

Guidelines for Converted Electric Vehicles

Technology Committee
Association for the Promotion of Electric Vehicles
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Converted electric vehicles and other automobiles to be driven on roads must have the structure and equipment conforming to the technical requirements specified in legislation related to the Road Transport Vehicle Act*. Requirements to which particular attention should be paid are specified in the Notice regarding the creation of the document entitled “Points to Keep in Mind for Electric Vehicle Conversion (EV conversion)” issued by the Kanto District Transport Bureau, Ministry of Land, Infrastructure, Transport and Tourism on September 29, 2010. However, the Notice does not fully cover all applicable requirements because converted electric vehicles greatly vary with regard to base vehicle structure, details of the conversion, and the parts used.

Converted electric vehicles must be made in compliance with the legislation related to the Road Transport Vehicle Act by referring to the Points to Keep in Mind for Electric Vehicle Conversion as mentioned above. Assuming that conversion is carried out as business involving the selling vehicles to an unspecified large number of users, it is necessary to further ensure vehicle safety and reliability.

Based on this point of view, the Technology Committee has established the attached “Guidelines for Converted Electric Vehicles” as voluntary standards. These Guidelines cover extensive technical requirements, ranging from those that must be satisfied to the ones that are advised to be satisfied. The Guidelines also stipulate precautions as needed, to supplement the Points to Keep in Mind for Electric Vehicle Conversion described above. These precautions should be taken when the requirements specified in the legislation related to the Road Transport Vehicle Act are applied to converted electric vehicles.

The Technical Committee will continue to strive to ascertain the actual status with regard to converted electric vehicles, such as the technologies that are employed in them and the way such vehicles are used. The Committee will also review these Guidelines as needed to respond to the actual status.

*For details of the related legislation, refer to the following websites:

- Safety Standards for Road Transport Vehicles (Ordinance No. 67 of the Ministry of Transport enacted on July 28, 1951) and the Notification of Details of Safety Standards for Road Transport Vehicles (Notification No. 619 to the Ministry of Land, Infrastructure, Transport and Tourism enacted on July 15, 2002):
http://www.mlit.go.jp/jidosha/jidosha_fr7_000007.html
- Administrative Regulations for the Examination established by the National Agency for Automobile and Land Transport Technology:
<https://www.naltec.go.jp/publication/regulation/shinsajimukitei.html>

Contents

Chapter 1 Scope

Chapter 2 Definition of Terms

Chapter 3 Technical Requirements for Structures and Devices

I General Electric Devices

- 1.Compliance with requirements specified for electric devices in the Notification of Details
2. Colors of electric cables
- 3.Protection against electric shock in case of collision
- 4.High-voltage shutoff system
- 5.Electromagnetic compatibility (EMC)
- 6.Monitoring of insulation resistance

II Drive Batteries

- 1.Drive battery safety
- 2.Method of drive battery installation
- 3.Inspection of drive battery electrolyte
- 4.Drive battery life indicator

III Motors and Drive-trains

- 1.Strength of connection between motor and drive-train
- 2.Strength of drive-train
- 3.Motor fixing method
- 4.Waterproof measures for high-voltage motor controller
- 5.Wires to the motor
- 6.Water resistance of in-wheel motors
- 7.Vehicle running performance
- 8.Method for confirming maximum output, rated output, and maximum torque

IV Speed Controllers and Accelerators

- 1.Failsafe functions and other functions for speed controllers and the like
- 2.Throttle safety
- 3.Installation of contactors

V DC/DC Converters and In-vehicle Battery Chargers

- 1.DC/DC converters
2. In-vehicle battery chargers

VI Brakes

1. Alternative devices, such as servo brake systems (changing the negative-pressure source and the air source)
- 2.Installation of electric regeneration brakes

VII Prevention of Sudden Starting due to Incorrect Operation

VIII Other Devices

1. Alternatives to power steering pumps
2. Alternatives to defrosters
3. Vehicle proximity warning devices

Chapter 4 Attached Sheets for Notification of Conversion

Chapter 5 Responsibilities of Vehicle Conversion Companies

Supplementary provision

Guidelines for Converted Electric Vehicles

Chapter 1 Scope

These Guidelines have been established for electric vehicles converted from relatively small four-wheel vehicles, which are equipped with manual transmission and have been previously driven on roads with assigned license plates. The Guidelines may be referred to for electric vehicles converted from other types of vehicles as well.

Provisions using “shall” indicate requirements to be satisfied and provisions using “should” indicate recommendations in these Guidelines.

Chapter 2 Definition of Terms

Definitions of terms used in these Guidelines are specified below and in legislation related to the Road Transport Vehicle Act, such as Attachment No. 110, “Technical Standards for Protection of Passengers from High Voltages in Electric and Electric Hybrid Vehicles” to “the Notification of Details of Safety Standards for Road Transport Vehicles (Notification No. 619 to the MLIT enacted on July 15, 2002)” which is hereafter called “the Notification of Details.”

- (1) *Vehicles made on or after yyyy* refer to vehicles shipped by automobile makers or automobile manufacturers on or after yyyy. Generally, the year of the initial registration or initial inspection stated on each vehicle’s inspection certificate applies.
- (2) *High voltage* refers to working voltage which is over 60V DC and 1500V or less, or over 30V AC (effective value) and 1000V (effective value) or less.
- (3) *A drive battery* refers to an electric storage and its assembly connected electrically in order to supply electrical power related to driving.
- (4) *A drive battery pack* refers to a single mechanical assembly with parts, such as drive battery modules, holding frames, trays and cases.
- (5) *Enclosure* refers to a part enclosing the internal units and providing protection against contacts from all directions.
- (6) *EMC* refers to electromagnetic compatibility, or the ability of an electric device to function properly without causing any electromagnetic interference and without failing due to electromagnetic waves.
- (7) *ECE Rule No.* refers to the number of one of the rules established for safety of automobiles based on the 1958 Agreement (Agreement concerning the Adoption of Uniform Technical Prescriptions for Wheeled Vehicles, Equipment and Parts Which Can Be Fitted and/or Be Used on Wheeled Vehicles and the Conditions for Reciprocal Recognition of Approvals Granted on the Basis of These Prescriptions.)
- (8) *WP29* refers to the World Forum for Harmonization of Vehicle Regulations, which was established within the United Nation Economic Commission for Europe. Activities of the Forum includes establishing of internationally harmonized standards for automobile safety and environment and managing the 1958 Agreement and the 1998 Agreement (Agreement concerning the Establishing of Global Technical Regulations for Wheeled Vehicles, Equipment and Parts Which Can Be Fitted and/or be Used on Wheeled Vehicles.) Japan has joined this forum since 1970’s.

(9) “*UN regulations*” refer to regulations with regard to safety and environment on vehicles, vehicle systems, parts, and components. The regulations also cover administrative procedures and requirements for performance testing. As for the administrative procedures, the regulations specify the followings:

- i) the type approval for the vehicle systems, parts, and components
- ii) the conformity of production to prove the manufacturer’s ability to produce a series of products that exactly match the specification
- iii) the mutual recognition of the type approval given by member countries

In 1998 Japan joined “Agreement concerning the Adoption of Uniform Technical Prescriptions for Wheeled Vehicles, Equipment and Parts Which Can Be Fitted and/or Be Used on Wheeled Vehicles and the Conditions for Reciprocal Recognition of Approvals Granted on the Basis of These Prescriptions” which was implemented in 1958.

(10) *A live part* refers to a conductive part intended to be electrically energized in normal use.

(11) *An electrical chassis* refers to a set made of conductive parts electrically linked together, whose potential is considered as reference.

(12) *A barrier* refers to a part providing protection against contact to the live parts from all directions of access.

(13) *An accelerator* refers to a potentiometer operated from an accelerator pedal via a wire or other means.

(14) *An accelerator position sensor* refers to a potentiometer directly connected to an accelerator pedal.

(15) *A speed controller* refers to a device that controls the rotation of a motor.

(16) *A contactor* refers to a device (relay) that controls a large current by using a small current to protect a contact frequently switched under high current and other severe conditions.

Chapter 3 Technical Requirements for Structures and Devices

I General Electric Devices

1. Compliance with requirements specified for electric devices in the Notification of Details

(1) Electric devices shall comply with requirements specified in Article 99 of the Notification of Details.

Explanation:

- Compliance with Articles 99.7 and 99.8 of the Notification of Details is mandatory for vehicles converted from those made in or after July 2012. This also applies to the vehicles converted on or before June 30th, 2012, when they receive the auto inspection, including the initial one, on or after July 1st, 2012.

- Article 99.3 specifies the requirements for:

- the protection against electric shock caused by high-voltage circuits, including protection against direct and indirect contact
- the drive battery, including the installation of protective devices against overcurrent and the method for installing open type drive batteries that generate hydrogen gas
- the indication of standby and operable states and so on.

2. Colors of electric cables

(1) High-voltage cables, excluding those inside enclosures, shall be identified with orange external coating.

Explanation:

Article 99.7.3 of the Notification of Details specifies the requirements for colors of electric cables and compliance with this article is mandatory for vehicles converted on or after June 23rd, 2014.

(2) DC electric cables shall have red coating on the positive end and black coating on the negative end. High-voltage cables with orange coating may be marked in red and black at the ends of the orange coating.

3. Protection against electric shock in case of collision

Electric devices should have a mechanism that shuts off high-voltage circuits using inertia relays or the like in case the vehicle is involved in a collision.

4. High-voltage shutoff system

(1) Vehicles shall be mounted with a service plug or equivalent equipment that shuts off high voltage without the use of any tool in order to protect workers from electric shock during maintenance work.

(2) If equipment other than a service plug is installed, the equipment shall be structured so that the drive battery enclosure cannot be opened when the equipment is ON and the equipment cannot be turned ON when the drive battery enclosure is open.

5. Electromagnetic compatibility (EMC)

Electric devices, particularly speed controllers, should be verified by their manufacturers regarding the electromagnetic compatibility in the environment where vehicles are used.

Explanation: Article 99.1 of the Notification of Details specifies the mandatory requirements that electric waves emitted from electric devices shall not disturb functions of radio equipment. In addition, electric devices should have immunity to electromagnetic waves to function properly. The requirement for electromagnetic compatibility is specified here, but please refer to ECE Rule No. 10 for the details including concrete testing methods. Article 21.1 and 2 of the Notification of Details, which are applied to the new vehicles inspected in the manufacturer at completion, also cite ECE Rule No. 10.

6. Monitoring of insulation resistance

Electric devices should be equipped with detectors to monitor the insulation resistance between the live parts and the electrical chassis.

II Drive Batteries

1. Drive battery safety

(1) Drive batteries shall have a system to shut off the power supply when they are fully charged, in order to prevent overcharging.

(2) Drive batteries shall have appropriate anti-heat radiation measures.

(3) Technical requirements regarding the rechargeable energy storage system (REESS)

- 02 series in UN Regulation No.100 has been revised; Based on Article 12.2 of UN Agreement, the revision was adopted and became mandatory for all the member nations taking UN Regulation No.100 on July 15th, 2013.

- Regarding REESS, tests shall be conducted with the procedure specified in the Annex 8 in UN Regulation No.100: Vibration (Regulation No.100.6.2.), Thermal shock and thermal cycling (6.3.), Mechanical shock (6.4.1.), Crush (6.4.2.), Fire resistance (6.5.), External short circuit protection (6.6.), Overcharge protection (6.7.), Over-discharge protection (6.8.), Over-temperature protection(6.9.), Emission (6.10.)

- Tests may be performed as, either vehicle based or component based (REESS system).

If the test is conducted with related subsystem(s) including the cells and their electrical connection, it shall be demonstrated that the REESS subsystem test result can reasonably represent the performance of the complete REESS with respect to its safety performance under the same conditions.

-Testing Mechanical shock, Crush, Fire resistance, and Emission may be performed as, either vehicle based or component based (REESS system) .

2.Method of drive battery installation

A drive battery pack shall be installed as specified in I 1.(1) and (2) as follows:

(1) A drive battery pack shall be installed in such a way that the weight balance of the converted vehicle shall not exceed the weight balance of the base vehicle. The drive battery pack shall be installed in the place specified in Attachment No. 111 to the Notification of Details.

Explanation: Attachment No. 111 to the Notification of Details specifies the following requirements:

- A driving battery pack and electric circuits with power systems having a part of working voltage over 60V DC or over 30V AC (effective value) shall be mounted in a position with specific conditions as follows:
 - (a) the horizontal distance from the front edge of the vehicle to that of the battery pack, which is parallel to the vehicle center line, shall be 420mm or more.
 - (b) the horizontal distance from the rear edge of the vehicle to that of the battery pack, which is parallel to the vehicle center line, shall be 300 mm or more.

(2) The drive battery pack shall satisfy the installation strength specified in Attachment No. 111 to the Notification of Details.

Explanation: Attachment No. 111 to the Notification of Details specifies the following requirements:

- The drive battery shall not rupture under acceleration in a direction in parallel with the vehicle center line of $\pm 196 \text{ m/s}^2$, in case of a passenger vehicle with a riding capacity of 10 or less, or a cargo vehicle with the gross vehicle weight under 3.5t.
- The drive battery shall not rupture under acceleration in a direction perpendicular to the vehicle center line of $\pm 78.4 \text{ m/s}^2$, in case of a passenger vehicle with a riding capacity of 9 or less, or a cargo vehicle with the gross vehicle weight of under 3.5t.

3.Inspection of drive battery electrolyte

The enclosure, barrier or other casings of the drive battery shall be structured for the facile maintenance, so that the electrolyte level and specific gravity can be checked at the intervals recommended by the manufacturers of the drive battery.

4.Drive battery life indicator

The driver's seat shall be equipped with an indicator to allow a driver to estimate the remaining life of the

drive battery or remaining travel distance.

III Motors and Drive-trains

1.Strength of connection between motor and drive-train

(1)The motor-transmission connection shall be via a metal plate of sufficient strength and made to a sufficient accuracy.

(2)The motor shall be installed in such a way that motor rotations will not cause abnormal vibrations or damage the drive-train including the transmission.

Explanation: The requirements specified in the safety standards state that the motor-transmission connection shall be rigid enough to withstand the running of the vehicle. In order to satisfy this requirement, points to which particular attention should be paid with regard to converted electric vehicles are supplementarily stated here.

2.Strength of drive-train

(1)The maximum motor torque shall be within a range that ensures the strength of the drive-train. For example, when a converted vehicle uses the unmodified drive-train (including the transmission) of the base vehicle and the maximum motor torque does not exceed the maximum engine torque of the base vehicle, the motor shall be considered to comply with this requirement.

(2)If the maximum motor torque can be easily changed, for example, by setting a controller, to a value exceeding the motor installation strength or the drive-train strength, such simple changes shall be prevented by taking appropriate measures such as sealing the motor.

Explanation: The requirements specified in the safety standards state that the drive-train shall be rigid. In order to satisfy this requirement, points to which particular attention should be paid with regard to converted electric vehicles are supplementarily stated here.

3.Motor fixing method

The motor shall be installed in a way to ensure a strength equivalent to the one of existing engine mount. When a converted vehicle uses the engine mount of a base vehicle without any modification and the weight and maximum torque of its motor does not exceed the weight and maximum torque of the engine of the base vehicle, the motor shall be considered to comply with this requirement.

Explanation: The requirements specified in the safety standards state that the motor shall be installed in a rigid way. In order to satisfy this requirement, points to which particular attention should be paid with regard to converted electric vehicles are supplementarily stated here.

4.Waterproof measures for high-voltage motor controller

(1) In cases where the motor is not waterproof, measures shall be taken so that water is prevented from splashing while the vehicle is running in the rain or is being washed.

(2)Parts, wires, and other components of the motor circuits shall be waterproof.

(3) Stringent waterproofing measures shall be taken during accelerator installation, for example, installing it inside the passenger compartment or putting it in a waterproof box installed in a position inside the engine

room where it is unlikely to be splashed by water.

5. Wires to the motor

(1) To prevent wires and terminals from burning, electric cables suitable for the amount of current shall be used. In particular, wires used for circuits that connect the drive battery to the motor shall be able to withstand the maximum driving current.

(2) Wires and terminals shall be strong enough to withstand the operating environment of the vehicle.

6. Water resistance of in-wheel motors

In-wheel motors shall cause no electric leakage, failures, or other problems in the normal operating environment.

Explanation: The requirements specified in Article 88.1 of the Notification of Details state that the motor shall fully withstand the running of the vehicle. Considering the usage environment of in-wheel motors, points to which particular attention should be paid with regard to converted electric vehicles are supplementarily stated here.

7. Vehicle running performance

Converted vehicles shall satisfy the following conditions depending on their classification:

Ordinary vehicles: $GVW \text{ (Gross vehicle weight)} \leq 135 \times kW \text{ (Maximum output)} - 1500$

Small vehicles and light motor vehicles: $GVW \text{ (Gross vehicle weight)} \leq 122 \times kW \text{ (Maximum output)} - 600$

8. Method for confirming maximum output, rated output, and maximum torque

The maximum output, rated output, and maximum torque values may be derived from performance curves or specifications provided by motor manufacturers or other parties, or from nameplates or other labels attached to motors.

IV Speed Controllers and Accelerators

1. Failsafe functions and other functions for speed controllers and the like

(1) To ensure stable performance, appropriate heat radiation measures to prevent damage caused by heat shall be taken for the speed controller and other similar devices (hereafter called “the speed controller or the like.”)

(2) If any abnormality occurs regarding the speed controller or the like, such as an abnormal temperature rise, the driver sitting in the driving seat shall be alerted.

(3) The speed controller or the like should be designed so as not to allow unintended accelerations and not to hinder the driver’s intended deceleration in cases of abnormality, disconnection or short circuit affecting the accelerator signal input line, or in cases where the accelerator or accelerator position sensor is disconnected, short circuited or gets stuck.

Explanation:

- These standards require devices to work properly in cases of abnormality. For example, speed controllers are required to detect the occurrence of abnormality and block the base (i.e. shut off the power supply and the regeneration) and allow free running, while mechanical braking systems are required to maintain their function in cases of abnormality. Accelerators and accelerator position sensors should have dual output

method for detecting abnormality.

- We will consider establishing requirements for brake override systems in response to changing situations.

2. Throttle safety

- (1) If the accelerator is used for motor rotation control, it shall have double return springs in order that its operation will be cancelled when a driver is not operating the accelerator pedal.
- (2) The accelerator shall be smoothly actuated by operation of the accelerator pedal, and the return springs of the accelerator pedal and accelerator shall have sufficient return strength.
- (3) If an accelerator position sensor directly connected to the accelerator pedal is used for motor rotation control, it shall have double return springs in order that its operation will be cancelled when a driver is not operating the accelerator pedal.

Explanation: The safety standards require the installation of double accelerator return springs. Points to which particular attention should be paid for converted electric vehicles are stated in (1) and (3) as supplementary requirements.

3. Installation of contactors

- (1) A contactor shall be installed between the drive battery and the speed controller, and it shall fully withstand severe conditions, such as frequent switching along with frequent accelerator operation.
- (2) The contactor shall have a rating higher than the maximum current of the speed controller and also higher than ratings of high-voltage circuit protective devices, such as fuses and circuit breakers.

V DC/DC Converters and In-vehicle Battery Chargers

1. DC/DC converters

- (1) Appropriate measures shall be taken to prevent a vehicle from running when lights or other auxiliary equipment is inoperable and to prevent such equipment from becoming inoperable when the vehicle becomes unable to run due to a voltage drop of the drive battery or for another reason. One example is equipping the vehicle with batteries for auxiliary equipment powered from a DC/DC converter. The batteries for auxiliary equipment may also be powered by solar cells.
- (2) A vehicle with no batteries auxiliary equipment shall have a DC/DC converter whose output current can withstand the maximum power consumption of the auxiliary equipment being used. Such a DC/DC converter shall also ensure the power supply for the auxiliary equipment such as hazard lights, when a voltage drop of the drive battery compulsorily stop the vehicle.

2. In-vehicle battery chargers

- (1) The in-vehicle battery charger shall be designed to stop power supply when the drive battery is fully charged. Chargers for lithium batteries shall be designed to stop charging automatically in order to prevent each cell from overcharging.
- (2) The in-vehicle battery shall not shorten the travel distance or adversely affect the service life of the drive battery.
- (3) The in-vehicle battery shall comply with specifications required by drive battery manufacturers and others.

VI Brakes

1. Alternative devices, such as servo brake systems (changing the negative-pressure source and the air source)

(1) If an electric vehicle is converted from a base vehicle that is equipped with a servo brake system using engine negative pressure, the electric vehicle shall be equipped with an electric negative-pressure pump or the like to ensure braking assistance equivalent to the original brakes of the base vehicle.

(2) An alert system shall be mounted on the driver's seat to indicate any failure of the electric negative-pressure pump or other assistance device, including the loss of negative pressure.

2. Installation of electric regeneration brakes

(1) An electric regeneration brake should be mounted as an alternative to engine braking.

(2) An electric regeneration brake should be operable even if the drive battery is fully charged.

(3) Brake lamps shall be turned on when the electric regeneration brake is applied and the deceleration is over 1.3m/s^2 .

Explanation: If the vehicle has no electric regeneration brake, the person in charge of converting the vehicle shall be responsible for ensuring the safety of the vehicle.

Brake lamps during the operation of an electric regeneration brake are classified into three categories based on the deceleration: Prohibited to light (the deceleration is 0.7m/s^2 or less), Voluntary to light (the deceleration is over 0.7m/s^2 and 1.3m/s^2 or less), and Mandatory to light (the deceleration is over 1.3m/s^2)

VII Prevention of Sudden Starting due to Incorrect Operation

A vehicle shall have a system that shows the driver the standby or operable state according to the requirement in I 1. (1). Measures shall be taken to prevent sudden starting and other accidents due to incorrect operation in accordance with the following requirements.

(1) With regard to operations for the switching of a vehicle into an operable state, there should be measures to ensure safety when a vehicle starts moving.

Explanation: Today manual transmission vehicles have a mechanism called clutch start system, which allows the engine to start only when the clutch pedal is pressed down. Automatic transmission vehicles have a key interlock function that allows the ignition key to be pulled out only when the shift lever is in Park as well as a shift lock function that allows the shift lever to be moved from Park only when the brake pedal is pressed down. Converted electric vehicles shall have appropriate measures created in reference to these functions. One possible example is to equip electric vehicles converted from manual transmission vehicles with a system that prevents ignition from turning on when the accelerator pedal is pressed. In case of conversion from automatic transmission vehicles, such a possible example is to allow the shift lever to be moved from the Park range for creeping only when the brake pedal is pressed.

(2) The state of running direction control unit should be able to be identified by a driver.

Explanation: This requirement is based on the requirements specified in Revision 01 series of ECE Rule No. 100, which is cited in Article 21.5 of the Notification of Details to be applied for the new vehicles inspected

in the manufacturer at completion. This requirement specifies that there shall be an indication on the instrument panel, independently of the gearbox indication specified in the Notification of Details under Article 10 of the existing safety standards.

(3) When the running direction control unit is in the reverse position, this state shall be notified to a driver by using a buzzer or other means. If such a function is not provided for the base vehicle, it should be added to the vehicle.

(4) The reverse speed shall be adequately restricted.

(5) A vehicle with no gearbox should be designed to allow the shift lever to be moved from Drive to Reverse and vice versa only when the accelerator pedal is not pressed and the brake pedal is pressed.

(6) When the vehicle has a creep mechanism, creeping shall be controlled properly.

Explanation: Properly controlled creeping contributes to convenience and safety at the time of hill starting or when parking in a garage. It has another advantage that when the brake pedal pressing force is reduced and the shift lever position differs from that intended by the driver (e.g. when the driver thinks the shift lever is in Neutral but it is actually in Drive), the driver can recognize the misunderstanding without pressing the accelerator pedal. However, further consideration is required as to whether this function is necessary.

(7) The requirement in II.(1) specifies that a vehicle should be equipped with a device that indicates to a driver that the vehicle is in a standby or operable state. This “indication” shall be a visual indication that is sufficient to enable a driver to be aware that the vehicle is in said state. In addition, if a vehicle is still in an operable state when a driver leaves it, an alert signal such as an optical or audio signal should be given to the driver.

Explanation: The latter part of this requirement is specified in ECE Rule No. 100 which is cited in Article 21.5 in the Notification of Details to be applied for the new vehicles inspected in the manufacturer at completion.

(8) An alert should be issued when the ignition key is pulled out with the parking brake off.

(9) A device should be mounted on the driver’s seat side to indicate that charging is in progress when charging.

(10) A vehicle shall be structured to be kept inoperable during charging from a fixed power supply.

Explanation: This requirement is based on the requirement specified in Revision 01 series to ECE Rule No. 100 which is cited in Article 21.5 in the Notification of Details to be applied for the new vehicles inspected in the manufacturer at completion.

VIII Other Devices

1. Alternatives to power steering pumps

(1) When an electric vehicle is converted from a base vehicle equipped with electric power steering, the control force of the converted electric vehicle shall be equivalent to that of the base vehicle.

(2) When an electric vehicle is converted from a base vehicle equipped with hydraulic power steering, the elimination of the power steering function is unavoidable. However, the converted electric vehicle should have a control force equivalent to that of the base vehicle, for example, by the installation of an electrically

actuated hydraulic pump.

2. Alternatives to defrosters

The defroster of a converted electric vehicle shall have a performance equivalent to that of the base vehicle.

3. Vehicle proximity warning devices

Converted electric vehicles should be equipped with a vehicle proximity warning device as specified in the Guidelines for Measures for Hybrid and Other Quiet Vehicles, the attachment to the Notification of the Guidelines for Measures for Hybrid and Other Quiet Vehicles (Announcement No. 255 of Engineering and Safety Department, Road Transport Bureau, MLIT, issued on January 29, 2010.)

Chapter 4 Attached Sheets for Notification of Conversion

It is necessary to notify district transport bureau branches in advance of the conversion of a vehicle: regional offices of the Light Motor Vehicle Inspection Organization for light motor vehicles, or Inspection Department of the National Agency for Automobile and Land Transport Technology for other types of vehicles. For notification, the following documents shall be submitted:

- List of electric devices (Attached Format 1)
- A sheet describing considerations with regard to compliance with technical standards related to protection against electric shock (Attached Format 2)
- A calculation sheet for the strength of the drive battery pack mounting (Attached Format 3)
- A sheet describing considerations with regard to compliance with EV conversion structure standards and a check sheet of measures against electric shock taken for electrically live components
- Drawings of high-voltage circuits
- Data that identifies the motor model, the maximum output (rotation speed), the rated output (rotation speed), and the maximum torque (rotation speed) of the vehicle to be converted. Examples are performance curves and specifications provided by motor manufacturers or other parties, and nameplates or other labels attached to motors.
- Calculation sheet for motor mounting strength, for a vehicle whose motor weight or maximum torque exceeds the engine weight or maximum torque, or for a vehicle which does not directly use the engine mount of the base vehicle.
- Drawings showing dimensions of connecting flanges and other parts for the connection between the motor and the transmission, calculation sheet for connection strength, and other related documents.

Chapter 5 Responsibilities of Vehicle Conversion Companies

(1) Vehicle conversion companies shall prepare the following documents and provide them to vehicle users to ensure the proper maintenance, management, and use of converted electric vehicles.

- Documents describing details of the conversion
- Lists of devices and parts added
- Inspection and maintenance manuals describing the maintenance of parts, drive battery replacement procedures, etc.
- Circuit diagrams
- Documents giving precautions regarding the driving of a converted electric vehicle

(2) When selling converted electric vehicles, vehicle conversion companies shall fully explain to users about the use, maintenance, and management of the converted electric vehicles

(3) Vehicle conversion companies shall provide users with full information about the drive battery, motor, and other parts added for conversion with clear instructions with regard to required inspection cycles, items, and methods, based on information provided by the manufacturers or vendors of the parts.

(4) Vehicle conversion companies shall provide users with full information about charging equipment and charging methods by referring to the Guidebook for Installing Charging Equipment for Electric Vehicles and Plug-in Hybrid Vehicles (METI and MLIT, December 2010.)

Supplementary provision revised on June 27th, 2012

These Guidelines shall come into force on July 1, 2012.

Supplementary provision revised on April 30th, 2020

These Guidelines shall come into force on May 11, 2020.