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Disclaimer

This manual was translated from its original Japanese version based on Japanese Law and Supply Provisions of Japanese Electricity Utility, to meet requests from many CHAdeMO international members. Therefore, we ask readers to keep in mind that different law and utility supply provision of other countries/states might make some content of this manual irrelevant.

1. Objectives

The objective of this manual is to systematically organize information needed when installing quick chargers and summarize technical information related to installation construction, as well as quick chargers, as a business so that it may be of help when considering the introduction of EV/quick chargers and the recharging service.

At the initial stages of recharging infrastructure preparation, one can expect a certain amount of assistance, such as corporate CSR activities and public subsidies, but it will be necessary to establish a recharging service business model in order to continuously expand the recharging infrastructure in conjunction with the full-blown spread of EV in the mid to long-term.

Meanwhile, there are an increasing number of business operators who are deliberating on how to maximize the synergistic effect of their own core businesses, such as the operations of a gasoline station, large scale parking lots or commercial facilities, etc., and the added value of the recharging service.

It will be difficult to completely optimize the recharging infrastructure if each business operator acts individually so collaborative efforts that hinge on the convenience to EV users are necessary. At the CHAdeMO Association Infrastructure Workshop, charger manufacturers, installation construction contractors, and recharging service operators have come together in the form of Infrastructure Workshop WG Activities to solve these issues and compile this manual.

2. The Current State of Quick Chargers

The latest information about CHAdeMO quick charger manufacturers and certified products can be found on the Association’s website under “CHAdeMO Chargers”. Operation information can be found on the “Charging Infrastructure-Operation” screen. And, quick charger installation locations can be found on the “Charger Location Map”.

- 4 -
3. Design/Construction

(NOTE) The electricity supply agreements and installation construction mentioned in this chapter are based on Japanese law.

3.1 Confirmation of Electric Supply/Demand Agreement, Confirmation of Type/Agreement Capacity

Since the capacity of CHAdeMO quick chargers is three-phase 200V input and maximum 50kW output, if it is normal that there be other electrical equipment located where the quick charger is to be installed, the total electricity draw will exceed 50kW which means that the quick charger will be installed as high voltage equipment, or as a domestic-use piece of electrical equipment for special high voltage consumers unless there are exceptional reasons.

However, when installing in outdoor parking lots, since the only other electrical equipment nearby are small capacity streetlights, the amount of contract electricity will be below 50kW thereby enabling electricity to be provided under a low-voltage electricity agreement.

(1) High Voltage Electricity Agreement

Apply to an electric company to be supplied high-voltage. (Consult your electric company for details)

Since there are multiple types of high-voltage electricity contracts for buildings, stores, department stores, supermarkets, and factories, etc., and because electric companies differ, you should confirm with your electric company in regards to the agreement type, agreement capacity, and rates and then apply after consultation.

If your contracted amount of electricity is below 500kW your electricity contract will be determined using the “Actual Amount Contracting Method”.

The maximum electricity demand that is the basis for the “Actual Amount Contracting Method” is determined by measuring the amount of electricity used by consumers every 30 minutes and taking the largest value recorded over one month. This value will increase as the amount of load equipment used simultaneously increases.

In this instance, the largest maximum electricity demand value recorded for all months during one-year will be the contracted electricity amount for the month, so by confirming the daily load curve for the day on which the maximum electricity demand value was generated you can estimate your contracted electricity amount by adding a value multiplied with a coefficient that considers the demand rate, to the load capacity of the quick charger.

Furthermore, the contracted amount of electricity for each month during the year after the start of the use of electricity will be the maximum electricity demand recorded between the month that electricity use started and that month.
If the contracted electricity amount is over 500kW, the contracted electricity amount will be determined through consultations between the consumer and the electric company.

Furthermore, if the contracted electricity amount is over 2000kW the contract shall be, as a rule, a special high voltage supply contract.

Plus, if your contract is a high voltage electricity agreement, the selection of a chief engineer is required since the quick charger will be labeled as a private-use piece of electric equipment. If you are installing the quick charger in a location where the chief engineer has already been selected, you must consult with the chief engineer in advance.

(2) Low Voltage Electricity Agreement

Apply with an electric company to be supplied low-voltage. (Consult your electric company for details)

1) In accordance with electricity supply clauses stipulated by electric companies, one premise is considered one demand location(*), and low voltage electricity agreements can be applied to parking lots, etc., for which the combined contracted lighting capacity and the contracted input electricity after installation of the quick charger is below 50kW.

(*) As a rule, the 1 premise is considered the 1 demand location for which the 1 supply/demand agreement is executed. Therefore, as a rule, the 1 supply/demand agreement will be executed for the quick charger and other electric equipment in the aforementioned demand location.

2) You should consult with your electric company in regard to the contracted lighting capacity and contracted input electricity amount after installation of a quick charger.

3) Electricity demand points refer to the electric lines of the power company or the connection between the lead-in and the contractor’s electric equipment. (Marked with a ●) The lines from the demand point to the lead-in switch and auxiliary support structures, such as the short lead-in poles, are considered to be the property of the contractor and are installed at the expense of the contractor. (Instrument transformers and electric meters are owned by the electric company).
3.2 Power Equipment Capacity Survey

(1) Desktop Deliberation

When surveying the capacity of power equipment, confirm the capacity of input transformers using a one-line wiring diagram (Figure 3-2-1), etc., or find the sum of each bank’s load equipment. Predict the maximum electricity demand from the load capacity and confirm that there is a bank that will satisfy the transformer capacity even when a quick charger is added.

Furthermore, you must confirm that there is a spare circuit in the MCCP or that you have room to install one. (Figure 3-2-2) Since electric equipment is designed to handle a specific load there is a good possibility that a quick charger can be installed if there is a spare circuit on the MCCB that can handle the switch capacity of 50(kW) input current in the one-line wiring diagram.

*Internal short circuiting and earth faults are protected against since quick chargers are installed with electricity leak circuit breakers but an MCCB is installed for the purpose of protecting the power cable.

*MCCB (wiring circuit breaker): Molded-Case Circuit Breaker

(2) Survey of Receiving/Transforming Equipment (on-site)

A final determination must be made by checking the load current or the patrol records of the receiving/transforming equipment (low voltage input panel: Figure 3-2-3). The following things should be checked during an on-site survey.

a. Confirmation of the demand indicator (maximum current indicator (red))

The demand indicator can be reset to its initial setting by pressing the clear button so you must check that it indicates the maximum value for the year.
b. Patrol record confirmation

Confirm the maximum load from the current values in the monthly patrol record. (Generally, the peak usage amounts during the summer and winter will be the largest values for the year.)

**c. Measurements**

Attach a meter and measure the actual current. Ideally measurements should be taken several times on days with large load demand.

*Calculate the actual load input of the measured current values or patrol records.

(Actual load input (W) = Current Value (A) X 200 (V) X √3 X power factor)

<Figure 3.2.1 One-Line Wiring Diagram (Example)
(3) Securing 50kW Input for Quick Chargers

Input transformer enhancement construction,

(1) If \((\text{actual load input kW} + 50kW < \text{Input transformer capacity})\) → then a quick charger can be installed from the perspective of capacity

(2) If \((\text{actual load input kW} + 50kW > \text{Input transformer capacity})\) → then increasing the capacity of the transformer is necessary.

Increasing the capacity of the transformer refers to either replacing the existing transformer with a transformer of larger capacity, or adding another input transformer. When adding another transformer it may be necessary to install a new high voltage switch and low voltage input panel.

< Figure 3-2-2 Low Voltage Input Board (Example)         Figure 3-2-3 Low Voltage Input Board (Example) >

(4) MCCB Survey

Check whether or not the low-voltage input panel (Figure 3-2-2) has a spare MCCB.

If there is a spare circuit and the MCCB meets the required capacity conditions it can be used for a quick charger. If there is no spare circuit, ascertain the load capacity from the actual load current of the MCCB being used by checking the one-line wiring diagram, taking actual measurements or look at the equipment’s nameplate. Then switch loads to a spare MCCB if there is one, or install an MCCB if there is space to do so.
*The capacity of the MCCB shall vary depending on the wiring design due to the relationship between the wiring panel capacity and the amount of heat.

3.3 Deliberating Changing Electricity Supply/Demand Agreement or Increasing the Capacity of Electric Power Equipment

If the results of the surveys implemented up to this point show that the electricity supply/demand contract must be altered or that electric power equipment must be newly added, consult with your chief electrical engineer and ask for an estimate from an electrician, and then proceed with power facility enhancement construction and contract changes. Furthermore, if you encounter problems such as not being able to secure installation space or having the capacity of the electrical equipment exceeding 50kW, you may choose to install a small capacity quick charger. In this instance, you may not have to alter your electrical supply/demand agreement.

3.4 Surveying the Power Cable Installation Route

(1) Surveying the power cable installation route

Electrical wiring for quick chargers can be largely categorized into two patterns depending on whether or not the receiving/transforming station is indoors (rooftop) or outdoors. Wiring route surveying will differ depending on the location, but the most important points when surveying your power cable installation routes are as follows.
### Chart 3-4-1 Conduit and Wiring Checklist

<table>
<thead>
<tr>
<th>Wiring Route</th>
<th>NO</th>
<th>Check List</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conduits</td>
<td>1</td>
<td>Have you selected a conduit that fits the size of the power cables?</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>Does the size take into account wiring connections, wires that pass through, cable bending radius and the number of conduits in the pull box?</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>In the case of cables pulled horizontally, can the box be installed within 30m?</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>Are no more than 3 right angle bends necessary between the boxes?</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>Can the protruding conduit pull box be installed at an interval that fits the power cable size?</td>
</tr>
<tr>
<td></td>
<td>6</td>
<td>Is the box installed in a location that enables inspections?</td>
</tr>
<tr>
<td></td>
<td>7</td>
<td>Are conduit support intervals appropriate?</td>
</tr>
<tr>
<td></td>
<td>8</td>
<td>Is there space between conduits around the panel/EPS?</td>
</tr>
<tr>
<td></td>
<td>9</td>
<td>Are the cable holes in the wall positioned to prevent water seepage?</td>
</tr>
<tr>
<td></td>
<td>10</td>
<td>Can cables be installed away from rooms that use water such as the kitchen or machine room?</td>
</tr>
<tr>
<td></td>
<td>11</td>
<td>Does the building have an expansion joint?</td>
</tr>
<tr>
<td></td>
<td>12</td>
<td>Is the area prone to damage from salt, snow, water or wind?</td>
</tr>
<tr>
<td>Cable Racks</td>
<td>1</td>
<td>Can you install a cable rack suited for cable size, the number of cables, and installation location?</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>Is the cable rack a width that considers the interval between cables?</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>Can holes in the floor or walls (especially within EPS) be made fireproof easily?</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>Are cable rack support intervals appropriate?</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>Is the area prone to damage from salt, snow, water or wind?</td>
</tr>
<tr>
<td>Buried Conduits</td>
<td>1</td>
<td>Can you dig deeper than expected?</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>Will large vehicles be traveling through the premises?</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>Are there any other buried conduits in the vicinity?</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>Can you install a hand hole near the charger?</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>Will the aerial lines of other equipment or buildings have an impact?</td>
</tr>
<tr>
<td>Aerial Lines</td>
<td>1</td>
<td>Is there any impact on the outer wall terminal storage?</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>Are there any obstacles near the lead-in poles, poles on the premises or near the installation location of feeder lines?</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>Are there any height restrictions on the premises?</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>Is the area prone to damage from salt, snow, water or wind?</td>
</tr>
</tbody>
</table>

* Expansion joint: Releases the energy generated by an earthquake to prevent buildings from deforming.
(2) Deliberating Construction Methods

When electrically wiring quick chargers, a method, or a combination of methods, of construction should be selected in accordance with the power cable installation route. Common wiring methods are as follows.

**a. Metal conduits**

This method uses screw-less conduits/thin steel conduits/thick steel conduits and can be applied to various locations such as indoors/outdoors (roof side).

**b. Cable racks**

This method employs cable racks for wiring and can be applied primarily to indoor EPS/electric rooms/mechanical rooms. It can also be used for outdoor rooftops and roof sides.

**c. Buried conduits**

This method entails burying conduits in the ground and the conduits to be buried are often made of hard corrugated polyethylene or copper tube linings. This method is used for inside wiring and is applied to primarily locations where electricity is supplied to outside the premises from a building or lead-in.

**d. Aerial lines**

This method entails erecting support structures such as wooden, concrete, or steel electric poles and, much like the buried conduit method, is applied to locations where electricity is supplied to outside the premises from a building or lead-in.

The following chart shows the types and installation location of conduits and cable racks for each method of electrical wiring.

< Chart 3-4-2 Conduit Application Chart >

<table>
<thead>
<tr>
<th>Conduit Types</th>
<th>Suitable Installation Locations</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Outside (roof-side)</td>
<td>Inside</td>
</tr>
<tr>
<td>Thin steel conduits (including screw-less)</td>
<td>∆</td>
<td>○</td>
</tr>
<tr>
<td>Thick steel conduits</td>
<td>○</td>
<td>∆</td>
</tr>
<tr>
<td>Copper lined conduits</td>
<td>∆</td>
<td>×</td>
</tr>
<tr>
<td>Hard corrugated polyethylene</td>
<td>×</td>
<td>×</td>
</tr>
<tr>
<td>Cable racks</td>
<td>○*</td>
<td>○</td>
</tr>
</tbody>
</table>

○: Suitable  ∆: Usable  ×: Not suitable
### 3.5 Considering Quick Charger Power Design

#### High Voltage Receiving

<table>
<thead>
<tr>
<th>Flow chart</th>
<th>Details to confirm/deliberate</th>
<th>Notes/Precautions</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1) Confirmation of electric equipment and selection of charger to be installed</td>
<td>a. Confirm electricity supply/demand contract and capacity. Confirm daily load curve. b. Deliberate charger capacity, function, design, cost. c. Confirm device size and installation method. d. Confirm power type (1φ・3φ), voltage and capacity.</td>
<td>a. Confirm information for selecting charger. b. Confirm using manufacturer’s construction specifications c. Confirm using manufacturer’s construction specifications</td>
</tr>
<tr>
<td>(2) Power Source Survey</td>
<td>a. Contact chief engineer in advance. b. Obtain electric equipment diagram and confirm overview. c. Confirm operation status of low voltage wiring panel (3φ: Input transformer or 1φ: Electric light transformer) d. If the transformer has available capacity, confirm that there is space on the low voltage wiring panel for a charger-dedicated breaker. e. If the transformer does not have available capacity, confirm that there is space to add a low voltage wiring panel (3φ: Input transformer or 1φ: Electric light transformer) f. Consult the electric company in advance</td>
<td>a. Confirm completion diagram and device creation overview b. Confirm maximum current value and inspection records.</td>
</tr>
<tr>
<td>(3) Installation Location Survey</td>
<td>a. Select the charger installation location. b. Confirm the status of the installation space (obstacles for inspection/charging)</td>
<td>c. Consider maintenance and inspection space when adding low voltage wiring panel. d. Decide on quick charger capacity.</td>
</tr>
<tr>
<td>(4) Wiring Route Survey</td>
<td>a. Confirm that the cable routes to the charger installation location can be secured. b. Deliberate cable installation method. (a) If the electric room is indoors: Electric room→Inside→Outside→Charger (b) If the electric room is outside: Electric room→Outside→Charger.</td>
<td>a. Confirm that there are no obstacles in the way of the cable route. b. Refer to 3.4 Deliberation of the Power Source Cable Installation Route</td>
</tr>
<tr>
<td>(5) Wiring Design</td>
<td>a. Determination of the transformer capacity. (if the transformer capacity is not sufficient b. Confirm distance from electric room. c. Selection of cable size, cable route and cable installation method. d. Creation of specifications, construction overview e. Creation of scope of maintenance diagram. f. If transformer station maintenance covers adding transformers and low voltage wiring panels, a notice of change to transformer station must be submitted to the fire department of jurisdiction.</td>
<td>a. Deliberate shortest route in consideration of voltage drop. b. Design wiring in accordance with technical standards and internal wiring regulations. Refer to charger construction specifications for more information. c. Independent wiring is recommended for chargers. d. Consider the charger breaker size recommended by the charger manufacturer</td>
</tr>
</tbody>
</table>
## (2) If converting from low voltage receiving to high voltage receiving

### Flow chart

<table>
<thead>
<tr>
<th>(1) Confirmation of Electric Work Piece and Selection of Charger to be Installed</th>
<th>Details to confirm/deliberate</th>
<th>Notes/Precautions</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>b. Deliberate charger capacity, function, design and cost.</td>
<td>b. Confirm using manufacturer’s construction specifications</td>
</tr>
<tr>
<td></td>
<td>c. Confirm equipment size and installation method.</td>
<td>c. Confirm using manufacturer’s construction specifications</td>
</tr>
<tr>
<td></td>
<td>d. Confirm power source type ((1 \Phi \cdot 3 \Phi)), voltage, and capacity.</td>
<td></td>
</tr>
<tr>
<td>(2) Power Source Survey</td>
<td>a. Obtain electric equipment diagram and confirm the overview.</td>
<td>a. Existing load equipment confirmation</td>
</tr>
<tr>
<td></td>
<td>b. Specify the proposed location for receiving/transforming equipment installation.</td>
<td>b. Select electric lead-in location.</td>
</tr>
<tr>
<td></td>
<td>c. Confirm the breakdown of the existing power load (distribution panel/input panel) and usage amount.</td>
<td>c. Measure current for usage amount.</td>
</tr>
<tr>
<td></td>
<td>d. Advance consultation with electric company.</td>
<td>d. Select quick charger capacity.</td>
</tr>
<tr>
<td>(3) Installation Location Survey</td>
<td>a. Selection of charger installation location.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>b. Confirm status of installation space (obstacles for inspection/charging)</td>
<td>a. Select installation location of local switch</td>
</tr>
<tr>
<td>(4) Wiring Design</td>
<td>a. From the power lead-in to the newly built electric room.</td>
<td>a. Refer to 3.4 Deliberation of Power Source Cable Installation Route</td>
</tr>
<tr>
<td></td>
<td>(a) Confirm electricity lead-in point and lead-in method.</td>
<td>b. Confirm route from existing power source panel to receiving/transforming equipment</td>
</tr>
<tr>
<td></td>
<td>(b) Confirm location of receiving/transforming equipment installation.</td>
<td>c. Confirm that there are no obstacles to the cable installation route.</td>
</tr>
<tr>
<td></td>
<td>(c) Confirm power cable route for the existing load.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(d) Deliberate the installation method and route from the receiving/transforming equipment~existing power source panel.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>b. From the newly built electric room to the quick charger installation location.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(a) Confirm that the cable route to quick the charger installation location can be secured.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(b) Deliberate the installation method. (same as for high voltage receiving.)</td>
<td></td>
</tr>
<tr>
<td>(5) Wiring Route Survey</td>
<td>a. Design of receiving equipment (newly built electric room)</td>
<td>a. Confirm that there are no obstacles in the way of the cable route.</td>
</tr>
<tr>
<td></td>
<td>(a) Deliberate the power configuration from the existing load to newly installed quick charger capacity.</td>
<td>b. Refer to 3.4 Deliberation of the Power Source Cable Installation Route</td>
</tr>
<tr>
<td></td>
<td>(b) Selection of transformer capacity/type.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>b. Low voltage trunk line design</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(a) Configure input trunk line system.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(b) Confirm distance from electric room.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(c) Select cable size, installation route, cable installation method.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>a. Deliberate the transformer type by an outside or inside location.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>b. Independent wiring is recommended for chargers.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>c. Deliberate shortest route in consideration of voltage drop.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>d. Design wiring in accordance</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>---</td>
<td>---</td>
<td></td>
</tr>
<tr>
<td>c.</td>
<td>Create specifications, construction overview.</td>
<td></td>
</tr>
<tr>
<td>d.</td>
<td>Create scope of maintenance diagram.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>with technical standards and internal wiring regulations. Refer to charger construction specifications for more information.</td>
<td></td>
</tr>
<tr>
<td>e.</td>
<td>Consider the charger breaker size recommended by the charger manufacturer</td>
<td></td>
</tr>
</tbody>
</table>
### (3) In the case of low voltage receiving

<table>
<thead>
<tr>
<th>Flow chart</th>
<th>Details to be Confirmed/Deliberated</th>
<th>Notes/Precautions</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1) <strong>Confirmation of Electric Work Piece</strong></td>
<td>a. Confirm electricity supply/demand contract and capacity.</td>
<td>a. Confirm information for charger selection.</td>
</tr>
<tr>
<td>and Selection of Charger to be Installed</td>
<td>b. Deliberate charger capacity, function, design and cost.</td>
<td>b. Confirm using manufacturer’s construction specifications.</td>
</tr>
<tr>
<td></td>
<td>c. Confirm equipment size and installation methods.</td>
<td>c. Confirm using manufacturer’s construction specifications.</td>
</tr>
<tr>
<td></td>
<td>d. Confirm power source type (1φ・3φ), voltage, and capacity.</td>
<td></td>
</tr>
<tr>
<td>(2) <strong>Power Source Survey</strong></td>
<td>a. Obtain electric equipment diagram and confirm the overview.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>b. Specify the proposed location for receiving/transferring equipment installation.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>c. Confirm the breakdown of the existing power load (distribution panel/input panel) and usage amount.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>d. Advance consultation with the electric company.</td>
<td></td>
</tr>
<tr>
<td>(3) <strong>Installation Location Survey</strong></td>
<td>a. Select the charger installation location.</td>
<td>a. Select the installation location of the local switch</td>
</tr>
<tr>
<td></td>
<td>b. Confirm the status of the installation space. (Any obstacles to inspections/charging)</td>
<td></td>
</tr>
<tr>
<td>(4) <strong>Wiring Route Survey</strong></td>
<td>a. Confirm the electricity lead-in point and lead-in method</td>
<td>a. Confirm that there are no obstacles in the way of the cable route.</td>
</tr>
<tr>
<td></td>
<td>b. Confirm the location of the lead-in panel equipment installation.</td>
<td>b. Refer to 3.4 Deliberation of Cable Installation Route.</td>
</tr>
<tr>
<td></td>
<td>c. Confirm that a power cable route to charger installation equipment can be secured.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>d. Deliberate installation method.</td>
<td></td>
</tr>
<tr>
<td>(5) <strong>Wiring Design</strong></td>
<td>a. Confirm distance from the lead-in panel.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>b. Select the cable size, installation route and cable installation method.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>c. Create specifications and the construction overview.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>d. Create the scope of the maintenance diagram.</td>
<td></td>
</tr>
</tbody>
</table>

### 3.6 Quick Charger Installation Environment

(1) **Installation environmental Considerations**

Currently, quick chargers are installed at service stations (SS), highway parking areas/service areas, large commercial facilities, and local government buildings, and it is predicted that they will be installed at more locations as public charging infrastructure expands. Installation
locations must be selected in consideration of the following because quick chargers will be installed in environments that enable usage by an undetermined number of people.

1) Well-lighted, well-traveled locations
2) Locations that are a certain distance away from main roads in order to lessen the possibility of accidents that can occur if located near main roads.
3) Locations that are easy for users to access (near buildings if it is a commercial facility, etc.)
4) Locations that do not impede the flow of people or traffic lines
5) Consideration should be made to only allow access by EV (EV dedicated marking, etc.)
6) Consideration should be given to securing waiting space assuming that many users may try to access the quick charger at the same time.
7) The fact that a certain level of noise is generated during charging should be taken into consideration when selecting a charger location. Areas near houses etcetera should be avoided. Furthermore, since special consideration is needed when installing at service stations such considerations will not be mentioned here and are instead mentioned in another chapter (4.3).

(2) Quick Charger Installation Location Example
The quick charger charging cable is often made shorter in consideration of operability. It is usually sold at a unit length of 3~5 meters. Meanwhile, since the quick charger connector insertion location (inlet) differs depending on the electric vehicle, it is necessary to thoroughly confirm the parking space and the quick charger installation location prior to construction.

**Inlet Location on EV**

| Leaf: Front-center | Stella: Back-right | i-MiEV: Back-left |

![Image of Inlet Location on EV](Figure 3-6-1)

4m radius: Cable approx. 5m long
a. When installing near car stops

Figure 3-6-1 shows a quick charger installation example at an existing parking space (behind the car stops). Rather than installing the quick charger with its center in line with the middle of the car stops, installing it so that the cable extraction port is in line with the center of the car stops enables the connector to reach equally to both the left and right sides of the vehicle. Much depends on the relationship to the location of the parked vehicle, but it is necessary to re-examine this location since the connector will not reach to the vehicle if it is not parked within a radius that is one meter shorter than the cable line.

The example in Figure 3-6-1 assumes that the vehicles with the inlet on the front of the car will park facing the quick charger. (The connector will not reach if the car is parked with its backend towards the quick charger.) This quick charger was installed under the assumption that the angle of the vehicle can be changed at will.

In the example in Photo 3-6-1, the quick charger has been installed so that it is behind the two parking spaces in line with the center car stops in order to enable the charging connector to reach easily to both sides of a vehicle parked in either spot.

However, consideration must be given to the side the cable extraction port is located on the quick charger because even if the quick charger is installed in the same location the connector may not reach to the inlet. (Refer to Appendix 2: Deliberating Necessary Cable Length (4m standard))

b. When installing next to a parking space

In the case of Figure 3-6-2, where space for the vehicle to enter and exit has been secured, a cable length of approximately five meters is more than sufficient to enable the connector to reach the vehicle's inlet even if the inlet location differs by moving the location of the vehicle either backward or forward. Installing the quick charger next to the parking space has the advantage of preventing
collisions, and can also be used in places where the flow of traffic is predetermined. Making the space as wide as possible also aids in improving convenience to the user by securing operation space. However, this type of installation is only possible in large parking lots since a large amount of space is occupied by the quick charger and vehicle.

Photo 3-6-2 shows an actual example where a large amount of space is secured in front and behind the vehicle.

In columned parking spaces that do not have a lot of room to enter and exit, there should be little problem if cars can enter from both the left and right. In cases such as Figure 3-6-3 where cars can only move from left to right a cable that is approximately five meters in length needs to be used and the space itself needs to be quite long. This is so that the car has enough room to maneuver in and out of the space and to also allow placement of the inlet as close as possible to the quick charger.
(3) Space required for installing a quick charger

The space required for quick charger installation can be broken down into “space required for construction”, “space required for maintenance” and “space required for intake and exhaust”. The instruction booklet of each quick charger notes the space required for that model and needs to be confirmed. Some quick chargers can be installed even if there is not enough space recommended by the manufacturer if certain conditions are met. Contact the manufacturer for details. Metal mesh can be used minus any problems when there is not enough space for air intake/exhaust). In particular, it is better to have a lot of space available in front of the quick charger for maintenance. Car stops and collision prevention poles can be installed as long as they do not interfere with the opening and closing of the door during maintenance. (Figure 3-6-4).

If installing a fee collection system you must also have space for that. (Photo 3-6-6).

The installation example in Photo 3-6-3 has little space between the wall and quick charger and the quick charger is installed next to the car stops, but charging is made possible by lengthening the charging cable. However, in this case the cable should be protected with a spiral, etc., in order to prevent wear caused by dragging the long cable across the ground.

In the example shown in Photo 3-6-4 where the quick charger is installed at a convenience store, even though there is not a lot of space between the wall and the quick charger a chain-link fence (metal mesh) is used for the back of the quick charger in consideration of the air intake/exhaust.
The installation example shown in Photo 3-6-5 is a poor example because the unit is surrounded by shrubbery that makes it difficult for users and maintenance personnel to access the quick charger.
(4) Accessory Equipment Needed When Installing a Quick Charger

When the vehicle to be charged needs to be maneuvered close to the quick charger, measures should be taken to prevent collisions. Common measures include installing car stops or poles and the following points should be taken into consideration when installing such objects.

a. Car stop installation

Car stops are installed to prevent the vehicle from colliding with the quick charger, so the farther away they are installed the better, however the length of the charging cable on current quick chargers is often approximately five meters so they cannot be too far away.

Automobiles and electric vehicles (EV) these days have long wheelbases and the distance from the back wheels to the bumper is relatively short so installing car stops approximately one meter from the front of the quick charger should be sufficient.

However, if there is the possibility that other vehicles may be parked in the EV, recharging space car stops should be installed in accordance with how the parking space is to be used and, for example, more than one meter away (to accommodate large sedans). (Figure 3-6-7a)

Photo 3-6-7b shows an example of installation at a highway parking area where it is assumed that trucks may also park in the recharging space so a large distance is put between the quick charger and the parking space. This is inconvenient because the cable has to be lengthened so it is better if only EVs are allowed to park in such spaces.
b. Installation of plastic poles or metal pipes

It is even safer if plastic poles (Photo 3-6-6~10) or metal pipes (Photo 3-6-11~13) are used in lieu of car stops to prevent collisions, but they need to be installed so they do not impede operations or maintenance. However, the maintenance space required by quick charger manufacturers is often the maximum amount of space needed and you should consult with the manufacturer to find out exactly how much space is really needed to perform maintenance, or decide on a pole installation location after the installation of the quick charger. (Figure 3-6-6)

Furthermore, it is okay to utilize removable poles etcetera as long as their operability does not interfere with maintenance. (Photo 3-6-8, 10, 11)
c. Dealing with rain and snow

Quick chargers are designed for outdoor use so they should not be rendered inoperable if they become wet but since both hands are needed to operate the connector it would be difficult to use if the user is holding an umbrella. Therefore, they should be installed under an awning or some type of roof to protect against rain. (Photo 3-6-14, 15)

Also, since they are inverters and some are forcibly cooled with air, you need to secure space for air intake and exhaust, so in regions that get a lot of snow, quick chargers have been installed under large roofs or inside shelters (Photo 3-6-16) and sometimes even totally enclosed areas (Photo 3-6-17).

Make sure to apply for a building permit with inspection agencies that have jurisdiction in the proposed region, or at the city office when building roofs or enclosures.

When installing quick chargers in regions that get a lot of snow, consideration must be given to installation location so that snow that accumulates on the roofs of neighboring buildings does not fall on the quick charger, and that roofs built over the quick charger can withstand the weight of accumulated snow.
3.7 Quick Charger Installation Construction

(1) Installation costs

Installation construction costs depend on installation conditions and can range anywhere from one million yen to several millions of yen. The main factors that impact the installation costs are: whether or not receiving/transferring facilities need to be newly installed or added to; the distance between the receiving/transferring equipment and the quick charger installation location; and, whether or not a conduit route needs to be dug.

There are also special cases where additional costs are needed such as if the receiving/transferring equipment is located on the top of roofs or underground, so an estimate from a professional contractor is needed.

(2) Things to consider concerning installation construction

The following mentions quick charger installation considerations:

a. Deliberating leveling conditions for quick charger installation

We recommend building the foundation for quick chargers a little higher than the GL surface to prevent flooding, but you must be careful not to make it too high because that will make the feed connector hard to use and the screen hard to see. We recommend a foundation approximately +50~100mm above the GL.

b. Foundation conditions when installing a quick charger

It is assumed that quick chargers will be secured to a strong foundation using anchor bolts. As long as you follow the following plan or manual it does not matter if you use foundation bolts or anchor bolts. But, you must confirm with the manufacturer since the actual size of the anchor bolts required differs according to the model. (Figure 3-7-1)

1) Manual for Anti-Quake Design and the Installation of Construction Electrical Equipment
(Japan Electrical Construction Association)
2) Construction Electrical Equipment Anti-Quake Design/Installation Plan
(The Building Center of Japan)
(3) Quick Charger Installation Examples
a. Foundation, Channel Base

Photo 3-7-1 shows a typical channel base construction example. It is common to use flexible corrugated conduits buried inside a concrete foundation through which to pass the cables.

Quick charger power cables are usually approximately 60sq~150sq due to the large amount of current that passes through them which, as shown in Photo 3-7-2, makes the foundation a bother to make, but cable work can be made easier with a box or pit type foundation.

When making a foundation that has a cable route inside of it, construction costs will increase due to digging work. It is not appropriate when installing a quick charger near a walkway because people can trip over it, but construction costs can be made much cheaper by laying the conduits inside the grooves in the base as shown in Photo 3-7-3.

In the case of an underground parking lot as shown in Photo 3-7-4~5, cables can be passed through conduits attached to the wall thereby decreasing construction costs as opposed to if digging was required.

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b. Local Switching Panel

Quick chargers are typically located in the corner of parking lots away from receiving/transforming equipment which makes shutting them down inconvenient. In this instance, installing a local switching panel nearby will make shut-down operations easier and allow for the installation of a back-up 200V outlet (Photo 3-7-6~7).

(4) Installation in special locations (example of installation at a service station)

When installing a quick charger at a service station there are many restrictions imposed by the Fire Service Act as dangerous materials are handled at these locations. Accordingly, you must consult with your local fire department having jurisdiction over the area in question when installing a quick charger.

a. Installation location (space) restrictions

According to the Fire Service Act, quick chargers cannot be installed at the following locations so the space that can be utilized at large service stations is quite restricted.

1) Open space at gas stations, open space at oil stations  
2) Above underground tanks  
3) Within 3m of oil holes, within 1.5m of vent pipes  
4) Within 2m of roads, within 3m of buildings  
5) In traffic lines for buildings or self-service car washes  
6) In spaces for hand-washing vehicles

b. Additional Accessory Equipment

In addition to being required to clearly label charging equipment in an easy-to-see location, installing security cameras, interphones, fire extinguishers, collision prevention poles, and Patlites, etc. you may also be required to raise the foundation depending on the installation.
location to protect against explosions. (Photo 3-7-8~10)

4. Operation

4.1 Maintenance standards

Chart 4-1-1 “Quick Charger Maintenance Standards (Reference Example)” compiles inspection details and items that must be inspected on a regular basis by the installer (approximately once a month) and periodically (approximately once a year) by the chief engineer. When an earthquake occurs, a regular inspection should be implemented to confirm that the bolts have not loosened and that the structure has not been deformed.
Chart 4-1-1 Quick Charger Maintenance Standards (Reference Example)

(1) Regular inspection by quick charger installation user (Frequency = Approx. 1/Month)

<table>
<thead>
<tr>
<th>No</th>
<th>Item</th>
<th>Details to be Confirmed</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Outer appearance</td>
<td>Wear or damage to charger connector cord (cable), connector, cable protector. Other abnormalities with outer appearance.</td>
</tr>
<tr>
<td>2</td>
<td>Abnormal sounds/odors</td>
<td>Are there any abnormal sounds or odors.</td>
</tr>
<tr>
<td>3</td>
<td>Cleaning</td>
<td>Exterior dirt, status of space around the exhaust port. Soiled removable filters.</td>
</tr>
</tbody>
</table>

(2) Periodic inspection by chief engineer (Frequency = Approx. 1/year)

<table>
<thead>
<tr>
<th>No</th>
<th>Item</th>
<th>Details to be Confirmed</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Installation Status</td>
<td>Presence of deformations, rust, abnormal sounds, abnormal odors, abnormal vibrations, etc.</td>
</tr>
<tr>
<td>2</td>
<td>Cleaning</td>
<td>Filters, fans, etc.</td>
</tr>
<tr>
<td>3</td>
<td>Outer appearance</td>
<td>Damage to charger connector, operation buttons, etc.</td>
</tr>
<tr>
<td>4</td>
<td>Operation Confirmation</td>
<td>Normal operation, alarms, display, etc.</td>
</tr>
<tr>
<td>5</td>
<td>Performance Confirmation</td>
<td>Insulation test, current leakage breaker, etc.</td>
</tr>
</tbody>
</table>

*Should be implemented after consultation with the manufacturer in cases where low voltage is supplied.

(3) Detailed manufacturer inspection

Detailed inspections should be implemented as needed after consultation with the manufacturer in the event of a malfunction.

4.3 Handling Quick Charger Malfunctions (Errors)

When a quick charger malfunctions, the first thing to do is immediately contact the charger manufacturer and inform them of the situation. This may happen in the following ways.

1) Installation manager → charger manufacturer
2) User (end user) → installation manager → charger manufacturer
3) User (end user) → charger manufacturer
In order to prepare for cases (2) and (3) it is important to have contact information for the manufacturer labeled on the unit.

(1) Contact Information

We are consulting with manufacturers to have contact information labeled in an easy to see place on the quick charger so that the user can contact someone in case of a quick charger malfunction. Figure 4-3-1 shows an example of displaying information on the screen, but we are also thinking of affixing a sticker having the same information.

If it is possible to get a manufacturer worker to come to the site without going through the facilities manager (in the case of an executed maintenance contract) than the manufacturer's contact information will be displayed, but if this is not the case, contact information for the facilities manager or managing company will be displayed.

In particular, we are consulting with manufacturers to display contact information that is viable 24 hours a day for quick chargers that can be used 24 hours a day. Certain manufacturers offer call-center services that are open 24 hours a day. So leveraging these services will be effective if the facilities manager cannot be reached.

Furthermore, we also need to consider giving the user advance notice through web sites, etc., in cases where quick chargers cannot be used due to malfunctions or inspections.

(2) Emergency Stop Button

In addition to charging stop buttons, quick chargers are also equipped with emergency stop buttons. Pushing this button will cause the main breaker to trip thereby minimizing the areas inside the charger that are engaged in recharging. (The main breakers of some products cannot be shut off)

So, if the door of the unit is found to be open as a result of a collision with a vehicle, etc., the emergency stop button should be pushed, regardless of whether the unit is in use or not, thereby tripping the breaker, after which the manufacturer needs to be contacted.

Furthermore, in the case of the display panel example shown in Figure 4-3-2, even if the unit is reset by holding down the stop button for more than three seconds, the manufacturer always needs to be contacted.
(3) Backup Recharging

When a quick charger malfunctions, even if the manufacturer has been contacted about the malfunction it may take hours before maintenance personnel arrive on site. To prepare for these cases, the installation of a 100(V)/200(V) outlet or a normal charger is being considered as backup charging equipment.

However, care must be taken when the considering the installation of an outlet because such an outlet cannot be installed from the same power source if a low-voltage three-phase contract has been executed for the quick charger input.

4.4 Handling Nighttime Users and Preventing Crime/Mischief

1) Handling Nighttime Users

In order to prepare for nighttime users, the installation of appropriate lighting and interphones (if a watchman is on duty relatively close by) should be taken into consideration as necessary.

2) Preventing Crime/Mischief

Quick chargers should be installed in bright places where there are a lot of people, but in cases where they are installed in places where there may be no one around, the installation of security cameras should be considered in order to prevent crime and mischief.

The charging connector storage unit can be locked, but we would need to consider a method to enable users to unlock it. (Figure 4-4-1)
4.5 Dealing with Magnetic Waves Emitted from Quick Chargers

The magnetic waves emitted from quick chargers may affect the operation of electric medical devices such as embedded pacemakers and embedded defibrillators. Therefore, the CHAdeMO Association Infrastructure Workshop has started discussions with pacemaker-related organizations and will be deliberating on quantitative standards to determine the impact of magnetic waves based on the results of tests using a combination of quick charger devices and pacemakers that will be implemented in the future.

Based on the results of this deliberation, we shall take action including informing people with pacemakers, etc., about such matters.

For the time being, we shall notify people with pacemakers that “they should stand away from the quick charger when recharging” or “ask another person to charge for them” using caution labels affixed to the unit.

5. User Services
5.1 Methods for Informing Users about Quick Charger Installation Locations

There are many cases where signs have been erected at large parking lots, etc., in order to guide EV users to quick charger installation locations. (Highway examples: Photo 5-1-1~3)

The signs should be placed in order and indicate the distance to the quick charger, the entrance to the quick charger station and then the quick charger station itself. The government needs to be consulted if signs conveying quick charger information are to be erected alongside roads.
An example of a sign in common use is “CHARGING PONT” (Figure 5-1-1, Appendix 7). The sign shown in the figure is a registered TEPCO trademark. So to use it, you must apply with TEPCO and execute a usage authorization contract that stipulates the terms of usage.

These signs may only be used to indicate the installation locations of chargers that can be accessed by an undetermined number of people.

Contact information: External Affairs G, Intellectual Property Center, TEPCO
1-1-3 Uchisaiwai-cho, Chiyoda-ku, Tokyo 〒100-8560 TEL: 03-6373-1111 (operator)

5.2 Displaying Warnings

Figure 5-2-1 shows an example of how the display panel shows the operating instructions for the quick charger’s charging connector.

Figure 5-2-2 shows an example of how operating instructions for the quick charger’s charging connector are shown on the front of the unit.

In all the cases, these instructions are determined by the
manufacturer, but instructions on how to use equipment unique to the installation locations, such as payment and authorization equipment, should be displayed in a place that is easy for the users to notice, such as on a sign next to the unit.
*Displaying warnings in English as well should also be considered.

5.3 Informing Users about Manners when using Quick Chargers

As the number of quick charger users increases in the future, public manners will become an important issue. We should strive to inform users about appropriate manners when using quick chargers by displaying them on signs next to the quick charger or via pamphlets that will be distributed.

< Quick charger manners that should be conveyed >

1) When finished using the quick charger, return the charging connector and cable to their storage locations and quickly move your vehicle for the next user.

2) When charging concludes, it is possible to continue to charge your vehicle to full capacity by pressing the start button once again, but this should not be done if there are people waiting in line to recharge their vehicles.

3) If the quick charger cannot be used due to a malfunction, you should call the displayed contact number.
6. Afterword

We have discussed the background and objectives, but it will be difficult to completely optimize the recharging infrastructure if each business operator acts independently. Hence, collaborative efforts that lead to EV user convenience are necessary. At the CHAdeMO Association Infrastructure Workshop, these issues have been compiled into this manual through Infrastructure Workshop WG Activities, so that they will be of use when considering the introduction of EV/recharging facilities and charging services. We hope that this will lead to the sharing of information between more people and the spread of EV.

Given that the “Guidebook for Charging Facility Installation” created by the Ministry of Economy, Trade and Industry will be released in November, this manual had to be put together in a very short amount of time. We would like to offer our gratitude to all those that helped in its creation.
Deliberation of the Length of Charger Cables required by Quick Chargers (QC)

(4m standard)

* The numbers in the chart indicate cable length. Units: mm

<table>
<thead>
<tr>
<th>Cable Extraction</th>
<th>EV Status</th>
<th>QC Installation Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Right side</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Cable is extracted from right side of QC when facing it)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Leaf (Parked forward)</td>
<td>Normal</td>
<td>2,640 4,166 3,813</td>
</tr>
<tr>
<td></td>
<td>Does not touch ground</td>
<td>— 2,985 —</td>
</tr>
<tr>
<td>i-MiEV (Parked backwards)</td>
<td>Normal</td>
<td>3,524 3,190 4,215</td>
</tr>
<tr>
<td></td>
<td>Does not touch ground</td>
<td>— — 3,935</td>
</tr>
<tr>
<td>Stella (Parked backwards)</td>
<td>Normal</td>
<td>4,216 (1)4,688 3,190</td>
</tr>
<tr>
<td></td>
<td>Does not touch ground</td>
<td>3,043 4,322 —</td>
</tr>
</tbody>
</table>

| Left side       |             |                          |
| (Cable is extracted from left side of QC when facing it) |            |                          |
| Leaf (Parked forward) | Normal | 2,640 3,813 4,166       |
|                  | Does not touch ground | — — 2,985          |
| i-MiEV (Parked backwards) | Normal | 4,216 3,190 (2)4,688   |
|                  | Does not touch ground | 3,043 — 4,322       |
| Stella (Parked backwards) | Normal | 3,524 4,215 3,190     |
|                  | Does not touch ground | — 3,935 —           |

1) Cable Status: Normal = Cable extends from inlet, lays on ground and connects to QC (Photo 1)
   Does not touch ground = The cable does not touch the ground (hanging mid-air) (photo 2)

2) QC Installation Location
<Centered> Car stops (tire side) ~ Front of QC: 1.2m ~ Cable length of 4m suitable for all vehicles
<Right/Left> Center of parking spot ~ Front of QC: 1.5m QC installed above car stop tire side line)
Only part exceeds 4m. (4m cable is not long enough)
[Cases where the cable exceeds 4m]

(1) Stella, QC on right, cable extracted from right

Plug-in Stella

i-MiEV, QC on left, cable extracted from left

i-MiEV

December 17, 2010
CHAdeMO Association
Infrastructure Workshop