Draft

GUIDELINES FOR IMPLEMENTATION OF BATTERY PACK AADHAAR SYSTEM

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

GUIDELINES FOR IMPLEMENTATION OF BATTERY PACK AADHAAR SYSTEM

1. INTRODUCTION

As the world moves toward digitalization and electrification, energy storage cells serve as the foundation for consistent, flexible, and efficient power delivery. As energy storage cells, batteries play a vital role, and lithium-ion batteries in particular are recognized for providing lightweight, efficient, and reliable power. India is rapidly emerging as a global competitor in the electric mobility revolution, driven by its ambitious commitments and strategic initiatives. Amid the global transition toward sustainable transportation, India is rapidly advancing its efforts to become a leader in the clean mobility revolution through targeted research and innovation. Batteries are the crux of EVs, seeing as the primary energy source that powers their operation. The demand for efficient, durable, and sustainable batteries has become critical, with the rapid expansion of electric vehicle market. However, the end of life management of batteries poses significant environmental challenges due to concerns over recycling, disposal, raw materials, electrochemistry, end of life treatment, cell manufacturing, modules, durability and resource depletion.

In addition to electric mobility, batteries play a vital role across a wide range of applications, including energy storage in private and domestic settings, industrial operations, and the generation and distribution of electrical energy. These diverse applications further amplify the need for robust battery management systems and sustainable practices. Recognizing these challenges, the Office of the Principal Scientific Advisor to the Government of India released the “e-Mobility R&D Roadmap for India,” which includes a key initiative titled “Guidelines for Implementation of Battery Aadhaar System.” This initiative aims to leverage indigenous knowledge and resources to tackle these complex issues and support India's sustainable energy future.

Battery Pack Aadhaar is an indigenous digital identification and data storage system developed to ensure end-to-end traceability of batteries throughout their entire lifecycle. It includes a unique identification number for each battery pack, capturing and storing vital information starting from raw material extraction and manufacturing to its usage, recycling, or final disposal. This system aims to bring transparency, accountability, and sustainability to the battery ecosystem by enabling accurate tracking of performance, and environmental impact. Battery Pack Aadhaar plays a crucial role in enabling second-life usage, regulatory compliance, and efficient recycling.

In alignment with the above developments, the Ministry of Road Transport & Highways (MoRTH) has constituted a committee for "Development of Guidelines for implementation of Battery Aadhaar System in India" as outlined in the office memorandum dated 17th September 2025.

2. SCOPE

This document aims to provide comprehensive guidance to organizations that are implementing the Battery Pack Aadhaar. It will help them understand how to interpret the content requirements which may be mandated by the battery Aadhaar regulation and prepare specific data attributes. Moreover, this guidance will be a central and beneficial resource for other participants in the battery value chain who are required to report or intend to access Battery Pack Aadhaar information.

This document refers to the battery categories covered by the Battery Waste Management Rules, 2022 (as amended as on date) published by the Ministry of Environment, Forest and Climate Change. Battery categories, that are required to maintain a Battery Pack Aadhaar as an electronic record include:

- Electric Vehicle Batteries for L category
- Electric Vehicle Batteries for M and N category
- Industrial Batteries with capacity > 2kWh

This guideline focuses exclusively on Electric Vehicle (EV) applications however it may also be referenced, if required, for industrial batteries with a capacity greater than 2 kWh. SLI (Starting, Lighting, and Ignition) batteries and portable batteries are outside the scope of this document.

This document provides general guidelines for implementation and an overview of data attributes, including category specific battery requirements and measurement units, as well as details on stakeholder group access to Battery Pack Aadhaar information.

Battery Pack Aadhaar content requirements are designed to enable comprehensive traceability and foster a circular economy for batteries, especially in the context of electric vehicles. Key information embedded within a Battery Pack Aadhaar includes:

- Battery Manufacturer Identifier (BMI)
- Battery Descriptor Section (BDS)
- Battery Identifier (BI)
- Battery Material Composition Section (BMCS)
- Battery Carbon Footprint (BCF)
- Battery Dynamic Data (BDD)

3. TERMS AND DEFINITIONS

3.1 **Battery:** means new or refurbished cell or battery, including accumulator, which is any source of electrical energy generated by the direct conversion of chemical energy and includes disposable primary or secondary battery. It may include internal or external storage and comprises one or more rechargeable or non-rechargeable cells, modules, or their assembled packs.

[SOURCE: Battery Waste Management Rules, 2022]

3.2 **Battery Cell:** A cell is the basic functional unit of a battery, comprising an assembly of electrodes, electrolyte, container, terminals, and separators that is source of electrical energy generated by the direct conversion of chemical energy and includes primary and/or secondary cell.

3.3 **Battery Module:** means any set of battery cells that are connected together or encapsulated within an outer casing to protect the cells against external impact, which is meant to be used either alone or in combination with other modules. These battery cells may be connected in either series, parallel, or a combination of both configurations.

3.4 **Battery Pack:** A battery pack refers to any set of interconnected cells or modules, or encapsulated within an outer casing, forming a complete and functional unit which is not meant to be split up or opened by the end-user.

3.5 **Battery Pack Aadhaar:** Digital record of a battery pack.

3.6 **Carbon Footprint:** The sum of greenhouse gas emissions and greenhouse gas removals associated with a product system, expressed in terms of carbon dioxide equivalents.

3.7 **Recycling:** A recovery process in which waste materials are transformed into new products, materials, or substances.

3.8 **Battery Status:** The current phase of a battery unit within its life cycle, categorized as ‘original’, ‘re-used’, “repurposed”, “remanufactured” or ‘waste’

3.9 **Static Data:** Data that do not change often or not on a regular basis.

3.10 **Dynamic Data:** Data that change often or on a regular basis.

3.11 **Non-rechargeable Battery:** Battery that is not designed to be electrically recharged.

3.12 **Rechargeable Battery:** Battery that is designed to be electrically recharged.

3.13 **Rated Capacity:** The total capacity, measured in ampere-hours (Ah), that can be drawn from a fully charged battery under reference conditions.

3.14 **State of Health:** A metric that reflects the current condition of a rechargeable battery and its ability to deliver the specified performance, in comparison to its initial condition.

3.15 **Waste Battery includes**

- Used and/or End of Life Battery and/or its components or spares or parts or consumables which may or may not be hazardous in nature.
- Pre-consumer Off-Spec Battery and its components or spares or parts or consumables.
- Battery whose date for appropriate use has expired.
- Battery which has been discarded by the user.

[SOURCE: Battery Waste Management Rules, 2022]

3.16 **Electric Vehicle Battery:** Any Battery specifically designed to provide traction to hybrid and electric vehicles for road transport.

[SOURCE: Battery Waste Management Rules,2022]

3.17 **Industrial Battery:** Any Battery designed for industrial uses, excluding Portable battery, Electric vehicle battery and Automotive battery. These may include sealed Battery (excluding portable battery); unsealed Battery (excluding automotive Battery) and energy storage system Battery.

[SOURCE: Battery Waste Management Rules,2022]

3.18 **Battery Manufacturer:** A person or an entity or a company as defined in the Companies Act, 2013 (18 of 2013) or a factory as in the Factories Act, 1948 (63 of 1948) which has facilities for manufacturing of Battery and/or its components.

[SOURCE: Battery Waste Management Rules,2022]

3.19 **Battery Producer:** An entity who engages in:

i) Manufacture and sale of Battery including refurbished Battery, including in equipment, under its own brand; or

ii) Sale of Battery including refurbished Battery, including in equipment, under its own brand produced by other manufacturers or suppliers; or

iii) Import of Battery or equipment containing Battery; or

iv) Manufacture or assembling of Battery or refurbished Battery including in equipment for sale to the Producer mentioned in sub-clause (ii) without its own brand name.

[SOURCE: Battery Waste Management Rules,2022]

3.20 **Portable battery:** A Battery that is sealed, less than five kilograms, not made for industrial purposes, electric vehicle or to be used as an Automotive Battery.

[SOURCE: Battery Waste Management Rules,2022]

3.21 **Automotive battery:** means any Battery used only for automotive starter, lighting or ignition power.

[SOURCE: Battery Waste Management Rules,2022]

3.22 **Battery category:** means any of the battery categories such as electric vehicle battery, or automotive battery or industrial battery or portable battery or waste battery.

3.23 **Type Approval Certificate (TAC):** means type approval certificate issued under Central Motor Vehicle Rules (CMVR), 1989.

3.24 **Type Approval:** means the establishment of initial compliance of model/ variant(s) of the batteries to the provisions of CMVR as defined in the Automotive Industry Standard AIS-037 as amended from time to time.

3.25 **Starting, lighting and ignition battery' or 'SLI battery'**: means a battery that is specifically designed to supply electric power for starting, lighting, or ignition and that can also be used for auxiliary or backup purposes in vehicles, other means of transport or machinery;

4. ABBREVATIONS

BPAN	Battery Pack Aadhaar Number
EV	Electric Vehicle
OEM	Original Equipment Manufacturer
BMI	Battery Manufacturer Identifier
BDS	Battery Descriptor Section
BI	Battery Identifier
BMCS	Battery Material Composition Section
BCF	Battery Carbon Footprint
BDD	Battery Dynamic Data
Ni-Cd	Nickel-Cadmium
Ni-MH	Nickel–Metal Hydride
Li-ion	Lithium-ion
SOH	State of Health
SoC	State of Charge
QR Code	Quick Response code
EOL	End of Life
TAC	Type approval certificate
EPR	Extended Producer Responsibility
BWM	Battery Waste Management
WMI	World Manufacturer Identifier
VIN	Vehicle Identification Number

5. CURRENT LEGISLATIONS & INTERNATIONAL BENCHMARKING

India's battery ecosystem is presently witnessing a phased evolution of regulatory requirements, with multiple frameworks under development or strengthening in parallel covering areas such as Extended Producer Responsibility (EPR) and Battery Waste Management compliance (specified in the Battery Waste Management Rules, 2022 published by Ministry of Environment, Forest and Climate Change), harmful substance restrictions, performance and durability reporting, State of Health (SoH) and lifetime disclosure, carbon footprint declaration, recycled content verification, and supply-chain due diligence. In this context, international initiatives such as the EU Battery Regulation and EU Battery Passport (Regulation (EU) 2023/1542) mechanisms provide useful benchmarking on lifecycle transparency, traceability, and digital compliance approaches; however, the Indian market's scale (especially 2W/3W dominance), cost sensitivity, and diverse stakeholder maturity require an India-first, practical implementation pathway that achieves compliance without imposing EU-level data burden and infrastructure cost on mass-market batteries. Hence, India needs a lean and scalable digital backbone that can support phased regulation roll-out, ensure minimum essential data availability offline when required, and still allow secure digital access and auditability for regulated stakeholders.

Battery Pack Aadhaar is positioned as one such strategic development serving as a foundational "digital identity and data backbone" for batteries through BPAN (alphanumeric), QR code (offline/static dataset), and a lean server layer (dynamic lifecycle events). Importantly, Battery Pack Aadhaar is not intended to be a standalone compliance silo; instead, it is designed to enable and accelerate other emerging regulations by providing standardized reference identifiers, verified baseline attributes, and lifecycle event records that can be reused by respective methodologies/guidelines (e.g., SoH computation approaches, performance/durability reporting formats, circularity and dismantling pathways, carbon footprint accounting boundaries, and recycled content verification). In other words, Battery Pack Aadhaar becomes the "common digital spine" that different regulatory workstreams can reference, reducing duplication of data capture across agencies and stakeholders, improving auditability, supporting enforcement under EPR/BWM rules, and enabling harmonization/interoperability with global standards where required. By keeping a large share of information accessible offline (BPAN + QR) and limiting server dependence mainly to lifecycle updates/events, the approach remains implementable at national scale while still meeting traceability, transparency, and cybersecurity expectations needed for future regulations.

Government initiatives such as the Production Linked Incentive (PLI) scheme are focused on advancing India's manufacturing capabilities in Advanced Chemistry Cells (ACC) by establishing giga-scale ACC and battery production facilities, with a strong emphasis on maximizing domestic value addition. The Battery Pack Aadhaar system will help to enable the government to verify whether the cells used in battery packs are produced domestically as mandated under ACC PLI.

6. STAKEHOLDERS

A digital record tracking a battery's journey, relies on a diverse ecosystem of "stakeholders." These stakeholders, ranging from raw material suppliers to recyclers (shown in Table 1), each contribute vital data throughout the battery's lifecycle. Their collective participation ensures transparency, promotes sustainability, and drives the circular economy for batteries.

Table 1 Battery Stakeholders

Battery Stakeholders	Description
Battery Producer / Battery Manufacturer	A legal entity that produces a battery and sells it under its own brand name or trademark as defined in this document.
Government Authority	Any stakeholder authorized by Government of India
Importer	A responsible person for bringing batteries into a country or region, ensuring compliance with all applicable safety, labelling, packaging, and documentation standards.
Distributor	A legal entity within the supply chain, excluding the manufacturer and importer, that supplies a battery to the market.
Service Provider	Any provider who performs specialized services related to the operation, maintenance, testing, refurbishment, or repurposing of batteries, without necessarily placing them on the market under their own name or trademark
Recycler	Any person who performs recycling operations within a permitted facility
End-user	Any person residing or established in India, to whom a product has been made available either as a consumer outside of any trade, business, craft, or profession or as a professional end-user during its industrial or professional activities.
Waste management operator	Any person dealing on a professional basis with the separate collection or treatment or recycling of waste batteries
Vehicle OEM	A Vehicle Original Equipment Manufacturer (OEM) is an entity that designs and manufactures vehicles, including vehicles equipped with batteries, and is responsible for providing associated support.
Battery repurposing entity	A legally recognized organization or business entity engaged in the collection, assessment, and processing of used or end-of-life batteries for the purpose of repurposing them for secondary applications.
Financier / Insurer / Used vehicle buyer	Any individual or legal entity that, in relation to vehicles including those equipped with batteries, undertakes the following activities: (a) provides financial assistance or credit for purchase or operation; (b) offers insurance coverage for the vehicle and associated risks; (c) purchases a previously owned or operated vehicle for personal use, resale, or other lawful purposes.

7. BATTERY PACK AADHAAR REQUIREMENTS

7.1 The Battery Pack Aadhaar shall apply to different battery categories mentioned in the section 2, “Scope” of this document.

7.2 The battery producer or importer shall have the obligation of assigning a unique Battery Pack Aadhaar Number (BPAN) to each battery that they introduce in the market and the battery they put to self-use. Battery producer or importer shall also have the obligation of marking the Battery Pack Aadhaar Number (both alphanumeric code and QR code) on the battery pack and also uploading the relevant Battery Pack Dynamic data on the official portal of BPAN established by Government of India.

7.3 Each BPAN shall consist of twenty-one (21) characters.

7.4 The BPAN shall be in a clearly visible and accessible position. The location shall be chosen in a way that it cannot be destroyed or deteriorate.

7.5 Each character in each BPAN shall be one of the letters in the set: [ABCDEFGHJKLMNPRSTUVWXYZ] or a numeral in the set: [123456789].

7.6 Any change in attributes of the BPAN due to recycling and repurposing shall result in a new BPAN by the same or a new producer or importer.

7.7 Guidelines would be specified to improve the reliability of the information uploaded by the manufacturers/producers in the supply chain. It is recommended that a Government entity to audit the premises of the battery manufacturers/producers to audit them for Battery Pack Aadhaar number generation capabilities.

7.8 Suppliers of battery cells and battery modules shall provide the information and documentation necessary to comply with the requirements of this document when supplying battery cells or modules to a manufacturer.

8. BATTERY DATA CHARACTERISTICS

The Battery Pack Aadhaar's technical design requires categorizing its many data attributes with equal behavioral Characteristics. Some attributes, like a battery's manufacturing date, are static and never change. In contrast, attributes like state of health, battery status are dynamic and need frequent updates for their use cases. The Battery Pack Aadhaar uses these ‘static’ and ‘dynamic’ classifications to group data attributes.

8.1 **Static Data**

In the context of a Battery Pack Aadhaar, static data is defined as the information that's established when the battery or battery pack is manufactured or assembled. This data remains unchanged unless there is a physical replacement of components or a modification to the battery’s operational parameters by its management system.

8.2 **Dynamic Data**

Dynamic data attributes in the Battery Pack Aadhaar are anticipated to evolve consistently throughout the battery’s lifecycle, as they capture changes in characteristics influenced by each battery’s unique usage patterns.

9. DATA ACCESS

Battery pack Aadhaar methodology enables users to access essential data of battery pack through alphanumeric code, which is static and publicly available. Another set of data is available via a QR code which is also static and available to limited public through an authorized access system. This information can be retrieved using the BPAN or an authorized QR code decoder.

The server-based data is dynamic and restricted to private access, ensuring secure handling of sensitive information. The server utilizes BMI and Battery Identifier (BI) to ensure precise identification and reliable traceability of battery pack data. Table 2 outlines the data access.

Table 2 Data Access

SN	Data Access	Description
1	Private Access	Accessible only to authorized entities such as Service Providers, Recyclers, Producers, or other approved stakeholders.
2	Public Access	Information that is publicly accessible and available to everyone.

10. METHODOLOGY

Battery Pack Aadhaar system consist of various digital identification methods such as QR code, and alphanumeric code that are utilized to store and access battery-specific data throughout its lifecycle shown in FIG 1. This methodology can support offline as well as on-site access to battery data, making it suitable for diverse field and industrial applications. A Battery Pack Aadhaar consist of three different sections as follows:

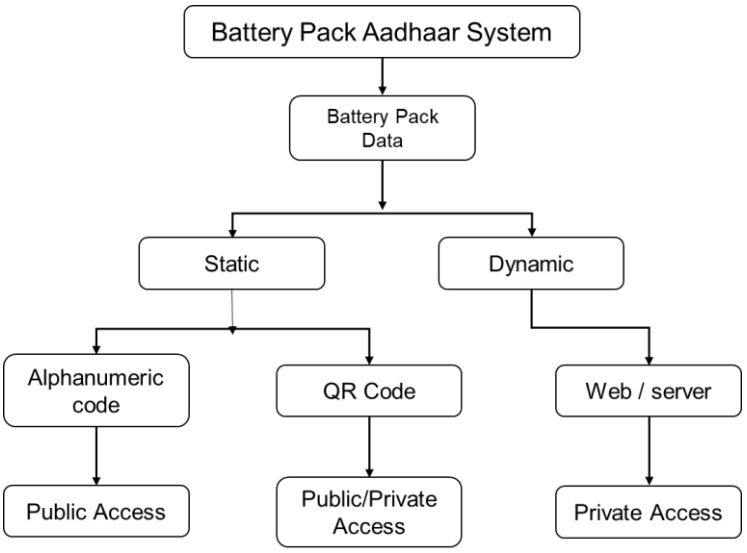


FIG. 1 Battery Pack Aadhaar Concept

10.1 **Alphanumeric Code Section**

Alphanumeric code involves a 21- character alphanumeric code physically affixed to the battery. Using this code, basic battery details can be decoded even without an internet connection. Each battery is assigned a distinct alphanumeric code, with each character representing specific information and these details can be decoded in accordance with the BPAN Regulation.

The parameters in alphanumeric code of BPAN are outlined in Annexure I.

10.2 **QR Code Section**

The QR code functions as a non-internet-based method, allowing access to essential static data such as battery material, descriptor, and carbon footprint parameters. These details are made available to recyclers, facilitating more efficient recycling processes and contributing to overall battery waste reduction. QR code parameters represented by a specific character are defined in Annexure II.

10.3 **Server based Data**

The server-based data of Battery Pack Aadhaar comprises the battery dynamic data (BDD), which is maintained and updated via a server. This server-based data includes critical parameters and operates as an internet-based method, where data is stored on a centralized server. This allows second-hand battery pack users to assess the battery pack's condition before purchase or reuse. This data is designed for scalability, allowing seamless integration of future upgrades and enhancements with each parameter in server represented by a specific number of digits as outlined in Annexure III.

11. BATTERY PACK AADHAAR CONTENT

Battery Pack Aadhaar information is systematically organized into six distinct categories. Five of these categories are dedicated to static data parameters, capturing fixed and unchanging details essential for identification and foundational understanding of the battery shown in FIG 2. In contrast, the last category (Battery Dynamic Data) is allocated for dynamic data parameters, designed to record real-time or frequently updated information that reflects the battery's current status and performance.

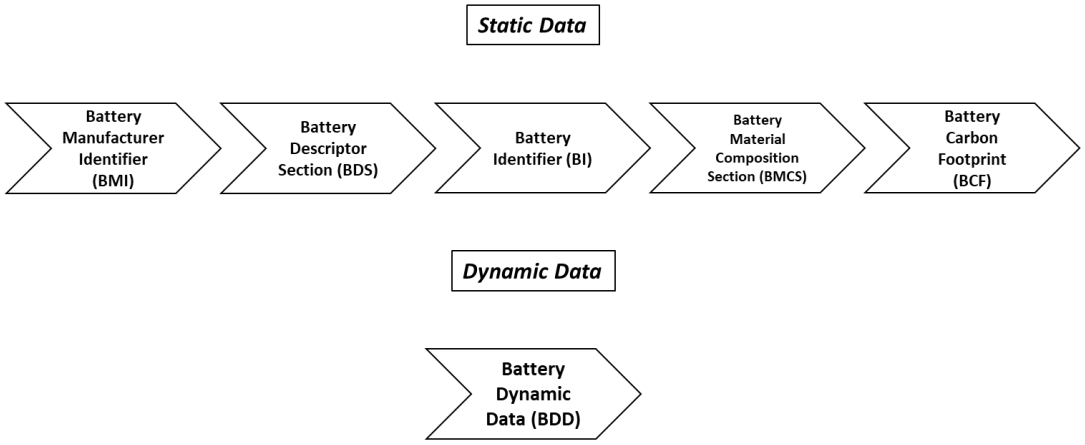


FIG. 2 Battery Pack Aadhaar Data Categories

11.1 **Battery Manufacturer Identifier (BMI)**

The Battery Manufacturer Identifier (BMI) shall be the first section of the BPAN and shall consist of Five characters pre-assigned by the national organization of the country shown in Annexure I. The first five characters uniquely identify the country and manufacturer of the battery pack. The first two characters of the BMI typically represents the region in which the manufacturer is located and remaining 3 characters represents the manufacturer. Table 3 outlines the BMI parameters.

Table 3 BMI Parameters

SN	Parameter
1	Country code
2	Manufacturer identifier

11.2 **Battery Descriptor Section (BDS)**

The Battery Descriptor Section (BDS) is designed to provide a concise summary of essential battery specifications, enabling quick access to critical information. It includes key parameters such as battery capacity, chemistry, voltage, and cell configuration, facilitating easy comparison across different battery models. This section consists of eight battery parameters shown in Table 4.

Table 4 BDS Parameters

SN	Parameter
1	Battery Capacity
2	Battery Chemistry
3	Nominal voltage
4	Cell Origin
5	Extinguisher Class

11.3 **Battery Identifier (BI)**

The Battery Identifier (BI) is an 8- character alphanumeric code designed to uniquely identify each battery. This code is structured into three distinct segments. The first segment encodes three-character manufacturing date, representing the year, month, and day of production. The second segment comprises a one-character factory code, indicating the manufacturing location. The third segment is a Four-digit sequential number that serves as a unique identifier for each battery, as detailed in Annexure I. Table 5 outlines the BI parameters.

Table 5 BI Parameters

SN	Parameter
1	Date of manufacturing
2	Factory code
3	Sequential Production Number

11.4 **Battery Material Composition Section (BMCS)**

The Battery Material Composition Section (BMCS) presents a comprehensive summary of the materials and performance characteristics that define the battery's structural and functional integrity. It details the composition of key components including the anode, cathode, electrolyte, separator, and current collector, providing clarity on the material types used shown in Table 6. This section includes the recyclability percentage, supporting environmental impact assessments and end-of-life planning. Additionally, the section specifies the content percentages different materials, enabling precise analysis for compliance, safety, and optimization purposes.

Table 6 BMCS Parameters

SN	Parameter
1	TAC Number
2	Number of cells per battery
3	Internal Resistance of Battery Pack
4	Battery Weight
5	Battery warranty

6	Cell Type
7	Cell form Factor
8	Type of construction of battery pack
9	Type of construction of Module
10	Type of Cooling System
11	Original power capability at 80% SoC
12	Original power capability at 20% SoC
13	Usable capacity between 80% & 20% SoC
14	BMS Hardware Version
15	BMS Software Version
16	Disassembly Method
17	Circularity Method
18	Recyclability
19	Material: Anode
20	Material: Cathode
21	Material: Electrolyte
22	Material: Separator
23	Material: current collector
24	Material: Battery casing
25	Material: Potting
26	Material 1 content
27	Material 2 content
28	Material 3 content
29	Material 4 content

11.5 **Battery Carbon Footprint (BCF)**

The Battery Carbon Footprint (BCF) aims at determining and validating relevant standards for the consistent collection of the greenhouse gas (GHG) footprint of batteries. This assessment covers the entire lifecycle, from raw material extraction (mine) through manufacturing, product distribution, and even includes the impact of using recycled (secondary battery) materials. Table 7 outlines the specific lifecycle stages required for this declaration. Table 8 outlines the BCF parameters.

Specifically, the Distribution stage accounts only for transportation up to the point of sale. The End-of-Life (EOL) and recycling stage encompasses collection, dismantling, and actual recycling processes. Beyond this, the regulation doesn't provide further specifics, except to exclude the manufacturing of battery recycling equipment. The carbon footprint calculation outlined in the EU battery passport regulation can be used for the measuring the carbon footprint parameter outlined in Table 8.

Table 7 Life cycle stages of Carbon Footprint

Stage	Life Cycle Stage	Description
Stage 1	Raw material acquisition and pre-processing	Includes mining and other relevant sourcing, pre-processing and transport of active materials, up to the manufacturing of battery cells and batteries components (active materials, separator, electrolyte, casings, active and passive battery components), and electric/electronics components.
Stage 2	Main product production	Assembly of battery cells and assembly of batteries with the battery cells and the electric/electronic components
Stage 3	Distribution	Transport to the point of sale
Stage 4	End-of-life and recycling	Collection, dismantling and recycling

Table 8 BCF Parameters

SN	Parameter
1	Total Battery Carbon Footprint Scaled (kgCO2e/kWh)
2	kgCO2e/kWh during Raw material acquisition stage (%)
3	kgCO2e/kWh during manufacturing stage (%)
4	kgCO2e/kWh during distribution stage (%)
5	kgCO2e/kWh during end of Life and Recycling stage (%)

11.6 Battery Dynamic Data (BDD)

The Battery Pack Aadhaar incorporates dynamic parameters that provide real-time insights into the battery's performance and health. Among the most critical of these parameters are the battery status, battery category, and State of Health (SOH), as detailed in the Annexure III. These parameters shown in Table 9, offer a dependable overview of the battery's current condition, enabling timely diagnostics and preventive maintenance. Continuous or periodic tracking of these parameters is vital for ensuring system reliability, maximizing performance, and supporting sustainable lifecycle management.

The Battery Pack Aadhaar framework relies on a central server to hold battery information that evolves over time, such as operational history, State of Health, usage conditions, safety incidents and end-of-life outcomes. This information cannot be kept reliably in a QR code or on-board memory alone, because those elements are either static or accessible only to a limited set of tools. The BDD serves as the dynamic counterpart to the static identifiers embedded in the Battery Identifier (BI) and Battery Manufacturer Identifier (BMI). While the QR code contains immutable information, BDD captures all lifecycle-dependent, safety-critical, and performance-driven information that must be updated as the battery progresses through different operational environments.

11.6.1 Purpose and Functional Role of BDD

The fundamental role of BDD is to provide a single, authoritative, tamper-proof representation of a battery's technical state at any point in its life. A suitable storage and access mechanism to be designed so that interoperability across the software platforms used by the various stakeholders such as OEMs, recyclers, service centers and government authorities is ensured.

BDD enables the following technical functions:

- State of Health (SOH) validation: Using cumulative metrics such as charge throughput, temperature history, imbalance events and cell-level anomalies, BDD supports both OEM-calculated SOH and regulator-validated SOH checks. The detailed methodology for validating SOH needs to be separately developed by the Government.

- Traceability and compliance: BDD form the digital chain-of-custody for ensuring that batteries entering the recycling ecosystem have undergone appropriate handling, dismantling and material recovery.

- Interoperability with international digital passport systems: The structured representation allows BDD to be mapped into European battery passport schemas, enabling cross-border regulatory integration without major redesign.

11.6.2 Use of Server Data for Monitoring and Validation

Because the data is online, regulators and authorized entities can use it for live tracking of fleets, trend

analysis, and targeted inspections. The same data stream supports automated State of Health calculations based on real-world usage and temperature history, rather than only design assumptions. Service centers authorized by Government or Battery Producer can retrieve the record before working on a battery, verify whether any abnormal events were recorded, and then upload new diagnostic results back to the server. Recyclers authorized by Government can add the outcome of treatment and material recovery, closing the loop. This continuous feedback allows Battery Pack Aadhaar to become a living record of each battery's life rather than a static label.

11.6.3 Future Perspective and Compatibility and harmonization with Global Standard

The Battery Pack Aadhaar design deliberately keeps the server schema simple and focused on a small set of high-value variables so that implementation remains robust, lightweight, and cost-effective for manufacturers and recyclers. At the same time, the data model is intentionally extensible. If, in future, if global-style battery passport becomes global requirement, the Battery Pack Aadhaar server can be mapped to that structure through standard APIs and data-field mapping, without changing anything on the physical battery or QR code. Additional fields required by the global battery passport system can be added on the server side as optional extensions, and Indian data fields can similarly be exposed to external systems if needed. This approach preserves compatibility in both directions, i.e., Battery Pack Aadhaar data can be translated into a global passport record, and a global passport carried by an imported product can be mapped into the Indian Battery Aadhaar schema.

11.6.4 Simplicity, Cost-Effectiveness and Data Integrity

By storing only, the essential dynamic parameters centrally, the system avoids the complexity and cost of managing very large datasets while still meeting the key objectives of safety, traceability, and sustainability. This lean design reduces the overhead on smaller manufacturers and recyclers, lowers integration costs, and makes nationwide roll-out more practical. Overall, the server-centric architecture offers a simple, scalable, and future-ready foundation that can grow with technology and regulatory needs while remaining compatible with emerging international battery passport frameworks.

Table 9 BDD Parameters

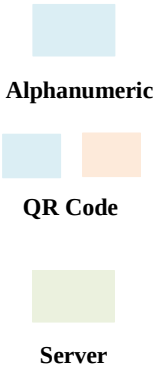
SN	Parameter
1	BPAN (Alphanumeric Code)
2	Battery Category
3	Battery Status
4	State of Health (SOH)
5	Actual Disassembly Method
6	Actual Circularity Method
7	Date & Time Stamp
8	QR code Recovery Data without BPAN
9	Reserved Field 1 (for future use)
10	Reserved Field 2 (for future use)

12. BATTERY PACK AADHAAR PARAMETERS

The following Table 10 lists the key parameters included in the Battery Pack Aadhaar.

Table 10 Battery Pack Aadhaar Parameters

SN	Categories	Parameters	Data Access
1	Battery Manufacturer Identifier (BMI)	Country code	Public
2		Manufacturer identifier	Public
3	Battery Descriptor Section (BDS)	Battery Capacity	Public
4		Battery Chemistry	Public
5		Nominal voltage	Public
6		Cell Origin	Public
7		Extinguisher Class	Public
12	Battery Identifier (BI) (Unique Serial Number)	Date of manufacturing	Public
13		Factory code	Public
14		Sequential Production Number	Public
15	Battery Material Composition Section (BMCS)	TAC Number	Public
16		Number of cells per battery	Public
17		Internal Resistance of Battery Pack	Public
18		Battery Weight	Public
19		Battery warranty	Public
20		Cell Type	Public
21		Cell form Factor	Public
22		Type of construction of battery pack	Private
23		Type of construction of Module	Private
24		Type of Cooling System	Private
25		Original power capability at 80% SoC	Private
26		Original power capability at 20% SoC	Public
27		Usable Capacity between 80% & 20% SoC	Private
28		BMS Hardware Version	Private
29		BMS Software Version	Private
30		Disassembly Method	Private
31		Circularity Method	Private
32		Recyclability	Private
33		Material: Anode	Private
34		Material: Cathode	Private
35		Material: Electrolyte	Private
36		Material: Separator	Private
37		Material: current collector	Private
38		Material: Battery casing	Private
39		Material: Potting	Private
40		Material 1 content	Private
41		Material 2 content	Private
42		Material 3 content	Private
43		Material 4 content	Private
44	Battery Carbon Footprint (BCF)	Total Battery Carbon Footprint Scaled ($kgCO_2e/kWh$)	Public
45		$kgCO_2e/kWh$ during Raw material acquisition stage (%)	Private
46		$kgCO_2e/kWh$ during manufacturing stage (%)	Private
47		$kgCO_2e/kWh$ during distribution stage (%)	Private
48		$kgCO_2e/kWh$ during end of Life and Recycling stage (%)	Private
49		BPAN (Alphanumeric Code)	Private



50	Battery Dynamic Data (BDD)	Battery Category	Private
51		Battery Status	Private
52		State of Health (SOH)	Private
53		Actual Disassembly Method	Private
54		Actual Circularity Method	Private
55		Date & Time Stamp	Private
56		QR code Recovery Data without BPAN	Private
57		Reserved Field 1 (for future use)	Private
58		Reserved Field 2 (for future use)	Private

13. BATTERY DATA EXECUTION

Battery data execution section outlines the structured flow of battery-related information along with the designated authorities responsible for updating each data type shown in Table 11.

Table 11 Battery Data Execution

Element	Function	Who Executes
BPAN Assignment	21- character unique Battery Pack Aadhaar number is generated including the categories BMI, BDS, & BI.	Battery Producer
Static Data Upload	Upload of fixed data.	Battery Producer
QR Code Generation	QR code linked with BPAN, encodes essential data.	Battery Producer
Public Access Interface	Provides read-only access to identity and battery data.	Authorized Stakeholder
Private Access Interface	Access to sensitive details like material composition, carbon footprint and dynamic data.	Recyclers / Authorized Stakeholder
Dynamic Data update	Event based updates during usage.	Service Provider / Recycler / Producer / Authorized Stakeholder

14. BATTERY PACK AADHAAR PARAMETER SEQUENCE

14.1 **Alphanumeric Code Parameters**

The 21-character BPAN alphanumeric code provides publicly accessible general information about the battery, with each parameter encoded using a specific alphanumeric character as illustrated in the FIG 3.

Char	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
Parameters	Country code		Manufacturer identifier assigned within India			Battery Capacity		Battery Chemistry	Nominal voltage		Cell Origin		Extinguisher Class	Manufacturing Year	Manufacturing Month	Manufacturing Date	Factory Name	Unique Serial Number			

FIG. 3 Alphanumeric Code Parameters

14.2 **QR Code Parameters**

The QR code contains essential battery information that supports recyclers during the recycling process, with each parameter encoded using a specific alphanumeric character as shown in the FIG 4.

22..27	28..32	33..36	37	38	39	40	41..49	50	51	52	53	54	55	56	57	58	59..64	65..70	71	72
→ TAC Number	Number of Cells	Internal Resistance of Battery Pack	Battery Weight		Battery warranty	Cell Type	Cell form Factor	Type of construction of battery pack	Type of construction of Module	Type of Cooling System	→ Original power capability at 80% SoC		→ Original power capability at 20% SoC		Usable Capacity between 80% & 20% SoC		BMS Hardware Version	BMS Software Version	Disassembly Method	

73	74	75	76	77	78	79	80	81	82	82..87	88..92	93..97	98..102	103	104	105..108	109..112	113..116	117..120
Circularity Method	Recyclability		→ Material: Anode	→ Material: Cathode	→ Material: Electrolyte	→ Material: Separator	→ Material: Current collector	→ Material: Battery casing	Material: Potting	→ Material 1 content	→ Material 2 content	→ Material 3 content	→ Material 4 content	Total Battery Carbon Footprint Scaled kgCO2e/kWh		→kg CO2e during Raw material acquisition stage	→kg CO2e during manufacturing stage	→kg CO2e during distribution stage	→kg CO2e during end of Life and Recycling stage

FIG. 4 QR Code Parameters

14.3 **Server Based Parameters**

The battery's dynamic data captures real-time operational parameters essential for monitoring performance and supporting end-of-life processes, with each parameter encoded using a designated alphanumeric character as shown in the FIG 5.

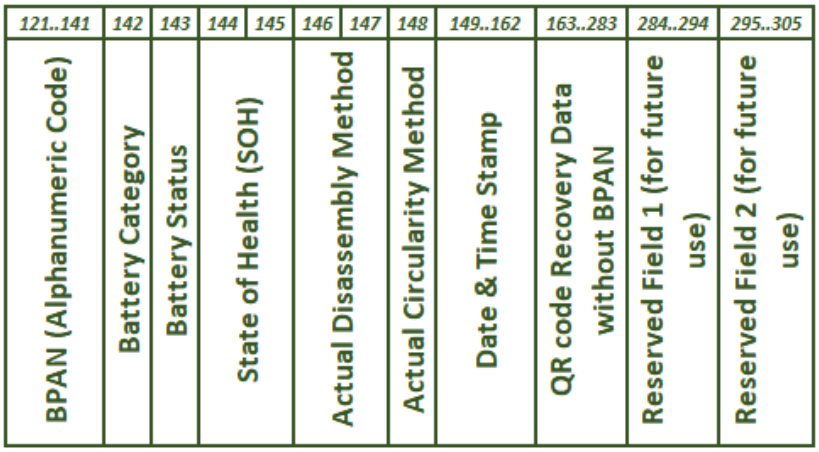


FIG. 5 Server Based Parameters

15. BATTERY PACK AADHAAR PILOT

FIG. 6 shows one of the Battery pack Aadhaar pilot.

FIG. 6 Battery Pack Aadhaar Pilot

15.1 **Alphanumeric Data**

Alphanumeric information of the BPAN Pilot given in FIG. 6 is decoded as given in Table 12 in accordance with BPAN guidelines.

Table 12 Alphanumeric Pilot Data

Categories	**Parameters**	**Battery Original Data**	**Aadhaar Code**	**Aadhaar Data From BPAN Regulation**
Battery Manufacturer Identifier (BMI)	Country code	India	MY	India
	Manufacturer identifier	Company 8	008	Company 8
Battery Descriptor Section (BDS)	Battery Capacity	30 kWh	A6	30 kWh
	Battery Chemistry	NMC	F	NMC
	Nominal voltage	307 V	KK	307 V
	Cell Origin	Korea	KL	KL - Korea
	Extinguisher Class	Class C	C	Class C
Battery Identifier (BI)	Unique Serial number = Date of manufacturing (3 digit) + factory code (1 digit) + sequential production number (4 digits)	Date: 250417 Factory code: 08, Sequential No: 0001	1DH80001	1 = 2025 D = April H = 17 8 = 8 (Factory code) 0001 = Serial No.

15.2 **QR Code Data**

QR Code information of the BPAN Pilot given in FIG 6 is decoded as given in Table 13 in accordance with BPAN guidelines.

Table 13 QR Code Pilot Data

Categories	Parameters	Aadhaar Code	Aadhaar Data From QR
Battery Manufacturer Identifier (BMI)	Country code	MY	India
	Manufacturer identifier	008	Company 8
Battery Descriptor Section (BDS)	Battery Capacity	A6	30 kWh
	Battery Chemistry	F	NMC
	Nominal voltage	KK	307 V
	Cell Origin	KL	KL - Korea
	Extinguisher Class	C	Class C
Battery Identifier (BI)	Unique Serial number = Date of manufacturing (3 digit) + factory code (1 digit) + sequential production number (4 digits)	1DH80001	1 = 2025 D = April H = 17 8 = 8 (Factory code) 0001 = Serial No.
Battery Material Composition Section (BMCS)	TAC Number	AP5184	AP5184
	Number of cells per battery	00096	96 Cells
	Internal Resistance of Battery Pack	1000	1000(factor)*1
	Battery Weight	NZ	420
	Battery warranty	J	9
	Cell Type	B	Prismatic
	Cell form Factor	18,65,20	Length, Width, Height(mm)
	Type of construction of battery pack	A	Cell-to-Module-to-Pack (CTMTP)
	Type of construction of Module	A	Series
	Type of Cooling System	A	Air
	Original power capability at 80% SoC	AZ	24 kW
	Original power capability at 20% SoC	AF	6 kW
	Usable Capacity between 80% & 20% SoC	4	4
	BMS Hardware Version	V1.0.6	V1.0.6
	BMS Software Version	V1.2.1	V1.2.1
	Disassembly Method	AA	Standard Manual Disassembly & Full Separation
	Circularity Method	A	Material Circularity Indicator (MCI)
	Recyclability	CD	70 %
	Material: Anode	A	Graphite
	Material: Cathode	A	lithium iron phosphate
	Material: Electrolyte	B	LiBF4 (Lithium Tetrafluoroborate)
	Material: Separator	B	Polypropylene (PP)
	Material: current collector	E	Copper (Cu)
	Material: Battery casing	A	Aluminium
	Material: Potting	A	Epoxy Resins
	Material 1 content	Li060	Lithium - 60%
	Material 2 content	Cb010	Cobalt - 10%
	Material 3 content	Ni015	Nickel - 15%
	Material 4 content	Gr028	Graphite - 28%
Battery Carbon Footprint (BCF)	Total Battery Carbon Footprint Scaled kgCO2e/kWh	010	010

	kgCO2e/kWh during Raw material acquisition stage	A050	50%
	kgCO2e/kWh during manufacturing stage	B020	20%
	kgCO2e/kWh during distribution stage	C010	10%
	kgCO2e/kWh during end of Life and Recycling stage	D020	20%

15.3 **Server based Data**

Table 14 Server Pilot Data

Categories	**Parameters**	**Aadhaar Code**	**Aadhaar Data from server**
Battery Dynamic Data (BDD)	BPAN (Alphanumeric Code)	MY008 A6FKKKLC 1DH80001	MY008 A6FKKKLC 1DH80001
	Battery Category	A	Electric Vehicle battery
	Battery Status	A	Operational
	State of Health (SOH)	080	80%
	Actual Disassembly Method	AA	Standard Manual Disassembly & Full Separation
	Actual Circularity Method	A	Material Circularity Indicator (MCI)
	Date & Time Stamp	20112025 15:20	20112025 15:20
	QR code Recovery Data without BPAN	AP51849610NZJ B18,65,20 AAA AZAF4V1.0.6V1.2.1 AAACDAABBEAALi060Cb010 Ni015Gr02810A050B020C010D020	String max 120 char
	Reserved Field 1 (for future use)	0000000001	
	Reserved Field 2 (for future use)	0000000002	

16. WAY FORWARD

Electric vehicle applications account for approximately 80–90% of the total lithium-ion battery demand in India, significantly exceeding demand from industrial or non-automotive applications. Accordingly, while the guideline recommends applicability of Battery Pack Aadhaar for industrial batteries above 2 kWh, it is proposed that electric vehicle batteries be given priority during standard formulation, considering their scale, safety implications, and regulatory relevance. This approach will ensure that the Battery Pack Aadhaar framework addresses the most impactful segment of the Indian battery ecosystem in its initial phase.

It is further recommended that the Battery Pack Aadhaar framework be taken forward through the Automotive Industry Standard (AIS) route under the Automotive Industry Standards Committee (AISC), following the established multi-step standardization process. This will enable structured stakeholder consultation, technical validation, and harmonization with existing automotive regulations while ensuring national uniformity and regulatory acceptance.

The AISC committee may include representatives from relevant stakeholders such as battery manufacturers, electric vehicle manufacturers, recyclers, testing agencies, and regulatory bodies, to ensure that practical implementation aspects across the battery lifecycle are adequately addressed.

To support effective implementation, the roles and responsibilities of various stakeholders across the battery lifecycle such as battery manufacturer registration, battery manufacturer identifier allocation, QR and alphanumeric marking, lifecycle data updates, and end-of-life reporting are proposed to be clearly defined.

Table 15 provides an illustrative example of stakeholder responsibilities and associated activities for typical electric vehicle battery applications, ensuring clarity, accountability, and traceability.

Table 15 Stakeholder Responsibilities and Associated Activities

Responsibility	With	Activity
Battery manufacturer	National Agency	Registration of Battery Manufacturer identifier and factory code (Like World Manufacturer Identifier (WMI) number used in Vehicle Identification Number (VIN)) One-time registration.
Battery manufacturer	Various suppliers & sub suppliers	Take relevant information required for Battery Pack Aadhaar number from cell, BMS, etc. supplier.
Battery manufacturer	Authorised Test Agency	Technical conformity assessment or Type approval (AIS 156/ AIS 038).
Battery manufacturer	Authorised Test Agency	Verification of Battery Pack Aadhaar number generation capability during plant audit /inspection. (AIS 037 COP standard).
Battery Manufacturer	NIC & National Agency	Generation of Battery Aadhaar number and QR code. Entering Initial Dynamic data on server.
Vehicle manufacturer	VAHAN Database	Through dedicated field for Battery Pack Aadhaar number in Form 20, which will feed data to VAHAN database, managed by MoRTH.
Vehicle manufacturer	End customer	Printing of Alphanumeric number and QR code on windshield / vehicle body/ as per prescribed guidelines.

Vehicle manufacturer	VAHAN Database	In use phase: change in Battery Pack Aadhaar number with new Battery Pack Aadhaar number in case battery pack is replaced with new battery pack.
Authorized operator	NIC & National Agency	Change in battery status from EV to stationary storage or second use or Recycle to dispose.
Authorized operator	NIC & National Agency	Recycler/waste operator adds dismantling + recovery outputs.

The proposed approach enables a phased and scalable rollout, beginning with electric vehicle batteries and subsequently extending to other battery categories. The supporting digital infrastructure shall remain lightweight and secure, with server-based usage limited to dynamic lifecycle events, while the majority of identification, safety, and material information remains available offline through physical alphanumeric marking and QR codes. Data implementation may be carried out in a phased manner as: Phase-1 (BMI+BDS+BI) for identification and key descriptors; Phase-2 (BMCS and BDD) for material composition/circularity attributes for dynamic lifecycle events such as status, SoH and end-of-life reporting with time stamp; and Phase-3 (BCF/Carbon Footprint) as an advanced requirement, recognizing the carbon footprint.

ANNEXURE I

Alphanumeric Code Parameter Configuration

1. Battery Manufacturer Identifier (BMI)

1.1. The region and country codes has been assigned from the reference of ISO 3779 as shown in Table 16, from here Country code and cell origin can be assigned.

Table 16 Country Codes

A-H (AFRICA)	J-R (ASIA)	S-Z (EUROPE)	1-5, 7F-50 (North America)	8-9 (South America)	6-7E (Oceania)
AA-AH South Africa	**J** Japan	**SA-SM** United Kingdom	**1, 4, 5 or 7F-70** United States	**8A-8E** Argentina	**6** Australia
AJ-AN Côte d'Ivoire	**KA-KE** Sri Lanka	**SN-ST** Germany (formerly East Germany)	**2** Canada	**8F-8K** Chile	**7A-7E** New Zealand
AP-A0 unassigned	**KF-KK** Israel	**SU-SZ** Poland	**3A-3X** Mexico	**8L-8R** Ecuador	
AR-AL Algeria	**KL-KR** Korea (South)	**S1-S2** Latvia	**3Y-37** Costa Rica	**8S-8W** Peru	
BA-BE Angola	**KS-KT** Jordan	**S3** Georgia	**38-39** Cayman Islands	**8X-82** Venezuela	
BF-BK Kenya	**L** China (Mainland)	**S4** Iceland	**30** unassigned	**82-82** Bolivia	
BL-BR Tanzania	**MA-ME, MY-M0** India	**S5-S0** unassigned		**83-80** unassigned	
BU Uganda	**MF-MK** Indonesia	**TA-TH** Switzerland		**9A-9E** Brazil	
BS-B0 unassigned	**ML-MR** Thailand	**TJ-TP** Czech Republic		**9F-9K** Colombia	
CA-CE Benin	**MS** Myanmar	**TR-TV** Hungary		**9L-9R** Paraguay	
CF-CK Madagascar	**MU** Mongolia	**TW-T2** Portugal		**9S-9W** Uruguay	
CL-CR Tunisia	**MX** Kazakhstan	**T3-T0** unassigned		**9X-92** Trinidad & Tobago	
CS-C0 unassigned	**NA-NE** Iran	**UA-UG** unassigned		**93–99** Brazil	
DA-DE Egypt	**NF-NK** Pakistan	**UH-UM** Denmark		**90** unassigned	
DF-DK Morocco	**NL-NR** Turkey	**UN-UT** Ireland			
DL-DR Zambia	**NS-NT** Uzbekistan	**UU-UZ** Romania			
DS-D0 unassigned	**NU-N0** unassigned	**U1-U4** North Macedonia			
EA-EE Ethiopia	**PA-PE** Philippines	**U5-U7** Slovakia			
EF-EK Mozambique	**PF-PK** Singapore	**U8-U0** Bosnia and Herzegovina			
EL-E0 unassigned	**PL-PR** Malaysia	**VA-VE** Austria			

FA-FE Ghana	**PS-PT** Bangladesh	**VF-VR** France			
FF-FK Nigeria		**VS-VW** Spain			
FL-F0 unassigned		**VX-V2** Serbia			
GA-G0 unassigned		**V3-V5** Croatia			
HA-H0 unassigned		**V6-V0** Estonia			
		W Germany (formerly East Germany)			
		XA-XE Bulgaria			
		XF-XK Greece			
		XL-XR Netherlands			
		XS-XW Russia (former USSR)			
		XX-XY Luxembourg			
		XZ-X0 Russia			
		YA-YE Belgium			
		YF-YK Finland			
		YL-YR Malta			
		YS-YW Sweden			
		YX-Y2 Norway			
		Y3-Y5 Belarus			
		Y6-Y0 Ukraine			
		ZA-ZU Italy			
		ZV-ZW unassigned			
		ZX-ZZ Slovenia			
		Z3-Z5 Lithuania			
		Z6-Z0 Russia			

1.2. Manufacturer Identifier has been assigned with five character alphanumeric as shown in Table 16, It consists of a two-character country code (e.g., for India: MA, MB, MC, MD, ME, MY, MZ, and M0) followed by a three-character manufacturer code. For India, this system allows for up to 2,87,496 unique manufacturer identifiers.

Table 17 Manufacturer Identifier

Code	Manufacturer
001	Company 1
002	Company 2
003	Company 3
004	Company 4
005	Company 5
006	Company 6
007	Company 7
008	Company 8
009	Company 9
010	Company 10
011	Company 11
012	Company 12
013	Company 13
014	Company 14
015	Company 15
016	Company 16
017	Company 17
018	Company 18
019	Company 19
020	Company 20
021 – ZZZ	Reserved

2. Battery Descriptor Section (BDS)

2.1 Battery Capacity (kWh) is provided in two-character alphanumeric code as per ANNEXURE IV.

2.2 Table 18 outlines the configuration of battery chemistry codes, the remaining characters in this table are reserved for future use.

Table 18 Battery Chemistry

Code	Battery Chemistry	Code	Battery Chemistry	Code	Battery Chemistry
A	Lead Acid	**M**		**Y**	
B	Nickel-Cadmium (Ni-Cd)	**N**		**Z**	
C	Nickel-Metal Hydride (Ni-MH)	**P**		**1**	
D	Sodium-Ion	**Q**		**2**	
E	LFP	**R**		**3**	
F	NMC	**S**		**4**	
G		**T**		**5**	
H		**U**		**6**	
J		**V**		**7**	
K		**W**		**8**	
L		**X**		**9**	

2.3 Nominal Voltage (V) is provided in two-character alphanumeric code as per ANNEXURE IV.

2.4 Cell Origin is provided in two-character alphanumeric code, referenced from Table 16.

2.5 Table 19 defines the configuration of Extinguishing agent, with the remaining characters reserved for future enhancement.

Table 19 Extinguishing Agent

Code	Extinguisher Class	Code	Extinguisher Class	Code	Extinguisher Class
A	Class A	**M**		**Y**	
B	Class B	**N**		**Z**	
C	Class C	**P**		**1**	
D	Class D	**Q**		**2**	
E	Class K	**R**		**3**	
F		**S**		**4**	
G		**T**		**5**	
H		**U**		**6**	
J		**V**		**7**	
K		**W**		**8**	
L		**X**		**9**	

3. Battery Identifier (BI)

3.1 Table 20 specifies the alphanumeric code structure for representing the manufacturing year.

Table 20 Manufacturing Year

Code	Manufacturing Year	Code	Manufacturing Year	Code	Manufacturing Year
1	2025	**C**	2036	**P**	2047
2	2026	**D**	2037	**Q**	2048
3	2027	**E**	2038	**R**	2049
4	2028	**F**	2039	**S**	2050
5	2029	**G**	2040	**T**	2051
6	2030	**H**	2041	**U**	2052
7	2031	**J**	2042	**V**	2053
8	2032	**K**	2043	**W**	2054
9	2033	**L**	2044	**X**	2055
A	2034	**M**	2045	**Y**	2056
B	2035	**N**	2046	**Z**	2057

3.2 Table 21 outlines the alphabetical code format used to represent the manufacturing month.

Table 21 Manufacturing Month

Code	Manufacturing Month
A	January
B	February
C	March
D	April
E	May
F	June
G	July
H	August
J	September
K	October
L	November
M	December

3.3 Table 22 specifies the alphanumeric code structure for representing the manufacturing date.

Table 22 Manufacturing Date

Code	Manufacturing Date	Code	Manufacturing Date	Code	Manufacturing Date
1	1	**C**	12	**P**	23
2	2	**D**	13	**Q**	24
3	3	**E**	14	**R**	25
4	4	**F**	15	**S**	26
5	5	**G**	16	**T**	27
6	6	**H**	17	**U**	28
7	7	**J**	18	**V**	29
8	8	**K**	19	**W**	30
9	9	**L**	20	**X**	31
A	10	**M**	21		
B	11	**N**	22		

3.4 Table 23 details the alphanumeric code format used to represent the factory name.

Table 23 Factory Name

Code	Factory Name	Code	Factory Name	Code	Factory Name
1	1	**C**	12	**P**	23
2	2	**D**	13	**Q**	24
3	3	**E**	14	**R**	25
4	4	**F**	15	**S**	26
5	5	**G**	16	**T**	27
6	6	**H**	17	**U**	28
7	7	**J**	18	**V**	29
8	8	**K**	19	**W**	30
9	9	**L**	20	**X**	31
A	10	**M**	21	**Y**	32
B	11	**N**	22	**Z**	33

ANNEXURE II

QR Code Parameter Configuration

1. Battery Material Composition Section (BMCS)

1.1 Battery Weight (kg) is provided in two-character alphanumeric code as per ANNEXURE IV.

1.2 Table 24 defines the configuration of battery warranty codes, with the remaining characters reserved for future enhancements and classifications.

Table 24 Battery Warranty

Code	Battery Warranty	Code	Battery Warranty	Code	Battery Warranty
A	1	**M**	12	**Y**	
B	2	**N**	13	**Z**	
C	3	**P**	14	**1**	
D	4	**Q**	15	**2**	
E	5	**R**	16	**3**	
F	6	**S**	17	**4**	
G	7	**T**	18	**5**	
H	8	**U**	19	**6**	
J	9	**V**	20	**7**	
K	10	**W**		**8**	
L	11	**X**		**9**	

1.3 Table 25 provides the structure for cell type code configuration, the remaining characters reserved for future updates and classifications.

Table 25 Cell Type

Code	Cell Type	Code	Cell Type	Code	Cell Type
A	Cylindrical	**M**		**Y**	
B	Prismatic	**N**		**Z**	
C	Pouch	**P**		**1**	
D	Blade	**Q**		**2**	
E		**R**		**3**	
F		**S**		**4**	
G		**T**		**5**	
H		**U**		**6**	
J		**V**		**7**	
K		**W**		**8**	
L		**X**		**9**	

1.4 Cell form factor is represented in table 26 the format by which the form factor is represented in the QR code.

Table 26 Form Factor Representation of Values

Type	Dimensions
Cylindrical	Diameter × Length (mm)
Prismatic	Length × Width × Height (mm)
Pouch	Length × Width × Thickness (mm)

1.5 Table 27 details the one-character alphabetic code format used to represent the type of construction of battery pack and module.

Table 27 Type of Construction

Type of Construction	Code	Information
Battery Pack	A	Cell-to-Module-to-Pack (CTMTP)
	B	Cell-to-Pack (CTP)
Module	A	Series
	B	Parallel

1.6 Table 28 details the type of cooling system used in the battery Pack

Table 28 Type of Cooling System

Type of Cooling System	Code	Information
Battery Pack	A	Air
	B	Liquid

1.7 Table 29 details the two-character alphanumeric code format used to represent the dismantling/disassembly method.

Table 29 Dismantling/Disassembly Method

Code	Dismantling/Disassembly Method
AA	Standard Manual Disassembly & Full Separation
AB	Direct Shredding Pre-Treatment
AC	Repurposing / Second-Life Pathway
AD	Emergency / Damaged Pack Procedure
AE	Module-Level Input Disassembly
AF	AI-Guided SoH Triage
AG	Electrolyte Extraction & Neutralization
AH	Robotic Automated Disassembly
AJ	Cryogenic / Inert-Atmosphere Disassembly
AK	Direct Cathode Refunctionalization (Direct Recycling)
AL	Biometallurgical Recycling
AM – 9Z	Reserved

1.8 Table 30 details the one-character alphanumeric code format used to represent the battery circularity method.

Table 30 Battery Circularity Method

Code	Circularity Method
A	Material Circularity Indicator (MCI)
B	Carbon Footprint (PEF Method)
C	Recycled Content & Recovery Metrics
D	Design for Circularity Score
E	Second-Life Utilization Index
F	Water / Resource Footprint Analysis
G	Full Life Cycle Assessment (LCA)
H	Pyro-Metallurgical Recovery
J - 9	Reserved

1.9 Table 31 details the two-character alphanumeric code format used to represent the recyclability percentage.

Table 31 Recyclability

Code	Recyclability (%)	Code	Recyclability (%)	Code	Recyclability (%)
AA	1	**BH**	41	**CQ**	81
AB	2	**BJ**	42	**CR**	82
AC	3	**BK**	43	**CS**	83
AD	4	**BL**	44	**CT**	84
AE	5	**BM**	45	**CU**	85
AF	6	**BN**	46	**CV**	86
AG	7	**BP**	47	**CW**	87
AH	8	**BQ**	48	**CX**	88
AJ	9	**BR**	49	**CY**	89
AK	10	**BS**	50	**CZ**	90
AL	11	**BT**	51	**C1**	91
AM	12	**BU**	52	**C2**	92
AN	13	**BV**	53	**C3**	93
AP	14	**BW**	54	**C4**	94
AQ	15	**BX**	55	**C5**	95
AR	16	**BY**	56	**C6**	96
AS	17	**BZ**	57	**C7**	97
AT	18	**B1**	58	**C8**	98
AU	19	**B2**	59	**C9**	99
AV	20	**B3**	60	**DA**	100
AW	21	**B4**	61		
AX	22	**B5**	62		
AY	23	**B6**	63		
AZ	24	**B7**	64		
A1	25	**B8**	65		
A2	26	**B9**	66		
A3	27	**CA**	67		
A4	28	**CB**	68		
A5	29	**CC**	69		
A6	30	**CD**	70		
A7	31	**CE**	71		
A8	32	**CF**	72		
A9	33	**CG**	73		
BA	34	**CH**	74		
BB	35	**CJ**	75		
BC	36	**CK**	76		
BD	37	**CL**	77		
BE	38	**CM**	78		
BF	39	**CN**	79		
BG	40	**CP**	80		

1.10 Table 32 defines the configuration of anode material codes, with the remaining characters reserved for future enhancements and classifications.

Table 32 Anode Material

Code	Anode	Code	Anode	Code	Anode
A	Graphite	**M**		**Y**	
B	Silicon	**N**		**Z**	
C	LTO	**P**		**1**	
D		**Q**		**2**	
E		**R**		**3**	
F		**S**		**4**	

G		**T**		**5**	
H		**U**		**6**	
J		**V**		**7**	
K		**W**		**8**	
L		**X**		**9**	

1.11 Table 33 defines the configuration of Cathode material codes, with the remaining characters reserved for future enhancements and classifications.

Table 33 Cathode Material

Code	Cathode	Code	Cathode	Code	Cathode
A	lithium iron phosphate (LiFePO4 or LFP)	**M**		**Y**	
B	lithium cobalt oxide (LiCoO2)	**N**		**Z**	
C	lithium manganese oxide	**P**		**1**	
D	lithium nickel manganese cobalt oxide (LiNiMnCoO2 or NMC)	**Q**		**2**	
E	NCA	**R**		**3**	
F	LMFP	**S**		**4**	
G		**T**		**5**	
H		**U**		**6**	
J		**V**		**7**	
K		**W**		**8**	
L		**X**		**9**	

1.12 Table 34 defines the configuration of electrolyte material codes, with the remaining characters reserved for future enhancements and classifications.

Table 34 Electrolyte Material

Code	Electrolyte	Code	Electrolyte	Code	Electrolyte
A	LiPF6 (Lithium Hexafluorophosphate)	**M**		**Y**	
B	LiBF4 (Lithium Tetrafluoroborate)	**N**		**Z**	
C	LiClO4 (Lithium Perchlorate)	**P**		**1**	
D	Solid State Electrolyte	**Q**		**2**	
E		**R**		**3**	
F		**S**		**4**	
G		**T**		**5**	
H		**U**		**6**	
J		**V**		**7**	
K		**W**		**8**	
L		**X**		**9**	

1.13 Table 35 outlines the configuration of separator material codes. The remaining characters in this table are reserved for future use.

Table 35 Separator Material

Code	Separator	Code	Separator	Code	Separator
A	Polyethylene (PE)	**M**		**Y**	
B	Polypropylene (PP)	**N**		**Z**	
C	Polyethylene-Polypropylene (PE/PP) Blend	**P**		**1**	
D	Glass Fiber Separators	**Q**		**2**	
E	Ceramic-Coated Separators	**R**		**3**	
F	Polyvinylidene Fluoride (PVDF) Separators	**S**		**4**	
G	Ion-Exchange Membranes	**T**		**5**	
H		**U**		**6**	
J		**V**		**7**	
K		**W**		**8**	
L		**X**		**9**	

1.14 Table 36 outlines the configuration of current collector material codes. The remaining characters in this table are reserved for future use.

Table 36 Current Collector Material

Code	Current Collector	Code	Current Collector	Code	Current Collector
A	Aluminium (Al)	**M**		**Y**	
B	Nickel (Ni)	**N**		**Z**	
C	Stainless Steel	**P**		**1**	
D	Aluminium-Copper Alloy	**Q**		**2**	
E	Copper (Cu)	**R**		**3**	
F	Graphene-Coated Copper	**S**		**4**	
G	Carbon-Based Materials	**T**		**5**	
H	Metal Nanoparticle Thin Film	**U**		**6**	
J	Carbon Fiber & Nanotubes	**V**		**7**	
K	Polymer-Based Composites	**W**		**8**	
L		**X**		**9**	

1.15 Table 37 outlines the configuration of battery casing material codes. The remaining characters in this table are reserved for future use.

Table 37 Battery Casing Material

Code	Battery Casing	Code	Battery Casing	Code	Battery Casing
A	Aluminium	**M**		**Y**	
B	Steel	**N**		**Z**	
C	Extruded Aluminium	**P**		**1**	
D	Die-Cast Aluminium	**Q**		**2**	
E	Glass Fiber Composites	**R**		**3**	
F	SMC (Sheet Moulding Compound) Composites	**S**		**4**	
G	Carbon Fibre Composites	**T**		**5**	

H	Thermoplastics	**U**		**6**	
J		**V**		**7**	
K		**W**		**8**	
L		**X**		**9**	

1.16 Table 38 outlines the configuration of battery potting material codes. The remaining characters in this table are reserved for future use.

Table 38 Battery Potting Material

Code	Potting Material	Code	Potting Material	Code	Potting Material
A	Epoxy Resins	**M**		**Y**	
B	Polyurethane (PU)	**N**		**Z**	
C	Silicone resins	**P**		**1**	
D	Acrylics	**Q**		**2**	
E		**R**		**3**	
F		**S**		**4**	
G		**T**		**5**	
H		**U**		**6**	
J		**V**		**7**	
K		**W**		**8**	
L		**X**		**9**	

1.17 Table 39 outlines the material content, assigned with two-character alphanumeric code.

Table 39 Material Content

Code	Material Content	Code	Material Content	Code	Material Content
An	Antimony	**Ga**	Gallium	**Pr**	Phosphate rock
Ar	Arsenic	**Ge**	Germanium	**Pg**	Platinum group metals (PGM)
Ba	Bauxite/Alumina/Aluminium	**Ha**	Hafnium	**Sc**	Scandium
Br	Baryte	**He**	Helium	**Si**	Silicon metal
Be	Beryllium	**HR**	Heavy rare earth elements (HREE)	**St**	Strontium
Bi	Bismuth	**LR**	Light rare earth elements (LREE)	**Ta**	Tantalum
Bo	Boron	**Li**	Lithium	**Ti**	Titanium metal
Cb	Cobalt	**Mg**	Magnesium	**Tu**	Tungsten
Cc	Coking coal	**Mn**	Manganese	**Va**	Vanadium
Co	Copper	**Gr**	Graphite	**An**	Phosphorus
Fe	Feldspar	**Ni**	Nickel – battery grade	**Ph**	Antimony
Fl	Fluorspar	**Nb**	Niobium		

1.18 Original power capabilities code assigned as per the total energy code configuration in Table 40.

Table 40 Original Power Capabilities

Parameter	Description
Original power capability at 80% SoC (kW)	Refer ANNEXURE IV for the corresponding coding configuration.
Original power capability at 20% SoC (kW)	Refer ANNEXURE IV for the corresponding coding configuration

1.19 Table 41 details the two-character alphanumeric code format used to represent the usable capacity between 80% & 20% SoC

Table 41 Usable Capacity Between 80% & 20% SoC (%)

Code	Usable Capacity Between 80% & 20% SoC (%)	Code	Usable Capacity Between 80% & 20% SoC (%)	Code	Usable Capacity Between 80% & 20% SoC (%)
AA	1	**BH**	41	**CQ**	81
AB	2	**BJ**	42	**CR**	82
AC	3	**BK**	43	**CS**	83
AD	4	**BL**	44	**CT**	84
AE	5	**BM**	45	**CU**	85
AF	6	**BN**	46	**CV**	86
AG	7	**BP**	47	**CW**	87
AH	8	**BQ**	48	**CX**	88
AJ	9	**BR**	49	**CY**	89
AK	10	**BS**	50	**CZ**	90
AL	11	**BT**	51	**C1**	91
AM	12	**BU**	52	**C2**	92
AN	13	**BV**	53	**C3**	93
AP	14	**BW**	54	**C4**	94
AQ	15	**BX**	55	**C5**	95
AR	16	**BY**	56	**C6**	96
AS	17	**BZ**	57	**C7**	97
AT	18	**B1**	58	**C8**	98
AU	19	**B2**	59	**C9**	99
AV	20	**B3**	60	**DA**	100
AW	21	**B4**	61		
AX	22	**B5**	62		
AY	23	**B6**	63		
AZ	24	**B7**	64		
A1	25	**B8**	65		
A2	26	**B9**	66		
A3	27	**CA**	67		
A4	28	**CB**	68		
A5	29	**CC**	69		
A6	30	**CD**	70		
A7	31	**CE**	71		
A8	32	**CF**	72		
A9	33	**CG**	73		
BA	34	**CH**	74		
BB	35	**CJ**	75		
BC	36	**CK**	76		
BD	37	**CL**	77		
BE	38	**CM**	78		
BF	39	**CN**	79		
BG	40	**CP**	80		

2. Battery Carbon Footprint

2.1 Table 42 outlines the battery carbon footprint, assigned with one alphabetic code.

Table 42 Carbon Footprint

Code	Parameters
A	Raw material acquisition stage
B	Manufacturing stage
C	Distribution stage
D	End of Life and Recycling stage

ANNEXURE III

Server Based Parameter Configuration

1. Table 43 outlines the battery category, assigned with one alphabetic character.

Table 43 Battery Category

Code	Battery Category
A	Electric Vehicle battery L category
B	Electric Vehicle battery M and N category
C	Industrial Battery> 2kwh
D-Z	Reserved

2. Table 44 outlines the battery category, assigned with one alphabetic character.

Table 44 Battery Status

Code	Battery Status
A	Operational (above 80 %)
B	Second Life (60-80%)
C	End of Life (below 60%)

ANNEXURE IV

1. Table 45 details the two-character alphanumeric code format used to represent the Battery capacity, Nominal voltage, Battery weight, and original power capability at 20% and 80% SoC.

Table 45 Parameter Configuration

Code	Parameter	Code	Parameter	Code	Parameter	Code	Parameter	Code	Parameter
AA	1	**BT**	51	**DB**	101	**EU**	151	**GC**	201
AB	2	**BU**	52	**DC**	102	**EV**	152	**GD**	202
AC	3	**BV**	53	**DD**	103	**EW**	153	**GE**	203
AD	4	**BW**	54	**DE**	104	**EX**	154	**GF**	204
AE	5	**BX**	55	**DF**	105	**EY**	155	**GG**	205
AF	6	**BY**	56	**DG**	106	**EZ**	156	**GH**	206
AG	7	**BZ**	57	**DH**	107	**E1**	157	**GJ**	207
AH	8	**B1**	58	**DJ**	108	**E2**	158	**GK**	208
AJ	9	**B2**	59	**DK**	109	**E3**	159	**GL**	209
AK	10	**B3**	60	**DL**	110	**E4**	160	**GM**	210
AL	11	**B4**	61	**DM**	111	**E5**	161	**GN**	211
AM	12	**B5**	62	**DN**	112	**E6**	162	**GP**	212
AN	13	**B6**	63	**DP**	113	**E7**	163	**GQ**	213
AP	14	**B7**	64	**DQ**	114	**E8**	164	**GR**	214
AQ	15	**B8**	65	**DR**	115	**E9**	165	**GS**	215
AR	16	**B9**	66	**DS**	116	**FA**	166	**GT**	216
AS	17	**CA**	67	**DT**	117	**FB**	167	**GU**	217
AT	18	**CB**	68	**DU**	118	**FC**	168	**GV**	218
AU	19	**CC**	69	**DV**	119	**FD**	169	**GW**	219
AV	20	**CD**	70	**DW**	120	**FE**	170	**GX**	220
AW	21	**CE**	71	**DX**	121	**FF**	171	**GY**	221
AX	22	**CF**	72	**DY**	122	**FG**	172	**GZ**	222
AY	23	**CG**	73	**DZ**	123	**FH**	173	**G1**	223
AZ	24	**CH**	74	**D1**	124	**FJ**	174	**G2**	224
A1	25	**CJ**	75	**D2**	125	**FK**	175	**G3**	225
A2	26	**CK**	76	**D3**	126	**FL**	176	**G4**	226
A3	27	**CL**	77	**D4**	127	**FM**	177	**G5**	227
A4	28	**CM**	78	**D5**	128	**FN**	178	**G6**	228
A5	29	**CN**	79	**D6**	129	**FP**	179	**G7**	229
A6	30	**CP**	80	**D7**	130	**FQ**	180	**G8**	230
A7	31	**CQ**	81	**D8**	131	**FR**	181	**G9**	231
A8	32	**CR**	82	**D9**	132	**FS**	182	**HA**	232
A9	33	**CS**	83	**EA**	133	**FT**	183	**HB**	233
BA	34	**CT**	84	**EB**	134	**FU**	184	**HC**	234
BB	35	**CU**	85	**EC**	135	**FV**	185	**HD**	235
BC	36	**CV**	86	**ED**	136	**FW**	186	**HE**	236
BD	37	**CW**	87	**EE**	137	**FX**	187	**HF**	237
BE	38	**CX**	88	**EF**	138	**FY**	188	**HG**	238
BF	39	**CY**	89	**EG**	139	**FZ**	189	**HH**	239
BG	40	**CZ**	90	**EH**	140	**F1**	190	**HJ**	240
BH	41	**C1**	91	**EJ**	141	**F2**	191	**HK**	241
BJ	42	**C2**	92	**EK**	142	**F3**	192	**HL**	242
BK	43	**C3**	93	**EL**	143	**F4**	193	**HM**	243
BL	44	**C4**	94	**EM**	144	**F5**	194	**HN**	244
BM	45	**C5**	95	**EN**	145	**F6**	195	**HP**	245
BN	46	**C6**	96	**EP**	146	**F7**	196	**HQ**	246
BP	47	**C7**	97	**EQ**	147	**F8**	197	**HR**	247
BQ	48	**C8**	98	**ER**	148	**F9**	198	**HS**	248
BR	49	**C9**	99	**ES**	149	**GA**	199	**HT**	249
BS	50	**DA**	100	**ET**	150	**GB**	200	**HU**	250

Code	Parameter	Code	Parameter	Code	Parameter	Code	Parameter	Code	Parameter
HV	251	**KM**	309	**MD**	367	**N5**	425	**QW**	483
HW	252	**KN**	310	**ME**	368	**N6**	426	**QX**	484
HX	253	**KP**	311	**MF**	369	**N7**	427	**QY**	485
HY	254	**KQ**	312	**MG**	370	**N8**	428	**QZ**	486
HZ	255	**KR**	313	**MH**	371	**N9**	429	**Q1**	487
H1	256	**KS**	314	**MJ**	372	**PA**	430	**Q2**	488
H2	257	**KT**	315	**MK**	373	**PB**	431	**Q3**	489
H3	258	**KU**	316	**ML**	374	**PC**	432	**Q4**	490
H4	259	**KV**	317	**MM**	375	**PD**	433	**Q5**	491
H5	260	**KW**	318	**MN**	376	**PE**	434	**Q6**	492
H6	261	**KX**	319	**MP**	377	**PF**	435	**Q7**	493
H7	262	**KY**	320	**MQ**	378	**PG**	436	**Q8**	494
H8	263	**KZ**	321	**MR**	379	**PH**	437	**Q9**	495
H9	264	**K1**	322	**MS**	380	**PJ**	438	**RA**	496
JA	265	**K2**	323	**MT**	381	**PK**	439	**RB**	497
JB	266	**K3**	324	**MU**	382	**PL**	440	**RC**	498
JC	267	**K4**	325	**MV**	383	**PM**	441	**RD**	499
JD	268	**K5**	326	**MW**	384	**PN**	442	**RE**	500
JE	269	**K6**	327	**MX**	385	**PP**	443	**RF**	501
JF	270	**K7**	328	**MY**	386	**PQ**	444	**RG**	502
JG	271	**K8**	329	**MZ**	387	**PR**	445	**RH**	503
JH	272	**K9**	330	**M1**	388	**PS**	446	**RJ**	504
JJ	273	**LA**	331	**M2**	389	**PT**	447	**RK**	505
JK	274	**LB**	332	**M3**	390	**PU**	448	**RL**	506
JL	275	**LC**	333	**M4**	391	**PV**	449	**RM**	507
JM	276	**LD**	334	**M5**	392	**PW**	450	**RN**	508
JN	277	**LE**	335	**M6**	393	**PX**	451	**RP**	509
JP	278	**LF**	336	**M7**	394	**PY**	452	**RQ**	510
JQ	279	**LG**	337	**M8**	395	**PZ**	453	**RR**	511
JR	280	**LH**	338	**M9**	396	**P1**	454	**RS**	512
JS	281	**LJ**	339	**NA**	397	**P2**	455	**RT**	513
JT	282	**LK**	340	**NB**	398	**P3**	456	**RU**	514
JU	283	**LL**	341	**NC**	399	**P4**	457	**RV**	515
JV	284	**LM**	342	**ND**	400	**P5**	458	**RW**	516
JW	285	**LN**	343	**NE**	401	**P6**	459	**RX**	517
JX	286	**LP**	344	**NF**	402	**P7**	460	**RY**	518
JY	287	**LQ**	345	**NG**	403	**P8**	461	**RZ**	519
JZ	288	**LR**	346	**NH**	404	**P9**	462	**R1**	520
J1	289	**LS**	347	**NJ**	405	**QA**	463	**R2**	521
J2	290	**LT**	348	**NK**	406	**QB**	464	**R3**	522
J3	291	**LU**	349	**NL**	407	**QC**	465	**R4**	523
J4	292	**LV**	350	**NM**	408	**QD**	466	**R5**	524
J5	293	**LW**	351	**NN**	409	**QE**	467	**R6**	525
J6	294	**LX**	352	**NP**	410	**QF**	468	**R7**	526
J7	295	**LY**	353	**NQ**	411	**QG**	469	**R8**	527
J8	296	**LZ**	354	**NR**	412	**QH**	470	**R9**	528
J9	297	**L1**	355	**NS**	413	**QJ**	471	**SA**	529
KA	298	**L2**	356	**NT**	414	**QK**	472	**SB**	530
KB	299	**L3**	357	**NU**	415	**QL**	473	**SC**	531
KC	300	**L4**	358	**NV**	416	**QM**	474	**SD**	532
KD	301	**L5**	359	**NW**	417	**QN**	475	**SE**	533
KE	302	**L6**	360	**NX**	418	**QP**	476	**SF**	534
KF	303	**L7**	361	**NY**	419	**QQ**	477	**SG**	535
KG	304	**L8**	362	**NZ**	420	**QR**	478	**SH**	536
KH	305	**L9**	363	**N1**	421	**QS**	479	**SJ**	537
KJ	306	**MA**	364	**N2**	422	**QT**	480	**SK**	538
KK	307	**MB**	365	**N3**	423	**QU**	481	**SL**	539
KL	308	**MC**	366	**N4**	424	**QV**	482	**SM**	540

Code	Parameter	Code	Parameter	Code	Parameter	Code	Parameter	Code	Parameter
SN	541	**UF**	600	**V8**	659	**X1**	718	**ZT**	777
SP	542	**UG**	601	**V9**	660	**X2**	719	**ZU**	778
SQ	543	**UH**	602	**WA**	661	**X3**	720	**ZV**	779
SR	544	**UJ**	603	**WB**	662	**X4**	721	**ZW**	780
SS	545	**UK**	604	**WC**	663	**X5**	722	**ZX**	781
ST	546	**UL**	605	**WD**	664	**X6**	723	**ZY**	782
SU	547	**UM**	606	**WE**	665	**X7**	724	**ZZ**	783
SV	548	**UN**	607	**WF**	666	**X8**	725	**Z1**	784
SW	549	**UP**	608	**WG**	667	**X9**	726	**Z2**	785
SX	550	**UQ**	609	**WH**	668	**YA**	727	**Z3**	786
SY	551	**UR**	610	**WJ**	669	**YB**	728	**Z4**	787
SZ	552	**US**	611	**WK**	670	**YC**	729	**Z5**	788
S1	553	**UT**	612	**WL**	671	**YD**	730	**Z6**	789
S2	554	**UU**	613	**WM**	672	**YE**	731	**Z7**	790
S3	555	**UV**	614	**WN**	673	**YF**	732	**Z8**	791
S4	556	**UW**	615	**WP**	674	**YG**	733	**Z9**	792
S5	557	**UX**	616	**WQ**	675	**YH**	734	**1A**	793
S6	558	**UY**	617	**WR**	676	**YJ**	735	**1B**	794
S7	559	**UZ**	618	**WS**	677	**YK**	736	**1C**	795
S8	560	**U1**	619	**WT**	678	**YL**	737	**1D**	796
S9	561	**U2**	620	**WU**	679	**YM**	738	**1E**	797
TA	562	**U3**	621	**WV**	680	**YN**	739	**1F**	798
TB	563	**U4**	622	**WW**	681	**YP**	740	**1G**	799
TC	564	**U5**	623	**WX**	682	**YQ**	741	**1H**	800
TD	565	**U6**	624	**WY**	683	**YR**	742	**1J**	801
TE	566	**U7**	625	**WZ**	684	**YS**	743	**1K**	802
TF	567	**U8**	626	**W1**	685	**YT**	744	**1L**	803
TG	568	**U9**	627	**W2**	686	**YU**	745	**1M**	804
TH	569	**VA**	628	**W3**	687	**YV**	746	**1N**	805
TJ	570	**VB**	629	**W4**	688	**YW**	747	**1P**	806
TK	571	**VC**	630	**W5**	689	**YX**	748	**1Q**	807
TL	572	**VD**	631	**W6**	690	**YY**	749	**1R**	808
TM	573	**VE**	632	**W7**	691	**YZ**	750	**1S**	809
TN	574	**VF**	633	**W8**	692	**Y1**	751	**1T**	810
TP	575	**VG**	634	**W9**	693	**Y2**	752	**1U**	811
TQ	576	**VH**	635	**XA**	694	**Y3**	753	**1V**	812
TR	577	**VJ**	636	**XB**	695	**Y4**	754	**1W**	813
TS	578	**VK**	637	**XC**	696	**Y5**	755	**1X**	814
TT	579	**VL**	638	**XD**	697	**Y6**	756	**1Y**	815
TU	580	**VM**	639	**XE**	698	**Y7**	757	**1Z**	816
TV	581	**VN**	640	**XF**	699	**Y8**	758	**2A**	817
TW	582	**VP**	641	**XG**	700	**Y9**	759	**2B**	818
TX	583	**VQ**	642	**XH**	701	**ZA**	760	**2C**	819
TY	584	**VR**	643	**XJ**	702	**ZB**	761	**2D**	820
TZ	585	**VS**	644	**XK**	703	**ZC**	762	**2E**	821
T1	586	**VT**	645	**XL**	704	**ZD**	763	**2F**	822
T2	587	**VU**	646	**XM**	705	**ZE**	764	**2G**	823
T3	588	**VV**	647	**XN**	706	**ZF**	765	**2H**	824
T4	589	**VW**	648	**XP**	707	**ZG**	766	**2J**	825
T5	590	**VX**	649	**XQ**	708	**ZH**	767	**2K**	826
T6	591	**VY**	650	**XR**	709	**ZJ**	768	**2L**	827
T7	592	**VZ**	651	**XS**	710	**ZK**	769	**2M**	828
T8	593	**V1**	652	**XT**	711	**ZL**	770	**2N**	829
T9	594	**V2**	653	**XU**	712	**ZM**	771	**2P**	830
UA	595	**V3**	654	**XV**	713	**ZN**	772	**2Q**	831
UB	596	**V4**	655	**XW**	714	**ZP**	773	**2R**	832
UC	597	**V5**	656	**XX**	715	**ZQ**	774	**2S**	833
UD	598	**V6**	657	**XY**	716	**ZR**	775	**2T**	834
UE	599	**V7**	658	**XZ**	717	**ZS**	776	**2U**	835

Code	Parameter	Code	Parameter	Code	Parameter	Code	Parameter	Code	Parameter
2V	836	**5G**	895	**7T**	954				
2W	837	**5H**	896	**7U**	955				
2X	838	**5J**	897	**7V**	956				
2Y	839	**5K**	898	**7W**	957				
2Z	840	**5L**	899	**7X**	958				
3A	841	**5M**	900	**7Y**	959				
3B	842	**5N**	901	**7Z**	960				
3C	843	**5P**	902	**8A**	961				
3D	844	**5Q**	903	**8B**	962				
3E	845	**5R**	904	**8C**	963				
3F	846	**5S**	905	**8D**	964				
3G	847	**5T**	906	**8E**	965				
3H	848	**5U**	907	**8F**	966				
3J	849	**5V**	908	**8G**	967				
3K	850	**5W**	909	**8H**	968				
3L	851	**5X**	910	**8J**	969				
3M	852	**5Y**	911	**8K**	970				
3N	853	**5Z**	912	**8L**	971				
3P	854	**6A**	913	**8M**	972				
3Q	855	**6B**	914	**8N**	973				
3R	856	**6C**	915	**8P**	974				
3S	857	**6D**	916	**8Q**	975				
3T	858	**6E**	917	**8R**	976				
3U	859	**6F**	918	**8S**	977				
3V	860	**6G**	919	**8T**	978				
3W	861	**6H**	920	**8U**	979				
3X	862	**6J**	921	**8V**	980				
3Y	863	**6K**	922	**8W**	981				
3Z	864	**6L**	923	**8X**	982				
4A	865	**6M**	924	**8Y**	983				
4B	866	**6N**	925	**8Z**	984				
4C	867	**6P**	926	**9A**	985				
4D	868	**6Q**	927	**9B**	986				
4E	869	**6R**	928	**9C**	987				
4F	870	**6S**	929	**9D**	988				
4G	871	**6T**	930	**9E**	989				
4H	872	**6U**	931	**9F**	990				
4J	873	**6V**	932	**9G**	991				
4K	874	**6W**	933	**9H**	992				
4L	875	**6X**	934	**9J**	993				
4M	876	**6Y**	935	**9K**	994				
4N	877	**6Z**	936	**9L**	995				
4P	878	**7A**	937	**9M**	996				
4Q	879	**7B**	938	**9N**	997				
4R	880	**7C**	939	**9P**	998				
4S	881	**7D**	940	**9Q**	999				
4T	882	**7E**	941	**9R**	1000				
4U	883	**7F**	942						
4V	884	**7G**	943						
4W	885	**7H**	944						
4X	886	**7J**	945						
4Y	887	**7K**	946						
4Z	888	**7L**	947						
5A	889	**7M**	948						
5B	890	**7N**	949						
5C	891	**7P**	950						
5D	892	**7Q**	951						
5E	893	**7R**	952						
5F	894	**7S**	953						

ANNEXURE V

ACKNOWLEDGEMENT

COMMITTEE	
Members	**Designation & Organization**
Dr. Tata Narasinga Rao	Adjunct Professor, Indian Institute of Technology, Hyderabad
Sh. K C Sharma	Advisor, MVL, Ministry of Road Transport & Highways
Mr. S. A Sundaresan	Prof. of Practice, Indian Institute of Technology, Madras
Prof. Sagar Mitra	Professor, Indian Institute of Technology, Bombay
Sh. Abhijit Mulay	Deputy Director, The Automotive Research Association of India
Sh. Ravi M	Lead-Regulations, Centre of Excellence for Zero Emission Trucking, IIT Madras
Sh. Suresh Babu Muttana	Scientist E/Director, Department of Science & Technology
Prof. Satishchandra Ogale	Director, Research Institute for Sustainable Energy, TCG-CREST
TECHNICAL CORDINATION AND CONTRIBUTION	
Dr. Ravindra Kumar	Sr. General Manager, The Automotive Research Association of India
Mr. Sreekumar U	General Manager, The Automotive Research Association of India
Ms. Bharati V. Mandekar	Deputy Manager, The Automotive Research Association of India
Mr. Mohammad Akramkhan	Research Engineer, The Automotive Research Association of India

ANNEXURE VI

No. RT-11036/137/2025-MVL
Government of India
Ministry of Road Transport & Highways
(MVL Section)
Transport Bhawan, 1, Parliament Street, New Delhi-110001

Dated the 17th September, 2025

OFFICE MEMORANDUM

Subject: Constitution of Committee for "Development of Guidelines for Implementation of Battery Aadhar System in India".

A battery Aadhaar is a digital record that contains data about every battery available in the market, providing details about the manufacturer, localization, material composition, durability, performance,recycling information, etc. India needs such kind of technology/system to localize and enable appropriate traceability and transparency in data so that battery manufacturers, consumers and recyclers may make well informed decisions. There is a definite need to develop the battery Aadhaar in the Indian context and to address requirement of comprehensive digital record of a battery's life cycle, from raw material extraction to manufacturing, usage, and recycling or disposal. A Committee may be constituted for Development of Guidelines for Implementation of Battery Aadhar System in India.

Committee

1.	Dr. Tata Narasinga Rao, Adjunct Professor, IIT Hyderabad	Chair
2.	Sh. K C Sharma, Advisor, MVL, MoRTH	Member Convenor
3.	Mr. S. A Sundaresan, Prof. of Practice, IIT Madras	Member
4.	Prof. Sagar Mitra- IIT Bombay	Member
5.	Sh. Abhijit Mulay, ARAI, Pune	Member
6.	Sh. Saravanan.B, CoEZET	Member
7.	Sh. Suresh Babu Muttana, Scientist E/Director, DST	Member
8.	Prof. Satishchandra Ogale, Director, RISE, TCG-CREST	Member
9.	Representative from Niti Aayog	Member
10.	Representative from MHI	Member

2. Terms of Reference (TOR) for the Committee

2.1 To study and benchmark similar international initiatives to understand all provisions related to circularity, supply chain due diligence, Carbon footprint, material composition and its performance/durability.

2.2 To decide boundary conditions and implementation strategy for the applicability of this regulation based on the Indian context.

2.3 To define digital framework, data attributes, parameters and comprehensive traceability considering India battery landscape.

2.4 To align Battery Aadhar System scheme with other government initiatives like ACC PLI, Phase manufacturing program, Battery Waste Management Rules, etc., to position it as a strategic enabler of Atmanirbhar Bharat and Make in India.

2.5 To prepare a consolidated report suggesting guidelines for the Implementation of the Battery Aadhar System in India.

2.6 Further the Committee may co-opt members from relevant stakeholders like battery manufacturers, researchers, recyclers, EV manufacturers, etc. in working committee to formulate a standard/regulation for the Implementation of the Battery Aadhar System in India.

3.0 The Committee is to submit its report within three months from the date of this letter.

2. This issues with the approval of the Competent Authority.

(Sandeep Kumar Singh)
Under Secretary to the Government of India
Tele/Fax: 23739074
e-mail: sandeepkr.singh@nic.in

To,

All Committee members

Copy to:

1. PPS to AS (MVL, T & RS)
2. PPS to CE(MVL)