



General Notice on Revised Li-ion battery Certification Requirements

Please note the following important update regarding compliance of li-ion batteries in future ICB bid.

All batteries shall be required to comply with revised specification and certification requirements, including those batteries integral-to or part of Lighting Global quality-approved kits or IEC62257-9 approved kits.

Full IEC or UL Certificates from ISO17025 accredited laboratories must be presented at time of tender. Each and every battery model and size offered must comply with the certifications in full. Batteries offered which do not comply with the requirements will lead to bids to be regarded as non-compliant.

This note is to allow prospective bidders to identify batteries which comply with the requirements and to obtain the necessary certifications.

Battery sizes.

Syst. no.	System Code	Description	Li-ion battery option		
			Minimum Battery (Ah @ C ₂₀ x @ V)	Chemistry	Type
1	SHS-M	SHS-medium	38 Ah x 12V	NMC	Portable or stationary
2	SHS-L	SHS-large	67Ah x 12V	NMC	Portable or stationary
3	E-Basic	Primary School	75 Ah x 24V	LFP	Stationary
4	E-A2Cs / E-A1CI	Middle school	156 Ah x 24V	LFP	Stationary
5	E-A3Cs / E-A2CI	High school	190 Ah x 24V	LFP	Stationary
6	H-SRHC	Rural health centre	75 Ah x 24V	LFP	Stationary
7	SL	Streetlight	26 Ah x 12V	LFP	Portable or stationary
8	RA-RB	Religious building	75 Ah x 24V	LFP	Stationary

Battery Specification

Please refer to important extract from the Battery Specification attached.

Incl: 3 Pages:

Extract of key points from specification:

C.4.3 Batteries

C.4.3.1 Certification standards

The compulsory required test standards for li-ion batteries:

Lithium-ion standard for batteries for portable applications (i.e. easily hand-held devices – see IEC definitions in text box below)

Safety test: All lithium-ion cells and batteries must have valid full IEC or UL certificate for:

- IEC 62133-2 (2017); Secondary cells and batteries containing alkaline or other non-acid electrolytes - Safety requirements for portable sealed secondary cells, and for batteries made from them, for use in portable applications
OR BOTH of
- UL 1642 (2012); Standard for Lithium batteries.
AND
- UL 2054; Standard for Household and Commercial Batteries.

Life cycle endurance test method (with cycle life indicated) for either cells or batteries:

- IEC 61960 (2017); Secondary cells and batteries containing alkaline or other non-acid electrolytes – Secondary lithium cells and batteries for portable applications.
OR
- IEC61427 (2013); Secondary cells and batteries for renewable energy storage - General requirements and methods of test - Part 1: Photovoltaic off-grid application.

Lithium-ion standard for batteries for stationary applications (i.e. all non-portable batteries)

Safety test: All lithium-ion cells must have valid full IEC certificate for:

- IEC 62133-2 (2017); Secondary cells and batteries containing alkaline or other non-acid electrolytes - Safety requirements for portable sealed secondary cells, and for batteries made from them, for use in portable applications. (for cell and pack, details on exact battery, cell and BMS.

Safety test: All stationary lithium-ion batteries must have valid full IEC or UL certificate for:

- IEC 62619 (2017); Secondary cells and batteries containing alkaline or other non-acid electrolytes. Safety requirements for secondary lithium cells and batteries, for use in industrial applications.
OR
- UL 1973; Standard for Batteries for Use in Light Electric Rail (LER) Applications and Stationary Applications.

Transport test: All stationary lithium-ion batteries must have valid full IEC or UL certificate for:

- IEC 62281 (2019-04); Safety of primary and secondary lithium cells and batteries during transport,
OR
- IEC 62133-2 (2017); as above,
OR
- UL 1642; as above
OR
- UN 38.3 (2015); United Nations Recommendations on the transport of dangerous goods: manual of tests and criteria, Clause UN38.3.

Life cycle endurance test method (with cycle life indicated) for either cells or batteries:

- IEC 62620 (2014); Secondary cells and batteries containing alkaline or other non-acid electrolytes. Secondary lithium cells and batteries for use in industrial applications.

OR

- IEC61427 (2013); Secondary cells and batteries for renewable energy storage - General requirements and methods of test - Part 1: Photovoltaic off-grid application.

In addition:

- Note that all compulsory certificates shall be provided for each battery, for each size, including the particular BMS. i.e. there are no *family-of battery tests* on one battery that shall cover other similar li-ion batteries from the same manufacturer. (The exception to this is the life-cycle testing)

IEC definition of battery for *Portable Applications*: [taken from IEC61960-3 (2017)]

Portable applications comprise hand-held equipment, transportable equipment and moveable equipment. Examples of the main uses are shown below:

- a) Hand-held equipment: smartphone, tablet PC's, audio/video players and similar equipment,*
- b) Transportable equipment: notebook computers, CD players, and similar equipment,*
- c) Moveable equipment:*
 - *18kg or less in mass and not fixed in place, or*
 - *Provided with wheels, castors or other means to facilitate movement by an ordinary person as required to perform its intended use,*
 - *Power tools, power assisted cycles, business use video cameras and similar equipment.*

Note 1: All applications using batteries whose nominal voltages are equal to or over the hazardous voltage of 60V are excluded.

Note 2: EESS (Electrical Energy Storage Systems) and UPS, which use batteries over 500Wh are excluded.

Note 3: Self-propelled vehicles are excluded.

Conclusion:

- ➔ All non-portable batteries shall be considered as *stationary batteries*.
- ➔ If in doubt use the *stationary battery* classification for applicable standards, which are adequate for all SHS batteries.

C.4.3.2 Particular requirements

- Allowed batteries shall be one of following types only:
 - Public facility systems: Li-ion LFP type for this procurement only as per *Table 6*.
 - SHS: NMC type only for this procurement as per *Table 6*.
- The expected battery life under the solar design cycling conditions shall be a minimum of 2,000 cycles.
- The battery cycle life under test-certified conditions:
 - Public facility li-ion batteries: at 90% DoD must exceed 2,000 cycles when tested as per IEC 61960 or IEC 61427-1, to 80% percent of rated capacity.
 - SHS Li-ion batteries: at 90% DoD must exceed 800 cycles when tested as per IEC 61960 or IEC61427-1, to 80% percent of rated capacity.
Modelled or tested life expectancy at 50% DoD must exceed 2,000 cycles - the conditions modelled must be elaborated and supporting curves provided.
- The safe temperature limit for IEC 62133-2 certified battery cell shall be at least 50°C for SHS and public facilities and 60°C for streetlights.
- Preferably only four standard sizes of batteries shall be used to facilitate spares and parts management.

C.4.3.3 General Requirements

- The rated amp hour capacity is specified at 25°C at the C20 (20 hour) discharge rate to to standard safe discharge voltages for Lithium Ion batteries, as indicated in *Table 6*.

- b) For consistent use of terminology and clarification of 4.3.2(a) Li-ion batteries are classified as one of the following types with the corresponding performance characteristics:
- c) The minimum rated capacity at C20 shall be not less than the values specified in *Table 3*, which refers to allowed Li-ion types. Capacity adjustments shall be made to accommodate any particular battery's performance and optimal depth of discharge to achieve the same expected cycle life.
- d) Li-ion batteries shall be carefully matched with charge controllers to prevent overcharge and unsafe thermal runaway conditions, justified based on certified ranges of relevant IEC standard. Li-ion batteries shall be provided with integrated Battery Management System (BMS), which provides the following key additional functions:
 - o Cell protection via passive balancing function for series-connected cell blocks
 - o Over-discharge protection
 - o Over-charge protection
 - o Over-current protection
 - o Short circuit protection
 - o Reverse polarity protection
 - o Over-temperature protection via temperature sensors in at least each cell-block (so up to 9 probes for a 24V battery), set to within the limits of the IEC 62133-2 certified li-ion cell. The minimum cut-off temperature is 50°C for SHS and public facilities and 60°C for streetlights.

C.4.3.4 Battery Banks

- a) Batteries may be connected in series to make up the required system voltage.
- b) No more than 2 batteries shall be connected in parallel.
- c) Batteries, which are connected in parallel, must be of the same model, type, age and size.

C.4.35 Component Warranty

- e) 3 years warranty on Batteries to 80% of design capacity, for all systems.

Table 1: Li-ion battery characteristics (for information purposes)

Description	Cell voltage characteristics	Typical Applications	Typical operating conditions		Acceptability within this procurement
			Max. load shed DoD	Expected minimum cycles	
Lithium Nickel Manganese Cobalt Oxide: LiNiMnCoO ₂ cathode / graphite anode Abbr: NMC (NCM, CMN, CNM, MNC, MCN similar with different metal combinations))	3.60V, 3.70V nominal; typical operating range 3.0–4.2V/cell, or higher	Provides high capacity and high power, high charge promotes thermal run-away and less safe: <i>E-bikes, medical devices, EVs, industrial</i>	90% or 2.5VPC	1,000-2,000	Yes, for SHS only
Lithium Iron Phosphate: LiFePO ₄ cathode / graphite anode Abbr: LFP or Li-phosphate	3.20, 3.30V nominal; typical operating range 2.5–3.65V/cell	Very flat voltage discharge curve but low capacity, elevated self-discharge, very safe: <i>Portable and stationary needing high load currents and endurance</i>	90% or 2.5VPC	1,000-2,000	Yes, for Public Facility only

All other li-ion battery types are not acceptable, as per below:

- **Lithium Nickel Cobalt Aluminum Oxide:** LiNiCoAlO_2 cathode, graphite anode; Abbr: NCA or Li-aluminum
- **Lithium Titanate:** $\text{Li}_4\text{Ti}_5\text{O}_{12}$ (titanate) anode, Abbr: LTO or Li-titanate
- **Lithium Cobalt Oxide:** LiCoO_2 cathode / graphite anode, Abbr: LCO or Li- cobalt
- **Lithium Manganese Oxide:** LiMn_2O_4 cathode / graphite anode, Abbr: LMO or Li-manganese

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