EV Charging Standards

- Future Trends And Direction

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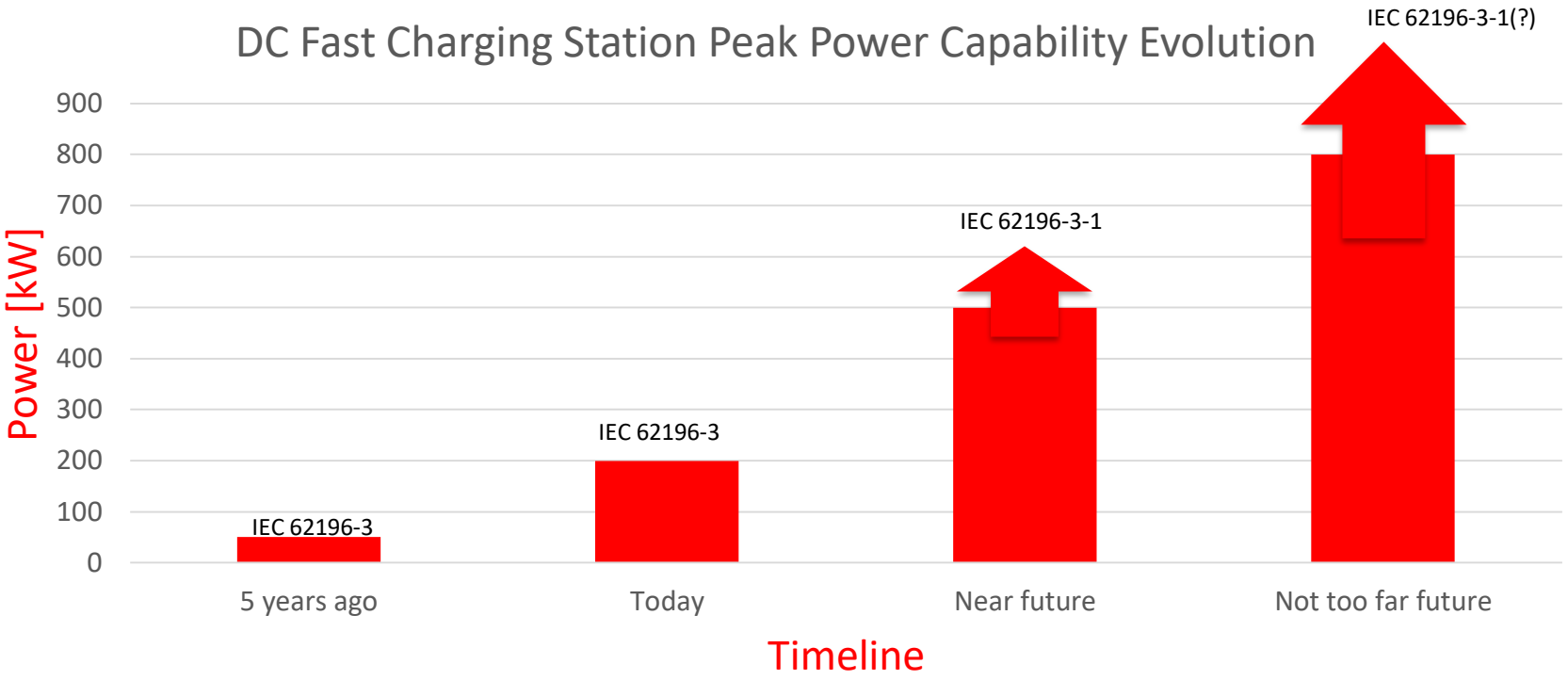
Past, Present, Future Of DC Fast Charge EVSEs



Regulations And Product Safety Standards:

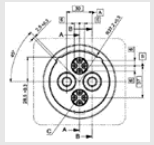
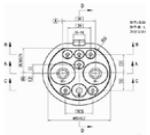
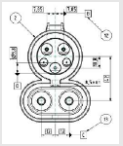
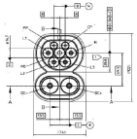
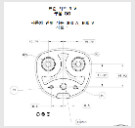
- IEC 61851-23 (2014): Electric vehicle conductive charging system – Part 23: DC electric vehicle charging station
  - System A: 500 V d.c.,
  - System B: 750 V d.c.
  - System C: 1 000 V d.c.

Where is the limitation?

- IEC 62196-3 (2014): 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

- KC 62196-3 (2018): Configuration GG (Tesla): Vehicle Coupler 300 A, 500 V D.C. → 150 kW

A Closer Look At Coupler Standards:

Configuration	Coupler Ratings	Power	Geometry
IEC 62196-3 (2014): Configuration AA (CHAdeMO)	200 A, 600 V D.C.	120 kW	
IEC 62196-3 (2014): Configuration BB (GB/China)	250 A, 750 V D.C.	187.5 kW	
IEC 62196-3 (2014): Configuration EE (Combo-1)	200 A, 600 V D.C.	120 kW	
IEC 62196-3 (2014): Configuration FF (Combo-2)	200 A, 1 000 V D.C.	200 kW	
KC 62196-3 (2018) Configuration GG (Tesla)	300 A, 500 V D.C.	150 kW	

Future Proposals For Product Safety Standards

- IEC 62196-3-1 (draft): Part 3-1: Vehicle connector, vehicle inlet and cable assembly for DC charging intended to be used with a thermal management system
  - Configuration AA (CHAdeMO): Vehicle Coupler 500 A, 600(?) V D.C. → 300(?) kW (from 120kW)
  - Configuration BB (GB/China): Vehicle Coupler ___ A, ___ V D.C. → ___ kW (from 187.5kW)
  - Configuration EE (Combo-1): Vehicle Coupler 500 A, 1 000 V D.C. → 500 kW (from 120kW)
  - Configuration FF (Combo-2): Vehicle Coupler 500 A, 1 000(?) V D.C. → 500(?) kW (from 200kW)
- KC 62196-3-1 (2019?): Configuration GG (Tesla): Vehicle Coupler 350 A (continuous at 35°C), 500 V D.C. → 175 kW+ (from 150kW)

Liquid Cooled Cables And Some Proposed Tests

- 90 °C temp limit on contacts:

16.101 Thermal sensing device

The accessory manufacturer shall provide the intervention value of the thermal sensing device in the installation manual. The intervention value is the value before DC contacts reach 90 °C.

DC Contacts

Liquid Cooled Cables And Some Proposed Tests

- Cable Anchorage (Pull+Twist) Test:

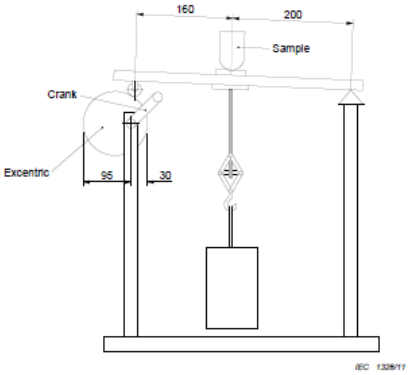


Figure 11 – Apparatus for testing the cable anchorage

Table 113 – Pull force and torque test values for cable anchorage

Rated current A	Pulling force N	Torque Nm	Maximum displacement mm
13 to 20	160	0,6	2
30 to 32	200	0,7	2
60 to 70	240	1,2	2
125	240	1,5	2
200	250	2,3	2
250	500	11,0	5
300	500	11,0	5
400	500	11,0	5
500	500	16,3	5

Thoughts For Future Charging Standards

- Regulate risk,
  not performance/technology/innovation

- Let the market decide!

Liquid Cooled Cables And Some Proposed Tests

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VS.

492 **16 General construction**

493 Clause 16 of IEC 62196-3:2014 applies except as follows:

494 **16.5** *Replacement:*

495 The maximum permissible temperature of those parts of the accessory and cable assembly that
496 can be grasped during normal operation carrying the rated current, shall not exceed:

497 – 50 °C for metal parts,

498 – 60 °C for non-metal parts.

Liquid Cooled Cables And Some Proposed Tests

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29 23H/---/DTS

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400	500	11,0	5
500	500	16,3	5

VS.

⇒ Use cable diameter vs. pull force, or

⇒ Use a multiple of the cable+connector weight.

Thoughts For Future Charging Standards

- Regulate risk, not performance/technology/innovation
  - Fewer constructional requirements
  - Better performance test requirements
  - Use “functional safety” principles

- Let the market decide!
  - Compatibility/Interoperability – more problems or more choices?
  - How about Adaptors?

Thank you!

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