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Indian Standard

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भाग 1 सामान्य और मार्गदर्शन

Electric Vehicle Battery Swap System
Part 1 General and Guidance

ICS 43.120

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NATIONAL FOREWORD

This Indian Standard (Part 1) which is identical with IEC 62840-1 'Electric Vehicle Battery Swap System — Part 1 General and Guidance' issued by the International Electrotechnical Commission (IEC) is adopted by the Bureau of Indian Standards on the recommendation of the Electrotechnology in Mobility Sectional Committee and approval of the Electrotechnical Division Council.

This standard has been issued in several parts. Other parts in this series are:

Part 2 Safety Requirements

Part 3 Central Management System (*under development*)

Part 4 Light Electric Vehicle Battery Swap (*under development*)

Part 5 Heavy Electric Vehicle Battery Swap (*under consideration*)

The text of the IEC Standard has been approved as suitable for publication as an Indian Standard without deviations. Certain conventions are, however, not identical to those used in Indian Standards. Attention is particularly drawn to the following:

a) Wherever the words 'International Standard' appears referring to this standard, they should be read as 'Indian Standard'.

b) Comma (,) has been used as a decimal marker, while in Indian Standards the current practice is to use a point (.) as the decimal marker.

In this adopted standard, reference appears to International Standards for which Indian Standards also exists. The corresponding Indian Standards, which are to be substituted, are listed below along with their degree of equivalence for the editions indicated:

International Standard	*Corresponding Indian Standard*	*Degree of Equivalence*
IEC 60038 IEC Standard Voltages	IS 12360 : 1988 Voltage bands for electrical installations including preferred voltages and frequency	Modified

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated expressing the result of a test, shall be rounded off in accordance with IS 2 : 2022 'Rules for rounding off numerical values (*second revision*)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

CONTENTS

INTRODUCTION

The purpose of the battery swap system is to provide energy partly or in total to electric road vehicles (EVs) through fast replacement of their swappable battery system (SBS). While charging, the EV typically takes a relatively long time, the battery swap process takes only a few minutes to complete. Thus it will reduce range anxiety and will facilitate travel for longer distances.

As there is a possibility to charge the batteries after their removal from the vehicle in various ways, the impact of this process on the critical infrastructure of the electrical grid is minimized.

Battery swap stations mainly include one or more of the following functions:

- swap of EV swappable battery system (SBS);
- storage of EV SBS;
- charging and cooling of EV SBS;
- testing, maintenance and safety management of EV SBS.

This document serves as generic requirements for battery swap systems for EVs.

The IEC 62840 series includes two parts:

– IEC 62840-1: General and guidance;
– IEC 62840-2: Safety requirements.

Indian Standard

ELECTRIC VEHICLE BATTERY SWAP SYSTEM
PART 1 GENERAL AND GUIDANCE

1 Scope

This part of IEC 62840, which is a Technical Specification, gives the general overview for battery swap systems, for the purposes of swapping batteries of electric road vehicles (EVs) when the vehicle powertrain is turned off and when the battery swap system is connected to the supply network at standard supply voltages according to IEC 60038 with a rated voltage up to 1 000 V AC and up to 1 500 V DC.

This document is applicable for battery swap systems for EV equipped with one or more swappable battery system (SBS).

NOTE Battery swap systems for light electric vehicles (LEVs) according to the IEC 61851-3[1] series are under consideration.

This document is not applicable to:

- aspects related to maintenance and service of the battery swap station (BSS);
- trolley buses, rail vehicles and vehicles designed primarily for use off-road;
- maintenance and service of EVs.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60038, *IEC standard voltages*

3 Terms and definitions

3.1
electric vehicle
EV
electric road vehicle
vehicle propelled by an electric motor drawing current from a rechargeable storage battery or from other portable energy storage devices (rechargeable, using energy from a source off the vehicle, such as residential or public electric service), which is manufactured primarily for use on public streets, roads or highways

[SOURCE: ISO 17409:2015, 3.19, modified — Some precisions have been added.]

3.2
battery swap system
battery swap station and supporting systems

1 Under consideration.

3.3
supporting system
system which serve the battery swap station

3.4
battery swap station
BSS
facility that provides EVs with a swappable battery system (SBS)

3.5
battery pack
energy storage device that includes cells or cell assemblies normally connected with cell electronics, voltage class B circuit and overcurrent shut-off device, including electrical interconnections, and interfaces for external systems

Note 1 to entry: For further explanation, see ISO 12405-1:2011, 5.4 and Clause A.2.

Note 2 to entry: Examples of external systems are cooling, voltage class B, auxiliary voltage class A and communication.

[SOURCE: ISO 12405-1:2011, 3.2]

3.6
swappable battery system
SBS
battery pack with a coupler for connecting charger/electric vehicle (EV), lock/unlock devices, battery control unit (BCU), thermal management unit, electrical protection circuit, enclosure and supporting devices

3.7
battery system
energy storage device that includes cells or cell assemblies or battery pack(s) as well as electrical circuits and electronics

Note 1 to entry: For further explanation, see ISO 12405-1:2011, 5.5.2, 5.5.3, A.3.1 and A.3.2. Battery system components can also be distributed in different devices within the vehicle.

Note 2 to entry: Examples of electronics are the BCU and contactors.

[SOURCE: ISO 12405-1:2011, 3.3]

3.8
swappable battery system coupler
SBS coupler
dedicated coupler for connecting a swappable battery system to an electric vehicle (EV) or to a charging rack

3.9
SBS charger
swappable battery system charger
device installed outside the EV to supply DC power to a swappable battery system (SBS) or a series of SBS

3.10
charging rack
equipment used for carrying a swappable battery system (SBS) and connecting a SBS to a charger to accomplish the charge process

3.11
storage rack
equipment used to store a swappable battery system (SBS)

3.12
transferring equipment
equipment used for transferring a swappable battery system (SBS) inside a battery swap station (BSS)

3.13
battery swap equipment
swap equipment
equipment used for mounting/unmounting a swappable battery system (SBS) to/ from electric vehicles (EVs)

Note 1 to entry: The battery transferring function may be integrated in the battery swap equipment.

3.14
battery control unit
BCU
electronic device that controls, manages, detects or calculates electric and thermal functions of the battery system and that provides communication between the battery system and the battery swap system

[SOURCE: ISO 12405-1:2011, 3.1, modified — The words "other vehicle controllers" have been replaced by "the battery swap system".]

3.15
human machine interface
HMI
interface between operating staff and the instrumentation and computer systems connected to the plant

Note 1 to entry: In this case, the plant refers to BSS.

[SOURCE: IEC 60050-395:2014, 395-07-48, modified — The note to entry has been replaced by a new note.]

4 System overview

4.1 Battery swap system

Battery swap systems provide quick, safe and reliable swapping of the swappable battery system (SBS) of electric vehicles (EVs). The batteries will be loaded in a battery swap station (BSS). The SBS are stored in a battery rack in the BSS. The battery swapping is carried out by means of appropriate manipulators.

EV battery swap system consists of:

- BSS,
- supporting systems,
- SBS, and
- power supply system.

Figure 1 shows the composition of the EV battery swap system and the relationships between the various systems.

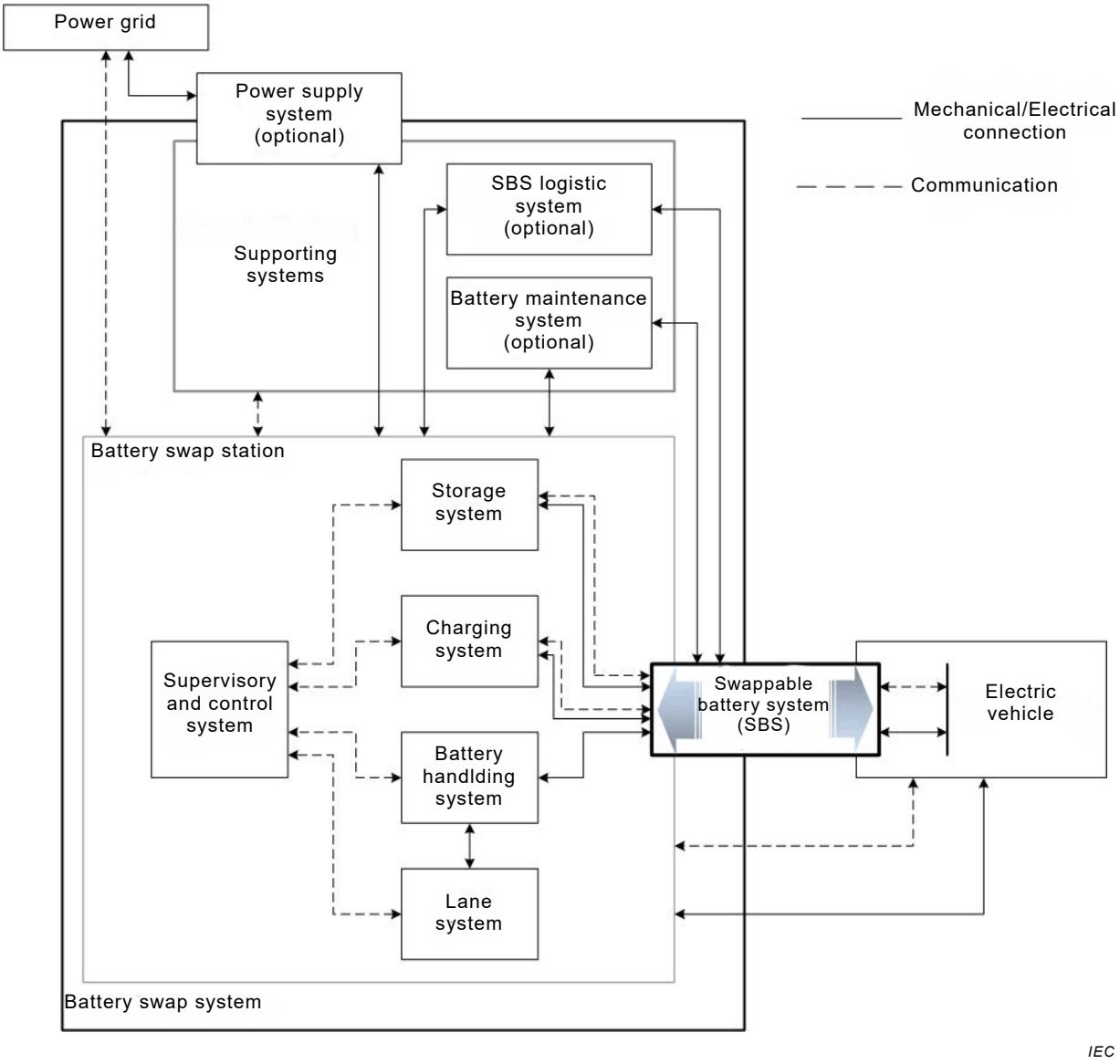

Figure 1 – EV battery swap system

4.2 Battery swap station

4.2.1 General description

BSS consists of systems, which provide battery mounting/unmounting, battery transfer, battery storage, battery charging and other functions. BSS may include:

- a lane system,
- a battery handling system,
- a storage system,
- a charging system, and
- a supervisory and control system.

4.2.2 Lane system

The lane system is used to transfer and/or position the EV to the designated location to get ready for battery handling. EVs leave safely through the lane system after SBS are exchanged. The lane system may provide functions such as:

- EV verification,
- EV validation,
- EV cleaning,
- EV positioning, and
- EV locking and unlocking.

The lane may include a cleaning station for the purposes of cleaning EV/battery parts before the swap process starts.

4.2.3 Battery handling system

The battery handling system consists of swap equipment and transferring equipment.

The system may provide functions such as:

- locking/unlocking,
- mounting/un-mounting, and
- transferring.

4.2.4 Storage system

The storage system is used to store the SBS safely. It shall monitor the status of the SBS and the ambient circumstances during storage.

This system consists of:

- a storage rack, and
- an equipment to communicate with supervisory and control system.

4.2.5 Charging system

The charging system is used to charge the SBS safely. It shall carry the SBS in the charging rack, communicate with the battery control unit (BCU) during the charging procedure, and control the charging procedure and its safe operation.

This system consists of:

- SBS charger(s),
- charging racks, and
- equipment to communicate with supervisory and control system.

4.2.6 Supervisory and control system

The supervisory and control system contains

- communication units,
- a data process module,
- data acquisition units,
- a data storage module,
- a remote control module, and
- a human machine interface (HMI).

The supervisory and control system monitors and controls all battery swap system processes.

This system may have communication with the power grid as well.

4.3 Supporting systems (optional)

4.3.1 General supporting systems

Supporting systems consist of equipment which assists in completing the battery swap process.

Supporting systems may include:

- a SBS logistic system, and
- a battery maintenance system.

4.3.2 SBS logistic system

SBS logistic system shall exchange and transport SBS between BSS and external facilities or EVs. Also, SBS logistic system can be used to charge an EV in emergency cases. It provides service and communication between BSS and external facilities or EVs in order to support the transportation of SBS.

4.3.3 Battery maintenance system

Battery maintenance system provides online or offline inspection and maintenance on SBS in order to ensure safety, reliability and to extend the lifetime of SBS.

4.4 Swappable battery system

Swappable battery system is the object of a battery swap system. A battery swappable vehicle has one or more swappable battery systems, which can be mounted or unmounted separately by the battery handling system.

4.5 Power supply system

Power supply system supplies electric power to the BSS and the supporting systems. Reverse power flow implementation is under consideration.

4.6 Interfaces

Interfaces in an EV battery swap system can be divided into internal interfaces and external interfaces according to the different functions of the systems. The external interfaces refer to physical (electrical connection, mechanical lock, steering etc.) and logical (communication protocols) interfaces between the battery swap system and other systems. The internal interfaces refer to physical and logical interfaces between systems within the battery swap system, including interfaces between the BSS and the supporting systems.

NOTE Interfaces are specified in the relevant part of the IEC 62840 series, which is under consideration.

External interfaces include:

- the interface between the SBS and the EV,
- the interface between the BSS and the EV,
- the interface between the power supply system and the power grid, and
- the interface between the battery swap station and the power grid;

Internal interfaces include:

- the interface between the BSS and the supporting systems,
- the interface between the supervisory and control system and the storage system,
- the interface between the supervisory and control system and the charging system,

- the interface between the supervisory and control system and the battery handling system,
- the interface between the supervisory and control system and the lane system,
- the interface between the battery handling system and the lane system,
- the interface between the storage system and the SBS,
- the interface between the charging system and the SBS,
- the interface between the battery handling system and the SBS,
- the interface between the SBS logistic system and the battery swap station,
- the interface between the SBS logistic system and the SBS,
- the interface between the battery maintenance system and the BSS,
- the interface between the battery maintenance system and the SBS, and
- the interface between the battery swap station and the power supply system.

4.7 Zones

4.7.1 General

The battery swap system is divided into 4 separate zones with different accessibility patterns:

- vehicle lane zone,
- battery swap zone,
- battery storage zone,and
- battery charging zone.

4.7.2 Vehicle lane zone

The vehicle lane zone provides access for the EV to the BSS and the battery swap zone. Table 1 shows accessibility of vehicle lane zone, which can be different according to local regulations or system requirements.

Table 1 – Accessibility of vehicle lane zone

Role	Action	Vehicle lane zone
		Accessibility
EV driver	Access	Fully authorized
	Operate	Conditional
	Maintenance	Forbidden
Station operating personnel	Access	Fully authorized
	Operate	Fully authorized
	Maintenance	Forbidden
Station maintenance personnel	Access	Fully authorized
	Operate	Forbidden
	Maintenance	Fully authorized

4.7.3 Battery swap zone

The battery swap zone defines where automatic/semi-automatic devices are mounting/unmounting SBS to and from the electric vehicles. Table 2 shows accessibility of battery swap zone, which can be different according to local regulations or system requirements.

Table 2 – Accessibility of battery swap zone

Role	Action	Battery swap zone
		Accessibility
EV driver	Access	Conditional
	Operate	Conditional
	Maintenance	Forbidden
Station operating personnel	Access	Fully authorized
	Operate	Fully authorized
	Maintenance	Forbidden
Station maintenance personnel	Access	Fully authorized
	Operate	Forbidden
	Maintenance	Fully authorized

4.7.4 Battery storage zone

The battery storage zone defines where SBS are stored, and manipulated by automatic/semi-automatic devices. Table 3 shows accessibility of battery storage zone, which can be different according to local regulations or system requirements.

Table 3 – Accessibility of battery storage zone

Role	Action	Battery storage zone
		Accessibility
EV driver	Access	Forbidden
	Operate	Forbidden
	Maintenance	Forbidden
Station operating personnel	Access	Fully authorized
	Operate	Fully authorized
	Maintenance	Forbidden
Station maintenance personnel	Aaccess	Fully authorized
	Operate	Forbidden
	Maintenance	Fully authorized

4.7.5 Battery charging zone

The battery charging zone defines where SBS are charged. Battery storage zone and battery charging zone can be the same physical location. This means the battery can be charged while it is stored. Table 4 shows accessibility of battery charging zone, which can be different according to local regulations or system requirements.

Table 4 – Accessibility of battery charging zone

Role	Action	Battery charging zone
		Accessibility
EV driver	Access	Forbidden
	Operate	Forbidden
	Maintenance	Forbidden
Station operating personnel	Access	Fully authorized
	Operate	Fully authorized
	Maintenance	Forbidden
Station maintenance personnel	Access	Fully authorized
	Operate	Forbidden
	Maintenance	Fully authorized

5 Classification

5.1 General

The BSS is classified as follows:

- according to automation level;
- according to SBS mounting direction;
- according to the swappable EV category.

5.2 Automation level

5.2.1 General

Automation levels are classified as follows:

- full automatic;
- semi-automatic;
- manual.

5.2.2 Full automatic

The full automatic battery swap processes includes:

- positioning the vehicle,
- swapping the SBS from/to the vehicle,
- transferring the SBS from/to the storage system,
- storing the SBS, and
- charging the SBS.

The full automatic battery swap process is operated by the automatic electrical/mechanical systems, without any human labour.

5.2.3 Semi-automatic

The semi-automatic battery swap process includes:

- positioning the vehicle,

- swapping the SBS from/to the EV,
- transferring the SBS from/to the storage system,
- storing the SBS, and
- charging the SBS.

The semi-automatic battery swap process is initiated and controlled by human operator while assisted by the electrical/mechanical systems equipped with sensors or other automatic devices.

5.2.4 Manual mode

The manual battery swap process is initiated, operated and controlled by human operators. In some cases, the operators may use electromechanical devices to assist.

5.3 SBS swapping direction

The physical direction of SBS swapping is classified as follows:

- side-swapping;
- bottom-swapping;
- top-swapping;
- front-swapping;
- rear-swapping;
- multiple direction.

Annex B contain examples for specific designs and technologies which are used in the different types of battery swap patterns.

5.4 EV categories

EV categories according to ISO 3833 or UNECE R100 are classified as follows:

- M1, swapping for passenger car;
- M2, M3, N1, N2, N3, swapping for commercial vehicle.

5.5 Environmental conditions

The battery swap system can be classified according to its suitability for use in severe environmental conditions other than those specified in this specification, if declared so by the manufacturer.

Where any special service conditions specified by the client exist, a special agreement regarding testing shall be made between the battery swap system manufacturer and the client.

Annex A
(informative)

Use case

A.1 Use case for positioning vehicle

Table A.1 shows the use case for positioning of the vehicle.

Table A.1 – Use case for positioning vehicle

Use case name	Positioning vehicle
Scope	To guide and/or position EV in battery swap workspace via lane system
Description	1) EV verification and validation 2) EV enters into the battery swap station 3) Cleaning the EV if necessary 4) Leading the vehicle into the battery swap workspace in right position (if needed) and locked (if needed) 5) Unlocked (if needed) and EV drives out
Users/actors	EV, Supervisory and control system, Lane system
Special requirements	1) EV verification and validation shall be accomplished via wireless devices such as radio frequency identification (RFID), reporting to the supervisory and control system. 2) It is recommended that the EV is cleaned before the battery is swapped if the SBS is mounted in the chassis of the vehicle body.

A.2 Use case for swapping battery pack

Table A.2 shows the use case for swapping battery pack.

Table A.2 – Use case for swapping battery pack

Use case name	Swapping battery pack
Scope	To transfer and mount/unmount SBS in the vehicle via handling devices
Description	1) Start process, unlock the SBS. 2) The handling devices transfer the charged SBS from the battery storage system. 3) The handling devices unmount the depleted SBS out from the vehicle body according to the supervisory and control system or according to the operator. 4) The handling devices mount the charged SBS into the vehicle body according to the command from supervisory and control system or from the operator. 5) The handling devices transfer the depleted SBS back to the battery storage system. 6) Lock the SBS and terminate the process.
Users/actors	EV, SBS, battery handling system, battery storage system, supervisory and control system, operator
Special requirements	When handling devices malfunction in the process of a battery swap, the handling devices should stop and send an abnormal signal to supervisory and control system. This process should be done while the passengers are getting on and off.

A.3 Use case for charging SBS

Table A.3 shows the use case for charging SBS.

Table A.3 – Use case for charging SBS

Use case name	Charging SBS
Scope	Charge SBS via charger
Description	After the SBS has been transferred into the charging rack (charging system), the charging system begins the charge process. The charger adjusts the charging parameters according to the requests from BCU in SBS and then sends the acquired data to the supervisory and control system.
Users/actors	SBS, charging system, supervisory and control system
Special requirements	1) The supervisory and control system sends a command to the SBS charger to suspend charging when it receives the alarm signal from a smoke detector or other detection device. 2) The SBS charger suspends charging and sends the abnormal stop message to the supervisory and control system when it receives the abnormal signal from BCU or from itself.

A.4 Use case for maintaining SBS

Table A.4 shows the use case for maintaining SBS.

Table A.4 – Use case for maintaining SBS

Use case name	Maintaining SBS
Scope	Ensure the safety and life cycle of the SBS by inspecting and maintaining via battery maintenance system
Description	According to a pre-defined maintenance cycle, or if the performance of the SBS is abnormal during charging or storage, the supervisory and control system or the operator orders the transfer of the SBS from the charging/storage system to the maintenance system. The battery maintenance system then inspects and maintains the SBS.
Users/actors	Battery maintenance system, supervisory and control system, SBS, storage system, operator
Special requirements	Maintenance shall be online or off-line.

A.5 Use case for emergency charging vehicle

Table A.5 shows the use case for emergency charging vehicle.

Table A.5 – Use case for emergency charging vehicle

Use case name	Emergency charging vehicle
Scope	To charge EV in emergency case
Description	1) The SBS logistics system receives an emergency charging request. 2) The SBS logistics system moves to the location of EV. 3) The power cable is connected between SBS logistics system and the EV. 4) The SBS in EV is charged using battery packs in the SBS logistics system. 5) The power cable is disconnected.
Users/actors	Battery logistics system, EV
Special requirements	Connecting and disconnecting power cable should be done manually.

Annex B
(informative)

Battery swap station solutions

B.1 General

According to the classification of BSS in 5.2 and 5.3, some of the BSS solutions are introduced in Annex B, as shown in Table B.1.

Table B.1 – Key index of the systems in different types of battery swap stations

System	Index	B.2.1	B.2.2	B.3.1	B.3.2	B.3.3
		Commercial vehicle	Commercial vehicle	Passenger car	Passenger car	Passenger car
		Automatic	Automatic	Semi-auto	Automatic	Automatic
		Side-swap	Top-swap	Rear-swap	Bottom-swap	Side-swap
Lane system	vehicle entrance (verification and validation)	●	●		●	●
	vehicle cleaning					
	vehicle positioning	●	●	●	●	●
	vehicle locking (if needed)					
	vehicle unlocking (if needed)					
	vehicle drive out	●	●	●	●	●
Handling system	start of process	●	●	●	●	●
	unlocking SBS	●	●	●	●	●
	disconnecting SBS	●	●	●	●	●
	removing depleted SBS vehicle	●	●	●	●	●
	taking away depleted SBS	●	●	●	●	●
	bring charged SBS from storage system	●	●	●	●	●
	moving charged SBS inside vehicle	●	●	●	●	●
	connecting SBS	●	●	●	●	●
	locking SBS	●	●	●	●	●
	termination of process	●	●	●	●	●
Storage system	storage rack	●	●	●	●	●
	locking devices	●	●	●	●	●
	thermal unit	●	●	●	●	●
	connecting devices	●	●		●	●
	monitoring and detection sensor		●			
Charging system	SBS charger	●	●	●	●	●
	charging rack	●	●	●	●	●
	charger controller	●	●	●	●	●
	connecting devices		●			
	communication with BCU	●	●	●	●	●
Supervisory and control system	monitor and control handling system	●	●		●	●
	monitor and control charging system	●	●	●	●	●
	monitor and control storage system	●	●		●	
	monitor and control power supply system	●	●		●	●
	monitor and control lane system	●	●		●	
	communication with the grid	●			●	

B.2 Commercial vehicles battery swap station

B.2.1 Automatic side-swapping station

Application scope: Applicable to commercial Evs, such as buses and sanitation trucks, which have battery packs installed in both sides of the vehicle body.

Composition of the working zone: The layout of the working area with the major equipment is shown as Figure B.1. Usually, this system consists of two sets of battery swap equipment, storage equipment, chargers, and one lane.

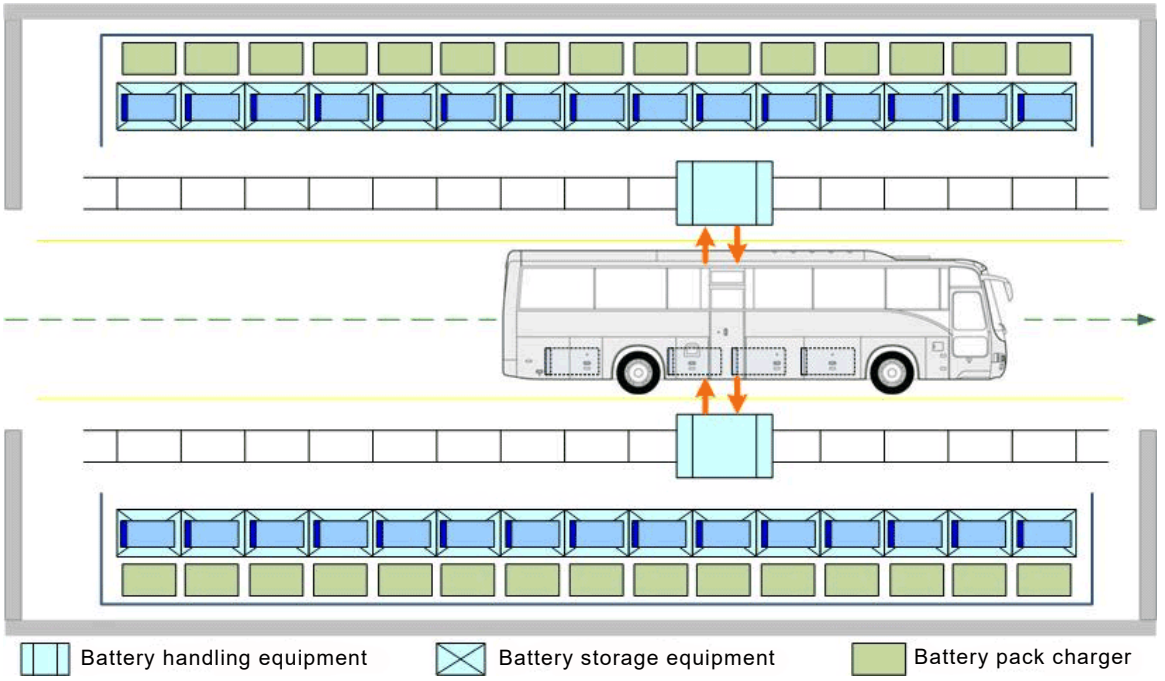

Figure B.1 – Automatic side-swapping station layout

Characteristics of the solution: The whole battery swapping, charging, and other management processes, should be automatically accomplished under the control of a supervisory and control system. This mode is of a high degree of automation, and requires a relatively large construction investment.

B.2.2 Automatic top-swapping station

Application scope: Applicable to commercial electric buses which have battery mounting module with sliding roof door.

Composition of the working zone: The layout of the working area's major equipment is shown in Figure B.2. Quick battery exchanging machine (QCM) with the swap equipment, charging (storage) racks, chargers is embedded on top of the bus stop structure.

IEC

Figure B.2 – Automatic top-swapping station layout

Characteristics of the solution: The whole battery swap, charge, and other management processes are automatically accomplished under the control of a supervisory and control system. This is an automatic battery swapping system and requires relatively small area and construction investment since it should be built at normal bus stops. A discharged battery is quickly replaced with the charged battery while the passengers are getting on and off.

B.3 Passenger cars battery swap station

B.3.1 Semi-automatic rear-swapping station

Application scope: Applicable to electric passenger vehicles, such as private cars and taxis, with battery packs installed in the trunk of the vehicle body.

Composition of the system: The layout of the working area's major equipment is shown in Figure B.3. Usually, this system consists of one or more sets of battery swap equipment, storage equipment, chargers, and lanes.

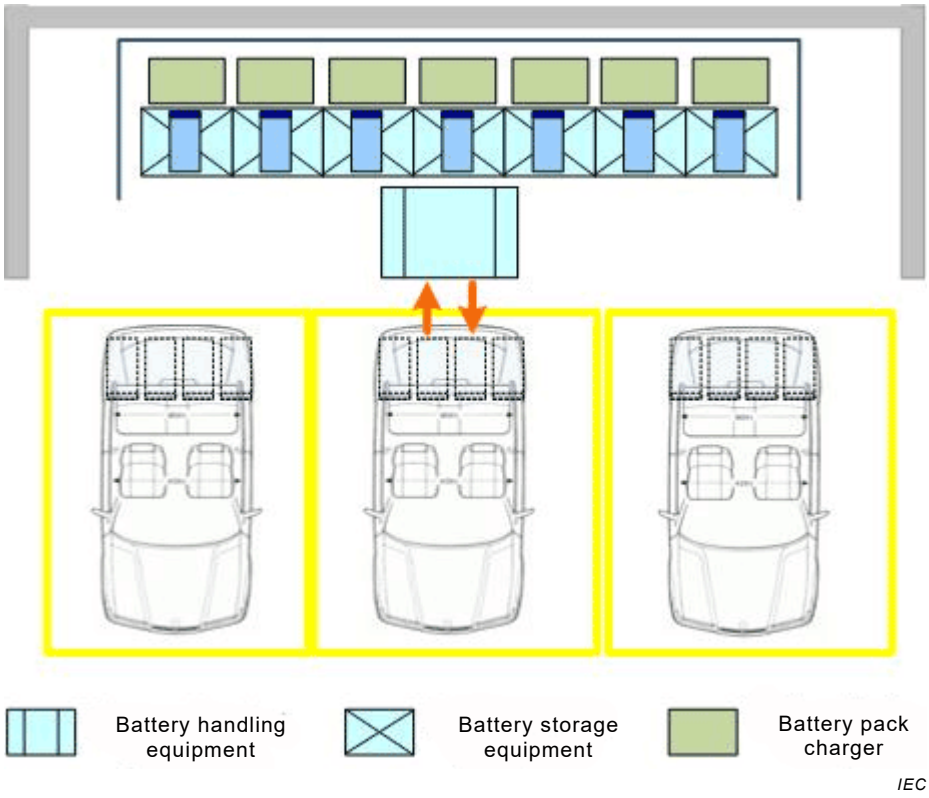

Figure B.3 – Semi-automatic rear-swapping station layout

Characteristics of the solution: Battery packs are conveyed by automatic electromechanical devices, and battery swapping is accomplished manually. The deployment may be flexible and construction investment may be relatively small. However, this requires large labour work, thus is not suitable for regions with a high labour cost.

B.3.2 Automatic bottom-swapping station

Application scope: Applicable to electric passenger vehicles, such as private cars and taxis, with battery packs installed in the chassis of the vehicle body.

Composition of the system: The layout of the working area's major equipment is shown in Figure B.4. Usually, this system consists of one set of battery swap equipment that is below the bottom of the vehicle, two sets of transferring equipment, storage equipment that is arranged by both sides of the vehicle, and the lane.

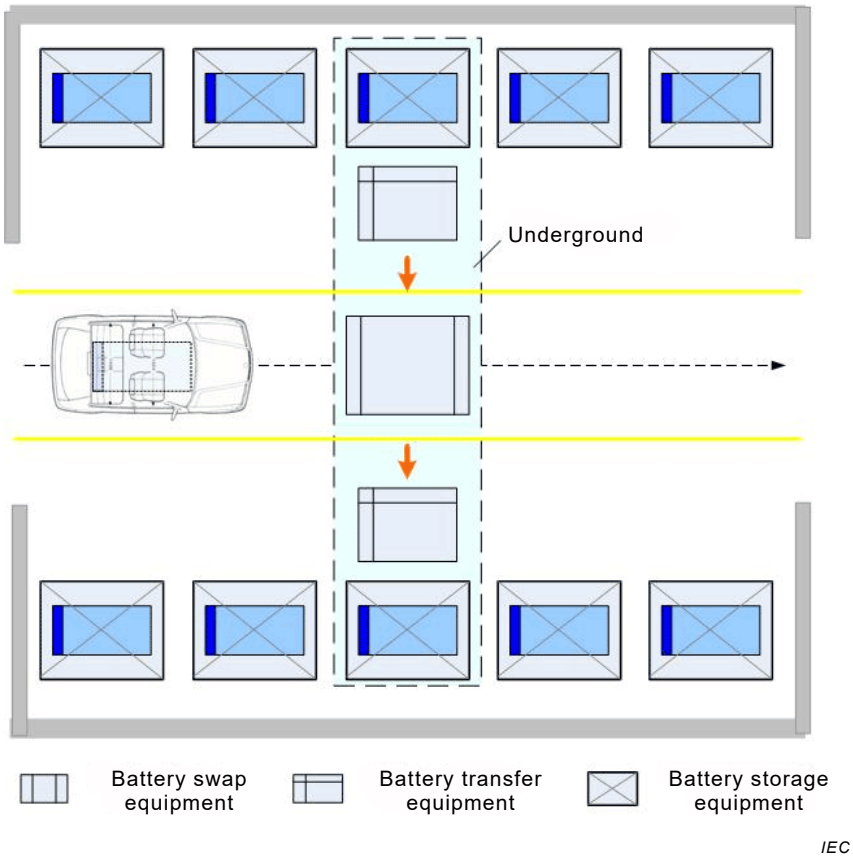

Figure B.4 – Automatic bottom-swapping station layout

Characteristics of the solution: The transferring, swapping, storage and charge process of battery packs should be automatically accomplished under the control of supervisory system. This is of a high degree of automation, and requires a relatively large area and construction investment.

B.3.3 Automatic side-swapping station

Application scope: Applicable to electric passenger vehicles, such as private cars and taxis, with battery packs installed in the chassis of the vehicle body.

Composition of the system: The layout of the working area's major equipment is shown in Figure B.5. Usually, this system consists of two sets of battery swap equipment that are on both sides of the vehicle, storage equipment and the lane.

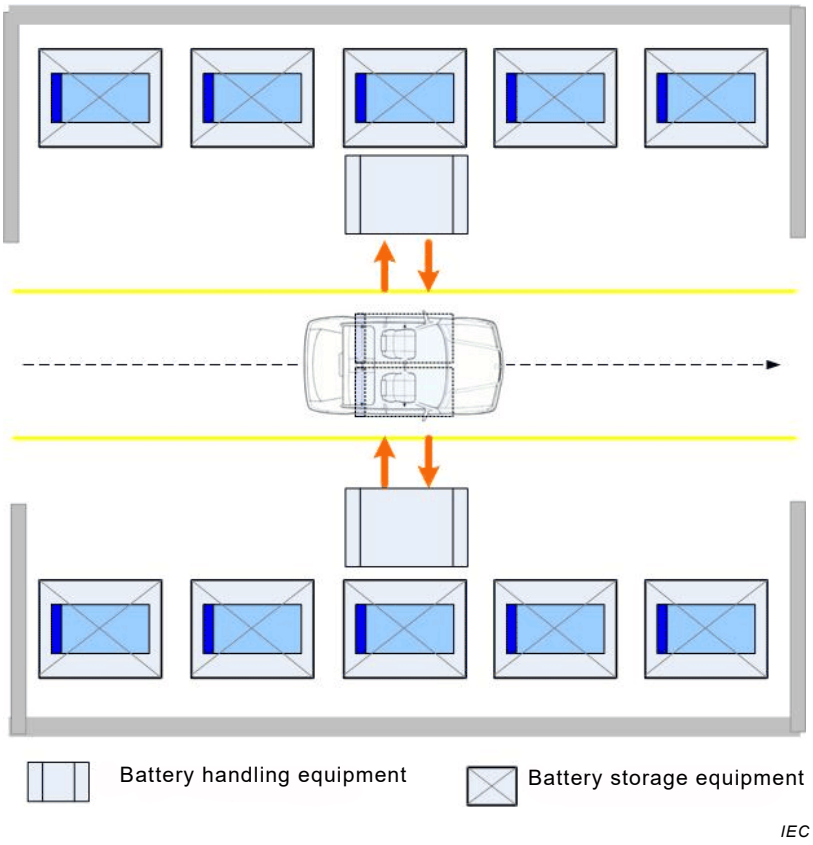

Figure B.5 – Automatic side-swapping station layout

Characteristics of the solution: The handling, storage and charge process of battery packs should be automatically accomplished under the control of supervisory system. This is of a high degree of automation, and requires a relatively large area and construction investment.

Bibliography

IEC 61000 (all parts), *Electromagnetic compatibility (EMC)*

IEC 61851-1, *Electric vehicle conductive charging system – Part 1: General Requirements*

IEC 61851-3 (all parts), *Electric vehicles conductive power supply system – Part 3: Requirements for light electric vehicles (LEV) communication*

IEC 61851-21-2[2], *Electric vehicle conductive charging system – Part 21-2: EMC requirements for OFF board electric vehicle charging systems* (under development.)

ISO 3833, *Road vehicles – Types – Terms and definitions*

ISO 12405-1:2011, *Electrically propelled road vehicles – Test specification for lithium-ion traction battery packs and systems – Part 1: High-power applications*

ISO 17409:2015, *Electrically propelled road vehicles – Connection to an external electric power supply – Safety requirements*

UNECE R100, *Uniform provisions concerning the approval of vehicles with regard to specific requirements for the electric power train*

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2 Under consideration.

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