

HC-STAK25-2phi 90° Sealed Shielded Connection System

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1. Scope

1.1. Content

This specification covers the performance, tests and quality requirements for the 2 position Connector and Header with HC-STAK25 contact system. Performance, tests, and quality requirements of the contact systems are not part of this specification but are included by the validation of the connector system.

1.2. Qualification

When tests are performed on the subject product line, procedures specified in Section 3.4 of this document shall be used. All inspections shall be performed using the applicable inspection plan and product drawing.

1.3. Qualification Test Results

The Qualification Test Report numbers are listed in Section 2.2 of this document. This documentation is on file at and available from Engineering Practices and Standards (EPS).

2. Applicable Documents and Forms

The following documents and forms constitute a part of this specification to the extent specified herein. Unless otherwise indicated, the latest edition of the document applies.

2.1. TE Documents

- [109-1](#): General Requirements for Testing
- [109-197](#): Test Specification (TE Test Specification vs EIA and IEC test Methods)
- [114-160204](#): Application Specification, HC-STAK 25-2phi XE High Voltage Connector
- [408-160054](#): Instruction Sheet, HC-STAK25-2phi High Voltage 4-Bolt Header

2.2. Qualification Test Report

- [501-160820](#): HC-STAK25-2phi 90° SEALED SHIELDED CONNECTION SYSTEM

2.3. Industry Documents

- IEC-60529: Degrees of Protection Provided by Enclosures (IP Code)
- USCAR-2: Performance Specification for Automotive Electrical Connector Systems
- USCAR-37: High Voltage Connector Performance Supplement to SAE/USCAR-2
- USCAR-25: Electrical Connector Assembly Ergonomic Design Criteria
- USCAR-38: Performance Specification for Ultrasonically Welded Wire Terminations

2.4. Customer Drawings

- [C-2840451](#): CU ALLOY, INNER FERRULE, HC-STAK 25
- [C-2840450](#): CU ALLOY, OUTER FERRULE, HC-STAK 25
- [C-2843128](#): CABLE SEAL, HC-STAK25 XE
- [C-2843126](#): CABLE SEAL RETAINER, HC-STAK25 XE
- [C-2843125](#): COLLET, HC-STAK25 XE
- [C-2843127](#): TAB CONTACT, HC-STAK25 XE-2PHI 090 PLG
- [C-2843129](#): FERRULE SLEEVE, HC-STAK25 XE
- [C-2843111](#): PLG SUB-ASSY, HC-STAK25 XE-2PHI 090
- [C-2843101](#): OUTER HSG ASSY, HC-STAK25 XE, HDR
- [C-2843102](#): INR HSG ASSY, HC-STAK25 XE, HDR
- [C-2843141](#): HDR OTR, INNR ASSY, HC-STAK25 XE-2PHI
- [C-2843100](#): 2POS, HC-STAK25, Plug Reference Drawing
(Available for part number relationships; not a saleable item)
- [C-2843110](#): 2POS, HC-STAK25, Header Reference Drawing
(Available for part number relationships; not a saleable item)

3. Requirements

3.1. Design and Construction

The Product shall be of design, construction, materials, and physical dimensions specified on the applicable product drawing.

3.2. Material

See customer drawings and material specifications.

3.3. Ratings

Table 1

Description	Range
Temperature class	USCAR-2, Class T3 (-40°to +125°C)
Sealing class	USCAR-2, Class S3
Vibration class	USCAR-2, Class V1 See Appendix 5.3
Working Voltage	1000 V _{DC}
Dielectric Withstand Voltage	4800 V _{DC}
Isolation Resistance	>100 MΩ
Material Group acc. to IEC 60664-1	See Appendix 5.2
Creepage/Clearance	See Appendix 5.2
Current Rating:	See Appendix 5.1
Degree of protection (IP code) against access, system un-mated	IP2XB; Touch Proof as per IEC 60529
Degree of protection (IP code), system mated	IP6K9K
Mating Cycles	10
HVIL capable	Yes
Identification of High Voltage component	Housing parts orange

3.4. Test Requirements and Procedures Summary

Unless otherwise specified, all tests shall be performed at ambient environmental conditions.

Table 2

TEST DESCRIPTION	REQUIREMENT	PROCEDURE
Initial examination of product	Meets requirements of product drawing.	USCAR-2, REV. 7, 5.1.8
Final examination of product	Meets visual requirements.	USCAR-2, REV. 7, 5.1.8
ELECTRICAL		
Protection against accidental contact, Plug	No contact between HV and Finger probe at 10 N +/-10%	IEC 60529
Protection against accidental contact, Header	No contact between HV and Finger probe at 10 N +/-10%	IEC 60529
Voltage Drop	USCAR-2, REV. 7, Section 5.3.2.4 1 mΩ maximum (Power)	USCAR-2, REV. 7, 5.3.2
Dry Circuit Resistance - HVIL	USCAR-2, REV. 7, Section 5.3.2.4 20 mΩ maximum (Signal, HVIL)	USCAR-2, REV. 7, Section 5.3.1
Dry Circuit Resistance - Shield	USCAR-2, REV. 7, Section 5.3.2.4 Record values for information only (Signal, Shield)	USCAR-2, REV. 7, Section 5.3.1
Insulation Resistance	USCAR-2, REV. 7, Section 5.5.1.4 1000V _{DC} Circuit to circuit, circuit to shield	USCAR-2, REV. 7, Section 5.5.1.3
Dielectric Withstand	USCAR-37, Section 5.5.2 No breakdown @4800V _{DC}	USCAR-37 Section 5.5.2
MECHANICAL		
Terminal insertion, HC-STAK25 Tab, Plug	TE Specification for HC-STAK25 XE Plug Tab Insertion: ≤110N	USCAR-37, Section 5.4.1.4
Terminal push-through, HC-STAK25 Tab, Plug	USCAR-37, Section 5.4.1.4.3 ≥ 50 N or MAX terminal insertion force, whichever is greater.	USCAR-37, Section 5.4.1.4
Terminal retention, HC-STAK25 Tab, Primary Lock only, Plug	TE Specification for HC-STAK25 XE Plug Tab Retention: ≥ 100N	USCAR-37, Section 5.4.1.4
Terminal retention, HC-STAK25 Tab, Primary and Secondary Lock, TPA in Lock position, Plug	USCAR-37, Section 5.4.1.4 ≥ 450 N, with harness fully assembled	USCAR-2, REV. 7, Section 5.4.1.3-B8 USCAR-37, Section 5.4.1.4
Terminal retention, HC-STAK25 Tab, Primary and Secondary Lock, TPA in Lock position, Moisture Conditioning, Plug	USCAR-37, Section 5.4.1.4 ≥ 450 N, with harness fully assembled	USCAR-2, REV. 7, Section 5.4.1.3-B8 USCAR-37, Section 5.4.1.4
Terminal retention, HC-STAK25 Tab, Primary and Secondary Lock, TPA in Lock position, Temp/Humidity cycling, Plug	USCAR-37, Section 5.4.1.4. ≥ 225 N, with harness fully assembled	USCAR-2, REV. 7, Section 5.6.2 USCAR-37, Section 5.4.1.4
Terminal retention, HC-STAK25 Tab, Primary and Secondary Lock, TPA in Lock, High-Temp Exposure, Plug	USCAR-37, Section 5.4.1.4. ≥ 225 N, with harness fully assembled	USCAR-2, REV. 7, Section 5.6.2 USCAR-37, Section 5.4.1.4
Terminal insertion, Tab, Header	TE Specification for HC-STAK25 XE Header Tab Insertion: ≤ 225N	USCAR-37, Section 5.4.1.4
Terminal push-through, Tab, (TPA in Pre-Lock position), Header	USCAR-37 Sec. 5.4.1.4-2 & -3 ≥ 50N or max Insertion Force whichever is greater	USCAR-37, Section 5.4.1.4
Terminal retention, Tab, Primary Lock only, TPA not engaged (locked), Header	TE Specification for HC-STAK25 XE Header Tab Retention: ≥ 100N	USCAR-37, Section 5.4.1.4
Terminal retention, Tab, Primary and Secondary Lock, Header	USCAR-37, Section 5.4.1.4. ≥ 450 N	USCAR-2, REV. 7, Section 5.4.1.3-B8 USCAR-37, Section 5.4.1.4
Terminal retention, Tab, Primary and Secondary Lock, Moisture Conditioning, Header	USCAR-37, Section 5.4.1.4. ≥ 450 N	USCAR-2, REV. 7, Section 5.4.1.3-B8 USCAR-37, Section 5.4.1.4

TEST DESCRIPTION	REQUIREMENT	PROCEDURE
Terminal retention, HC-STAK25 Tab, Primary and Secondary Lock, TPA in Lock position, Temp/Humidity cycling, Header	USCAR-37, Section 5.4.1.4. ≥ 225 N	USCAR-2, REV. 7, Section 5.6.2 USCAR-37, Section 5.4.1.4
Terminal retention, HC-STAK25 Tab, Primary and Secondary Lock, TPA in Lock position, High-Temp Exposure, Header	USCAR-37, Section 5.4.1.4. ≥ 225 N	USCAR-2, REV. 7, Section 5.6.2 USCAR-37, Section 5.4.1.4
Header Pin (HVIL) Push-Out, TPA in Pre-Lock position, Moisture Conditioning, Header	USCAR-2 REV. 7, Section 5.7.1.4 ≤ 15N	USCAR-2 REV. 7, Section 5.7.1.4
Header Pin (HVIL) Retention, TPA in Pre-Lock position, Moisture Conditioning, Header	USCAR-2 REV. 7, Section 5.7.1.4 ≤ 15N	USCAR-2 REV. 7, Section 5.7.1.4
Rear cable retainer insertion (install Cable Seal & Collet, then record force to install rear cable retainer), Plug	USCAR-2, REV. 7, Section 5.4.5.1.4 ≤ 60N	USCAR-2, REV. 7, Section 5.4.5.1
Rear cable retainer retention, Plug	USCAR-2, REV. 7, Section 5.4.5.1.4 ≥ 25N	USCAR-2, REV. 7, Section 5.4.5.1
HVIL Connector Mating Force, (HVIL Pins & HVIL Connector Fully populated)	USCAR-2, REV. 7 Sec. 5.4.2.3.A ≤ 75N	USCAR-2, REV. 7, Section 5.4.2.3
HVIL Connector Un-mating Force, (HVIL Pins & HVIL Connector Fully populated, Primary locking disabled)	USCAR-2, REV. 7 Sec. 5.4.2.3.B ≤ 75N	USCAR-2, REV. 7, Section 5.4.2.3
HVIL Connector Retention Force, (HVIL Pins & HVIL Connector Unpopulated Primary locking engaged)	USCAR-2, REV. 7 Sec. 5.4.2.3.B ≥ 110N	USCAR-2, REV. 7, Section 5.4.2.3
TPA Header Inner Engagement, Header (Unpopulated, Pre-Set → Lock)	USCAR-2, REV. 7, Section 5.4.5.2.4 ≥ 15N	USCAR-2, REV. 7, Section 5.4.5.2
TPA, Header Inner Push-out, (Push on base of forks HC-STAK25 FORKS)	≥ Mate Force in Conn-mate/un-mate	USCAR-2, REV. 7, Section 5.4.5.2
TPA Header Inner Engagement, Header (Fully populated, Pre-Set → Lock)	USCAR-2, REV. 7, Section 5.4.5.2.4 ≤ 60N	USCAR-2, REV. 7, Section 5.4.5.2
TPA, Header Inner Removal, Header (Unpopulated, Pre-Set → Remove)	USCAR-2, REV. 7, Section 5.4.5.2.4 ≥ 25N	USCAR-2, REV. 7, Section 5.4.5.2
TPA Plug Inner Engagement, Plug (Unpopulated, Pre-Set → Lock)	USCAR-2, REV. 7, Section 5.4.5.2.4 ≥ 15N	USCAR-2, REV. 7, Section 5.4.5.2
TPA Plug Inner Engagement, Plug (Fully Populated, Pre-Set → Lock)	USCAR-2, REV. 7, Section 5.4.5.2.4 ≤ 60N	USCAR-2, REV. 7, Section 5.4.5.2
TPA Plug Inner Disengagement, Plug (Fully populated, Lock → Pre-Set)	USCAR-2, REV. 7, Section 5.4.5.2.4 ≤ 60N (after 1st mate)	USCAR-2, REV. 7, Section 5.4.5.2
TPA Plug Inner Disengagement, Plug (Fully populated, Lock → Pre-Set)	USCAR-2, REV. 7, Section 5.4.5.2.4 ≥ 18N (after 2nd mate)	USCAR-2, REV. 7, Section 5.4.5.2
TPA, Plug Inner Removal, Plug (Unpopulated, Pre-Set → Remove)	USCAR-2, REV. 7, Section 5.4.5.2.4 ≥ 25N	USCAR-2, REV. 7, Section 5.4.5.2
CPA Engagement, Plug (Unmated, Lever open, Pre-Set → Lock)	USCAR-2, REV. 7, Section 5.4.5.2.4 ≥ 60N	USCAR-2, REV. 7, Section 5.4.5.2
CPA Engagement, Plug (Mated, Lever closed, Pre-Set → Lock)	USCAR-2, REV. 6, Section 5.4.5.2.4 ≤ 22N	USCAR-2, REV. 6, Section 5.4.5.2
CPA Disengagement, Plug (Mated, Lever closed, Lock → Pre-Set)	USCAR-2, REV. 7, Section 5.4.5.2.4 10N ≤ X ≤ 30N	USCAR-2, REV. 7, Section 5.4.5.2
CPA removal, Plug (Unmated, Lever open, pre-set → Remove)	USCAR-2, REV. 7, Section 5.4.5.2.4 ≥ 30N	USCAR-2, REV. 7, Section 5.4.5.2
Audible Click	USCAR-2, REV. 7, Section 5.4.7.4 Record values for information only	USCAR-2, REV. 7, Section 5.4.7
Audible Click, Moisture Conditioning	USCAR-2, REV. 7, Section 5.4.7.4 Record values for information only	USCAR-2, REV. 7, Section 5.4.7

TEST DESCRIPTION	REQUIREMENT	PROCEDURE
Pre-Lock Engage Force	USCAR-2, REV. 7, Section 5.4.3.4-1 $\leq 75\text{N}$	USCAR-2, REV. 7, Section 5.4.3.3.A
Pre-Lock Disengage Force	USCAR-2, REV. 7, Section 5.4.3.4-2 $15\text{N} \leq x \leq 75\text{N}$	USCAR-2, REV. 7, Section 5.4.3.3.A
Connector Mating Force (with Lever)	USCAR-2, REV. 7, Section 5.4.3.4-4 $\leq 75\text{N}$	USCAR-2, REV. 7, Section 5.4.3.3.C
Un-mating Force (using Lever) (CPA disable)	USCAR-2, REV. 7, Section 5.4.3.4-4 $\leq 75\text{N}$	USCAR-2, REV. 7, Section 5.4.3.3.C
Force to release lever from shipping position (Connector Class 3) (Lever open/lock)	USCAR-2, REV. 7, Section 5.4.3.4-3 $\geq 90\text{N}$	USCAR-2, REV. 7, Section 5.4.3.3.B
Lever Release Force (from closed position with latches engaged, CPA closed)	USCAR-2, REV. 7, Section 5.4.3.4-5 $\geq 60\text{N}$	USCAR-2, REV. 7, Section 5.4.3.3.C
Retention Force (unpopulated, CPA disable, Lever closed)	USCAR-2, REV. 7, Section 5.4.3.4-6 $\geq 110\text{N}$	USCAR-2, REV. 7, Section 5.4.3.3.D
Polarization feature Effectiveness (Incorrect orientation 90, 180) (Plug A --> Hdr A)	USCAR-2, REV. 7, Section 5.4.4.4.1 No functional damage No electrical contact	USCAR-2, REV. 7, Section 5.4.4.3.4b
Polarization feature Effectiveness (Incorrect orientation 90, 180) (Plug B --> Hdr B)	USCAR-2, REV. 7, Section 5.4.4.4.1 No functional damage No electrical contact	USCAR-2, REV. 7, Section 5.4.4.3.4b
Drop Test, Plug (Lever closed, CPA in Lock position, TPA in Pre-Lock position)	TE Specification for HC-STAK25 XE Plug Drop Test: Component is to be scrapped if dropped.	USCAR-2, REV. 7, Section 5.4.8
Drop Test, Header Inner + Outer Assy (TPA in Pre-Lock position)	TE Specification for HC-STAK25 XE Header Component Drop Test: Component is to be scrapped if dropped.	USCAR-2, REV. 7, Section 5.4.8
Drop Test, Header Outer Assy	TE Specification for HC-STAK25 XE Header Component Drop Test: Component is to be scrapped if dropped.	USCAR-2, REV. 7, Section 5.4.8
Drop Test, Header Inner Assy (TPA in Pre-Lock position)	TE Specification for HC-STAK25 XE Header Component Drop Test: Component is to be scrapped if dropped.	USCAR-2, REV. 7, Section 5.4.8
Cavity Damage, Plug	USCAR-2, REV. 7, Section 5.4.9.4 TPA does not fully lock	USCAR-2, REV. 7, Section 5.4.9
Terminal Retention Plug tab after Cavity Damage sequence, Primary and Secondary Lock, Plug	USCAR-2, REV. 7, Section 5.4.1.4 $\geq 450\text{N}$	USCAR-2, REV. 7, Section 5.4.9
Cavity Damage, Plug HVIL	USCAR-2, REV. 7, Section 5.4.9.4 TPA does not fully lock	USCAR-2, REV. 7, Section 5.4.9
Connector Seal Retention, Plug (Un-mated connector)	USCAR-2, REV. 7, Section 5.4.13.4 Peripheral seal not displaced	USCAR-2, REV. 7, Section 5.4.13.3
Connector Seal Retention, Header (Un-mated connector)	USCAR-2, REV. 7, Section 5.4.13.4 Face seal not displaced	USCAR-2, REV. 7, Section 5.4.13.3
Terminal/Cavity Polarization - Plug Tab	USCAR-2, REV. 7, Section 5.4.10.3 Terminal shall not seat @ 1.5X terminal insertion force or 15N - whichever is greater	USCAR-2, REV. 7, Section 5.4.10.3
Terminal/Cavity Polarization - Header Tab	USCAR-2, REV. 7, Section 5.4.10.3 Terminal shall not seat @ 1.5X terminal insertion force or 15N - whichever is greater	USCAR-2, REV. 7, Section 5.4.10.3
Mechanical Assist Integrity	USCAR-2, REV. 7, Section 5.4.12.4 No damage or separation	USCAR-2, REV. 7, Section 5.4.12.3

TEST DESCRIPTION	REQUIREMENT	PROCEDURE
Shield termination isolation test	USCAR-37, Section 5.2.4.4 $R \geq 100\text{M}\Omega$ @ 1000 VDC	USCAR-37, Section 5.2.5
Shield Termination Ferrule Retention	USCAR-37, Section 5.2.4.5 $\geq 150\text{N}$	USCAR-37, Section 5.2.4
ENVIRONMENTAL		
Vibration/Mechanical Shock	USCAR-2, REV. 7, Section 5.1.9 No loss of continuity for more than 1 μ s	USCAR-2, REV. 7, Section 5.4.6, Vibration Class V1 – See Appendix 5.3
Thermal Shock	Conditioning only	USCAR-2, REV. 7, Section 5.6.1
Temperature/Humidity cycling	Conditioning only	USCAR-2, REV. 7, Section 5.6.2
High Temperature Exposure	Conditioning only	USCAR-2, REV. 7, Section 5.6.3
Pressure/Vacuum Leak - Initial	USCAR-2, REV. 7, Section 5.6.6.4 48kPa, No leaks	USCAR-2, REV. 7, Section 5.6.6
Pressure/Vacuum Leak – After Conditioning	USCAR-2, REV. 7, Section 5.6.6.4 28kPa, No leaks	USCAR-2, REV. 7, Section 5.6.6
Submersion	USCAR-2, REV. 7, Section 5.6.5.4 Conditioning only • 0°C Solution • 30-40cm depth • 30 minutes	USCAR-2, REV. 7, Section 5.6.5
High Pressure Spray	USCAR-2, REV. 7, Section 5.6.7.4 Conditioning only • 14-16 L/min • 8,000-10,000 kPa • 80 $\pm$ 5°C	USCAR-2, REV. 7, Section 5.6.7
Fluid Resistance	No excessive swelling that impacts function	USCAR-2, REV. 7, Section 5.6.4 9 fluids per table 5.6.4.3


NOTE

Shall meet visual requirements, show no physical damage, and meet requirements of additional tests as specified in the Product Qualification and Requalification Test Sequence shown in Section 3.5.

3.5. Product Qualification and Requalification Test Sequence

Table 3

TEST OR EXAMINATION	TEST GROUP															
	1					2.1					2.2		3			
	SAMPLE SIZE															
	10	10	10	10	10	10	10	10	10	10	10	10	10	15	5	5
	TEST SEQUENCE (a)															
Visual Inspection	1,5	1,3	1,4	1,4	1,4	1,5	1,3	1,4	1,4	1,4	1,4	1,4	1,4	1,3	1,3	1,3
Terminal insertion, HC-STAK25 Plug Tab to the PLUG ASSY (TPA in Pre-Lock position)	2															
Terminal push-through, HC-STAK25 Plug Tab to the PLUG ASSY (TPA in Pre-Lock position)	3															
Terminal retention, HC-STAK25 Plug Tab to the PLUG ASSY (Primary Lock Only TPA in Pre-Lock position)	4															
Terminal retention, HC-STAK25 Plug Tab to the PLUG ASSY (Primary and Secondary Lock, TPA in Lock position)		2	3	3	3											
Moisture Conditioning			2					2			2	2				
Temp/Humidity Cycling				2					2							
High-Temp Exposure					2					2						
Terminal insertion, HC-STAK25 Header Tab						2										
Terminal push-through HC-STAK25 Header Tab						3										
Terminal retention, HC-STAK25 Header Tab (Primary Lock Only, TPA not engaged (locked) with the Header Tab)						4										
Terminal retention, HC-STAK25 Header Tab (Primary and Secondary Lock, TPA in Lock position)							2	3	3	3						
HVIL Pin Retention, HVIL Stitched Pin (TPA in Pre-Lock position)																
Header Pin (HVIL) Push-Out, TPA in Pre-Lock position, Header											3					
Header Pin (HVIL) Retention, TPA in Pre-Lock position, Header												3				
Rear cable retainer insertion, Plug													2			
Rear cable retainer retention, Plug													3			
HVIL Connector Mating Force (Header INR HSG populated with HVIL Pins, HVIL Connector populated)														2		
HVIL Connector Un-mating Force (Header INR HSG populated with HVIL Pins and mated with HVIL Connector populated with Generation Y Receptacles, testing to be done with Primary locking disabled)															2	
HVIL Connector Retention Force (Header INR HSG unpopulated and mated with HVIL Connector unpopulated, Primary locking engaged)																2

Table 3, Continued

TEST OR EXAMINATION	TEST GROUP																		
	3										4		5					6	
	SAMPLE SIZE																		
	10	10	10	10	10	10	10	10	10	10	8	8	10	10	10	5	2	2	
	TEST SEQUENCE (a)																		
Visual Inspection	1,4	1,3	1,3	1,3	1,5	1,3	1,3	1,4	1,3	1,3	1,4	1,6	1,3	1,3	1,3	1,3	1,3		
TPA, HDR INR Engage, Header Inner Assy, (Forks populated, No Header Tabs populated, Pre-set → Lock)	2																		
TPA, HDR INR Push-out (Push on base of forks using tool provided)	3																		
TPA, HDR INR Engage, Header Inner Assy (Header Tabs populated, TPA in pre-set position, Pre-set → Lock)		2																	
TPA HDR INR Removal (Header Inner Assy, No Header Tabs populated, pre-set → Remove)			2																
TPA, PLUG INR Engage, Plug Inner Assy, (HVIL Shunt not populated, Plug Tabs not populated, Pre-set → Lock)				2															
TPA, PLUG INR Engage, Plug Inner Assy (HVIL Shunt populated, Plug Tabs populated, Pre-set → Lock)					2														
TPA, Plug INR Disengage, Plug Inner Assy (HVIL Shunt populated, Plug Tabs populated, Lock → Pre-set)1 st mate					3														
TPA, Plug INR Disengage, Plug Inner Assy (HVIL Shunt populated, Plug Tabs populated, Lock → Pre-set)2 nd mate					4														
TPA, Plug INR Removal, Plug Inner Assy (HVIL Shunt not populated, Plug Tabs not populated, pre-set→ Remove)						2													
CPA Engagement PLUG (Un-mated, Lever open, Pre-set → Lock)							2												
CPA Engagement PLUG (Mated, Lever closed, Pre-set → Lock)								2											
CPA Disengagement PLUG (Mated, Lever closed, Lock → Pre-Set)									3										
CPA Removal PLUG (Unmated, Lever open, pre-set → Remove)										2									
Audible Click, Ambient sound 80 dB(A) MIN per Ford SDS 5B-1											2	3							
Moisture Conditioning												2							
Pre-Lock Engage Force (Fully populated)													2						
Pre-Lock Disengage Force (Fully populated)														3					
Connector Mating Force (With Lever, fully populated)															4				
Un-mating Force (Using Lever, CPA disabled)																5			
Force to release Lever from shipping position (Class 3, Lever locked in open position)															2				
Lever Release Force (from closed position with latches engaged, CPA closed)																2			
Retention Force (unpopulated, CPA open, Lever closed)																	2		
Polarization feature Effectiveness (incorrect orientation 90, 180, correct key, populated, Plug A --> Hdr A)																	2		
Polarization feature Effectiveness (incorrect orientation 90, 180, correct key, populated, Plug B --> Hdr B)																	2		

Table 3, Continued

TEST OR EXAMINATION	TEST GROUP														
	7				8		9		10		18	19	20	22	23
	SAMPLE SIZE														
	18	18	18	18	5	5	10	10	10	10	5	10	9	1	1
	TEST SEQUENCE (a)														
Visual Inspection	1,3	1,3	1,3	1,3	1,4	1,3	1,3	1,3	1,3	1,3	1,3	1,3	1,3	1	1
Drop Test, (Plug Connector, CPA in locked position, 1 Meter, 3 connector per orientation, 6 orientations (X-up, X-down, Y-up, Y-down, Z-up, Z-down))	2														
Drop Test, (Header Inner + Outer Assy, TPA in Pre-Set position, 1 Meter, 3 connector per orientation, 6 orientations (X-up, X-down, Y-up, Y-down, Z-up, Z-down))		2													
Drop Test (Header Outer Assy, 1 Meter, 2 without inner housing, 1 with inner housing assembled connector per orientation, 6 orientations (X-up, X-down, Y-up, Y-down, Z-up, Z-down))			2												
Drop Test (Header Inner Assy, TPA in Pre-Set position, 1 Meter, 3 connector per orientation, 6 orientations (X-up, X-down, Y-up, Y-down, Z-up, Z-down))				2											
Cavity Damage, (1x Partially installed terminal (plug tab) per connector)					2										
Terminal Retention after seating terminal and TPA, Plug tab (Primary and Secondary Lock)					3										
Cavity Damage, (1x Partially installed terminal (Gen Y) per connector)						2									
Connector Seal Retention, Peripheral Seal (Unmated Plug Connector)							2								
Connector Seal Retention, Peripheral Seal (Unmated Header Connector)								2							
Terminal/Cavity Polarization (Plug tab)									2						
Terminal/Cavity Polarization (Header tab)										2					
Mechanical Assist Integrity											2				
Shield termination isolation test												2			
Shield termination retention												3			
Fluids Resistance, 30 min soak, 9 fluids													2		
Protection against accidental contact (Header)														2	
Protection against accidental contact (Plug)															2

Table 3, Continued

TEST OR EXAMINATION	TEST GROUP						
	11a	11b	12	13	14	15	16
	SAMPLE SIZE						
	10	10	10	10	10	10	10
	TEST SEQUENCE (a)						
Visual Inspection	1,9	1,9	1,3,11	1,9	1,9	1, 15	1,12, 22
Connector Cycling (Mate/unmate connector pairs 10 times)	2	2		2	2	2	2
Voltage Drop (HV Conductors only, use 350A on 70mm ² wire)	3,6	3,6	5,8	3,6	3,6		
Dry Circuit Resistance (HVIL, Shield)	4,7	4,7	6,9	4,7	4,7		
Vibration/Mechanical Shock (V1 profile, 20 hrs/axis random vibration, 5-10 ms ,10 shocks/positive axis @ 35g)	5						
Vibration/Mechanical Shock (V1 profile, 8 hrs/axis random vibration,10 shocks/positive axis @ 35g)		5					
Thermal Shock (max. temp. 125°C, 100x cycles)			7				
Temp/Humidity Cycling (max. temp. 125°C, 40x cycles)				5		6	
High Temp Exposure (max. temp. 125°C, 1008hrs)					5		13
High Temp Exposure (max. temp. 125°C, 240hrs)							6
Dielectric Withstand	8	8	10	8	8	14	21
Mate/Unmate connector (1 cycle only.)			2				
Connector Cycling (Mate/unmate connector Remaining 9 cycles)			4				
Isolation Resistance (1000VDC)						3,5,7,9,11, 13	3,5,7,9,11, 14,16,18,20
Pressure/Vacuum Leak (48kPa)						4	4
Pressure/Vacuum Leak (28kPa)						8	8,15
Submersion						10	10,17
High Pressure Spray						12	19


NOTE

(a) Numbers indicate sequence in which tests are performed.

4. Quality Assurance Provisions

4.1. Qualification Testing

4.1.1 Specimen Selection

The samples shall be prepared in accordance with product drawings and shall be selected at random from current production.

4.1.2 Test Sequence

Qualification inspection shall be verified by testing specimens as specified in Chapter 3.5.

4.2. Requalification Testing

If changes significantly affecting form, fit, or function depending on the product or manufacturing process, product engineering shall coordinate requalification testing, consisting of all or part of the original testing sequence as determined by development/product, quality, and reliability engineering.

4.3. Acceptance

Acceptance is based on verification that the product meets the requirements of chapter 4. Failures attributed to equipment, test setup, or operator deficiencies shall not disqualify the product. When product failure occurs, corrective action shall be taken, and samples resubmitted for qualification. Testing to confirm corrective action is required before resubmittal.

4.4. Quality Conformance Inspection

The applicable quality inspection plan will specify the sampling acceptable quality level to be used. Dimensional and functional requirements shall be in accordance with the applicable customer drawing and this specification.

5. Appendix

5.1. Current Rating

HC-STAK25-2phi 90° Plug – Header Connector System

Maximum Material Service Temperature for the HC-STAK25 Terminals (T_M): 150 °C

Receptacle: C15100 base material with Ag/Ni plating

Tab: C11000 base material with Ag/Ni plating

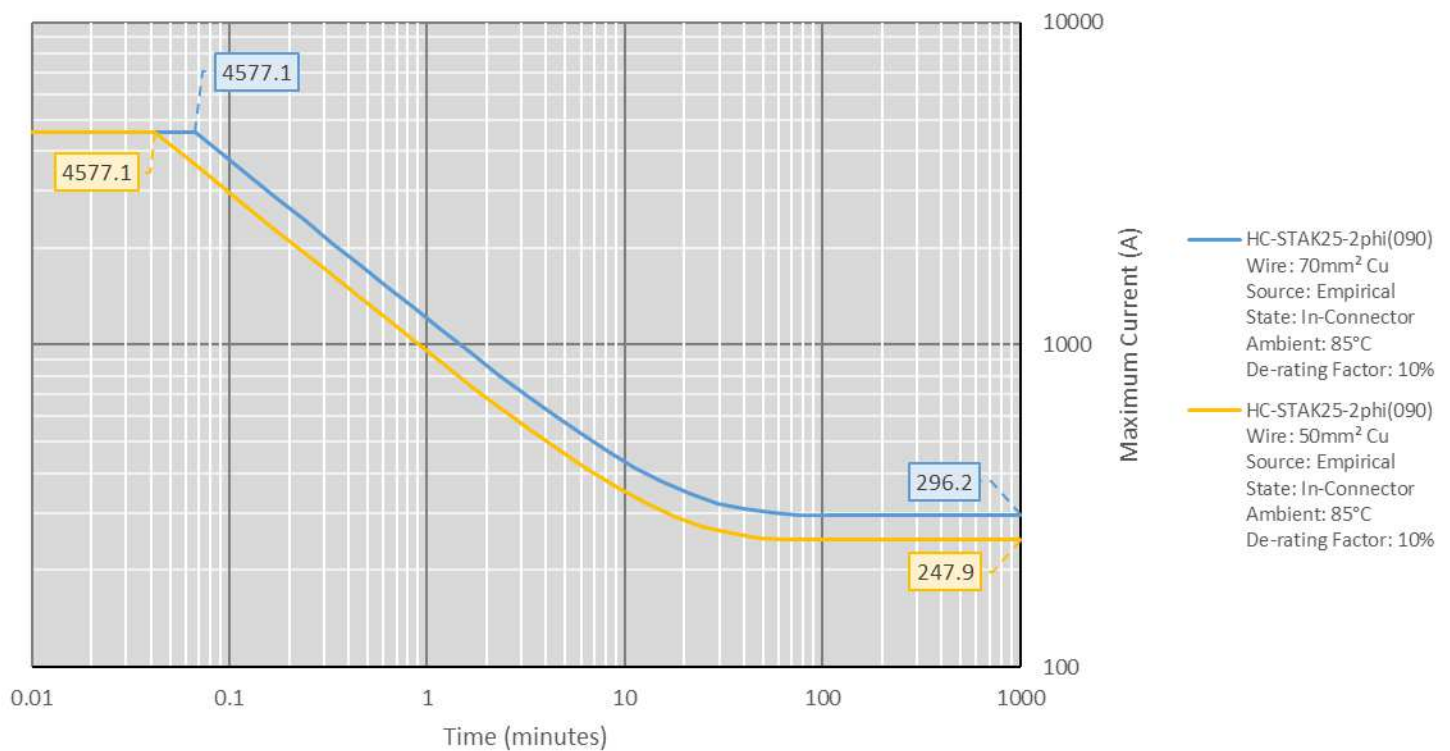
Cable: COROPLAST TI_9-2611_FHLR2GCB2G_70, 70mm², Copper, Shielded

Continuous Current Rating with 70mm² Cu Cable @ 85°C, 10% de-rating factor: **296.2 A**

Continuous Current Rating with 50mm² Cu Cable @ 85°C, 10% de-rating factor: **247.9 A**

Figure 1: Transient/Overload/Steady-State Current De-Rating

Transient/Overload/Steady-State Current De-Rating



The conditions under which the thermal-electric parameters were extracted prioritized testing parity and consistency. Application factors (e.g. conductor length, wire covering, mounting surface, proximity to additional heat sources, etc.) are not included and may have a non-trivial impact on performance.

5.2. Creepage and Clearance

Table 4

Assembly	Description	Minimum Clearance Distance (mm)	Minimum Creepage Distance (mm)
Header Assembly – Unmated Condition (Header Inner Housing: CTI 600)	HV & HV	12.90	13.12
	HV & HVIL	7.59	13.14
	HV to Ground/Shield	12.69	5.97
Plug Assembly – Unmated Condition (Plug Inner Housing: CTI 600)	HV & HV	14.26	14.32
	HV & HVIL	11.60	12.36
	HV to Ground/Shield	10.60	12.63
Plug and Header Assembly – Mated (Inner Housings: CTI 600)	HV & HV	12.90	12.90
	HV & HVIL	11.51	10.17
	HV to Ground/Shield	11.33	11.55


NOTE

Values are derived from CAD model with nominal geometry.

5.3. Dynamic Load

Ensure that the cables are rigidly secured at harness tie-down points, and that each tie-down point is static relative to the header mounting surface. A single tie-down point is required within 100mm or less from the cable exit of the connector, per USCAR-2 5.4.6.3, and at least one additional tie-down point is recommended within the 50mm range shown below in Figure 2. Having strain relief, which is static to the header mounting surface and placed near the cable exit of the connector, will improve the vibration performance of the system. Applications requiring vibration performance exceeding USCAR-2 Vibration Class V1 will require validation with a stabilization component like what is shown in Figure 3.

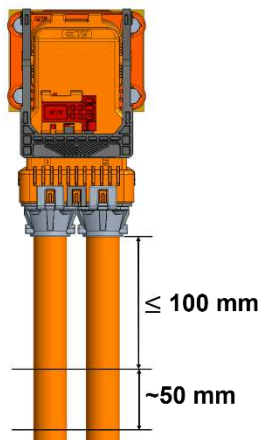


Figure 2: Cable Fixation Points per USCAR-2, V1

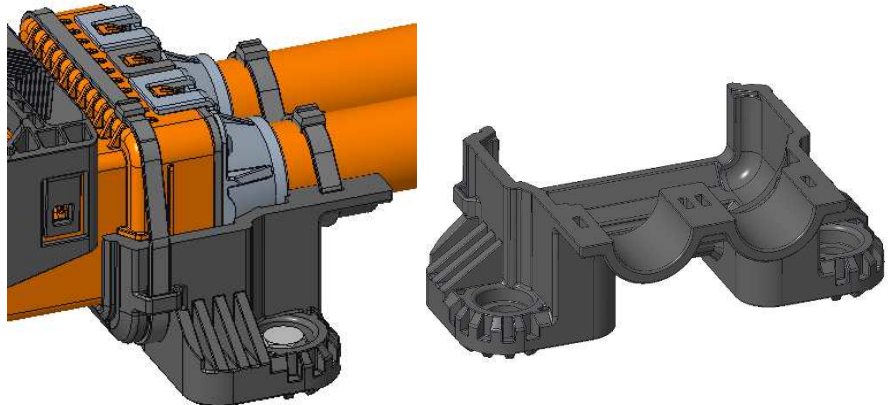


Figure 3: Example of a stabilization component for applications requiring vibration harsher than USCAR-2 Vibration Class V1.

Table 5: Class Schedule for Shock (USCAR-2 Rev7)

Vibration Class	Shocks per Axis	Wave Shape	Direction (+/-)	Duration (ms)	Acceleration (g)
V1	10	Half Sine Wave	Positive	5 ~ 10	35

Table 6: Vibration Duration

Vibration Class	Sine Duration (Hrs./axis)	Random Duration (Hrs./axis)	Thermal Cycling
V1	N/A	8	N/A

Table 7: Vibration Schedule: V1 - Random

F (Hz)	PSD (m/s ²) ² /Hz	PSD (g ² /Hz)
5.0	0.192	0.00200
12.5	23.8	0.24800
77.5	0.307	0.00320
145.0	0.192	0.00200
200.0	1.13	0.01180
230.0	0.031	0.00032
1000.0	0.002	0.00002
g _{rms}	17.74	1.81 g

<u>LTR</u>	<u>REVISION RECORD</u>	<u>DWN</u>	<u>APP</u>	<u>DATE</u>
A	Initial Report	Girish TG	L. Gatesman M. Brown	13 APR 2023
B	Working Voltage added to Table 1. Final validation details added to Table 3. Section 5.3 updated with Figure 3 and related verbiage.	Girish TG	L. Gatesman M. Brown	31 JUL 2023