

**GSO 2698 : 2024**

**المتطلبات الفنية للمركبات الكهربائية**

**Technical Requirements for Electric Vehicles**

ICS: **43.120**

## Electric Vehicles Technical Requirement

### 1. Scope

This standard is concerned with all battery electric vehicles with a speed of more than 25 km / h taking into consideration the compatibility with the relevant Gulf standards and regulations. The performance of the electrical vehicle is part of this regulation.

### 2. Definitions

In implementing the provisions of this technical regulation, the following words and expressions shall have the meanings indicated opposite each of them, unless the context of the text indicates otherwise:

- 2.1 **Electrical Motor Vehicle:** An electric car is an alternative fuel automobile that uses electric motors and motor controllers for propulsion, in place of the internal combustion engine (ICE). EVs store electricity in an energy storage device, such as a battery, which must be replenished by plugging into an electrical source.
- 2.2 **Rechargeable Energy Storage System (REESS):** means the rechargeable energy storage system that provides electric energy for electric propulsion.  
The REESS may include subsystem(s) together with the necessary ancillary systems for physical support, thermal management, electronic control.
- 2.3 **Electric power train:** means the electrical circuit which includes the traction motor(s), and may include the REESS, the electric energy conversion system, the electronic converters, the associated wiring harness and connectors, and the coupling system for charging the REESS.
- 2.4 **Electric Vehicle Charging System.** A system of components that is supplied to the vehicle for the purpose of recharging electric vehicle storage batteries.
- 2.5 **Electric Vehicle Connector.** A device that establishes an electrical connection to the electric vehicle for the purpose of power transfer and information exchange. This device is part of the electric vehicle coupler.
- 2.6 **Electric Vehicle Coupler.** A mating electric vehicle inlet and electric vehicle connector set.
- 2.7 **Electric Vehicle Inlet.** The device on the electric vehicle into which the electric vehicle connector is inserted for power transfer and information exchange. For the purposes of this Code, the electric vehicle inlet is part of the electric vehicle and not part of the electric vehicle supply equipment.
- 2.8 **Electric Vehicle Storage Battery.** A battery, comprised of one or more rechargeable electrochemical cells that has no provision for the release of excessive gas pressure during normal charging and operation, or for the addition of water or electrolyte, or for external measurements of electrolyte specific gravity.
- 2.9 **Electric Vehicle Supply Equipment (EVSE ).** The conductors, including the ungrounded, grounded, and equipment grounding conductors and the electric vehicle connectors, attachment plugs, and all other fittings, devices, power outlets, or apparatus installed specifically for the purpose of transferring energy between the premises wiring and the electric vehicle.

2.10 Electric Vehicle Supply Equipment System. A system of components that supplied to the vehicle for providing input power to an on-board charger.

2.11 Personnel Protection System. A system of personnel protection devices provide protection against electric shock of personnel.

### 3. **Electric vehicle requirements**

EV vehicles companies can apply for a UAE certificate of conformity based on FMVSS and US-EPA standards that are equivalent to the ECE standards mentioned in this regulation.

#### 3.1 **General requirements on protection against electrical chock**

These requirements shall reduce deaths and injuries during a crash, during electric shock, which occur because of electrolyte spillage from propulsion batteries, intrusion of propulsion battery system components into the occupant compartment and electric shock.

These electrical safety requirements apply to high voltage buses of electric power train and electrical components which are galvanically connected to the high voltage bus of electric power train under conditions where they are not connected to external high voltage power supplies.

##### 3.1.1 Protection against direct contact

- For high voltage live parts inside the passenger compartment or luggage compartment, the protection degree IPXXD shall be provided.
- For high voltage live parts in areas other than the passenger compartment or luggage compartment, the protection degree IPXXB shall be provided.
- Live parts solid insulator, barrier, enclosure, etc ...shall not be able to be opened, disassembled or removed without the use of tools .
- Connectors and vehicles inlet can be separate without the use of tools if its comply with one at least from the following :
  - Comply with the above requirements.
  - provided with a locking mechanism.
  - The voltage of the live parts becomes equal or below DC 60V or below AC 30V (rms) within 1 second after the connector is separated.

##### 3.1.2 Protection against indirect contact:

- The exposed conductive parts, such as the conductive barrier and enclosure, shall be galvanic ally connected securely to the electrical chassis. And the resistance between all exposed conductive parts and the electrical chassis shall be less than 0.1ohm when there is current flow of at least 0.2 A .
- For vehicles which are intended to be connected to the grounded external electric power supply through the conductive connection between vehicle inlet and vehicle connector, a device to enable the galvanically connection shall be provided. The device should enable connection to the earth ground before exterior voltage is applied to the vehicle and retain the connection until after the exterior voltage is removed from the vehicle.

### 3.1.3 Isolation resistance

#### 3.1.3.1 Electric power train consisting of separate Direct Current- or Alternating Current-buses

If AC high voltage buses and DC high voltage buses are galvanically isolated from each other, isolation resistance between the high voltage bus and the electrical chassis shall have a minimum value of 100  $\Omega$ /volt of the working voltage for DC buses, and a minimum value of 500  $\Omega$ /volt of the working voltage for AC buses.

#### 3.1.3.1 Electric power train consisting of combined DC- and AC-buses

If AC high voltage buses and DC high voltage buses are galvanically connected, isolation resistance between the high voltage bus and the electrical chassis shall have a minimum value of 500  $\Omega$ /volt of the working voltage.

### 3.1.4 Rechargeable energy storage system (REESS)

REESS should have type approved in accordance with UNECE 100 Rev.3, as well as, it should comply with the following:

- The REESS or vehicle system shall provide a signal to activate the warning in the event of operational failure of the vehicle controls (e.g. input and output signals to the management system of REESS, sensors within REESS, etc.) that manage the safe operation of the REESS.
- The REESS or vehicle system shall provide a signal to activate the warning in the case of a thermal event in the REESS (as specified by the manufacturer).
- For a REESS containing flammable electrolyte, the REESS or vehicle system shall provide a signal to activate the advance warning indication in the vehicle to allow egress or 5 minutes prior to the presence of a hazardous situation inside the passenger compartment such as fire, explosion or smoke. REESS or vehicle manufacturer shall specify the parameters (for example, temperature, voltage or electrical current) which trigger the warning indication.
- If the REESS can be externally charged, vehicle movement by its own propulsion system shall be impossible as long as the vehicle connector is physically connected to the vehicle inlet.
- A warning to the driver in the event of low REESS state of charge shall be provided. The manufacturer shall determine the necessary level of REESS energy remaining.
- Battery that may produce hydrogen gas shall be provided with a ventilation fan or a ventilation duct to prevent the accumulation of hydrogen gas.
- During a normal charge procedure in the conditions given in Annex 8, hydrogen emissions shall be below 125 g during 5 h, or below 25 x t<sub>2</sub> g during t<sub>2</sub> (in h).

### 3.1.5 Protection against water effects.

The vehicles shall maintain isolation resistance after exposure to water (e.g. washing, driving through standing water). This paragraph shall not apply to electrical circuits that are galvanically connected to each other, where the DC part of these circuits is connected to the electrical chassis.

The vehicle manufacturer can choose to comply one the following requirements in (3.3.1 or 3.3.2 or 3.3.3):

3.1.5.1 The vehicle manufacturer shall follow the test procedures specified in Annex3, just after each exposure, and with the vehicle still wet, the resistance shall be less than 0.1  $\Omega$  when there is current flow of at least 0.2 amperes.

In addition, after a 24-hour pause, the isolation resistance test shall again be performed, and the isolation resistance requirements shall be met.

3.1.5.2 The following two tests should apply:

3.1.5.2.1 Washing.

This test is intended to simulate the normal washing of vehicles, but not specific cleaning using high water pressure or underbody washing.

The areas of the vehicle regarding this test are border lines, i.e. a seal of two parts such as flaps, glass seals, outline of opening parts, outline of front grille and seals of lamps.

All border lines shall be exposed and followed in all directions with the water stream using a hose nozzle and conditions in accordance with IPX5 as specified in Annex 3.

3.1.5.2.2 Driving through standing water.

The vehicle shall be driven in a wade pool, with 10 cm water depth, over 500 m at a speed of 20  $\pm$  2 km/h, in a time of approximately 1.5 min.

If the wade pool used is less than 500 m in length, then the vehicle shall be driven through it several times. The total time, including the periods outside the wade pool, shall be less than 10 min.

3.1.5.3 If an isolation resistance monitoring system is provided, and the isolation resistance less than the requirements given in paragraph 3.1.3. is detected, a warning shall be indicated to the driver. The function of the on-board isolation resistance monitoring system shall be confirmed by a documentation from the manufacturer.

### 3.1.6 Vibration test.

The test shall be conducted in accordance the below procedures:

During the test, there shall be no evidence of electrolyte leakage, rupture (applicable to high voltage REESS only), venting (for REESS other than open-type traction battery), fire or explosion. The evidence of electrolyte leakage shall be verified by visual inspection. For a high voltage REESS, the isolation resistance measured after the test shall not be less than 100  $\Omega/V$ .

3.1.6.1 Purpose.

The purpose of this test is to verify the safety performance of the REESS under a vibration environment which the REESS will likely experience during the normal operation of the vehicle

### 3.1.6.2 Installations.

This test shall be conducted either with the complete REESS or with REESS subsystem(s). If the manufacturer chooses to test with subsystem(s), the manufacturer shall demonstrate that the test result can reasonably represent the performance of the complete REESS with respect to its safety performance under the same conditions. If the electronic management unit for the REESS is not integrated in the casing enclosing the cells, then the electronic management unit may be omitted from installation on the Tested-Device if so requested by the manufacturer.

### 3.1.6.3 Procedure for conducting a standard cycle.

Procedure for conducting a standard cycle for a complete REESS, REESS subsystem(s), or complete vehicle.

#### 3.1.6.3.1 Standard discharge:

Discharge rate: The discharge procedure including termination criteria shall be defined by the manufacturer. If not specified, then it shall be a discharge with 1C current for a complete REESS and REESS subsystems.

Discharge limit (end voltage): Specified by the manufacturer.

For a complete vehicle, discharge procedure using a dynamometer shall be defined by the manufacturer. Discharge termination will be according to vehicle controls.

Rest period after discharge: minimum 15 min

#### 3.1.6.3.2 Standard charge:

The charge procedure shall be defined by the manufacturer. If not specified, then it shall be a charge with C/3 current. Charging is continued until normally terminated.

For a complete vehicle that can be charged by an external source, charge procedure using an external electric power supply shall be defined by the manufacturer. For a complete vehicle that can be charged by on-board energy sources, a charge procedure using a dynamometer shall be defined by the manufacturer. Charge termination will be according to vehicle controls.

### 3.1.6.4 Test procedure:

The Tested-Device shall be subjected to a vibration having a sinusoidal waveform with a logarithmic sweep between 7 Hz and 50 Hz and back to 7 Hz traversed in 15 minutes. This cycle shall be repeated 12 times for a total of 3 hours in the vertical direction of the mounting orientation of the REESS as specified by the manufacturer.

The correlation between frequency and acceleration shall be as shown in following table:

## Frequency and acceleration

<i>Frequency (Hz)</i>	<i>Acceleration (m/s<sup>2</sup>)</i>
7 - 18	10
18 - 30	gradually reduced from 10 to 2
30 - 50	2

- At the request of the manufacturer, a higher acceleration level as well as a higher maximum frequency may be used.
- At the choice of the manufacturer, a vibration test profile determined by the vehicle manufacturer verified for the vehicle application may be used as a substitute for the frequency - acceleration correlation of above table.
- The REESS certified according to this condition shall be limited to the installation for a specific vehicle type.
- After the vibration profile, a standard cycle as described in paragraph 3.4.3. shall be conducted,
- The test shall end with an observation period of 1 hour at the ambient temperature conditions of the test environment.
- The test temperature should be according to ECE R 100 rev3 Or UN GTR 20 regulation.

As an alternative to the tests mentioned in clauses 3.1.5 and 3.1.6 of the Vehicle Wash Test and Vibration Test, the corresponding tests according to Regulation No. ECE R 100 can be accepted.

## **3.2 Impact Strength**

### **3.2.1 Frontal Impact**

This requirement specifies the limit of the rearward displacement of the steering to reduce the likelihood of chest, neck or head injuries. The body injuries are measured by using dummies with electrical impulse connections and measuring instruments. The electrical protection and electrolyte spillage are also measured.

#### **3.2.1.1 Mechanical protection:**

After the frontal impact:

- The part of the steering control surface directed towards the driver shall not present any rough edges likely to increase the danger or severity of injuries to the driver. The steering displacement shall be less than 127mm.
- No rigid component in the passenger compartment shall constitute a risk of serious injury to the occupants.
- The side doors of the vehicle shall not open under the effect of the impact to prevent occupant thrown out during an impact.
- The opening of doors to enable all the passengers to emerge shall be possible without the use of tools.

- The dummy performance criteria shall be complied to indicate that the occupants will not receive any serious injuries.

For detailed requirements on the electrical safety requirements refer to UNECE 94

### 3.2.1.2 Electrical Protection

The following conditions shall be complied to avoid any electric shock:

#### 3.2.1.2.1 Protection against Electrical Shock

As a result of impact one of the following conditions indicated in items below shall be complied to avoid any electric shock:

##### 3.2.1.2.1.1 Absence of high voltage

The voltages between high voltage buses shall be low as possible. The voltages  $V_b, V_1$  and  $V_2$  of the high voltage buses shall be equal or less than 30VAC or 60 VDC .The voltage measurement shall be made no earlier than 5 seconds, but, not later than 60 seconds after the impact.

##### 3.2.1.2.1.2 Low electrical energy

The total energy on the high voltage buses shall be low as possible. The total energy (TE) on the high voltage buses shall be less than 2.0 Joules.

##### 3.2.1.2.1.3 Physical protection

- The resistance between all exposed conductive parts and the electrical chassis shall be low as possible, lower than 0.1ohm when there is a current flow of at least 0.2 A.
- For protection against direct contact with high voltage live parts the protection IPXXB shall be provided.

##### 3.2.1.2.1.4 Isolation resistance

The isolation resistance between the high voltage bus and the electrical chassis shall have a minimum value of 100  $\Omega$ /volt of the working voltage for DC buses, and a minimum value of 500  $\Omega$ /volt of the working voltage for AC buses.

### 3.2.1.3 Electrolyte spillage

As a result of impact there shall be no electrolyte leakage or should be no more than 7 per cent by volume of the REESS electrolyte with a maximum of 5.0 l to avoid fire or electric shock and to reduce deaths and injuries. In the period from the impact until 30 minutes after no electrolyte from the REESS shall spill into the passenger compartment and no more than 7% with a maximum of 5.0 l of electrolyte shall spill from the REESS except open type traction batteries outside the passenger compartment

### 3.2.1.4 RESS retention

As a result of impact, the REESS (Electrical Power Train) shall not enter the passenger compartment during or after the impact.

For detailed requirements on the electrical safety requirements refer to UNECE 100

## 3.2.2 Rear Impact

This requirement specifies the limit of the inward displacement of the passenger compartment to reduce the likelihood of death and injuries. Its purpose is to protect passengers from the risk of fire or toxic or any electrical shock as a result of electrolyte spillage inside the passenger compartment during and after motor vehicle crashes.



### 3.2.2.1 Mechanical effect

After the rear impact on the vehicle the following shall be met:

- The longitudinal displacement of the vertical projection of the floor shall not cause any injury to the passengers. Longitudinal relative displacement of R point of rear seat should be less than 75mm".
- The side doors of the vehicle shall not open under the effect of the impact to prevent occupant thrown out during any impact
- The opening of doors to enable all the passengers to emerge shall be possible without the use of tools.

### 3.2.3 Side Impact

This requirement is to protect the occupants in side impact crashes. The purpose of this regulation is to reduce the risk of serious and fatal injury to the passenger in case of accidents. It also covers the requirements to avoid electrical shock.

#### 3.2.3.1 Static side Impact

- The side doors shall be reinforced to reduce the impact forces from the side and to reduce the injuries or deaths due to side impact.
- The strength of the body structure and doors shall be such when tested the vehicle in accordance with Gulf standard the vehicle shall meet the following requirement to indicate the structure is strong enough to absorb the forces applied on them:
  - The initial crush resistance be more than 1020 kg.
  - The intermediate crush resistance be more than 1590 kg
  - The peak crush resistance be more than twice the curb weight of the vehicle or 3175 kg whichever is less.

#### 3.2.3.2 Dynamic side Impact

- After the impact, the side doors should be strong enough that the passengers will not receive any serious injuries in a side impact with other vehicles or rollover accidents. The body injuries are measured by using dummies with electrical impulse connections and measuring instruments.
- At the end of specified impact no rigid component in the passenger compartment shall constitute a risk of serious injury to the passengers.
- The side doors of the vehicle which are not impacted shall not open under the effect of the impact, and the latches shall not separate from the striker to prevent passenger thrown out during an accident.
- After the side impact the conditions indicated in item 3/2/1/2 shall be complied to avoid electric shock.

#### 3.2.3.3 Roof Strength

This requirement establishes strength requirement for the passenger compartment roof to reduce deaths and injuries due to crushing of the roof into the passenger compartment in rollover crashes. The maximum displacement of any vehicle less than 2722kg after the impact the roof of vehicle shall not exceed 127 mm when tested according to GSO regulation .

For detailed requirements on the safety requirements refer to GSO standards and standards in annex 1 .

#### **4. Performance of the electrical vehicles**

##### **4.1 Electrical performance**

- The Technical Service in charge of the tests conducts the measurement of the electric energy consumption according to the method and test cycle described in UNECER 101 -Annex 7 to this Regulation.
- The Technical Service in charge of the tests conducts the measurement of the electric range of the vehicle according to this Regulation. The electric range measured by this regulation is the only one which may be included in sales promotional material. This value must also be used for the calculations
- The result of the electric energy consumption must be expressed in Watt hours per kilometer (Wh/km) and the range in km, both rounded to the nearest whole number.
- If the measured value of electric energy exceeds the manufacturer's declared electric energy value by more than 4 %, then another test is run on the same vehicle. When the average of the two test results does not exceed the manufacturer's declared value by more than 4 %, then the value declared by the manufacturer is taken as the type approval value.
- If the average still exceeds the declared value by more than 4 %, a final test is run on the same vehicle. The average of the three test results is taken as the type approval value.
- The electric range value adopted as the type approval value shall be the value declared by the manufacturer if this is no more than the value measured by the Technical Service. The declared value may be lower than the measured value without any limitations.
- If the declared range value exceeds the value measured by the Technical Service, then another test is run on the same vehicle. When the manufacturer declared value does not exceed the average of the two test results, then the value declared by the manufacturer is taken as the type approval value.
- If the declared value still exceeds the average measured value a final test is run on the same vehicle. The average of the three results is taken as the type approval value.

##### **4.2 Test conditions**

###### **4.2.1. Condition of the vehicle**

- The vehicle tyres shall be inflated to the pressure specified by the vehicle manufacturer when the tyres are at the ambient temperature.
- The lighting and light-signaling and auxiliary devices shall be off, except those required for testing and usual daytime operation of the vehicle.
- All energy storage systems available for other than traction purposes (electric, hydraulic, pneumatic, etc.) shall be charged up to their maximum level specified by the manufacturer.
- If the batteries are operated above the ambient temperature, the operator shall follow the procedure recommended by the vehicle manufacturer in order to keep the temperature of the battery in the normal operating range.

- The manufacturer's agent shall be in a position to attest that the thermal management system of the battery is neither disabled nor reduced.
- The vehicle must have undergone at least 300 km during the seven days before the test with those batteries that are installed in the test vehicle.

#### 4.3 Test methods

The electrical range should be test according to ISO 8714 and the same test sequence in annex A in ISO 8714 shall be used to define energy consumption and range.

If the electric vehicle complies with the latest version of UN-R101 it's accepted as an alternative to ISO 8714.

#### 4.4 Electric energy consumption, C

All cars should be equipped with the electrical car performance label. The performance values must be specified at the standard conditions based on a declaration and on the responsibility of the manufacturer.

The energy consumption C is the Energy required to travel D km in standardized conditions, shall be calculated using the formula:

$$C = \frac{E}{D}$$

Expressed in watt-hours per kilometer (Wh/km), rounded to the nearest whole number.

E: Energy in Wh

D : test is the distance covered during the test (km).

Electric energy consumption (Wh / Km ) shall be not more than 300 Wh/ Km .

#### 4.5 Total Range:

The maximum distance an electrified vehicle can travel using battery power over a designated test sequence on a fully charged traction battery, to the end of the test sequence expressed in kilometers (km). It should be at least 200 KM it should be specified and declared from manufactures

### 5. Manufacture Responsibility

- 5.1 The manufacturers should carryout type test for all the requirements of this regulation.
- 5.2 Each manufacturer shall prepare manual with risks and all the warnings for safe use for electrical cars.
- 5.3 Warning shall be written in case of any accident with following meaning:
  - A damaged 400 V circuit component or cable may cause burns or electrocution so do not touch damaged orange 400 V cables or the 400 V components.
  - If the traction battery is damaged, there may be a delayed risk of fire. In this Case, it is necessary to place the vehicle or the damaged battery under surveillance in a dedicated and secure storage area so as to prevent the start of a fire.
  - The manufacturers and dealers shall provide proper training to civil defense departments on response and proved them with:
    - a- procedure for a vehicle involved in an impact whilst charging.
    - b- Procedure for a vehicle on fire and should include:

- Hazards and protective equipment to be use.
- Action procedure to extinguish the vehicle.

c- Instructions for avoiding high voltage area and Instructions for freeing vehicle occupants.

- Prohibited cutting areas.
- Recommended cutting areas.

d - Procedure in the event of an electrolyte leak from the traction battery.

- 5.4 The manufacturers or his dealer should have at least one workshop with all qualified and trained people for regular maintenance and repairing their vehicles.
- 5.5 All cars should be equipped with the electrical car performance label, it must be non-removable and placed at area can be easily seen.
- 5.6 Training the buyer on the correct and safe way to use these vehicles, how to maintain them, how to charge their batteries, etc

## **6. Electric Vehicle Charging and Supply Equipment Systems**

### **6.1 Equipment Construction**

#### **6.1.1 Electric Vehicle Coupler:**

The electric vehicle coupler shall comply with:

- The electric vehicle coupler shall have a configuration that is non-interchangeable with wiring devices in other electrical systems. Non-grounding-type electric vehicle couplers shall not be interchangeable with grounding-type electric vehicle couplers.
- The electric vehicle coupler shall be constructed and installed so as to guard against inadvertent contact by persons with parts made live from the electric vehicle supply equipment or the electric vehicle battery.
- The electric vehicle coupler shall be provided with a positive means to prevent unintentional disconnection.
- If a grounding pole is provided, the electric vehicle coupler shall be so designed that the grounding pole connection is the first to make and the last to break contact.

#### **6.1.2 Power Rating:**

Electric vehicle supply equipment shall have sufficient rating to supply the load served . Where an automatic load management system is used, the maximum electric vehicle supply equipment load on a service or feeder shall be the maximum load permitted by the automatic load management system.

#### **6.1.3 Markings:**

- All electric vehicle supply equipment shall be marked by the manufacturer as follows:  
“FOR USE WITH ELECTRIC VEHICLES “
- The electric vehicle supply equipment shall be clearly marked if ventilation not required by the manufacturer as follows:  
“Ventilation not required “
- The electric vehicle supply equipment shall be clearly marked by the manufacturer,

“Ventilation Required.”

The marking shall be located so as to be clearly visible after installation.

#### 6.1.4 Cords and Cables:

The cable for cord-connected equipment shall comply with all of the following:

- The overall useable length shall not exceed 7.5 m unless equipped with a cable management system that is part of a listed the electric vehicle supply equipment or electric vehicle charging system.
- Where the electric vehicle supply equipment or charging system is not fixed in place, the cord exposed useable length shall be measured from the face of the attachment plug to the face of the electric vehicle connector.
- Where the electric vehicle supply equipment or charging system is fixed in place, the useable length of the output cable shall be measured from the cable exit of the electric vehicle supply equipment or charging system to the face of the electric vehicle connector.

Other cable types and assemblies listed as being suitable for the purpose, including optional hybrid communications, signal, and composite optical fiber cables, shall be permitted.

#### 6.1.5 Interlock.

Electric vehicle supply equipment shall be provided with an interlock that de-energizes the electric vehicle connector and its cable whenever the electrical connector is uncoupled from the electric vehicle.

#### 6.1.6 Automatic De-Energization of Cable.

The electric vehicle supply equipment or the cable-connector combination of the equipment shall be provided with an automatic means to de-energize the cable conductors and electric vehicle connector upon exposure to strain that could result in either cable rupture or separation of the cable from the electric connector and exposure of live parts.

#### 6.1.7 Personnel Protection System (Emergency disconnected devices)

The electric vehicle supply equipment shall have a listed system of protection against electric shock of personnel.

## 6.2 Installation

#### 6.2.1 Branch Circuit Markings.

When a branch circuit is installed to supply electric vehicle supply equipment (or electric vehicle charging system), a label shall be permanently affixed adjacent to the outlet box and shall contain the following information:

“For use with electric vehicle supply equipment (or) electric vehicle charging system)”,  
In addition to showing the appropriate voltage and current data for use

#### 6.2.2 Overcurrent Protection.

Overcurrent protection for feeders and branch circuits supplying electric vehicle supply equipment shall be sized for continuous duty and shall have a rating of not less than 125 percent of the maximum load of the electric vehicle supply equipment. Where non-

continuous loads are supplied from the same feeder or branch circuit, the overcurrent device shall have a rating of not less than the sum of the non-continuous loads plus 125 percent of the continuous loads.

### 6.2.3 Electric Vehicle Supply Equipment Connection.

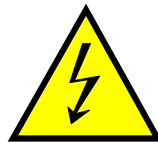
Electric vehicle supply equipment shall be permitted to be cord and plug connected to the premises wiring system in accordance with one of the following:

- Electric vehicle supply equipment that is rated 250 volts maximum and complies with all of the following:
  - It is intended for connection to receptacle outlets rated no more than 50 amperes.
  - It is installed to facilitate any of the following:
    - a. Facilitate maintenance and repair
    - b. Repositioning of Portable, movable, or EVSE fastened in place
- The length of the power supply cord for electric vehicle supply equipment fastened in place is limited to (1.8 m).
- Receptacles are located to avoid physical damage to the flexible cord.
- All other electric vehicle supply equipment shall be permanently connected to the premises wiring system.

## 7. Marking

- The REESS having high voltage capability shall be identify with the symbol shown in Figure 1. The symbol background shall be yellow, the bordering and the arrow shall be black.
- Cables for high voltage buses which are not located within enclosures shall be identified by having an outer covering with orange.

### Marking of High Voltage Equipment



## 8. Spare Tire

Electric vehicles equipped with a repair kit are exempted from the requirement to provide the vehicle with a spare tire, which is mentioned in the Gulf Technical Regulation No. GSO 42.

## Annex 1

## GSO Standards / Technical Regulation for Electrical Motor Vehicles

No.	GSO Standard	Arabic Title	English Title
1	GSO 36	السيارات - طرق اختبار تحمل الصدمات - الجزء الأول : الصدمة الأمامية	motor vehicles – methods of test for impact strength - Part 1 : frontal impact
2	GSO 37	السيارات - طرق تحمل الصدمات - الجزء الثاني : الصدمة الخلفية بالصادم المتحرك	Motor vehicles –methods of test for impact strength - Part 2 : moving barrier rear impact
3	GSO 38	السيارات - طرق اختبار تحمل الصدمات - الجزء الثالث أ : الصدمة الجانبية	Motor vehicles -methods of test for impact strength - Part 3 a : side impact
4	GSO 39	السيارات - طرق اختبار تحمل الصدمات - الجزء الرابع : متانة السقف	Motor vehicles -methods of test for impact strength - Part 4 :roof strength
5	GSO 40	السيارات . تحمل الصدمات	Motor vehicles -impact strength
6	GSO 41	السيارات - أداة الوقاية الخارجية الأمامية والخلفية لسيارات الركوب (الصدّامات وغيرها) وطرق اختبارها.	Motor Vehicles: front and rear exterior protection devices for passenger's cars (Bum Pers etc.) and its methods of test.
7	GSO 42	السيارات - المتطلبات العامة	Motor vehicles - General requirements
8	GSO 48	السيارات - شهادات المطابقة	Motor vehicles conformity certificates
9	GSO 51	إطارات سيارات الركوب - الجزء الأول : التسميات والتميز والبيانات الإيضاحية والأبعاد والأحمال وضغوط النفخ.	Passenger car tyres - Part 1: Nomenclature, designation, marking, dimensions, load capacities and inflation pressure
10	GSO 52	إطارات سيارات الركوب - الجزء الثاني : المتطلبات العامة	Passenger car tyre - part 2: general requirement
11	GSO 53	إطارات سيارات الركوب - الجزء الثالث : طرق الاختبار	Passenger car tyres - part 3: methods of test
12	GSO 96	السيارات - طرق اختبار أحزمة الأمان	Motor vehicles - Methods of testing safety belts.
13	GSO 97	السيارات - أحزمة الأمان	Motor vehicles - safety belts

No.	GSO Standard	Arabic Title	English Title
14	GSO 98	السيارات - قابلية الأجزاء الداخلية للاشتعال وطرق اختبارها.	Motor vehicles-flammability of interior materials and testing methods
15	GSO 99	مركبات الطرق - المنبهات الصوتية - المواصفات الفنية	Road vehicles - Sound signaling devices - Technical specification
16	GSO 159	السيارات - الأبعاد والأوزان	Motor Vehicles - Dimensions and weights
17	GSO 279	طرق اختبار فرش السيارات - قماش تنجيد مقاعد السيارة	Car Upholstery - Testing Methods of Fabric for Car Seats
18	GSO 280	فرش السيارات - قماش تنجيد مقاعد السيارة	Car Upholstery - Fabric for Car Seats
19	GSO 289	مركبات الطرق - لوحات الأرقام ذات الخلفية العاكسة وطرق اختبارها	Road vehicles retro - reflective number plates and its methods of test
20	GSO 290	كتيب إرشادات الأجهزة والمعدات	Instruction Manual for Appliances and Equipment
21	GSO 419	السيارات - طرق اختبار أقفال الأبواب ومفصلاتها	Motor vehicles - methods of test for door locks and door hinges
22	GSO 420	السيارات - أقفال الأبواب ومفصلاتها	Motor vehicles - door locks and door hinges
23	GSO 421	السيارات - طرق اختبار مرايا الرؤية الخلفية	Motor vehicles - Methods of testing of rear view mirrors.
24	GSO 422	السيارات - مرايا الرؤية الخلفية.	Motor Vehicles: Rearview mirrors
25	GSO 581	اشتراطات تخزين إطارات السيارات	Requirements for storage of motor vehicle tyres
26	GSO 645	إطارات السيارات متعددة الأغراض والشاحنات والحافلات والمقطورات - الجزء الأول: المسميات والتميز والبيانات الإيضاحية والأبعاد والأحمال وضغوط النفخ.	Multi-Purpose Vehicles, Trucks, Buses and Trailers Tyres - Truck and Bus - Part 1: Nomenclature, Designation Marking, Dimensions, Load Capacities and Inflation Pressures
27	GSO 646	إطارات السيارات متعددة الأغراض والشاحنات والحافلات والمقطورات - الجزء الثاني: طرق الاختبار.	Multi-Purpose Vehicles, Trucks, Buses and Trailers Tyres - Part 2: Methods of Test
28	GSO 647	إطارات السيارات متعددة الأغراض والشاحنات والحافلات والمقطورات - الجزء الثالث: المتطلبات العامة	Multi-Purpose Vehicles, Trucks, Buses and Trailers Tyres - Part 3: General Requirements



No.	GSO Standard	Arabic Title	English Title
29	GSO 963	السيارات - المتطلبات العامة لسيارات الإسعاف	Motor vehicles -General requirements for ambulance.
30	GSO 1052	إطارات السيارات - العجلات والإطارات الاحتياطية المؤقتة وطرق اختبارها.	Motor vehicles tyers - temporary use spare wheels /tyers and there methods test
31	GSO 1053	السيارات. الحماية من السرقة	Motor Vehicles - Protection against theft
32	GSO 1503	أنوار المصابيح الأمامية للسيارات - متطلبات الأمان.	Motor Vehicle - Head Lamps Safety Requirements.
33	GSO 1598	السيارات - مساند الرأس وطرق اختبارها.	Motor Vehicles - Head restraints and method of testing.
34	GSO 1625	السيارات - محددات السرعة - الجزء الثاني : المتطلبات الفنية	Motor vehicles – Speed limiters – Part 2: Technical requirements.
35	GSO 1626	السيارات - محددات السرعة - الجزء الثالث : طرق الاختبار	Motor vehicles – speed limiters – Part 3: Methods of test.
36	GSO 1677	السيارات - زجاج الأمان متعدد الطبقات	Motor vehicles – laminated safety glass
37	GSO 1707	السيارات – طرق اختبار تحمل الصدمات – الجزء الثالث ب : الصدمة الجانبية بالصادم المتحرك	motor vehicles – methods of test for impact strength – Part 3b -moving barrier side impact
38	GSO 1708	السيارات – طرق اختبار تحمل الصدمات – الجزء الثالث ج : الصدمة الجانبية بالصادم المتحرك	motor vehicles – methods of test for impact strength – part 3c : moving barrier side impact
39	GSO 1709	السيارات – وسائل تثبيت الطفل	Motor vehicles – child restraint system
40	GSO 1710	السيارات - طرق اختبار وسائل الطفل	Motor vehicles methods of testing of child restraint system
41	GSO 1711	السيارات محددات السرعة - الجزء الأول : المتطلبات العامة ، فحص الجهاز ، شهادات المطابقة، اعتماد الطراز.	Motor vehicles – Speed limits – Part 1 : General requirements , Equipment inspection , Certification and type approval
42	GSO 1780	السيارات – الرقم المميز للمركبة – المتطلبات	Motor Vehicle – Identification Number (Vin) Requirements
43	GSO 1781	السيارات – الرمز العالمي لصانع المركبة	Motor Vehicles – World manufacturer identifier code
44	GSO 1782	السيارات – الرقم المميز للمركبة – وضعة وتثبيته	Motor Vehicles – VIN-Location and attachment

No.	GSO Standard	Arabic Title	English Title
45	GSO 1783	إطارات سيارات الركوب درجة مقامة تأكل الموطىء والسحب والحرارة.	Motor Vehicles Tyres – Treadwear, Traction and Temperature Resistance Grading
46	GSO 1784	إطارات سيارات الركوب – طرق اختبار درجة مقاومة الإطار للحرارة.	Motor Vehicles Tyres – Method of Testing of Tire Temperature Resistance Grading.
47	GSO ISO 3537	السيارات - مواد زجاج الأمان - طرق الاختبارات الميكانيكية	Road vehicles - Safety glazing materials - Mechanical tests Road vehicles -
48	GSO ISO 3538	السيارات - زجاج الأمان - طرق اختبار الخصائص البصرية	Road Vehicles - Safety Glasses - Test Methods for Optical Properties
49	GSO ISO 6311	السيارات – طرق اختبار بطانات المكابح – الجزء الأول – إجهاد القص الداخلي لمادة البطانة	Motor vehicles – methods of terting for broke lining – part 1: internal shear strength of lining material.
50	GSO ECE 13H	السيارات - نظام مكابح سيارات الركوب والسيارات متعددة الأغراض	Motor Vehicles - Braking system of Passenger Car and Multi-Purpose Vehicles
51	GSO ECE 13H-1	السيارات - طرق الاختبار لنظام المكابح - الجزء الأول : أداء المكابح	Motor Vehicles: Methods of Test for Braking System -- Part 1: Braking Performance
52	GSO ECE 13H-2	السيارات - طرق الاختبار لنظام المكابح - الجزء الثاني : تعيين سعة أجهزة تخزين الطاقة	Motor Vehicles: Methods of Test for Braking System -- Part 2: Determination of Capacity of Energy Storage Devices
53	GSO ECE 13H-3	السيارات - طرق الاختبار لنظام المكابح - الجزء الثالث : تعيين توزيع المكابح بين محاور المركبات	Motor Vehicles: Methods of Test for Braking System – Part 3: Determination of Distribution of Braking among the Axles of Vehicles
54	GSO ECE 13H-4	السيارات - طرق الاختبار لنظام المكابح - الجزء الرابع : تعيين وظيفة الأنظمة ضد القفل	Motor Vehicles: Methods of Test for Braking System -- Part 4: Determination of Function of Anti-Lock Systems
55	GSO ECE 13H-5	السيارات -- طرق الاختبار لنظام المكابح -- الجزء الخامس : تعيين أداء بطانة الكبح باستخدام دينامومتر القصور الذاتي	Motor Vehicles: Methods of Test for Braking System -- Part 5: Determination of Performance of Brake Lining Using Inertia Dynamometer
56	GSO ECE 13H-6	السيارات -- طرق الاختبار لمكابح النظام -- الجزء السادس : تعيين معامل الالتصاق	Motor Vehicles: Methods of Test for Braking System -- Part 6: Determination of Coefficient of Adhesion

No.	GSO Standard	Arabic Title	English Title
<b>التركيبات الكهربائية والحماية ضد الصدمة الكهربائية (Electrical installations and protection against electric shock)</b>			
57	GSO IEC 61140	الحماية من الصدمة الكهربائية - مظاهر مشتركة للتركيبات والمعدات .	Protection against electric shock - Common aspects for installation and equipment
58	GSO IEC 60364-7-722*	التركيبات الكهربائية ذات الجهد المنخفض - الجزء رقم (722-7) : متطلبات التركيبات أو المواقع الخاصة - اجهزة التغذية للمركبات الكهربائية .	Low-voltage electrical installations - Part 7-722: Requirements for special installations or locations - Supplies for electric vehicles
59	GSO ISO 10924-1	مركبات الطرق -- قواطع الدائرة -- الجزء الأول : التعاريف و المتطلبات العامة للاختبار	Road vehicles -- Circuit breakers -- Part 1: Definitions and general test requirements
60	GSO ISO 10924-4	مركبات الطرق -- قواطع الدائرة -- الجزء الرابع : قواطع الدائرة المتوسطة مع عروة (نوع نصلي)، من سي بي 15	road vehicles -- circuit breakers -- part 4: medium circuit breakers with tabs (blade type), form cb15
<b>الانظمة الكهربائية للمركبات الكهربائية – انظمة الشحن (Electrical systems for electric road vehicles -Charging systems)</b>			
61	GSO IEC TS 61439-7	تجميعات معدات الوصل والفصل والتحكم ذات الجهد المنخفض- الجزء 7: تجميعات لأغراض معينة مثل المراسي ومواقع التخميم وساحات التسوق ومحطات شحن المركبات الكهربائية	Low-voltage switchgear and controlgear assemblies - Part 7: Assemblies for specific applications such as marinas, camping sites, market squares, electric vehicles charging stations.
62	GSO IEC 61851-1	نظام الشحن الكهربائي الموصل للمركبة - الجزء رقم (1) : متطلبات عامة	Electric vehicle conductive charging system - Part 1: General requirements
63	GSO IEC 61851-22	نظام الشحن الكهربائي الموصل للمركبة - الجزء رقم (22) : مركز شحن مركبة كهربائية مغذى بتيار متردد	Electric vehicle conductive charging system - Part 22: AC electric vehicle charging station
64	GSO IEC 61980-1	الانظمة اللاسلكية لنقل الطاقة الخاصة بالمركبات الكهربائية – الجزء رقم (1) : متطلبات عامة	Electric vehicle wireless power transfer (WPT) systems - Part 1: General requirements

No.	GSO Standard	Arabic Title	English Title
65	GSO IEC 61851-23	نظام الشحن الكهربائي الموصل للمركبة- الجزء 23: محطة شحن مركبة كهربائية يتيار مستمر	Electric vehicle conductive charging system - Part 23: DC electric vehicle charging station
66	GSO IEC 61851-24	نظام الشحن الكهربائي الموصل للمركبة- الجزء 24: التوصيل الرقمي بين محطة شحن المركبة الكهربائية بتيار مستمر ونظام التحكم في شحن المركبة الكهربائية يتار مستمر	Electric vehicle conductive charging system - Part 24: Digital communication between a d.c. EV charging station and an electric vehicle for control of d.c. charging
<b>(Switches, boxes and enclosures for household and similar purposes, plugs and socket outlets for d.c. and for the charging of electrical vehicles including their connectors)</b>			
68	GSO IEC 62196-1	القوابس ، منافذ المقابس ، موصلات المركبات ومداخل المركبات – موصل الشحن للمركبات الكهربائية – الجزء 1: المتطلبات العامة	Plugs, socket-outlets, vehicle connectors and vehicle inlets - Conductive charging of electric vehicles - Part 1: General requirements
69	GSO IEC 62196-2	القابسات والمقابس ووصلات المركبة ومداخل المركبة - الشحن التوصيلي للمركبات الكهربائية - الجزء 2: توافق الأبعاد ومتطلبات قابلية التبادل لمسمار التيار المتردد وملحقات صمام التلامس	Plugs, socket-outlets, vehicle connectors and vehicle inlets - Conductive charging of electric vehicles - Part 2: Dimensional compatibility and interchangeability requirements for a.c. pin and contact-tube accessories
70	GSO IEC 62196-3	القابسات والمقابس ووصلات المركبة ومداخل المركبة - الشحن التوصيلي للمركبات الكهربائية - الجزء 2: توافق الأبعاد ومتطلبات قابلية التبادل لمسمار التيار المستمر ومستمر/ متردد و صمام التلامس للمقرنات المركبة	Plugs, socket-outlets, vehicle connectors and vehicle inlets - Conductive charging of electric vehicles - Part 3: Dimensional compatibility and interchangeability requirements for d.c. and a.c./d.c. pin and contact-tube vehicle couplers
71	GSO ISO 8820-1	مركبات الطرق الوعرة -- أسلاك المصاهر -- الجزء 1: تعاريف ومتطلبات اختبار عامة	Road vehicles -- Fuse-links -- Part 1: Definitions and general test requirements
72	GSO ISO 8820-6	مركبات الطرق الوعرة -- أسلاك المصاهر -- الجزء 6: أسلاك مصاهر بمسما مفرد	Road vehicles -- Fuse-links -- Part 6: Single- bolt fuse-links

No.	GSO Standard	Arabic Title	English Title
73	GSO IEC 60269-1	مصاهر الجهد المنخفض الجزء الأول : المتطلبات العامة.	Low-voltage fuses - Part 1: General requirements
74	GSO IEC 62335	قواطع الدائرة - أدوات الوقاية الأرضية المحمولة القابلة للوصل والفصل والتي تعمل بالتيار المتبقي لتطبيقات المركبات فئة (ا) والمغذاة ببطارية .	Circuit breakers - Switched protective earth portable residual current devices for class I and battery powered vehicle applications
<b>التوافق الكهرومغناطيسي (Electromagnetic compatibility EMC)</b>			
75	GSO IEC 61851-21-1	نظام الشحن الكهربائي الموصل للمركبة- الجزء 21-1 : متطلبات التوافق الكهرومغناطيسي للشاحن المركب علي المركبات الكهربية لاتصال الموصل لمصدر تيار متردد/ مستمر	Electric vehicle conductive charging system - Part 21-1 Electric vehicle on-board charger EMC requirements for conductive connection to AC/DC supply
76	GSO IEC 61851-21-2	نظام الشحن الكهربائي الموصل للمركبة- الجزء 21-2 : متطلبات التوافق الكهرومغناطيسي لشاحن المركبات الكهربائية لاتصال الموصل لمصدر تيار متردد/ مستمر- متطلبات التوافق الكهرومغناطيسي لأنظمة شحن المركبات الكهربائية الخارجية	Electric vehicle conductive charging system - Part 21-2: Electric vehicle requirements for conductive connection to an AC/DC supply - EMC requirements for off-board electric vehicle charging systems
77	GSO IEC 60050-161	المفردات الدولية الكهروتقنية (IEV)- الفصل 161 : التوافق الكهرومغناطيسي	International Electrotechnical Vocabulary (IEV) – Chapter 161: Electromagnetic compatibility
<b>الكابلات الكهربائية لمركبات الطرق الكهربائية (Cables for electric road vehicles)</b>			
78	GSO ISO 6722-1	مركبات الطرق -- الكابلات الأحادية القلب ذات جهد 60 فولت و 600 فولت -- الجزء 1: الأبعاد وطرق الاختبار والمتطلبات الخاصة بكابلات النحاس الموصلة	Road vehicles -- 60 V and 600 V single-core cables -- Part 1: Dimensions, test methods and requirements for copper conductor cables
79	GSO ISO 6722-2	مركبات الطرق -- الكابلات الأحادية القلب ذات جهد 60 فولت و 600 فولت -- الجزء 2: أبعاد	Road vehicles -- 60 V and 600 V single-core cables -- Part 2: Dimensions, test methods

No.	GSO Standard	Arabic Title	English Title
		كابلات الألومنيوم الموصلة وطرق اختبارها ومتطلباتها	and requirements for aluminium conductor cables
80	GSO IEC/TR 60783	تمديدات ووصلات مركبات الطرق الكهربائية	Wiring and connectors for electric road vehicles
81	GSO ISO 4141-1	مركبات الطرق الوعرة -- كابلات التوصيل متعددة القلوب -- الجزء 1: طرق اختبار ومتطلبات الأداء الأساسي للكابلات المغلفة	Road vehicles -- Multi-core connecting cables -- Part 1: Test methods and requirements for basic performance sheathed cables
82	GSO ISO 4141-2	مركبات الطرق الوعرة -- كابلات التوصيل متعددة القلوب -- الجزء 2: طرق اختبار ومتطلبات الأداء العالي للكابلات المغلفة	Road vehicles -- Multi-core connecting cables -- Part 2: Test methods and requirements for high performance sheathed cables
83	GSO ISO 4141-3	مركبات الطرق الوعرة -- كابلات التوصيل متعددة القلوب -- الجزء 3: التركيب والأبعاد ووسم الكابلات للجهد المنخفض المغلفة وغير محجبة	Road vehicles -- Multi-core connecting cables -- Part 3: Construction, dimensions and marking of unscreened sheathed low-voltage cables
84	GSO ISO 4141-4	مركبات الطرق الوعرة -- كابلات التوصيل متعددة القلوب -- الجزء 4: طريقة اختبار المفاصل ومتطلبات تجميعات الكابلات ذات ملفات	Road vehicles -- Multi-core connecting cables -- Part 4: Test methods and requirements for coiled cable assemblies
85	ISO 14572*	مركبات الطرق الوعرة -- الكابلات المستديرة متعددة الأقطاب المغلفة غير المحجبة لجهود 60 فولت و600 فولت -- طرق اختبار ومتطلبات أداء الكابلات الأساسي والعالي	Road vehicles -- Round, sheathed, 60 V and 600 V screened and unscreened single- or multi-core cables -- Test methods and requirements for basic- and high-performance cables
86	GSO IEC/TR 62602	موصلات الكابلات المعزولة - بيانات أحجام النظام الأمريكي لقياس الأسلاك (AWG) ولمقاسات الموصلات بوحدات KCMIL.	Conductors of insulated cables - Data for AWG and KCMIL sizes

No.	GSO Standard	Arabic Title	English Title
<b>متطلبات السلامة (Safety Requirements)</b>			
87	GSO IEC/TS 60479-1	تأثيرات التيار على الجنس البشرى والحيوانات -الجزء الأول : سمات عامة	Effects of current on human beings and livestock - Part 1: General aspects
88	GSO IEC 60479-2	تأثيرات التيار المار خلال الجسم البشرى - الجزء الثاني : سمات خاصة	Effects of current on human beings and livestock - Part 2: Special aspects
89	GSO IEC 60755	المتطلبات العامة لأجهزة الحماية العاملة بالتيار المتبقي	General requirements for residual current operated protective devices
90	GSO ISO 17409	مركبات الطرق المدفوعة كهربائياً- التوصيل لمصدر قدرة كهربية خارجي - متطلبات السلامة	Electrically propelled road vehicles -- Connection to an external electric power supply -- Safety requirements
91	GSO ISO 6469-1	مركبات الطرق المدفوعة كهربائياً -- مواصفات السلامة -- الجزء 1: نظام تخزين الطاقة الداخلي القابل لإعادة الشحن	Electrically propelled road vehicles -- Safety specifications -- Part 1: On-board rechargeable energy storage system (RESS)
92	GSO ISO 6469-2	مركبات الطرق المدفوعة كهربائياً -- مواصفات السلامة -- الجزء 2: وسائل سلامة تشغيل المركبات والحماية من الأعطال	Electrically propelled road vehicles -- Safety specifications -- Part 2: Vehicle operational safety means and protection against failures
93	GSO ISO 6469-3	مركبات الطرق المدفوعة كهربائياً -- مواصفات السلامة -- الجزء 3: حماية الأشخاص من الصدمة الكهربائية	Electrically propelled road vehicles -- Safety specifications -- Part 3: Protection of persons against electric shock
94	GSO IEC 60445	تمييز أطراف توصيل المعدات ونهايات الموصلات الخاصة ، شاملاً الأسس العامة لنظام رقمي حرفي	Basic and safety principles for man-machine interface, marking and identification - Identification of equipment terminals, conductor terminations and conductors
95	GSO IEC 60529	درجات الحماية التي توفرها الأغلفة الخارجية (النظام الرمزي IP)	Degrees of protection provided by enclosures (IP Code)

No.	GSO Standard	Arabic Title	English Title
<b>قياسات أداء المركبة الكهربائية (Measurements of electrical vehicle performance)</b>			
96	GSO ISO 8715	مركبات الطرق الكهربائية -- خصائص التشغيل على الطريق	Electric road vehicles -- Road operating characteristics
97	GSO ISO 8714	مركبات الطرق الكهربائية -- استهلاك ومدى الطاقة المسترجعة -- إجراءات الاختبار لسيارات الركوب والمركبات التجارية الخفيفة	Electric road vehicles -- Reference energy consumption and range -- Test procedures for passenger cars and light commercial vehicles
<b>المركبات لكهربائية - المفردات (Electric road vehicle – Vocabulary)</b>			
98	GSO ISO/TR 8713	مركبات الطرق المدفوعة كهربائياً -- المفردات	Electrically propelled road vehicles -- Vocabulary
99	GSO IEC 60050-482	المفردات الدولية الكهروتقنية - الفصل 482 : الخلايا الأولية والثانوية والبطاريات (النضائد)	International Electrotechnical Vocabulary - Part 482: Primary and secondary cells and batteries
<b>البطاريات (Batteries)</b>			
101	GSO IEC TS 62840-1	نظام مبادلة بطارية المركبة الكهربائية – الجزء 1: عام واسترشادي	Electric vehicle battery swap system - Part 1: General and guidance
102	GSO IEC 62840-2	نظام مبادلة بطارية المركبة الكهربائية – الجزء 2: متطلبات السلامة	Electric vehicle battery swap system - Part 2: Safety requirements
105	GSO IEC 61982-4	البطاريات الثانوية (باستثناء بطاريات الليثيوم) لدفع مركبات الطرق الكهربائية- الجزء 4: متطلبات السلامة لخلايا والموديلات من النيكل والمعدن المهدرج	Secondary batteries (except lithium) for the propulsion of electric road vehicles - Part 4: Safety requirements of nickel-metal hydride cells and modules.
106	GSO IEC 61982	البطاريات الثانوية (باستثناء بطاريات الليثيوم) لدفع مركبات الطرق الكهربائية - اختبارات التحمل والأداء.	secondary batteries (except lithium) for the propulsion of electric road vehicles - performance and endurance tests
107	GSO IEC 62281	سلامة بطاريات وخلايا الليثيوم الابتدائية والثانوية أثناء النقل	Safety of primary and secondary lithium cells and batteries during transport



No.	GSO Standard	Arabic Title	English Title
108	GSO IEC 62660-1	خلايا أيون- الليثيوم الثانوية لدفع مركبات الطرق الكهربائية -- الجزء 1 : اختبار الأداء	Secondary lithium-ion cells for the propulsion of electric road vehicles - Part 1: Performance testing
109	GSO IEC 62660-2	خلايا أيون - الليثيوم الثانوية لدفع مركبات الطرق الكهربائية -- الجزء 2 : اختبار الموثوقية والاستعمال الخاطئ	Secondary lithium-ion cells for the propulsion of electric road vehicles - Part 2: Reliability and abuse testing
110	GSO IEC 62485-3	متطلبات السلامة للبطاريات الثانوية وتركيبات البطاريات - الجزء 3 : بطاريات الجر	Safety requirements for secondary batteries and battery installations - Part 3: Traction batteries
111	GSO IEC 60622	البطاريات والخلايا الثانوية المحتوية على مواد قلوية أو اليكتروليتات غير حمضية أخرى - الخلايا المنشورية الأحادية القابلة لإعادة الشحن المحكمة والمصنعة من النيكل كادميوم	Secondary cells and batteries containing alkaline or other non-acid electrolytes - Sealed nickel-cadmium prismatic rechargeable single cells
112	GSO IEC 61434	البطاريات والخلايا الثانوية المحتوية على مواد قلوية أو اليكتروليتات غير حمضية أخرى - دليل تحديد التيار في مواصفات البطاريات والخلايا الثانوية المحتوية على قلوي	Secondary cells and batteries containing alkaline or other non-acid electrolytes - Guide to designation of current in alkaline secondary cell and battery standards
113	GSO IEC 62133-1	البطاريات والخلايا الثانوية المحتوية على مواد قلوية أو اليكتروليتات غير حمضية أخرى - متطلبات الأمان للبطاريات والخلايا الثانوية المحكمة والمحمولة والبطاريات المصنعة منهم ، للاستخدام في التطبيقات المحمولة الجزء 1: انظمة النيكل	Secondary cells and batteries containing alkaline or other non-acid electrolytes - Safety requirements for portable sealed secondary cells, and for batteries made from them, for use in portable applications - Part 1: Nickel systems
114	GSO IEC 62133-2	لبطاريات والخلايا الثانوية المحتوية على مواد قلوية أو اليكتروليتات غير حمضية أخرى - متطلبات الأمان للبطاريات والخلايا الثانوية المحكمة والمحمولة والبطاريات المصنعة منهم ، للاستخدام في التطبيقات المحمولة الجزء 1: انظمة الليثيوم	Secondary cells and batteries containing alkaline or other non-acid electrolytes - Safety requirements for portable sealed secondary lithium cells, and for batteries made from them, for use in portable applications - Part 2: Lithium systems

No.	GSO Standard	Arabic Title	English Title
115	GSO IEC/TR 62188	البطاريات والخلايا الثانوية المحتوية على مواد قلوية أو اليكتروليرات غير حمضية أخرى - توصيات التصميم والتصنيع للبطاريات المحمولة المصنعة من الخلايا الثانوية المحكمة	Secondary cells and batteries containing alkaline or other non-acid electrolytes - Design and manufacturing recommendations for portable batteries made from sealed secondary cells
116	GSO IEC/TR 61438	مخاطر السلامة والصحة المحتملة عند استخدام البطاريات والخلايا الثانوية القلوية- دليل الصناع والمستخدمين	Possible safety and health hazards in the use of alkaline secondary cells and batteries - Guide to equipment manufacturers and users
<b>مواصفات عامة لمركبات الطرق (Road vehicles -- General information)</b>			
117	GSO ISO 15118-1	مركبات الطرق – واجهة الاتصال الشبكي – الجزء 1: المعلومات العامة وتعريف حالة الاستخدام	Road vehicles -- Vehicle to grid communication interface -- Part 1: General information and use-case definition
118	GSO ISO 15118-2	مركبات الطرق – واجهة الاتصال الشبكي – الجزء 2: متطلبات بروتوكول التطبيق والشبكة	Road vehicles -- Vehicle-to-Grid Communication Interface -- Part 2: Network and application protocol requirements
119	GSO ISO 15118-3	مركبات الطرق – واجهة الاتصال الشبكي – الجزء 3: متطلبات طبقة ربط البيانات والربط المادي	Road vehicles -- Vehicle to grid communication interface -- Part 3: Physical and data link layer requirements
120	GSO ECE R 100 rev3	الاشتراطات الموحدة الخاصة بالمتطلبات العامة للمركبات الكهربائية	The approval of vehicles with regard to specific requirements for the electric power train
121	GSO ECER 101	الموافقة على سيارات الركاب التي تعمل بمحرك احتراق داخلي فقط، أو بمحرك كهربائي هجين فيما يتعلق بقياس انبعاث الكربون ثاني أكسيد الكربون واستهلاك الوقود و / أو قياس استهلاك الطاقة والمدى الكهربائي، وقياس استهلاك الطاقة الكهربائية والمدى الكهربائي	The approval of passenger cars powered by an internal combustion engine only, or powered by a hybrid electric power train with regard to the measurement of the emission of carbon dioxide and fuel consumption and/or the measurement of electric energy consumption and electric

No.	GSO Standard	Arabic Title	English Title
		بالنسبة للمركبات من الفئات M1 و N1 التي تعمل بالجر الكهربائي فقط .	range, and of categories M1 and N1 vehicles powered by an electric power train only with regard to the measurement of electric energy consumption and electric range
122	GSO ECE R12	الاشتراطات الموحدة الخاصة باعتماد المركبات فيما يتعلق بحماية السائق من آلية القيادة في حالة التصادم	The approval of vehicles with regard to the protection of the driver against the steering mechanism in the event of impact
123	GSO ECE Re 121	الأحكام الموحدة المتعلقة بالموافقة على مواقع أدوات التحكم المُشغلة بواسطة السائق و أدوات التحذير و المؤشرات	The approval of vehicles with regard to the location and identification of hand controls, tell-tales and indicators
124	GSO ECE R 94	الاشتراطات الموحدة الخاصة بحماية الركاب من الصدمة لمامية	The approval of vehicles with regard to the protection of the occupants in the event of a frontal collision
125	GSO ECE R 95	الاشتراطات الموحدة الخاصة بحماية الركاب من الصدمة الجانبية	The approval of vehicles with regard to the protection of the occupants in the event of a lateral collision
126	GSO ECE R 32	الاشتراطات الموحدة الخاصة بسلوك هيكل المركبة خلال الصدمة الخلفية	The Approval Of Vehicles With Regard To The Behavior Of The Structure Of The Impacted Vehicle In A Rear-End Collision
127	GSO FMVSS 305	المركبات الكهربائية - الحماية من الصدمة الكهربائية	Electric-Powered Vehicles -- Electrolyte Spillage and Electrical Shock Protection

**Annex 2****International Standards for Electrical Motor Vehicles**

ISO	IEC	Technical Regulation
Electric road vehicle – Vocabulary		
ISO 8713:2005		Electric road vehicles – Vocabulary
	IEC 60417	Graphical symbols for use on equipment
	IEC 60446	Basic and safety principles for man-machine interface, marking and identification. Identification of conductors by colors or numerals.
	IEC 60529	Degrees of protection provided by enclosures (IP Code)
Batteries		
ISO 6469-1: 2009 Ed. 2		Electric road vehicles - Safety specifications - Part 1: On-board rechargeable energy storage system (RESS)
ISO/DIS 12405-1 under revision		Electrically propelled road vehicles — Test specification for lithium-ion traction battery packs and systems — Part 1: High power applications
ISO/WD 12405-2 under development		Electrically propelled road vehicles — Test specification for lithium-ion traction battery packs and systems — Part 1: High energy applications
	IEC 62619	Secondary cells and batteries containing alkaline or other non-acid electrolytes - Safety requirements for large format secondary lithium cells and batteries for use in industrial applications
	IEC 60050-482	International Electro technical Vocabulary (IEV) - Part 482: Primary and secondary cells and batteries
	IEC 60050-486	International Electro technical Vocabulary (IEV) - Chapter 486: Secondary cells and batteries
	IEC 60622	Secondary cells and batteries containing alkaline or other non-acid electrolytes Sealed nickel-cadmium prismatic rechargeable single cells
	IEC 60623	Secondary cells and batteries containing alkaline or other non-acid electrolytes Vented nickel-cadmium prismatic rechargeable single cells

ISO	IEC	Technical Regulation
	IEC 61434	Secondary cells and batteries containing alkaline or other non-acid electrolytes Guide to the designation of current in alkaline secondary cell and battery standards
	IEC 61982-1 under revision	Secondary batteries (except lithium) for the propulsion of electric road vehicles - Part 1: Performance and endurance tests
	IEC 61982-2	Secondary batteries for the propulsion of electric road vehicles - Part 2: Dynamic discharge performance test and dynamic endurance test
	IEC 61982-3	Secondary batteries for the propulsion of electric road vehicles -Part 3: Performance and life testing (traffic compatible, urban use vehicles)
	IEC 61982-4 IEC 62660-1	Secondary batteries for the propulsion of electric road vehicles – Part 1: Test parameters
	IEC 61982-5 IEC 62660-2	Secondary batteries for the propulsion of electric road vehicles –Part 5: Safety testing for lithium-ion cells and batteries
	IEC 62133	Secondary cells and batteries containing alkaline or other non-acid electrolytes - Safety requirements for portable sealed secondary cells, and for batteries made from them, for use in portable applications
	IEC/TR 62188	Secondary cells and batteries containing alkaline or other non-acid electrolytes – Design and manufacturing recommendations for portable batteries made from sealed secondary cells
	IEC 62281	Safety of primary and secondary lithium cells and batteries during transport
	IEC 62660-1	Secondary lithium-ion cells for the propulsion of electric road vehicles - Part 1: Performance testing
	IEC 62660-2	Secondary lithium-ion cells for the propulsion of electric road vehicles - Part 2: Reliability and abuse testing
	IEC 62485-2	Safety requirements for secondary batteries and battery installations – Part 2: Stationary batteries
	IEC 62485-3	Safety requirements for secondary batteries and battery installations – Part 3: Traction batteries
	IEC/TS 61438	Possible safety and health hazards in the use of alkaline secondary cells and batteries - Guide to equipment manufacturers and users
Charging systems		

ISO	IEC	Technical Regulation
	IEC 61439 series	Low-voltage switchgear and control gear assemblies
	IEC 60947-1	Low-voltage switchgear and control gear – Part 1: General rules
	IEC 60947-2	Low-voltage switchgear and control gear – Part 2 : Circuit-breakers
	IEC 60947-3	Low-voltage switchgear and control gear - Part 3: Switches, disconnections, switch- disconnections and fuse-combination units
	IEC 61851-1	Electric vehicle conductive charging system - Part 1: General requirements
	IEC 61851-21	Electric vehicle conductive charging system - Part 21: Electric vehicle requirements for conductive connection to an a.c./d.c. supply
	IEC 61851-22	Electric vehicle conductive charging system - Part 22: AC electric vehicle charging station
	IEC 61851-23	Electric vehicle conductive charging system - Part 23: d.c. electric vehicle charging station
	IEC 62196-1 under revision	Plugs, socket-outlets, vehicle couplers and vehicle inlets - Conductive charging of electric vehicles - Part 1: Charging of electric vehicles up to 250 A a.c. and 400 A d.c.
	IEC 62196-2 under development	Plugs, socket-outlets and vehicle couplers – Conductive charging of electricity vehicles – Part 2: Dimensional interchangeability requirements for a.c. pin and contact-tube accessories
<b>Wiring, connectors, controllers, rotating machines</b>		
ISO 6722		Road vehicles – 60 V and 600 V single-core cables – Dimensions, test methods and requirements
ISO 4141-1		Multi-core connecting cables – Part 1: Test methods and requirements for basic performance sheathed cables
ISO 4141-2		Multi-core connecting cables – Part 2: Test methods and requirements for high performance sheathed cables
ISO 4141-3		Multi-core connecting cables – Part 3: Construction, dimensions and marking of unscreened sheathed low-voltage cables
ISO 4141-4		Multi-core connecting cables – Part 4: Test methods and requirements for coiled cable assemblies
ISO 14572		Road vehicles – Round, unscreened 60 V and 600 V multicore sheathed cables – Test methods and requirements for basic and high performance cables

ISO	IEC	Technical Regulation
ISO 10924-1		Road vehicles – Circuit breakers – Part 1: Definitions and general test requirements
ISO 10924-4		Road vehicles – Circuit breakers – Part 4: Medium circuit breakers with tabs (blade type), Form CB15
	IEC 60309	(all parts) Plugs, socket-outlets and couplers for industrial purposes
	IEC 60309-1	Plugs, socket-outlets and couplers for industrial purposes – Part 1: General requirements
	IEC 60309-2	Plugs, socket-outlets and couplers for industrial purposes – Part 2: Dimensional interchangeability requirements for pin and contact-tube accessories
	IEC 60309-4	Plugs, socket-outlets and couplers for industrial purposes – Part 4: Switched socket-outlets and connectors with or without interlock
	IEC/TR 60783	Wiring and connectors for electric road vehicles
	IEC 60664-1	Insulation coordination for equipment within low-voltage systems – Part 1: Principles, requirements and tests
	IEC/TR 60783	Wiring and connectors for electric road vehicles
	IEC 60811 series	Common test methods for insulating and sheathing materials of electric cables and optical cables
	IEC 60884	Plugs and socket-outlets for household and similar purposes
	IEC/TR 62602	Conductors of insulated cables – Data for AWG and KCMIL sizes
	IEC 60481	Coupling devices for power line carrier systems
	IEC 61850 series	Communication networks and systems in substations
	IEC/PAS 62559	Intelligrid methodology for developing requirements for energy systems
<b>Vehicle safety &amp; personnel protection</b>		
ISO 6469-1: 2009		Electrically propelled road vehicles -- Safety specifications -- Part 1: On-board rechargeable energy storage system (RESS)
ISO 6469-2: 2009		Electric road vehicles - Safety specifications - Part 2: Vehicle operational safety means and protection against failures
ISO 6469-3: 2001		Electric road vehicles - Safety specifications - Part 3: Protection of persons against electric hazards

ISO	IEC	Technical Regulation
+ ISO 6469-3:2001/Cor 1:2003		
ISO 6469-3* ed. 2 under publication		Electric road vehicles - Safety specifications - Part 3: Protection of persons against electric hazards
ISO 8820-1: 2008		Road vehicles - Fuse-links - Part 1: Definitions and general test requirements
ISO 8820-6: 2007		Road vehicles - Fuse-links - Part 6: Single- bolt fuse-links
	IEC 61140	Protection against electrical shock – Common aspects for installation and equipment
	IEC/TS 60479 series	Effects of current on human beings and livestock
	IEC 60269-1	Low-voltage fuses – Part 1 : General requirements
	IEC 62335	Circuit breakers – Switched protective earth portable residual current devices for class I and battery powered vehicle applications
	IEC 60755	General requirements for residual current operated protective devices
<b>EMC (Electro-magnetic compatibility)</b>		
	IEC 61000-3-2	Electromagnetic compatibility (EMC) – Part 3-2: Limits – Limits for armonic current emissions (equipment input current < 16 A per phase)
	IEC 61000-3-3	Electromagnetic compatibility (EMC) – Part 3-3: Limits – Limitation of voltage changes, voltage fluctuations and flicker in public low-voltage systems for equipment with rated current ≤ 16 A per phase and not subjected to conditional connection
	IEC 61000-3-12	Electromagnetic compatibility (EMC)--Part 3-4 Limits – Limitation of mission of harmonic currents in low-voltage power supply systems for equipment with rated current > 16 A
	IEC 61000-3-11	Electromagnetic Compatibility (EMC) – Part 3-11 – Limits – Limitation of voltage changes, voltage fluctuations and flicker in public low-voltage systems - Equipment with rated current ≤ 75 A per phase and subjected to conditional connection



ISO	IEC	Technical Regulation
	IEC 61000-3-12	Electromagnetic Compatibility (EMC) – Part 3-12 – Limits for harmonic current emissions produced by equipment connected to public low-voltage systems with input current > 16 A and ≤ 75 A per phase
	IEC 61000-4-1	Electromagnetic compatibility (EMC) – Part 4-1 – Testing and measurement techniques – Overview of IEC 61000-4 series
	IEC 61000-4-2	Electromagnetic compatibility (EMC) – Part 4-2 – Testing and measurement techniques – Electrostatic discharge immunity test
	IEC 61000-4-3	Electromagnetic compatibility (EMC) – Part 4-3 – Testing and measurement techniques – Radiated, radio-frequency, electromagnetic field immunity test
	IEC 61000-4-4	Electromagnetic Compatibility (EMC) – Part 4-4 – Testing and measurement techniques – Electrical fast transients/burst immunity test
	IEC 61000-4-5	Electromagnetic Compatibility (EMC) – Part 4-5 – Testing and measurement techniques – Surge immunity test
	IEC 61000-4-6	Electromagnetic Compatibility (EMC) – Part 4-6 – Testing and measurement techniques – Immunity to conducted disturbances, induced by radio-frequency fields
	IEC 61000-4-7	Testing and measurement techniques – General guide on harmonics and interharmonics measurements and instrumentation, for power supply systems and equipment connected thereto
	IEC 61000-4-8	Electromagnetic Compatibility (EMC) – Part 4-8 – Testing and measurement techniques – Power frequency magnetic field immunity test
	IEC 61000-4-11	Electromagnetic compatibility (EMC) – Part 4-11: Testing and measurement techniques – Voltage dips, short interruptions and voltage variations immunity tests
	IEC 61000-4-13	Electromagnetic compatibility (EMC) - Part 4-13: Testing and measurement techniques - Harmonics and interharmonics including mains signalling at a.c. power port, low frequency immunity tests
	IEC 61000-4-15	Electromagnetic compatibility (EMC) - Part 4-15: Testing and measurement techniques – Flickermeter – Functional and design specifications
	IEC 61000-4-21	Electromagnetic compatibility (EMC) – Part 4-21: Testing and measurement techniques – Reverberation chamber test methods
	IEC 61000-6-1:2005	Electromagnetic Compatibility (EMC) – Part 6-1 – Generic standards Immunity for residential, commercial and light-industrial environments

ISO	IEC	Technical Regulation
	IEC 61000-6-2	Electromagnetic Compatibility (EMC) – Part 6-2 – Generic standards Immunity for industrial environments
	IEC 61000-6-3:2006	Electromagnetic Compatibility (EMC) – Part 6-3 – Generic standards Emission standard for residential, commercial and light-industrial environments
	IEC 61000-6-4:2006	Electromagnetic Compatibility (EMC) – Part 6-4 – Generic standards Emission standard for industrial environments
	CISPR 22	Information Technology Equipment - Radio Disturbance Characteristics - Limits and Methods of Measurement.
	CISPR 11	Industrial, Scientific and Medical (ISM) Radio-Frequency Equipment - Electromagnetic disturbance characteristics - Limits and methods of measurement.
	CISPR 16-X-X	Specification for radio disturbance and immunity measuring apparatus and methods
	CISPR 12	Vehicles, boats and internal combustion engine driven devices - Radio disturbance characteristics - Limits and methods of measurement for the protection of receivers except those installed in the vehicle/boat/device itself or in adjacent vehicles/boats/devices.
	CISPR 25	Radio disturbance characteristics for the protection of receivers used on board vehicles, boats, and on devices - Limits and methods of measurement
	IEC 61204-3	Low-Voltage Power Supplies, D.C. Output – Part 3: Electromagnetic Compatibility (EMC)
	IEC 62040-2	Uninterruptible power systems (UPS) – Part 2: Electromagnetic compatibility (EMC) Requirements
	IEC 60050 (161)	International Electrotechnical Vocabulary (IEV) – Chapter 161: Electromagnetic compatibility
	IEC 60870-2-1	Telecontrol equipment and systems – Part 2: Operating conditions – Section 1: Power supply and electromagnetic compatibility
<b>Measurements of electrical vehicle performance</b>		
ISO 8715:2001		Electric road vehicles - Road operating characteristics
ISO 8714:2002		Electric road vehicles - Reference energy consumption and range - Test procedures for passenger cars and light commercial vehicles

ISO	IEC	Technical Regulation
ISO 8715		Electrically propelled road vehicles - Measurement of road operating ability - Part 1: Pure electric vehicles
ISO 8714		Electrically propelled road vehicles - Measurement of energy performances - Part 1: Pure electric vehicles
UNECE and FMVSS Regulations		
<b>UNECE GTR 20</b>		Global Technical Regulation on the Electric Vehicle Safety (EVS)
<b>UNECE Regulation 100</b>		the approval of vehicles with regard to specific requirements for the electric power train
<b>UNECE Regulation 12</b>		the approval of vehicles with regard to the protection of the driver against the steering mechanism in the event of impact
<b>UNECE Regulation 121</b>		the approval of vehicles with regard to the location and identification of hand controls, tell-tales and indicators
<b>UNECE Regulation 94</b>		the approval of vehicles with regard to the protection of the occupants in the event of a frontal collision
<b>UNECE Regulation 95</b>		the approval of vehicles with regard to the protection of the occupants in the event of a lateral collision
<b>UNECE Regulation 32</b>		The Approval Of Vehicles With Regard To The Behavior Of The Structure Of The Impacted Vehicle In A Rear-End Collision
<b>FMVSS 305</b>		Electric-Powered Vehicles: Electrolyte Spillage and Electrical Shock Protection

## Annex 2

### 1. Workstation for EV

#### 1.1 Protection against electrical hazards in the working area

Before undertaking any operation on an electrical installation, an electrical risk assessment must be carried out to identify and prevent electrical hazards during an operation or when using an electrical vehicle in the workstation.

This assessment must specify how the operation is to be carried out and what measures and precautions need to be taken to ensure safety.

#### 1.2 Staff Training requirements

- All staff involved in the operations on or near to an electrical installation must be trained in the safety requirements, safety rules and in-house instructions applicable to the operation.
- The goal of the training and education for the staff in the workshop is to:
  - a. Learn about the dangers associated with electricity and be able to identify the hazards.
  - b. Learn about the preventive actions and know how to apply them.
  - c. Educate Customers on the use and ownership of an Electric Vehicle
- Staff must wear clothes appropriate to the workstation and conditions in which they are required to work. This may include the use of snugly fitted clothing or additional personal protective equipment (PPE)

#### 1.3 Staff responsibility in the workshop:

We can classify the staff in the workshop to :

##### 1.3.1 Qualified person

Trained person with relevant knowledge and experience to analyze electrical risks and avoid the hazards electricity could bring about. He could be Battery Specialist or EV Technician. He can do all type of maintenance and repairing.

##### 1.3.2 Informed person

Person sufficiently informed so as to avoid the dangers that electricity could bring about, Could be body or Mechanical Technician, Service or body shop Manager. He can make all type of maintenance and repairing except electrical and battery repairing.

##### 1.3.3 Ordinary person

Untrained Person who is neither qualified, nor an informed person. He could be sales executive, or service advisor he cannot do any type of maintenance and repairing.

All the workshops for repairing or do a service for electrical vehicles should have at least one qualified person.

### 2. Safety Equipment for EV Workstation

- Clear instructor to use the lock out system before working on the High Voltage System and moving Accident Damaged Vehicles.

- Employer is responsible for Providing and maintaining PPE for all staff .
- It is compulsory for the staff to wear individual protection equipment during any operation in the orange zone (Battery removal, Lockout)
- The workstation should have a collective protection equipment (CPE ) for :
  - Battery Repair area
  - Vehicle Protected Area
  - Insulation
- The workstation should have a workspace for high voltage system repairs at it should have a warning Panel the meaning of :  
“Dangers area, high voltage working area”

### 3. **Handling a vehicle involve in an accident:**

The vehicle must be locked out prior to any repair, with an open space for parking the electric vehicle and 5 meters of empty spaces around the electric vehicle. In the event of damage to the structure, battery, or any high-voltage wires, a qualified person must assess the integrity of the following components:

- Exposed Components
- Leaking Fluids
- Damaged Battery / Wiring
- Vehicle Locked Out

If any of above it should be putting in isolated area.

### Annex 3

#### **Verification method for testing authorities confirming document-based isolation resistance compliance of electrical design of the vehicle after water exposure.**

This annex describes the applicable requirements when certifying the manufacturers' high voltage equipment or system components against adverse water effects rather than a physical test. Vehicle manufacturers shall provide information to testing authorities to identify, as a point of reference, the mounting location for each high-voltage component in/on the vehicle.

1. Documentation shall contain the following information:

(a) on how the manufacturer tested isolation resistance compliance of electrical design of the vehicle by using fresh water;

(b) on how, after the test had been carried out, the high-voltage component or system was inspected for ingress of water and how, depending on its mounting location, each high voltage component/system met the appropriate degree of protection against water.

2. The testing authority will verify and confirm the authenticity of documented conditions that have been observed, and should have been complied with, during the process of certification by manufacturer:

2.1. It is permitted that, during the test, the moisture contained inside the enclosure is partly condensed. The dew which may be deposited is not considered as ingress of water. For the purpose of the tests, the surface area of the tested high-voltage component or system is calculated with an accuracy of 10 per cent. If possible, the tested high-voltage component or system is run energized. If the tested high-voltage component or system is energized, adequate safety precautions are taken.

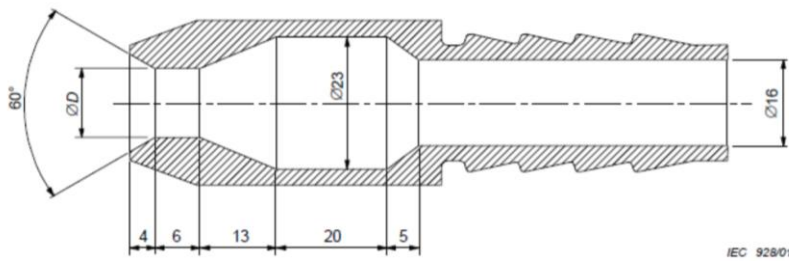
2.2. For electrical components, externally attached (e.g. in engine compartment), open underneath, both exposed or protected locations, the testing authority shall verify, with a view to confirming the compliance, whether the test is conducted by spraying the high-voltage component or system from all practicable directions with a stream of water from a standard test nozzle as shown in Figure 1. The following parameters are observed during the test in particular:

(a) Nozzle internal diameter: 6.3 mm;

(b) Delivery rate: 11.9 – 13.2 l/min;

- (c) Water pressure at the nozzle: approximately 30 kPa (0.3 bar);
- (d) Test duration per m<sup>2</sup> of surface area of the tested high-voltage component or system: 1 min;
- (e) Minimum test duration: 3 min;
- (f) Distance from nozzle to tested high-voltage component or system surface: approximately 3 m (this distance may be reduced, if necessary to ensure proper wetting when spraying upwards).

Figure 1- **Standard nozzle for the test**

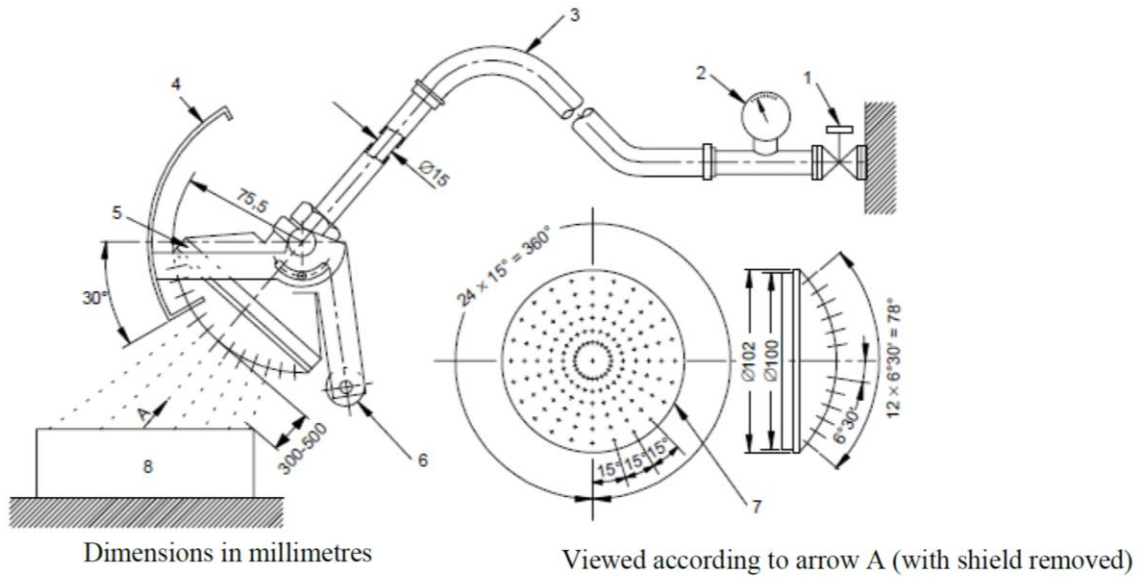


Dimensions in millimeters  $D$  is 6.3 mm as specified in (a) above.

2.3. For electrical components, externally attached (e.g. in engine compartment), covered from underneath, the testing authority shall verify, with a view to confirming the compliance, whether:

- (a) The cover protects the component against direct spray water from underneath and is not visible;
- (b) The test is conducted by using splashing test nozzle as shown in Figure 2;
- (c) The moving shield is removed from the spray nozzle and the machine is sprayed from all practicable directions;
- (d) The water pressure is adjusted to give a delivery rate of  $(10 \pm 0.5)$  l/min (pressure approximately 80 kPa to 100 kPa (0.8 bar to 1.0 bar));
- (e) The test duration is 1 min/m<sup>2</sup> of calculated surface area of the machine (excluding any mounting surface and cooling fin) with a minimum duration of 5 min.

Figure 2 - Splashing test nozzle



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*Note:*

- |                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                 |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <ul style="list-style-type: none"> <li>1. Cock</li> <li>2. Pressure gauge</li> <li>3. Hose</li> <li>4. Moving shield – aluminium</li> <li>5. Spray nozzle</li> <li>6. Counter weight</li> </ul> | <ul style="list-style-type: none"> <li>7. Spray nozzle – brass with 121 holes <math>\varnothing 0,5</math>:               <ul style="list-style-type: none"> <li>1 hole in centre</li> <li>2 inner circles of 12 holes at <math>30^\circ</math> pitch</li> <li>4 outer circles of 24 holes at <math>15^\circ</math> pitch</li> </ul> </li> <li>8. Machine under test</li> </ul> |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

3. The entire high voltage system or each component is checked to comply with the isolation resistance requirement with the following conditions:

- (a) The electric chassis shall be simulated by an electric conductor, e.g. a metal plate, and the components are attached with their standard mounting devices to it;
- (b) Cables, where provided, shall be connected to the component.