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**High Speed Data, female connector 90°, 4 pos., shielded**  
*High Speed Data, Buchsenstecker 90°, 4 pol., geschirmt*

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The product described in this document has not been fully tested to ensure conformance to the requirements outlined below. Therefore, TE Connectivity (TE) makes no representation or warranty, express or implied, that the product will comply with these requirements. Further, TE may change these requirements based on the results of additional testing and evaluation. Contact TE Engineering for further details.

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## 1. CONTENT

*Inhalt*

**This specification covers the performance, tests and quality requirements for the High Speed Data connector system 90°, 4 pos., shielded. These products are only permissible for car interior.**

*Diese Spezifikation beschreibt die Eigenschaften, Tests und Qualitätsanforderungen für High Speed Data, Stecker System 90°, 4 pol., geschirmt. Diese Produkte dürfen nur im Fahrzeuginnenraum eingesetzt werden.*

### 1.1 Product Table

*Produktübersicht*

**Different versions are available.**

*Es sind verschiedene Ausführungsvarianten verfügbar.*

- **Order No. See drawing**  
*Bestell-Nr. siehe Zeichnung*

### 1.2 Qualification

*Qualifikation*

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

*Bei der Prüfung der genannten Produkte sind die nachfolgend genannten Richtlinien und Normen zu verwenden. Alle Prüfungen müssen nach den zugehörigen Prüfplänen und Produktzeichnungen durchgeführt werden.*

## 2. APPLICABLE DOCUMENTS

*ANWENDBARE UNTERLAGEN*

**The following documents form a part of this specification to the extent specified herein. In the events of conflict between the requirements of this specification and the product drawing or of conflict between the requirements of this specification and the referenced documents, this specification shall take precedence.**

*Die nachfolgend genannten Unterlagen, sofern darauf verwiesen wird, sind Teil dieser Spezifikation. Im Falle des Widerspruches zwischen dieser Spezifikation und der Produktzeichnung oder des Widerspruches zwischen dieser Spezifikation und den aufgeführten Unterlagen hat diese Spezifikation Vorrang.*

## 2.1 TE Documents

### TE Unterlagen

#### A 109-1:

##### **General Requirements for Test Specifications**

*Allgemeine Anforderungen für die Testabläufe*

#### B Customer Drawings and Name

*Kundenzeichnungen und Benennung*

#### C Product Specifications

*Produktspezifikationen*

**108-94106 Product specification for the HSD Connector System (system specification)**  
*Produktspezifikation für das HSD Steckverbindersystem (System-Spezifikation, elektrische und HF Eigenschaften)*

#### D HSD-Test-Specification

*HSD-Test-Spezifikation*

**109-18261 Test specification for the HSD Connector System**  
*Testspezifikation für das HSD Steckverbindersystem*

#### E Application Specification

*Verarbeitungsspezifikation*

**114-94117 Application specification for the HSD female connector System 90°**  
*Verarbeitungsspezifikation für den HSD Buchsenstecker System 90°*

## 2.2 Other Documents

### Allgemeine Unterlagen

#### A DIN IEC 512

##### **Electromechanical components for electronic equipment, basic testing procedures and measuring methods**

*elektrisch-mechanische Bauelemente für elektronische Einrichtungen, Meß- und Prüfverfahren.*

**Edition May 1994 / Ausgabe May 1994**

#### B DIN IEC 68

##### **Electrical engineering, basic environmental testing procedures**

*Elektrotechnik, Grundlegende Umweltprüfverfahren*

**Edition August 1991 / Ausgabe August 1991**

#### C IDB 1394

##### **1394 Copper Automotive Standard (Supplement to IDB 1394)**

*1394 Automobil Standard (Anhang zu IDB 1394)*

**Edition June 2008 / Ausgabe Juni 2008**

#### D SAE/USCar 2 Rev. 5

##### **Performance Specification for Automotive Electrical Connector Systems**

*Durchführungsspezifikation für elektrische Steckverbinder Systeme im Fahrzeug*

**Edition November 2007 / Ausgabe November 2007**

**ONLY FOR SEALED CONNECTOR SYSTEM!**

**NUR FUER STECKVERBINDER SYSTEM MIT DICHTUNG!**

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### 3. REQUIREMENTS ANFORDERUNGEN

#### 3.1 Design and Construction *Entwurf und Konstruktion*

**Product shall be of the design, construction and physical dimensions specified on the applicable production drawing.**

*Das Produkt muss in seiner Ausführung und seinen physikalischen Abmessungen der Produktionszeichnung entsprechen.*

#### 3.2 Materials *Werkstoffe*

**Descriptions for material see in production drawing.**

*Angaben hierzu sind den Zeichnungsunterlagen zu entnehmen.*

#### 3.3 Performance and Test Description *Merkmale und Testbeschreibung*

**The product is designed to meet the electrical, mechanical and environmental performance requirements specified in paragraph 3.4. All tests are performed at ambient environmental conditions per IEC 512 unless otherwise specified.**

*Das Produkt erfüllt die in Abschnitt 3.4 aufgeführten elektrischen, mechanischen und klimatischen Anforderungen. Soweit nicht anders spezifiziert, sind alle Prüfungen unter den in der IEC 512 genannten Umweltbedingungen durchgeführt.*

### 3.4 Test Requirements and Procedures Summary

Anforderungen und Prüfungen

- acc. TE HSD-Test-Spezifikation 109-18261  
gemäß TE HSD-Test-Spezifikation 109-18261

Eigenschaft	Akzeptanzkriterien Acceptance Criteria	Characteristic
<b>Mechanische Daten</b>		<b>Mechanical Data</b>
Steckzyklen	min. 25	Mating cycles
Steckkraft Steckerpaar	max. 30N	Mating Force Connector Pair
Trennkraft Steckerpaar	min. 5N max. 25N	Unmating Force Connector Pair
Haltekraft Steckerverriegelung	min. 110N	Retention Force Connector Lock
Kraft zur Betätigung der Steckerverriegelung	min. 3N max. 15N	Connector Lock
Lehren-Auszugskraft Innenleiter Steckkraft: Ziehkraft:	max. 5N min. 0,28N	Gauge Retention Force Outer Contact Mating Force: Unmating Force:
Lehren-Auszugskraft Außenleiter Steckkraft: Ziehkraft:	max. 20N min. 2N	Gauge Retention Force Inner Contact Mating Force: Unmating Force:
Zulässige Einführkraft des Steckers in das Gehäuse	max. 50N	Acceptance for Insertion Force Connector into Housing
Haltekraft Primärverriegelung des Steckers im Gehäuse, Initial	min. 60N *)	Retention-Force Primary Lock Connector to Housing, initial
Haltekraft Primär- und Sekundärverriegelung des Steckers im Gehäuse, Initial	min.110N	Retention-Force Primary and Secondary Lock Connector to Housing, initial
Haltekraft Primär- und Sekundärverriegelung des Steckers im Gehäuse, nach Feuchtebelastung	min.90N *)	Retention-Force Primary and Secondary Lock Connector to Housing, post moisture
Kodierungseffizienz	min. 80N	Polarization Feature Effectiveness
Kabelhaltekraft	min. 110N	Cable Retention Force
Kabelverdrehung	min. 20Ncm	Cable Torsion
<b>Elektrische Daten</b>		<b>Electrical Data</b>
Kontaktwiderstand vor Belastung Außenleiter Signalkontakt	max. 7.5 mOhm max. 15 mOhm (for 90°)	Contact Resistance before exposure Outer Contact Signal Contact
Kontaktwiderstand nach Belastung Außenleiter Signalkontakt	max. 40 mOhm max. 40 mOhm	Contact Resistance after exposure Outer Contact Signal Contact
Isolationswiderstand	min. 1.000 MOhm	Isolation Resistance
Strombelastbarkeit bei 80° C	min. 2,6A *)	Test Current Capability at 80°C
Betriebsspannung	100 Vrms	Operating Voltage
Prüfspannung	500 Vrms	Test Voltage

<b>Daten der Signalübertragung</b>		<b>Signal Propagation Data</b>
Impedanz Steckverbinder	100 +/- 15 Ohm	Impedance Connector only
Impedanz Kabelbaugruppe	=> Spec. 108-94106, Chap./ Kap.3	Cable Assembly Impedance
Ausbreitungsgeschwindigkeit im Kabel	=> Spec. 108-94106, Chap./ Kap.3	Propagation Delay within cable
Laufzeitdifferenz im Adernpaar Stecker gerade - gerade Stecker gerade - gewinkelt	max. 5 ps max. 25ps	Propagation Delay Skew in a Wire pair Connectors straight - straight Connectors straight - angled
Laufzeitdifferenz im Kabel im Adernpaar	=> Spec. 108-94106, Chap./ Kap.3	Cable Propagation Delay Skew within a wire pair between wire pairs
Laufzeitdifferenz zwischen Adernpaaren Stecker gerade - gerade Stecker gerade - gewinkelt	max. 5 ps max. 5 ps	Propagation Delay Skew between Wire pairs Connectors straight - straight Connectors straight - angled
Laufzeitdifferenz im Kabel im Adernpaar zwischen Adernpaaren	=> Spec. 108-94106, Chap./ Kap.3	Cable Propagation Delay Skew within a wire pair between wire pairs
Einfügedämpfung eines gesteckten Steckerpaares	max. 0.2 dB @ 1GHz	Insertion Loss of a mated pair of connectors
Einfügedämpfung Kabel f < 250Mhz f < 400Mhz f < 500Mhz f < 800Mhz f < 1000 Mhz	< 0.60 dB/m < 0.75 dB/m < 0.85 dB/m < 1.15 dB/m < 1.30 dB/m	Cable Insertion Loss f < 250 MHz f < 400 MHz f < 500 MHz f < 800 MHz f < 1000 MHz
Variation Einfügedämpfung im Temperaturbereich -40°C - +105°C	=> Spec. 108-94106, Chap./ Kap.3	Variation of Insertion Loss in the temp.-range -40°C - +105°C
Rückflussdämpfung Steckerpaar 0 - 1 GHz 0 - 2 GHz	max. -20 dB max. -17 dB	Return Loss Mated Conn. - Pair 0 - 1 GHz 0 - 2 GHz
zulässige deterministische Unschärfe	max. 200 ps	maximum deterministic Jitter
Nahnebensprechen	=> Spec. 108-94106, Chap./ Kap.3	Near End Cross Talk
Fernebensprechen	=> Spec. 108-94106, Chap./ Kap.3	Far End Cross Talk
Schirmungsdämpfung Kabelbaugruppe 0 - 1 GHz 0 - 2 GHz	min. 70 dB min. 60 dB	Shielding Attenuation Cable Assembly 0 - 1 GHz 0 - 2 GHz
Schirmungsdämpfung der Gehäusedurchführung 0 - 1 GHz 0 - 2 GHz	min. 65 dB min. 60 dB	Shielding Attenuation Bulkhead Feedthrough 0 - 1 GHz 0 - 2 GHz

**Depending on the used cable-type, deviations are possible.**

*In Anhängigkeit der verwendeten Leitung, sind Abweichungen möglich.*

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**Deviating to TE Test-Spec 109-18261**

*Abweichend zu TE Test-Spec. 109-18261*

<b>Umwelt - Daten</b>		<b>Environmental Data</b>
Mechanischer Schock	DIN IEC 60068-2-27	Mechanical Shock
Vibration	DIN IEC 60068-2-64 (Class 2)	Vibration
Aufschlag aus Höhe	1m	Drop from height
Temperaturschock	DIN IEC 60068-2-14 -40°C - +105°C	Thermal Shock
Temperatur-Feuchte-Zyklus	USCar 2.4 -5.6.2. Test Temperature +105°C	Temperature Humidity Cycling
Hitzebeständigkeit	DIN IEC 60068 2-2 Temperature +105°C	Dry Heat

<b>Materialien</b>		<b>Materials</b>
Außenleiter	CuZn, CuSn	Outer Contacts
Innenleiter	CuZn, CuSn	Inner Contacts
Dielektrikum	PA, LCP, PBT	Dielectric
Dichtungen	Silicone, Rubber	Gaskets
Crimphülsen	CuSn	Crimp Ferrule
Gehäuse und Sicherungen	PA, PBT, POM	Housings and Locks

<b>Oberflächen</b>		<b>Platings</b>
Außenleiter	Ni, Au	Outer Contacts
Signalkontakte	Au	Signal Contacts

**This table is part of the TE HSD Test-Specification, all values apply to the test conditions specified there.**

*Die Tabelle ist Bestandteil der TE HSD-Test-Spezifikation, die Werte gelten unter den dort ausgeführten Prüfbedingungen.*

- **acc. IDB 1394**  
*gemäß IDB 1394*

**Performance Group A: Basic Construction, workmanship, dimensions, and plating thickness**

Phase	Test to be performed			Measurements to be performed		Requirements
	Title	ID No.	Severity or conditions	Title	ID No.	Performance Level
A.1				Visual Inspection	USCAR-2, Rev. 5, 5.1.8	With aid of 10X magnification; No evidence of deterioration, cracks, deformities, etc., that could affect their functionality or distort their appearance. No deviation from dimensional tolerances of critical dimensions.
A.2				Plating Thickness Measurements		No deviation from plating materials and thickness specifications.

**Performance Group B: Copper Socket DC Electrical Functionality when subjected to Mechanical Shock and Vibration**

Phase	Test to be performed			Measurements to be performed		Requirements
	Title	ID No.	Severity or conditions	Title	ID No.	Performance Level
B.1	None		Mount socket rigidly. Insert plug by hand.	Dry Circuit Resistance	USCAR-2, Rev. 5, 5.3.1	50 milliohms maximum initial per mated contact
B.2	Connector Cycling	USCAR-2, Rev. 5 , 5.1.7	Cycle connector 25x.	Dry Circuit Resistance	USCAR-2, Rev. 5, 5.3.1	30 milliohms maximum change from initial per mated contact
B.3	Vibration	USCAR-2, Rev. 5, 5.4.6	Vibration per Figure 5.4.6.3, For components not coupled to engine. Grms=1.81.	Circuit Continuity Monitoring 7 ohms greater than 1micro-second	USCAR-2, Rev. 5, 5.1.9	No resistance change exceeding FFS ohms for more than 1 microsecond. (Each contact)
B.4	Mechanical Shock (Specified Pulse)	USCAR-2, Rev. 5, 5.4.6	10 half-sine wave impulses (10 milliseconds duration at 35 Gs force)	Circuit Continuity Monitoring 7 ohms greater than 1micro-second	USCAR-2, Rev. 5, 5.1.9	No resistance change exceeding FFS ohms for more than 1 microsecond. (Each contact)



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<b>B.5</b>	None			Dry Circuit Resistance	USCAR-2, Rev. 5, 5.3.1	30 milliohms maximum change from initial per mated contact
				Visual Inspection	USCAR-2, Rev. 5, 5.1.8	With aid of 10X magnification; No evidence of deterioration, cracks, deformities, etc., that could affect their functionality or distort their appearance.

**Performance Group C.1: Copper Socket DC Electrical Functionality when subjected to Humidity Stress**

Phase	Test to be performed			Measurements to be performed		Requirements
	Title	ID No.	Severity or conditions	Title	ID No.	Performance Level
<b>C.1.1</b>	None		Mount socket rigidly. Insert plug by hand.	Dry Circuit Resistance	USCAR-2, Rev. 5, 5.3.1	50 milliohms maximum initial per mated contact
<b>C.1.2</b>	Connector Cycling	USCAR-2, Rev. 5, 5.1.7	Cycle connector 25x.	Dry Circuit Resistance	USCAR-2, Rev. 5, 5.3.1	30 milliohms maximum change from initial per mated contact
<b>C.1.3</b>	Temperature/ Humidity Cycling	USCAR-2, Rev. 5, 5.6.2	-40 to 100C per class 2 environment. Maximum humidity per Figure 5.6.2.3. Total duration 320 hours (40 cycles).	Dry Circuit Resistance	USCAR-2, Rev. 5, 5.3.1	30 milliohms maximum change from initial per mated contact
				Visual Inspection	USCAR-2, Rev. 5, 5.1.8	With aid of 10X magnification; No evidence of deterioration, cracks, deformities, etc., that could affect their functionality or distort their appearance.

**Performance Group C.2: Copper Socket Isolation Resistance Functionality when subjected to Humidity Stress**

Phase	Test to be performed			Measurements to be performed		Requirements
	Title	ID No.	Severity or conditions	Title	ID No.	Performance Level
C.2.1	Connector Cycling	USCAR-2, Rev. 5, 5.1.7	Cycle connector 25x.	Isolation Resistance	USCAR-2, Rev. 5, 5.5.1.4	Resistance between adjacent terminals must exceed 20 megohm at 500 VDC.
C.2.2	Temperature/Humidity Cycling	USCAR-2, Rev. 5, 5.6.2	-40 to 100C per class 2 environment. Maximum humidity per Figure 5.6.2.3. Total duration 320 hours (40 cycles).	Isolation Resistance	USCAR-2, Rev. 5, 5.5.1.4	Resistance between adjacent terminals must exceed 20 megohm at 500 VDC.

**Performance Group C.3: Copper Socket Signal Integrity Functionality when subjected to Humidity Stress**

Phase	Test to be performed			Measurements to be performed		Requirements
	Title	ID No.	Severity or conditions	Title	ID No.	Performance Level
C.3.1	Mated Connector and Termination Impedance		160 ps rise time at 50 ps, 100ps, and 150 ps beyond the connector launch plane	Impedance - Differential Mode (Connector Only)	IEEE Std 1394-2000 Annex K.3	System Impedance (ZTP) = 100 Ω: ZPTAConn = 100Ω +/- 15Ω  System Impedance (ZTP) = 110 Ohms : ZPTAConn = 110Ω +/- 15Ω

<b>C.3.2</b>	Cable Impedance			Impedance - Differential Mode (Cable Assembly)	IEEE Std 1394-2000 Annex K.3	System Impedance (ZTP) = 100 Ω: ZTPA=100Ω +/- 6Ω ZTPB=100Ω +/- 6Ω  System Impedance (ZTP) =110 Ohms : ZTPA=110Ω +/- 6Ω ZTPB=110 Ω +/- 6Ω
<b>C.3.3</b>	Propagation Velocity within a cable			Velocity of Propagation Differential Mode	IEEE Std 1394-2000 Annex K.5	min 66% Co

<b>C.3.4</b>	Propagation Delay Skew within a mated connector pair - straight			Propagation Skew - Differential Mode	IEEE Std 1394-2000 Annex K.6	max 10 ps
<b>C.3.5</b>	Propagation Delay Skew within a wire pair		Per meter	Propagation Skew - Differential Mode	IEEE Std 1394-2000 Annex K.6	max 10 ps/m
<b>C.3.6</b>	Maximum Propagation Delay Skew of entire cable assembly			Propagation Skew - Differential Mode	IEEE Std 1394-2000 Annex K.6	160 ps
<b>C.3.7</b>	Total Cable Insertion Loss (Attenuation)			Attenuation	IEEE Std 1394-2000 Annex K.6	f < 250 MHz < 4.8 dB f < 400 MHz < 6.0 dB f < 500 MHz < 6.8 dB f < 800 MHz < 9.2 dB f < 1000 MHz < 10.4 dB
<b>C.3.8</b>	Return Loss (Mated Connector Pair)			Return Loss	ANSI/EIA 364-108	0 - 1 GHz -20 dB max
<b>C.3.9</b>	Near End Cross Talk (Mated Connector Pair)			Cross Talk	IEEE Std 1394-2000 Annex K.8	max. 5 % (differential TDT at 160 ps, 10-90% rise time) max. -30 dB (0 – 1 GHz)
<b>C.3.10</b>	Far End Cross Talk (Mated Connector Pair)			Cross Talk	IEEE Std 1394-2000 Annex K.8	max. 5 % (differential TDT at 160 ps, 10-90% rise time) max. -30 dB (0 – 1 GHz)
<b>C.3.11</b>	Connector Cycling	USCA R-2, Rev. 5, 5.1.7	Cycle connector 25x.			
<b>C.3.12</b>	Temperature/ Humidity	USCA R-2,	-40 to 100C per class 2			

	Cycling	Rev. 5, 5.6.2	environment . Maximum humidity per Figure 5.6.2.3. Total duration 320 hours (40 cycles).			
<b>C.3.13</b> - <b>C.3.22</b>	Repeat C.3.1 through C.3.10					

NOTE – Phase C.1, C.2 and/or C.3 can be combined if the sample configuration is suitable for the laboratory.

**Performance Group D: Copper Socket DC Electrical Functionality when subjected to Thermal Shock**

Phase	Test to be performed			Measurements to be performed		Requirements
	Title	ID No.	Severity or conditions	Title	ID No.	Performance Level
<b>D.1</b>	None		Mount socket rigidly. Insert plug by hand.	Dry Circuit Resistance	USCAR-2, Rev. 5, 5.3.1	50 milliohm maximum initial per mated contact
<b>D.2</b>	Connector Cycling	USCAR-2, Rev. 5, 5.1.7	Cycle connector 25x.	Dry Circuit Resistance	USCAR-2, Rev. 5, 5.3.1	30 milliohm maximum change from initial per mated contact
<b>D.3</b>	Thermal Shock	USCAR-2, Rev. 5, 5.6.1	-40 to 100C per class 2 environment. Total duration 100 cycles, 30 minute dwell.	Dry Circuit Resistance	USCAR-2, Rev. 5, 5.3.1	30 milliohm maximum change from initial per mated contact
				Visual Inspection	USCAR-2, Rev. 5, 5.1.8	With aid of 10X magnification; No evidence of deterioration, cracks, deformities, etc., that could affect their functionality or distort their appearance.

**Performance Group E: Copper Socket Mechanical Functionality when subjected to Temperature Life Stress**

Phase	Test to be performed			Measurements to be performed		Requirements
	Title	ID No.	Severity or conditions	Title	ID No.	Performance Level
<b>E.1</b>	None		Mate Force Only	Connector-Connector Mating/Un-mating Force	USCAR-2, Rev. 5, 5.4.2	55N Max Mate Force
<b>E.2</b>	Connector Cycling	USCAR-2, Rev. 5, 5.1.7	Cycle connector 25x.			

<b>E.3</b>	High temperature exposure	USCAR-2, Rev. 5, 5.6.3	100 C for 1008 hours mated			
<b>E.4</b>			Un-mate Force w/ & w/o Lock & Lock Actuation Force	Connector-Connector Unmating Force Only	USCAR-2, Rev. 5, 5.4.2	Connectors with locks: Un-mating force w/ Locke engaged; 100N Min, Connector Lock Manipulation Force; 3N min to 60N max  Connectors without locks:. Un-mating force w/o Lock; 5N min 55N max

Note: Phase E.1 and E.2 can be combined if the sample configuration is suitable for the laboratory.

**Performance Group F: General Tests**

Phase	Test to be performed			Measurements to be performed		Requirements
	Title	ID No.	Severity or conditions	Title	ID No.	Performance Level
<b>F.1</b>	Connector/ Cable Axial Pull test (5 cable assemblies with connector at one end 1m long, 5 mating connectors.)		Fix connector housing and apply a 100N load to the cable for one minute on cable axis.	Continuity	ANSI/EIA 364-46B	No discontinuity 1 microsecond or longer. (Each contact).
				Visual Inspection	USCAR-2, Rev. 5, 5.1.8	No jacket tears or visual exposure of shield. No jacket movement greater than 1.5 mm at point of exit from the connector or over mold.
<b>F.2</b>	Cable Flexing (5 cable assemblies with plug at one end 1m long, 5 mating connectors.)	ANSI/EIA 364-41C	Test Condition 1, Dimension X= 25 mm, 25 Cycles	Continuity	ANSI/EIA 364-46B	No discontinuity > 1 microsecond (Each contact).
				Isolation Resistance	USCAR-2, Rev. 5, 5.1.4	Resistance between adjacent terminals must exceed 20 megohm at 500 VDC.
				Visual Inspection	USCAR-2, Rev. 5, 5.1.8	With aid of 10X magnification; No jacket tears or visual exposure of shield, evidence of deterioration, cracks, deformities, etc., that could affect their functionality or distort their appearance. No jacket movement greater than 1.5 mm at point of exit.

<b>F.3</b>	Audible Click (5 mating connector pairs w/o humidity aging, 5 mating connector pairs w/ humidity aging.)	USCAR-2, Rev. 5, 5.4.7	95% - 98% RH @ 40C, 6 hours Minimum	Audible Click	USCAR-2, Rev. 5, 5.4.7	Report Data - Desired Goal:7 dB above Ambient unconditioned , 5 dB above Ambient conditioned
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<b>F.4</b>	Polarization Feature Effectiveness ( 1 mating connector pair per mis-mating orientation )	USCAR-2, Rev. 5, 5.4.7	80N	Continuity	USCAR-2, Rev. 5, 5.4.7	No contact with mating contacts during mis-mating.
				Visual Inspection	USCAR-2, Rev. 5, 5.1.8	With aid of 10X magnification; No evidence of deterioration, cracks, deformities, etc., that could affect their functionality or distort their appearance. No deviation from dimensional tolerances of critical dimensions.
<b>F.5</b>	Cavity Damage (5 plug terminals, 5 plug housings, 5 socket terminals, 5 socket housings)	USCAR-2, Rev. 5, 5.4.9		Visual Inspection	USCAR-2, Rev. 5, 5.1.8	Confirm that the secondary lock (TPA) does not fully seat when the terminal partially inserted.
			Remove force, fully seat terminal and fully seat secondary lock (TPA),	Terminal/ Connector Extraction Force	USCAR-2, Rev. 5, 5.4.1	USCAR-2, Rev. 5, 5.4.1.4
<b>F.6</b>	Connector Drop (10 Plug & Socket Connector Cable Assemblies)	USCAR-2, Rev. 5, 5.4.8	3 Drops of each unmated connector @ 1m	Visual Inspection	USCAR-2, Rev. 5, 5.1.8	With aid of 10X magnification; No evidence of deterioration, cracks, deformities, etc., that could affect their functionality or distort their appearance.

Notes:

- 1) Test Group F is not sequential. Each phase above is an independent test with separate sets of samples for each phase.
- 2) Cable length for Test Phase F.1 may be changed to facilitate laboratory and test equipment requirements.
- 3) Phase F.5 is applicable to connector systems with secondary locks (TPA's).

### 3.5 Qualification and Requalification Test Sequence Qualifikations- und Requalifikationsprüfungen

- acc. TE-HSD-Test-Spezifikation 109-18261  
gemäß TE HSD-Test-Spezifikation 109-18261

Prüfgruppe Test group		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Prüfvorschrift Abschnitt Test Specification Section		Steck- und Ziehkraft <b>Mating- / Unmating Force</b>	Lehren-Auszugskraft <b>Gauge Retention Force</b>	Wirksamkeit der Kodierung <b>Polarization Effectiveness</b>	Zugprüfung <b>Pull Test</b>	Kabelausrückkraft <b>Cable Retention Force</b>	Kabelverdrehschlagkraft <b>Cable Torsion</b>	Aufschlagprüfung <b>Drop Test</b>	Mechan. Schock, Vibration <b>Mechanical Shock, Vibration</b>	Gehäuse-Einführ- / Auszugskraft <b>Terminal Insertion/Retention Force</b>	Betätigung Sekundärverriegelung <b>Secondary Lock Manipulation</b>	Kabel- und Stecker-Impedanz <b>Cable- and Connector Impedance</b>	Signalübertragung <b>Transmission Parameters</b>	Dämpfung, Unschärfe, Übersprechen <b>Attenuation, Jitter and Cross-Talk</b>	Schirmungseffizienz <b>Shielding Efficiency</b>	Strombelastbarkeit <b>Maximum Test Current</b>	Temperaturschock <b>Thermal Shock</b>	Temperatur- und Feuchtezyklus <b>Temperature / Humidity Cycling</b>	Hitzebeständigkeit <b>High Temperature Exposure</b>
	Anzahl Prüfmuster <b>Sample size</b>	10	10	12	10	5	5	3	5	10	5	5	5	5	5	5	10	10	10
	Prüfreihenfolge/Test sequence <sup>1)</sup>																		
5.1.	Allgemeines <b>General</b>	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
5.1.5.	Stecken und Ziehen <b>Connector Cycling</b>				4			4	4			4	4	4		4	4	4	4
5.1.6.	Sichtprüfung <b>Visual Inspection</b>	2 5	2 4	2 5	2 23	2 5	2 6	2 7	2 23	2 4 7	2 4	2 6	2 8	2 9	2 5	2 6	2 23	2 23	2 24
5.1.7.	Kritische Abmessungen <b>Critical Dimensions</b>	3		3	3 14	3	3 5	3 6	3 14			3	3	3	3	3	3 14	3 14	3 15
5.1.8.	Stromkreis-Überwachung <b>Circuit Continuity Monitoring</b>				13				13										

Prüfgruppe Test group		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
5.2.1.	Steck- und Ziehkraft Stecker <b>Mating/Unmating Force Connectors</b>	4																	
5.2.2.	Lehren-Auszugskraft <b>Gauge Retention Force</b>		3																
5.2.3.	Wirksamkeit der Kodiervorrichtung <b>Polarization Effectiveness</b>			4															
5.2.4.	Mechanische Zugprüfung <b>Pull Test</b>				13														
5.2.5.	Kabelausreißkraft <b>Cable Retention Force</b>					4													
5.2.6.	Kabelverdrehung <b>Cable Torsion</b>						4												
5.2.7.	Aufschlagprüfung <b>Drop Test</b>							5											
5.2.8.	Mechanischer Schock, Vibration <b>Mechanical Shock, Vibration</b>								13										
5.2.9.	Gehäuse Einführ-/Auszugskraft <b>Terminal Insertion/Retention Force</b>									3 6									
5.2.10.	Betätigung d. Sekundärverriegelung <b>Manipulation of Secondary Lock</b>										3								
5.3.1.	Kontaktwiderstand <b>Contact Resistance</b>				11 21				11 21								11 21	11 21	11 22
5.3.2.	Isolationswiderstand <b>Isolation Resistance</b>				12 22				12 22								12 22	12 22	12 23
5.3.3.	Strombelastbarkeit <b>Maximum Test Current (Derating)</b>															5			
5.4.1.	Impedanz der Kabelbaugruppe <b>Cable Assembly Impedance</b>				5 15				5 15			5					5 15	5 15	5 16



Prüfgruppe Test group		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
5.4.2.	Ausbreitungsgeschwindigkeit <b>Propagation delay</b>												5						
5.4.3.	Laufzeitdifferenz im Aderpaar <b>Propagation Delay Skew</b>				6 16				6 16				6				6 16	6 16	6 17
5.4.4.	Einfügungsdämpfung <b>Attenuation</b>				7 17				7 17					7			7 17	7 17	7 18
5.4.5.	Temperaturgang der E.-Dämpfung <b>Attenuation Temperature-Variation</b>													8					
5.4.6.	Rückflußdämpfung <b>Return Loss</b>				8 18				8 18				7				8 18	8 18	8 19
5.4.7.	Zulässige Unschärfe <b>Maximum Jitter</b>				9 19				9 19					5			9 19	9 19	9 20
5.4.8.	Übersprechen <b>Cross Talk</b>				10 20				10 20					6			10 20	10 20	10 21
5.4.9. 5.4.10.	Schirmungseffizienz <b>Shielding Effectiveness</b>														4				
5.5.1.	Temperaturschock <b>Thermal Shock</b>																13		
5.5.2.	Temperatur-Feuchte-Zyklus <b>Temperature Humidity Cycling</b>									5									13
5.5.3.	Hitzebeständigkeit <b>High Temperature Exposure</b>																		13

1) **Numbers indicate sequence in which test are performed.**  
*Die Zahlen geben die Reihenfolge an, in der die Prüfungen erfolgen.*

- acc. IDB 1394  
gemäß IDB 1394

**Cable to Cable Configurations**

Cable to Cable Configurations	Performance Group														
	A	B	C.1	C.2	C.3	D	E.1	E.2(5)	F.1	F.2	F.3	F.4 (4)	F.5	F.6	Total
Sockets, not assembled to a cable	3														3
Socket Terminals Terminated to Wires													5		5
Socket Housings with TPA's w/o Terminals Installed											16		5		21
Cable assemblies with a Socket assembled to one end, ~ 75 mm long												3			3
Cable assemblies with a Socket assembled to one end, > 75 mm long (1)	3		10	3		10	10	10							46
Cable assemblies with a Socket assembled to one end, > 100 mm long (2).		10													10
Cable assemblies with a Socket assembled to one end, >= 1m long.									5	5				10	20
Plugs, not assembled to cable	3														3
Plug Terminals Terminated to Wires													5		5
Plug Housings with TPA's w/o Terminals Installed												16	5		21
Cable assemblies with a Plug assembled to one end, ~ 75 mm long												3			3
Cable assemblies with a Plug assembled to one end, > 75 mm long (1)	3		10	3		10	10	10							46
Cable assemblies with a Plug assembled to one end, > 100 mm long (2)		10													10
Cable assemblies with a Plug assembled to one end, >= 1m long.									5	5				10	20
Socket and Plug assemblies configured for signal integrity measurements (3)					3										3

**Number of samples required by each performance group regardless of circuit size**

Notes:

- (1) Samples are to be prepared to facilitate resistance measurements made at points on the wire 75 mm back from the contact/wire termination.
- (2) Samples are to be prepared to facilitate clamping the cable 100mm back from the connector housing in a vibration fixture and resistance measurements made at points on the wire 75 mm back from the contact/wire termination.
- (3) Samples are to be prepared to facilitate high speed signal integrity measurements. Configurations are to include any necessary SI fixtures.
- (4) One connector pair mis-mate orientation. See Test Group F.4
- (5) The same samples are used for phases E.2, E.3, and E.4.

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#### 4. QUALITY ASSURANCE PROVISIONS QUALITÄTSSICHERUNGSMASSNAHMEN

##### 4.1 Qualification Testing Qualifikationsprüfung

###### A Sample Selection Auswahl der Prüflinge

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

*Die Prüflinge müssen den Zeichnungsunterlagen entsprechen. Sie sind der laufenden Produktion zufällig zu entnehmen.*

###### B Test Sequence Prüfgruppen

**Qualification inspection shall be verified by testing samples as specified in Paragraph 3.5.**

*Die Prüfungen müssen gemäß der unter Abschnitt 3.5 aufgeführten Prüfgruppen durchgeführt werden.*

##### 4.2 Requalification Testing Requalifikationsprüfung

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

*Falls signifikante, die vereinbarten Eigenschaften berührende Änderungen der Form, Ausstattung oder Funktion des Produktes oder dessen Herstellungsverfahrens vorgenommen wurden, wird die zuständige Entwicklungsabteilung einen Requalifikationstest koordinieren. Dieser besteht aus einem Teil oder den gesamten ursprünglichen Prüfgruppen, je nach Festlegung durch die Entwicklungs- und Qualitätssicherungsabteilung.*

##### 4.3 Acceptance Abnahme

**Acceptance is based on verification that the product meets the requirements of Paragraph 3.4. 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.**

*Die Abnahme basiert auf dem Nachweis, daß das Produkt den Anforderungen nach Abschnitt 3.4 genügt. Abweichungen, die auf Meßgeräte, Meßanordnungen oder Bedienungsmängel zurückzuführen sind, dürfen nicht zum Entzug der Qualifikation führen. Tritt eine Abweichung auf, müssen korrigierende Maßnahmen ergriffen werden und die Qualifikation ist erneut nachzuweisen. Vor dieser Requalifikation ist durch entsprechende Prüfungen der Erfolg der Korrekturmaßnahme zu bestätigen.*

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#### 4.4 Prüfung Conformance Inspection

*Prüfung und Konformität*

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

*Die Konformitätsprüfung erfolgt nach dem zugehörigen Qualitätsinspektionsplan, der die annehmbare Qualitätsgrenzlage nach dem Stichprobenumfang festlegt. Maßliche und funktionelle Anforderungen müssen mit den Produktzeichnungen und dieser Spezifikation übereinstimmen.*