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The Prospect of International Standardization for Electric Vehicles

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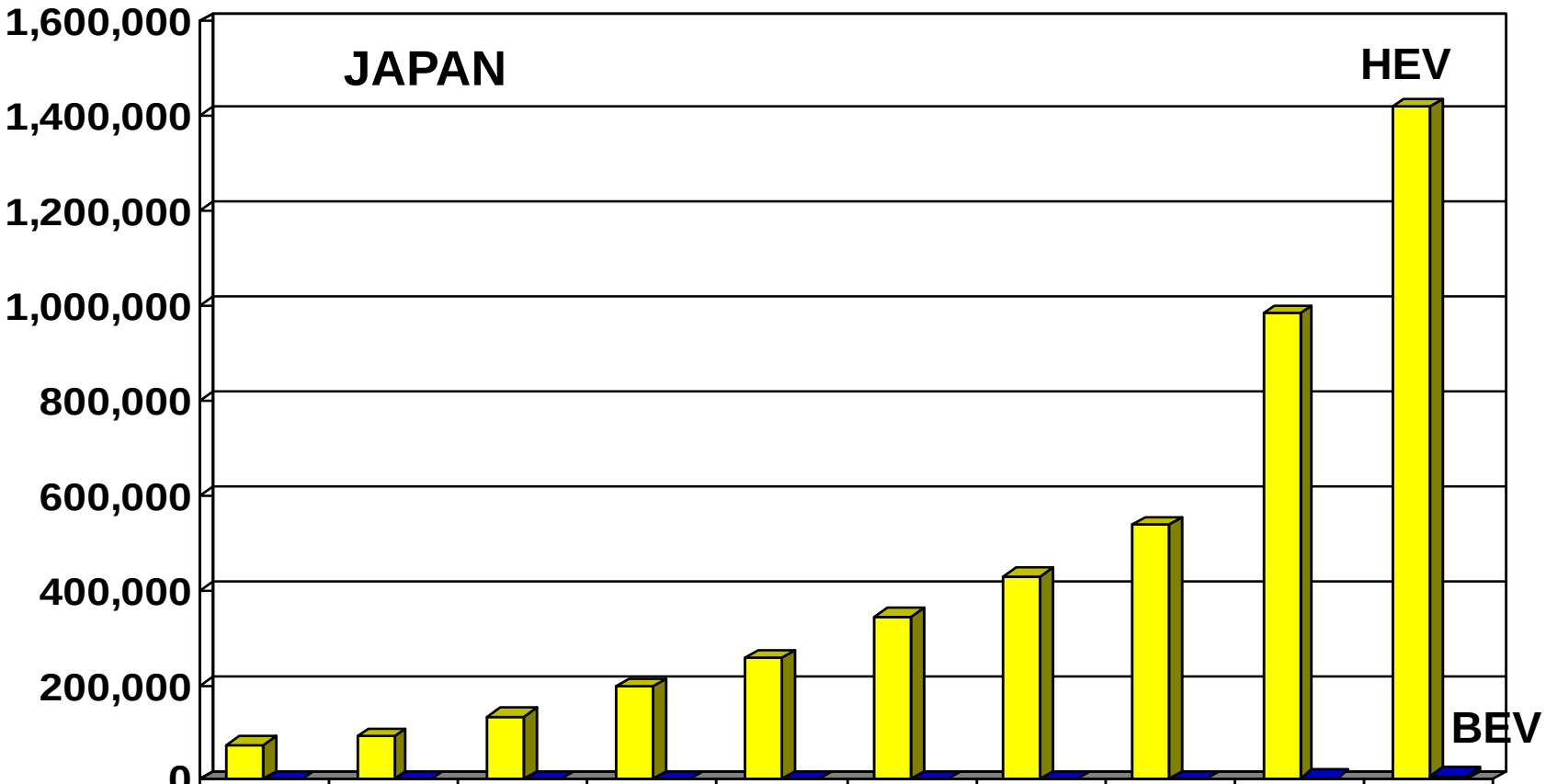
The number of BEV･HEV in operation in Japan

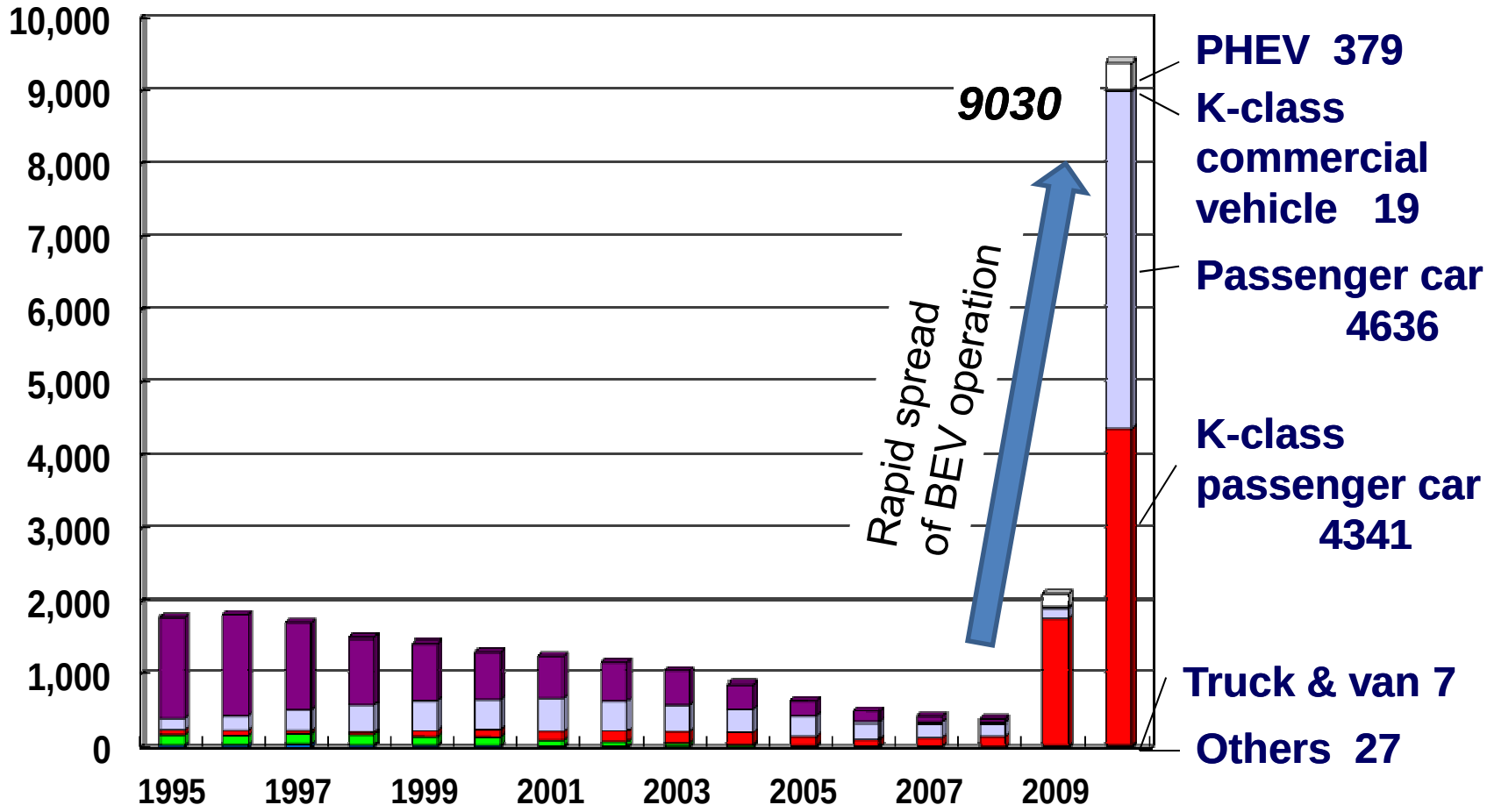
Development of international standardization for EV and batteies is urgent to match the rapid spread of Electric Vehicles.



	'02.3	'03.3	'04.3	'05.3	'06.3	'07.3	'08.3	'09.3	'10.3	'11.3
HEV	74,600	91,200	132,500	196,800	256,600	342,700	427,900	536,500	983,800	1,418,400
BEV	1,260	1,174	1,056	875	647	505	421	389	1,941	9,030

The number of BEV in operation in Japan

Number of BEV operation has been increased rapidly in these years although the nember itself is not large.

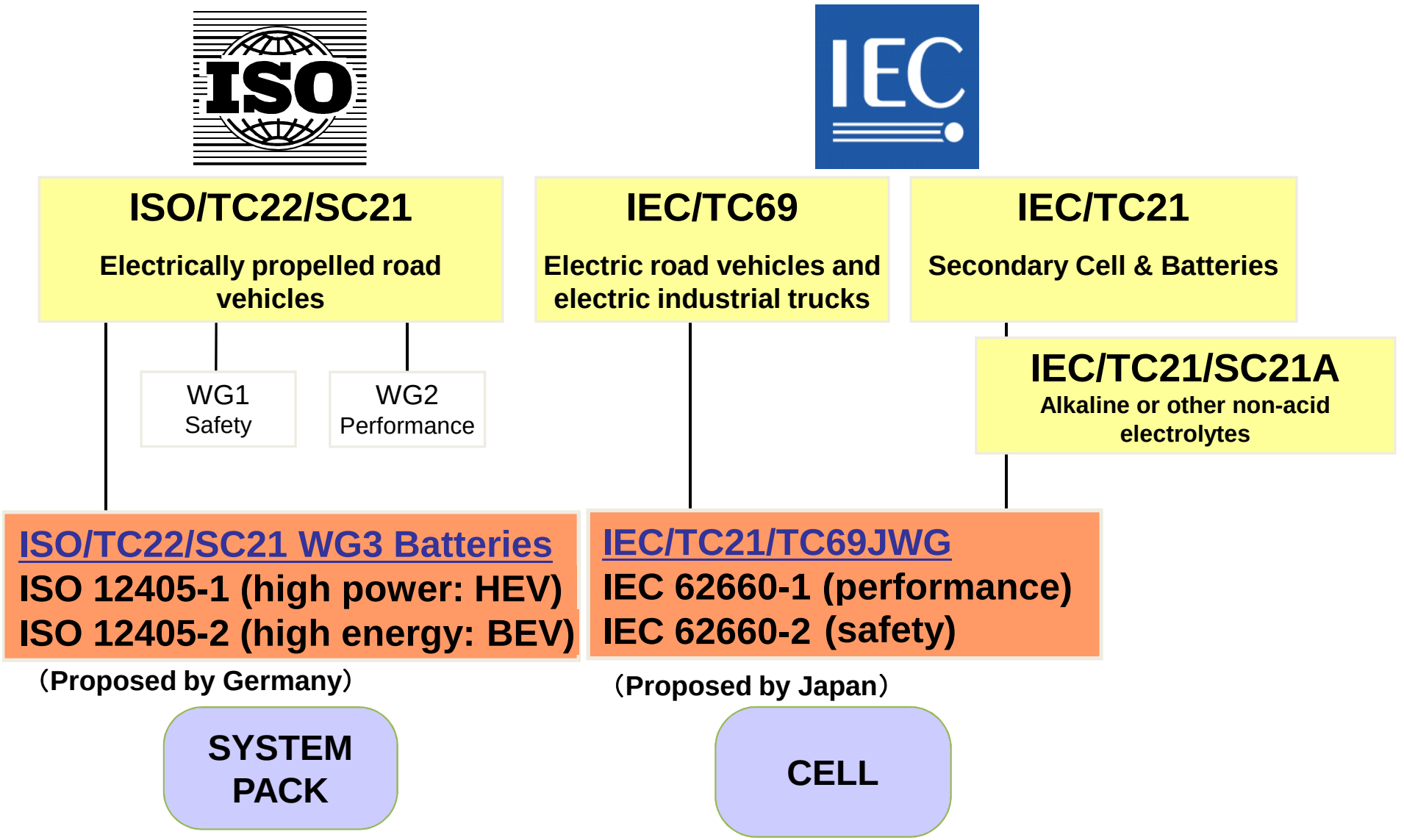


"K-class" is the Japanese classification for vehicles which are less than 3.4m long and with an engine displacement of 660cc or less.

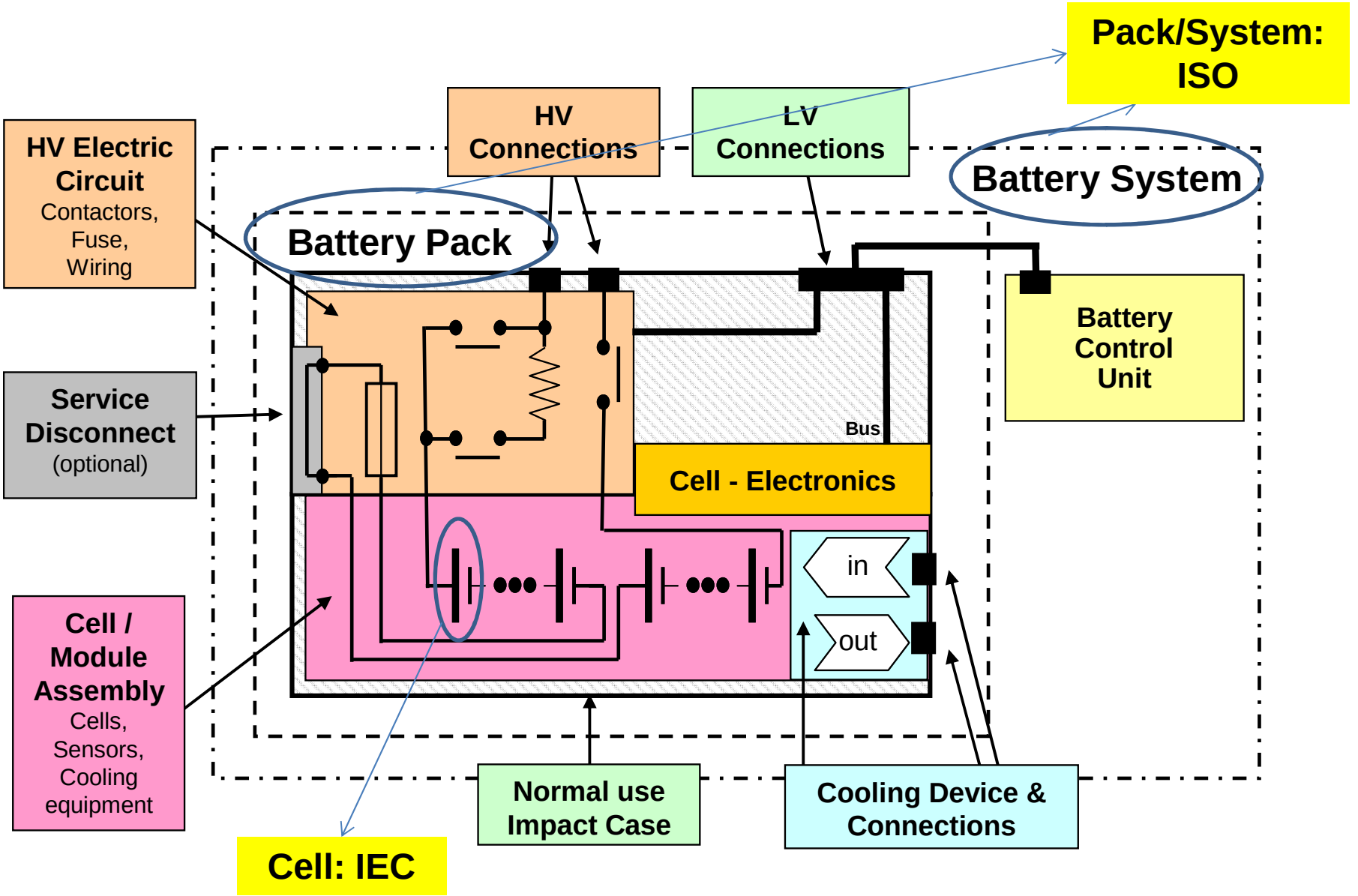
Part 1

Standardization for Automotive Li-ion Batteries

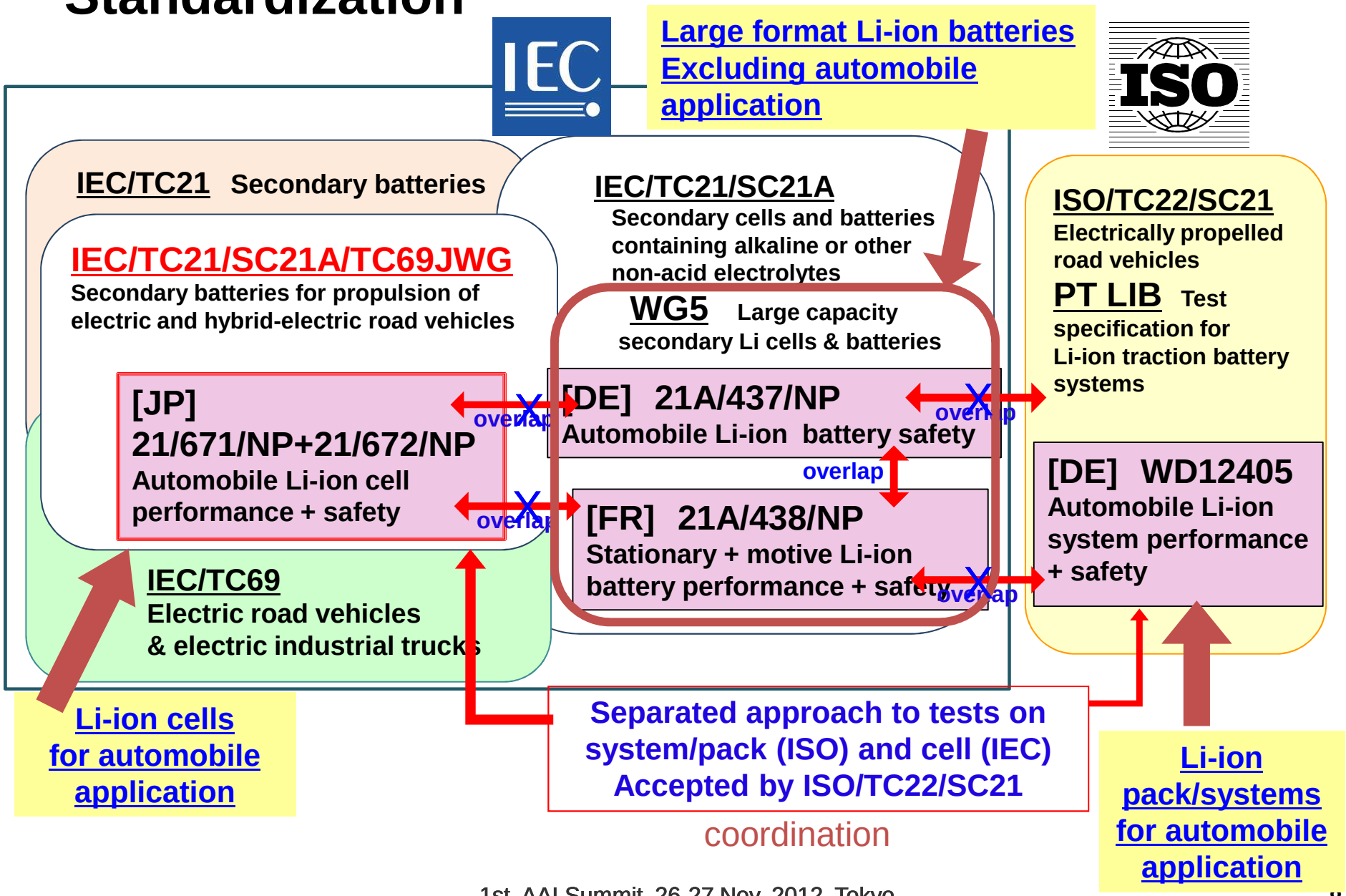
ISO/IEC Project Structure for Li-ion Batteries



Distinction between cell and system/pack

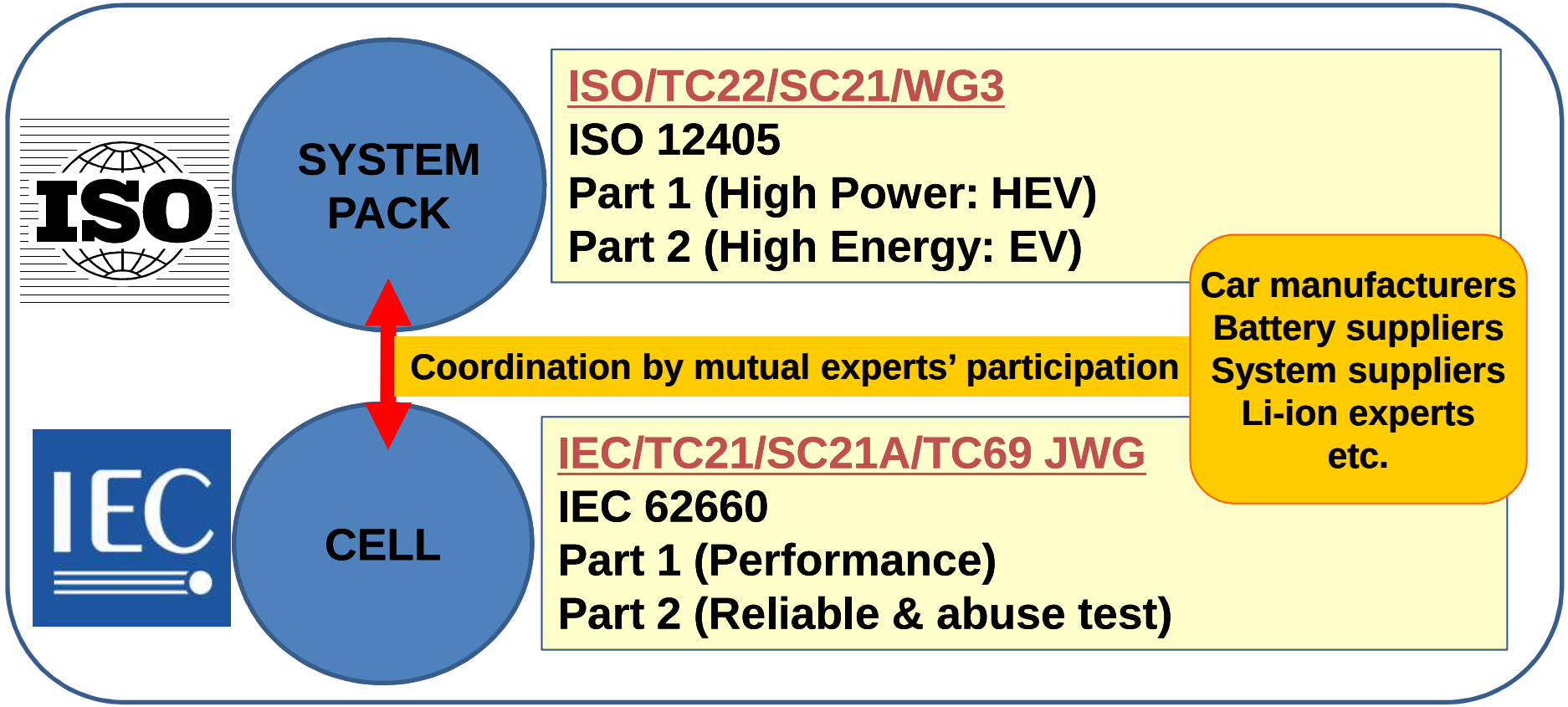


Agreement for Automobile Li-ion Battery Standardization



Proposed Framework for the Standardization of Automobile Li-ion Battery Testing

IEC 62660-1 and IEC 62660-2 aim to provide specific cell level testing standards to be coupled with system/pack level testing standards. Automobile manufacturers' participation is indispensable to develop effective standards for Li-ion batteries for automobile application.



4 of these standards have been already published.

Other standards of Li-ion Batteries for EV

Under Development

【 ISO/TC22/SC21/WG3】

Pack/System: ISO12405-3 (Safety Requirement)

【 IEC/TC69/TC21/SC21A/JWG】

Cell: IEC62660-3 (Safety Requirement)　(Planned)

【 ISO/TC22/SC21/WG3
IEC/TC69/TC21/SC21A/JWG 】

Cell: IEC/ISO　PAS16898 (Cell size)

International Standardization of batteries for EV is still going on. Participation of Asian stakeholders is most important.

Part 2

JARI Safety Approach for Li-ion Batteries

Safety Research for FC·EV
- Hy-SEF activities

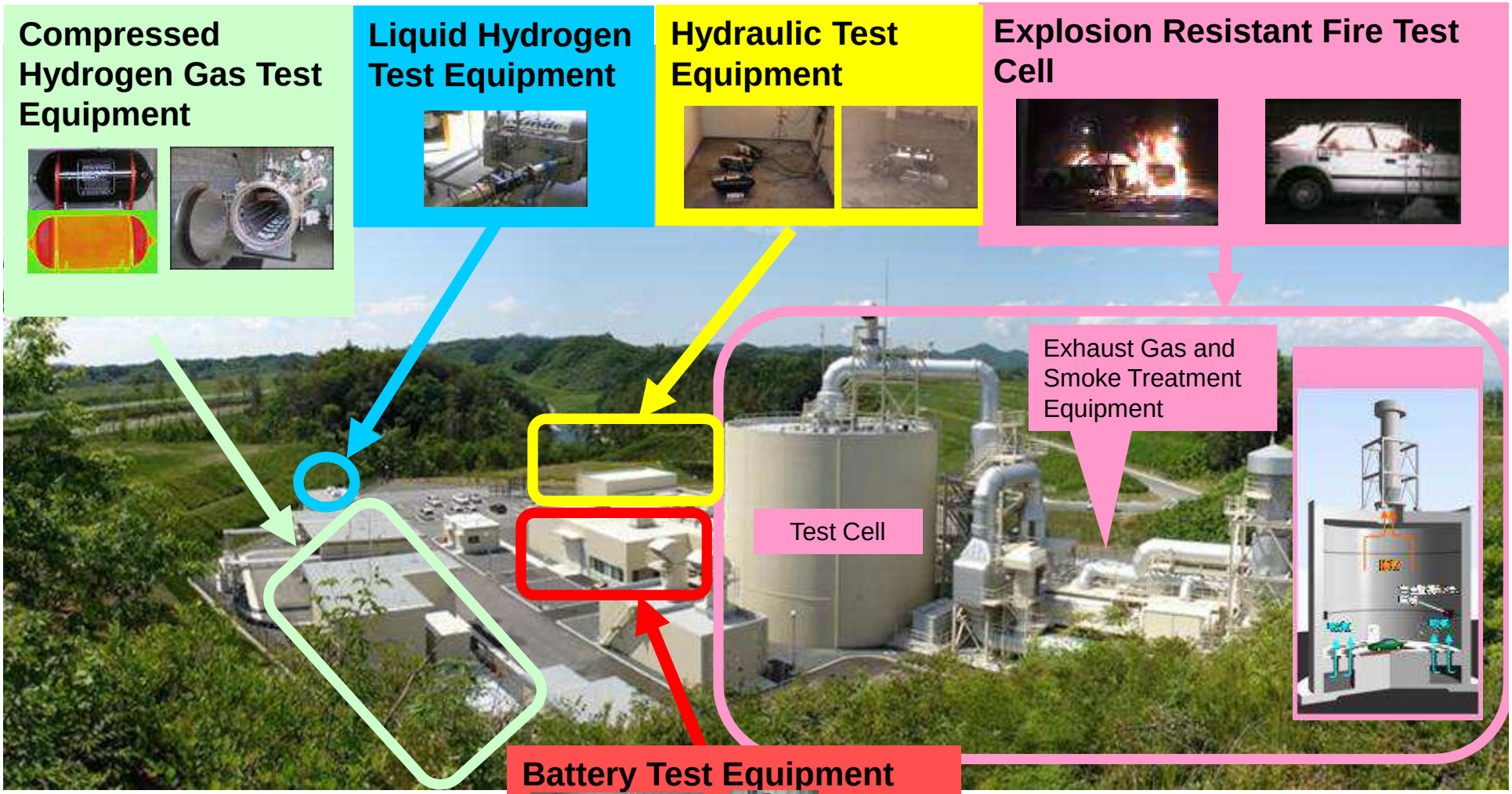
Safety Evaluation for EV, FCV and Hydrogen

- **Li-ion Batteries (EV safety)**

- **Safety of Vehicle & Hydrogen Storage**
  (Property of released hydrogen flame,
  Safety release method of hydrogen)
- **Manuals for vehicle fire accidents**
  (Fire fighting, Rescue, Safety distance)

- **FCV Crash Test Procedures**
  (Hydrogen leakage limit, etc.)

Hy-SEF : Hydrogen and fuel cell vehicle Safety Evaluation Facility



Safety Research for Li-ion Battery

1) Investigation of the safety evaluation test items

2) Safety evaluation tests

Focusing on the test procedure: Relationship between test conditions and the results Overcharge, overdischarge, short circuit, penetration, crush, vibration, bonfire, etc

3) Proposal for safety evaluation test methods to ISO/IEC

	Battery charge/discharge test unit	Penetration/crush test unit	Environmental test chamber
Specification	Voltage: Max. 500 V Current: Max. 300 A Short circuit current: Max. 5,000 A Voltage and temperature measurement: Each 20 ch.	Penetration Stroke: 150 mm Load: Max. 20 kN Speed: 30 to 250 mm/s Crush Stroke: 300 mm Load: Max. 50 kN	Temperature: -40 to 150 ºC Humidity: 20 to 98 %RH
Photograph			

The safety evaluation items

Safety evaluation test items	
Electrical tests	Overcharge
	Overdischarge
	Short circuit
	Overvoltage
Mechanical tests	Penetration
	Controlled crush
	Vibration
	Mechanical shock
	Drop
	Dynamic crush
	Curb crash
Environmental tests	Immersion
	High temperature
	Thermal shock
	Temperature cycles
	Dewing
Fire test	Bonfire
	Vehicle fire

Grobal Technical Regulation for Safety

Those data taken at JARI were also provided into UN-ECE and gtr.

【UN-ECE/ TRANS /WP.29/GRSP】
(http://www.unece.org/trans/main/welcwp29.html)

Vehicle Regurations

-EV, HEV etc. ECE R100, ECE R94&R95 etc.（58 agreement）

-FCV：HFCV gtr (98 agreement: Under deliberations)

Components

-RESS（ Rechargeable Energy Storage Systems）:
ECE R100 Part2 (Under deliberations)

JARI will be able to provide these technical expertise as a testing agency.

Part 3

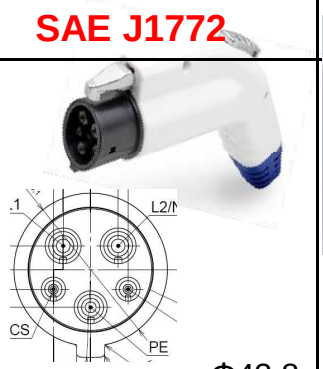
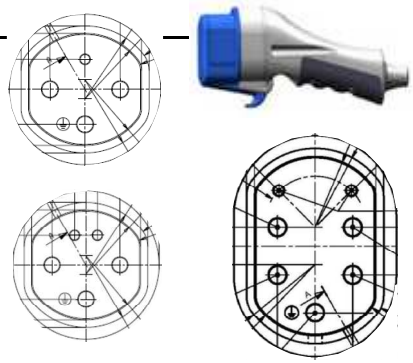
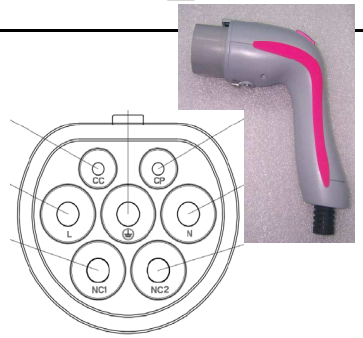
Standardization for Battery Charging and JARI's Certification of Charging System

Infrastructure for EVs in Japan

【Nomal Charger】
1-phase 100V:1.5kW
1-phase 200V:3kW

【 Quick Charger 】
3-phase 200V:20-50kW

AC charging interfaces standardization

	IEC 62196-2			China
	Type1（**Japan**）	Type2（Germany）	Type3（Italy）	
Phase	Single	Single/Three	Single/Three	Single/Three
Rated Current	32A (single phase) 80A (single, US only)	70A (single phase) /63A (three phase)	32A→63A？ (single/three phase)	70A (single phase) /63A (three phase)
Rated Voltage	250V (300V US only)	480V	250V	220V (single phase)/ 380V (three phase)
# of pins	5	7	4 or 5 (single phase) / 7 (three phase)	7
Scope	Coupler	Coupler, Plug & Socket	Coupler, Plug & Socket	Coupler, Plug & Socket
Compatibility	**SAE J1772**			–
Connector Design	 Φ43.8	 Φ56.0		
Locking	Option	Yes	Yes	Yes
Shutter	No	No	Yes	No

Quick Charger Specifications (for Japanese Market)

Charger Specifications

- Input: 3-phase 200V
-Maximum DC output power:
  50kW
-Maximum DC output voltage:
  500V
-Maximum DC output current:
  125A

5 minute charge for 40km (25 miles) driving range
10 minute charge for 60km (37 miles) driving range

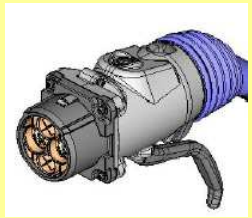
DC charging system / interface standardization

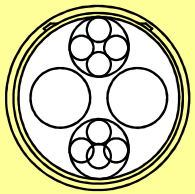
DC charging system

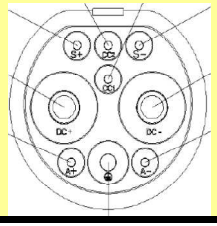
Japan (CHAdeMO) / China	Germany / US
Dedicated charging system	**AC/DC combined ("Combo") system**

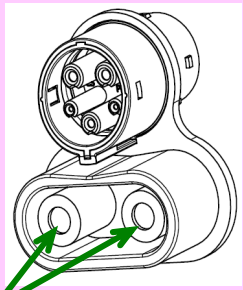
Vehicle Coupler

Japan (CHAdeMO)	China	US	Germany
・Pure DC	・Pure DC	・Low power: AC/DC common ・High power: AC/DC Combo	・Low power: AC/DC common ・High power: AC/DC Combo

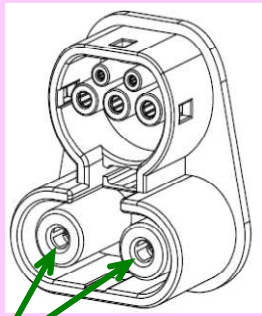








Additional
DC terminals



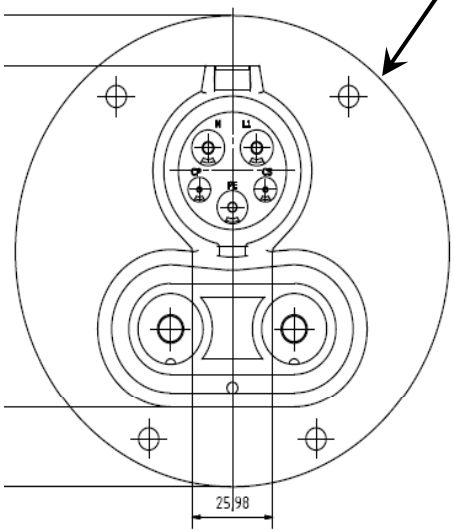
Additional
DC terminals

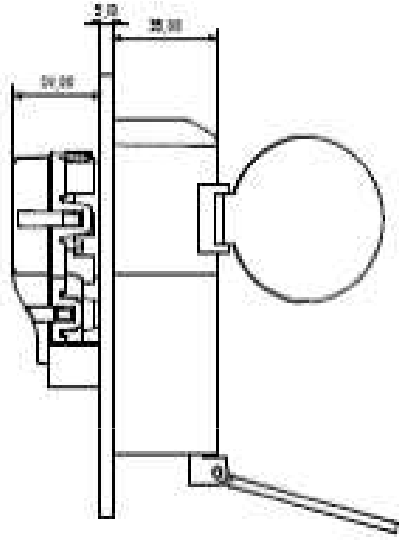
DC charging system / interface standardization

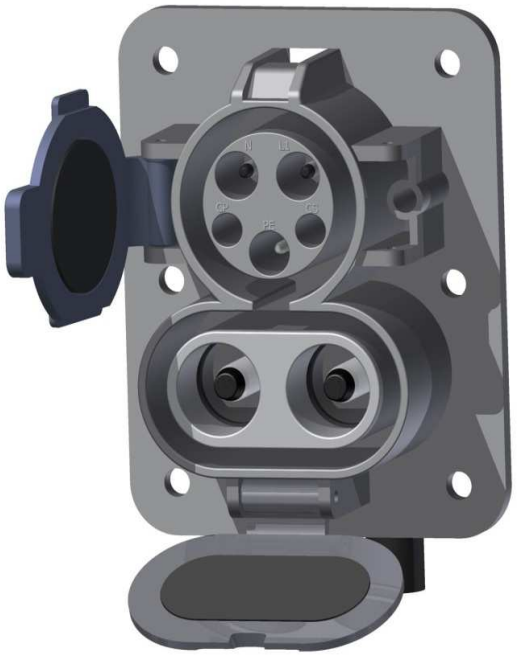
“Combo” vehicle inlet concept of US and Germany

Vehicle Inlet (Type 1)

φ140







Vehicle Inlet (Type 2)

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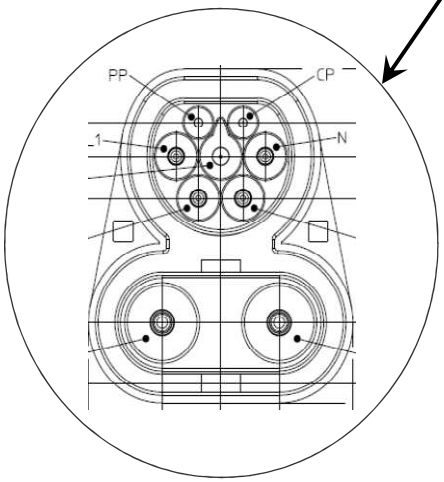

Type1 and Type 2 “combo” vehicle inlets use a common structure for both AC and DC charging.

Aspect of standardization for this field

- IEC has not reached the single specification for both AC and DC couplers.

- There are many stakeholders in this field, unlike other technical fields.
  - Interests among the automotive industry, electric power suppliers.
  - Differences in the power situation in national and regional areas

Consensus challenges.

It is essential to build a relationship of mutual trust among stakeholders

Interoperability for Charging System

- As for charging system, it needs to have certain interoperability to match each EV and charger.
- It needs to have certification system to establish infrastructure for EV charging system. Otherwise, each charger needs to be checked for each EV.
- JARI has started the certification system for AC charging in Japan. We will be able to support these activities.

Thank you for your attention.

If you have any comments and questions,
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