Installation and Operation Manual

Low Power (LP) DC Power System

LPS Power Enclosure
LPB Battery Enclosure
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1. Safety and Recommended Practices

General Practices

For use in restricted-access locations only
Suitable for mounting on concrete or other non-combustible surface only

The power enclosure accepts an AC voltage between 90 and 300V AC, 47 to 63Hz, and produces a regulated output of 10.5 to 56V DC. The enclosure is capable of delivering a maximum of 14A (redundant 7A) of DC power in an ambient operating temperature range of -40ºC to +50ºC.

CAUTION: HAZARDOUS VOLTAGE AND ENERGY LEVELS ARE PRESENT WHICH CAN PRODUCE SERIOUS SHOCKS AND BURNS. Only authorized, qualified, and trained personnel should attempt to work on this equipment. Refer to datasheets for full product specifications.

Observe all local and national electrical, environmental, and workplace codes.

Each power shelf should be fed from a dedicated AC branch circuit of a TN power system.

If a line cord is used as the AC connection means, the plug end of the cord is considered to be the primary disconnect means, and reasonable access must be given to the plug and receptacle area. The receptacle must be fed with a breaker or fuse sized for 15 amp service.

For hard-wired AC connections, a readily accessible disconnect device shall be incorporated in the building installation wiring. The breaker or fuse must be sized for 15 amp service.

CAUTION: All rectifiers employ internal double pole/neutral fusing.

The alarm contacts are rated for a maximum voltage of 60V, SELV (Safety Extra Low Voltage) and a maximum continuous current of 0.5A.

Connection and mounting torque requirements are listed in Table 2.

Shipping the power shelf with rectifiers installed is not recommended. Rectifiers are shipped in separate boxes provided by Eltek Valere.
FCC Compliance Statement

NOTE: This device complies with Part 15 of FCC Rules. Operation is subject to the following two conditions:

1. This device may not cause harmful interference.
2. This device must accept any interference received, including interference that may cause undesired operation.

WARNING: Changes or modifications to this unit not expressly approved by the party responsible for the compliance could void the user's authority to operate this equipment.
2. Power Enclosure Specifications

The power enclosure is two (2) rack units high, 17.25” wide, and 6.43” deep. The power enclosure will hold two (2) rectifiers with a user interface board, and connections for batteries. See Section 10 for battery enclosure information.

AC requirements

Rectifier Input Voltages

The LP system is powered by C-series rectifiers, which operate on an AC service with a nominal voltage between 100V AC and 240V AC and a maximum current of a 15A. Rectifiers that work in the LP system are listed in Table 1.

<table>
<thead>
<tr>
<th>Model</th>
<th>Nominal DC Voltage (Vdc)</th>
<th>DC Voltage Range (Vdc)</th>
<th>Max Output Current (Idc)</th>
<th>AC Voltage Range (Vac)</th>
</tr>
</thead>
<tbody>
<tr>
<td>C0350A</td>
<td>48</td>
<td>42 - 56</td>
<td>7</td>
<td>90 - 300</td>
</tr>
</tbody>
</table>

Table 1 - Rectifier Specifications

AC Input Diagrams

This system utilizes a single feed AC architecture as shown in Figure 1 via a side mounted IEC320 receptacle, seen in Figure 7.

Single Feed

A single feed architecture powers both rectifier slots on one (1) AC feed. The AC feed requires a 15A breaker feeding 14AWG wire and an IEC320 plug.
This system will accept GMT fuses up to 15A.

**Circuit 100**

![DC Wire Diagram (Circuit 100)](image)

Each system is equipped with eight (8) GMT fuses and a connection for an optional battery enclosure, as shown in Figure 2. GMT fuse connections are made with compression screws. Size the DC wiring based on fuse rating. Maximum wire size for fuse connections is 12AWG wire.

**Grounding**

The DC ground screw pointed out in Figure 8 ties the fuse returns to the chassis. It is recommended to use a 6 AWG wire from the mounting bracket of the power enclosure to a central office ground bus to properly ground the system. See the grounding instructions on page 16 for more details.

**DC Output Wire Sizing**

There are two main considerations for sizing DC wire: ampacity and voltage drop. Ampacity refers to a safe current carrying level as specified by non-profit organizations such as Underwriters Laboratories (UL) and the National Fire Prevention Association (NFPA), which publishes the National Electric Code (NEC). Voltage drop is simply the amount of voltage loss in a length of wire due to ohmic resistance of the conductor. DC wire may be sized for either ampacity or voltage drop depending on branch load loop length and conductor heating. In general, ampacity considerations will drive wire selection for short loop lengths (less than 50 feet) and voltage drop will drive wire selection for long loop lengths (greater than 50 feet). NEC Table 310.16 provides ampacity values for various sizes, bundles, and insulation temperature rated wire.
For the LP system, DC wire size should be determined by fuse rating.

**WARNING:** Always follow NEC rules and your local company practices when selecting DC wiring and protection.

**Torque Settings**

Table 2 shows recommended torque settings for all mechanical and electrical connections according to screw or nut size.

<table>
<thead>
<tr>
<th>Screw or Nut Size</th>
<th>Torque (in-lbs)</th>
<th>Torque (N·m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>4-40</td>
<td>6</td>
<td>1</td>
</tr>
<tr>
<td>6-32</td>
<td>12</td>
<td>1.5</td>
</tr>
<tr>
<td>8-32</td>
<td>22</td>
<td>3</td>
</tr>
<tr>
<td>10-32</td>
<td>37</td>
<td>4.25</td>
</tr>
<tr>
<td>12-24</td>
<td>50</td>
<td>5.75</td>
</tr>
<tr>
<td>⅛-20</td>
<td>65</td>
<td>7.5</td>
</tr>
</tbody>
</table>

Table 2 - Recommended Torque Settings
3. Required Tools

Eltek Valere systems are designed to be installed with a minimum number of commonly available tools.

- #1 & #2 Flat head and Phillips screwdrivers
- Torque wrench
- 5/16” box wrenches, sockets, and/or nut drivers
- Wire and cable strippers
- Wire and cable crimpers
4. Site and Equipment Preparation

Before unpacking the DC Power Plant, note any physical package damage that could indicate potential damage to the contents. After removing DC Power Plant from boxes and packing material, inspect for shipping and/or other damage. Contact sales or technical support immediately if any damage is present. Have all tools, wire, cables, and hardware within easy reach. To the extent possible, ensure a clean (free of debris, dust, and foreign material) work environment. Care should be taken in the installation process to prevent exposure of the equipment to wire clippings. If possible, the rectifiers should remained sealed in their shipping boxes until the shelf wiring is complete. Ensure all AC and DC power sources are off and disconnected.
5. Power Plant Mounting and Wiring

Before installing the power system the following safety requirements should be considered.

- **Elevated Operating Ambient:** If installed in a closed or multi-unit rack assembly, the operating ambient temperature of the rack environment may be greater than room ambient. Therefore, consideration should be given to installing the equipment in an environment compatible with the maximum ambient temperature (Tamb) specified by the manufacturer.

- **Reduced Air Flow:** Installation of the equipment in a rack should be such that the amount of air flow required for safe operation of the equipment is not compromised.

- **Mechanical Loading:** Mounting of the equipment in the rack should be such that a hazardous condition is not achieved due to uneven mechanical loading.

- **Circuit Overloading:** Consideration should be given to the connection of the equipment to the supply circuit and the effect that overloading of the circuits might have on overcurrent protection and supply wiring. Appropriate consideration of equipment nameplate ratings should be used when addressing this concern.

- **Reliable Earthing:** Reliable earthing of rack-mounted equipment should be maintained. Particular attention should be given to supply connections other than direct connections to the branch circuit (e.g. use of power strips).

These instructions are meant for installation of the power enclosure as a stand alone unit. For battery enclosure installation see section 10.

**Bracket Installation**

Brackets can be installed either for wall mount (Figure 3) or rack mount (Figure 4). Use the counter-sunk screws provided to attach the bracket in the desired position.
Mechanical Mounting

This equipment is intended for normal operations and is to be installed in a standard 19” telecommunications rack or wall mounted.

Rack Mounting

Mounting hardware (#12-24 screws) is supplied with the LP system enclosure. Eltek Valere recommends having assistance to hold the system in place during installation.

1. Thread a screw partway on each side of the rack.
2. Place the keyhole on partially threaded screws to assist in installation of the shelf.
3. Have an assistant hold the shelf in place while installing the other screws. Use at least two (2) screws per bracket. Torque to specifications in Table 2 on page 9.

Wall Mounting

Hardware for wall mounting is not supplied. If mounting the system to a wall, choose a suitable mounting surface that can support the loaded weight of the system. Either #12 or 1/4” screws with washers are recommended. Use at least four (4) key holes on the rear of the enclosure when securing it to the wall. The bracket ears are only necessary if extra support is required.

1. Place the enclosure in the desired position on the wall.
2. Mark the location of at least four of the key holes.
3. Remove the enclosure and install either #12 or 1/4” screws with washers.
4. Hang the enclosure on the screws. If desired, tighten down the screws to secure the box.
AC Input

Single Feed

1. Connect the AC cord into the IEC320 receptacle.
2. Use the AC cord clamp in the kit provided to secure the IEC320 plug to the shelf.
3. When ready, plug the other end into an appropriate AC outlet.
DC Output Connections

Circuit 100

NOTE: Use the “Distribution Label” card, located on the door of the distribution bay, to check fuse and breaker locations.

WARNING: For continued protection against fire, only replace a fuse with another of the same type and rating. Indicating fuses have exposed live parts. Use caution when replacing or servicing them.

Circuit 100 contains eight (8) GMT fuse connections in the power enclosure. All connections are front accessible (Figure 8).

![Diagram of GMT fuse connections]

Figure 8 – DC Output Connections (Circuit 100)

1. For GMT output and return connections, place wire into appropriate position on the compression screw terminal strip (Figure 8)
2. Tighten to 4 in-lbs.
3. Select the wire size according the section “DC Output Wire Sizing” on page 8. GMT cables should be routed out of the power enclosure through the cable holes just to the right of the GMT terminal block.
4. Install fuses into the appropriate slot in the GMT fuse block shown in Figure 8.
Grounding

There is a #6-32 screw inserted into the DC grounding position pointed out in Figure 8. It is recommended to connect a 6 AWG wire from the mounting bracket of the power enclosure to a central office ground bar to properly ground the system. Burndy lug YA6CL1-BOX is recommended. See Figure 9.

![Figure 9 - Recommended Grounding Method](image)

Follow the instruction in the section “Mounting and Grounding” on page 24 for securing ground to the battery enclosure. In the event that a floating system is needed the screw can be removed to float the returns from the chassis.

Alarm Connections

Four (4) form C relays are available through compression screw connectors that are shown in Figure 10. Connect wire into the common (C) and either the normally open (NO), or normally closed (NC) depending on the alarm polarity of your equipment. Alarms are labeled AC for AC input failure, RECT for rectifier failure, DIST for fuse open alarms, and BAT for low voltage alarm. See Table 5 in the Troubleshooting section for an explanation of alarms and possible solutions to these conditions.
6. Test and Turn-Up

Power Up

1. Secure and check all AC and DC connections.

2. Install each rectifier sequentially by sliding the unit into the shelf until it attaches to the backplane; use the thumb screws to secure each rectifier into position as shown in Figure 11.

The rectifiers will start in high fan speed mode, if rectifier contains fans, and reduce speed according to the ambient and plant conditions within 10 seconds. If there are alarms present, refer to Section 9 for troubleshooting assistance.

![Thumb screw](image)

Figure 11 - Rectifier Insertion
7. Controller Card

Voltage Adjustment

The controller card is located in the power enclosure as seen in Figure 12. Use the voltage adjust switch to adjust the rectifier output voltage in 50mV increments.

NOTE: Allow 10 seconds to pass after adjusting the float voltage before removing rectifiers.

Monitoring Output Voltage / Current

Output voltage can be monitored by placing a volt meter—set to measure DC voltage—into the “Vout” and “Common” measuring points (Figure 12).

Output current can be monitored by placing the volt meter—set to measure DC volts—into the Iout and common measuring points (Figure 12). Use the conversion factor 1mV = 1A.

LED Lamp Test

For the LED lamp test, press the battery test push button for less than 2 seconds. The system will illuminate all system LED’s for 3 seconds.
Battery Test

The battery test will only operate if rectifiers are installed and are running in an AC OK and DC OK state, and temperature compensation is not active. Use the following directions to execute a battery test:

1. Press the battery test push button for more than 3 seconds.
2. The system will initiate an LED lamp test, turn the LED’s off for one second, and then start the battery test for 30 seconds.
3. During the test, the rectifier output voltage will be set to 45V DC. If the battery voltage stays above 46.5V DC the green OK LED will blink. If the battery voltage drops below 46V DC, the red ALARM LED will blink for several seconds and then return to the previous state.
4. The system will return to normal operation after 30 seconds.

Dip Switches

Dip switches are available to adjust the temperature compensation state and the low voltage (LV) setpoint. See Figure 12 for location.

Temperature Compensation

Enable temperature compensation by setting dip switch number 1 (see Figure 13) to the ON position. Temperature compensation will activate if the battery temperature exceeds 30°C, at which point the output voltage will start reducing. The SYSTEM OK green LED will blink slowly when temperature compensation is active. Temperature compensation does not trigger any alarm via the form-C relays. See Table 4 for default setpoints.

NOTE: The System OK green LED blinks only when temperature compensation is active, not when it is enabled.

Adjusting Float Voltage

To adjust the float voltage, while temperature compensation is active, follow the directions below.

1. Set the temperature compensation dip switch number 1 to the OFF position
2. Follow the voltage adjustment instructions in the section “Voltage Adjustment” on page 18.
3. Set the temperature compensation dip switch to the ON position
Low Voltage Alarm

The low voltage alarm setting can be adjusted within the ranges listed in Table 3. The adjustments correspond to the dip switch patterns in Table 3. A battery fail or low voltage alarm (BAT) will be triggered when the system voltage drops below the LV setting for more than 1 second.

0 = OFF
1 = ON
x = N/A

Figure 13 - Dip Switches

<table>
<thead>
<tr>
<th>Dip switch positions 1234</th>
<th>LV setting</th>
</tr>
</thead>
<tbody>
<tr>
<td>x000</td>
<td>48.0 Vdc</td>
</tr>
<tr>
<td>x100</td>
<td>48.5 Vdc</td>
</tr>
<tr>
<td>x010</td>
<td>49.0 Vdc</td>
</tr>
<tr>
<td>x110</td>
<td>49.5 Vdc</td>
</tr>
<tr>
<td>x001</td>
<td>50.0 Vdc</td>
</tr>
<tr>
<td>x101</td>
<td>50.5 Vdc</td>
</tr>
<tr>
<td>x011</td>
<td>51.0 Vdc</td>
</tr>
<tr>
<td>x111</td>
<td>51.5 Vdc</td>
</tr>
</tbody>
</table>

Table 3 - LV Setting Logic Table
<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
<th>Default</th>
</tr>
</thead>
<tbody>
<tr>
<td>Float Voltage</td>
<td>The voltage to which the rectifiers will regulate the plant during float mode.</td>
<td>54 Vdc</td>
</tr>
<tr>
<td>Low Voltage Alarm (BAT)</td>
<td>The system will alarm if the plant voltage drops below this setpoint for more than one second.</td>
<td>51 Vdc</td>
</tr>
<tr>
<td>Temperature Compensation Status</td>
<td>Enables thermal compensation. Thermal compensation adjusts the float voltage of the rectifiers to decrease the temperature of the batteries.</td>
<td>ON</td>
</tr>
<tr>
<td>High Voltage Alarm</td>
<td>The system will alarm (DIST) if the plant voltage increases above this setpoint for more than one second.</td>
<td>57 Vdc</td>
</tr>
<tr>
<td>High Voltage Shutdown</td>
<td>The rectifiers will shutdown if the plant voltage exceeds this setpoint.</td>
<td>60.5 Vdc</td>
</tr>
<tr>
<td>Temperature Compensation Start</td>
<td>The high temperature at which the system activates thermal compensation.</td>
<td>30°C</td>
</tr>
<tr>
<td>Temperature Compensation Slope</td>
<td>The slope value at which the system will reduce the float voltage per degree if thermal compensation is active.</td>
<td>72 mV/°C</td>
</tr>
<tr>
<td>Temperature Compensation Stop Voltage</td>
<td>The minimum voltage to which the system will reduce plant voltage for thermal compensation.</td>
<td>50 Vdc</td>
</tr>
</tbody>
</table>

Table 4 - Controller Settings
8. Replacement Items

Rectifier Removal

The rectifiers are hot swappable, therefore a rectifier may be removed while the system is operating.

1. Using a screw driver or your fingers, loosen the rectifier screw to detach the rectifiers from the shelf.

2. Grab the handle and remove the rectifier from the system.

Reverse the preceding procedure for inserting a new rectifier.

Figure 14 - Rectifier Removal
9. Troubleshooting

The modular, plug-n-play nature of this plant makes diagnostics and repair very easy.

Make sure that all rectifiers are properly seated and latched into their respective slots. Make sure that all power and signal connectors are properly mated. Table 5 lists problems and potential solutions.

<table>
<thead>
<tr>
<th>Alarm</th>
<th>Problem</th>
<th>Solutions</th>
</tr>
</thead>
<tbody>
<tr>
<td>AC relay in conjunction with no LEDs lit on the rectifiers</td>
<td>Commercial power has been lost to the specified rectifiers.</td>
<td>Reset commercial circuit breaker to the dedicated AC circuit that feeds system. Seek alternative power source until power is restored.</td>
</tr>
<tr>
<td>RECT relay in conjunction with the DC OK LED off and ALM LED on the rectifier or no LEDs on the rectifier</td>
<td>Rectifier(s) have quit working</td>
<td>Replace failed rectifier</td>
</tr>
<tr>
<td>Rectifier(s) have shutdown due to excessive heat.</td>
<td>Reduce the amount of heat in the enclosure. Unit will auto recover.</td>
<td></td>
</tr>
<tr>
<td>DIST relay</td>
<td>Fuse open</td>
<td>Replace the fuse</td>
</tr>
<tr>
<td>Battery breaker tripped or off</td>
<td>Turn battery breaker on</td>
<td></td>
</tr>
<tr>
<td>High Voltage</td>
<td>Replace bad rectifier</td>
<td></td>
</tr>
<tr>
<td>Temperature Compensation Active (Green LED blinking slowly)</td>
<td>Plant Voltage drops with increasing temperature and LED is blinking slowly</td>
<td>Temperature compensation is in effect reducing the output to the batteries. If this does not reduce the battery temp. enough, disconnect the batteries from the rectifiers.</td>
</tr>
<tr>
<td>Room temperature is above temperature setpoint.</td>
<td>Cool the room down</td>
<td></td>
</tr>
<tr>
<td>BAT</td>
<td>System voltage is below low voltage (LV) threshold for more than 1 second</td>
<td>Replace the batteries or look for alternative power source.</td>
</tr>
<tr>
<td>If the rectifiers are working, the float voltage setpoint has been set below LV setpoint, raise float voltage value above LV setpoint. This could also be caused by temperature compensation lowering the rectifier voltage below the LV setpoint. See temper</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 5 - Problems and Solutions
10. Battery Enclosure Installation

NOTE: The following instructions for battery installation show a 48V configuration with four (4) batteries. Use the following instructions to assist in the installation of the optional LPB012 battery enclosure. The larger LPB040 enclosure is described in a separate document supplied with its kit.

Mounting and Grounding

As with the power enclosure, this equipment is intended for normal operations. It is designed for installation into a standard 19” telecommunications rack and wall mounting.

Rack Mounting

Mounting hardware (#12-24 screws) is supplied with the LP system enclosure. Eltek Valere recommends having assistance to hold the system in place during installation.

1. Thread a screw partway on each side of the rack.
2. Place the keyhole on partially threaded screws to assist in installation of the shelf.
3. Have an assistant hold the shelf in place while installing the other screws. Use at least three (3) screws per bracket. Torque to specifications in Table 2 on page 9.

Wall Mounting

Hardware for wall mounting is not supplied. If mounting the system to a wall, choose a suitable mounting surface that can support the loaded weight of the system. Either #12 or 1/4” screws with washers are recommended. Use all six (6) key holes on the rear of the enclosure when securing it to the wall. The bracket ears are only necessary if extra support is required.

1. Attach the mounting brackets to the power enclosure for grounding points (see Figure 15).
2. Mark the location of at least four of the key holes.
3. Remove the enclosure and install either #12 or 1/4” screws with washers.
4. Hang the enclosure on the screws. If desired, tighten down the screws to secure the box.
Grounding

Attach the provided DC ground cable (CA410002723) to the mounting bracket of the battery enclosure and the other end to the mounting bracket of the power enclosure. See the section “Grounding” on page 16 for information on grounding the power enclosure. Torque mounting hardware according to Table 2. This cable is a 14AWG wire with ring terminals for a #10 screw.

Battery Installation

The optional battery enclosure is designed for both 7A-hr and 12A-hr batteries. Because the size difference between the battery types, anchors for the Velcro straps are in different positions. The enclosure in Figure 16 is designed for 12A-hr batteries. The anchor on the right side is mounted to the right wall. In the 7A-hr battery enclosure, the anchor must be removed and mounted to the back wall, as shown in Figure 23 on page 29.
The battery output cable connector is shown in Figure 18 and the pin out is in Table 6.

### Table 6 - Battery Input Connector Pin Out

<table>
<thead>
<tr>
<th>Pin</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Battery +</td>
</tr>
<tr>
<td>2</td>
<td>Battery -</td>
</tr>
<tr>
<td>3</td>
<td>Tprobe +</td>
</tr>
<tr>
<td>4</td>
<td>Tprobe -</td>
</tr>
<tr>
<td>5</td>
<td>CB alarm return</td>
</tr>
<tr>
<td>6</td>
<td>CB alarm output</td>
</tr>
</tbody>
</table>

### Battery Installation

1. Follow instructions in the section “Mounting and Grounding” on page 24 before proceeding.
2. Verify that the battery breaker is turned off.
3. Install side B of the battery output cable into the battery output connection shown in Figure 19. Route the cable through the cable entry holes just to the right and connect side A of the cable to the battery input connection of the power enclosure shown in Figure 20.
4. If connecting only one battery enclosure, proceed to the next step.

If connecting multiple battery enclosures, plug side B of the battery output cable into the battery output connection of the second enclosure. Route the cable through the cable entry holes of enclosure two and connect side A of the cable to the battery daisy chain connector of enclosure one shown in Figure 21. Repeat for additional battery enclosures.
NOTE: Some installation photos in this section do not include the battery output cable for photo clarity, but it is recommended that this cable be installed before proceeding with these instructions.

5. If installing 12A-hr batteries, continue to the next step.

If installing 7A-hr batteries remove the Velcro strap anchor on the right side of the system and install it into the position pointed out in Figure 23.
6. Thread the Velcro strap (provided) through the strap anchors.

7. Plug the battery input cable (clip side down) into an open position on the “battery cable connections” pointed out in Figure 17.

8. Connect the cable (CA112002477) to a battery. Connect the red wire to the positive (colored red on the battery) and the black wire to the negative (colored black on the battery), as seen in Figure 24.

9. Turn the battery around and slide it into the enclosure with the terminals facing the rear of the enclosure. If installing 12 A-Hr batteries, slide the battery to the far right as shown in Figure 25.
10. Repeat steps 7 to 9 for the remaining batteries.

11. Secure the Velcro strap (Figure 26 and Figure 27).

12. When ready turn the battery breaker on.

13. Verify the polarity of the connections before attaching equipment to the system.

This concludes the LP System (LPS) and Battery Enclosure (LPB) installation procedure.

For questions about installation or operation, please contact Eltek Valere Technical Services at 1-866-240-6614.
## 11. Revision Record

<table>
<thead>
<tr>
<th>Revision</th>
<th>Release</th>
<th>Description</th>
<th>CO</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>01/01/05</td>
<td>Release</td>
<td>NA</td>
</tr>
<tr>
<td>2</td>
<td>06/01/07</td>
<td>Mounting instructions expanded; AC cord kit added; more controller information added; battery enclosure section added</td>
<td>NA</td>
</tr>
<tr>
<td>3</td>
<td>09/15/08</td>
<td>Wire sizing removed (UL requirement); 24V system information removed (discontinued); more step-by-step procedures incorporated; battery section revised</td>
<td>NA</td>
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</tbody>
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