

## Connection requirements for 3x25 A – 3x80 A charging stations

For installing a standardised grid connection in a charging station



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## 1. Introduction

This document contains the requirements for the integration of a 3x25A to 3x80A grid connection in a charging station for electric vehicles. This document is intended for manufacturers of these charging station.

The requirements have been drawn up in such a way that safe and reliable connection to the electricity grid of the grid operator remains ensured. The charging station will be inspected by ElaadNL, together with the grid operators, for admission to the electricity grid in accordance with these requirements. An overview of the charging stations that are already approved by the grid operators can be found on the website of ElaadNL.

## 2. Application

The requirements drawn up in this document relate to the grid operator's section in a charging station with a connected load of 3x25 A to 3x80 A. Application of a smart meter which has been required in public charging stations since 24 June 2017 on account of the order in council entitled "Decree on the infrastructure for alternative fuels" is included. The grid operator is responsible for this part of the charging station and uses protection devices as shown in Appendix 1. The customer is responsible for the customer's part which is located beyond the transition point of the grid operator (the meter).

The following applies to the inspection of charging stations based on the connection specifications:

- From July 1, 2019, all new charging stations to be installed are to at least comply with connection requirements v2.0.

Pilots and research assignments relating to charging stations which are part of demonstrable arrangements which have been agreed with the grid operators are exempted from the inspection requirements.

## 3. Connection method

Manufacturers are expected to configure the charging station so that a standard main terminal box as used by the grid operator is incorporated (see requirement 20). The joint grid operators are developing new compact connection modules for use in unmanned objects including charging stations, which will result in a new version of the connection specifications. With this new solution, the protection devices used for charging stations will also be standardised further whereby all the grid operators will start using gG tube-type fuses (10.3 x 38 mm) for a connection capacity of 3 x 25 A and NH000 gG NH-fuses for 3 X 35 A, 3 x 50 A, 3 x 63 A and 3 x 80 A. The possibilities with regard to software selectivity will also be evaluated based on the current, relevant pilot projects. Until then, this version of the connection requirements will apply.

#### 4. Change history

Date+version	Requirements affected	Type of change
<b>1-1-2017, v1.0</b>	-	-
<b>30-1-2017, v1.1</b>	H2 + requirements 33 and 34	Requirement relating to telephone number for failure reporting added Responsibility for cylinder added H2 responsibilities clarified
<b>30-4-2018, v2.0</b>	3, 6, 8, 18, 20, 22, 23, 26, 27, 28, 31, 35 and 36	Requirements in v1.1 which have been removed
	1, 2, 7, 10, 11, 13, 14, 15, 16, 17, 18, 19, 20, 21, 23, 26, 33 and 34	Requirements in v2.0 which have been adjusted compared to v1.1
	3, 4, 5, 6, 8, 9, 11, 24, 27, 28, 29, 30, 31 and 32	Requirements in v2.0 which are new compared to v1.1
<b>17-5-2018, v2.0 REV B</b>	Section 2, Requirement: 1, 2, 10 and 22 14	Textual Addition of cable pipe diameter
<b>11-06-2018, v2.0 REV C</b>	Section 3 20 33	Textual Adjustment of type of stainless steel screw Textual
<b>19-06-2019, v2.0 REV C-1</b>	Section 11	Addition of optional master-slave requirements
<b>12-07-2019, v2.0 REV C-2</b>	Appendix 2, 3, 4 and 5	Clarification of requirements

#### 5. General information and requirements

#	Description	Inspection assessment
<b>1</b>	The meter in the grid connection will be supplied and installed by the grid operator. That meter is a Smart kWh meter used by the grid operators. See Appendix 2 for the applied smart meters per grid operator.	N/a.
<b>2</b>	The external diameter of the connection cable for the charging station may vary from 16 to 30 mm. This Information is to be used for the choice of strain relief.	N/a .
<b>3</b>	The whole assembly complies with IEC-61439-7.	Test report.
<b>4</b>	The charging station complies with IEC-61851.	Test report.
<b>5</b>	Where the requirements refer to the charging station, this means the zone where the grid operator's components are installed, unless it is clear from the context that reference is made to the whole charging station including the customer compartment.	N/a.
<b>6</b>	These specifications apply to normal environmental conditions in accordance with IEC-61439. In specific cases, different environmental conditions may apply for which specific additional requirements may be set.	Clarification of the conditions which the charging station is suitable for.

## 6. Requirements relating to the housing of the charging station

#	Description	Inspection assessment
7	The housing of the charging station has IP44 protection (in accordance with NEN/EN/IEC 61439-7 and NEN/EN/IEC 61851-1).	Test report in accordance with NEN-EN-IEC 60529.
8	The housing of the charging station has IK10 impact resistance (in accordance with NEN/EN/IEC 61439-7).	Test report in accordance with NEN-EN-IEC 62262.
9	The mechanical strength of the charging station shall comply with the requirements for installation in public spaces in accordance with subsection 10.2.102 of NEN/EN/IEC 61439-7.	Test report in accordance with NEN-EN-IEC 61439-7.
10	The average air temperature in the charging station at the connection box and the smart meter must not be higher than 55 degrees Celsius over a period of one hour. It is assumed that the ambient temperature (*) outside the charging station is 40 degrees.	Test/measurement report in accordance with NEN-EN-IEC 61439-7.
11	Condensation could be formed in the charging station. This must not lead to hazardous situations or cause equipment to fail. Adequate measures are to be taken in order to prevent this.	Visual inspection/Manufacturer's comments.
12	The housing of the charging station does not let any UV radiation pass so that the grid operator's components will not be affected by UV radiation (leading to ageing).	Visual inspection and in the case of a transparent housing a material declaration relating to UV absorption.

\* The term 'ambient temperature' refers to the outside temperature at a distance of 1.5 m from the charging station. The grid connection will be installed in the charging station where the air temperature in the charging station shall be higher than the ambient temperature.

## 7. Requirements relating to the foundations

#	Description	Inspection assessment
13	If applicable or necessary, the charging station is mounted on the foundation. This mount can only be made and removed from inside the charging station.	Visual inspection.
14	A round impact-resistant cable pipe with a thickness of 3 mm and diameter of 50 mm is supplied with the charging station. This is only designated for the grid operator's connection cable to pass through. The earthing cable of the earthing rod must be laid in a separate cable pipe. The cable pipe(s) has/have a minimum bending radius of 500 mm for the grid operator's connection cable. If the cable pipes are cast in the foundations, they are to be arranged so that the connection	Visual inspection (supplier must make this demonstrable; cable pipe(s) must also be supplied).

	<p>cable is 20mm above the edge of the foundation so the connection cable cannot scrape against any sharp edges in the foundations. For clarification see the example in appendix 3.</p>	
15	<p>The connection cable may be fed in on a minimum of two sides of the foundations. The infeed height of the connection cable is 60 cm below ground level.</p>	Visual inspection.

## 8. Requirements in respect of cable inlet, connection and protection

N#	Description	Inspection assessment
16	<p>An installation manual in accordance with the agreed format is provided with the charging station (see the ElaadNL website for the format).</p>	Check to make sure that the manual is in accordance with the format.
17	<p>It must not be possible for damage to be caused to the connection cable and any earthing cable when they are fed into the charging station.</p>	Visual inspection.
18	<p>A strain relief must be mounted on the cable directly above the foundation and in a straight line. It should not be necessary to bend the cable for mounting it in the strain relief and terminal. For clarification see the example in appendix 4.</p>	Visual inspection.
19	<p>The strain relief is capable of absorbing a minimum tensile force from the connection cable of 400 N.</p>	Trial installation and application of a straight 400 N load (40 kg) to the cable.
20	<p>The space required for the grid operator's section at the bottom of the charging station measures 755 (h) x 225 (w) x 150 mm (d). The width of the hatch is also 225 mm.</p> <p>The space of the grid operator consist of:</p> <ul style="list-style-type: none"> <li>○ Meter panel fitted with a smart meter produces a requirement for free space of: 350 (h) x 225 (w) x 150 (d).</li> <li>○ Terminal box with 5 cm for the earth feed on the right-hand side produces a requirement for free space of: 205 (h) x 225 (w) x 130 (d).</li> <li>○ Free space from the bottom of the terminal box to ground level of 200 mm (h).</li> </ul> <p>A watertight plywood mounting plate with a minimum thickness of 18 mm (which complies with NEN EN 636-2/2015 climate class 2, suitable for sheltered installation outdoors) is to</p>	Trial installation, measurement and visual inspection based on dimensional drawing.

	<p>be installed for mounting the terminal box and the meter panel.</p> <p>The terminal box and the meter panel will be installed by the grid operator when the charging station is connected to the grid, using 4 x 16 mm self-drilling stainless steel screws with crosshead Pozidriv 2.</p> <p>Appendix 5 gives an overview of these requirements.</p>	
<b>21</b>	<p>A main earthing rail is mounted at the bottom of the charging station. It must be possible to connect the following to this:</p> <ul style="list-style-type: none"> <li>- the (customer's) earth electrode;</li> <li>- the connection to all third-party conductive parts of the charging station;</li> <li>- if the housing of the charging station is made of metal it should always be earth neutral (if applicable).</li> <li>- an extra connection point for the grid operator.</li> </ul>	Visual inspection.
<b>22</b>	<p>During maintenance, it should be possible to connect a safety earthing without having to disconnect existing wiring.</p> <p>This safety earthing must be installed ahead of the protection device when viewed from the grid.</p>	Visual inspection using an earthing case.
<b>23</b>	<p>There is selectivity between the protection device in the charging station (and any slaves connected) and the protection device in the grid connection.</p> <p>The protection device used in the grid connection is in accordance with the overview of protection devices used by each grid operator (see Appendix 1).</p>	Provision of proof by the supplier in the form of a selectivity calculation/graphs.
<b>24</b>	<p>The manufacturer of the charging station shall ensure that sufficient length of wiring is present for connecting the grid operator's smart meter.</p> <p>This flexible wiring, fitted with 18 mm conductor end sleeves, is connected to the customer's installation. Besides, the wiring is heat resistant up to 90 Celsius (pD90). The outgoing wiring is 16 mm<sup>2</sup> for connections up to 3x80 A and 25 mm<sup>2</sup> for a 3x80 A connection.</p> <p>The diameter of the neutral conductor should be at least equal to the diameter of the phase conductors.</p>	Visual inspection.

## 9. Requirements relating to the use of a smart meter

#	Description	Inspection assessment
25	The kWh meter supplied by the grid operator should be installed and replaced in accordance with the applicable assembly instructions.	Visual inspection + trial installation.
26	There is 20 mm of free space on the top of the kWh meter. There is 50 mm of free space on the bottom from the terminal strip (under the terminal cover). It must be possible for the calibration of the kWh meter to be carried out safely. The connection wires must not obstruct the measuring terminals and wires in order to ensure that the risk of shorting between the housing and test pin is ruled out.	Physical measurement or visual inspection based on dimensional drawing.

The grid operator uses a meter which can be read out remotely. The 450, 800, 900, 1800 and 2100 MHz mobile datacom solutions available in the Netherlands will be used for this purpose. Housings of charging stations form a relatively strong barrier to the wireless signal for smart meters. The (radio) damping of this signal at the location where the meter will be installed is often between 15 and 30 dB and will depend on the type of station, the frequency and the positioning of the station in relation to the transmission antennas.

Requirements must be set for a charging station in order to guarantee the reception of the smart meter signals. The radio damping of the charging station must be sufficiently low. If this cannot be achieved, it should be possible to mount an external antenna on the charging station.

### 9.1 Damping

The manufacturer has to take measures so that the radio damping of the charging station is reduced.

#	Description	Inspection assessment
27	The damping of the station is lower than 8 dB for all current frequencies, namely the current 450, 800, 900, 1800 and 2100 MHz frequencies.	Test report which shows that the radio damping at the mounting position of the smart meter is lower than 8 dB for all current frequencies.

### 9.2 External antenna

If the damping is too high, the manufacturer has to prepare the charging station for the installation of an external 'puck' antenna by (or on behalf of) the grid operator.

#	Description	Inspection assessment
28	The antenna will be mounted on the outside of the charging station on an earthed steel surface. That surface will serve as a base plate for the puck antenna and should measure at least 30 x 30 cm. The place where the antenna may be mounted on the base plate is flat and has a diameter of 17 cm, enabling the antenna	Physical measurement and visual inspection based on dimensional drawing.

	to be mounted neatly and watertight on the base plate. The place where the antenna may be mounted is also solid enough to prevent external forces on the antenna from causing damage to the charging station.	
<b>29</b>	The base plate shall have a maximum thickness of 45 mm. In the centre of the flat area where the antenna can be mounted, there is a hole through the charging station with a diameter of 19 mm. That hole is sealed as standard. It must be possible to remove this cap when an antenna is installed, without further damage being caused to the charging station. The place where the antenna can be fitted can be accessed by the installer from inside the charging station so that the antenna can be installed sufficiently securely using standard tools.	Physical measurement and visual inspection based on dimensional drawing. Check by removing the cap and carrying out the trial installation of the antenna.
<b>30</b>	When installing the antenna and connecting the antenna to the meter, the installer must route the wiring through the station. It must be possible for him to find a route that he can use for this purpose. It is preferable for the route to be specified by the manufacturer while taking into account the vulnerability of the wiring and connectors (MMCX, MCX, SMA and SMB). It is also possible for the antenna, wiring and connectors to be replaced later on. Connectors with a perpendicular connection and coaxial cables which do not allow significant bending (bends with a minimum radius of 5 cm) must also be taken into account.	Physical measurement and visual inspection based on dimensional drawing. Check by carrying out trial installation of the antenna.
<b>31</b>	It must be possible for an external antenna to be installed and connected safely. Once installed, an antenna must not lead to new and/or greater risks for users, for the environment or when works are being carried out on the charging station.	Best effort test ElaadNL based on risk analysis by manufacturer.
<b>32</b>	If the charging station is provided with a cover for the external antenna, such as an antenna cap, then this must not lead to more than 8 dB of damping. The installer must be able to install the antenna and therefore be able to remove and reinstall the cap. In addition, there must be room underneath the cap for a 40mm thick antenna; the same requirements relating to mountability will continue to apply.	Trial installation and visual inspection based on dimensional drawing.

## 10. Requirements relating to access

#	Description	Inspection assessment
33	<p>The access hatch/door of the charging station is fitted with a lever for the installation of two cylinders.</p> <ol style="list-style-type: none"> <li>1. The cylinder of the CPO/maintenance party for the charging station is to be fitted in the factory by the manufacturer.</li> <li>2. The grid operator's cylinder, installed by the grid operator when the charging station is connected. The manufacturer is to provide an opening in which the grid operator can install the grid operator's cylinder (S2 half euro profile cylinder). It should be possible for the grid operator to open the door for the purpose of realising the connection of the charging station and installing the grid operator's cylinder, initially using an installation key/pass key, without the intervention of third parties.</li> </ol> <p>For safety concerns, it must not be possible to put an object inside the charging station directly via the opening for the cylinder. Therefore a barrier is to be provided in front of (on the outside of)/behind (on the inside of) the cylinder opening. The installation manual should clearly describe how the grid operator can open the charging station, initially using an installation key/pass key, and how the cylinder can be fitted, without the intervention of third parties.</p>	Visual inspection.
34	<p>The telephone number for failure reporting of the CPO/customer/owner of the connection is clearly and durably displayed on the charging station so that unsafe situations can be reported and it is possible to communicate with the grid operator via the CPO.</p>	<p>Markings which are applied by means of moulding, pressing, engraving or a comparable method, including plastic laminated labels: visual inspection. In all other cases: visual inspection and check on the durability of printing by rubbing a rag soaked in water over the marking for 15 s followed by a rag soaked in petroleum ether for another 15 s. After the test, the marking must be easily legible to the naked eye.</p>

## Optional requirements

### 11. Requirements for the master-slave construction

#	Description	Inspection assessment
35	There is sufficient space available in the charging stations to install outgoing cable(s) safely. The outgoing cable(s) must not affect the safety, operation or accessibility of the grid operator's components.	Visual inspection.
36	The outgoing cable(s) must not be routed via the cable glands and cable pipes of the grid operator's connection cable and earthing cable.	Visual inspection.
37	The outgoing cable(s) to the slaves must be connected to a separate circuit in the customer's section; looping through directly from the grid connection is not permitted. For selectivity, see requirement 23.	Visual inspection.
38	Just like the feeder cable for the charging station, the outgoing cable(s) should be provided with its own strain reliefs of at least 400 N.	This is an advise and will not be inspected.
39	It must be possible to visually distinguish the outgoing cable(s) and cable pipe of the master charging station from the grid operator's cable based on pipe colour, printing or labels on the cable pipe.	Visual inspection.
40	If a different object is used as a distributor such as a distribution box. In that case, you should consult the relevant grid operator to find out the grid operator's requirements which have been set for that object. The layout of this charging station is to be submitted to the relevant grid operator for approval.	N/a.

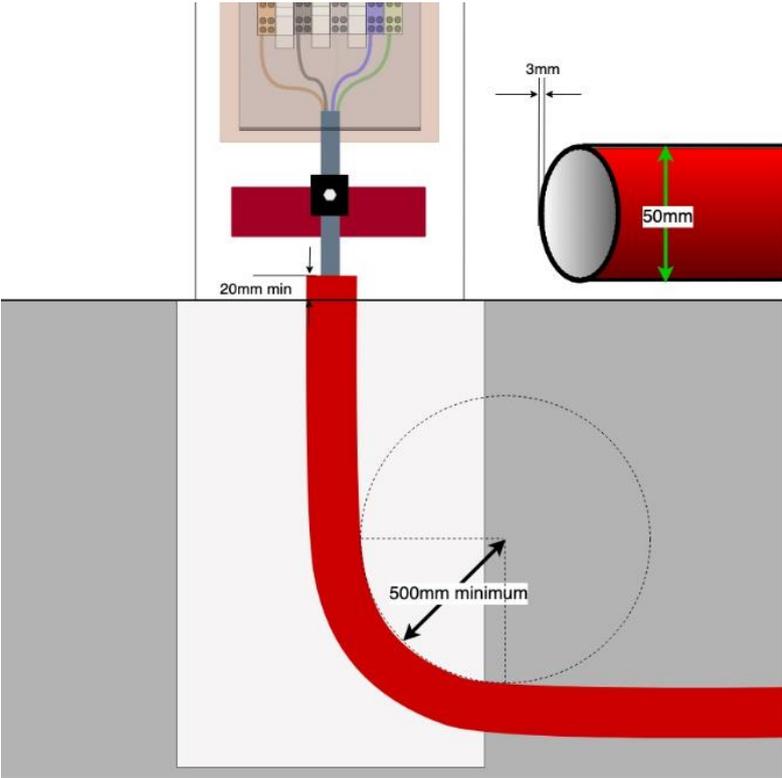
## Appendix 1. Overview of protection devices used by each grid operator

Electrical safety			Regional Grid Operators						
Connection-capacity	Fuses grid operators	Characteristic	Coteq	Enduris	Enexis	Liander	Rendo	Stedin	Westland Infra
3 x 25A	Miniature Circuit Breaker 25 A Fuse cartridge 10,3 x 38 mm	C gG	x	x	x	x	x	x	x
3 x 35A	Miniature Circuit Breaker 40 A	C	x	x	x	x	x	x	
3 x 50A	Miniature Circuit Breaker 50 A Knife blade fuse NH00	C gG	x	x	x	x	x	x	x
3 x 63A	Miniature Circuit Breaker 63 A Miniature Circuit Breaker 63 A Knife blade fuse NH00	B C gG	x	x	x	x	x	x	x
3 x 80A	Miniature Circuit Breaker 80A Miniature Circuit Breaker 80A Knife blade fuse NH000	B C gG	x	x	x	x	x	x	x

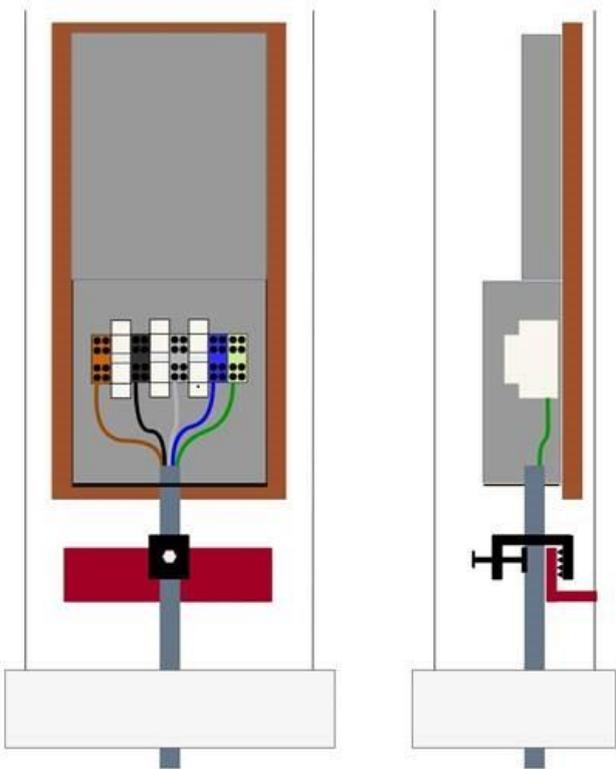
## Appendix 2. Overview of smart meters used by each grid operator

Information sheet smart meters				Regional Grid Operators						
(E)SMR5 3-phase smart meters	Height (mm)	Width (mm)	Depth (mm)	Coteq	Enduris	Enexis	Liander	Rendo	Stedin	Westland Infra
Landis+Gyr E350 SMR 5.0 GPRS	260	176	84		x		x		x	x
Landis+Gyr E350 SMR 5.0 CDMA	260	189	84				x		x	x
Landis+Gyr E360 SME 5.0	252	172	75		x		x		x	x
Iskraemeco SMR 5.0	244	177	78		x (GPRS)		x		x	x
ZIV ESMR 5.0 LTE	250	165	71	x		x		x		
Sagemcom T210 ESMR 5.0 LTE	303	170	85	x		x		x		
SSMR5.0 Kaifa	234	170	76							

Appendix 3. Requirement 14: application round (red) impact resistant cable pipe diameter



Appendix 4. Requirement 18: inlet of the connection cable in a straight line



## Appendix 5. layout and dimensions of the grid operator's section

