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Safety for Electric vehicle

28th May 2024

Nissan Motor Asia Pacific
Yasumasa Akiyama

Agenda

1. Introduction of Nissan
2. Global regulation and standard for EV
3. High reliable and performance EV – Beyond regulation
4. Other than vehicle development

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NISSAN Corporate Profile

As of September 2023

Company Name	Nissan Motor Co., Ltd.
President and CEO	Makoto Uchida
Head Office	Yokohama City, Japan
Date of Establishment	December 26, 1933
Paid-in Capital	605,813 million yen
Consolidated net sales	10,597 billions of yen (FY22)
Sales volume	3,305 K units (FY22)

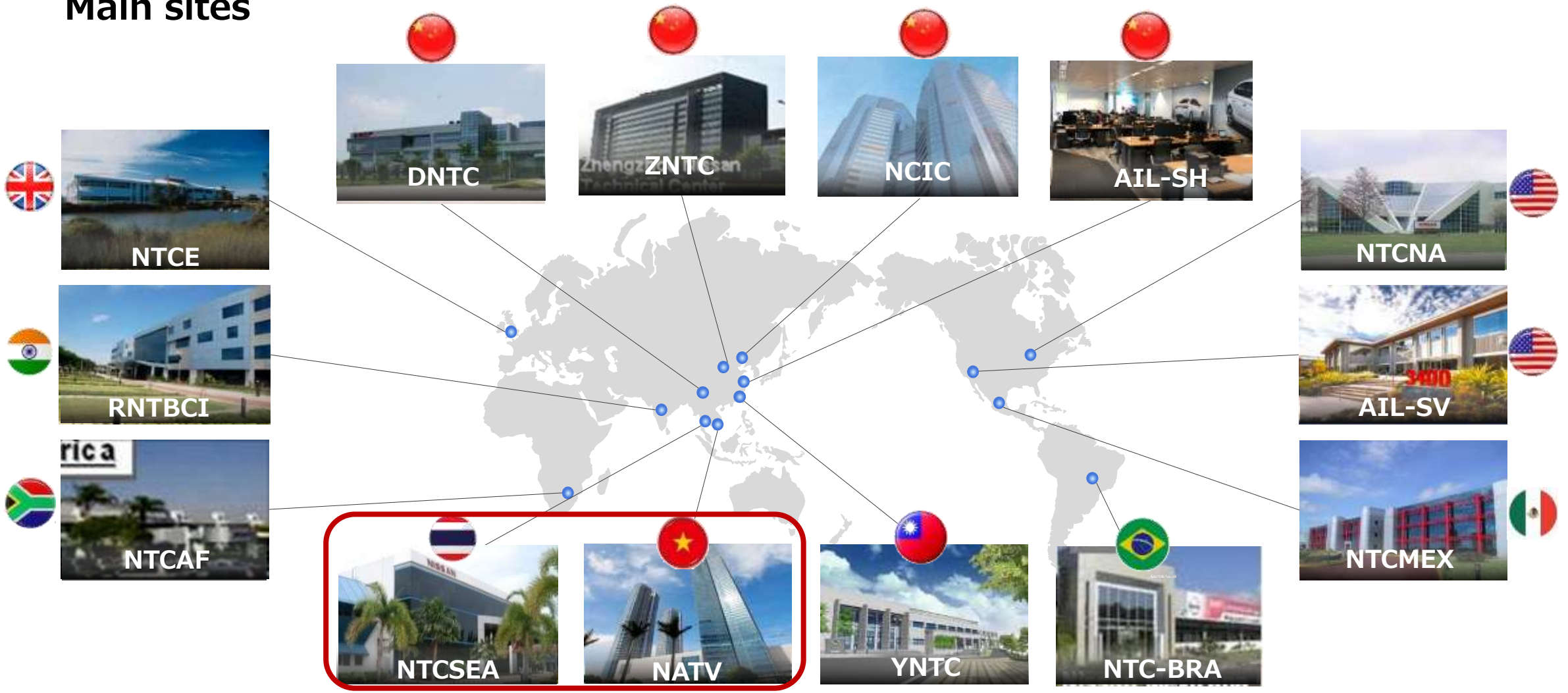
- Offers products and services in more than 160 countries worldwide
- Number of Employees : 131,719 (consolidated basis)

Global R&D sites

As of March 2023

- 44 sites in 16 countries

Main sites



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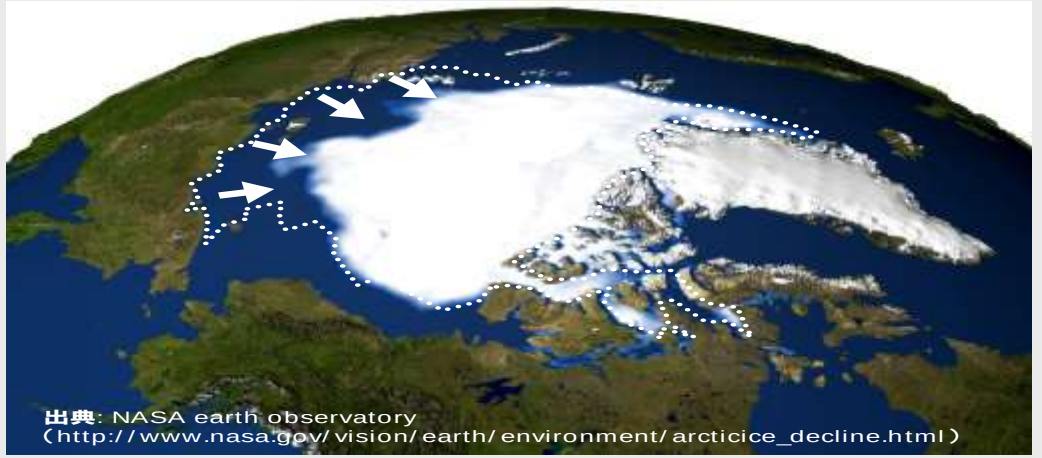
Issues surrounding motor vehicle

Energy

Global Warming



Congestion

Traffic Accidents

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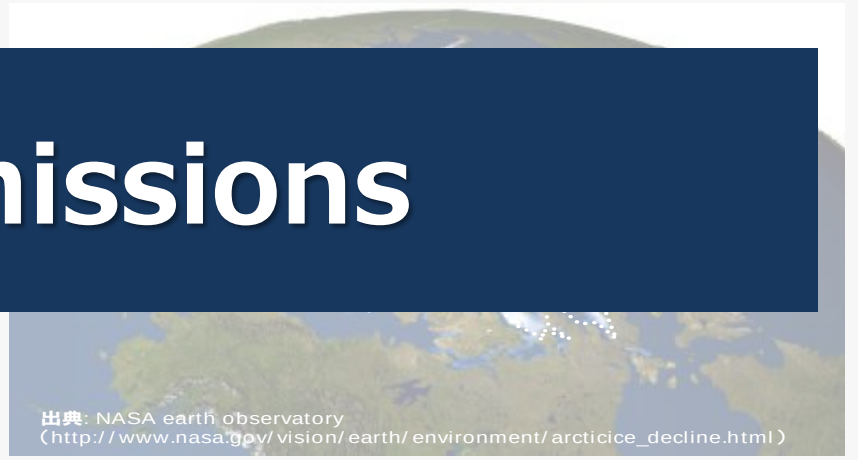
Nissan's Challenge

energy

global warming



Zero Emissions

traffic jam

Traffic accident

Zero Fatalities

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Nissan's technology strategy

Energy

Global Warming

Electrification

ZERO EMISSION

e-POWER

Intelligence

ProPILOT

Congestion

Traffic Accidents

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Electrification

e-POWER

Refueling

charging

Zero Emission

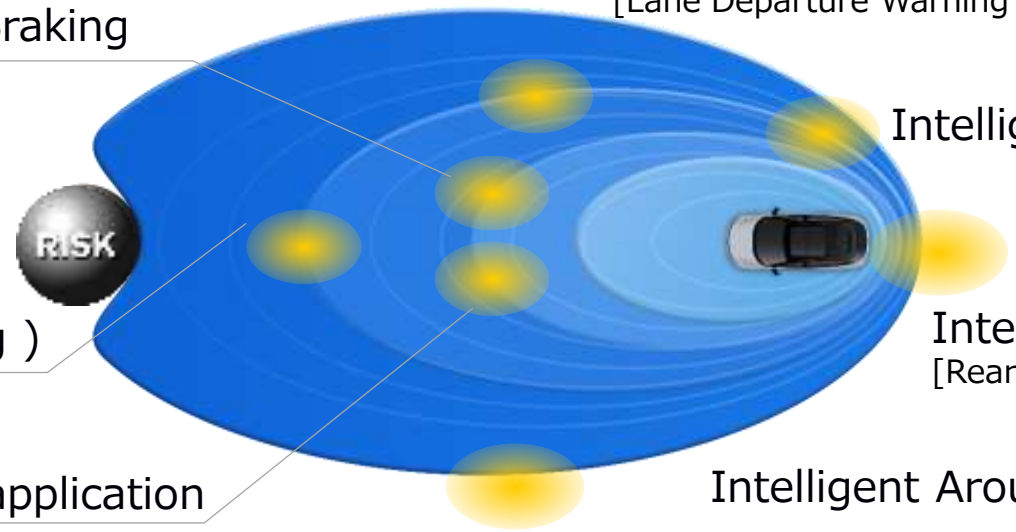
Intelligence

"Zero Fatalities" Initiative

- Aiming to be able to respond to all risks that may occur in the real world

"Safety Shield" Concept

✓ More than 20 years of development and market experience in 360-degree active safety technology



Intelligent Lane Intervention (LI)
[Lane Departure Warning / Prevention]

Intelligent Emergency Braking

Intelligent Blind Spot Intervention (BSI)

Intelligent FCW
(Forward Collision Warning)

Intelligent Back-Up Intervention (BUI)
[Rear Cross Traffic Alert / Prevention]

Emergency Assist for Pedal misapplication

Intelligent Around View Monitor (AVM)

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List of United Nations Regulation(UN R)

- More than 165 UN regulations exist for most of parts and motor vehicles.

リサイクル可能率	**%以上	133

: UN R (United Nations Regulation)

: UN R (Items which are also included in UN GTR)

UN R No & TITLE

3.REFLEX REFLECTORS
4.Rr REGISTRATION PLATE LAMPS
6.DIRECTION INDICATORS
7.POSITION LAMP,STOP LAMP
10.RADIO INTERFERENCE SUPPRESSION
11.DOOR LATCHES & HINGES
12.STEERING MECHANISM
13.BRAKING
13H.BRAKING(M1)
14.SAFETY BELT ANCHORAGES
16.SAFETY BELTS
17.SEATS
19.Fr FOG LAMPS
21.INTERIOR FITTINGS
23.REVERSING LAMPS
24.DIESEL SMOKE
25.HEAD RESTRAINTS
26, 61.EXTERNAL PROJECTIONS
28.AUDIBLE WARNING DEVICES
29.CAB (COMMERCIAL VEHICLE)
30, 54.TYRES
34.PREVENTION OF FIRE RISKS
35.FOOT CONTROLS
38.Rr FOG LAMPS
39.SPEEDOMETER
43.SAFETY GLAZING MATERIALS
45.HEADLAMPS CLEANERS
46.REAR-VIEW MIRRORS
48.LAMP INSTALLATION
49.DIESEL EMISSION
51.NOISE
55.MECHANICAL COUPLING
58.Rr UNDERRUN PROTECTION
64.SPARE WHEELS/TYRES, RUN FLAT TYRE, TPMS
66.STRENGTH OF SUPER STRUCTURE (LARGE PASSENGER VEHICLE)
73.LATERAL PROTECTION(GOODS VEHICLE)
77.PARKING LAMP
79.STEERING EQUIPMENT
80.SEAT (LARGE PASSENGERVEHICLE)
83.EXHAUST EMISSION
85.ENGINE POWER
87.DAYTIME RUNNING LAMPS
89.SPEED LIMITATION DEVICES
91.SIDE-MARKER LAMPS
93.Fr UNDERRUN PROTECTION
94.FRONTAL IMPACT
95.LATERAL IMPACT
100.BATTERY ELECTRIC VEHICLES
101.CO2 AND FUEL CONSUMPTION
112.HEADLAMPS
116.ANTI THEFT
117.TYRE NOISE
118.FLAME-RETARDANT IN INTERIOR
119.CORNERING LAMPS
121.TELL-TALES AND INDICATORS
122.HEATING SYSTEM
123.AFS
125.FORWARD VISION
127.PEDESTRIAN PROTECTION
130.LDWS (HEAVY VEHICLE)
131.AEBS (HEAVY VEHICLE)
133.RECYCLABLITY
134.HFCV
135.POLE SIDE IMPACT(PSI)
137.FULL-LAP FRONTAL IMPACT
138.QUIET ROAD TRANSPORT VEHICLES
142.TYRE INSTALLATION
144. ACCIDENT EMERGENCY CALL SYSTEMS
151.BLIND SPOT INFORMATION SYSTEM
152.AEBS (LIGHT VEHICLE)
153.THE FUEL SYSTEM INTEGRITY AND SAFETY OF ELECTRIC POWER TRAIN IN THE EVENT OF REAR-END COLLISION
154.WLTP
155.CYBERSECURITY AND CYBERSECURITY MANAGEMENT SYSTEMS
156.SOFTWARE UPDATE AND SOFTWARE UPDATE MANAGEMENT SYSTEM
157.AUTOMATED LANE KEEPING SYSTEM
158.REVERSING MOTION AND THE DRIVER'S AWARENESS OF VULNERABLE ROAD USERS BEHIND VEHICLE
159.MOVING OFF INFORMATION SYSTEM FOR THE DIRECTION OF PEDESTRIANS AND CYCLISTS (MOIS)
160.EVENT DATA RECORDER(EDR)
161 THE DEVICE AGAINST UNAUTHORIZED USE (A LOCKING SYSTEM)
162 IMMOBILIZER
163 VEHICLE ALARM SYSTEMS
164 STUDDED TYRES
165 REVERSE WARNING SOUND(RWS)
166 VULNERABLE ROAD USERS IN FRONT AND SIDE CLOSE PROXIMITY
168 Global Real Driving Emissions

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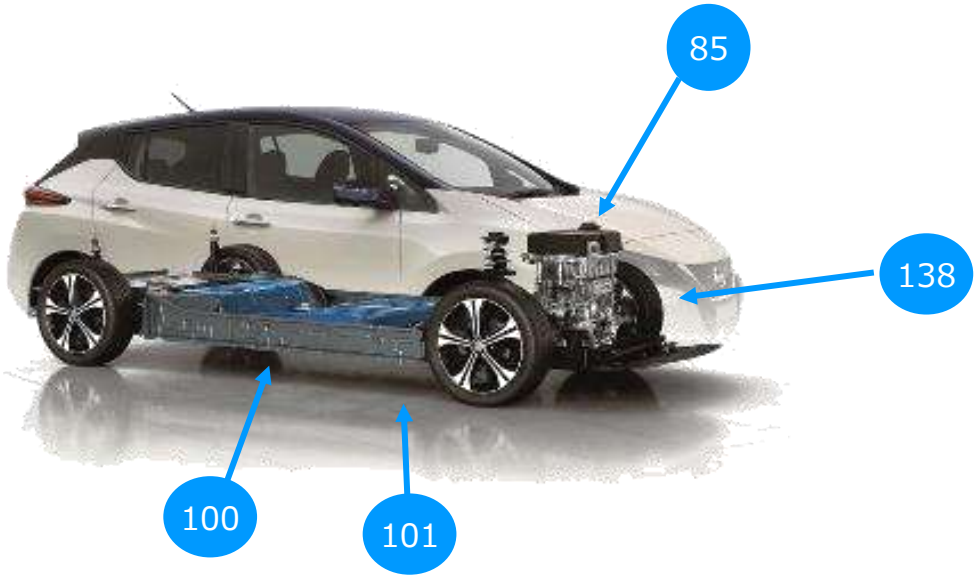
EV unique vehicle regulations

- There are several key regulations for EV safety

EV unique UN R No & TITLE

85.ENGINE POWER ➔ **MOTOR POWER**
100.**BATTERY ELECTRIC VEHICLES**
101.CO2 AND FUEL CONSUMPTION ➔ **Driving range & Electrical power consumption**
138.**QUIET ROAD TRANSPORT VEHICLES**



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EV unique vehicle regulations

- Key contents of UN R100 – Battery electric vehicles
  - Protection against electric shock
  - Crash test (with Vehicle or Battery)
  - Rechargeable Electrical Energy Storage System (REESS) requirement
    - Thermal shock
    - Fire resistance
    - External short circuit protection
    - Over charge protection

- Key contents of UN R138 – QUIET ROAD TRANSPORT VEHICLES
  - Need to equip AVAS (Acoustic Vehicle Alerting System) for Quiet vehicles to alert vehicle is nearby you
    - When vehicle is 20km/h or less (Forward & Rear)
    - The sound must be different from natural phenomenon sounds

International standard for Quick Charing system

- Main Quick Charger protocol in the world
  - Safety concept to avoid misusage of charging is determined in these protocols.

	CHAdeMO	GB/T	US-COMBO CCS1	EUR-COMBO CCS2
Connector				
Inlet				
UN / IEC	✓	✓	✓	✓
US	IEEE		SAE	
EU / EN	✓			✓
JP / JIS	✓	✓	✓	✓
CN / GB		✓		
Protocol	CAN		PLC	
Start @	2009	2013	2014	2013

Source: CHAdeMO association

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High reliable and performance EV – Beyond regulation #1

Fire or major battery failures: 0

Over 573,000 Units*  =  Over 116.1 million cells*

Reliable under repeated charging and discharging
➔ Capacity after 500 cycles

2nd generation LEAF	More than 90%
Conventional Lithium-ion Battery	Approx. 70%

* Nissan internal study result. As of December 2021

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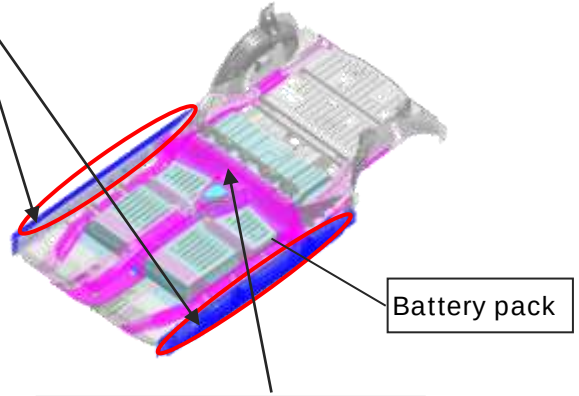
High reliable and performance EV – Beyond regulation #2

Concept of CRASH SAFETY – HIGH VOLTAGE

Many EV customers have concerns about collision when it comes to an EV.
Need to develop highly reliable EV to protect driver and passenger.

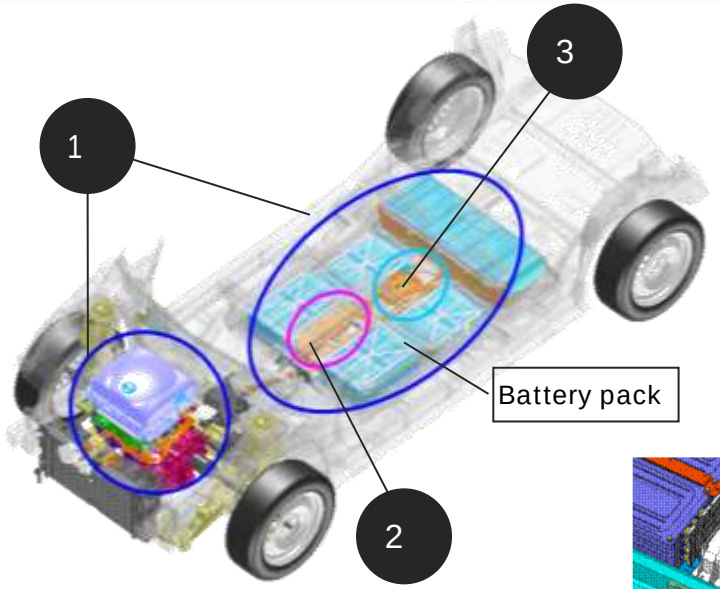
Battery protection structure

Impact Energy Absorbed Body
Control body deformation by impact energy absorbed body

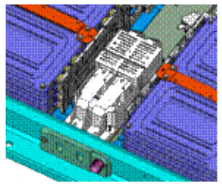


Protection Structure
Battery Pack is protected by body structure

High voltage protection design



1. High voltage parts are protected by considered component layout and body structure.
2. High voltage is shut down by impact sensing system.
3. Short circuit is prevented by fuse in a battery pack



A high-voltage shut down device is set in a battery pack.

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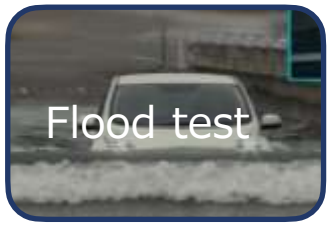
High reliable and performance EV – Beyond regulation #3

High reliable and performance EV – Beyond regulation #4



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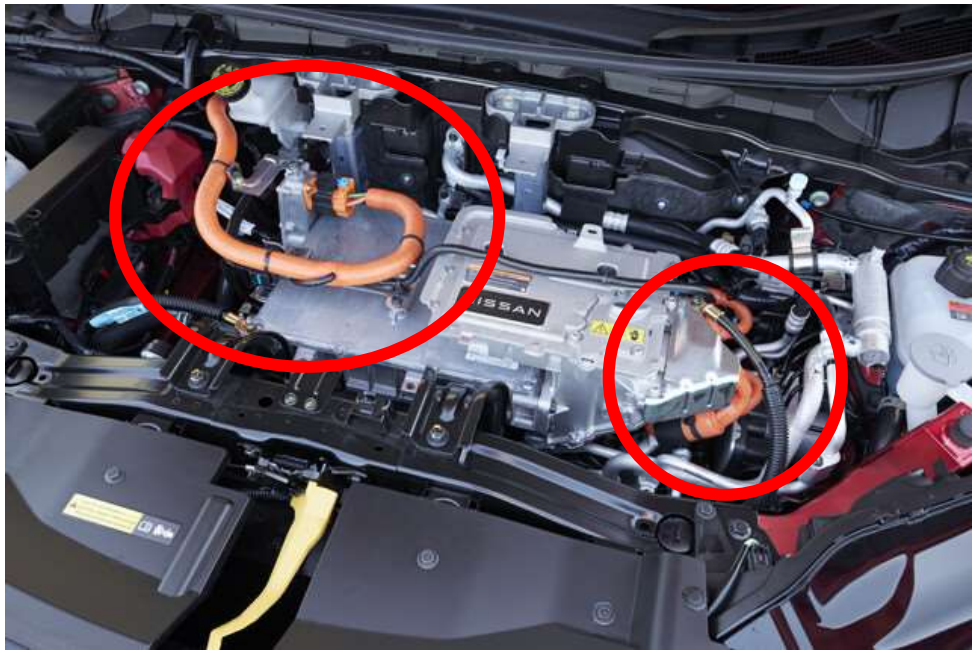
Safety for drivers

- Warning labels are set to eliminate any risk of electric shock
- High voltage harness is colored orange to visibly understand the caution

WARNING label for High voltage battery

High voltage harness with orange color



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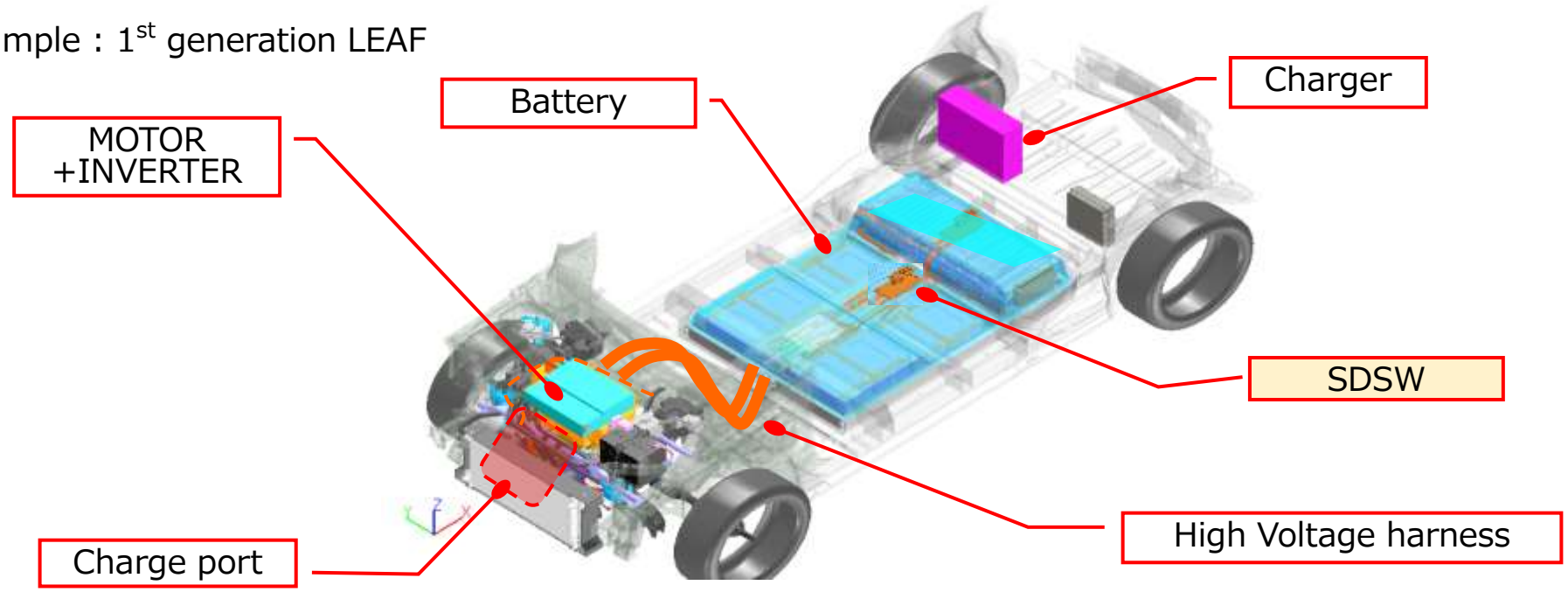
Safety for technicians #1

- It’s important to take care the safety for technicians of vehicle test and service maintenance

  - Understand the high voltage parts layout
  - Understand Service Disconnect Switch(SDSW) function
    *SDSW : Switch to shut down the high voltage circuit for vehicle maintenance and/or rescue

Example : 1st generation LEAF



Safety for technicians #2

- It’s important to take care the safety for technicians of vehicle test and service maintenance
  - Educate EV unique test method and instruments

<Special tools>

Electrically insulated gloves

Electrically insulated safety shoes

<Special method for vehicle test>

Instrument Preparation Before Test Phase	Normal Preparation Test Phase	After Test Check Post Test Phase
Battery Voltage Measurement	Sensor check	Insulation resistance check
Battery charge/discharge	Ready ON	Sensor/parts removal
Battery removal	Crash Test	Battery removal
Sensor fitment	EV check	Battery check
Battery re-install to car	Battery voltage measure	Move battery to storeroom
Sensor Check	IGN Off	High voltage parts removal
	SD switch	High voltage parts damage check

Key Notes

- ✓ There are several EV unique regulations / standards
- ✓ Think beyond regulation to develop reliable & safe EV
- ✓ Need to take care of drivers and technicians especially protecting from electric shock by high voltage parts

Zero Emission

T h a n k y o u !

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Thank you