Class 1

CI 2-32/500

Product Specification Vehicle Charge Inlet Type CCS 2 – 120mm2

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| Indicates Change

1. SCOPE

1.1. Introduction

The TE CCS2 charging inlet was designed to power electric and hybrid vehicles that comply with standard IEC 62196-3.

The maximum rated current for AC is 32A at the maximum voltage of 480V.

The maximum rated current for DC is 500A continuously with cooled connector and 1000V.

The maximum rated current for DC is 600A for 50min with cooled connector and 1000V.

The maximum rated current for DC is 700A for 8min with cooled connector and 1000V.

The maximum rated current for DC is 335A with uncooled connector and 1000V.

The content of this specification covers the technical characteristics, performance and test requirements for the EV CHARGE INLET Combined Charging System Type 2 further mentioned as CCS2.

When tests are performed the following specifications and standards shall be used. All inspections shall be performed using the applicable inspection plan and customer drawing.

2. APPLICABLE DOCUMENTS

The following mentioned documents are part of this specification. Unless otherwise specified, the latest edition of the documents applies. In the event of conflict between the requirements of this specification and the information contained in the referenced documents, this specification shall take precedence.

2.1. TE Connectivity Documents

General Requirements

Requirement	Description
109-1 Rev. J	General Requirements for Testing

Table 1

Drawings

Optional LED indicators, for more information see customer drawings.

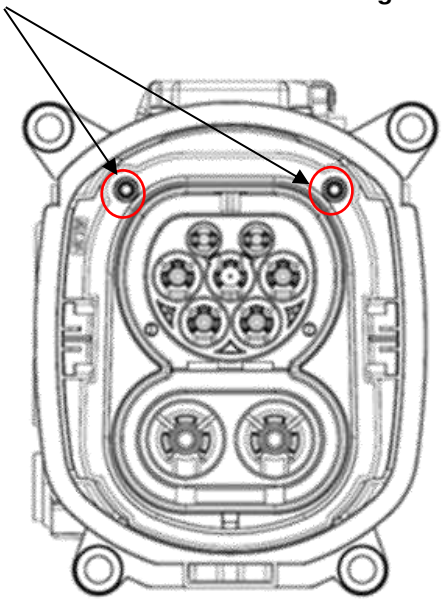


Figure 1

Drawing	Description
CD-2401362	Charge Inlet, Assy, CCS2

Table 2

Specifications

Specification	Description
114-94757	Application Specification EV Charge Inlet CCS2
114-94842	Ultrasonic Weld Connection Spec. (180° DC-Contact)
114-13000	Micro MATE-N-LOK Connectors
108-94519	Actuator-Specification

Table 3

2.2. Other Documents

Specification	Description
IEC 62196-1: 2014/06	General requirements
IEC 62196-2: 2016/02	Dimensional compatibility and interchangeability requirements for AC pin and contact-tube accessories
IEC 62196-3: 2014/06	Dimensional compatibility and interchangeability requirements for DC and AC/DC pin and contact-tube vehicle couplers
SAE J1772: 2016/02	SAE Electric Vehicle and Plug in Hybrid Electric Vehicle Conductive Charge Coupler

Table 4

3. REQUIREMENTS

3.1. Design and Construction

The product has been designed to withstand its environment and the effects it has on it.

3.2. Material

The Material data is available in the IMDS (International Material Data System of the Automotive Industry).

3.3. Product Ratings

Dimensions

Mating-Face Geometry	compatible with IEC 62196-2 Sheet 2-IIf and IEC 62196-3 Sheet 3-IVa
Screw Points	See Drawing

Environmental conditions

Ambient temperature	-40 °C …. +50 °C
Max. altitude	5000m above sea-level
Protection degree	IP5KX with flaps closed condition IP6KX with flaps opened condition IPX7 Temp. reduce to 85°C

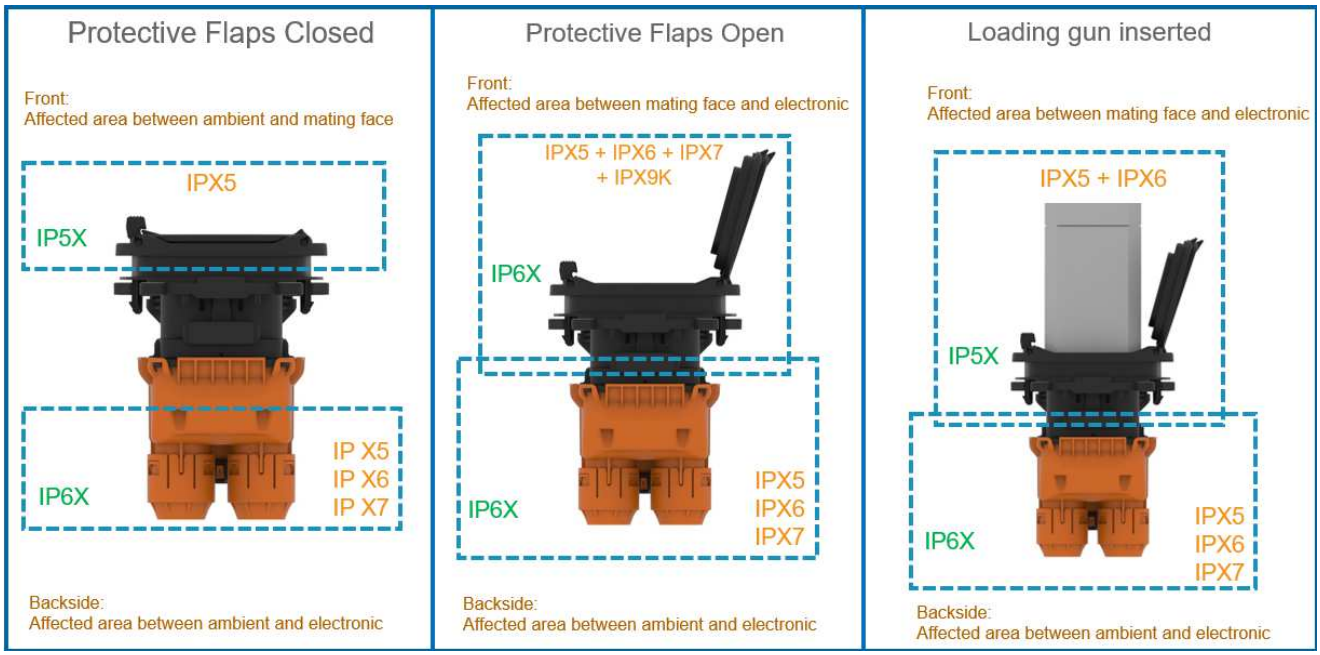


Figure 2

Electrical Properties

Max. charging performance	22 kW (AC) / 500 kW (DC)
Type of charging current	AC / DC
Number of AC-phases	3
Number of Terminals	9 (PE, L1, L2, L3, L4/N, DC+, DC-, CP, PP)
Rated current	32A AC / 500A DC
Rated voltage	480V AC / 1000V DC
Signal pin rated current	2A
Signal pin rated voltage	30V
Type of signal transmission	Analog
Insulation resistance of adjacent contacts	200MΩ
Resistant coding	acc. IEC 61851-1
Light option	White/Green/Red/Blue nom. Voltage11V/20mA Allowed Voltage Range 8…16V

Mechanical Properties

Mating / un-mating endurance	<= 10000 cycles
Insertion force	typical <100N (depending on connector)
Retention force	typical <100N (depending on connector)
Mechanical Stability of charging socket	max. 500N in all directions (max. Lever-Length 100mm)
Vibration Level	ISO 16750-3 Test VII

Temperature Sensoring

Temperature Sensor Type	PT1000
Type of Sensor	DIN EN 60751
Recommended measuring current	nominal 0.1mA / max. 1mA continuous or corresponding pulse/pause ratio
Temperature Sensor Offset DC (steady state)	max. -5K
Temperature Sensor Offset AC (steady state)	-12K TYP.
Proposed Shutdown DC	-continuous monitored dT/dt (Temperature rise per time) > 1,5K/sec • Delta T between DC+ and DC- >12K • 85°C measured temperature at sensor (Equivalent to max. contact temperature 90°C)
Proposed Shutdown AC	78°C measured temperature at sensor (Equivalent to max. contact temperature 90°C)

Actuator

see TE Actuator-Specification TE-108-94519

Installation

Orientation	See pictures
Max. Angle	180°-60°/+5°

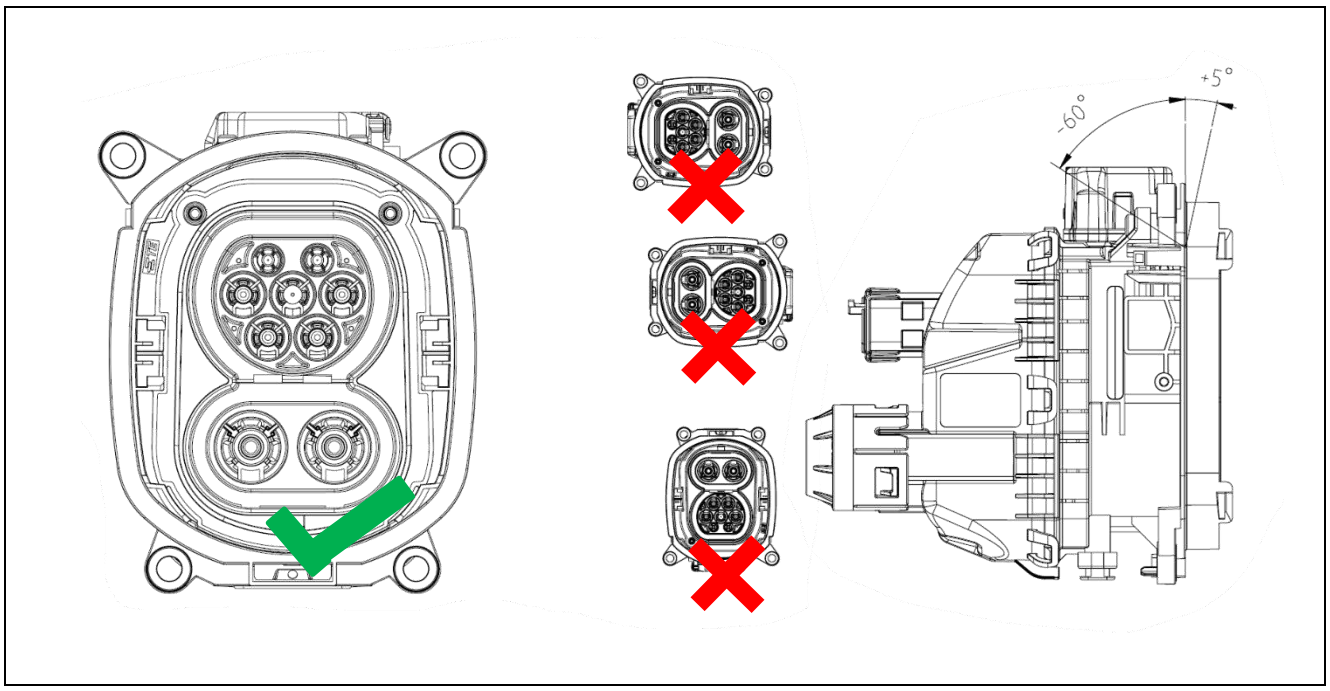


Figure 3

3.4. Performance requirements and Test descriptions

The product shall be designed to meet the electrical, mechanical, and environmental performance requirements specified in table 5. All tests shall be performed in the room temperature, unless otherwise specified.

3.5. Test Requirements and procedures summary:

General Test

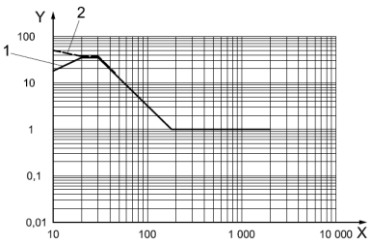
Test Items	Requirements	Procedures
OPTICAL INSPECTIONS		
Visual and Dimensional examination	Meets requirements of product drawing	Acc. To DIN EN 60512-1-1:2003-01, E 0.1
MECHANICAL INSPECTIONS		
Mechanical stability of the charging socket	Max. Force at initial crack; >500N.	At a mated condition of dummy plug and charge inlet HSG, Max. initial breakage force applied on the dummy plug at 100mm distance recorded. As per Special mechanical test
Function of the Primary and Secondary lock / latch play	The latch must be checked by pulling the inserted pins ≤ 10N	The primary locking latch device must latch with an audible click while pins insertion and checked by pulling the pins by force ≤10N Acc. to LV214: 2010-03, E 6.2
	At the final stop, it must be possible to lock the secondary locking device.	At final position of secondary lock, it should be locked. Acc. to LV214: 2010-03, E 6.3
Actuation forces of the secondary lock	Closing forces of the secondary lock Closing Force of Sec. Lock AC F_C < 50N Closing Force of Sec. Lock DC F_C < 50N	The secondary lock actuation from pre-lock to end-lock F_C < 50N Acc. to LV214: 2010-03, E 6.4
	Closing NOK forces of the secondary lock, selectively loaded Closing NOK Force of Sec. Lock AC $F_{C\ NOK} > F_C + 50N$ Closing NOK Force of Sec. Lock DC $F_{C\ NOK} > F_C + 50N$	The secondary lock actuation from pre-lock to end-lock at contact pin half insertion $F_{C\ NOK} > F_C + 50N$ Acc. to LV214: 2010-03, E 6.4

<table>
<tr><td rowspan="3">Contact retention in the charge inlet housing</td><td>Contact insertion forces

Value Determination</td><td>Acc. to LV214:2010-03, E 8.1</td></tr>
<tr><td>Contact removal force, Primary lock only

Contact Ø3, CP and PP $F_{S\leq 1mm}$ > 120N
Contact Ø6, PE $F_{S\leq 1mm}$ > 120N
Contact Ø6, AC $F_{S\leq 1mm}$ > 120N
Contact Ø8, DC $F_{S\leq 1mm}$ > 180N</td><td>Acc. to LV214:2010-03, E 8.2.1</td></tr>
<tr><td>Contact removal force, Primary and secondary lock

Value Determination</td><td>-</td></tr>
<tr><td>Vibration Test

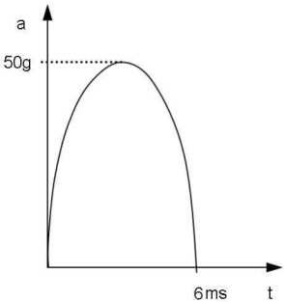
 

Key
X frequency, Hz
Y power spectral density, $(m/s^2)^2/Hz$
1 standard random test profile
2 additional profile in case of $f_n < 30$ Hz</td><td>No physical damage of housings and contacts, no derogation of function; the connection may not open during the test.

Test VII Commercial vehicle, sprung masses, Table 12

Table 12 — Values for PSD and frequency
<table><tr><th>Frequency
Hz</th><th>PSD
$(m/s^2)^2/Hz$</th></tr><tr><td>10</td><td>18</td></tr><tr><td>20</td><td>36</td></tr><tr><td>30</td><td>36</td></tr><tr><td>180</td><td>1</td></tr><tr><td>2 000</td><td>1</td></tr><tr><td colspan="2">NOTE r.m.s. acceleration value = 57,9 m/s^2.</td></tr></table></td><td>Acc. To ISO16750-3:2012, 4.1.2.7

(Acceleration 57.9 m/s² (5g))</td></tr>
<tr><td>Mechanical shock

 
</td><td>Operation mode not in function

Level of sharpness level 2
Acceleration 500 m/s² (50g)
Pulse form half-sinusoidal
Pulse duration 6 ms
Number of axes 3 axis (X, Y, Z)
Shocks per axis 10 shocks (10 per direction)
Total number of shocks 30 shocks</td><td>Acc. to ISO 16750-1, 4.2.2.2

(10 successive shocks in 3 axis X, Y and Z is 30 shocks)</td></tr>
</table>

ELECTRICAL INSPECTIONS		
Functional Test	Measure the 4,4kOhm Coding-Resistor, R5 Measure the resistance of the signal pins to the related 12pos header pins. Check the PCB socket contacts for wear Measure the three temperature sensors and validate versus actual charge inlet temperature Drive actuator in lock and unlock position as per drawing Measure contact resistance for all power contact terminals (AC, PE, and DC)	As per customer drawing
Temperature Shock	The product requirements shall be maintained during the test. T_{min} - 40°C, T_{max} 85°C Dwell Time - 45min each, 144 cycles	Acc. to IEC 60068-2-2 (Vibration) Acc. to IEC 60068-2-14 (Environment)
Insulation Resistance	R_{iso} > 200MΩ at 1000V DC	Acc. to ISO 60512-3-1
Temperature Rise	Temperature Rise with HPC (High power charging) cooling system Supplied current 500A, 600A, and 700A to inlet, Monitoring T-rise, terminal temp. 90°C max. Refer *Figure 4, Figure 5 and Figure 6* for T-Rise curve	-
ENVIRONMENTAL INSPECTIONS		
Aging in Dry Heat	The product requirements shall be maintained during the test.	Acc. To IEC 60068-2-2 Temp 85°C Test Duration - 120 h
Humidity	The product requirements shall be maintained during the test. The test is concluded with functional test in normal climate.	Acc. to IEC 60068-2-78 Temp 65°C 93% humidity 100h

Degree of Protection	Grade Dust (with flap closed) - IP5KX - IP6KX Water (with flap removed) - IPX5 - IPX6 - IPX7 - IPX9K 1) No medium must penetrate in quantities, which do not impair performance and study (possible use of water finding paste and visual inspection)	Acc. To below specs ISO 20653 – High velocity water ISO 20654 – Strong high velocity water ISO 20656 – High pressure/steam-jet cleaning ISO 20655 – Temporary Immersion ISO 20657 – Dust protection ISO 20659 – Dust Tight

Table 5

4. TEMPERATURE RISE CURVES:

4.1. 500A T-Rise curve

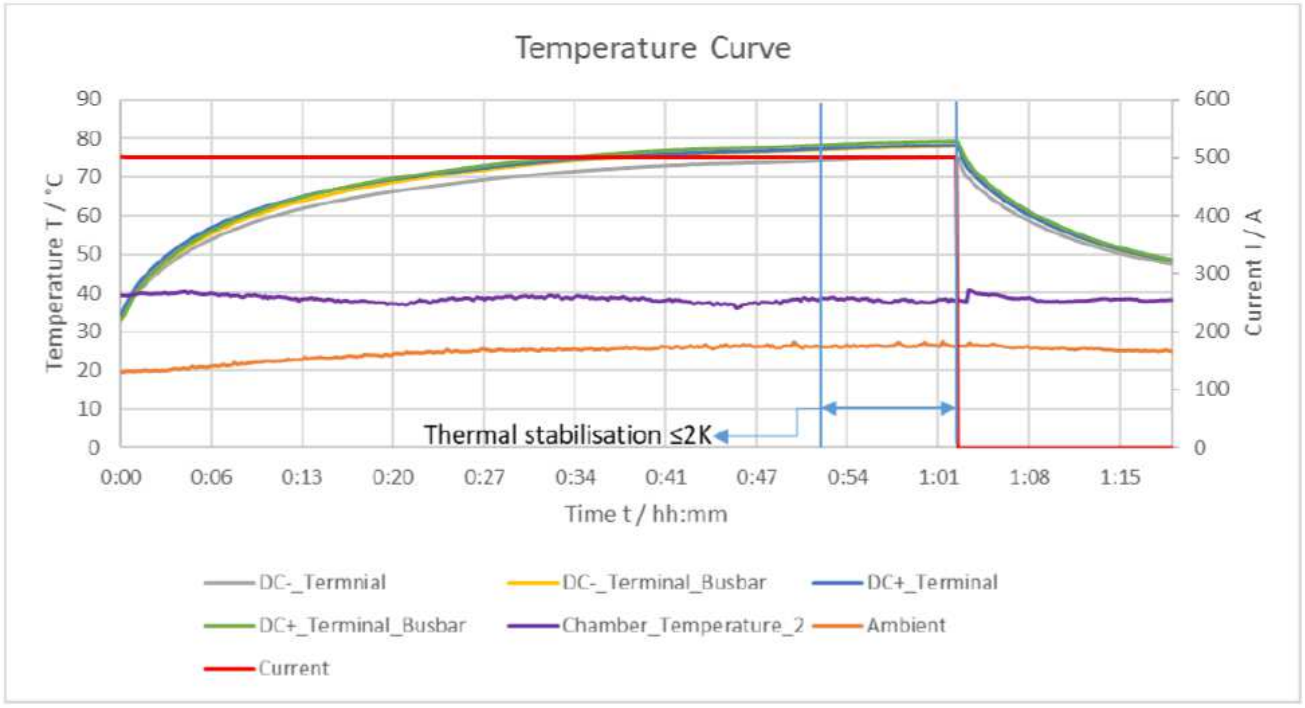


Figure 4

4.2. 600A T-Rise curve

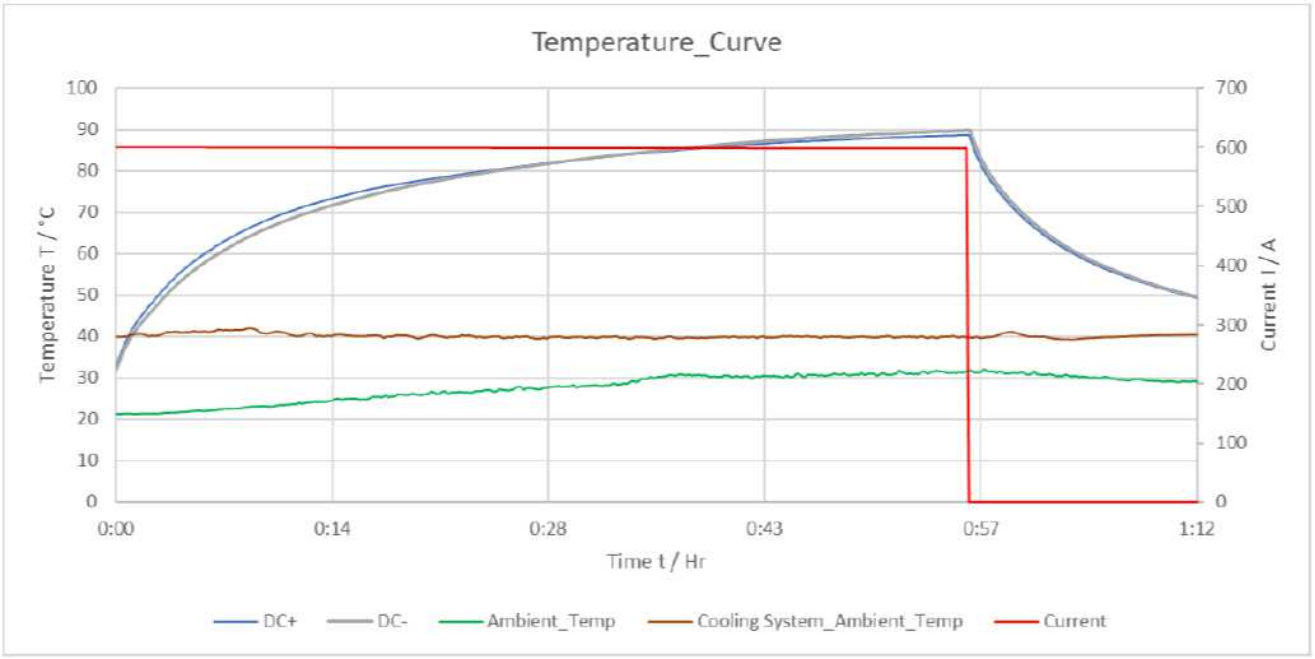


Figure 5

4.3. 700A T-Rise curve

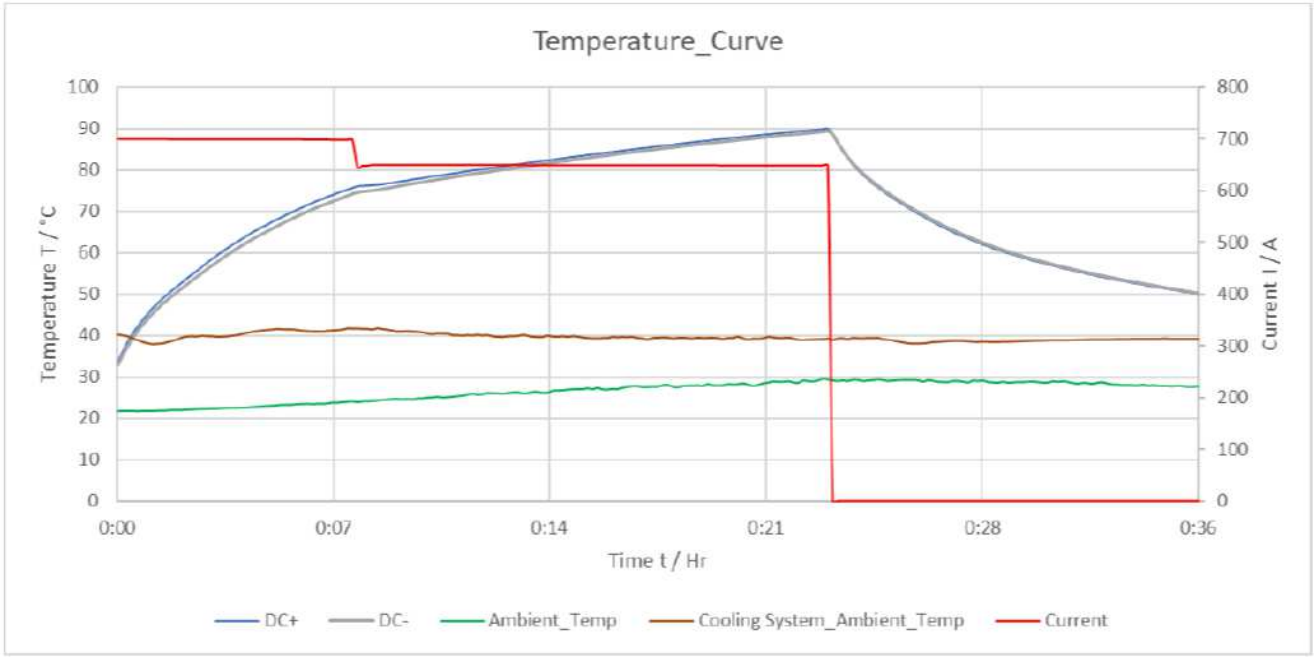


Figure 6

At 8 min, our coolant returns flow temperature from DC- and DC+ crossing safety temperature limit of 85˚C as per our Huber and Suhner HPC500 cooling system safety manual. Current was reduced by 50A(From 700A to 650A) to keep coolant return temperature within 85˚C.

LTR	REVISION RECORD	DWN	APVD	DATE
A	INITIAL DOCUMENT	SUPRIYA S	KASHYAP P B	30 JUNE 2023
A1	UPDATED • SHEET 1: Test Requirements and Procedures Summary • SHEET 3: Specifications	RAKSHITH N	KASHYAP P B	10 JULY 2023
A2	Scope introduction updated in chapter 1.1. Figure 2 image updated in chapter 3.3. Electrical inspections – T-Rise updated in chapter 3.5. Temperature Rise curve figure 4, Figure 5, Figure 6 added	SUPRIYA S	KASHYAP P B	27 JULY 2023
A3	Temperature rises at 700A statement updated in Chapter 4.3	SUPRIYA S	KASHYAP P B	30 NOVEMEBER 2023