out wheelie bin” symbol is placed on this product to encourage you to recycle wherever possible. Please be environmentally responsible and recycle this product through your recycling facility at its end of life. Do not dispose of this product as unsorted municipal waste. Follow local municipal waste ordinances for proper disposal provisions to reduce the environmental impact of waste electrical and electronic equipment (WEEE).

For information regarding the scrapping of this equipment, please browse [www.VertivCo.com](http://www.VertivCo.com) or call our worldwide technical support.

- Toll Free: 00 80011554499
- Toll Number Based in Italy: +39 0298250222
2 NOMENCLATURE AND COMPONENTS

This section describes the model-number configuration for Liebert® DSE units and components.

2.1 Liebert DSE Model-number Nomenclature

2.1 above describes each digit of the model number.

Table 2.1 DSE Model Number

<table>
<thead>
<tr>
<th>Model Number Digits 1 to 10</th>
<th>Model Details</th>
<th>Model Number Digits 11 to 14</th>
</tr>
</thead>
<tbody>
<tr>
<td>1  2  3  4  5  6  7  8  9  10</td>
<td>11 12 13 14 15 16 17 18 19 20 21</td>
<td>22 23 24 25</td>
</tr>
<tr>
<td>D  A  2  5  0  D  P  3  A  T</td>
<td>0  2  0  8  1  1  L  O  B  D  P</td>
<td>1  2  3  S</td>
</tr>
</tbody>
</table>

Table 2.2 DSE Model-number Digit Definitions

<table>
<thead>
<tr>
<th>Digit</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Digits 1 and 2 = Product Family</td>
<td></td>
</tr>
<tr>
<td>DA = Liebert® DSE</td>
<td></td>
</tr>
<tr>
<td>Digit 3, 4, 5 = Nominal Cooling Capacity, kW</td>
<td></td>
</tr>
<tr>
<td>250 = 250 kW</td>
<td></td>
</tr>
<tr>
<td>Digit 6 = Air Discharge</td>
<td></td>
</tr>
<tr>
<td>D = Downflow, bottom discharge</td>
<td></td>
</tr>
<tr>
<td>H = Downflow, horizontal discharge</td>
<td></td>
</tr>
<tr>
<td>Digit 7 = System Type</td>
<td></td>
</tr>
<tr>
<td>P = Air-cooled, Econ-O-Phase ready</td>
<td></td>
</tr>
<tr>
<td>Digit 8 = Air-flow (Fan Type)</td>
<td></td>
</tr>
<tr>
<td>3 = Direct-drive + VFD (plenum)</td>
<td></td>
</tr>
<tr>
<td>Digit 9 = Voltage</td>
<td></td>
</tr>
<tr>
<td>A = 460 V - 3 ph - 60 Hz</td>
<td></td>
</tr>
<tr>
<td>B = 575 V - 3 ph - 60 Hz</td>
<td></td>
</tr>
<tr>
<td>G = 415 V - 3 ph - 50 Hz</td>
<td></td>
</tr>
<tr>
<td>*For applications that require less than 400 V/3 ph/50 Hz, please consult your local sales office for assistance.</td>
<td></td>
</tr>
<tr>
<td>Digit 10 = Cooling System</td>
<td></td>
</tr>
<tr>
<td>T = Tandem with digital scroll, R-410A</td>
<td></td>
</tr>
<tr>
<td>P = Tandem with digital scroll, R-410A with Power Factor Correction</td>
<td></td>
</tr>
<tr>
<td>Digit 11 = Humidifier</td>
<td></td>
</tr>
<tr>
<td>0 = No humidifier</td>
<td></td>
</tr>
<tr>
<td>Digit 12 = Display</td>
<td></td>
</tr>
<tr>
<td>2 = iCOM (High Definition)</td>
<td></td>
</tr>
<tr>
<td>Digit 13 = Reheat</td>
<td></td>
</tr>
<tr>
<td>0 = None</td>
<td></td>
</tr>
</tbody>
</table>
### Table 2.2  DSE Model-number Digit Definitions (continued)

<table>
<thead>
<tr>
<th>Digit</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Digit 14</strong> = Air Filter</td>
<td></td>
</tr>
<tr>
<td>8 = MERV 8, 4-in.</td>
<td></td>
</tr>
<tr>
<td>9 = MERV 11, 4-in.</td>
<td></td>
</tr>
<tr>
<td><strong>Digit 15</strong> = Coil Option</td>
<td></td>
</tr>
<tr>
<td>1 = Non-coated coil, indoor unit</td>
<td></td>
</tr>
<tr>
<td>2 = Coated coil, indoor unit</td>
<td></td>
</tr>
<tr>
<td><strong>Digit 16</strong> = Enclosure Option</td>
<td></td>
</tr>
<tr>
<td>1 = Color standard</td>
<td></td>
</tr>
<tr>
<td>2 = Color optional</td>
<td></td>
</tr>
<tr>
<td><strong>Digit 17</strong> = High-voltage option</td>
<td></td>
</tr>
<tr>
<td>L = Locking disconnect</td>
<td></td>
</tr>
<tr>
<td>5 = Locking disconnect, with condensate pump</td>
<td></td>
</tr>
<tr>
<td>S = Dual locking disconnect with reversing starter and condenser sub-feed</td>
<td></td>
</tr>
<tr>
<td>9 = Dual locking disconnect with reversing starter with condensate-pump and condenser sub-feed</td>
<td></td>
</tr>
<tr>
<td><strong>Digit 18</strong> = Option packages</td>
<td></td>
</tr>
<tr>
<td>0 = None</td>
<td></td>
</tr>
<tr>
<td>L = Option package #1 - low-voltage terminal package</td>
<td></td>
</tr>
<tr>
<td>R = Remote humidifier contact</td>
<td></td>
</tr>
<tr>
<td><strong>Digit 19</strong> = Monitoring</td>
<td></td>
</tr>
<tr>
<td>B = Base comms and connectivity</td>
<td></td>
</tr>
<tr>
<td><strong>Digit 20</strong> = Sensors</td>
<td></td>
</tr>
<tr>
<td>0 = None</td>
<td></td>
</tr>
<tr>
<td>H = High-temperature sensor</td>
<td></td>
</tr>
<tr>
<td>C = Compressor-overload sensors</td>
<td></td>
</tr>
<tr>
<td>A = Compressor, high-temperature sensors</td>
<td></td>
</tr>
<tr>
<td><strong>Digit 21</strong> = Packaging</td>
<td></td>
</tr>
<tr>
<td>P = Domestic</td>
<td></td>
</tr>
<tr>
<td>C = Export</td>
<td></td>
</tr>
<tr>
<td><strong>Digit 22-24</strong> = Factory Configuration Number</td>
<td></td>
</tr>
<tr>
<td><strong>Digit 25</strong> = Configuration Code</td>
<td></td>
</tr>
<tr>
<td>A = 1</td>
<td></td>
</tr>
<tr>
<td>S = Special-feature authorization (SFA). A non-standard configuration or feature of the product that requires the local factory representative to work directly with the factory.</td>
<td></td>
</tr>
</tbody>
</table>
2.2 Component Location

The unit component locations are described in the submittal documents included in the Submittal Drawings on page 67.

The following table lists the relevant documents by number and title.

<table>
<thead>
<tr>
<th>Document Number</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>DPN004368</td>
<td>Component Location, Typical, Downflow, Horizontal-discharge Models, DA250</td>
</tr>
<tr>
<td>DPN004258</td>
<td>Component Location, Typical, MCV440 (8-fan)</td>
</tr>
<tr>
<td>DPN004260</td>
<td>Component Location, Typical, MCV440 (16-fan)</td>
</tr>
</tbody>
</table>
2.3 Blower Configurations

Figure 2.1 Downflow, horizontal-discharge blower configurations with EC fans
Figure 2.2  Downflow, bottom-discharge blower configurations with EC fans
3 SYSTEM DATA

3.1 Capacity and Performance Data

Table 3.1  Capacity data for 60-Hz, Downflow, horizontal-discharge models

<table>
<thead>
<tr>
<th>Air-side ΔT</th>
<th>Supply-air Temperature °F</th>
<th>Supply-air Temperature °C</th>
<th>Return-air Temperature °F</th>
<th>Return-air Temperature °C</th>
<th>Outdoor Temperature °F</th>
<th>Outdoor Temperature °C</th>
<th>Air flow CFM</th>
<th>Net Sensible Capacity kBtu/hr</th>
<th>Input Power kW</th>
<th>SCOP</th>
</tr>
</thead>
<tbody>
<tr>
<td>20</td>
<td>70</td>
<td>21</td>
<td>90</td>
<td>32</td>
<td>95</td>
<td>35</td>
<td>40,500</td>
<td>68,810</td>
<td>248.4</td>
<td>848</td>
</tr>
<tr>
<td></td>
<td>74</td>
<td>23</td>
<td>94</td>
<td>34</td>
<td>95</td>
<td>35</td>
<td>43,000</td>
<td>73,057</td>
<td>259.7</td>
<td>886</td>
</tr>
<tr>
<td>25</td>
<td>70</td>
<td>21</td>
<td>95</td>
<td>35</td>
<td>95</td>
<td>35</td>
<td>34,000</td>
<td>57,766</td>
<td>258.5</td>
<td>882</td>
</tr>
<tr>
<td></td>
<td>74</td>
<td>23</td>
<td>99</td>
<td>37</td>
<td>95</td>
<td>35</td>
<td>36,000</td>
<td>61,164</td>
<td>272</td>
<td>928</td>
</tr>
</tbody>
</table>

1. Total Cooling Capacity is not shown because the DA250 is 100% sensible.
2. Capacity data is rated and factory certified per ASHRAE 127-2007 with a 5% tolerance.
3. For downflow, bottom-discharge options, consult the factory.
4. Quantity of Fans is 3, External Static pressure 0.1 in. and Dewpoint of 52.3°F.
5. For return-air temperatures outside the range shown, please consult factory.
6. Maximum air-flow calibration voltage must be adjusted based on the required air flow. See Table 3.4 on the next page, for values.

Table 3.2  Capacity data for 50-Hz, Downflow, horizontal-discharge models

<table>
<thead>
<tr>
<th>Air-side ΔT</th>
<th>Supply-air Temperature °F</th>
<th>Supply-air Temperature °C</th>
<th>Return-air Temperature °F</th>
<th>Return-air Temperature °C</th>
<th>Outdoor Temperature °F</th>
<th>Outdoor Temperature °C</th>
<th>Air flow CFM</th>
<th>Net Sensible Capacity kBtu/hr</th>
<th>Input Power kW</th>
<th>SCOP</th>
</tr>
</thead>
<tbody>
<tr>
<td>20</td>
<td>70</td>
<td>21</td>
<td>90</td>
<td>32</td>
<td>95</td>
<td>35</td>
<td>36,000</td>
<td>61,165</td>
<td>220</td>
<td>751</td>
</tr>
<tr>
<td></td>
<td>74</td>
<td>23</td>
<td>94</td>
<td>34</td>
<td>95</td>
<td>35</td>
<td>38,000</td>
<td>64,560</td>
<td>231</td>
<td>788</td>
</tr>
<tr>
<td>25</td>
<td>70</td>
<td>21</td>
<td>95</td>
<td>35</td>
<td>95</td>
<td>35</td>
<td>30,600</td>
<td>52,000</td>
<td>232</td>
<td>792</td>
</tr>
<tr>
<td></td>
<td>74</td>
<td>23</td>
<td>99</td>
<td>37</td>
<td>95</td>
<td>35</td>
<td>32,500</td>
<td>55,225</td>
<td>243</td>
<td>829</td>
</tr>
</tbody>
</table>

1. Total Cooling Capacity is not shown because the DA250 is 100% sensible.
2. Capacity data is rated and factory certified per ASHRAE 127-2007 with a 5% tolerance.
3. For downflow, bottom-discharge options, consult the factory.
4. Quantity of Fans is 3, External Static pressure 0.1 in. and Dewpoint of 52.3°F.
5. For return-air temperatures outside the range shown, please consult factory.
6. Maximum air-flow calibration voltage must be adjusted based on the required air flow. See Table 3.4 on the next page, for values.
3.2 Physical Data

### Table 3.3 Physical data for 60/50-Hz models

<table>
<thead>
<tr>
<th>Model Size</th>
<th>DA250, Downflow, Horizontal Discharge</th>
</tr>
</thead>
<tbody>
<tr>
<td>EVAPORATOR COIL - Copper Tube/Aluminum Fin</td>
<td></td>
</tr>
<tr>
<td>Face Area, sq. ft. (sq. m)</td>
<td>67.5 (6.27)</td>
</tr>
<tr>
<td>Rows of Coil</td>
<td>4</td>
</tr>
<tr>
<td>Face Velocity, FPM (m/s), Std. Air Volume</td>
<td></td>
</tr>
<tr>
<td>520 ft/min (158.5 m/s) based on 35,000 CFM (5946 CMH)</td>
<td></td>
</tr>
<tr>
<td>540 ft/min (165 m/s) based on 36,500 CFM (62,013 CMH)</td>
<td></td>
</tr>
<tr>
<td>622 ft/min (189 m/s) based on 42,000 CFM (71,358 CMH)</td>
<td></td>
</tr>
<tr>
<td>FILTER SECTION - Disposable Type - Nominal Sizes and Quantities</td>
<td></td>
</tr>
<tr>
<td>Nominal Size, inches</td>
<td>28 x 22 x 4</td>
</tr>
<tr>
<td>Quantity</td>
<td>15</td>
</tr>
<tr>
<td>UNIT PIPING CONNECTION SIZES (not external line sizes)</td>
<td></td>
</tr>
<tr>
<td>Condensate Drain w/opt Condensate Pump, OD</td>
<td>1/2-in. O.D. Cu</td>
</tr>
<tr>
<td>Condensate Drain, FTP</td>
<td>3/4 in.</td>
</tr>
<tr>
<td>Liquid Line, O.D. Cu</td>
<td>1-3/8 in. O.D. Cu</td>
</tr>
<tr>
<td>Hot Gas Line, O.D. Cu</td>
<td>1-5/8 in. O.D. Cu</td>
</tr>
</tbody>
</table>

### Table 3.4 Air-flow Calibration Voltage

<table>
<thead>
<tr>
<th>Air flow* at 0.1 in. (25 Pa) ESP</th>
<th>Air-flow calibration voltage</th>
</tr>
</thead>
<tbody>
<tr>
<td>CFM</td>
<td>CMH</td>
</tr>
<tr>
<td>25,000</td>
<td>42480</td>
</tr>
<tr>
<td>26,000</td>
<td>44179</td>
</tr>
<tr>
<td>27,000</td>
<td>45878</td>
</tr>
<tr>
<td>28,000</td>
<td>47578</td>
</tr>
<tr>
<td>29,000</td>
<td>49277</td>
</tr>
<tr>
<td>30,000</td>
<td>50976</td>
</tr>
<tr>
<td>31,000</td>
<td>52675</td>
</tr>
<tr>
<td>32,000</td>
<td>54374</td>
</tr>
<tr>
<td>33,000</td>
<td>56074</td>
</tr>
<tr>
<td>34,000</td>
<td>57773</td>
</tr>
<tr>
<td>35,000</td>
<td>59472</td>
</tr>
<tr>
<td>36,000</td>
<td>61171</td>
</tr>
<tr>
<td>37,000</td>
<td>62870</td>
</tr>
<tr>
<td>38,000</td>
<td>64570</td>
</tr>
<tr>
<td>39,000</td>
<td>66269</td>
</tr>
<tr>
<td>Air flow* at 0.1 in. (25 Pa) ESP</td>
<td>Air-flow calibration voltage</td>
</tr>
<tr>
<td>---------------------------------</td>
<td>-----------------------------</td>
</tr>
<tr>
<td>CFM</td>
<td>CMH</td>
</tr>
<tr>
<td>40,000</td>
<td>67968</td>
</tr>
<tr>
<td>41,000</td>
<td>69667</td>
</tr>
<tr>
<td>42,000</td>
<td>71366</td>
</tr>
<tr>
<td>43,000</td>
<td>73066</td>
</tr>
<tr>
<td>44,000</td>
<td>74765</td>
</tr>
</tbody>
</table>

*Maximum air-flow calibration voltage must be adjusted based on the required air flow.
4 PLANNING GUIDELINES

4.1 Shipping Dimensions and Unit Weights

Table 4.1 Downflow unit domestic and export shipping dimensions and weights

<table>
<thead>
<tr>
<th>Model #</th>
<th>Domestic Packaging</th>
<th>Export Packaging</th>
<th>Dry Weight, lb (kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Ship Weight, lb (kg)</td>
<td>Shipping Dimensions, in. (mm)</td>
<td>Ship Weight, lb (kg)</td>
</tr>
<tr>
<td>DA250</td>
<td>6160 (2794)</td>
<td>90 x 128 x 97 (2286 x 3251 x 2464)</td>
<td>6540 (2966)</td>
</tr>
<tr>
<td>Fan section</td>
<td>3000 (1361)</td>
<td>90 x 128 x 54 (2286 x 3251 x 1372)</td>
<td>3370 (1528)</td>
</tr>
</tbody>
</table>

Table 4.2 MCV Condenser unit domestic and export shipping dimensions and weights

<table>
<thead>
<tr>
<th>Model #</th>
<th>Domestic Packaging</th>
<th>Export Packaging</th>
<th>Dry Weight, lb (kg)</th>
<th>Max. Operation Weight, lb (kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Ship Weight, lb (kg)</td>
<td>Shipping dimensions, ft (mm)</td>
<td>Ship Weight, lb (kg)</td>
<td>Shipping dimensions, ft (mm)</td>
</tr>
<tr>
<td>MCV440 (single skid)</td>
<td>5900 (2676)</td>
<td>8 ft 6 in. x 14 ft 6 in. x 9 ft 6 in. (2591 x 4420 x 2896)</td>
<td>6200 (2812)</td>
<td>9 ft 5 in. x 14 ft 9 in. x 9 ft 6 in. (2870 x 4496 x 2896)</td>
</tr>
<tr>
<td>MCV440 (dual skid)</td>
<td>11,800 (5352)</td>
<td>8 ft 6 in. x 29 ft x 9 ft 6 in. (2591 x 8839 x 2896)</td>
<td>12,300 (5579)</td>
<td>9 ft 5 in. x 29 ft 4 in. x 9 ft 6 in. (2870 x 8941 x 2896)</td>
</tr>
</tbody>
</table>

4.2 Planning Dimensions

The unit, floor stand, and plenum dimensions are described in the submittal documents included in the Submittal Drawings on page 67.

The following table lists the relevant documents by number and title.

Table 4.3 Dimension Planning Drawings

<table>
<thead>
<tr>
<th>Document Number</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>DPN004366</td>
<td>Cabinet and Plenum Dimensional Data, DA250 Downflow, Horizontal Discharge</td>
</tr>
<tr>
<td>DPN004516</td>
<td>Cabinet and Plenum Dimensional Data, DA250 Downflow, Bottom Discharge</td>
</tr>
<tr>
<td>DPN004514</td>
<td>Installation and Service Clearance Data, DA250 Downflow, Horizontal and Bottom Discharge</td>
</tr>
<tr>
<td>DPN004581</td>
<td>Floor planning dimensional data for adjacent DA250 units</td>
</tr>
<tr>
<td>DPN004511</td>
<td>Floorstand Dimensional Data, DA250</td>
</tr>
<tr>
<td>DPN004367</td>
<td>Cabinet and Plenum Airflow Schematic, DA250 Downflow, Horizontal Discharge</td>
</tr>
<tr>
<td>DPN004557</td>
<td>Cabinet and Plenum Airflow Schematic, DA250 Downflow, Bottom Discharge</td>
</tr>
</tbody>
</table>
This page intentionally left blank
5 PRE-INSTALLATION PREPARATION AND GUIDELINES

NOTE: Before installing unit, determine whether any building alterations are required to run piping, wiring and ductwork. Follow all unit dimensional drawings and refer to the submittal engineering dimensional drawings of individual units for proper clearances.

Refer to Table 22 on page 11, and submittal drawings to determine the type of system being installed and anticipate building alterations, piping and ductwork needed.

The unit dimensions, pipe-connection locations, and piping schematics are described in the submittal documents included in the Submittal Drawings on page 67.

- Verify that the floor is level, solid and sufficient to support the unit. See Shipping Dimensions and Unit Weights on page 21 for unit weights.
- Confirm that the room is properly insulated and has a sealed vapor barrier.
- For proper humidity control, keep outside or fresh air to an absolute minimum (less than 5% of total air circulated in the room).
- Do not install a Liebert® DSE in an alcove or at the end of a long, narrow room.
- Install the units as close as possible to the largest heat load.
- Allow at least the minimum recommended clearances for maintenance and service. See the appropriate submittal drawings for dimensions.

We recommend installing an under-floor water detection system. Contact your Vertiv representative for information.

5.1 Planning Dimensions

The indoor and heat-rejection unit dimensions are described in the submittal documents included in the Submittal Drawings on page 67.

5.2 Connections and System Setup

- The unit requires a drain, which must comply with all applicable codes. This drain line may contain boiling water. See Field-installed, Gravity-fed Drain Line Requirements on page 38, for details.
- If seismic requirements apply, consult your Vertiv representative for information about a seismic-rated floor stand.

NOTE: Seal openings around electrical connection to prevent air leakage. Failure to do so could reduce the unit’s cooling performance.

The DSE controls superheat with an electronic expansion valve (EEV). The EEV controller adjusts the orifice based on suction pressure and temperature. The EEV control will drive the valve to maintain the superheat setpoint, set in the Liebert® iCOM, using a Proportional, Integral, Derivative (PID) routine. The PID control values are set at the factory for most applications. These default values PID will allow stable superheat control of the unit.

5.3 Operating Conditions

The Liebert® DSE must be operated in a conditioned space within the operating envelope that ASHRAE recommends for data centers. Operating the DSE outside of this envelope can decrease equipment reliability. Refer to ASHRAE’s publication, “Thermal Guidelines for Data Processing Environments.”

The recommended maximum for return-air temperature is 105°F (40°C) and maximum dew point is 59°F (15°C). The recommended minimum return-air temperature setpoint for the DSE is 85°F (29.4°C).

5.3.1 Humidification Control

The humidifier option is not available on the DA250. A remote humidifier contact is available for a stand-alone humidifier.
6 EQUIPMENT INSPECTION AND HANDLING

SAFETY INFORMATION

WARNING! Risk of top-heavy unit falling over. Improper handling can cause equipment damage, injury or death. Read all of the following instructions and verify that all lifting and moving equipment is rated for the weight of the unit before attempting to move, lift, remove packaging from or prepare the unit for installation. Unit weights are specified in Shipping Dimensions and Unit Weights on page 21.

CAUTION: Risk of contact with sharp edges, splinters, and exposed fasteners. Can cause injury. Only properly trained and qualified personnel wearing appropriate, OSHA-approved PPE should attempt to move, lift, remove packaging from or prepare the unit for installation.

NOTICE
Risk of passageway interference. Can cause unit and/or structure damage. The unit may be too large to fit through a passageway while on or off the skid. Measure the unit and passageway dimensions, and refer to the installation plans prior to moving the unit to verify clearances.

NOTICE
Risk of damage from forklift. Can cause unit damage. Keep tines of the forklift level and at a height suitable to fit below the skid and/or unit to prevent exterior and/or underside damage.

NOTICE
Risk of improper storage. Keep the unit upright, indoors and protected from dampness, freezing temperatures and contact damage.

Upon arrival of the unit and before unpacking:
- Verify that the labeled equipment matches the bill of lading.
- Carefully inspect all items for visible or concealed damage.
- Report damage immediately to the carrier and file a damage claim with a copy sent to Vertiv or to your sales representative.

Equipment Recommended for Handling the Unit:
- Forklift
- Slings
- Spreader bars
- Beam trolleys
- Chain hoists
- Gantries

6.1 Packaging Material

All material used to package this unit is recyclable. Please save for future use or dispose of the material appropriately.
6.2 Handling the Unit while Packaged

If possible, transport the unit with a forklift

When using a forklift:

- Make sure that the lift has adjustable forks, and are spread to the widest allowable distance to still fit under the skid.
- Make sure that the fork length is suitable for the skid length. Skid length is 128 in. (3251 mm).
- If the unit must be lifted higher than 2 in. (51 mm) to 4 in. (102 mm), all personnel not directly involved in moving the unit must be 20 ft (5 m) or farther from the unit.
- Always refer to the location of the center-of-gravity indicators when lifting the unit, see Figure 6.1 below.

Figure 6.1 Center-of-gravity indicator

![Center-of-gravity indicator](image-url)
6.3 Unpacking the Unit

NOTE: The bag may remain in place to protect from dust and to protect the unit panels, or it may be removed for immediate installation.

1. Remove the bag from the unit when ready to remove the skid and install the unit.

Figure 6.2 Unpacking the Unit

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Remove exterior wrap from unit</td>
</tr>
<tr>
<td>2</td>
<td>Remove corner and side packaging planks</td>
</tr>
<tr>
<td>3</td>
<td>Leave the bag on the unit until ready to install</td>
</tr>
</tbody>
</table>
6.4 Removing the Unit from the Skid

NOTE: If you do not follow these steps, damage could occur to the panels and/or base of the unit.

1. Referring to Figure 6.3 below, use a 9/16-in. socket driver to remove the lag screws (24 total) from the 4 corner brackets to detach the unit from the skid.

Figure 6.3 Remove corner bracket
2. Open the door indicated in Figure 6.4 below, and locate the rigging-fastener kit that is secured to the bottom base inside the door.

3. Using the instructions included in the kit, install the rigging hardware for lifting the unit from the skid. Figure 6.4 below, shows an example of one of the eye nuts installed.

**Figure 6.4 Locate the rigging-fastener hardware kit**
4. Attach the recommended rigging equipment to the eye-nuts installed in Step 3.
5. Using the rigging equipment, lift the unit from the skid, and remove the skid from under the unit, see Figure 6.5 below.

Figure 6.5 Lifting unit and removing skid
6. Use the rigging equipment to move the unit to the final installation location, see Figure 6.6 below.

Figure 6.6 Moving the unit with rigging

6.5 Unpacking and Handling the Fan Section

See the "Instructions Package/Handling Fan Section DA250" document included with the fan section to un-crate and handle the fan section.
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7 ELECTRICAL REQUIREMENTS

7.1 Indoor-unit Electrical Power Requirements

Table 7.1 Electrical Data—DA250

<table>
<thead>
<tr>
<th>Unit Voltage Rating</th>
<th>FLA</th>
<th>WSA</th>
<th>OPD</th>
</tr>
</thead>
<tbody>
<tr>
<td>460 V, 60 Hz</td>
<td>170.6</td>
<td>177.3</td>
<td>200</td>
</tr>
<tr>
<td>575 V, 60 Hz</td>
<td>145.8</td>
<td>151.7</td>
<td>175</td>
</tr>
<tr>
<td>415 V, 50 Hz</td>
<td>169</td>
<td>175.3</td>
<td>200</td>
</tr>
</tbody>
</table>

1. FLA = full-load amps, WSA = wire-size amps, OPD = maximum overcurrent-protection device.
2. Full-load amperage values do not reflect operating amperage values.
3. For 380-V, 50-Hz application, consult the factory for SFA.

See Table 9.3 on page 48, for the heat-rejection electrical data.

Table 7.2 Electrical Data—Single-point Power, DA250 + MCV440 + PRE

<table>
<thead>
<tr>
<th>Unit Voltage Rating</th>
<th>DA250 + MCV440 + PRE</th>
</tr>
</thead>
<tbody>
<tr>
<td>460 V, 60 Hz</td>
<td>193</td>
</tr>
<tr>
<td>575 V, 60 Hz</td>
<td>163.7</td>
</tr>
<tr>
<td>415 V, 50 Hz</td>
<td>197</td>
</tr>
</tbody>
</table>

See Table 9.3 on page 48, for the heat-rejection electrical data.

1. For 380-V, 50-Hz application, consult the factory for SFA.

7.2 Electrical Field Connections

Three-phase electrical service is required for all models. Electrical service must conform to national and local electrical codes. Refer to equipment nameplate regarding wire size and circuit protection requirements. Refer the appropriate submittal drawing, listed in Table 7.3 on the next page, for electrical service entrances into unit.

A manual electrical disconnect switch should be installed in accordance with local codes and distribution system. Consult local codes for external disconnect requirements.
The electrical and unit-to-unit connections are described in the submittal documents included in the Submittal Drawings on page 67.

The following table lists the relevant documents by number and title.

<table>
<thead>
<tr>
<th>Document Number</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>DPN004797</td>
<td>Electrical Field Connections, Downflow, DA250</td>
</tr>
<tr>
<td>DPN003886</td>
<td>CANbus cable connections between indoor unit, Liebert® MCV condenser</td>
</tr>
<tr>
<td>Unit-to-Unit Networking</td>
<td>Liebert® iCOM Unit-to-unit Network Connections</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Document Number</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>DPN004257</td>
<td>Condenser connection data, MCV440, Single skid</td>
</tr>
<tr>
<td>DPN004262</td>
<td>Condenser connection data, MCV440, Dual skid</td>
</tr>
</tbody>
</table>

**WARNING!** Arc flash and electric shock hazard. Open all local and remote electric power-supply disconnect switches, verify with a voltmeter that power is Off and wear appropriate, OSHA-approved personal protective equipment (PPE) per NFPA 70E before working within the electric control enclosure. Failure to comply can cause serious injury or death. Customer must provide earth ground to unit, per NEC, CEC and local codes, as applicable. Before proceeding with installation, read all instructions, verify that all the parts are included and check the nameplate to be sure the voltage matches available utility power. The Liebert® controller does not isolate power from the unit, even in the “Unit Off” mode. Some internal components require and receive power even during the “Unit Off” mode of the controller. The factory-supplied disconnect switch is inside the unit. The line side of this switch contains live high-voltage. The only way to ensure that there is NO voltage inside the unit is to install and open a remote disconnect switch. Refer to unit electrical schematic. Follow all local codes.

**WARNING!** Risk of electric shock. Can cause equipment damage, injury or death. Open all local and remote electric power supply disconnect switches and verify with a voltmeter that power is off before working within any electric connection enclosures. Service and maintenance work must be performed only by properly trained and qualified personnel and in accordance with applicable regulations and manufacturers’ specifications. Opening or removing the covers to any equipment may expose personnel to lethal voltages within the unit even when it is apparently not operating and the input wiring is disconnected from the electrical source.

**WARNING!** Risk of improper wire sizing/rating and loose electrical connections. Can cause overheated wire and electrical connection terminals resulting in smoke, fire, equipment and building damage, injury or death. Use correctly sized copper wire only and verify that all electrical connections are tight before turning power On. Check all electrical connections periodically and tighten as necessary.
WARNING! Risk of wiring damage, short circuits and electric shock. Can cause overheated wiring, smoke, fire, activation of fire suppression systems and EMS personnel and equipment, building and equipment damage, injury or death. Insert CSA certified or UL listed bushings into holes and or knockouts used to route wiring through metal panels to protect the wire insulation from contact with sheet metal edges.

NOTICE
Risk of improper electrical connection of three-phase input power. Can cause backward compressor rotation and unit damage. Service technicians should use a gauge set on the system during the initial start up to verify that the three-phase power is connected properly. Three-phase power must be connected to the unit line voltage terminals in the proper sequence so that the compressors rotate in the proper direction. Incoming power must be properly phased to prevent compressors from running backward. We recommend checking the unit’s phasing with proper instrumentation to ensure that power connections were made correctly. We also recommend verifying discharge and suction pressures during start up to ensure that the compressors are running in the correct direction.

NOTICE
Risk of improper electrical supply connection. Can cause equipment damage. See transformer label for primary tap connections. Installer will need to change transformer primary taps if applied unit voltage is other than pre-wired tap voltage.

NOTE: Seal openings around piping and electrical connection to prevent air leakage. Failure to do so could reduce the unit’s cooling performance.
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8 PIPING AND REFRIGERANT REQUIREMENTS

All fluid and refrigeration connections to the unit are sweat copper. Factory-installed piping brackets must not be removed. Field-installed piping must be installed in accordance with local codes and must be properly assembled, supported, isolated and insulated. Avoid piping runs through noise-sensitive areas, such as office walls and conference rooms.

Refer to specific text and detailed diagrams in this manual for other unit-specific piping requirements.

All piping below the elevated floor must be located so that it offers the least resistance to air flow. Careful planning of the piping layout under the raised floor is required to prevent the air flow from being blocked. When installing piping on the subfloor, we recommend that the pipes be mounted in a horizontal plane rather than stacked one above the other. Whenever possible, the pipes should be run parallel to the air flow.

The following pipe connections are required:

- A drain line from the unit.
- A drain line from the secondary drain pan (if applicable).
- Refrigerant piping connections between the evaporator unit and the MCV440 heat-rejection skid. See Refrigerant Piping and Charging on page 39.

The pipe connection locations, piping general arrangement and schematics are described in the submittal documents included in the Submittal Drawings on page 67.

The following tables list the relevant documents by number and title.

**Table 8.1 Piping General-arrangement Drawings**

<table>
<thead>
<tr>
<th>Document Number</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>DPN004476</td>
<td>Piping Schematic, DA250</td>
</tr>
</tbody>
</table>

**Table 8.2 Piping Connection Drawings**

<table>
<thead>
<tr>
<th>Document Number</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>DPN004208</td>
<td>Connection Locations, DA250</td>
</tr>
</tbody>
</table>

8.1 Drain Fluid Piping

**NOTICE**

Risk of water leakage. Can cause severe property damage and loss of critical data center equipment.

The Liebert® DSE requires a water drain connection. Improper installation, application and service practices can result in water leakage from the unit.

Do not locate the unit directly above any equipment that could sustain water damage.

We recommend installing monitored leak detection equipment for the water supply lines and the internal unit water lines.
8.1.1 Field-installed, Gravity-fed Drain Line Requirements

NOTICE
Risk of water backing up in the drain line. Leaking and overflowing water can cause equipment and building damage.

Do not install an external trap in the drain line. This line already has a factory-installed trap inside the cabinet. Installation of a second trap will prevent drain-water flow and will cause the water to overflow the drain pan.

This line may contain boiling water. Use copper or other material that is rated for handling boiling water for the drain line. Sagging condensate drain lines may inadvertently create an external trap.

Observe the following requirements when installing and routing the drain line:

- The drain line must be sized for 2 gpm (7.6 l/m) flow.
- The drain line must be located so it will not be exposed to freezing temperatures.
- The drain should be the full size of the drain connection.
- The drain line must slope continuously away from the unit. Pitch drain line toward drain a minimum of 1/8 in. (3 mm) per 1 ft (305 mm) of length.
- Drain is trapped internally. Do not externally-trap the drain line.
- The drain line must be rigid enough that it does not sag between supports, which unintentionally creates traps.
- Use copper or other material suitable for draining water that can reach temperatures up to 212°F (100°C).
- The drain line must comply with all applicable codes.
- We recommend installing monitored, under-floor leak-detection equipment.

8.1.2 Condensate-pump Drain Line Requirements

NOTICE
Risk of water backing up in the drain line. Leaking and overflowing water can cause equipment and building damage.

Do not install an external trap in the drain line. This line already has a factory-installed trap inside the cabinet. Installation of a second trap will prevent drain-water flow and will cause the water to overflow the drain pan.

This line may contain boiling water. Use copper or other material that is rated for handling boiling water for the drain line. Sagging condensate drain lines may inadvertently create an external trap.

Observe the following requirements when installing and routing the drain line:

- The drain line must be located so it will not be exposed to freezing temperatures.
- Size the piping based on the available condensate head.
- Drain is trapped internally. Do not externally-trap the drain line.
- The drain line must be rigid enough that it does not sag between supports, which unintentionally creates traps.
- Use copper or other material suitable for draining water that can reach temperatures up to 212°F (100°C).
- We recommend installing monitored, under-floor leak-detection equipment.

Factory-installed Condensate Pump

If your unit includes an optional condensate pump, the pump is factory-installed inside the unit and a 3/4-in. copper sweat connection is provided on the unit.
On 460-V, 60-Hz units, the condensate pump is rated for approximately 390 gph at 30 ft (1476 l/hr at 762 kPa) total head.

On 415-V, 50-Hz units, the condensate pump is rated for approximately 390 gph at 15 ft (1476 l/hr at 381 kPa) total head.

8.2 Refrigerant Piping and Charging

**WARNING!** Risk of over-pressurization of the refrigeration system. Can cause explosive discharge of high-pressure refrigerant, loss of refrigerant, environmental pollution, equipment damage, injury, or death. This unit contains fluids and gases under high pressure. Use extreme caution when charging the refrigerant system. Do not pressurize the system higher than the design pressure marked on the unit’s nameplate. For systems requiring EU CE compliance (50 Hz), the system installer must provide and install a pressure relief valve in the high side refrigerant circuit that is rated same as the refrigerant high side “Max Allowable Pressure” rating that is marked on the unit serial tag. Do not install a shutoff valve between the compressor and the field installed relief valve. The pressure relief valve must be CE-certified to the EU Pressure Equipment Directive by an EU “Notified Body.”

**CAUTION:** Risk of excessive refrigerant line pressure. Can cause tubing and component rupture resulting in equipment damage and personal injury. Do not close off the refrigerant-line isolation valve for repairs unless a pressure-relief valve is field-installed in the line between the isolation valve and the check valve. The pressure-relief valve must be rated 5% to 10% higher than the system-design pressure. An increase in ambient temperature can cause the pressure of the isolated refrigerant to rise and exceed the system-design pressure rating (marked on the unit nameplate).

Consult local building and plumbing codes for installation requirements of additional pressure-relief devices when isolation valves are field installed. Do not isolate any refrigerant circuits from over-pressurization protection.

**NOTICE**

Risk of oil contamination with water. Can cause equipment damage.

Liebert® DSE systems require the use of POE (polyolester) oil. POE oil absorbs water at a much faster rate when exposed to air than previously used oils. Because water is the enemy of a reliable refrigeration system, extreme care must be used when opening systems during installation or service. If water is absorbed into the POE oil, it will not be easily removed and will not be removed through the normal evacuation process. If the oil is too wet, it may require an oil change. POE oils also have a property that makes them act as a solvent in a refrigeration system. Maintaining system cleanliness is extremely important because the oil will tend to bring any foreign matter back to the compressor.

**NOTICE**

Risk of improper refrigerant charging. Can cause equipment damage.

Refrigerant charge must be weighed into air-cooled compressorized systems before they are started. Starting digital scroll compressors without proper refrigerant charging can cause the compressors to operate at less than 5°F (–15°C) evaporator temperature and at less than 52 psig (358 kPa). Operation for extended periods at less than 52 psig (358 kPa) can cause premature compressor failure.
8.2.1 Refrigerant Piping Guidelines for Air-cooled Systems

- Air-cooled units ship with a nitrogen holding charge. Do not vent the evaporator until all refrigerant piping is in place, ready for connection to the unit and condenser.
- Use copper piping with a brazing alloy with a minimum temperature of 1350°F (732°C), such as Sil-Fos. Avoid soft solders, such as 50/50 or 95/5.
- Use a flow of dry nitrogen through the piping during brazing to prevent formation of copper oxide scale inside the piping. When copper is heated in the presence of air, copper oxide forms. POE oils will dissolve these oxides from inside the copper pipes and deposit them throughout the system, clogging filter driers and affecting other system components.
- A pure dry nitrogen flow of 1-3 ft³/min (0.5-1.5 l/s) inside the pipe during brazing is sufficient to displace the air. Control the flow using a suitable measuring device.
- Ensure that the tubing surfaces to be brazed are clean and that all burrs have been removed from the ends of the tubes.
- Ensure that all loose material has been cleaned from inside the tubing before brazing.
- Protect all refrigerant line components within 18 in. (460 mm) of the brazing site by wrapping them with a wet cloth or with a suitable heat-sink compound.
- Isolate piping from building using vibration-isolating supports.
- The outlet of the receivers on the outdoor, MCV440 heat-rejection skid must be higher than the elevation of the electronic-expansion valves (EEV) inside the indoor unit. If the vertical height of the receiver outlet is greater than 60 ft (18.3 m) above the EEV, consult the factory. The MCV440 heat-rejection skid cannot be installed below the evaporator.
- Install traps on hot-gas (discharge) lines at the base of vertical risers over 5 ft (1.5 m) and every 20 ft (6 m) or evenly-divided over the vertical rise. The DA250 has internally-installed traps on the hot-gas lines.
- Pitch horizontal hot-gas piping down at a minimum rate of 1/2 in. per 10 ft (42 mm per 10 m) so that gravity will aid in moving oil in the direction of refrigerant/oil flow.
- Consult factory if piping run exceeds 200 ft (61 m) linear length or 300 ft (91 m) equivalent length.
- Keep piping clean and dry, especially on units with R-410A refrigerant.
- Avoid piping runs through noise-sensitive areas.
- Do not run piping directly in front of discharge air stream.
- Refrigerant oil – do not mix oil types (see Compressor Oil on page 57).

Refer to ASHRAE Refrigeration Handbook for general, good-practice refrigeration piping. The indoor cooling unit has a factory-installed high-pressure safety switch in the high side refrigerant circuit. A fusible plug kit is installed in each Liebert® DSE receiver.

**NOTE:** All indoor and outdoor field refrigerant piping must be insulated 1/2 in. minimum. All outdoor insulation must be UV and ozone resistant.

- Refer to Refrigerant Line Sizes and Equivalent Lengths on the facing page, for recommended refrigerant piping sizes based on equivalent pipe lengths.
- Refer to Refrigerant Charge Requirements for Air-cooled Systems on the facing page, for the refrigerant-charge requirements of the system.
- Refer to Charging Air-cooled Systems on page 44, for charging information.

8.2.2 Piping Layout and Condenser Positioning

The piping layout and condenser positioning is detailed in the submittal documents included in the Submittal Drawings on page 67.

The following table lists the relevant documents by number and title.

<table>
<thead>
<tr>
<th>Document Number</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>DPN003965</td>
<td>Mounting the MCV Condenser/EconoPhase Above or at Same Level as DSE</td>
</tr>
</tbody>
</table>
8.2.3 Refrigerant Line Sizes and Equivalent Lengths

Table 8.4 Recommended Refrigerant Line Sizes, OD Copper

<table>
<thead>
<tr>
<th>Model</th>
<th>Equivalent Length</th>
<th>Hot Gas Line, in.</th>
<th>Liquid Line, in.</th>
</tr>
</thead>
<tbody>
<tr>
<td>DA250</td>
<td>50 ft (15 m)</td>
<td>1-5/8</td>
<td>1-3/8</td>
</tr>
<tr>
<td></td>
<td>100 ft (30 m)</td>
<td>1-5/8</td>
<td>1-3/8</td>
</tr>
<tr>
<td></td>
<td>150 ft (45 m)</td>
<td>1-5/8*</td>
<td>1-3/8*</td>
</tr>
<tr>
<td></td>
<td>300 ft (91 m)</td>
<td>1-5/8*</td>
<td>1-3/8*</td>
</tr>
</tbody>
</table>

*The DA250 unit can be extended to a maximum 200-ft (61-m) linear or 300-ft (91-m) equivalent length.

Source: DPN000788 Rev. 13

NOTE: See the piping schematics for your system in Submittal Drawings on page 67. For installations using pre-fabricated heat-rejection skids, included piping must be factored into total equivalent length calculation. Please consult factory for details.

8.2.4 Refrigerant Charge Requirements for Air-cooled Systems

The following tables provide the refrigerant charge requirements for the Liebert® DSE, connected piping, and condenser options.

Table 8.5 Indoor Unit Approximate Refrigerant Charge for R-410A Per Circuit

<table>
<thead>
<tr>
<th>System Type</th>
<th>Model</th>
<th>Outer Circuit, lb (kg)</th>
<th>Inner Circuit, lb (kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Air-cooled</td>
<td>DA250</td>
<td>25 (11.3)</td>
<td>25 (11.3)</td>
</tr>
</tbody>
</table>

*System Charge = indoor unit + MCV440 heat-rejection skid + refrigerant lines. For system charges over 200 lb. (90.7 kg), consult your Vertiv representative.

See Table 12.2 on page 57 for the recommended oil for the system.

Source: DPN003960 Rev. 3

Table 8.6 MCV440 Heat-rejection Skid Refrigerant Charge for R-410A Per Circuit Including PRE

<table>
<thead>
<tr>
<th>Standard Condenser Model</th>
<th>Per circuit, lb (kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>MCV440</td>
<td>40 (18.14)</td>
</tr>
</tbody>
</table>

Condenser charge includes receivers and Liebert® EconoPhase pump module.

Table 8.7 Interconnecting Piping Refrigerant Charge for R-410A, lb per 100 ft (kg per 30 m)

<table>
<thead>
<tr>
<th>Line Size, O.D., in.</th>
<th>Liquid Line</th>
<th>Hot Gas Line</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-3/8</td>
<td>51.5 (23.5)</td>
<td>5.9 (2.7)</td>
</tr>
<tr>
<td>1-5/8</td>
<td>—</td>
<td>8.4 (3.7)</td>
</tr>
</tbody>
</table>

Source: DPN003099, Rev. 1
8.2.5 Additional Oil Requirements for Scroll and Digital-scroll Compressors

NOTICE

Risk of improper compressor lubrication. Can cause compressor and refrigerant system damage.

Failure to use oil types, viscosities and quantities recommended by the compressor manufacturer may reduce compressor life and void the compressor warranty. See Table 12.2 on page 57 for the recommended oil for the system.

- Do not mix polyolester (POE) and mineral-based oils.
- Do not mix oils of different viscosities.
- Consult your Vertiv sales representative, visit https://www.vertivco.com/en-us/support/, or contact the compressor manufacturer if questions arise.

See Table 8.8 on the facing page, for the amount required for various system charge levels.

In addition to oil added based on system charge, additional oil is required for discharge-line field-installed traps. Standard-formed tube traps are required, see Figure 8.1 below and Table 8.9 on the facing page, because straight tubes and fittings used as traps require much more oil and the length of the straight tube can vary.

After the system has been fully charged with refrigerant, use a hand pump to add the additional oil at the suction side of the system while the system is running.

The amount of oil added by field service must be recorded on the tag marked “Oil Added Field Service Record,” attached to each compressor. The date of oil addition must be included as well.

**Figure 8.1 Standard-formed Tube Trap Versus Straight-tubes-and-fittings Trap**

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Standard-formed tube trap</td>
</tr>
<tr>
<td>2</td>
<td>Straight tubes and fittings trap</td>
</tr>
</tbody>
</table>
### Table 8.8  Additional Oil Required per Refrigerant Charge

<table>
<thead>
<tr>
<th>Refrigerant System Charge Per Circuit, lb (kg) *</th>
<th>Model</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>DA250</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Additional Oil Required Per Circuit, oz (ml)</td>
<td></td>
</tr>
<tr>
<td>&lt; 40 (18.1)</td>
<td>0</td>
</tr>
<tr>
<td>40 (18.1)</td>
<td>10 (300)</td>
</tr>
<tr>
<td>50 (22.7)</td>
<td>18 (530)</td>
</tr>
<tr>
<td>60 (27.2)</td>
<td>26 (770)</td>
</tr>
<tr>
<td>70 (31.8)</td>
<td>34 (1010)</td>
</tr>
<tr>
<td>80 (36.3)</td>
<td>42 (1240)</td>
</tr>
<tr>
<td>90 (40.8)</td>
<td>50 (1480)</td>
</tr>
<tr>
<td>100 (45.4)</td>
<td>58 (1720)</td>
</tr>
<tr>
<td>110 (49.9)</td>
<td>66 (1950)</td>
</tr>
<tr>
<td>120 (54.4)</td>
<td>74 (2190)</td>
</tr>
<tr>
<td>130 (59.0)</td>
<td>82 (2430)</td>
</tr>
<tr>
<td>140 (63.5)</td>
<td>90 (2660)</td>
</tr>
<tr>
<td>150 (68.0)</td>
<td>98 (2900)</td>
</tr>
<tr>
<td>160 (72.6)</td>
<td>106 (3130)</td>
</tr>
<tr>
<td>170 (77.1)</td>
<td>114 (3370)</td>
</tr>
<tr>
<td>180 (81.6)</td>
<td>122 (3610)</td>
</tr>
<tr>
<td>190 (86.2)</td>
<td>130 (3840)</td>
</tr>
<tr>
<td>200 (90.7)</td>
<td>138 (4080)</td>
</tr>
</tbody>
</table>

*System Charge = indoor unit + MCV440 heat-rejection skid + refrigerant lines and is calculated per circuit. For system charges over 200 lb. (90.7 kg), consult your Vertiv representative. See 12.5 on page 57 for the recommended oil for the system.
Source: DPN003950 Rev. 5

### Table 8.9  Volume of Oil in Standard-form Trap by Pipe Diameter

<table>
<thead>
<tr>
<th>Pipe diameter, in.</th>
<th>Oil volume, oz (ml)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/2</td>
<td>0.2 (5.9)</td>
</tr>
<tr>
<td>5/8</td>
<td>0.4 (11.8)</td>
</tr>
<tr>
<td>3/4</td>
<td>0.6 (17.7)</td>
</tr>
<tr>
<td>7/8</td>
<td>0.9 (26.6)</td>
</tr>
<tr>
<td>1-1/8</td>
<td>1.8 (53.2)</td>
</tr>
<tr>
<td>1-3/8</td>
<td>3.3 (97.6)</td>
</tr>
<tr>
<td>1-5/8</td>
<td>5.5 (162.7)</td>
</tr>
</tbody>
</table>

Source: DPN003950, Rev. 3
8.2.6 Evacuation, Leak-testing, and Charging Air-cooled Systems

Two discharge lines and two liquid lines must be field-installed between the indoor unit and the outdoor condenser.

NOTE: Keep the evaporator unit, and condenser closed with their factory charge of dry nitrogen while all field piping is installed. Keep the field piping clean and dry during installation. Do not allow it to stand open to the atmosphere. When all the field interconnecting piping is in place, vent each outdoor unit’s dry nitrogen charge and connect to the field piping. Finally, vent the evaporator unit’s dry nitrogen charge and make its piping connection last. Follow all proper brazing practices, including a dry nitrogen purge to maintain system cleanliness. The condenser connection pipes must be wrapped with a wet cloth to keep the pressure and temperature sensors cool during any brazing.

Evacuation and Leak-testing Air-cooled Systems

For proper leak-check and evacuation, you must open all system valves and account for all check valves.

NOTE: The system includes a factory-installed check valve and an additional downstream Schrader valve with core in the compressor discharge line. Proper evacuation of the condenser side of the compressor can be accomplished only using the downstream Schrader valve. See the appropriate piping schematic for your system in Submittal Drawings on page 67.

1. Starting with Circuit #1, open the service valves and place a 150 PSIG (1034 kPa) of dry nitrogen with a tracer of refrigerant. Check system for leaks with a suitable leak detector.
2. With pressure still in Circuit #1, open the compressor service valves in Circuit #2.
   - If pressure increases in Circuit #2, the system is cross-circuiting and must be re-checked for proper piping.
   - If there is no pressure increase, repeat step 1 on Circuit #2.
3. After completion of leak testing, release the test pressure, (observe local code) and pull an initial deep vacuum of 500 microns on the system with a suitable pump.
4. After 4 hours, check the pressure readings and, if they have not changed, break vacuum with dry nitrogen. Pull a second and third vacuum to 500 microns or less. Re-check the pressure after 2 hours.
   When the 3 checks are complete, remove the jumper hose from the service-valve fitting and the condenser, and proceed to Charging Air-cooled Systems below.

Charging Air-cooled Systems

NOTICE

Risk of improper refrigerant charging. Can cause equipment damage.

R-410A is a blended refrigerant and must be introduced and charged from the cylinder only as a liquid.

When adding liquid refrigerant to an operating system, it may be necessary to add the refrigerant through the compressor suction service valve. Care must be exercised to avoid damage to the compressor. We recommend connecting a sight glass between the charging hose and the compressor suction service valve. This will permit adjustment of the cylinder hand valve so that liquid can leave the cylinder while allowing vapor to enter the compressor.

NOTICE

Risk of improper operation. Can cause compressor failure.

Operating the unit with the EEV closed can cause compressor failure. The reheat and humidifier are disabled. A minimum of 20 psig (138 kPa) must be established and maintained for the compressor to operate. The charging function can be reset as many times as required to complete
To charge the system:

1. Check the nameplate on the indoor unit for refrigerant type to be used. Unit control configurations differ depending on refrigerant type.
2. The unit must be operating during charging, refer to Checklist for Completed Installation on page 49.
3. Calculate the amount of charge for the system. See Refrigerant Charge Requirements for Air-cooled Systems on page 41.
4. Accurately weigh in as much of the system charge as possible before starting the unit. Do not exceed the calculated charge by more than 0.5 lb (0.37 kg).
5. Close the MVC heat-rejection skid disconnect switch.
   - We recommend charging the unit with the return-air setpoint between 75°F and 85°F (24°C and 29°C).
   - The return-air temperature to the unit being charged must be stable and must be maintained greater than 65°F (18°C). If this is not possible due to lack of heat load, then the load banks must be used to offset the cooling load during start-up. See Target Refrigerant-level in Sight Glasses at Outdoor Temperatures below.
6. Close the Liebert® DSE disconnect switch.
7. In the Service menu of the Liebert® iCOM controller, select Diagnostics/Service > Diagnostics:
   b. In Evaporator Fan options set Motors to On to operate the fan during Manual Mode.
   c. In Compressor Circuit 1 options, set Compressor Mode to Charge to operate the compressor at full capacity, energize the blower motor, and open the EEV.
   d. Reset the charge function as many times as needed to complete unit charging.

NOTE: Manual Mode times-out after 30 minutes.

   e. Repeat step 7 for Compressor Circuit 2.
8. Check the refrigerant level in the refrigerant-level sight glasses on each receiver after the unit has been operating for at least 15 minutes.

NOTE: You must establish and maintain a minimum 20 psig (138 kPa) for the compressor to operate.

   a. Repeat step 7 for Compressor Circuit 2.
9. Adjust the refrigerant level in each circuit to meet the level shown in Target Refrigerant-level in Sight Glasses at Outdoor Temperatures below.
10. After adjusting the refrigerant, allow the system to operate an additional 15 minutes before checking for the need of further adjustment.
11. Repeat the procedure for the second circuit.

NOTE: A digital-scroll compressor can have a clear sight glass only when operating at 100% capacity. When operating with a receiver, the sight glass might not become clear even when operating at 100% capacity. When operating below 100%, the sight glass may show bubbles with each 15-second unloading cycle.

**Target Refrigerant-level in Sight Glasses at Outdoor Temperatures**

- 40°F (4.5°C) and lower—bottom sight glass is 3/4 full
- 40°F (4.5°C) and higher—bottom sight glass is full

If the return air temperature cannot be maintained between 75°F and 85°F (24°C and 29°C) due to lack of load, then the liquid-level receiver must be adjusted to the following if return air is between 65°F and 75°F (18°C and 24°C):

- 40°F (4.5°C) and lower—Charge to the bottom of the top sight glass.
- 40°F (4.5°C) and higher—top sight glass is 1/4 full
9 HEAT-REJECTION SKID

9.1 Planning Dimensions

The unit dimensions are described in the submittal documents included in the Submittal Drawings on page 67.

The following table lists the relevant documents by number and title.

<table>
<thead>
<tr>
<th>Document Number</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>DPN004259</td>
<td>Cabinet Dimensional Data, MCV440, Single skid</td>
</tr>
<tr>
<td>DPN004261</td>
<td>Cabinet Dimensional Data, MCV440, Dual skid</td>
</tr>
</tbody>
</table>

9.2 Liebert MCV Match-up Selections

Table 9.2 High-efficiency Condenser Match-ups

<table>
<thead>
<tr>
<th>Outdoor Design Ambient Temp., °F (°C)</th>
<th>Maximum Return Air Temp., °F (°C)</th>
<th>DSE Models</th>
</tr>
</thead>
<tbody>
<tr>
<td>Up to 105 (41)</td>
<td>85 (29) to 105 (41)</td>
<td>DA250</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>DSE Models</th>
</tr>
</thead>
<tbody>
<tr>
<td>MCV440</td>
</tr>
</tbody>
</table>

9.3 Liebert MCV Electrical Power Requirements

Condenser-rated voltage should be verified with available power supply before installation. Refer to the unit’s electrical schematic and serial tag for specific electrical requirements. Line voltage electrical service is required for all condensers at the location of the condenser.

For the most reliable operation of the system, the indoor unit and the MCV condenser should be on the same power source. The Liebert® DSE system offers an option for a power feed from the active source on the indoor unit to the outdoor condenser. This configuration provides the greatest reliability and fastest recovery during power loss or source change.

When powering the outdoor condenser from the indoor unit, there is a breaker/fuse on the indoor unit and the wire sizing requirements are provided in Table 9.3 on the next page.

A unit disconnect is standard on the MCV skid. However, a site disconnect may be required per local code to isolate the unit for maintenance. Refer to the unit’s serial tag for specific condenser electrical requirements (Table 9.3 on the next page).

Route the supply power to the site disconnect switch and then to factory-provided high-voltage enclosure located on the MCV heat-rejection skid. Reference submittal drawings listed in Table 9.1 above.
Table 9.3 Electrical Data—MCV440 Heat-rejection Skid, including EconoPhase

<table>
<thead>
<tr>
<th>Unit Voltage Rating</th>
<th>MCV440 + PRE</th>
</tr>
</thead>
<tbody>
<tr>
<td>460 V, 60 Hz</td>
<td></td>
</tr>
<tr>
<td>FLA</td>
<td>29.4</td>
</tr>
<tr>
<td>WSA</td>
<td>30.3</td>
</tr>
<tr>
<td>OPD</td>
<td>35</td>
</tr>
<tr>
<td>575 V, 60 Hz</td>
<td></td>
</tr>
<tr>
<td>FLA</td>
<td>23.5</td>
</tr>
<tr>
<td>WSA</td>
<td>24.2</td>
</tr>
<tr>
<td>OPD</td>
<td>35</td>
</tr>
<tr>
<td>415 V, 50 Hz</td>
<td></td>
</tr>
<tr>
<td>FLA</td>
<td>35.4</td>
</tr>
<tr>
<td>WSA</td>
<td>36.3</td>
</tr>
<tr>
<td>OPD</td>
<td>45</td>
</tr>
</tbody>
</table>

*For 380-V, 50-Hz application, consult the factory for SFA.

9.4 Liebert MCV Connection Locations

Field-installed piping must be installed according to local codes.

The pipe connection locations are described in the submittal documents included in the Submittal Drawings on page 67.

The following table lists the relevant documents by number and title.

Table 9.4 Connection Drawings

<table>
<thead>
<tr>
<th>Document Number</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>DPN004208</td>
<td>Connection Locations, DA250</td>
</tr>
<tr>
<td>DPN004257</td>
<td>Condenser connection data, MCV440, Single skid</td>
</tr>
<tr>
<td>DPN004262</td>
<td>Condenser connection data, MCV440, Dual skid</td>
</tr>
</tbody>
</table>
10 CHECKLIST FOR COMPLETED INSTALLATION

10.1 Moving and Placing Equipment
   1. Unpack and check received material.
   2. Proper clearance for service access has been maintained around the equipment.
   3. Equipment is level and mounting fasteners are tight.

10.2 Electrical Installation Checks
   1. Supply voltage and phase matches equipment nameplate.
   2. Power wiring connections completed to the disconnect switch, evaporator unit and heat rejection equipment.
   3. Power line circuit breakers or fuses have proper ratings for equipment installed.
   4. Control wiring connections completed between indoor evaporator and heat-rejection equipment.
   5. All internal and external high- and low-voltage wiring connections are tight.
   6. Confirm that unit is properly grounded to an earth ground.
   7. Control transformer setting matches incoming power.
   8. Electrical service conforms to national and local codes.
   9. Check blowers and compressors for proper rotation.

10.3 Piping Installation Checks
   1. Piping completed to refrigerant loop.
   2. Piping has been leak-checked.
   3. Additional oil has been added for system charges over 40 pounds (18.1kg) per circuit. See Additional Oil Requirements for Scroll and Digital-scroll Compressors on page 42.
   4. Piping is properly sized, sloped and trapped as shown in the piping schematics.
   5. Check piping inside and outside of equipment for proper support and adequate spacing to prevent rub-through.
   6. Ensure that factory clamps have been reinstalled.
   7. Drain line connected, not obstructed, and pitched per local code.

10.4 Other Installation Checks
   1. Ducting or plenum assembly complete (if required), maintain access to filters.
   2. Filters installed.
   3. Check fasteners that secure motors—some may have become loose during shipment.
   4. Verify water detection is properly installed around all units (recommended).
   5. Blower drive system rotates freely.
   6. All fans are free of debris.
   7. Set fan air-flow calibration voltage. Refer to Table 3.4 on page 18, for values. The values are set in the iCOM Service menu > Setpoints > Fan.
11 INITIAL START-UP CHECKS AND COMMISSIONING PROCEDURE FOR WARRANTY INSPECTION

WARNING! Arc flash and electric shock hazard. Open all local and remote electric power-supply disconnect switches, verify with a voltmeter that power is Off and wear appropriate, OSHA-approved personal protective equipment (PPE) per NFPA 70E before working within the electric control enclosure. Failure to comply can cause serious injury or death. Customer must provide earth ground to unit, per NEC, CEC and local codes, as applicable. Before proceeding with installation, read all instructions, verify that all the parts are included and check the nameplate to be sure the voltage matches available utility power. The Liebert® controller does not isolate power from the unit, even in the “Unit Off” mode. Some internal components require and receive power even during the “Unit Off” mode of the controller. The factory-supplied disconnect switch is inside the unit. The line side of this switch contains live high-voltage. The only way to ensure that there is NO voltage inside the unit is to install and open a remote disconnect switch. Refer to unit electrical schematic. Follow all local codes.

WARNING! Risk of improper wiring, piping, moving, lifting and handling. Can cause equipment damage, serious injury or death. Installation and service of this equipment should be done only by qualified personnel who have been specially-trained in the installation of air-conditioning equipment and who are wearing appropriate, OSHA-approved PPE.

NOTICE

Risk of improper electrical connection of three-phase input power. Can cause backward compressor rotation and unit damage. Service technicians should use a gauge set on the system during the initial start up to verify that the three-phase power is connected properly. Three-phase power must be connected to the unit line voltage terminals in the proper sequence so that the compressors rotate in the proper direction. Incoming power must be properly phased to prevent compressors from running backward. We recommend checking the unit’s phasing with proper instrumentation to ensure that power connections were made correctly. We also recommend verifying discharge and suction pressures during start up to ensure that the compressors are running in the correct direction.

- Confirm that all items on Checklist for Completed Installation on page 49 have been done.
- Locate “Liebert® DSE Warranty Inspection Check Sheet” in the unit’s electric panel.
- Complete “Liebert® DSE Warranty Inspection Check Sheet” during start-up.
- Forward the completed “Liebert® DSE Warranty Inspection Check Sheet” to your local sales office. This information must be completed and forwarded to validate warranty.
- Contact your local sales representative or technical support if you have any questions or problems during unit start-up and commissioning. Visit https://www.vertivco.com/en-us/support/ or call 1-800-543-2778 for contacts.
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12 MAINTENANCE

WARNING! Arc flash and electric shock hazard. Open all local and remote electric power-supply disconnect switches, verify with a voltmeter that power is Off and wear appropriate, OSHA-approved personal protective equipment (PPE) per NFPA 70E before working within the electric control enclosure. Failure to comply can cause serious injury or death. Customer must provide earth ground to unit, per NEC, CEC and local codes, as applicable. Before proceeding with installation, read all instructions, verify that all the parts are included and check the nameplate to be sure the voltage matches available utility power. The Liebert® controller does not isolate power from the unit, even in the “Unit Off” mode. Some internal components require and receive power even during the “Unit Off” mode of the controller. The factory-supplied disconnect switch is inside the unit. The line side of this switch contains live high-voltage. The only way to ensure that there is NO voltage inside the unit is to install and open a remote disconnect switch. Refer to unit electrical schematic. Follow all local codes.

WARNING! Risk of electric shock. Can cause equipment damage, injury or death. Open all local and remote electric power supply disconnect switches and verify with a voltmeter that power is off before working within any electric connection enclosures. Service and maintenance work must be performed only by properly trained and qualified personnel and in accordance with applicable regulations and manufacturers’ specifications. Opening or removing the covers to any equipment may expose personnel to lethal voltages within the unit even when it is apparently not operating and the input wiring is disconnected from the electrical source.

WARNING! Risk of improper wiring, piping, moving, lifting and handling. Can cause equipment damage, serious injury or death. Installation and service of this equipment should be done only by qualified personnel who have been specially-trained in the installation of air-conditioning equipment and who are wearing appropriate, OSHA-approved PPE.

The Liebert® DSE is a single component in the facility heat-removal system. The system includes air distribution (raised floors, duct systems), outdoor heat rejection (condensers, pumps) and indoor cooling and humidity loads (equipment load, location, outside air infiltration). Proper application and maintenance of the entire system is critical to the life and reliability of the thermal-management units.

- Good maintenance practices are essential to minimizing operation costs and maximizing product life.
- Read and follow monthly and semi-annual maintenance schedules included in this manual. These MINIMUM maintenance intervals may need to be more frequent based on site-specific conditions.
- See the Liebert®iCOM™ user manual, SL-31075, for instructions on using the controller to predict some service maintenance intervals.
- We recommend the use of trained and authorized service personnel, extended service contracts and factory-specified replacement parts. Contact your Vertiv sales representative.

12.1 Filters

NOTICE

Risk of improper filter installation. Can cause filter collapse and airflow reduction.

To maximize the performance and reliability of the equipment, use only Vertiv filters. Contact your Vertiv representative to order replacement filters.

Verify that filters are installed and positioned so the air-flow direction marked on the filter is the same direction as unit air flow.
### 12.1.1 Replacing the Filters

**WARNING!** Risk of contact with high-speed moving parts. Can cause injury or death. Open all local and remote electric power-supply disconnect switches, verify with a voltmeter that power is off, and verify that all the fan blades have stopped moving before working in the unit.

1. Enter the unit through the service access door, and locate the supply-side air filters in front of the heat exchanger.
2. Referring to **Figure 12.1** on the facing page, remove all 15 filters:
   - Remove filter 15 first using the slot at that position.
   - Slide filter 14 down to the slot and remove.
   - Slide filters 13 through 10 over, then down to the slot and remove.
   - Slide filters 6 through 9 over to the slot and remove.
   - Slide filter 5 up to the slot and remove.
   - Slide filters 4 through 1 over, then up to the slot and remove.
3. Install the new filters in each row in the reverse order as removed, installing the filter in position 15/slot last.

---

<table>
<thead>
<tr>
<th>Unit size</th>
<th>Filter Type</th>
<th>Filter Size, Width x Length x Depth</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>DA250</td>
<td>MERV 8</td>
<td>28 x 22 x 4</td>
<td>15</td>
</tr>
</tbody>
</table>
12.2 Fan Maintenance

12.2.1 Fan Assembly Troubleshooting

Any safety hazards stemming from the device must be re-evaluated once it is installed in the end device. Do not make any modifications, additions or conversions to the fan assembly without the approval of Vertiv.

WARNING! Risk of electric shock. Can cause serious injury or death. Open all local and remote electric power-supply disconnect switches and verify with a voltmeter that power is off before opening the fan motor electric-connection enclosure. Use only fully-trained and qualified HVAC technicians to replace or perform maintenance on the EC fans.

WARNING! Risk of contact with high-speed rotating fan blades. Can cause serious injury or death. Open all local and remote electric power-supply disconnect switches, verify with a voltmeter that power is off, and verify that all fan blades have stopped rotating before working in the unit cabinet or on the fan assembly. If control voltage is applied, the fan motor can restart without warning after a power failure.
CAUTION: Risk of exposure to harmful noise levels. Can cause hearing injury or loss. Depending on the installation and operating conditions, a sound pressure level greater than 70 dB(A) may arise. Take appropriate technical safety measures. Operating personnel must wear appropriate, OSHA-approved PPE and observe all appropriate hearing-protection safety requirements.

CAUTION: Risk of contact with hot surfaces. Can cause injury. The compressor, refrigerant discharge lines, fan motor, and some electrical components are extremely hot during unit operation. Allow sufficient time for them to cool to a touch-safe temperature before working within the unit cabinet. Use extreme caution and wear appropriate, OSHA-approved PPE when working on or near hot components.

NOTICE
Risk of improper power-supply connection. Can cause equipment damage and loss of warranty coverage.

Prior to connecting any equipment to a main or alternate power source (for example: back-up generator systems) for start-up, commissioning, testing, or normal operation, ensure that these sources are correctly adjusted to the nameplate voltage and frequency of all equipment to be connected. In general, power-source voltages should be stabilized and regulated to within ±10% of the load nameplate nominal voltage. Also, ensure that no three-phase sources are single-phased at any time.

NOTE: Do not assume that the fan blades will not start to spin. If the motor is in a fault condition, it will safely shut down. Once the fault condition is cleared, there are certain conditions in which the motor will automatically resume operation.

12.2.2 Fan Impellers
Fan impellers should be periodically inspected and any debris removed. Check to ensure that the impellers can rotate freely.
Consult the factory for fan-assembly maintenance and removal instructions. Do not attempt to service or remove the fans without first contacting Vertiv support at 1-800-543-2778.

12.2.3 Blower-motor Lubrication
The motor is initially lubricated at the factory.
- Contact the motor manufacturer for the lubrication interval for motor bearings.
- Contact the motor manufacturer to determine the type of grease to use for lubrication.

12.2.4 Removing Fan Assembly
Do not attempt to remove the fan assemblies without first contacting Vertiv Technical Support at 1-800-543-2778.

12.3 Condensate-drain and Condensate-pump System Maintenance

12.3.1 Condensate Drain
Check for and clear obstructions in tubing during routine maintenance.
12.3.2 Condensate Pump

**WARNING!** Risk of electric shock. Can cause injury or death. Open all local and remote electric power-supply disconnect switches and verify that power is Off with a voltmeter before working within the condensate pump electrical connection enclosure. The Liebert® iCOM™ does not isolate power from the unit, even in the “Unit Off” mode. Some internal components require and receive power even during the “Unit Off” mode of the Liebert® iCOM.

To maintain the condensate pump:
1. Disconnect power to the unit using the disconnect switch.
2. Check for and clear obstructions in gravity lines leading to the condensate pump.
3. Remove the sump, clean with a stiff nylon brush and flush with water.
4. Inspect and clear clogs in the discharge check valve and float mechanism.
5. Reassemble and check for leaks.

12.4 Electronic Expansion Valve (EEV) Maintenance

The EEV controls superheat through the Liebert® iCOM™ controls by actively measuring suction pressure via a transducer attached to the suction-line rotalock and suction temperature via a thermister strapped to the suction line. The EEV actively adjusts the orifice size and resulting mass flow of refrigerant to maintain the superheat setpoint (set in Liebert® iCOM). The EEV is used in place of the standard thermal expansion valve (TXV).

**WARNING!** Risk of electric shock. Can cause serious injury or death. The Liebert® iCOM microprocessor does not isolate power from the unit, even in the "Unit Off" mode. Some internal components require and receive power even during the "unit off" mode of the Liebert® iCOM control. Open all local and remote electric power disconnect switches and verify with a voltmeter that power is Off before working on any component of the system.

NOTE: Intermittent loss of subcooling may result in EEV/superheat instability. If superheat instability is observed, check for proper refrigerant level in receiver (see Refrigerant Piping Guidelines for Air-cooled Systems on page 40 for the proper charge level). If proper charge is observed in receiver, and superheat remains unstable, then increase superheat setting in the Liebert® iCOM to 15°F (8.49°C).

12.5 Compressor Maintenance
12.5.1 Compressor Oil

**NOTICE**

Risk of improper compressor lubrication. Can cause compressor and refrigerant system damage.

Failure to use oil types, viscosities and quantities recommended by the compressor manufacturer may reduce compressor life and void the compressor warranty.

- Do not mix polyolester (POE) and mineral-based oils.
- Do not mix oils of different viscosities.
- Consult Vertiv technical support or the compressor manufacturer if questions arise.

<table>
<thead>
<tr>
<th>Compressor Type</th>
<th>Oil Type</th>
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</thead>
<tbody>
<tr>
<td>Copeland Scroll and Digital Scroll</td>
<td>POE Oil - ISO 32 Centistoke Viscosity&lt;sup&gt;1&lt;/sup&gt;</td>
</tr>
</tbody>
</table>

<sup>1</sup> Use Copeland POE Oil ULTRA 32-3MAF or other Copeland-approved oils.

Source: DPN003950. Rev.5
12.5.2 Rotalock Valve

WARNING! Risk of explosive discharge of high-pressure refrigerant. Can cause serious injury. Neutral and service ports on the rotalock valve do not have a valve core. Front-seat the service valves and relieve pressure from the compressor before loosening a part or a component attached to the service valve. Follow local codes to properly reclaim refrigerant.

- The Neutral port remains open to the compressor side in all positions of the valve stem. Figure 12.2 below. A high-pressure cut-out switch or low-pressure switch/transducer will be connected to this port.
- The Service port is closed to the system when valve stem is back-seated. Figure 12.2 below. It is open to the system as soon as the valve is adjusted away from the back-seated position.

Figure 12.2 Rotalock valve

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
<th>Item</th>
<th>Description</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>Service port (gauge)</td>
<td>4</td>
<td>Compressor side of valve</td>
</tr>
<tr>
<td>2</td>
<td>Front seat</td>
<td>5</td>
<td>Neutral port</td>
</tr>
<tr>
<td>3</td>
<td>Back seat</td>
<td>6</td>
<td>System side of valve</td>
</tr>
</tbody>
</table>

12.5.3 Replacement Compressors

Replacement compressors are available through your Vertiv sales office. If the unit is under warranty, the replacement compressor must be obtained from and the original compressor returned to your local Vertiv sales office. Compressors are shipped in reusable packaging, and the original compressor should be returned in the same packaging.

12.5.4 Compressor Motor Burnout

If a burnout has occurred, a full system clean-out is required. If not cleaned, compressor and system problems will continue.

Consult the factory for compressor maintenance. Do not attempt to remove the compressor without first contacting Vertiv support at 1-800-543-2778.

12.5.5 Unloading Solenoid(s) on a Digital-scroll Compressor

When replacing a digital-scroll compressor, the digital solenoid valve and coil must be replaced. The compressor and valve kit are shipped separately. The valve kit must be field-brazed to the top of the compressor in proper orientation and supported with the original factory bracket.
12.5.6 Replacing the Compressor

WARNING! Risk of electric shock. Can cause serious injury or death. The Liebert® iCOM microprocessor does not isolate power from the unit, even in the "Unit Off" mode. Some internal components require and receive power even during the "unit off" mode of the Liebert® iCOM control. Open all local and remote electric power disconnect switches and verify with a voltmeter that power is Off before working on any component of the system.

WARNING! Risk of over-pressurization of the refrigeration system. Can cause explosive discharge of high-pressure refrigerant, loss of refrigerant, environmental pollution, equipment damage, injury, or death. This unit contains fluids and gases under high pressure. Use extreme caution when charging the refrigerant system. Do not pressurize the system higher than the design pressure marked on the unit's nameplate. For systems requiring EU CE compliance (50 Hz), the system installer must provide and install a pressure relief valve in the high side refrigerant circuit that is rated same as the refrigerant high side “Max Allowable Pressure” rating that is marked on the unit serial tag. Do not install a shutoff valve between the compressor and the field installed relief valve. The pressure relief valve must be CE-certified to the EU Pressure Equipment Directive by an EU “Notified Body.”

NOTE: Release of refrigerant to the atmosphere is harmful to the environment. Refrigerant must be recycled or discarded in accordance with federal, state, and local regulations.

1. Attach suction and discharge gauges to access fittings.
2. Front-seat service valves to isolate the compressor. Recover refrigerant using an approved recovery procedure and equipment. Use a filter drier when charging the system with recovered refrigerant.
3. Remove marked pressure transducer and discharge pressure switch. Disconnect all electrical connections.
4. Detach service valves from compressor.
5. Remove failed compressor.
6. If required, follow compressor manufacturer’s suggested clean-out procedures.
7. Install replacement compressor and make all connections. Replace gaskets or seals on service valves. Replace unloading solenoid.
8. Evacuate, charge and operate per the appropriate procedure per local codes:
   - Evacuation, Leak-testing, and Charging Air-cooled Systems on page 44

NOTICE

Risk of improper component re-installation. Can cause equipment damage.

Identify and mark location of suction pressure transducer and discharge pressure switch. These devices look similar and they must be reinstalled in their original location.

12.6 Evaporator Coil

The DA250 units contain single slab coils. This results in different evaporator (suction) temperatures between System 1 and System 2. The outer coil (System 1) will operate at a higher evaporator temperature than the inner coil (System 2) when operating at the same compressor loading.
12.7 Air-Cooled Condenser Maintenance

Restricted airflow will reduce operating efficiency and could result in high compressor-head pressure and loss of cooling.

- Clear coil surface of all debris that will inhibit airflow.
- Check for bent or damaged coil fins and correct.
- Do not permit snow to accumulate around or under outdoor unit.
- Periodically consider commercial cleaning of coil surface.
- Inspect fans, motors and controls for proper operation.
- Check all piping and capillaries for proper support.
- Inspect for leaks.
- Check contactors for pitting. Replace if pitted.
13 PREVENTIVE MAINTENANCE CHECKLIST

Source: DPN002952, Rev. 4

Inspection Date

Job Name

Indoor Unit Model #

Indoor Unit Serial Number #

Condenser/Drycooler Model #

Condenser/Drycooler Serial #

Room Temperature/Humidity °

% Ambient Temperature °

Not all units will have all components. To determine your unit's configuration, compare the Indoor Unit Model # above and the information in the Components and Nomenclature section.

Good maintenance practices are essential to minimizing operation cost and maximizing product life. Read and follow all applicable maintenance checks listed below. At a minimum, these checks should be performed semi-annually. However, maintenance intervals may need to be more frequent based on site-specific conditions. Review the unit user manual for further information on unit operation. We recommend the use of trained and authorized service personnel, extended service contracts, and factory-certified replacement parts. Contact your local sales representative for more details.

Check all that apply:

Evaporator/Filters

1. Check/Replace filters
2. Grille area unrestricted
3. Wipe section clean
4. Coil clean
5. Clean condensate pan
6. Clean trap in condensate drain
7. Check/Test filter-clog switch operation (if equipped)

Blower Section (EC fan)

1. Mounting bolts tight
2. Fan-guard bolts tight
3. Impeller spins freely
4. Check/Test air sail switch (if equipped)
5. Motor amp draw
   • Compare to nameplate amps

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</table>

Condensate Pump (if equipped)

1. Check for debris in sump
2. Check operation of float(s) (free movement)
3. Check/Clean discharge check valve

Electrical Panel

1. Check fuses
2. Check contactors for pitting (Replace if pitted)
3. Check/Re-torque wire connections
Controls
1. Check/Verify control operation (Sequence)
2. Check/Test changeover device(s) (if equipped)
3. Check/Test water-detection device(s) (if equipped)
4. Check/Test CAN connection between indoor and outdoor units (if equipped)

Refrigeration Piping
1. Check refrigerant lines (clamps secure/no rubbing/no leaks)
2. Check for moisture (sight glass)
3. Check for restriction temperature drop across filter drier

Compressor Section
1. Check oil level
2. Check for oil leaks
3. Check compressor mounts (springs/bushings)
4. Cap tubes (not rubbing)
5. Check/Re-torque wire connections (inside compressor box)
6. Compressor operation (vibration/noise)
7. Check crank-case heater fuses/operation
8. Check for refrigerant leaks
9. Suction pressure
   Circuit #1 ____  Circuit #2 ____  Circuit #3 ____
10. Discharge Pressure
    Circuit #1 ____  Circuit #2 ____  Circuit #3 ____
11. Superheat
    Circuit #1 ____  Circuit #2 ____  Circuit #3 ____
12. Low-pressure switch cut out
    Circuit #1 ____  Circuit #2 ____  Circuit #3 ____
13. Low pressure cut in
    Circuit #1 ____  Circuit #2 ____  Circuit #3 ____
14. High pressure cut out
    Circuit #1 ____  Circuit #2 ____  Circuit #3 ____
15. Amp draw
    Circuit #1A L1 L2 L3
    Circuit #1B (if tandem) L1 L2 L3
    Circuit #2A L1 L2 L3
    Circuit #2B (if tandem) L1 L2 L3
Liebert® MCV Condenser

1. Coil clean of debris (Clean coil if required)
2. Fans free of debris
3. Fans securely mounted
4. Motor bearings in good condition
5. Check all refrigerant lines for vibration isolation. Support as necessary
6. Check for refrigerant leaks
7. Check surge-protection device (if installed) status-indicator lights
8. Check/Re-torque wire connections
9. Check contactors for pitting (replace if pitted)
10. Verify operation sequence/set points
11. Charge verification:
   a. Outdoor Ambient Temperature ________
   b. Subcooling ________
   c. Indoor-unit Return-air Temperature ________
   d. Sight-glass level (if Lee-Temp or pumped refrigerant) ________
12. Motor amp draw

<table>
<thead>
<tr>
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</table>

Liebert® EconoPhase Pumped-refrigerant Economizer

1. Check for refrigerant leaks
2. Check/Re-torque wire connections
3. Check contactors for pitting (replace if pitted)
4. Verify pump-speed control operation
5. Check pump mounting
MAINTENANCE NOTES

Name
Signature
Company

Make photocopies for your records. Compare readings/information to previous maintenance worksheet.

To locate your local Vertiv representative for Vertiv-engineered parts, check https://www.vertivco.com/en-us/support/ or Call 1-800-543-2778.
APPENDICES

Appendix A: Technical Support and Contacts

A.1 Technical Support/Service in the United States

Vertiv™ Corporation
24x7 dispatch of technicians for all products.
1-800-543-2378

Liebert® Thermal Management Products
1-800-543-2778

Liebert® Channel Products
1-800-222-5877

Liebert® AC and DC Power Products
1-800-543-2378

A.2 Locations

United States
Vertiv Headquarters
1050 Dearborn Drive
Columbus, OH, 43085, USA

Europe
Via Leonardo Da Vinci 8 Zona Industriale Tognana
35028 Piove Di Sacco (PD) Italy

Asia
7/F, Dah Sing Financial Centre
3108 Gloucester Road
Wanchai, Hong Kong
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Appendix B: Submittal Drawings

The submittal drawings are in the order of document part number (DPN). Table B.1 below, groups the drawings by topic/application.

Table B.1 Submittal-drawings Contents

<table>
<thead>
<tr>
<th>Document Number</th>
<th>Title</th>
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<tbody>
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<td><strong>Component Location</strong></td>
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<tr>
<td>DPN004368</td>
<td>Component Location, Typical, Downflow Models, DA250</td>
</tr>
<tr>
<td>DPN004258</td>
<td>Component Location, Typical, MCV440 (8-fan)</td>
</tr>
<tr>
<td>DPN004260</td>
<td>Component Location, Typical, MCV440 (16-fan)</td>
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<tr>
<td>DPN004581</td>
<td>Floor planning dimensional data for adjacent DA250 units</td>
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<tr>
<td><strong>Planning Dimensions - Downflow Units</strong></td>
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<tr>
<td>DPN004366</td>
<td>Cabinet and Plenum Dimensional Data, DA250 Downflow, Horizontal Discharge</td>
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<tr>
<td>DPN004516</td>
<td>Cabinet and Plenum Dimensional Data, DA250 Downflow, Bottom Discharge</td>
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<td>DPN004514</td>
<td>Installation and Service Clearance Data, DA250 Downflow, Horizontal and Bottom Discharge</td>
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<td><strong>Planning Dimensions - Floor Stands</strong></td>
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<tr>
<td>DPN004511</td>
<td>Floorstand Dimensional Data, DA250</td>
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<td>Cabinet and Plenum Airflow Schematic, DA250 Downflow, Horizontal Discharge</td>
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<td>DPN003886</td>
<td>CANbus cable connections between indoor unit, Liebert® MCV condenser</td>
</tr>
<tr>
<td>DPN004257</td>
<td>Condenser connection data, MCV440, Single skid</td>
</tr>
<tr>
<td>DPN004262</td>
<td>Condenser connection data, MCV440, Dual skid</td>
</tr>
<tr>
<td><strong>Unit-to-Unit Networking</strong></td>
<td></td>
</tr>
<tr>
<td>DPN004351</td>
<td>Liebert® iCOM Unit-to-unit Network Connections</td>
</tr>
<tr>
<td><strong>Liebert MCV Heat-rejection Skid Planning Dimensions</strong></td>
<td></td>
</tr>
<tr>
<td>DPN004259</td>
<td>Cabinet Dimensional Data, MCV440, Single skid</td>
</tr>
<tr>
<td>DPN004261</td>
<td>Cabinet Dimensional Data, MCV440, Dual skid</td>
</tr>
<tr>
<td><strong>Liebert MCV Heat-rejection Skid Piping Connections</strong></td>
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<tr>
<td>DPN004257</td>
<td>Condenser connection data, MCV440, Single skid</td>
</tr>
<tr>
<td>DPN004262</td>
<td>Condenser connection data, MCV440, Dual skid</td>
</tr>
</tbody>
</table>
LIEBERT HEAT REJECTION SKID

CANbus & INTERLOCK CONNECTIONS
MCV + ECONOPHASE + BASE ASSEMBLY

NOTE:
ONE Liebert DSE system shown for simplicity.

DETAIL 3
JUMPER AND DIPSWITCH LOCATION

FACTORY WIRED
FIELD INSTALLED

DETAIL 4 LOW VOLTAGE JUNCTION BOX

DETAIL 2
HEAT REJECTION INTERLOCK (B)

SEE SHEET 2 FOR COMPONENT NOTES, CABLE NOTES, & WIRE NOTES

DETAIL 1 CANBUS CABLE CONNECTION (A)

INDOOR DSE UNIT
CANbus & INTERLOCK CONNECTIONS
MCV + ECONOPHASE + BASE ASSEMBLY

COMPONENT NOTES:
1. COMPONENT APPEARANCE, ORIENTATION, AND POSITION MAY VARY BETWEEN PRODUCT LINES. TERMINAL NAMES REMAIN CONSTANT.
2. ALL CIRCUITS TO THESE CONNECTION POINTS REMAIN CONSTANT.

CAN & CABLE NOTES (A):
1. CABLE MUST HAVE THE FOLLOWING SPECIFICATIONS:
   - BRAIDED SHIELD OR FOIL SHIELD WITH DRAIN WIRE
   - SHIELD MUST BE WIRED TO GROUND AT INDOOR UNIT
   - 22-18AWG STRANDED TINNED COPPER
   - TWISTED PAIR (MINIMUM 4 TWISTS PER FOOT)
   - LOW CAPACITANCE (15pF/FT OR LESS)
   - MUST BE RATED TO MEET LOCAL CODES AND CONDITIONS.
   - EXAMPLES BELDEN 89207 (PLENUM RATED), OR ALPHA WIRE 6454 CATEGORY 5, 5E, OR HIGHER.
2. DO NOT RUN IN SAME CONDUIT, RACEWAY, OR CHASE AS HIGH VOLTAGE WIRING.
3. FOR CANBUS NETWORK LENGTHS GREATER THAN 450FT (137M), CONTACT LIEBERT FACTORY.

INTERLOCK WIRE NOTES (B):
1. FIELD SUPPLIED WIRE
   - 3 CONDUCTOR 18AWG OR GREATER
   - RATED 600V
2. RUN FIELD SUPPLIED WIRES BETWEEN THE INDOOR UNIT AND THE LOW VOLTAGE JUNCTION BOX.
AIR COOLED PIPING SCHEMATIC
LIEBERT MCV MOUNTED ABOVE LIEBERT DA150-250

Notes:

1. The outlet of the receiver must be higher than the elevation of the EEV inside the indoor unit. The vertical height must not be greater than 60 ft (18.3 m).
2. Unit must be trapped at bottom of riser with any rise over 5 feet (1.5m) high. If rise exceeds 25 feet (7.5m), then a trap is required in 20 foot (6.1m) increments or evenly divided. DA250 with horizontal discharge has internally installed traps on the hot gas discharge line.
3. Pitch horizontal hot gas piping at a minimum of ½ inch per 10 feet (42mm per 10m) so that gravity will aid in moving oil in the direction of the refrigeration flow.
4. Unit piping entrance varies by unit and may be through the top of the unit.
5. All indoor and outdoor field refrigerant piping must be insulated, ½ inch minimum. All outdoor insulation must be UV and ozone resistant.
6. Consult factory for any exceptions to the above guidelines.

<table>
<thead>
<tr>
<th>Internal EEV Height</th>
<th>H inch (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>DA150 - 165</td>
<td>43 (1092)</td>
</tr>
<tr>
<td>DA250</td>
<td>56 (1422)</td>
</tr>
</tbody>
</table>

Field Piping

DA250 with horizontal discharge should be piped out the top of unit.
Notes:
1. The outlet of the receiver must be higher than the elevation of the EEV inside the indoor unit.
2. Unit must be trapped at bottom of riser with any rise over 5 feet (1.5m) high. If rise exceeds 25 feet (7.5m), then a trap is required in 20 foot (6.1m) increments or evenly divided. DA250 with horizontal discharge has internally installed traps on the hot gas discharge line.
3. Pitch horizontal hot gas piping at a minimum of ½ inch per 10 feet (42mm per 10m) so that gravity will aid in moving oil in the direction of the refrigeration flow.
4. Unit piping entrance varies by unit and may be through the top of the unit.
5. All indoor and outdoor field refrigerant piping must be insulated, ½ inch minimum. All outdoor insulation must be UV and ozone resistant.
6. Consult factory for any exceptions to the above guidelines.
**PRIMARY CONNECTION LOCATIONS**

**DA250**

- **HR HV Heat Rejection High Voltage**: 117-1/2 (2984) X in. (mm) 4-1/2 (113) Y in. (mm) 114-3/8 (2904) 5-3/8 (136)
- **HR LV Heat Rejection Low Voltage**: 114-3/4 (2914) X in. (mm) 4-3/4 (122) Y in. (mm) 86-1/8 (2189) 6-5/8 (168)
- **HV1 Electrical Conn. (High Volt)**: 117-12 (2984) X in. (mm) 10-5/8 (269) Y in. (mm) 7-1/4 (183)
- **HV2 Electrical Conn. (High Volt)**: 114-3/4 (2914) X in. (mm) 11 (2818)
- **LV1 Electrical Conn. (Low Volt)**: 114-3/4 (2914) X in. (mm) 10-3/4 (274) Y in. (mm) 8-3/4 (223)
- **LV2 Electrical Conn. (Low Volt)**: 114-3/4 (2914) X in. (mm) 84-1/8 (2138) Y in. (mm) 7-5/8 (193)
- **LV3 Condensate Drain**: 6-3/4 (172) X in. (mm) 86-1/8 (2189) Y in. (mm) 8-5/8 (218)
- **CD Condensate Drain**: N/A X in. (mm) 8-5/8 (218) Y in. (mm) 7-5/8 (193) Connection Size/Opening 3/4" NPT Female
- **LIQ C1 Condensate Drain w/ Optional Pump**: 1-1/4 (32) X in. (mm) 3-7/8 (98) Y in. (mm) N/A Connection Size/Opening 1/2" O.D. Cu
- **LIQ C2 Condensate Drain w/ Optional Pump**: 2 (51) X in. (mm) 7-5/8 (193) Y in. (mm) 4-7/8 (123) Connection Size/Opening 1-3/8" O.D. Cu
- **HG C1 Hot Gas Circuit**: 4-3/4 (121) X in. (mm) 10-5/8 (270) Y in. (mm) 7-5/8 (193) Connection Size/Opening 1-5/8" O.D. Cu
- **HG C2 Hot Gas Circuit**: 2 (51) X in. (mm) 13-5/8 (346) Y in. (mm) 4-7/8 (123) Connection Size/Opening 1-5/8" O.D. Cu

**Notes:**
1. Drawing not to scale. All dimensions from right corner on service side and have a tolerance of ± 1/2" (13mm).
2. Field pitch Condensate Drain line a minimum of 1/8" (3.2mm) per 12" (305mm). All units contain a factory installed condensate trap. Do not trap external to the unit.
3. Select appropriate drain system materials. The drain must comply with all local codes.
4. Piping connection can be made at the top or bottom of the unit.
Notes:
1. Field to provide hole for conduit for high voltage disconnect box and low voltage distribution panel.
1. Coils
2. EC Fans
3. Econophase Pump
4. High voltage customer connection
5. Low voltage customer connection
6. Piping connections

Note:
1. Piping connections for entire assembly are in one location (item 6).
2. Electrical connections for entire assembly are located in high voltage customer connection boxes (item 4) and low voltage customer connection box (item 5).
LIEBERT HEAT REJECTION SKID

CABINET & ANCHOR DIMENSIONAL DATA
MCV440 + ECONOPHASE + BASE ASSEMBLY

NOTES:
1) Minimum clearance on the Main Unit Disconnect Enclosure shall be 48” (1219mm) or per local code.
2) Recommended minimum 48” (1219mm) clearance when multiple skids are mounted side by side to ensure proper airflow. Contact the factory for other spacing requirements.
3) Preliminary assembly weight 5,365 lbs (2,433 kg).
NOTES:
1) Underside of unit, coil and fan removed for clarity.
2) Four mounting holes and four 3/4" field supplied bolts required to secure skid base assembly to customer support structure. Bolt grade to be specified by local requirements.
### Component Location Diagram

**MCV440 (2) + ECONOPHASE (2) + Base Assembly**

1. MCV440 Electric Panel System 1
2. MCV440 Electric Panel System 2
3. Coils
4. EC Fans
5. ECONOPHASE - System 1
6. ECONOPHASE - System 2
7. High voltage customer connection System 1
8. High voltage customer connection System 2
9. Low voltage customer connection System 1
10. Low voltage customer connection System 2
11. Piping connections Systems 1 & 2

**Front**
- 1
- 4
- 2
- 3
- 6

**Rear**
- 9
- 7
- 8
- 10
- 11

**System 1**
- 1
- 9
- 10
- 11

**System 2**
- 4
- 5
- 6

**Note:**
1. Electrical connections for entire assembly are located in high voltage customer connection boxes (items 7 & 8) and low voltage customer connection box (item 9 & 10).
2. Piping connections for entire assembly are in one location (item 11).
Notes:
1. Minimum clearance of the Main Unit Disconnect Enclosure shall be 48” (1219mm) or per local electrical code.
2. Recommended minimum 48” (1219mm) clearance when multiple skids are mounted side by side to ensure proper airflow. Contact the factory for other spacing requirements.
3. Dry weight 10,550 lbs. (4,785 kg) Shipping weight 11,580 lbs (5,253 kg).

Main
Electrical
Box
End

101 1/4"
(2572mm)

350"
(8892mm)

350"
(8892mm)

111"
(2819mm)
CABINET & ANCHOR DIMENSIONAL DATA
MCV440 (2) + ECONOPHASE (2) + BASE ASSEMBLY

Underside of Unit
Coil and Fans removed for clarity

Notes:
1. Eight mounting holes and eight 3/4" field supplied bolts required to secure skid base assembly to customer support structure. Bolt grade to be specified by local requirements.
Notes:
1. Field to provide hole for conduit for high voltage disconnect box and low voltage distribution panel.

Form No.: DPN001040_REV4
Page: 1 / 1
REV: 1
REV DATE: 10/17
UNIT TO UNIT NETWORK CONNECTIONS

- TB3
- P71, P72
- P74, P64
- E5
- P67
- P66
- P11
- P12
- P21
- P20
- P13
- P7
- P76
- P95
- P100

RS485
ETHERNET
SITE AND BMS COMMUNICATION CONNECTIONS

DETAIL A

ICOM MICROPROCESSOR AND I/O BOARD
ETHERNET CABLE (FIELD SUPPLIED)
UNIT-TO-UNIT NETWORKING SWITCH (FIELD SUPPLIED)

TO / FROM OTHER NETWORKED UNITS

P95 DVI-D CABLE CONNECTION TO 7-INCH ICOM DISPLAY
P100 POWER SUPPLY TO 7-INCH ICOM DISPLAY
UNIT TO UNIT NETWORK CONNECTIONS

NOTE* For dual-unit network configurations only
CABINET DIMENSIONAL DATA
DA250 W/ HORIZONTAL DISCHARGE

Front View
(Data Hall Side)

61" (1550mm) Fan Section
65 1/8" (1654mm) Louvers
59" (1499mm) Louver Section
118 3/8" (3007mm) Louvers

Top View

83 1/2" (2122mm)
120 1/8" (3050mm)

Notes:
1. Louvers in non-raised floor application.

Rear View
(Service on Gallery Side)

44 3/8" (1127mm)
65 1/8" (1654mm) Louvers
59" (1499mm) Louver Section
134 1/8" (3406mm)

For Unit Disassembly Data
Refer to DPN004369
LIEBERT DSE

AIRFLOW SCHEMATIC
DA250 DOWNFLOW UNIT W/ HORIZONTAL DISCHARGE

Return Air from Data Center

Supply Air to Data Center

Front
(Data Hall Side)
1. Blower/Motor (Typical 3)
2. Line Reactor Transformers (Typical 3)
3. Evaporator Coil
4. Air Filters
5. Condensate Pump (optional)
6. Compressor Compartment
7. Electric Panel
8. 575v Step Down Transformer
9. VFD Assemblies (Typical 3)
PIPING SCHEMATIC
DA125, DA150, DA165 & DA250 with LIEBERT MCV

Notes:
1. Two refrigeration circuits provided. Single refrigeration circuit shown for clarity.
2. Circuit 1 must be maintained between indoor unit, condenser and EconoPhase unit. Circuit 2 must be maintained between indoor unit, condenser and EconoPhase unit.
3. Schematic representation shown. Do not use for specific connection locations.
4. The outlet of the receiver must be higher than the elevation of the EEV inside the indoor unit. This vertical height must not exceed 60ft. (18.3m). Liebert DSE Receiver required for systems with or without EconoPhase unit.
5. All indoor and outdoor field refrigerant piping must be insulated, 1/2" minimum thickness. All outdoor insulation must be UV and ozone resistant.
6. Components are not supplied by Liebert but are required for proper circuit operation and maintenance (DA250 with top piping has internally installed traps on the discharge lines).
7. Traps must be installed and horizontal lines pitched to ensure proper oil return and to reduce liquid flood back to compressor. Pitch horizontal gas piping at a minimum of 1/2" per 10 feet (42mm per 10m) so that gravity will aid in moving oil in the direction of the refrigeration flow.
8. Do not isolate any refrigeration circuits from over pressurization protection.
FLOORSTAND DIMENSIONAL DATA

DA250

Notes:

1. Leveling feet are provided with ±1-1/2" (38mm) adjustment from nominal height "A".
2. Dimensions are to center of feet.

<table>
<thead>
<tr>
<th>Height in. (mm)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td></td>
</tr>
<tr>
<td>24 (610)</td>
<td></td>
</tr>
<tr>
<td>30 (762)</td>
<td></td>
</tr>
<tr>
<td>36 (914)</td>
<td></td>
</tr>
<tr>
<td>42 (1069)</td>
<td></td>
</tr>
<tr>
<td>48 (1219)</td>
<td></td>
</tr>
</tbody>
</table>
LIEBERT DSE

INSTALLATION & SERVICE CLEARANCE DATA DA250
INSTALLATION, REPLACEMENT FROM DATA CENTER SIDE, MAINTENANCE FROM GALLERY

- Fan service zone Piping & Cables must not be routed in this zone.
- Installation and replacement clearance for full unit.
- Installation and coil replacement service clearance with disassembly.

Data Hall

Gallery Side

Electrical Panel Access

88" (2235mm)

42" (1067mm)

68" (1727mm)
**INSTALLATION & SERVICE CLEARANCE DATA DA250**

**INSTALLATION, SERVICE, AND MAINTENANCE FROM GALLERY**

- **Data Hall**
  - Fan service zone
  - Piping & Cables must not be routed in this zone.

- **Gallery Side**
  - 88" (2235mm)
    - Full Unit and Electrical Panel Access
  - 68" (1727mm)
    - Unit Disassembly access and Electrical Panel access
FULL UNIT AND ELECTRICAL PANEL ACCESS

DATA HALL

FAN SERVICE ZONE
PIPING & CABLES
MUST NOT BE
ROUTED IN THIS ZONE.

68" (1727mm)

UNIT DISASSEMBLY ACCESS
AND ELECTRICAL PANEL ACCESS

FAN SERVICE ZONE
PIPING & CABLES
MUST NOT BE
ROUTED IN THIS ZONE.
LIEBERT DSE

CABINET DIMENSIONAL DATA
DA250 W/ BOTTOM DISCHARGE

Front View
(Data Hall Side)

Top View

Rear View
(Service on Gallery Side)

For Unit Disassembly Data
Refer to DPN004369

61" (1550mm)
Fan Section

120 1/8" (3051mm)

83 1/2" (2122mm)

44 3/8" (1127mm)

134 1/8" (3406mm)
Gasketing shown is for pictorial purposes only to show edges of unit that require gap sealing. Gasketing and method to be provided and applied by others in the field.

Minimum Gap to be filled with gasketing between each unit:

Gap is measured between frame members of adjacent units.

Data Hall Side
ELECTRICAL FIELD CONNECTIONS
DA250 DOWNFLOW MODELS

STANDARD ELECTRICAL CONNECTIONS

1) High voltage entrance - Located in bottom and top of box (quantity 3)
2) Low voltage entrance – Located in bottom and top of box (quantity 4)
3) Three phase electrical service - Terminals are on top of disconnect switch. Three phase service not provided by Liebert.
4) Earth ground - Terminal for field supplied earth grounding wire and component ground terminal strip.
5) Unit factory installed disconnect switch and Main Fuses – Access to the high voltage electric panel compartment can be obtained only with the switch in the “off” position. Fused disconnects are provided with a defeater button that allows access to the electrical panel when power is on.
6) Remote unit shutdown - Replace existing jumper between terminals 37 & 38 with field supplied normally closed switch having a minimum 75VA, 24VAC rating. Use field supplied Class 1 wiring.
7) Customer alarm inputs - Terminals for field supplied, normally open contacts, having a minimum 75VA, 24VAC rating, between terminals 24 & 50, 51, 55, 56. Use field supplied Class 1 wiring. Terminal availability varies by unit options.
8) Common alarm - On any alarm, normally open dry contact is closed across terminals 75 & 76 for remote indication. 1 AMP, 24VAC max load. Use Class 1 field supplied wiring.
9) Heat rejection interlock - On any call for compressor operation, normally open dry contact is closed across terminals 70 & 71 & 230 to heat rejection equipment. 1 AMP, 24VAC max load. Use Class 1 field supplied wiring.

CANbus ELECTRICAL CONNECTIONS

10) CANbus Connector – Terminal block with terminals 49-1 (CAN-H) and 49-3 (CAN-L) + SH (shield connection). The terminals are used to connect the CANbus communication cable able (provided by others) from the indoor unit to the Liebert MCV Condenser skid
11) CANbus Cable – CANbus cable provided by others to connect to the outdoor condenser and optional PRE unit. No special considerations are required when the total external cable connection between the indoor unit and outdoor unit(s) is less than 450FT (137M). For total external cable connections greater than 450FT (137M). For external cable connections greater than 450FT (137M), but less than 800FT (243M) a CANbus isolator is required (Contact Factory).

Cable must have the following specifications:
- Braided shield or foil shield with drain wire
- Shield must be wired to ground at indoor unit
- 22-18AWG stranded tinned copper
- Twisted pair (minimum 4 twists per foot)
- Low Capacitance (15pF/FT or less)
- Must be rated to meet local codes and conditions
- EXAMPLES BELDEN 89207 (PLENUM RATED), OR ALPHA WIRE 6454 CATEGORY 5, 5E, OR HIGHER
- Do not run in same conduit, raceway, or chase as high voltage wiring.
- For CANbus network lengths greater than 450FT (137M) call Factory.
OPTIONAL ELECTRICAL CONNECTIONS

12) Condensate alarm (with condensate pump option) - On pump high water indication, normally open dry contact is closed across terminals 88 & 89 for remote indication. 1 AMP, 24VAC max load. Use Class 1 field supplied wiring.

13) Remote humidifier - On any call for humidification, normally open dry contact is closed across terminals 11 & 12 to signal field supplied remote humidifier. 1 AMP, 24VAC max load. Use Class 1 field supplied wiring.

14) Reverse Starter contacts - Normally open dry contact is closed across terminals 102 & 103 for power supply 1 and 106 & 107 for power supply 2 to indicate the active power feed. 1 AMP, 24VAC max load. Use Class 1 field supplied wiring.

15) Heat Rejection Power Connection - Terminals are on bottom of fuse block. Use class 1 field supplied wiring for connection to Heat Rejection unit.

16) Smoke sensor alarm - Factory wired dry contacts from smoke sensor are 91-common, 92-NO, and 93-NC. Supervised contacts, 80 & 81, open on sensor trouble indication. This smoke sensor is not intended to function as, or replace, any room smoke detection system that may be required by local or national codes. 1 AMP, 24VAC max load. Use Class 1 field supplied wiring.

17) Analog inputs - Terminals 41, 42, 43, and 44 are user configurable for 0-10V, 0-5V, or 4-20MA.

OPTIONAL LOW VOLTAGE TERMINAL PACKAGE CONNECTIONS

18) Remote unit shutdown - Two additional contact pairs available for unit shutdown (labeled as 37B & 38B, 37C & 38C). Replace jumpers with field supplied normally closed switch having a minimum 75VA, 24VAC rating. Use field supplied Class 1 wiring.

19) Common alarm - On any alarm, two additional normally open dry contacts are closed across terminals 94 & 95 and 96 & 97 for remote indication. 1 AMP, 24VAC max load. Use Class 1 field supplied wiring.

20) Main fan enabled contact - On VFD enable, normally open dry contact is closed across terminals 84 & 85 for remote indication. 1 AMP, 24VAC max load. Use Class 1 field supplied wiring.

21) LiquiTect shutdown and dry contact - On LiquiTect activation, normally open dry contact is closed across terminals 56 & 59 for remote indication (LiquiTect sensor ordered separately). 1 AMP, 24VAC max load. Use Class 1 field supplied wiring.

OPTIONAL COMMUNICATION CONNECTIONS

22) Unit-to-Unit – Plug 64 is reserved for U2U communication

23) Site and BMS – Plug 74 and terminal block 3 are reserved for Site and BMS connections. Plug 74 is an eight pin RJ45 for a Cat 5 cable. Terminal block 3 is a two position screw terminal block for use with twisted pair wires.
LIEBERT DSE

ELECTRICAL FIELD CONNECTIONS
DA250 DOWNFLOW MODELS

DETAIL A
Appendix C: Guide Specifications

The following are the guide specifications for the Liebert® DSE.
Liebert DSE™ Model DA250
Guide Specifications

1.0 GENERAL

1.1 SUMMARY
These specifications describe requirements for a Thermal Management system. The system shall be designed to control temperature 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 system sensible coefficient of performance (SCOP) shall meet ASHRAE 90.1

1.3 SUBMITTALS
Submittals shall be provided with the agreement of 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 service (non-data center) side.

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 DA250

The unit frame section and fan plenum frame shall be welded, formed sheet metal. They shall be protected against corrosion using the autophoretic coating process. The unit section and the fan plenum shall be shipped as two separate sections. The fan plenum shall be field mounted on top of the unit frame section.

2.1.1 DOWNFLOW AIR-SUPPLY CONFIGURATIONS

2.1.1.1 Downflow Air Bottom Discharge

The supply air shall exit from the bottom of the unit.

2.1.1.2 Downflow Air Horizontal Discharge

The supply air shall exit from the front (data hall side) of the unit.

2.1.2 Downflow Air Return

The return air shall enter the unit from the top.

2.1.3 Exterior Panels

The exterior panels shall be insulated with a minimum 1 in. (25mm), 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 _RAL-7021 (gray-black). The fan plenum shall be painted to match color of the main unit.

2.2 FILTERS—DA250

The filter chamber shall be located within the evaporator coil cabinet, and filters shall be removable from the service side (non-data center side) of the unit.

2.2.1 Filters, 4 in. MERV 8 or MERV11

Filters shall be deep-pleated, 4 in. (102 mm) filters with an ASHRAE 52.2-2007 MERV8 or MERV11 rating.

Extra Filter Set

_____ 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 shall prevent access to the high-voltage electrical components until switched to the “OFF” position.

2.3.1 DUAL INPUT POWER (OPTIONAL)

The unit shall be provided with two (2) manual disconnect switches mounted in the high-voltage section of the electrical panel. In addition, the unit shall include reversing starter with electronic timers, phase loss monitors and a selector switch. In the event of a loss of primary power, the unit will automatically switch over to a secondary power source. Upon return of primary power, the unit will automatically return to the primary power source.
2.4 SHORT-CIRCUIT CURRENT RATING (SCCR)

The electrical panel shall provide at least 65,000A SCCR.

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

Plenum Fans with Direct Drive Motors and Variable Speed Drive

The fans shall be plug/plenum type, motorized impellers, single inlet and dynamically balanced. The drive package shall be direct drive, and provided with variable speed drives (3 drives per unit). The fans shall be located to blow air over the Slab coil to ensure even air distribution and maximum coil performance.

- Downflow DA250 fan motors shall be nominal 15hp (11.2 kW) each, with a maximum operating speed of 1800 rpm; quantity, 3.

2.6 REFRIGERATION SYSTEM

2.6.1 Dual Circuit - DA250

Each unit shall include two (2) independent refrigeration circuits and each circuit shall include liquid line filter driers, refrigerant sight glass with moisture indicator and electronic expansion valves. Compressors shall be located outside the air stream and shall be removable and serviceable from the service side of the unit. Each compressor circuit shall be connected to the full-face area of the evaporator coil.

2.7 COMPRESSORS

2.7.1 Tandem Digital Scroll Compressors—DA250

The compressors shall be tandem, scroll-type with a variable capacity operation capability of one compressor of the pair. Compressor solenoid valve shall unload the compressor and allow for variable capacity operation. The compressor shall have vibration isolators, thermal overloads, automatic reset high-pressure switch with lockout after three failures, rotalock service valves, suction line strainer and a maximum operating speed of 3500 rpm. The compressor motor shall be suction gas cooled.

2.8 CRANK-CASE HEATERS

The compressors shall include crankcase heaters, powered from the indoor unit electric panel.

2.9 EVAPORATOR COIL

The evaporator coil shall be Slab design for downflow units and have ___67.5___ sq. ft. (___6.3___ sq m) face area, ___4___ rows deep. It shall be constructed of rifled copper tubes and aluminum fins with a maximum face velocity of ___518___ ft. per minute (___2.6___ m/s) at ___35000___ CFM (___59,465___ CMH). A stainless steel condensate drain pan shall be provided.
2.10 **R-410A REFRIGERANT**

The system shall be designed for use with R-410A refrigerant, which meets the U.S. Clean Air Act for phase-out of HCFC refrigerants. Refrigerant shall be field supplied and field charged by the installing contractor.

2.11 **AIR-COOLED SYSTEMS**

The indoor evaporator unit shall include refrigerant piping and shall have a factory holding charge of nitrogen. The hot-gas and liquid lines shall be spun shut and each shall include a factory-installed Schrader valve. Field-relief of the Schrader valve shall indicate a leak-free system from the factory. Installing contractor shall cut the evaporator piping and shall evacuate and charge the system. Refrigerant shall be supplied by the installing contractor.
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 mounted 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 allows 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.
- Context-Sensitive Help—The Liebert iCOM shall 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 have the ability to configure the Liebert iCOM 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 shall be configurable through the display.
- Additional Readouts—The Liebert iCOM shall permit 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 integrated 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 ability to store the local service or sales contact information.

• Upgradeable—Liebert iCOM firmware upgrades shall be performed through a USB connection.

• Timers/Sleep Mode—The menu shall allow various customer settings for turning on/off unit.

• Menu Layout—The menus shall be divided into two main menu screens: User and Service. The User screen shall contain the menus to access parameters required for basic unit control and setup. The Service screen shall be designed for service personal 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 field-provided sensors. 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® 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 shall activate an audible and visual alarm in the event of any of the following conditions:

- High Temperature
- Low Temperature
- High Humidity
- Low Humidity
- Fan Fault
- Change Filters
- Loss of Air Flow
- Loss of Power
- Compressor Overload
- High Head Pressure
- Low Suction Pressure
- 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 shall include:

- Leak Under Floor
- Smoke Detected
- Standby Unit On

Each alarm (unit and custom) shall 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:

**Cooling Capacity**
- Supply
- Remote
- Return

**Fan Speed**
- Supply
- Remote
- Return
- Manual (for diagnostics or to receive a signal from the BMS through 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.
3.4 MULTI-UNIT COORDINATION

Liebert iCOM teamwork shall save energy by preventing multiple units in an area from operating in opposing modes. Teamwork allows the control to optimize a group of connected 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 derived 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):** 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 units controlling sensors. All sensor readings are shared.

- **Teamwork Mode 3 - Optimized Aisle (Optimized Aisle):** May be applied 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 that the inlet rack temperature is being met. Cooling (Compressors, Economizer or EconoPhase) is controlled off 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 3–Optimized Aisle mode with remote temperature sensors. In Teamwork Mode 3, Cascade mode will stage units On based on the temperature and humidity readings and their deviation from setpoint. Cascade mode coordinates the fan speed dynamically to save energy and to meet 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 needs by cascading units On or putting them back 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 shall provide 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 shall assume the same responsibilities as the master until communication is restored.

3.8 VIRTUAL BACK-DRAFT DAMPER

The Liebert iCOM shall allow the use of a virtual back-draft damper, eliminating the need for a mechanical damper. This shall allow the fans of a stand-by unit to spin in reverse at a low speed (15% or less) to act as a damper.

3.9 COMPRESSOR SHORT CYCLE CONTROL

Compressor short cycle control shall be available to prevent compressor short-cycling and needless compressor wear.

3.10 LIEBERT MCV™ AND ECONOPHASE COMMUNICATION

Units shall be matched with Liebert MCV Premium Condensers and/or optional Liebert EconoPhase unit and shall communicate with them via field-supplied CANbus wires. This communication shall allow Liebert iCOM to control Liebert MCV condenser/EconoPhase modes and operation and to monitor their health and alarm status.

3.11 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.

3.12 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 outage.

3.13 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.

3.14 LOW-PRESSURE MONITORING

Units shall ship standard with low-pressure transducers for monitoring individual compressor suction pressure. If the pressure falls due to loss of charge or other mechanical cause, the corresponding circuit shall shut down to prevent equipment damage. The user shall be notified of the low-pressure condition through the local display and remote monitoring.
3.15 **WINTER START TIME DELAY**

An adjustable software timer shall be provided to assist with compressor starting during cold weather. When the compressor starts, the low-pressure input shall be ignored for the period set in the user-adjustable timer. Once the delay after the compressor start has elapsed, the low-pressure input should remain in the normal state. If the low pressure input does not remain in the normal state after the delay has elapsed, the circuit shall lock out on low pressure. The low-pressure alarm shall be announced on the local display and communicated to remote monitoring systems.

3.16 **ADVANCED FREEZE PROTECTION**

Units shall ship standard with advanced freeze protection enabled. The advanced freeze protection shall monitor the pressure of each circuit using a transducer. The control shall interact with the fan and compressor to prevent the unit coil from freezing if circuit suction pressure drops. Applying fan speed to direct expansion systems requires limitations to avoid freezing condensate on the coil when the unit operates below 100% fan speed. Liebert iCOM's advanced freeze protection provides the ability to predict freeze conditions and correct this condition automatically by adjusting fan speed and compressor capacity. If a freeze condition is detected, the user shall be notified through the local display and remote monitoring systems.

3.17 **ADVANCED HIGH-PRESSURE PROTECTION**

When the compressor is initially activated, the system shall be monitored for a high pressure. When high pressure is detected, the control shall reduce the system discharge pressure by altering the compressor loading and the condenser fan speed, preventing circuit shut down. If the unit is unsuccessful in correcting the problem through this interaction, an alarm shall occur and the affected compressor shall be immediately locked off. The control shall automatically re-enable the compressor when pressure returns to a safe level.

3.18 **REFRIGERANT PRESSURE TRANSDUCER FAILURE**

The control shall monitor the high-side and low-side refrigerant pressure transducers. If the control senses that the transducer has failed, has been disconnected, shorted or the reading has gone out of range, the user shall be notified through the local display and remote monitoring. The corresponding circuit that the failure has occurred on shall be disabled to prevent unit damage.

3.19 **OIL RETURN PROTECTION**

The control shall monitor compressor operation and staging to ensure that liquid and hot gas velocity are maintained for proper oil return to the compressor.

3.20 **DIGITAL SCROLL HIGH-TEMPERATURE PROTECTION**

The control shall monitor digital scroll temperature during unit operation. A compressor temperature limit shall be imposed to help prevent damage to the compressor. If the temperature reaches the maximum temperature limit, the compressor shall be locked out for 30 minutes and an alarm shall be annunciacted on the local display and through monitoring. After the initial lockout, the control shall continue to monitor compressor temperature during the off-cycle and re-enable the circuit once a safe operating temperature is reached and the 30 minutes has elapsed. The control shall store the number of high-temperature trips. The number of trips shall be accessible through the local display.
3.21 DIGITAL SCROLL SENSOR FAILURE
The control shall monitor the status of the digital scroll sensor(s). If the control senses the thermistor becomes disconnected, shorted or the reading goes out of range, the user will be notified through an event on the local display and remote monitoring.

3.22 COMPRESSOR SEQUENCING
A user-selectable compressor sequencing parameter shall be provided and access through the local control. This sequencing parameter presents the user with three choices:

- Always use Compressor 1 as lead compressor.
- Always use Compressor 2 as lead compressor.
- Auto: The unit shall automatically stage compressors to keep each unit's run time within 8 hours of the other unit's run time. NOTE: The Auto setting attempts to maintain equal run times between compressors. However, the control will not turn Off a compressor to equalize run time when it is needed to control the space.
  - **First priority**: If the safety timings are acceptable for only one compressor, that compressor shall be the next to be started/stopped.
  - **Second priority**: If both compressors are Off, the one with fewer working hours shall be the next to start.
  - **Third priority**: If both compressors are in operation, the one that has been operating longer since the last start shall be the next to be stopped.

3.23 COMPRESSOR HIGH- AND LOW-TEMPERATURE LIMIT PROTECTION
The control shall monitor the return air to ensure that the compressor(s) are operated within the manufacturer's defined window of operation. If the return air temperature deviates from the manufacturer's window of operation, the Liebert iCOM shall automatically adjust to prevent damage to the cooling unit or reduction in its reliability.
3.24 COMRESSOR RUN TIME MONITORING

- The control shall log these compressor statistics:
  - Number of compressor starts
  - Run hours
  - Average run time
  - Starts per day
  - Starts per day worst
  - Number of high-pressure alarms
  - Operating phase in which the high-pressure alarm occurred
  - Number of low-pressure alarms
  - Operating phase in which the low-pressure alarm occurred
  - Number of compressor overloads
  - Number of high-temperature alarms (scroll compressors)

The user shall have the ability to monitor compressor operating temperature and pressure from the local display to be used as a diagnostic tool.

3.25 MANUAL COMPRESSOR DISABLEMENT

The user shall have the ability to disable compressor operation using a set of either normally-open or normally-closed dry contacts tied directly to the control or through remote monitoring. An additional enable/disable feature shall be provided to allow the user to permanently disable an individual compressor circuit for maintenance using the local display.

3.26 MANUAL COMPRESSOR OPERATION

The user shall be able to operate each compressor manually from the local display. The user shall be able to energize refrigeration components including liquid-line solenoid valves, compressor contactors, electronic expansion valves and adjust capacity for troubleshooting or repair. The control shall monitor the compressor during manual operation and shall shut the compressor down if needed to prevent electrical or mechanical damage.
4.0 MISCELLANEOUS OPTIONS

4.1 HIGH-TEMPERATURE SENSOR—OPTIONAL
The high-temperature sensor shall be factory-installed in the unit and shall be factory-set to 125°F (52°C). It shall immediately shut down the environmental control system when activated. The sensor shall be mounted with the sensing element in the return air.

4.2 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.

4.3 CONDENSATE PUMP, DUAL FLOAT—OPTIONAL
The condensate pump shall have a minimum capacity of 145 GPH (548 l/h) at 20 ft (58 kPa) head. It shall be complete with integral dual-float switches, pump-and-motor assembly and reservoir. The secondary float shall send a signal to the local alarm and shut down the unit upon high water condition.

4.4 LOW VOLTAGE TERMINAL PACKAGE—OPTIONAL
Factory-installed and factory-wired terminals shall be provided.

- **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.)

4.5 REMOTE HUMIDIFIER CONTACT—OPTIONAL
A pair of N/O contacts provided for connection to a remote humidifier that allow the unit's humidity controller to control a humidifier outside the unit. Power to operate the remote humidifier does not come from the unit.

4.6 FAN OVERLOAD
The fan fault alarm is standard on all models.

4.7 COMPRESSOR OVERLOAD—STANDARD
A pair of N/O contacts shall be factory-installed and wired to each compressor to indicate Compressor Overload.
4.8 QUICK RESTART FUNCTION—OPTIONAL

Unit restart time for full cooling shall be 40 seconds or less after power to the unit has been restored, with fans starting within 15 seconds. The unit shall be equipped with a optional capacitive buffer to provide the Liebert iCOM with a minimum of 3 minutes of ride-through power. The UPS or capacitive buffer shall provide power to the Liebert IS-UNITY-DP™ card for continuous connectivity to Building Management System/Building Automation Systems (where applicable).

4.9 WIRED REMOTE SENSOR(S)—OPTIONAL

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

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

____ (quantity) solid state water sensors shall be provided for installation under the raised floor.

4.11 FLOOR STAND—OPTIONAL FOR RAISED-FLOOR APPLICATIONS

The floor stand shall be constructed of a welded steel frame. The floor stand shall have adjustable legs with vibration isolation pads. The floor stand shall be ____ in. (______mm) high.
5.0 HEAT REJECTION

5.1 LIEBERT MCV CONDENSER SUMMARY

These specifications describe requirements for a Liebert air-cooled condenser for a Liebert Thermal Management system. The condenser shall be designed to reject waste heat to outdoor air and to control refrigerant head pressure as indoor equipment loading and outdoor ambient conditions change.

The manufacturer shall design and furnish all equipment in the quantities and configurations shown on the project drawings. Standard 60 Hz units are 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 condenser model number shall be: ____________________________

5.2 LIEBERT MCV CONDENSER DESIGN REQUIREMENTS

The air-cooled condenser shall be a factory-assembled unit, complete with integral electrical panel, EconopPhase pump package, and designed for outdoor installation. The condenser shall be a draw-through design.

The unit is to be supplied for operation using a 460volt/3phase/60Hz power supply.

5.3 LIEBERT MCV CONDENSER STANDARD FEATURES-ALL CONDENSERS

Condenser shall consist of microchannel condenser coil(s), propeller fan(s) direct-driven by individual fan motor(s), electrical controls. The Liebert air-cooled condenser shall provide positive refrigerant head pressure control to the indoor cooling unit by adjusting heat rejection capacity. Microchannel coils shall provide superior heat transfer, reduce air-side pressure drop, increase energy efficiency and significantly reduce the system refrigerant volume required. EC fans and fan operating techniques shall provide reduced maximum sound levels.

5.4 LIEBERT MCV CONDENSER COIL

5.4.1 Aluminum Microchannel Coil

Microchannel coils shall be constructed of aluminum microchannel tubes, fins and manifolds. Tubes shall be flat and contain multiple, parallel flow microchannels and span between aluminum headers. Full-depth louvered aluminum fins shall fill spaces between the tubes. Tubes, fins and aluminum headers shall be oven brazed to form a complete refrigerant-to-air heat exchanger coil. Copper stub pipes shall be electric resistance welded to aluminum coils and joints protected with polyolefin to seal joints from corrosive environmental elements. Coil assemblies shall be factory leak-tested at a minimum of 300 psig (2068kPag). Hot gas and liquid lines shall be copper and shall be brazed using nitrogen gas flow to the stub pipes with spun closed ends for customer piping connections.

5.5 CONDENSER FAN

The fan motor/blade assembly shall have an external rotor motor, fan blades and fan/finger guard. Fan blades shall be constructed of cast aluminum or glass-reinforced polymeric material. Fan guards shall be heavy gauge, close meshed steel wire, coated with a black corrosion resistant finish. Fan terminal blocks shall be located in an IP54 enclosure located on the top of the fan motor. Fan assemblies shall be factory-balanced, tested before shipment and mounted securely to the condenser structure.
5.5.1 EC Fan Motor

The EC Fan motors shall be electronically commutated for variable speed operation and shall have ball bearings. The EC fans shall provide internal overload protection through built-in electronics. Each EC fan motor shall have a built-in controller and communication module, linked via RS485 communication wire to each fan and the Premium Control Board, allowing each fan to receive and respond to precise fan speed inputs from the Premium Control Board.

5.6 CONDENSER ELECTRICAL CONTROLS

Electrical controls and service connection terminals shall be provided and factory wired inside the attached control panel section. A locking disconnect switch shall be factory-mounted and wired to the electrical panel and controlled via an externally mounted locking and lockable door handle. Only high-voltage supply wiring and low voltage indoor unit communication/interlock wiring are required at condenser installation.

5.7 PREMIUM EFFICIENCY FAN CONTROL

The Liebert MC EC Fan/Premium Control System shall include an electronic control board, EC fan motor(s) with internal overload protection, refrigerant and ambient temperature thermistors and refrigerant pressure transducers. The Premium Control Board shall communicate directly with the indoor unit's Liebert iCOM® control via field supplied CANbus communication wires and via field-supplied low-voltage interlock wires. The control board shall use sensor and communication inputs to maintain refrigerant pressure by controlling each EC fan on the same refrigerant circuit to the same speed. The control system provides refrigerant head pressure and system starting for outdoor ambient temperature as low as -30°F (-35 °C), provided the total temperature design range (from minimum to maximum) is 125°F (70°C) or less.

The mode of the Liebert MC shall be controlled by the Liebert DSE iCOM control and shall be in either DX, EconoPhase or Idle Mode by each refrigerant circuit. Dual circuit condensers shall operate fans to meet airflow needs and mode of each circuit independent of the other. Fan(s) on common refrigerant circuit shall operate in synchronous speed when that circuit is active.

5.8 SKID LOCKING DISCONNECT

A locking-type disconnect switch shall be factory-mounted and wired to the electrical panel. The switch shall be accessible from the outside of the unit with the door closed, and shall prevent access to the high-voltage electrical components until switched to the Off position. The locking disconnect shall be lockable in support of lockout/tag-out safety programs.

5.8.1 Short Circuit Current Rating

The electrical panel shall provide at least 65,000A SCCR.

5.8.2 575V Option

The secondary electrical enclosure shall contain a factory wired transformer and fusing to support 575V input power. All internal wiring shall be provided to connect main and secondary electrical enclosures. High-voltage supply and low voltage indoor unit communication/interlock connections shall be made in the main electrical enclosure.
5.9 **CABINET**

The condenser cabinet shall be divided into fan and coil sections by full width baffles per corresponding DX circuits. Internal structural support members, including coil support frame, shall be painted or galvanized steel for strength and corrosion resistance. Panel doors are provided on the outside of each coil/fan section to provide for coil cleaning. An electrical panel shall be contained inside a factory mounted, NEMA 3R weatherproof electrical enclosure. Galvanized steel base is available and required to support the condenser mounting, rigging and airflow.

5.10 **LIEBERT DSE™ RECEIVER**

Liebert DSE Receiver shall be painted, un-insulated receiver with integral fusible plug, formed copper pipe for ease of connecting condenser liquid line to receiver and mounting bracket. These receivers are factory installed and piped to the Liebert MCV Skid assembly.

5.11 **LIEBERT ECONOPHASE**

The Liebert EconoPhase has two variable speed refrigerant pumps controlled by individual VFDs, factory wired electrical panel, factory piped and tested refrigerant piping all housed within a bright aluminum NEMA 3R enclosure. The Liebert EconoPhase is mounted, wired, and piped into the Liebert MCV Condenser Skid to provide significant jobsite installation savings. The Liebert EconoPhase refrigerant pumps are individually activated and speed controlled during cooler outdoor ambient, coordinated with Liebert DSE compressors idled and refrigerant bypassed around them. Cool temperatures, such as mild weather and at night, partial economization and power savings is provided with one pump activated and one compressor idled. Colder temperatures, such as winter weather, allow both Liebert DSE compressors to be idled and EconoPhase pumps to be controlled independently to provide full economization.

5.12 **CONDENSER HOUSING**

The condenser housing is constructed of galvanized steel and divided into individual fan sections by full width baffles. Internal structural support members, including coil support frame, are galvanized steel for strength and corrosion resistance. Panel doors are provided on the outside of each coil/fan section to provide for coil cleaning. Galvanized steel base is available and required to support the condenser mounting, rigging and airflow.

Condenser shall be shipped pre-installed on a base structure that includes the EconoPhase pumped refrigerant economizer, refrigerant receivers and all associated piping.
6.0 EXECUTION

6.1 INSTALLATION OF THERMAL MANAGEMENT UNITS

The customer or the customer's representative shall be responsible for the following:

6.1.1 General

Install Thermal Management units in accordance with the manufacturer's installation instructions. Install units plumb and level, firmly anchored in locations indicated and maintain the manufacturer's recommended clearances.

6.1.2 Electrical Wiring

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

6.2 PIPING CONNECTIONS

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

6.2.1 Supply and Drain Water Piping

Connect water-supply and drains to air-conditioning unit. Provide pitch and trap as manufacturer's instructions and local codes require.

6.3 FIELD QUALITY CONTROL

Start cooling units in accordance with the 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.

6.4 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.

Engage manufacturer's field service technician to provide warranty start-up supervision and assist in programming of unit(s) controls and ancillary panels supplied by them.