

Installing Battery Backup Units

Cisco Catalyst IR8140 Heavy Duty Router supports up to three battery backup units (BBUs) that provide power to the router if the router's AC power supply fails or is not available. This section describes the BBU features and installation procedures.

These topics are discussed:

- Battery Backup Operations, on page 1
- BBU Status, on page 2
- Battery Backup Mode, on page 3
- BBU Lifecycle Handling and Storage Guidelines, on page 3
- Preparing to Install a BBU, on page 6
- BBU Components, on page 7
- Online Insertion and Removal, on page 8
- Installing BBUs in the Router, on page 8
- BBU Technical Specifications, on page 16

Battery Backup Operations

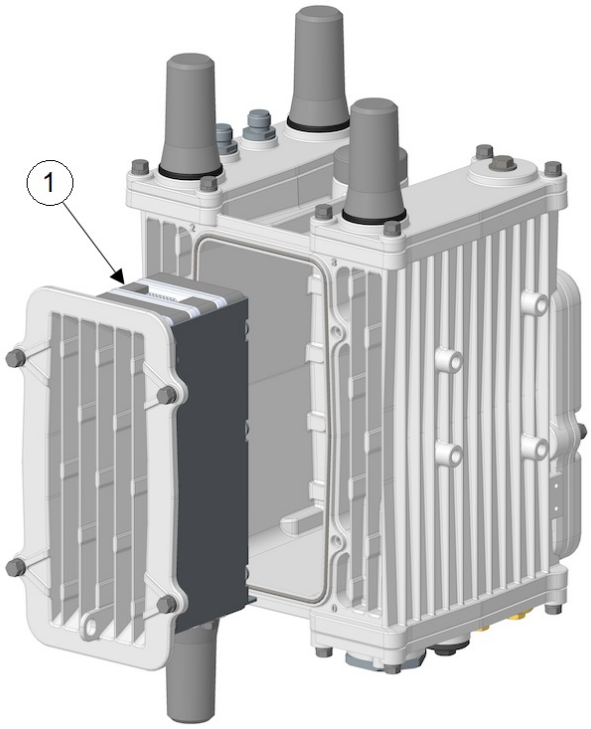
BBUs provide the router with an emergency power source if the AC power source is unavailable.

The router supports up to three BBUs. The units are mounted in the center-front of the IR8140H. When you install three BBUs, up to 8 hours of battery backup power is available on a fully-loaded system in the event of an AC power failure. BBUs can be replaced in the field.

BBUs can be installed in the router when the router is powered on and operating normally.

The BBU's internal components include battery cells, a primary protection circuit, a fuel gauge, and a charger. For detailed, illustrated descriptions of a BBU, see BBU Components, on page 7.

Figure 1: Battery Backup Units Mounted on Router



Item	Cisco Product ID (PID)	Description
1	IRMH-BATT-4AH	Battery backup units. The router supports up to three BBUs.

BBU Status

A BBU must first be enabled before it can begin supplying power to the router. The BBU continues to supply power to the router until at least one of the following conditions is met:

- All BBUs are completely discharged.
- AC power to the router is restored.
- The BBU is disabled with software commands (see Cisco Catalyst IR8140 Heavy Duty Series Router Software Configuration).

Note For information on technical details about the router power path selection and the conditions that trigger a BBU to begin operating, see BBU Technical Specifications, on page 16.

Battery Backup Mode

This section describes the impact on the router configuration and operating capabilities when the router switches from AC power to BBU power.

BBU Capacity

The router supports up to three BBUs at one time. You should install as many BBUs, as needed, up to three, to meet your emergency power requirements.

If all the installed batteries fully discharge while providing backup power to the router, the router will send a dying gasp message and then shut down.

Router Configuration

The router's software configuration is not impacted when the router switches from AC power to BBU power.

Universal Interface Module Operation

By default, the UIMs installed in the slots continue to operate normally when the router switches from AC power to BBU power.

You can configure the router to automatically power off specific modules when the router switches to BBU power.

BBU Lifecycle Handling and Storage Guidelines

This section contains information about the BBU status and condition during the BBU lifecycle and how to approach and manage it.

BBU Storage-Related Definitions

- Shelf life: Shelf life is the length of time before a BBU needs to be recharged in order to avoid BBU over-discharge.
- State of charge: State of charge (SoC) is the amount of charge on a battery and it is expressed as a percentage value. For example, an SoC of 100 percent represents a battery that is fully charged, and an SoC of 0 percent represents a battery that is fully discharged.

BBU Shipping and Receiving Guidelines

The BBU shipping and receiving guidelines define the BBU SoC status and how it can be managed at this stage of the BBU life cycle:

- Cisco ships BBUs with a minimum of 60 percent SoC from the Cisco contract manufacturer.

- Each BBU should have a minimum SoC of 50 percent on being received from the Cisco contract manufacturer.
  - A minimum SoC of 50 percent allows for approximately 10 weeks between shipment from Cisco's contract manufacturer and a customer checking the SoC.
  - SoC decreases by approximately 1 percent per week (because of self-discharge).
  - The BBU SoC status can be checked using the CLI.
  - BBUs with less than 50 percent SoC should be recharged by the system integrator or customer to >50 percent SoC.

BBU Storage and Handling Guidelines

The BBU storage and handling guidelines define the BBU shelf life status and how it can be managed at this stage of the BBU lifecycle:

- The shelf life of a BBU installed in a router with discharge disabled and BBU disabled, or for a spare BBU, is typically 6 to 12 months.
- Prior to its connection to an AC source, a BBU's shelf life is a minimum of 21 days.
- When long-term storage at a customer site is anticipated, Cisco requires that a BBU be recharged prior to the expiration of shelf life.
- When AC power is disconnected and the Cisco IR8140H router is removed from service:
  - The router switches to DC power supplied by the BBUs and remains powered for approximately 8 hours.
  - After 8 hours the BBUs reach low-voltage disconnect, and the remaining shelf life is a minimum of 21 days.
  - The BBUs should be placed in BBU disable mode when the router is removed from service in order to extend BBU shelf life up to 365 + 21 days
  - The remaining shelf life depends on the SoC prior to the removal of AC power and the BBU being placed in the BBU disable mode.
  - Disabling a BBU at 0 percent SoC means a minimum remaining shelf life of 21 days, and disabling a BBU 100 percent SoC means a maximum remaining shelf life of 386 days.

Recharging a BBU

To recharge a BBU:

Procedure

Step 1 Connect the router to an AC power source.

Step 2 Enable the BBU.

Step 3 Allow at least 8 hours of charge time per BBU, that is, for routers with three BBUs each, allow 24 hours charge time per router.

Step 4 When the charge time is completed, disable a BBU if it will not be used as backup power for this router.

Replacing a BBU

When you replace a BBU in the router, we highly recommend that you do the following:

- Replace all the BBUs.
- Verify that all the replacement BBUs are the same version.

When a router operates with different BBU versions, it may result in misbehavior in the BBU functionality.

To replace a BBU:

Procedure

Step 1 Disconnect the BBU module from the router according to the instructions provided in Removing the BBU Cage from the Faceplate, on page 13 and Removing BBU Modules from the BBU Cage, on page 10.

Step 2 Replace all the BBUs of the router at the same time.

Note
Do not mix used BBUs with new BBUs.

BBU Disposal Guidelines

Instructions for disposal of BBUs:

- For routers under warranty, follow the standard Cisco Return Material Authorization (RMA) procedures.
- If Cisco identifies a BBU or set of BBUs as a nonfunctional item that can be discarded without being returned for failure analysis, BBUs removed for replacement must be disposed of in accordance with local guidelines.
- U.S. and Canadian customers should utilize www.call2recycle.org to properly recycle the lithium ion BBUs.
- For local recycling outside of the U.S. and Canada, customers should contact the following Cisco email for guidance specific to the customer's country or region—environment@cisco.com
- For further local take-back and recycling information, customers can find the relevant information at: www.cisco-returns.com.

Preparing to Install a BBU

Before installing BBUs in the router, ensure that the following guidelines have been met.

Tools You Must Have

You must use a #1 Phillips screwdriver to install or remove the BBUs inside the BBU cage. You also need these tools:

- T15 Torx Driver
- 10-mm Socket Driver

Safety Warnings

We recommend that you also read the safety warnings in Installation Safety and Site Preparation.

Warning **Statement 1015—**Battery Handling

To reduce risk of fire, explosion, or leakage of flammable liquid or gas:

- Replace the battery only with the same or equivalent type recommended by the manufacturer.
- Do not dismantle, crush, puncture, use a sharp tool to remove, short the external contacts, or dispose of the battery in fire.
- Do not use if battery is warped or swollen.
- Do not store or use battery in a temperature > .
- Do not store or use battery in low air pressure environment < .

When a router operates with different BBU versions, it may result in misbehavior in the BBU functionality.

Preventing Electrostatic Discharge Damage

BBUs are sensitive to electrostatic discharge (ESD) damage that can occur when electronic cards or components are handled improperly, and result in complete or intermittent failures.

To prevent ESD damage, follow these guidelines:

- Always use an ESD wrist or ankle strap and ensure that it makes good skin contact.
- Connect the equipment end of the strap to an unfinished chassis surface.
- Place the BBUs on an antistatic surface or in a static shielding bag. If a BBU will be returned to the factory, immediately place it in a static shielding bag.
- Avoid contact between the battery and clothing. The wrist strap protects the battery from ESD voltages on the body only; ESD voltages on clothing can still cause damage.

- Do not remove the wrist strap until the installation is complete.

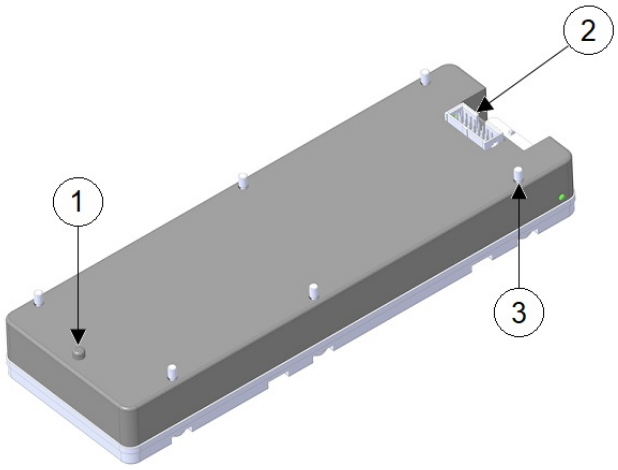
BBU Components

This section illustrates and describes the BBU components that you should be familiar with when installing the BBUs.

Note For technical specifications of the components described in this section, see BBU Technical Specifications, on page 16.

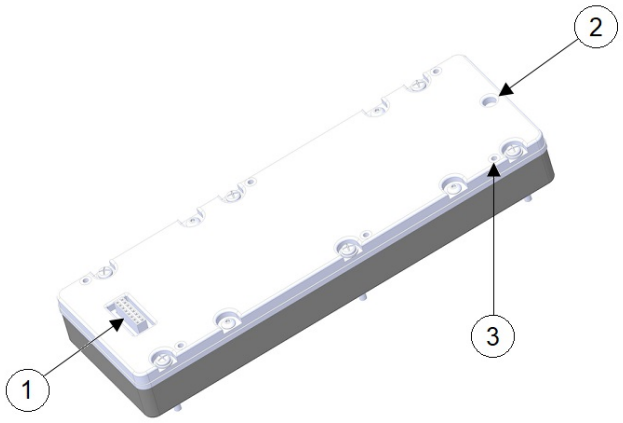
There is a plug connector at the back and a socket connector at the front of each BBU. Also, there is a BBU alignment pin at the back and an alignment hole at the front. When BBUs are plugged into each other, they mate front to back. The plug connector engages with the socket connector, and the alignment pin with the alignment hole. When you connect a second or third battery to a battery that is already installed, use the alignment pin and hole to ensure correct battery position and align the battery connectors.

Figure 2: Rear of Battery Backup Unit



Item	Description
1	BBU Alignment Pin
2	BBU Interface Plug
3	Captive screws (6) for installing the BBU for stacking or installing BBUs inside the BBU bracket of the BBU module

Figure 3: Front of Battery Backup Unit



Item	Description
1	BBU Interface Socket
2	BBU Alignment Hole
3	Captive Nut (6) for installing the BBU for stacking or installing BBUs inside the BBU bracket of the BBU module

Online Insertion and Removal

Online Insertion and Removal (OIR) of BBU is supported for IR8140H from Cisco IOS XE Release 17.7.1.

Installing BBUs in the Router

This section describes how to install a BBU in the router. A new BBU will be about 50 percent charged when you receive it.

Caution When you install a BBU in the router, if no AC power is being supplied to the router, the BBU (if it is not in a disabled state) will immediately begin to power the router when it is connected.

To prevent the BBU from powering the router prior to installation in the field, the BBU is disabled during shipment. To ensure that the BBU can be charged and power the router when required, enable the BBU right after installation.

Follow these steps to install BBUs in the router:

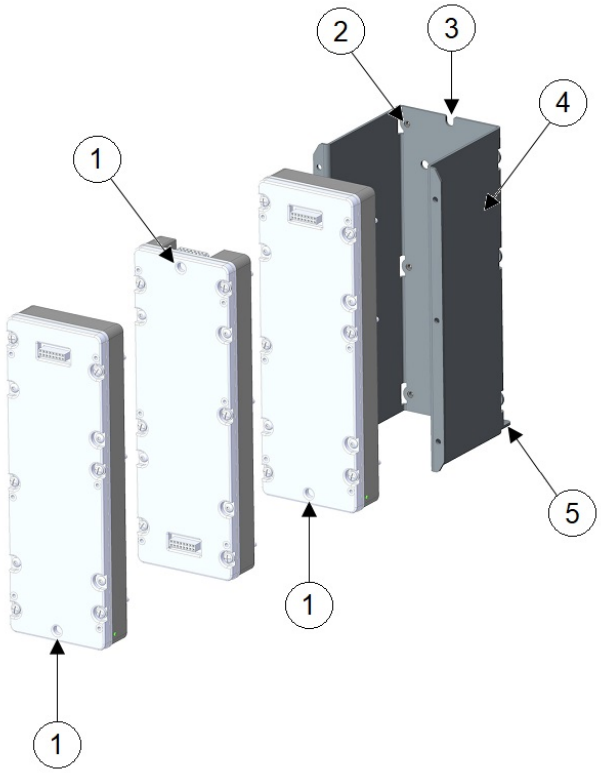
1. Install BBU Modules to the BBU Cage, on page 9
2. Attaching the BBU Cage to the Faceplate, on page 10
3. Installing BBU Assembly or Blank to the Router, on page 13

Follow these steps to remove BBUs from the router:

1. Removing the BBU Assembly or Blank from the Router, on page 16
2. Removing the BBU Cage from the Faceplate, on page 13
3. Removing BBU Modules from the BBU Cage, on page 10

Install BBU Modules to the BBU Cage

Follow these steps to install BBU modules to the BBU cage:



1	Alignment hole	4	BBU cage
2	Captive nuts (6)	5	BBU security tab
3	BBU cage pin notch		

Procedure

Step 1 To install the first BBU module, line up the BBU pin with the BBU cage pin notch, and then torque the six captive screws to 7 to 9 in-lbs with a #1 Phillips screwdriver in sequence, as shown in the following figure.

Step 2 To install a second BBU module, line up the BBU alignment pin with the BBU alignment hole, and press the plug and socket connectors together. Torque the six captive screws to 7 to 9 in-lbs with a #1 Phillips screwdriver in sequence, as shown in the following figure.

Step 3 To install a third BBU module, line up the BBU alignment pin with the BBU alignment hole and press the plug and socket connectors together. Torque the six captive screws to 7 to 9 in-lbs with a #1 Phillips screwdriver in sequence, as shown in the following figure.



Removing BBU Modules from the BBU Cage

To remove BBU modules from the BBU cage, you must start with the last BBU module and work inward towards the back of the BBU cage.

Procedure

Step 1 Loosen the six captive screws using a #1 Phillips screwdriver and pull off the BBU module.

Step 2 Proceed to the next BBU module until all the modules are removed.

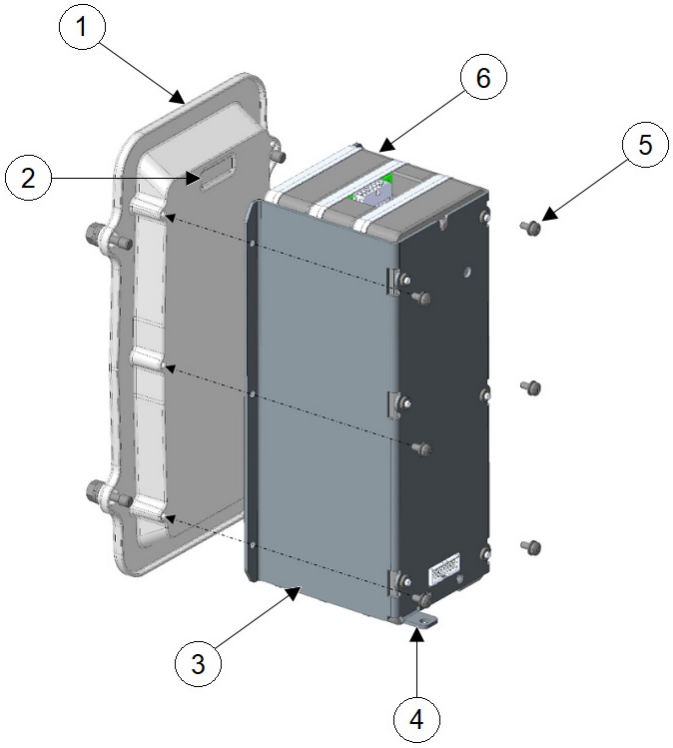
Attaching the BBU Cage to the Faceplate

Follow these steps to attach the BBU cage to the faceplate:

Procedure

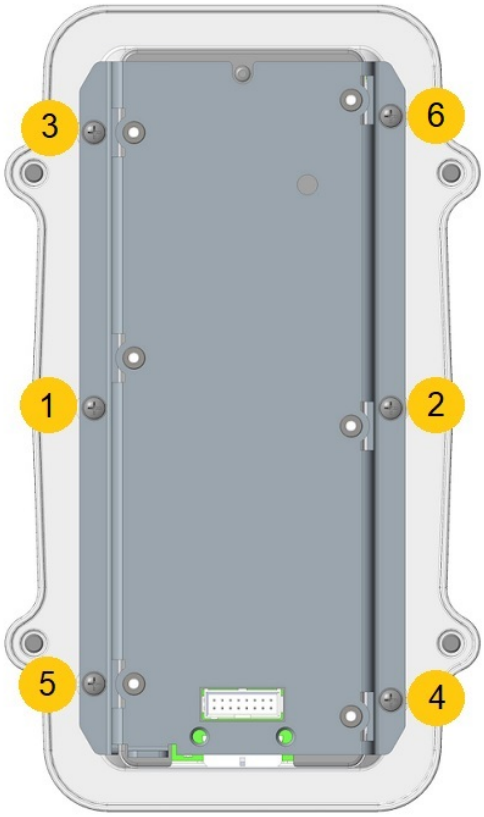
Step 1 Align the BBU cage or assembly to the faceplate, as shown in the following figure. Note the location of the BBU security tab in relation to the faceplate connector relief.

Figure 4: Attaching BBU Cage to Faceplate

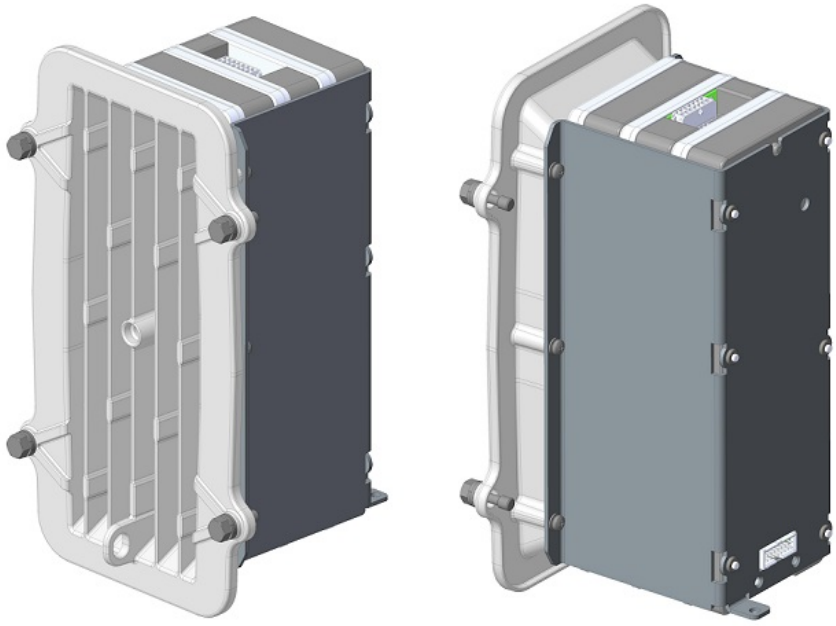


1	Faceplate	4	BBU security tab
2	Connector relief	5	M3.5 screws (6)
3	BBU cage	6	BBU module

Step 2 Insert six M3.5 screws in the locations as shown in the following figure. Torque screws to 10 to 12 in-lbs in sequence, as shown in the following figure.



The BBU assembly is now ready to be mounted to the router.



Removing the BBU Cage from the Faceplate

Follow these steps to remove the BBU cage from the faceplate:

Procedure

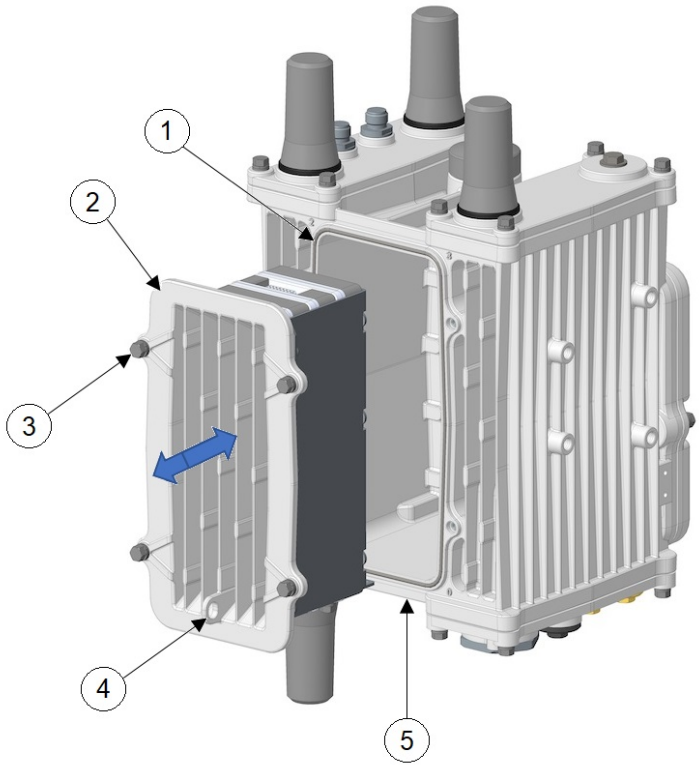
Step 1 Use a T15 Torx driver to remove the six M3.5 screws that attach the BBU cage to the faceplate. Do not discard the screws.

Step 2 Remove the BBU cage or assembly from the faceplate.

Installing BBU Assembly or Blank to the Router

Follow these steps to install the BBU assembly or blank to the router:

Figure 5: BBU Assembly or Blank Mounted on the Router



1	BBU gasket	4	Padlock tab
2	BBU assembly or blank	5	BBU security screw at the bottom of the router
3	M6 bolts (4)		

Procedure

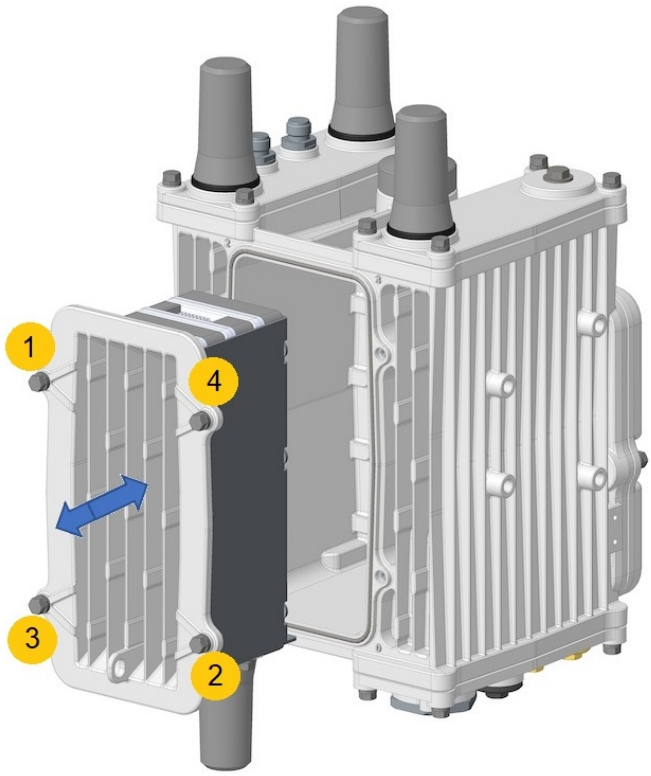
Step 1 Ensure that the BBU gasket is fully installed in the gasket groove and that the sealing surface is clean.

Step 2 Ensure that the BBU security screw is fully backed out (see Install the BBU Security Screw, on page 15).

Step 3 Align the BBU assembly or blank with the router chassis, and note the location of the padlock tab.

Step 4 Carefully push the BBU assembly fully into the cavity. BBU is self aligning with internal guide pins. Do not leave the BBU assembly unattended until the M6 bolts have been tightened.

Step 5 Torque the M6 bolts with a 10-mm socket driver. Torque to 15 to 20 in-lbs in the sequence shown below. Then repeat torque sequence to 30 to 35 in-lbs for final torque.



Install the BBU Security Screw

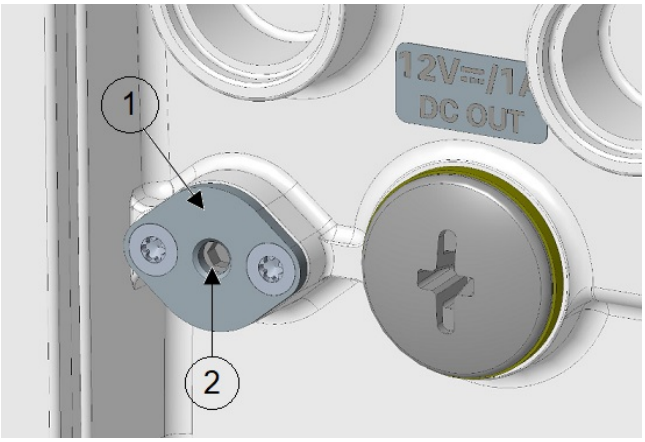
The BBU security screw is located at the bottom of the router.

Follow these steps to install the BBU security screw:

Procedure

Step 1 Ensure that the BBU security screw is backed out until it hits the retention plate.

Figure 6: BBU Security Screw



1	Retention plate (do not remove)	2	BBU security screw (require 3-mm Hex head)

Step 2 Install the BBU assembly and torque bolts according to the detailed instructions in Installing BBU Assembly or Blank to the Router, on page 13.

Step 3 Tighten and torque the BBU security screw to 10 to 12 in-lbs.

Removing the BBU Assembly or Blank from the Router

Follow these steps to remove the BBU assembly or blank from the router:

Procedure

Step 1 Back out the BBU security screw until it hits the retention plate. See Figure 6: BBU Security Screw, on page 16.

Step 2 Loosen four M6 bolts with a 10-mm socket on the BBU faceplate (do not remove the bolts from the faceplate).

Step 3 Pull the BBU assembly or blank out straight.

Caution
The BBU assembly is heavy.

Step 4 Ensure that the BBU gasket stays in place and the sealing surface is clean.

BBU Technical Specifications

This section describes the specifications and standards supported by the BBUs.

Router Power Path Selection

During normal operation, the router is powered by the integrated AC power supply. The BBU enters the discharge mode and begins providing power to the router when the AC power is interrupted outside the range of 85 to 250 V for more than 20 ms. The BBUs can either charge or discharge; they cannot support both simultaneously.

Discharge Conditions

Table 1: Battery Backup Unit—Discharging Specifications

Discharge Conditions	Description
Duration	4 hours minimum with a 10 W power load
Entry to discharge[1]	• AC power (range of 85 to 250 V) not detected for more than 20 ms • Remaining BBU capacity >5 percent • External ambient temperature is within -40 to 122°F (-40 to 50°C)
Exit discharge[2]	• AC power restored in the range of 85 to 250V for more than 20 ms. • Remaining BBU capacity <5 percent • External ambient temperature is outside the range of -40 to 122°F (-40 to 50°C)

1 All conditions are met.
2 Any condition is met and system is detected.

Low Battery Status

The device triggers a syslog message and an SNMP trap when the battery average levels falls below 20%. Use the command **show platform hardware battery details** to view the current average BBU power levels. When multiple battery units are used in the device (upto maximum 3 units), the battery unit discharges in a sequential order.

When three BBUs are used, and the device shows the current average battery power level as 20%, the third BBU power level will be about 60%.

Charge Conditions

Table 2: Battery Backup Unit—Charging Specifications

Charge Conditions	Description
Power draw	No more than 20 W when charging

Charge Conditions	Description
Entry to charging limit[3]	• State of Charge (SOC) <85 percent • AC power detected in the range of 85 to 250V for more than 20 ms. • External ambient temperature is within -4 to 104°F (-20 to 40°C)
Exit charging[4]	• AC power (range of 85 to 250 V) not detected for more than 20 ms. • External ambient temperature is outside the range of -4 to 104°F (-20 to 40°C)

[3] All conditions are met.
[4] Any condition is met and system is detected.

Operating and Storage Temperatures

Table 3: Battery Backup Unit—Operating and Storage Temperatures

BBU State	Local BBU Internal Temperature	External Ambient Temperature
Charging	+32 to 122°F (0 to 50°C)	-4 to 104°F (-20 to 40°C)
Discharging	-4 to 140°F (-20 to 60°C)	-40 to 122°F (-40 to 50°C)
Operation (Idle)	-4 to 185°F (-20 to 85°C)	-40 to 158°F (-40 to 70°C)
Storage and shipping	+14 to 113°F (-10 to 45°C) for 3 months maximum	• Short term: +14 to 113°F (-10 to 45°C) for 3 months maximum • Long term: +27 to 77°F (-3 to 25°C) - 65% Relative Humidity - 40 to 90% SoC

Battery Life

Table 4: Battery Backup Unit — Battery Life

Product ID	Battery Life	Charge-Discharge Cycle
IRMH-BATT-4AH	5 years	500