

## Schedule G

### Standard Specification

### Containerized Building

This document has been prepared for the titled project or named part thereof and should not be relied upon or used for any other project without an independent check being carried out as to its suitability and prior written authorization of Hatch being obtained. Hatch accepts no responsibility or liability for the consequence of this document being used for a purpose other than the purposes for which it was commissioned. Any person using or relying on the document for such other purpose agrees and will by such use or reliance be taken to confirm their agreement to indemnify Hatch for all loss or damage resulting therefrom. Hatch accepts no responsibility or liability for this document to any party other than the person by whom it was commissioned.

To the extent that this report is based on information supplied by other parties, Hatch accepts no liability for any loss or damage suffered, whether through contract or tort, stemming from any conclusions based on data supplied by parties other than Hatch and used by Hatch in preparing this report.

2022-03-24	0	Approved for Use	V. Lalonde	S. Fortier	D. Anders
<b>Date</b>	<b>Rev.</b>	<b>Status</b>	<b>Prepared By</b>	<b>Checked By</b>	<b>Approved By</b>
<b>HATCH</b>					

Schedule G

**Table of Contents**

<b>1. General .....</b>	<b>1</b>
<b>2. Codes and Regulations.....</b>	<b>4</b>
2.2 Standards .....	5
<b>3. Service Conditions .....</b>	<b>6</b>
3.1 Site Conditions .....	6
<b>4. Design Requirements.....</b>	<b>6</b>
4.1 General requirements.....	6
4.2 Performance .....	7
4.2.1 Manufacturing Criteria .....	7
4.3 Structural Requirements.....	7
4.3.1 General .....	7
4.3.2 Design loads .....	7
4.3.3 Materials .....	8
4.4 Architectural requirement .....	8
4.4.1 Enclosure .....	8
4.4.2 Floor 9	
4.4.3 Walls 9	
4.4.4 Ceiling 10	
4.4.5 Walls, floor and roof insulation.....	10
4.4.6 Doors 10	
4.4.7 Door Hardware .....	11
4.4.8 Finish Materials.....	11
4.5 Platforms, Ladders and Stairs .....	12
<b>5. Building Services.....</b>	<b>12</b>
5.1 Fire Detection Requirements.....	12
5.2 Electrical Requirements.....	13
5.2.1 Interior Lighting .....	13
5.2.2 Emergency Lighting .....	14
5.2.3 Exterior Lighting.....	14
5.2.4 Receptacles .....	14
5.2.5 Wiring and Raceways .....	15
5.2.6 Cabling.....	15
5.2.7 Grounding .....	15
5.2.8 Electrical Distribution .....	16
5.3 HVAC Requirements .....	16
5.3.2 Specific Requirements.....	17
5.4 Miscellaneous.....	17
<b>6. Nameplates, Tagging and Identification .....</b>	<b>17</b>
6.1 General.....	17

Schedule G

<b>7. Inspection, Assembly and Testing .....</b>	<b>18</b>
7.1 Inspection .....	18
7.1.2 General .....	18
7.1.3 Mechanical Check .....	18
7.1.4 Electrical Check .....	18
7.1.5 Witness .....	19
7.1.6 Failure to Pass Tests .....	19
<b>8. Documentation.....</b>	<b>19</b>
8.1 Drawings, manuals and Electronics Files.....	19
<b>9. Shipping Preparation and Transportation .....</b>	<b>20</b>
9.1.2 Lifting Procedure.....	20

*List of Tables*

Table 1 Operating Conditions .....	6
Table 2 Door and Frame Sheet Metal Thickness .....	11
Table 3 Illumination Levels.....	14

Schedule G

## 1. General

1.1.1.1 This document shall be read as part of a complete Specifications package including St. Lucia Electricity Services Ltd. (LUCELEC) documents and other technical appendices:

- *Energy Storage System* Request for Proposal (RFP)
- *Battery Energy Storage System* Specification
- *Power Conversion System* Specification
- Power Transformer Specification
- *Energy Management System* Specifications
- Electrical Balance of Plant and Installation Specifications
- Site Works and Civil Balance of Plant Specifications
- Containerized Building Specification
- Packaging and Shipping Requirements

1.1.1.2 Following definitions will be used for this Specification:

- a.) ***Balance of Plant*** or ***BOP*** – electrical and site works for the entire facility, excluding the *ESS* equipment and *EMS*
- b.) ***Battery Energy Storage System*** or ***BESS*** – A lithium-ion electrochemical storage device capable of delivering or absorbing electrical energy at its *DC Bus*
- c.) ***Battery Management System*** or ***BMS*** – the control and monitoring system for the *BESS* designed to manage all internal bank functions and internal protection. The *BMS* shall communicate with the *PCS* and *EMS*
- d.) ***Battery Module***- An assembly of rechargeable battery cells with a convenient mechanical arrangement and a degree of protection
- e.) ***Battery Rack*** – a free standing assembly of battery modules, integrated as part of an overall *BESS*
- f.) ***Calendar Life*** – The expected number of calendar years that the battery is expected to last independent of charge and discharge cycles
- g.) ***Contract*** – The agreement resulting from this RFP process
- h.) ***Contractor***– the successful *Proponent* with whom the *LUCELEC* may enter into a *Contract*
- i.) ***Current Transformer*** or ***CT*** - an instrument transformer used to step down a measured current for metering, control or protection purposes
- j.) ***DC Bus*** – the direct current connection between the *PCS* and *BESS* capable of carrying rated system power

Schedule G

- k.) **Depth of Discharge** or **DOD** – the ratio of the amount of energy discharged from the *BESS* to the maximum dischargeable energy capacity of the *BESS*
- l.) **End of Life** or **EOL** – the defined remaining *BESS* capacity as a percentage of the amount of initial *BESS* capacity at which the *BESS* system becomes not functional as initially designed
- m.) **Energy Storage System** or *ESS* – - consists of a *Battery Energy Storage System (BESS)* and a *Power Conversion System (PCS)*
- n.) **Energy Management System** or *EMS* – the *Contractor* supplied power plant control system that communicates to the *PCS* and coordinates plant functions
- o.) **Factory Acceptance Testing** or *FAT* – performance testing of all equipment at the factory to ensure it meets the specifications and requirements prior to shipment to site
- p.) **Factory Integration Testing** or *FIT* - performance testing at the factory of an integrated system, consisting of the *ESS*, *PCS* and *EMS* to ensure interface between components is functional prior to shipment to site
- q.) **Input/Output** or *I/O* – refers to the input or output signals associated with a control system or component of the control system such as a programmable logic controller.
- r.) **Inspection and Test Plan** or *ITP* – the plan for managing the quality control and assurance of a particular the construction work providing information on the requirements, overview of the method(s) to be used, responsibilities of relevant parties, and documentary evidence to be provided to verify compliance
- s.) **Human Machine Interface** or *HMI* – A user interface that serves as the main point of interaction between an operator of the battery plant and the settings, functions and commands associated with the plant
- t.) **Low Voltage Bus** – the alternating current connection between the *PCS* inverter and the step-up transformer
- u.) **LUCELEC** – St. Lucia Electricity Services Ltd.
- v.) **LUCELEC's Representative** – The person appointed by the *LUCELEC* who has responsibility for managing the *Contract* and, unless *Contractor* is expressly advised otherwise, *LUCELEC's Representative* (1) has full authority to act on behalf of and bind the *LUCELEC*, and (2) may, in writing, delegate any or all of his or her authority to any other person
- w.) **Power Conversion System** or *PCS* – The Battery *PCS* is the power interface from the battery system to the AC electrical grid
- x.) **Proponent** or **Tenderer** – Each company receiving this *Request for Proposal*

Schedule G

- y.) **Proposal** – Documents submitted by *Proponents* in response to this *RFP*
  - z.) **Potential Transformer** or **PT** - also known as a Voltage Transformer, an instrument transformer used to step down the main connection voltage for metering, control or protection purposes
  - aa.) **Programmable Logic Controller** or **PLC** – A ruggedized industrial computer on which the core logic of the control system resides
  - bb.) **Primary Frequency Response** or **PFR** – The first stage of frequency control in response to a disturbance on the power system frequency. Traditionally provided by fast acting governor systems.
  - cc.) **Request for Proposal** or **RFP** – This Request for Proposal including all attached and referenced documents and subsequent addenda
  - dd.) **Remote terminal unit** or **RTU** - A controller that interfaces with a physical system or sub-system of the plant and transmits information to the SCADA network.
  - ee.) **Supervisory Control and Data Acquisition System** or **SCADA** – the plant Supervisory Control and Data Acquisition system supplied by *LUCELEC*
  - ff.) **SCADA Network** – the communications network that facilitates the communication between *PLCs* and other networked components within the *BESS*
  - gg.) **Site Acceptance Testing** or **SAT** – performance testing of all installed equipment at site to ensure it meets the specifications and requirements and that there was no damage during shipment or installation
  - hh.) **State of Charge** or **SOC** – the ratio of present dischargeable energy storage capacity to maximum dischargeable energy storage capacity expressed either in percentage or MWh
  - ii.) **Subcontractor** – Any firm/individual that the *Contractor* may contract with to perform a portion or all of the *Work* and for which the *Contractor* assumes liability
  - jj.) **System Control Center** or **SCC** – The *LUCELEC* control center that dictates power system commands to distributed generators through the *LUCELEC SCADA*
  - kk.) **Uninterruptible Power Supply** or **UPS** - an electrical apparatus that provides emergency power to a load when the input power source or mains power fails.
  - ll.) **Work** or **Supply** – All or any part of the services and obligations required to be performed under the *Contract*.
- 1.1.1.3 This Specification is for the supply of all labour, materials, and services required for the design, engineering, detail, fabrication, supply, packaging, testing, delivery, installation (including delivery, unloading, placement on foundation, anchoring, connection to grounding grid, and connection of all cabling), and commissioning of quantity of one Containerized Building to be used as part of a new *Energy Storage System (ESS)* to be installed in Vieux

Schedule G

Fort, St. Lucia, beside the La Tourney Solar PV . This Specification provides the technical requirements for the Containerized Building.

- 1.1.1.4 The work called for is subject to the purchase order documents. They include the Specification, the general conditions of contract, any specific conditions, and any other attachments, all of which form an integral part of the contract. The *Contractor* shall be responsible for and be governed by all requirements therein. **Any exceptions to this Specification shall be stated in writing by the Contractor and a suitable alternative can be priced as an option.**
- 1.1.1.5 The supplied equipment shall be designed for continuous operation, and all components shall be of a robust, industrially proven design.
- 1.1.1.6 The *Contractor* supply shall include all components and accessories as required for the proper and safe operation of the complete system.
- 1.1.1.7 Compliance with this Specification does not relieve the *Contractor* of the responsibility to provide safe and reliable equipment. The *Contractor* shall have overall responsibility for the safety of the *ESS* design. Any areas of the *ESS* that pose a risk to the environment, personnel, or *LUCELEC*'s assets are to be clearly communicated to *LUCELEC* and its representative.
- 1.1.1.8 The equipment shall be complete in every aspect and ready to operate after installation and connection.

## 2. Codes and Regulations

- 2.1.1.1 The Containerized Building shall comply with all applicable provincial regulations and local codes for the federal, provincial, and local jurisdiction in which the Containerized Building is to be installed.
- 2.1.1.2 All electrical components shall meet all OECS Building Code, and IEC 60364 Electrical installations of buildings requirements and bear a recognized certification mark such as one of CE, etc. All electrical assemblies or sub-assemblies shall also bear such certification. All *Containerized Building* subsystems shall either be listed or be field evaluated for installation in the St. Lucia by an approved agency.
- 2.1.1.3 *Proponents* shall clearly indicate in their *Proposals* the standards which the requested equipment meets. *Proponents* shall clearly indicate if field certification is required for any necessary standards.
- 2.1.1.4 Certification of equipment shall be at the *Contractor's* expense.
- 2.1.1.5 In case of conflict between these standards and this Specification, the *Contractor* shall notify *LUCELEC* and its representative in writing of such conflicts as soon as they become known.

Schedule G

## 2.2 Standards

- 2.2.1.1 The supplied equipment shall be designed, manufactured, and tested in accordance with the most current revision of the following applicable standards, codes, and regulations:
- OECS Building Code Grenada, St. Vincent & the Grenadines, St. Lucia, Montserrat, latest version (OECS Building Code)
  - International Electrotechnical Commission (IEC).
  - American Welding Society (AWS).
  - ASTM International (ASTM).
  - IEC 60364 Electrical installations of buildings.
- 2.2.1.2 The *Contractor* is responsible for any on-site certification or other inspection requirements, if required.
- 2.2.1.3 Compliance of the equipment and all its associated parts with the above-mentioned codes, standards and regulations does not release the *Contractor* from the responsibility of supplying the equipment and accessories of proper design, electrically and mechanically suited to meet the guaranteed values at the specified service conditions.
- 2.2.1.4 All electrical equipment and components shall be CE approved and shall carry the CE labels. In the event of equipment not bearing the CE standard certification, the *Contractor* must validate the possibility of installing the equipment on *LUCELEC's* site, even if it is not accredited by CE standard certification.
- 2.2.1.5 Where there is a discrepancy in requirements between the codes, standards and regulations, the references, or this document, the *Contractor* shall apply the most stringent requirements of the conflicting documents so that the design, manufacture and testing of the equipment are carried out to the highest degree of quality set forth by this group of documents.
- 2.2.1.6 If any of the requirements in this Specification are in conflict with the standards, the *Contractor* shall notify *LUCELEC*. Equipment that does not comply with this specification will be rejected and shall be credited, replaced, or brought into full compliance at the *Contractor's* expense.
- 2.2.1.7 The construction of the building envelope must conform to the requirements of the latest revision of the "CARICOM Regional Energy Efficiency Building Code".
- 2.2.1.8 The Containerized Building shall be compliant with all fire safety standards, including NFPA 855 for the battery energy storage system.
- 2.2.1.9 The *Contractor* shall indicate in its *Proposal* documents the composition and the calculated R-Value for each of the applicable building components.

## Schedule G

### 3. Service Conditions

#### 3.1 Site Conditions

3.1.1.1 For further details about the site conditions, refer to Section 3 of the *Request for Proposal*.

**Table 1 Operating Conditions**

Characteristics	Data
Environment	Outdoor
Ambient Temperature Range (Min, Max)	21 to 40 °C
Average Relative Humidity	66% to 85%
Elevation above sea level	Sea level, coastal region
<b>Seismic data</b>	
• Sa (0.2)	<b>1.227</b>
• Sa (1.0)	<b>0.393</b>
• PGA (Peak Ground Acceleration) <sup>1</sup>	<b>0.225</b>

### 4. Design Requirements

#### 4.1 General requirements

4.1.1.1 Unless specifically stated otherwise, the design of all buildings, structures and related facilities shall be performed in accordance with the latest revision of the codes, specifications, standards, regulations and other references. In addition to these, the design will comply with any laws or regulations of local authorities. In the event of conflicting requirements, the most stringent will apply:

- The building shall be a containerized assembly, to house the necessary equipment as shown on the general arrangement drawing;
- Building shall be designed to house the required equipment, provide access clearances and floor space for all equipment. Clearances should be as per the arrangement drawing and/or code requirements;
- The building shall be supplied complete with all necessary component parts, including certified lifting lugs, to form a complete building system. All parts shall be new and free from defects in material and workmanship;
- The *Contractor* shall be responsible for the design and fabrication of the building, taking into consideration the required equipment to be installed inside the building and the environmental conditions at the site;

<sup>1</sup> Bozzoni, Francesca et al. "Probabilistic Seismic Hazard Assessment at the Eastern Caribbean Islands." Bulletin of the Seismological Society of America 101 (2011): 2499-2521.

Schedule G

- Building shall be in non-combustible construction using materials permitted by the building code, except for thermosetting foam insulation and aluminum which are prohibited unless located inside a sealed cabinet or panel.
- The prefabricated metal electrical control building shall be an elevated, air-conditioned structure.

## **4.2 Performance**

### **4.2.1 Manufacturing Criteria**

- 4.2.1.1 The Containerized Building components shall be the product of one manufacturer who has been regularly engaged in the design of pre-engineered and containerized structures.
- 4.2.1.2 All material shall be new, unused, and free from defects.
- 4.2.1.3 The enclosure design shall be designed with materials that are generally low maintenance or maintenance free.

## **4.3 Structural Requirements**

### **4.3.1 General**

- 4.3.1.1 Design for Containerized Building shall meet the same criteria as those fully site-erected as per Building Code Grenada, St. Vincent & the Grenadines, St. Lucia, Montserrat (OECS).
- 4.3.1.2 Structure calculations, approved by the *Contractor's* Engineer, shall be submitted for review to *LUCELEC's* Representative before the construction of the building. On-site installation details will also be submitted for equipment offloading and installation.
- 4.3.1.3 Building drawings shall be sealed with an APESL (Association of Professional Engineers of Saint Lucia) seal.
- 4.3.1.4 Sufficient space shall be provided for storage of spare parts and battery diagnostic devices. The environment should be appropriate for housing the spare parts and diagnostic devices.
- 4.3.1.5 Lifting lugs, sling locations, and any other required provisions shall be included to allow for unloading and site installation.
- 4.3.1.6 The design of the structural system shall be done by the building manufacturer (Seller) and shall respect the OECS Building Code (latest version).
- 4.3.1.7 All internal equipment should be able to withstand large vibration during transportation.

### **4.3.2 Design loads**

- 4.3.2.1 The building and all parts shall be designed and constructed to safely support all loads and load combinations as defined in the OECS Building Code. Ultimate and serviceability criteria required by the applicable codes and standards must be satisfied. The buildings shall be designed according, but not limited, to the following loads:

Schedule G

- Dead loads shall be the weight of all building materials and installed equipment (including any future equipment if required) according to the OECS Building Code;
- Live loads shall be according to the OECS Building Code;
- Wind, rain loads shall be according to the OECS Building Code;
- Seismic loads shall be according to the OECS Building Code;
- Equipment loads/services loads from any items that may be mounted on the floor/roof/walls;
- Any anticipated forces during load-out, lifting and transportation.

4.3.2.2 Floor supporting fixed equipment shall be designed for the load from the equipment with appropriate impact factors over the floor area occupied by the equipment plus the applicable uniform load of 9.8 kN/m<sup>2</sup> over the remaining floor areas. Appropriate dynamic loads from moving carts or other vehicles as well as equipment which must be rolled-in-place must also be considered.

4.3.2.3 Electrical equipment shall be anchored to the floor according to manufacturer installation specifications. Equipment anchors shall be designed to withstand seismic loads.

### **4.3.3 Materials**

4.3.3.1 All structural materials shall be selected by the building manufacturer to suit the design loads of the building, combustibility requirements as per OECS Building Code, and appropriate for the given design life.

4.3.3.2 When welded steel structures form part of the structures of these buildings; the manufacturer will be required to obtain certification from the American Welding Society (AWS) to the requirements of AWS D1.1 standard.

## **4.4 Architectural requirement**

### **4.4.1 Enclosure**

4.4.1.1 The building system shall be a non-combustible construction according to the National Building Code definition. The building shall be constructed using non-combustible material.

4.4.1.2 The maximum floor deflection, while lifting the electrical equipment housing with all equipment mounted inside, shall be kept within the acceptable tolerances to ensure the integrity of all major electrical equipment, and to ensure that bus bars, supports or insulators are not subject to damage or stress. It is the *Contractor's* responsibility to validate the specific requirements of their equipment with respective Manufacturers.

4.4.1.3 The enclosure layout shall include two (2) exterior man doors. A canopy shall be provided over each man door.

4.4.1.4 One (1) equipment door shall be provided. Dimensions to be determined by the *Contractor*, allowing equipment installations and removal.

---

Schedule G

- 4.4.1.5 The enclosure (outer roof, walls and floor) shall be one (1) hour fire rated.
- 4.4.1.6 All openings in the fire-rated construction shall be protected to provide the same fire rating as the penetrated construction (i.e., one (1) hour). This includes, but is not limited to, doors and openings for conduits, cable trays and ducts.
- 4.4.1.7 The enclosure shall be provided with effective air leakage control assuring that the joints between assemblies and all penetration are airtight.
- 4.4.1.8 Structural elements in the enclosure shall be located within insulated part of assemblies.
- 4.4.1.9 The floor shall be insulated. Care should be taken in the design of the floor to minimize thermal bridges.
- 4.4.1.10 Sufficient air lock/entry lock space shall be provided in order for personnel to perform battery maintenance work regardless of weather conditions and ambient temperature.

**4.4.2 Floor**

- 4.4.2.1 The floor shall be made of 6.35 mm minimum thickness flat and durable steel plates, with a non-skidding surface and reinforcement underneath, as required;
- 4.4.2.2 Seams shall be continuously welded or tightly fitted. Seams that are not continuously welded shall be subject to final approval by the Engineer;
- 4.4.2.3 The floor surface shall be finished with scuff-resistant, non-skidding epoxy;
- 4.4.2.4 The floor shall be designed to withstand both live and dead loads;
- 4.4.2.5 The floor shall contain a protective liner so that insulation is not exposed. This shall prevent animals and rodents from nesting in the insulation of the building;
- 4.4.2.6 The exposed floor in front of electrical panels shall be insulated with high grade PVC insulation mat, rated for 15 kV.

**4.4.3 Walls**

- 4.4.3.1 The building interior shall be lined with aluminum or steel liner panels installed vertically on the walls; the liner panels shall have a sufficient gauge to meet insulation and structural requirements. Matching base, jamb, header and ceiling trim shall also be provided. *Contractor's* drawings shall indicate the location of all wall metal studs or panel ribs for future attachment of wall-mounted equipment.
- 4.4.3.2 The *Contractor* shall make all necessary openings in the cladding for mechanical and electrical purposes. These openings shall be shop-reinforced, as required. The joints around all openings, penetrations, pipes and other accessories shall be perfectly tight. The *Contractor* shall provide flexible flashings around pipes. Sealants shall be fire-resistant.

Schedule G

**4.4.4 Ceiling**

4.4.4.1 The ceiling shall be designed to support cable trays or cable racks to be attached to the ceiling panels, which shall be structurally attached to the rafters or trusses. Support strips shall be installed to reinforce the ceiling panels to support the cable trays

4.4.4.2 The ceiling shall be covered with aluminum or steel liner panels, of sufficient gauge to meet insulation and structural requirements.

**4.4.5 Walls, floor and roof insulation**

4.4.5.1 The insulation material shall be:

- Mineral fiber insulating material;
- Density: 32 kg/m<sup>3</sup>;
- Fire propagation index: 0;
- Humidity absorbance: 0,01%, according to ASTM C1104;
- RSI Index: 0.71 per 25 mm thickness in compliance to ASTM C518;

4.4.5.2 The building envelope shall be constructed for an efficient use of energy in accordance with the CARICOM Regional Energy Efficiency Building Code.

4.4.5.3 The insulation values of the enclosure shall be as follows:

- Walls - Minimum RSI 3.7 (R21);
- Roof - Minimum RSI 3.7 (R21);
- Floor - Minimum RSI 3.7 (R21).
- Windows and glazing installed shall have a minimum thermal resistance U value of 2.839 W/m<sup>2</sup>-K (R 2)

**4.4.6 Doors**

4.4.6.1 Standard door height shall be 2135 mm (7'-0").

4.4.6.2 Standard door width shall be 915 mm (3'-0").

4.4.6.3 Doors shall be of galvanized sheet steel, insulated and fire rated

4.4.6.4 Door frames shall be welded type, profiled, galvanized sheet steel.

4.4.6.5 Doors excluding glazing shall have a minimum thermal resistance of RSI 2.1 (R12)

4.4.6.6 Door and frame sheet metal thickness shall be as per following:

## Schedule G

**Table 2 Door and Frame Sheet Metal Thickness**

	Minimum Sheet Metal Thickness (mm)	
	Door	Frame
Medium Duty	1.6 mm (16 ga.)	1.9 mm (14 ga.)

## 4.4.6.7 Finish:

- Doors and frames shall be painted with non-rusting mat finish.

**4.4.7 Door Hardware**

## 4.4.7.1 Hardware shall comply with the applicable standards for extra heavy-duty hardware and shall include the following:

- Unless otherwise noted, all exterior doors shall open outwards;
- Mortised stainless-steel butt hinges;
- Mortised door handles (knob style) with locksets;
- Door closers on fire rated doors and washrooms;
- Kick plates;
- Weather stripping and door sill for acoustics and air infiltration control;
- Door stops;
- Door cylinders and locksets shall be by “Medeco”;
- Door hardware shall be equipped with “master key” system which shall be coordinated with *LUCELEC*. The *Contractor* shall provide a key cutter and blank keys.

**4.4.8 Finish Materials**

## 4.4.8.1 All finish materials shall be commercial heavy-duty type.

## 4.4.8.2 The interior finish shall be a 24-gauge minimum, flush metal liner panel, with concealed fasteners, on walls and ceiling with baked-on factory paint and matching trim.

## 4.4.8.3 All interior and exterior metal surfaces shall be degreased, cleared of rust, sandblasted when necessary, shall be smooth and without imperfection, and shall be coated with rust-resistant primer.

## Schedule G

### **4.5 Platforms, Ladders and Stairs**

- 4.5.1.1 The minimum width of the landing shall be at least 300 mm wider than the door opening.
- 4.5.1.2 The minimum width of the stairs and platform shall be 900 mm.
- 4.5.1.3 The height of the elevated access landing for exterior doors shall be coordinated with the foundation design.
- 4.5.1.4 The construction of the elevated access stairs shall be entirely of galvanized steel, including all structural steel components, grating, railings and steps.
- 4.5.1.5 Structural steel will comply to standard ASTM A500 grade C
- 4.5.1.6 Gratings will comply to standard ANSI/NAAMM MBG 531, Metal Bar Grating Manual.
- 4.5.1.7 Grating will be anti-slip with grab bars 32 mm x 4.8 mm spaced at 23.8 mm c/c and transversal bars at 102 mm c/c. All grating panels will be belt. Gratings will be galvanized.
- 4.5.1.8 Stairs will be of anti-slip grating as manufactured by Fisher & Ludlow with grab bars 32 mm x 4.8 mm and nosing fabricated with checkered plate 50 x 10 painted safety yellow.
- 4.5.1.9 Handrails will be painted safety yellow.
- 4.5.1.10 All handrails will be fabricated using pipes conform to standard ASTM A53, grade B, without weld.
- 4.5.1.11 Anchorage points for harness are required on the platforms.
- 4.5.1.12 Structural steel shall be painted to prevent rusting by an epoxy base coating.
- 4.5.1.13 Paint system shall be:
  - Exposed steel: System 2.

## **5. Building Services**

### **5.1 Fire Detection Requirements**

- 5.1.1.1 The fire detection system shall be designed according to all applicable codes and standards.
- 5.1.1.2 Mandatory Codes are:
  - Codes to be followed when required for specific areas or application;
  - OECS Building Code Grenada, St. Vincent & the Grenadines, St. Lucia, Montserrat 2015;
  - NFPA Standards (NFPA 72 and 855);

Schedule G

5.1.1.3 Compliance of the fire detection equipment and all associated components with the above standards does not relieve the *Contractor* from the responsibility of supplying properly designed equipment and accessories that are electrically and mechanically suited to meet the operating guarantees at the specified service conditions.

5.1.1.4 In addition, the following equipment shall be provided:

- A fire detection device shall be included with each container;
- A fire suppression system suitable for lithium-ion batteries shall be included within each container;
- A flammable gas detection device shall be included within each container;
- A flammable gas management plan, to manage flammable gases (including hydrogen) that may evolve in a thermal runaway, shall be provided for the *Contractor's* proposed design.
- The final definition of the devices to be used shall be established on a per module basis, but the following requirements shall be provided as a minimum:
  - ◆ Manual pull stations shall be installed on the inside of each of the building's exit doors;
  - ◆ Smoke/heat/gas detectors shall be installed in sufficient quantity to ensure appropriate coverage of the building module;
  - ◆ Internal and external strobes and horns shall be installed in sufficient quantity to ensure the appropriate coverage of the building module;
  - ◆ Intelligent, microprocessors controlled, addressable devices shall be used.

5.1.1.5 Initiating device circuits, such a manual pull stations, multi-sensor and duct smoke detectors, shall be Class A type loop:

- Devices shall be locally connected to a local Fire Alarm Control Panel (FACP) with LCD display.

5.1.1.6 This FACP shall be connected to the main *LUCELEC* FACP using a dedicated communication network that will allow remote diagnostics from the central control room (installed by Others). All required communication hardware shall be provided.

## 5.2 Electrical Requirements

### 5.2.1 Interior Lighting

5.2.1.1 The building shall be furnished with factory installed LED lighting fixtures and controlled by a motion sensor. The LED lighting fixtures should be vapour and explosion proof and should be resistant to corrosion.

Schedule G

5.2.1.2 Lighting shall be designed to achieve average maintained illumination levels in accordance with values indicated in the table below; and no lower than values given in the:

- Illumination Engineering Society of North America (IESNA):

**Table 3 Illumination Levels**

Area or Facility	Level (LUX)	Ref. Height (MM)
Electrical room	430-540	750 above floor

5.2.1.3 The light loss factor shall be assumed as: 0.7.

5.2.1.4 The uniformity ratios shall not be less than 0.4 (defined as minimum/average), and not greater than four (4) (defined as max/min).

**5.2.2 Emergency Lighting**

5.2.2.1 The building shall be furnished with factory installed emergency lighting.

5.2.2.2 25% of the electrical room lighting shall remain on upon failure of the normal power source.

5.2.2.3 This lighting system shall provide immediate emergency lights for maintaining 1 FC for at least 60 minutes upon failure of the normal power source and shall switch off automatically when power is restored.

5.2.2.4 Lighting fixtures shall be LED type.

**5.2.3 Exterior Lighting**

5.2.3.1 The building shall be furnished with factory installed, wall-mount LED type lighting fixtures. One (1) fixture shall be supplied and installed above each external door. Exterior lighting shall be controlled by a photocell.

5.2.3.2 CCTV & LED Screen for monitoring switchyard from E-House. Minimum four cameras. CCTV cameras shall be provided inside E-house container to cover all areas and one each at each entrance door. Cameras shall be designed in order to work at all times, even when lighting within the E-house and containers are off.

**5.2.4 Receptacles**

5.2.4.1 The building shall be furnished with factory installed, duplex type, industrial grade, 230 V convenient receptacles appropriately installed around the inside perimeter of the building. Manufacturer shall also install two (2) outdoor outlets complete with Ground Fault Interrupter in a weather-proof enclosure.

5.2.4.2 All outdoor equipment including the balance of plant equipment should have receptacles in their control cabinets or should have receptacles nearby for maintenance.

Schedule G

## 5.2.5 **Wiring and Raceways**

- 5.2.5.1 The building shall be furnished complete with all interconnecting wiring, factory installed and connected, with a surface mounted, rigid, galvanized steel conduit. Each interconnecting wire shall be identified by PVC sleeve, or equivalent, at each end. Wire identification shall match the manufacturer's interconnection drawings.
- 5.2.5.2 The *Contractor* shall provide all power and control cabling, within its scope of installation, required between the electrical equipment.
- 5.2.5.3 The *Contractor* shall include cable tray interface to the containers. Entrance shall include weatherproof provisions such as a hood to protect from water ingress and shall have provisions for sealing and animal/rodent entry prevention.
- 5.2.5.4 Cable trays and accessories shall be heavy-duty, galvanized steel ladder type CSA Class D1 with 30 cm rung spacing, 100 mm usable depth and minimum radius of 600 mm. The tray support system and hardware will be galvanized steel. Hot dipped galvanized rigid steel conduit with threaded fittings will be used where conduit installation is required.

## 5.2.6 **Cabling**

- 5.2.6.1 1000 V cables will be multi-conductor copper or aluminum, with 90° C XLPE insulation, with a black jacket and minimum 4.0 mm<sup>2</sup> (#12 AWG) gauge.
- 5.2.6.2 All the alarms from equipment inside the building (temperature, fire detection panel, smoke detector, intrusion, HVAC, automatic transfer switch) shall be connected to terminal blocks. All cables shall be XLPE insulation level 600 V and 2.5 mm<sup>2</sup> (#14 AWG) gauge.
- 5.2.6.3 Entrance into panels (protection and services) shall be from the top.
- 5.2.1.1 All conductors shall be identified at both ends with ring type wire markers. All terminal blocks shall also be clearly identified.

## 5.2.7 **Grounding**

- 5.2.7.1 The building shall be furnished complete with suitable factory installed grounding connections, which shall bond all electrical equipment enclosure frames/ground buses to the building frame.
- 5.2.7.2 The grounding system shall provide grounding of all electrical equipment and the building frame.
- 5.2.7.3 The grounding system shall connect to each end of the ground bus in each assembly of the equipment.
- 5.2.7.4 Two (2) ground bars shall be located at opposite corners of the interior of the building.

Schedule G

**5.2.8 Electrical Distribution**

- 5.2.8.1 The building services shall be supplied from a 415 V, 3-phase, 3-wire, 50 Hz power source within the E-Room.
- 5.2.8.2 The *Contractor* shall provide all the power/lighting distribution panels with breakers, distribution transformers, fused disconnect switches, etc., necessary for the building services.
- 5.2.8.3 All circuits to be protected by residual current circuit breaker with overcurrent protection (RCBOs).

**5.3 HVAC Requirements**

- 5.3.1.1 The *Contractor* shall design and provide a complete and operational HVAC system including all accessories. All components of the system shall be industrial type and bear the CE label.
- 5.3.1.2 The design of the HVAC systems will include all equipment such as the air-conditioning unit, electric unit heaters, exhaust fans as well as all ductwork, insulation and ductwork accessories.
- 5.3.1.3 The ventilation system shall be equipped with air intake hoods equipped with filters and placed at a sufficient height from the ground such as to prevent any dust intake.
- 5.3.1.4 HVAC equipment shall not be selected for use at their maximum capacity. A capacity increase margin of 20% shall be incorporated.
- 5.3.1.5 Outdoor equipment shall be suitable for utilization as per the site conditions in this specifications package.
- 5.3.1.6 The A/C indoor and the outdoor condenser units shall be designed for continuous service, operating on a 24-hour per day, 365 days per year basis, at full load without requiring excessive maintenance, repairs, long work stoppages or direct operator supervision.
- 5.3.1.7 The condenser units shall have copper finned coils.
- 5.3.1.8 The compressor shall use non-ozone depleting refrigerant and shall have a minimum five (5) year warranty.
- 5.3.1.9 The HVAC system shall be positive pressure.
- 5.3.1.10 Free cooling system is not acceptable.
- 5.3.1.11 Low ambient option for condenser is required to cool the electrical rooms at low outside temperature. All necessary connections shall be supplied for the installation.
- 5.3.1.12 The *Contractor* shall provide complete calculations for sizing the capacity of the heating, air-conditioning and ventilation systems. The *Contractor* shall consider in its calculations the heat loads coming from equipment, lighting, and the building envelope.

Schedule G

### 5.3.2 **Specific Requirements**

#### 5.3.2.1 Indoor design temperatures:

- The thermal management system shall be designed to maintain the temperature within the container such that the batteries operate within their optimal temperature range. The *Contractor* shall provide *LUCELEC* this temperature range.
- Highest temperature (max) = 21 C (\*);
- Lowest temperature (min) = 12 C (\*);
- Maximum fresh air change/h = 1.5;
  - If this value is insufficient for safe operation of the batteries and maximizing the lifespan of the batteries, *Contractor* can provide deviation and rationale for this deviation.
- \*: Average Uniform Temperature throughout the entire E-Room.

5.3.2.2 Alarms to SCADA, in case of low or high ambient temperature, shall be included. Temperature probes with adjustable alarm contacts shall be installed.

### 5.4 **Miscellaneous**

5.4.1.1 All eaves, struts, rake girts, splice plates, eaves plates, ridge, wall caps, jambs, base channel, lintels, and flashings shall be made of galvanized 26 (0.551 mm) gauge steel with a minimum coating class of 0.3814 kg per. sq. m in accordance with ASTM A-525.

5.4.1.2 The *Contractor* shall provide one (1) self-contained emergency eyewash station located near the batteries, as well as two 960 ml bottles of sterile saline eyewash solution.

5.4.1.3 The *Contractor* will provide a minimum of two (2) fire extinguishers (dry chemical, ABC rated, 10 lbs). The fire extinguishers are wall-mounted and installed at each door.

## 6. **Nameplates, Tagging and Identification**

### 6.1 **General**

6.1.1.1 All auxiliary equipment, terminals and other equipment shall be identified by a nameplate; lettering shall be as stipulated on the datasheet indicating the device number and function. The nameplates shall be screwed on or 3M type with minimum 3 mm (1/8") characters. The nameplate list shall be submitted for approval.

6.1.1.2 All equipment tags, nameplates and safety instructions shall be in English.

Schedule G

## **7. Inspection, Assembly and Testing**

### **7.1 Inspection**

7.1.1.1 The following outlines the minimum requirements for final inspection of a Containerized Building. All checks and tests outlined below shall be made at the factory prior to releasing the building for shipment.

#### **7.1.2 General**

7.1.2.1 The following items shall be checked against the drawings and the drawing specifications to ensure compliance:

- Physical arrangement, including layouts.

#### **7.1.3 Mechanical Check**

7.1.3.1 The following items shall be inspected either visually or mechanically:

- Units shall be free of all manufacturing, wiring, and assembly debris;
- Openings caulked (fans, louvers, etc.);
- Switchgear door insulated and gasketed (when the switchgear is accessible from the rear);
- Hoods over fans, louvers, etc.;
- Removable filters over intake fans, louvers;
- Proper mounting thresholds;
- Personnel door gasketed, crash-bar hardware;
- Vertical seams caulked at doorframes;
- Weather cap over doors, including transom;
- Master nameplates;
- Air leakage tests.

#### **7.1.4 Electrical Check**

7.1.4.1 The following items shall be checked to ensure compliance:

- The voltage rating of components (i.e., fans, air conditioners, heaters, etc.), shall be verified against the Bill of Material;
- The size and type of wire shall be checked against the standards and/or *LUCELEC* specifications;

---

Schedule G

- The continuity of wiring and operation of equipment shall be verified by applying voltage to all circuits;
- The layout and size of the conduit shall be checked against the standards and all applicable codes.

### **7.1.5 Witness**

7.1.5.1 *LUCELEC* reserves the right to witness any or all tests plus any quality control dielectric tests performed, at no additional cost. Sufficient notification shall be given to allow *LUCELEC*'s Representative(s) to be present for the tests. A minimum of fifteen (15) working days should be allowed.

### **7.1.6 Failure to Pass Tests**

7.1.6.1 Should the equipment fail to meet the test requirements of the standards, *LUCELEC* shall be notified immediately, and reserves the right to refuse the equipment.

## **8. Documentation**

### **8.1 Drawings, manuals and Electronics Files**

8.1.1.1 The *Contractor* shall provide two (2) sets of reviewed drawings for *LUCELEC*'s approval no later than two (2) weeks following the receipt of the purchase order. The drawings shall identify the *Contractor*, the company, the purchase order number, and the nameplate information. The drawings shall be in English and in metric units.

8.1.1.2 The *Contractor* shall provide three (3) sets of instruction manuals and an electronic copy. The instruction manual shall include the *Contractor*'s information regarding the assembly and operation, a bill of material, a reduced size set of final drawings, and all instructions for equipment provided by third parties.

8.1.1.3 The manuals shall be specifically prepared for the project. Generic information shall be marked or highlighted for the specifics of the project. All manuals and documents shall be in English.

8.1.1.4 The *Contractor* shall be responsible for sealing all issue for construction or final drawings with an APESL (Association of Professional Engineers of Saint Lucia) seal

8.1.1.5 The *Contractor* shall provide three (3) sets of final drawings and an electronic copy.

8.1.1.6 The *Contractor* shall provide three (3) copies of the final test reports and an electronic copy prior to shipping. Electronic files of all the *Contractor*'s documents including, but not limited to, drawings reviewed and final in Bentley MicroStation (preferred, AutoCAD is acceptable for shop drawings) and Acrobat formats, technical specifications, instruction manuals, and test reports shall be provided on USB memory disk. The disks shall be accompanied by a paper list of all document numbers and titles included on the disks. This list shall also be on the USB.

Schedule G

8.1.1.7 The documentation shall address the specific product provided. When generic literature is provided, the *Contractor* shall customize the information by pointing to the appropriate model and applicable text.

## 9. Shipping Preparation and Transportation

9.1.1.1 The maximum permissible dimensions and weight for land transport of the building, including the trailer will depend on the type of vehicle. The *Contractor* is responsible to validate the shipping requirements for their system and trucks. The *Contractor* shall advise *LUCELEC* if there is concern with these limitations.

9.1.1.2 The buildings shall be constructed in a single shipping section whenever feasible.

9.1.1.3 The following items shall be shipped loose, if applicable:

- Outside lights, timers;
- Air conditioners, vent fans;
- Assembly hardware;

If, temporary brackets need to be installed for transportation purpose, they shall be painted in Red. The temporary brackets shall be removed by the *Contractor* or its *Subcontractor* at the site.

### 9.1.2 Lifting Procedure

9.1.2.1 The building shall have lifting lugs welded and/or bolted to trusses to easily accommodate lifting of the building.

9.1.2.2 Lifting eyebolts shall be provided at all corners of the assemblies to facilitate handling and installation.

9.1.2.3 The structure of the electrical equipment housing shall be sufficient to permit lifting with all the equipment mounted inside. Accessories shall be provided for on-site lifting.

9.1.2.4 The housing shall be designed so that it can be lifted off in one piece with all the equipment installed and wired inside.

9.1.2.5 A lifting plan and a lifting diagram, approved by the *Contractor's* Engineer, shall be submitted to *LUCELEC* for approval. The above-mentioned diagram and the drawings for the building shall be supplied together with the building to the site.

**END OF SECTION**