

Rolls Royce 'MTU' Low Voltage Ground Battery Manual

Design, Installation, Operation, Maintenance
Commissioning and Emergency Response

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Version History

Version	Revision Date	Revision By	Details
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1	07/05/2024	M. Adair / M. Ikoro	Document revised based on feedback from battery review panel.
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1. Preamble

Following internal consultation, information and instructions related to the Rolls Royce 'MTU' LV battery systems shall be included within this manual until a level of maturity and confidence on deployment has been reached. At this point, it is proposed that the updated content is formally published within standards, procedures and workplace instructions.

2. Purpose

The purpose of this manual to provide information and instruction related to the design, installation, operation, commissioning and emergency response applicable to Rolls Royce 'MTU' LV ground batteries on Endeavour Energy's distribution network.

Specific content covered within this document includes:

- LV Battery product identification codes
- Technical specifications
- Installation methods
- Operational requirements
- Maintenance requirements
- Emergency response requirements

3. References

External Regulations

Australian Dangerous Goods Code 2022 Edition 7.8

NSW Work Health and Safety Act 2011

NSW Work Health and Safety Regulation 2017

External Standards

AS/NZS 3000 - Electrical Installations – Wiring Rules

AS/NZS 4777.1:2016 – Inverter Installation Requirements Standard

AS/NZS 4777.2:2020 - Inverter Requirements standard

AS/NZS 5139:2019 - Battery Energy Storage System Installation requirements

AS/NZS 60529:2004 – Degrees of protection provided by enclosures (IP Code)

AS/NZS 61000.3.12:2013 – Limits for harmonic currents produced by equipment connected to public low-voltage systems

AS/NZS 62477.1:2016 - Safety requirements for power electronic converter systems and equipment

External Standards

EN 61010-1: 2010 A1 - Safety requirement battery systems

EN 61439-1 - Inverter general construction and safety

IEC 62619:2022 - Safety requirements for secondary lithium cells and batteries, for use in industrial applications

Company Standards, Policies and Procedures

Company policy 9.1.7 – Commissioning Network Electrical Assets

Company Policy (Network) 9.2.5 – Network Asset Design

Company Policy (Network) 9.7.1 – Network Asset Construction

Company Policy (Network) 9.8.3 – Network Operations

Company Policy (Network) 9.9.1 – Network Asset Maintenance

EDI 100 – Earthing Design Instruction Distribution earthing design

EMS 0016 – Environmental Management Standard Industrial and Construction Noise

EMS 0007 – Environmental Management Standard Waste management

MCI 0006 – Mains Construction Instruction Underground construction standards manual

PDI5000 – Protection of Embedded Generation

SDI 120 – Testing and Commissioning for Distribution Systems Amendments

HSE Bulletin 22-16 - Community Batteries (Underground)

HSE Bulletin 23-09 - Class 9 Dangerous Goods Transportation and Storage (Batteries)

TB 0342 - Fault and Emergency Response to a Network Battery Fire/Vehicle Impact

TB 0349 - Restrictions on Mains Extension or New Services from BESS Nodes

TB 0332 – LV Battery and LV STATCOM features added to GIS and GISCAD

Design Drawings

Refer to site specific detailed designs.

4. Definitions and Abbreviations

Abbreviation	Meaning
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ADMS	Advanced Distribution Management System
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Abbreviation	Meaning
BESS	Battery Energy Storage System
DERMS	Distributed Energy Resource Management System
EE	Endeavour Energy
FAT	Factory Acceptance Testing
FCAS	Frequency Control Ancillary Services
FDS	Functional Design Specification
ITP	Inspection and Test Plan
ITR	Inspection and Test Report
O&M	Operating & Maintenance
QA	Quality Assurance
SAT	Site Acceptance Test
SCADA	Supervisory Control and Data Acquisition
SWMS	Safe Work Method Statement
VPP	Virtual Power Plant
WAE	Work As Executed

Practices and Procedures

1.1 General

1.1.1 Background

A LV Ground Battery is a grid connected battery energy storage system with an LV switchboard, which is mounted onto plinth.

LV Ground Batteries smooth out local LV network demand and generation. They can charge off excess solar generation and export this energy back into the network in periods of high demand (such as the evening period). This improves network utilisation, reliability, and quality of supply for customers.

In addition, Ground Batteries may also be directed to charge at times of low spot market price and dispatched at high spot market price, which can occur at any time. A retail partner is required for market participation. Typical markets may include market arbitrage, FCAS, virtual power plants, and power purchase agreements.

Ground Batteries on Endeavour Energy's network will serve two main purposes:

- **Network Support:** Where a LV Ground Battery is deployed solely to support the network by reducing peak demand (forecast overloading), improving solar hosting capacity, or solving quality of supply issues.
- **'Community Batteries':** This is a metered version of a LV Ground Battery that is used for purposes of both, network support, and market services, allowing both benefits to be achieved.



Figure 3: Image of installed Rolls Royce 'MTU' Energy Pack and electrical meter box.

1.1.2 Product Approval and Stock Codes

The following table provides product material numbers relating to the Rolls Royce MTU.

Table 1: Rolls-Royce MTU Product part number

Product Ref	Product description
QS/6 200kVA / 444kWh	MTU Energy Pack

1.1.3 Technical Specifications

The technical specifications for MTU Energy Pack QS/6 200kVA /444 kWh are as follows:

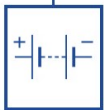
Table 2: Rolls-Royce MTU technical specifications

Sections	Parameter	Unit	Value
General	MTU EnergyPack type		QS/6
	Number	#	1
	Nominal apparent power charge/discharge	KVA	200
	Peak apparent power charge/discharge (60s)	KVA	220
	Overload (kVA) acceptance (60s)	%	10%
	Nominal active power charge/discharge	kW	200
	Peak active power charge/discharge (60s)	kW	220
	Overload (kW) acceptance (60s)	%	10%
	Nominal capacity (DC) 1)	kWh	444
	Nominal voltage at BESS terminal	V	400
	Nominal frequency	Hz	50
	Nominal current	A	280
	Peak current (60s) / Short-circuit current (5s)	A	310
	Power factor		0 ind ... 1 ... 0 cap

Sections	Parameter	Unit	Value
Electrical Properties	Nominal voltage at BESS terminal	V	400
	BESS transformer (dry type) integrated		yes
	Transformer ratio (inverter side / grid side)	V	490/400
	Transformer internal connection		Dyn5
	Grid configuration		TN-S
	Nominal frequency	Hz	50
	Nominal current	A	280
	Peak current (60s) / Short-circuit current (5s)	A	310
	Max. short-circuit withstand capability	kA	17
	Power factor		0 ind ... 1 ... 0 cap
	Imbalance between phases		up to 100%
	Inverter type		bi-directional, four-quadrant operation
	Operation modes		grid-forming (droop/isochronous), grid-following, black start
	Nominal round trip efficiency (IEC 62933-2-1)		>82%
Physical and Ambient Properties	Protection class of battery room		IP55
	Operating ambient temperature	°C	-20 °C to +40 °C
	Humidity		≤100%, condensing
	Altitude	m	≤2,000 ASL
	Corrosion level		C5 - marine environment
	Inverter cooling concept		liquid cooled
	Battery cooling concept		air cooled
	Housing type		QS/6
	Dimensions (L x W x H)	m	3.30 x 2.20 x 2.40
	Weight without batteries	tons	Approx. 4
	Weight with batteries	tons	Approx. 7.5
Battery specifications	Battery supplier		Battery supplier
	Battery type		MM3f
	Battery chemistry		Lithium-ion (NMC)
	Number of racks	#	5
	Rack type		242S 1P
	Nominal rack power	kW	89
	Peak rack power (discharge)	kW	107
	Nominal rack capacity	kWh	89
	Nominal rack capacity	Ah	100
	Nominal depth of discharge	%	100%
	Voltage range	Vdc	806.4 - 1045.8

1.1.4 SAP structure and GIS Designs

Standard symbology has been created for LV Ground Batteries within GIS and ADMS. These include:

GIS – UG Battery	
Circuit Diagram	
UG Component	

For further information on the data capture process, refer to the SAP or GIS data requirements, refer to TB 0332 – *LV Battery and LV STATCOM features added to GIS and GISCAD*.

1.2 Installation

All LV Ground Batteries and associated connecting infrastructure should be installed as per detailed designs. If the installation is unclear, the installation team should escalate any concerns to the Designer to confirm the installation requirements.

Stages for the installation, checking and testing of Rolls-Royce MTU (QS6) include:

1. Preliminary works
2. Installation methods
3. Visual checks
4. Safety checks
5. Wiring and Cable termination
6. Router and Antenna Installation
7. Electrical connections check at LC filter & transformer

For detailed information steps, refer to Annexure A - *MTU QS6 Installation Method*.

1.2.1 Location

The location of the community battery installation is determined on basis of network needs, factors such as transformer loading (percentage of utilisation), percentage PV customer and forecast future curtailment, Bushfire vulnerability, over/under voltage issues, network topography and stakeholder consultation. These considerations are factored in by Future Grid, Corporate Communications and Design teams to select the appropriate location for battery.

The project scope should define the battery location; therefore Future Grid (Investment Proponent) shall be responsible to determine the final location. The Project Manager is accountable to ensure all activities are undertaken to secure the site.

1.2.2 Asset Numbering

An asset number shall be installed on the battery exterior, which represents the equipment name developed within SAP. This unique equipment name can be found on the detailed design. The following naming convention shall be followed:

- **BTGS 000X**

Where X represents unique Ground Batteries as numerical integers from 1 to 9999.

Numbering shall be installed the same as an underground network switch or distribution substation. i.e. black numbering, white background and sealed with edge sealer.

Refer to Technical Bulletin *TB 0332 – LV Battery and LV STATCOM features added to GIS and GISCAD*.

Easement Considerations

As a general rule, LV Ground Batteries will be installed within a road corridor or Council green space. Although there may be some exceptions where an easement is required. In this instance, the Designer shall define an easement and shall work with the property team to implement this. Easement terms shall also outline adequate access for heavy vehicles and plant. Refer to the Battery Design Guide for further information.

Fire Risk and Mitigation Measures

LV Ground Batteries have been designed and manufactured to self-contain a fire if thermal runaway is encountered. As a precautionary measure, NSW Fire & Rescue have recommended a 3.0 meter exclusion zone to other assets. This exclusion zone can be reduced if a fire rated barrier is introduced. Detailed designs consider this exclusion zone.

Meter Box Requirements

A separate meter box shall be designed, constructed and installed adjacent to the Rolls Royce battery unit as per the detailed design.

Initially the installation will be installed without a revenue meter, therefore a DIN rail mounted terminal block (or similar) shall be installed in the position of the revenue meter.

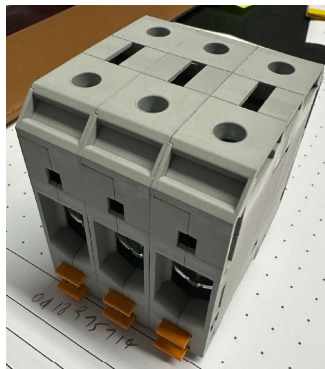


Figure 4: Temporary terminal block in lieu of revenue meter.

Note: An additional centralised protection scheme incorporating passive anti-islanding is required to meet AS4777.1. The Rolls Royce solution already incorporates this additional this additional scheme as an integrated solution.

1.2.4 Communications

The Rolls-Royce MTU unit contains Endeavour Energy supplied 4G modems which are connected to Endeavour Energy's 4G APN. This allows telemetry data to be continuously streamed back into Endeavour Energy's environment to monitor the status and effectiveness of the units.

Note: Prior to delivery, a modem must be pre-configured by the Future Grid Engineer and sent to Penske (MTU) to install within the unit. The modem is then remotely factory tested before dispatch.

1.2.5 Earthing

Earthing requirements will be specified on electrical designs. Key specifications are as follows:

- Install one (1) 12 mm diameter copper clad electrode at a minimum depth of 1.2 m.
- A main earth cable as specified in the design drawing to be connected between the main electrode and main earth bar.
- Main earth cable to be labelled “Main Earth Connection, do not disconnect”.
- The location of the main earth electrode to be identified within the switchboard.
- An MEN link (supplied) must be installed between the main earth bar and main neutral bar.
- Two (2) additional equipotential bonds as specified in the design drawing shall be connected to two (2) separate earth connection points to the external metal housing. Cables should be installed prior to the slab being poured. These cables are to be terminated to the earth bar and at two diagonal points exterior to the Rolls Royce MTU unit (once installed)

For further information on earthing refer to Appendix A - *MTU QS6 Installation Method*.

Note: Any specific addition manufacturers requirements should also be incorporated within detailed design and applied.

1.2.6 Transformer Monitoring

A permanent power quality DSub monitor is to be installed at the first upstream distribution substation.

The Dsub monitor will be installed by Field Operations as part of the applicable project and onboarded onto the Edge Zero platform by Future Grid. The meter shall be funded by the project.

1.2.7 Transport and Storage

Rolls Royce MTU battery units will be transported to site directly from the manufacturer.

Lithium batteries of any size currently do not require EPA licensing; however, some special conditions may exist related to transportation of Lithium-ion battery cells.

For details requirements on the safe transportation of Samsung SDI batteries, refer to the Storage and Transportation of Low Voltage Network and Community Batteries Manual. For further support on dangerous goods, email environment@endeavourenergy.com.au.

Load Restraint (Tie Down) Requirements

Rolls Royce MTU units shall be delivered directly to site from the Supplier. Endeavour Energy (or nominated contractor) may be required to transport other hardware or equipment to site. As part of the Chain of Responsibilities, Endeavour Energy staff should ensure that suppliers and external contractors use appropriate load restraint methods. For more information, refer to Storage and Transportation of Low Voltage Network and Community Batteries Manual.

Locking Requirements

As part of our Security of Critical Infrastructure (SOCI) requirements, adequate locks shall be installed to the battery unit(s) and meter box (community batteries only). The project Manager shall coordinate with locking to install D3 locks.

Testing and Pre-Commissioning Checks

Prior to energisation, the installation shall be visually inspected, functionally checked and tested (as required) by the Responsible Officer. Refer to SDI 120 - Testing and Commissioning for Distribution Systems Amendments for all checking and testing requirements.

IMPORTANT: Additionally, the manufacturers pre-commissioning checks should be followed as listed within Annexure C - Pre-Commissioning Checks.

All internal connections shall be checked as per the battery installation guide and battery is safe to be turned ON and energised. The modem should be turned on. At least 2 bars from SIM1 and SIM2 should be turned on showing a solid green light.

The Future Grid Engineer should be available to check the connection communication is healthy. In addition, the Future Grid Engineer should be able to confirm anti-islanding operates as intended.

For further details on MTU functional checks, refer to Annexure B - *Functional Checklist*.

1.2.4 Data Capture and Validation

Prior to commissioning, the Project Manager shall enter asset serial numbers, and the Future Grid Engineer shall enter all other applicable data within the following asset register: [MASTER BATTERY & STATCOM REGISTER](#).

1.2.5 Commissioning

Once the installation is complete, the following commissioning steps must be carried out:

1. Energisation and equipment powering-up
2. Functional Checks
3. Load / capacity testing

For further information on these steps, refer to Annexure E - *Commissioning Process*.

1.2.6 Checking for Defects

When the Penske MTU (QS6) unit arrives on site, a check for defects should be undertaken. Any defects should be documented and escalated to the project Manager to manage warranty claims. An acceptance and defect form should be completed. Refer to *Annexure D - Acceptance and Defects List*.

1.3 Operation

1.3.1 Electrical Isolation (Normal Operation)

The Rolls Royce MTU battery can be electrically isolated from the network via a set of links within the dedicated LV switch pillar, located adjacent to the battery system. Once isolated at the LV links or LV circuit breaker, or for any upstream network outage, the LV ground-mounted battery will automatically disconnect from the network via an internal contactor in accordance with AS4777.1.

IMPORTANT: Isolation procedures for ground-mounted community batteries should strictly follow HSE Bulletin 22-16 – Isolation requirements for community batteries (underground).

Note: An Authorised person may deem it necessary to isolate at the next upstream isolation point if deemed necessary. Refer to Section 5.5 *Fault & Emergency Response*.

1.3.2 Identifying Battery Isolation Points

To ensure staff can identify the upstream battery isolation points, the following warning sign shall be applied to both the distribution substation and LV pillar.

Note: This warning sign should also be noted on the detailed electrical design.



Figure 5: Warning label to be applied to switch pillar and supplying distribution substation.

1.3.3 Tripping (Anti-Islanding)

The MTU units have both passive and active anti-islanding protection, hence will automatically disconnect from the grid via an internal disconnection switch during an outage. Installation with an LVCB panel allows for the isolation via circuit breakers and fuses to provide additional safety.

For anti-islanding operational checks, refer to Annexure E – Commissioning Process.

1.3.4 Local Control

Local control has is available on the Rolls Royce MTU. A description of pushbutton control and controller states are shown in the following figures.

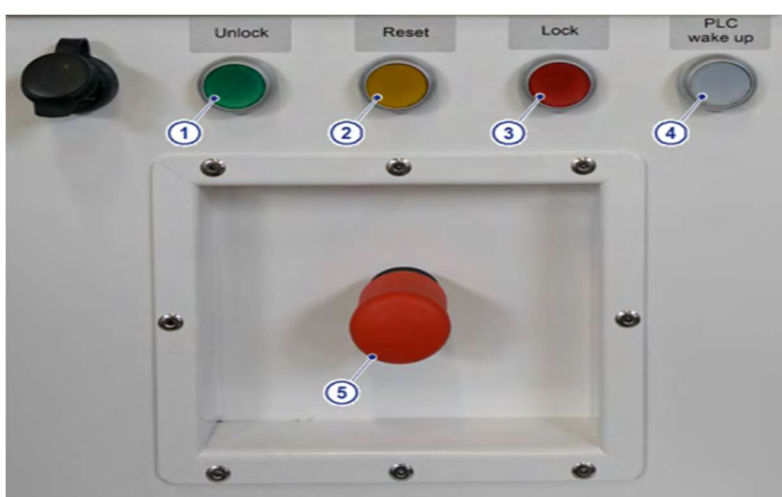


Figure 6: Rolls Royce MTU push button controls

- | | | |
|------------------------------|------------------------------|------------------------------|
| 1 Green pushbutton (UN-LOCK) | 3 Red pushbutton (LOCK/STOP) | 5 EMERGENCY STOP push-button |
| 2 Yellow pushbutton (RESET) | 4 White pushbutton (WakeUp) | |

White pushbutton (WakeUp)	Meaning
On	24 VDC supply for ESSC is available. The other lamps indicate the state of the BESS.
Off	24 VDC supply for ESSC is missing. The ESSC is switched off and out of service
Green pushbutton (UNLOCK)	Meaning
On	BESS is switched on and running (inverter is switched on)
Slow flashing	BESS is switched on in standby mode
Rapid flashing	BESS is switched on and starting up / shutting down
Yellow pushbutton (RESET)	Meaning
Slow flashing	BESS is active in fault state
Red pushbutton (LOCK/STOP)	Meaning
On	BESS is active and interlocked

Figure 7: Rolls Royce MTU push button states

1.3.5 Software and Monitoring

Measurement and performance data can be viewed through the graphic user interface, human-machine interface (HMI) is a web application used to monitor, configure, and control the controller. The table below provides a list of telemetry signals that are available to query over the API.

- Voltage (V)
- Frequency (Hz)
- Battery State of Charge (SOC) %
- Inverter Power (kW)
- Battery state of energy (SOE) kWh
- Operating state
- Grid connection status
- Additional information

1.4 Maintenance

For the interim, Endeavour Energy staff will not carry out maintenance of the Rolls Royce 'MTU' units until an asset management strategy is developed, outlining Endeavour Energy's maintenance approach. The Future Grid team shall monitor the battery alarms and failure events via the battery software interface.

Endeavour Energy staff will not modify or repair the internal power electronics associated with the MTU unit. In the case of immediate failure, the unit should be referred to Penske. In this instance, the Operations Manager shall refer the failure to cfg_device_notifications@endeavourenergy.com.au, where the Future Grid Engineer will further investigate and diagnose in coordination with Penske.

For background information, the maintenance system for the rolls Royce MTU is based on a preventative maintenance concept. Preventive maintenance facilitates advance operational planning and ensures a high level of equipment availability. The maintenance intervals as well as the required scopes of maintenance tasks are based on operational experience and therefore to be considered as recommendations.

Regular monitoring of internal fan speeds and internal temperature via the AutoGrid / DERMS software will act as sufficient indication for fan performance and maintenance requirements.

It is anticipated that a battery replacement is likely only required after 15-years of operation, depending on site specific temperature and conditions. Rolls-Royce MTU (QS6) battery are expected to have a 15-year minimum expected lifetime.

Information about the latest maintenance schedule is available at: <http://www.mtu-solutions.com>.

The following table provides the relevant contact information for Penske inquiries.

Table 3: Penske service contact

Contact	Email	Telephone
Penske local branch service support	jfuller@penske.com.au	02 9794 2600
Rolls-Royce - After Hours support		1800 023 236

1.5 Fault & Emergency Response

Two response scenarios are considered when responding to battery failure or impact. These include:

1. **Major incident:** Significant damage or failure is observed within the battery system or immediate connecting infrastructure, such as a motor vehicle impact or fire.
2. **Minor incident:** Minor damage or failure is observed within the battery system or immediate connecting infrastructure, such as component malfunction, hail damage, or minor damage.

Endeavour Energy first responders shall classify the incident related to the damage observed to the battery systems and connecting infrastructure. If in doubt, a major incident shall be classified.

For **major incidents**, the following actions should be taken:

1. Isolate the LV network supply at the closest point upstream without compromising health and safety. Open LV links at adjacent switch pillar or pole. If unsafe to do so, isolate from the next accessible upstream network isolation point. LV protective bonds are to be applied as per Electrical Safety Rules.
Note: If necessary, the LV battery can be completely disconnected from the network as per the Endeavour Energy Electrical Safety Rules. i.e. disconnected apparatus.
2. Contact local emergency services.
3. Secure the area and make safe until Emergency Services arrive.
4. Support Emergency Services required to address electrical hazards, limiting damage where possible to nearby assets.
5. Immediately fence off the surrounding battery area with a 3.0 meter radius from the battery as recommended by NSW Fire & Rescue.
6. Notify the relevant Field Operations Manager, who will then liaise with a Future Grid representative on the next business day via either an email to cfg_device_notifications@endeavourenergy.com.au, or a phone call to the Future Grid Engineer.

The Future Grid representative will advise the Retail provider of the incident.

An Endeavour Energy team will attend the site at the earliest opportunity. The team will consist of:

- I. Future Grid Engineer
- II. Field Operations Manager
- III. HSE Representative
- IV. Safety Representative
- V. Supplier Representative

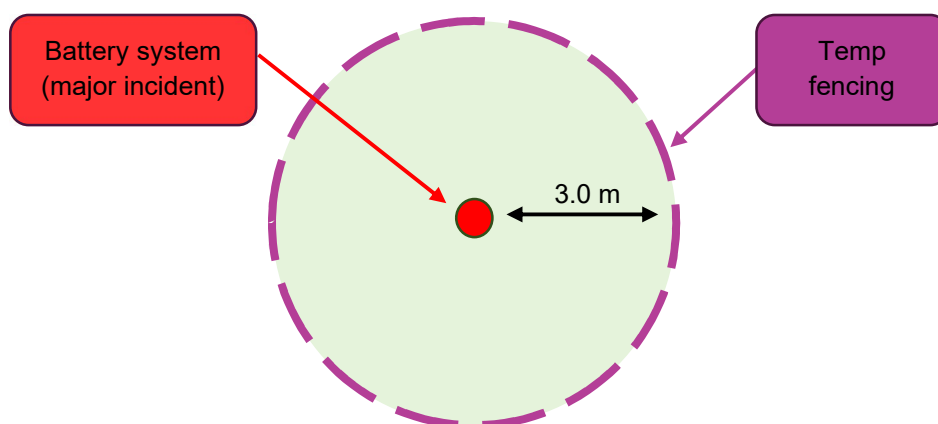


Figure 8: Temporary fencing requirements for a major battery incident.

IMPORTANT: For further information on identifying and responding to a network battery fire or vehicle collision, refer to TB 0342 - Fault and Emergency Response to a Network Battery Fire/Vehicle Impact.

For **minor incidents**, the following actions should be taken:

1. Make safe if required. Isolate if required – refer to step 1 above for major incidents.
2. Notify the relevant Operations Manager, who will then liaise with a Future Grid representative on the next business day via either an email to cfg_device_notifications@endeavourenergy.com.au, or a phone call to the Future Grid Engineer.

NOTE: Refer to the Process Map on Reactive BESS Troubleshoot_Repair Annexure G for more information.

5.6.1 BESS Subject to Intermix

Isolate the battery from the nearest safest LV isolation point and reach out to Future Grid using cfg_device_notifications@endeavourenergy.com.au. Future Grid will subsequently get in touch with the supplier, who will then assess the BESS unit onsite. Once the assessment is completed, a clearance will be issued to either energize or decommission the unit. Decommissioning can occur following the steps outlined in *Section 5.6 Fault & Emergency Response*.

Supplier	Contact Details
Penske	Phone: 02 9794 2600 email: jfuller@penske.com.au

5.6.2 Recording Incidents in SAP

For all faults, defects or repairs, an incident shall be raised in SAP for the repair to be recorded, costed accordingly. The incident shall be assigned to the battery asset number.

1.6 Disposal

LV Ground 'MTU' units that have been damaged beyond repair, or have reached the end of their life, shall be isolated from the network per *Section 5.5 Fault & Emergency Response* and disposed.

A third part contractor shall dispose of the entire battery system. The Operations Manager should coordinate with the internal Environmental Specialist to commence disposal activities. An email shall be sent to environment@endeavourenergy.com.au for the Sustainability & Environmental team to commence third party disposal activities.

Disposal procedures shall be followed by the third party contractor in accordance with EMS0007 – Waste management. Disposal of equipment must be registered onto the equipment register (refer to GNV 1026 – Equipment Register) and disposed with an approved method (refer to GSU 0012 – Selection and Approval of a Disposal Method).

5. Responsibilities

Manager Future Energy Strategy has the responsibility to update the document regularly based on changes to legislation, industry standards, best practice, or internal feedback.

All Endeavour Energy staff and associated third party contractors have the responsibility to maintain compliance with this manual.

Annexure A: MTU QS6 Installation Method

Installation and inspection processes include the following stages:

1. Preliminary works
2. Installation methods
3. Visual checks
4. Safety checks
5. Wiring and Cable termination
6. Router and Antenna Installation (completed by Supplier)

Preliminary Works

Prepare the site, ducts, earthing, footings and concreted slab as per the structural and electrical designs. Refer to site specific standard drawings.

The Rolls-Royce MTU (QS6) is installed on a concrete slab (poured at site), at an appropriate location with suitable clearances from other infrastructure.

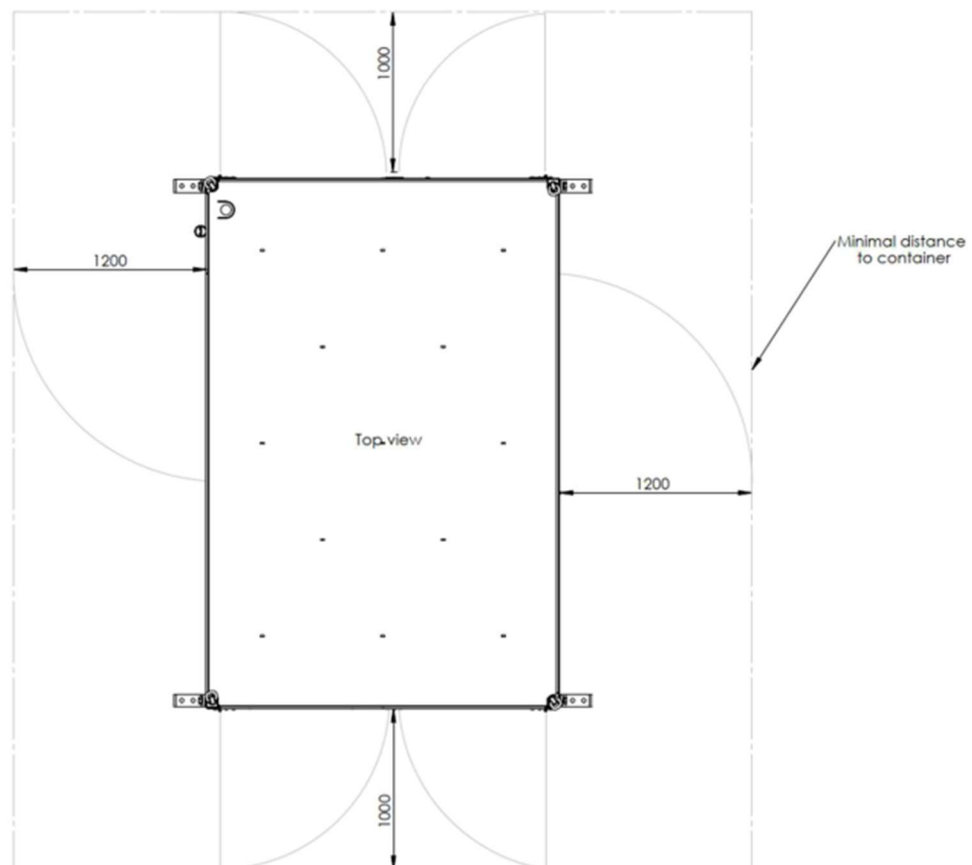


Figure 9: Clearances requirement

Ensure that cable penetration and HVAC condensation drains are kept clear as shown in Figure 6.



Figure 10: Foundation civil works before installation.



Figure 11: Concrete slab

Installation Method

Lift the Rolls Royce MTU unit onto the concrete slab using a suitable crane and lifting plan. Four eyebolts are positioned to enable lifting of the container into final position as shown in Figure 8.



Figure 12: BESS lifting method

Install Mounting Brackets

The Rolls Royce MTU (QS6) unit must be anchored to the foundation using the mounting brackets provided as shown in Figures 9 and 10. Install mounting brackets with screws, spring washers and washers on the four (4) corners of the housing and tighten screws.

Note: Mounting brackets and screw fixtures are supplied with the Rolls-Royce MTU (QS6) unit.



Figure 13: Mounting hardware.

LV Switchboard Inspection and Checks

Carry out a visual inspections of the LV switchboard prior to installation.



Figure 14: LV Switchboard opened for visual checking.

LV Switchboard Installation

Safely lift the LV switchboard and anchor the unit to the concrete slab, ensuring cables are not damaged.



Figure 15: Lifting and installation of LV Switchboard

Earthing and Grounding

Connect the two earth ground equipotential bond cables at either end of the Rolls Royce MTU (QS6) unit as shown in Figure 12. The earthing wire should be connected to two of the earthing points with a cable plug (M10) diagonally to each other.



Figure 16: Terminating equipotential grounding cables.

Note: The grounding points are located at the four corner fittings at the bottom of the housing of the BESS and marked with the sign for earthing / ground connection.



Figure 17: External earthing installation.

Power Cable Connection

Connect incoming phase conductors, neutral and earthing conductors. Ensure that the cable termination between the Electrical switchboard and the MTU QS6 is terminated as per the design drawing.



Figure 18: power cable connection between LV switchboard and BESS electrical area

Route the power cables under the housing into the BESS electrical area from the LV switchboard as how in figure 10 and as per EE's earthing design details.

Notes:

- *EE are to provide cable lugs and glands.*
- *Cable glands and plates must be sealed to prevent ambient air ingress and satisfy IP class IP55 requirement.*
- *The modem, antenna and communications cables should be installed in the Rolls Royce MTU unit by the Supplier.*

Electrical Connection Checks at LCL Filter and Transformer

Complete the following steps to visually inspect the LCL filter:

1. Temporarily remove the guard on the LCL transformer assembly.
2. Check LCL filter for contamination.
3. Use a brush or vacuum cleaner to carefully remove any dust and foreign objects as necessary.
4. Use a torque wrench to tighten all screws of electrical connections as per specified tightening torque (supplied by the manufacturer and coordinated by the Project Manager).
5. Reinstall the guard on the LCL transformer assembly.

Annexure B: Functional Checklist

#	Test / Check	Acceptance Criteria	Accepted (Y/N)	Notes
4.4.1	Check ethernet connection to router	Data connection live to control platform (AutoGrid/SCADA)		
4.4.2	Check power connection Performed using a multi-meter directly on terminals within rack	400V between L1, L2, L3 230V between L1, N		
4.4.3	Check for errors and warnings Step 1: Clear history by acknowledge faults Step: 2 Check values	Modbus signals: BESS Error = 0 BESS warning = 0		To be performed by Customer Future Grid Engineer
4.4.4	Power test - Charge - Discharge	Charge setpoint = 60kW monitor inverter active power = 60kW – Discharge setpoint = 60kW monitor inverter active power = 60kW		To be performed by Customer Future Grid Engineer
4.4.5	Check SoC value	Within range 0-100%		To be performed by Customer Future Grid Engineer

Annexure C: Pre-Commissioning Checks

#	Test / Check	Accepted (y/n)	Notes
4.3.1.1	Cable routing until termination point on BESS side		
4.3.1.2	Power cable connected (according to operating instructions)		
4.3.1.3	Signal cable connected (according to operating instructions)		
4.3.1.4	Switchgear/network transfer switch connections made		
4.3.1.5	Sealed cable entries of BESS (according to operating instructions)		
4.3.1.6	Cables connected and step/touch protection checked		
4.3.1.7	Grounding point connected Note: The grounding points are located at all four lower corners of the container and are marked with the symbol for grounding connections. BESS must be grounded through at least one grounding point in accordance with Australian standards		
4.3.1.8	Earth measurement carried out on earth connections in accordance with EE standards and requirements		
4.3.1.9	Insulation measurement of the connection cables (power cables) carried out as EE requirements		
4.3.1.10	Accessories checked for completeness and transport damage according to scope of delivery		
4.3.1.11	Air flow to intake unobstructed (air conditioner and inverter cooler)		
4.3.1.12	Accessories checked for completeness and transport damage according to scope of delivery		
4.3.1.13	Check for signs of corrosion		
4.3.1.14	Working internet connection 4G Network available		
4.3.1.15	Configuration and documentation of all network communication devices with IP addresses finished		
4.3.1.16	Check alignment of the battery modules after transport, align as necessary		

Annexure D: Acceptance and Defects List

List defective items within the below table.

#	Detailed Description	Date of Completion

With its signatures the customer confirms acceptance of the system delivery. Any outstanding items as detailed above shall be brought to in order by Penske Rolls Royce or its representative within an agreed period of time.

Place	Date	Place	Date
----- -----		----- -----	
Signature		Signature	
Company		Company	
Name	Title	Name	Title

Annexure E: Commissioning Process

Energisation, testing and commissioning steps are as follows:

1. Energisation and equipment powering-up
2. Functional Checks
3. Load / capacity testing

Energisation and Powering-up Steps

After all works has been completed and prior to commissioning, check the following:

1. The incoming switch and CBs on the electrical control panel are in the **OPEN** position.
2. Ensure all connections on the Rolls Royce MTU battery are intact.
3. Ensure the all the CBs inside the Rolls Royce MTU unit is in **appropriate** position for energisation (liaise with Penske commissioning representative)



Figure 19: E-stop push button location

4. Ensure that EMERGENCY STOP push-button is open position.
5. Close the door of the Rolls Royce MTU battery unit.
6. Ensure that EMERGENCY STOP push-button is open position.
7. Confirm the fuses are pulled out from the outgoing LV feeder in the relevant padmount sub. (note: where there is no dedicated feeder is not available and double connection was done supply could be energised up to the electrical control panel)
8. Confirm the links are closed in the LV pillar.
9. Where the meter has been installed, confirm the fuses are in and all connections are intact.



Figure 20: Metering with fuses

10. Where required, insert the fuses into the LV switchgear in the padmount substation using approved live low voltage procedures.



Figure 21: Padmount substation

11. CLOSE all circuit breakers and sub-main isolators on the electrical control panel.



Figure 22: Electrical control panel.

12. CLOSE the incoming switch (SPD) in the electrical control panel.



Figure 23: Location of main switch.

13. Open the Battery door and confirm the pushbuttons lights up or flashes.

Locking

The Project Manager shall ensure that all EE authorised D3 locks and barells have been installed by the locking team for both the LV switchboard and Rolls Royce MTU unit.

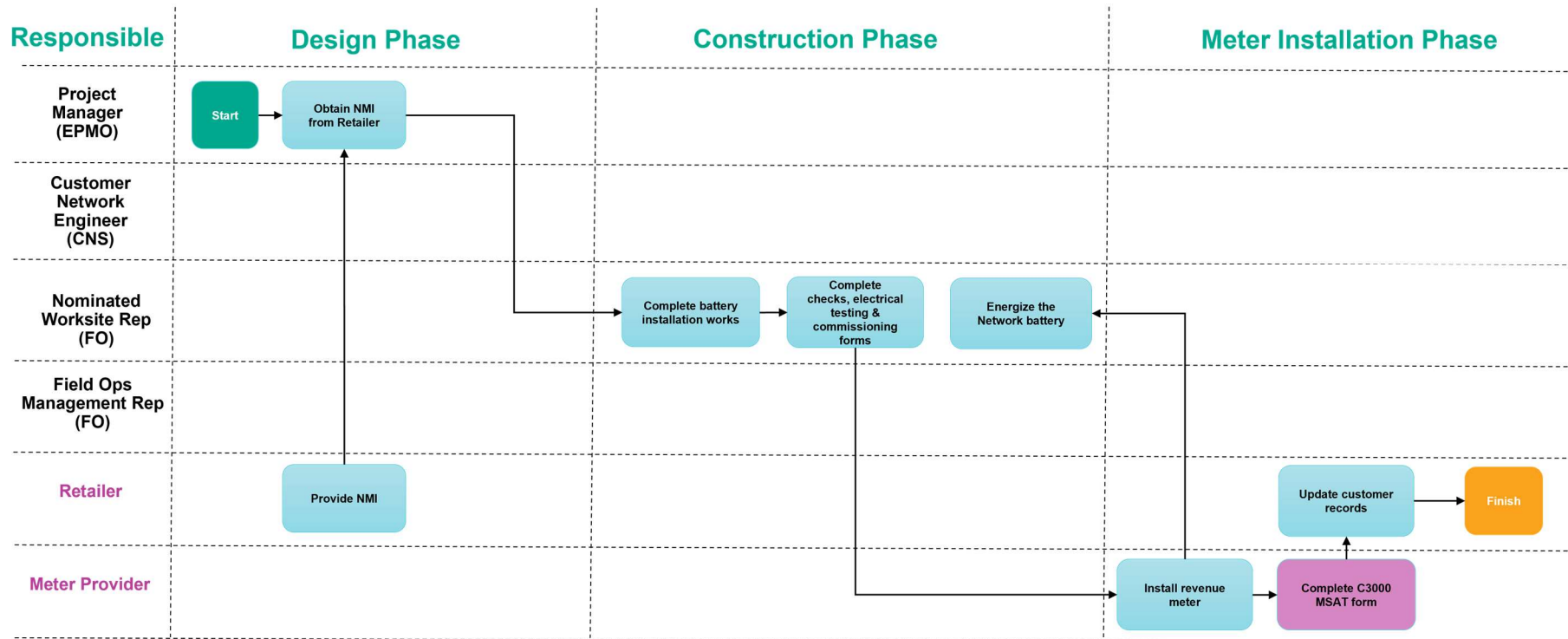
Active Anti-Islanding Checks

Once EE's Customer Future Grid Engineer is satisfied that all readings are available at the remote end, on site coordination is required to switch off the equipment, confirming anti-islanding operates as intended. The following steps are required:

1. Open the SPD (400A) grid circuit breaker within the LV switchboard.
2. Check that the unit trips in $< 2s$ and reports an active anti-island trip by checking for any power supply on the outgoing terminal on the LV Switchboard (BESS) 400A CB. (**Note: no power supply should be available**)
3. Close the SPD (400A) grid circuit breaker within the LV switchboard.
4. After few minutes communicate with EEs Power Quality Engineer to confirm communication has been established.

Annexure F: Community Battery Connection & Registration Process

Community Battery Connection and Registration Process – Ground Mounted BESS



Important Notes:

- E.E will isolate the LV prior to Retailer works and LVAA will be issued which will be held by E.E staff but Retailer staff will sign on/off;
- Retailer staff will not need to be E.E authorised but will work under the direct supervision of E.E staff;
- E.E will provide Traffic Management (if applicable);
- Retailer will work to E.E safe systems of work and will sign on the risk assessments.

Annexure G: Process Map on Reactive BESS Troubleshoot repair

