

High Speed Data, Connector System 90°, 4 pos., shielded, diameter ≤ 4x0.22 mm²
High Speed Data, Steckverbinder System 90°, 4 pol., geschirmt, Querschnitt ≤ 4x0,22 mm²

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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 Customer Drawings and Name
Kundenzeichnungen und Benennung

B Product Specifications
Produktspezifikationen

108-94106 Product specification for the HSD Connector System (System Specification)
Produktspezifikation für das HSD Steckverbindersystem (System-Spezifikation)

C HSD-Test-Specification
HSD-Test-Spezifikation

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

D 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
<i>elektrisch-mechanische Bauelemente für elektronische Einrichtungen, Meß- und Prüfverfahren.</i>
Edition May 1994 / Ausgabe May 1994 |
| B | DIN IEC 68 | Electrical engineering, basic environmental testing procedures
<i>Elektrotechnik, Grundlegende Umweltprüfverfahren</i>
Edition August 1991 / Ausgabe August 1991 |
| C | IDB 1394 | 1394 Copper Automotive Standard (Supplement to IDB 1394)
<i>1394 Automobil Standard (Anhang zu IDB 1394)</i>
Edition June 2008 / Ausgabe Juni 2008 |
| D | SAE/USCar 2
Rev. 5 | Performance Specification for Automotive Electrical Connector Systems
<i>Durchführungsspezifikation für elektrische Steckverbinder Systeme im Fahrzeug</i>
Edition November 2007 / Ausgabe November 2007
ONLY FOR SEALED CONNECTOR SYSTEM!
<i>NUR FUER STECKVERBINDER SYSTEM MIT DICHTUNG!</i> |

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-Specification 109-18261**
gemäß TE HSD-Test-Spezifikation 109-18261

Eigenschaft	Akzeptanzkriterien Acceptance Criteria	Characteristic
Mechanische Daten		Mechanical Data
Steckzyklen	min 25	Mating cycles
Steckkraft Steckerpaar	max. 30 N	Mating Force Connector Pair
Trennkraft Steckerpaar	min. 5 N max. 25 N	Unmating Force Connector Pair
Haltekraft Steckerverriegelung	min. 110 N	Retention Force Connector Lock
Kraft zur Betätigung der Steckerverriegelung	min. 3 N max. 15 N	Connector Lock
Lehren-Auszugskraft Innenleiter Steckkraft Ziehkraft	max. 5 N min. 0.28 N	Gauge Retention Force Center Contact Mating Force Unmating Force
Lehren-Auszugskraft Außenleiter Steckkraft Ziehkraft	max. 20 N min. 2 N	Gauge Retention Force Outer Contact Mating Force Unmating Force
Zulässige Einführkraft des Steckers in das Gehäuse	max. 50 N	Acceptance for Insertion Force Connector into Housing
Haltekraft Primärverriegelung des Steckers im Gehäuse, Initial	min. 60 N	Retention-Force Primary Lock Connector to Housing, initial
Haltekraft Primär- und Sekundärverriegelung des Steckers im Gehäuse, Initial	min.110 N	Retention-Force Primary and Secondary Lock Connector to Housing, initial
Haltekraft Primär- und Sekundärverriegelung des Steckers im Gehäuse, nach Feuchtebelastung	min. 90 N	Retention-Force Primary and Secondary Lock Connector to Housing, post moisture
Kodierungseffizienz	min. 80 N	Polarization Feature Effectiveness
Kabelhaltekraft	min. 110 N	Cable Retention Force
Kabelverdrehung	min. 20Ncm	Cable Torsion
Elektrische Daten		Electrical Data
Kontaktwiderstand vor Belastung Außenleiter Signalkontakt	max. 7.5 mOhm max. 15 mOhm	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. 2.6 A	Test Current Capability at 80°C
Betriebsspannung	100 Vrms	Operating Voltage
Prüfspannung	500 Vrms	Test Voltage

Daten der Signalübertragung		Signal Propagation Data
Impedanz Steckverbinder mit Leitung 90 Ω ¹⁾ Leitung 100 Ω ^{2,3)}	informative 100 Ω ± 15 Ω	Impedance Connector only for cable 90 Ω ¹⁾ cable 100 Ω ^{2,3)}
Impedanz Kabelbaugruppe	=> Spec. 108-94106, Chap. / Kap.3	Cable Assembly Impedance
Laufzeitdifferenz im Kabel im Adernpaar zwischen Adernpaaren	=> Spec. 108-94106, Chap. / Kap.3	Cable Propagation Delay Skew within a wire pair between wire pairs
Laufzeitdifferenz im Adernpaar	max. 25ps	Propagation Delay Skew in a Wire pair
Laufzeitdifferenz zwischen Adernpaaren	max. 5 ps	Propagation Delay Skew between Wire pairs
Einfügedämpfung eines gesteckten Steckerpaares	max. 0.2 dB @ 1GHz	Insertion Loss of a mated pair of connectors
Einfügedämpfung Kabel f < 250 MHz f < 400 MHz f < 500 MHz f < 800 MHz 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
Rückflussdämpfung Steckerpaar mit Leitung 90 Ω ¹⁾ 0 – 0,5 GHz 0,5 - 1 GHz mit Leitung 100 Ω ^{2,3)} 0 - 1 GHz 1 - 2 GHz 2 - 3 GHz	max. -15 dB ¹⁾ max. -12 dB ¹⁾ max. -17 dB ^{2,3)} max. -15 dB ^{2,3)} max. -10 dB ³⁾	Return Loss of mated Connector - Pair with cable 90 Ω ¹⁾ 0 - 0.5 GHz 0.5 - 1 GHz with cable 100 Ω ^{2,3)} 0 - 1 GHz 1 - 2 GHz 2 - 3 GHz
Nahnebensprechen 0 - 1 GHz 1 - 2 GHz 2 - 3 GHz	max. -20 dB ^{1,2,3)} max. -15 dB ^{2,3)} max. -15 dB ³⁾	Near End Cross Talk 0 - 1 GHz 1 - 2 GHz 2 - 3 GHz
Fernnebensprechen 0 - 1 GHz 1 - 2 GHz 2 - 3 GHz	max. -25 dB ^{1,2,3)} max. -20 dB ^{2,3)} max. -20 dB ³⁾	Far End Cross Talk 0 - 1 GHz 1 - 2 GHz 2 - 3 GHz
Schirmungsdämpfung Kabelbaugruppe 0 - 1 GHz 1 - 2 GHz 2 - 3 GHz	min. 70 dB ^{1,2,3)} min. 60 dB ^{2,3)} min. 60 dB ³⁾	Shielding Attenuation Cable Assembly 0 - 1 GHz 1 - 2 GHz 2 - 3 GHz

- ¹⁾ **Valid for cables class Ib reg. TEC 108-94106**
Gültig für Leitungen Klasse Ib gemäß TEC 109-94106
- ²⁾ **Valid for cables class Ia reg. TEC 108-94106**
Gültig für Leitungen Klasse Ia gemäß TEC 109-94106
- ³⁾ **Valid for cables class IIa reg. TEC 108-94106**
Gültig für Leitungen Klasse IIa gemäß TEC 109-94106

Umwelt - Daten		Environmental Data
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

Materialien		Materials
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

Oberflächen		Platings
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

Note: Cable related values only valid for cable Leoni Dacar 535 (cable class 1a reg. TEC 108-94106)
Anmerkung: Leitungsbezogene Kennwerte nur für Leitung Leoni Dacar 535 (Klasse 1a gemäß TEC 108-94106)

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)
B.5	None			Dry Circuit Resistance	USCAR-2, Rev. 5, 5.3.1	30 milliohms maximum change from initial per mated contact
B.6				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
C.1.1	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
C.1.2	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
C.1.3	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 100°C 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
C.3.2	Cable Impedance			Impedance - Differential Mode (Cable Assembly)	IEEE Std 1394-2000 Annex K.3	System Impedance (ZTP) = 100 Ω: ZTPA=100Ω +/- 6Ω ZTPB=100Ω +/- 6 Ω System Impedance (ZTP) =110 Ohms : ZTPA=110Ω +/- 6Ω ZTPB=110 Ω +/- 6Ω
C.3.3	Propagation Velocity within a cable			Velocity of Propagation Differential Mode	IEEE Std 1394-2000 Annex K.5	min 66% Co
C.3.4	Propagation Delay Skew within a mated connector pair - straight			Propagation Skew - Differential Mode	IEEE Std 1394-2000 Annex K.6	max 10 ps
C.3.5	Propagation Delay Skew within a wire pair		Per meter	Propagation Skew - Differential Mode	IEEE Std 1394-2000 Annex K.6	max 10 ps/m
C.3.6	Maximum Propagation Delay Skew of entire cable assembly			Propagation Skew - Differential Mode	IEEE Std 1394-2000 Annex K.6	160 ps
C.3.7	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
C.3.8	Return Loss (Mated Connector Pair)			Return Loss	ANSI/EIA 364-108	max -20 dB (0 - 1 GHz)
C.3.9	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)
C.3.10	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)
C.3.11	Connector Cycling	USCAR-2, Rev. 5, 5.1.7	Cycle connector 25x.			

C.3.12	Temperature/ Humidity Cycling	USCAR-2, Rev. 5, 5.6.2	-40 to 100°C per class 2 environment. Maximum humidity per Figure 5.6.2.3. Total duration 320 hours (40 cycles).			
C.3.13 - C.3.22	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
D.1	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
D.2	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
D.3	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
E.1	None		Mate Force Only	Connector-Connector Mating/Un-mating Force	USCAR-2, Rev. 5, 5.4.2	55N Max Mate Force
E.2	Connector Cycling	USCAR-2, Rev. 5, 5.1.7	Cycle connector 25x.			
E.3	High temperature exposure	USCAR-2, Rev. 5, 5.6.3	100 C for 1008 hours mated			
E.4			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
F.1	Connector/ Cable Axial Pull test (5 cable assemblies with con. 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.
F.2	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 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.
F.3	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
F.4	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.
F.5	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
F.6	Connector Drop (10 Plug & Socket Con.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-Specification 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 Mating / Unmating Force	Lehren-Auszugskraft Gauge Retention Force	Wirksamkeit der Kodierung Polarization Effectiveness	Zugprüfung Pull Test	Kabelausreißkraft Cable Retention Force	Kabelverrehungskraft Cable Torsion	Aufschlagprüfung Drop Test	Mechan. Schock, Vibration Mechanical Shock, Vibration	Gehäuse-Einführ- / Auszugskraft Terminal Insertion/Retention Force	Betätigung Sekundärverriegelung Secondary Lock Manipulation	Kabel- und Stecker-Impedanz Cable- and Connector Impedance	Signalübertragung Transmission Parameters	Dämpfung und Übersprechen Attenuation and Cross-Talk	Schirmungseffizienz Shielding Efficiency	Strombelastbarkeit Maximum Test Current	Temperaturschock Thermal Shock	Temperatur- und Feuchtezyklus Temperature / Humidity Cycling	Hitzebeständigkeit High Temperature Exposure
	Anzahl Prüfmuster Sample size	10	10	12	10	5	5	3	5	10	5	5	5	5	5	5	10	10	10
	Prüfreihenfolge/Test sequence ¹⁾																		
5.1.	Allgemeines General	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
5.1.5.	Stecken und Ziehen Connector Cycling				4			4	4			4	4	4		4	4	4	4
5.1.6.	Sichtprüfung Visual Inspection	2 5	2 4	2 5	2 21	2 5	2 6	2 7	2 21	2 4 7	2 4	2 6	2 8	2 7	2 5	2 6	2 21	2 21	2 22
5.1.7.	Kritische Abmessungen Critical Dimensions	3		3	3 13	3	3 5	3 6	3 13			3	3	3	3	3	3 12	3 12	3 12
5.1.8.	Stromkreis-Überwachung Circuit Continuity Monitoring				12				12										

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 Mating/Unmating Force Connectors	4																	
5.2.2.	Lehren-Auszugskraft Gauge Retention Force		3																
5.2.3.	Wirksamkeit der Kodiervorrichtung Polarization Effectiveness			4															
5.2.4.	Mechanische Zugprüfung Pull Test				12														
5.2.5.	Kabelausrückkraft Cable Retention Force					4													
5.2.6.	Kabelverdrehung Cable Torsion						4												
5.2.7.	Aufschlagprüfung Drop Test							5											
5.2.8.	Mechanischer Schock, Vibration Mechanical Shock, Vibration								12										
5.2.9.	Gehäuse Einführ-/Auszugskraft Terminal Insertion/Retention Force									3 6									
5.2.10.	Betätigung d. Sekundärverriegelung Manipulation of Secondary Lock										3								
5.3.1.	Kontaktwiderstand Contact Resistance				10 19				10 19								10 19	10 19	11 20
5.3.2.	Isolationswiderstand Isolation Resistance				11 20				11 20								11 20	11 20	11 21
5.3.3.	Strombelastbarkeit Maximum Test Current (Derating)															5			
5.4.1.	Impedanz der Kabelbaugruppe Cable Assembly Impedance				5 14				5 15			5					5 14	5 14	5 15

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 Propagation delay												5						
5.4.3.	Laufzeitdifferenz im Adempaar Propagation Delay Skew				6 15				6 15				6				6 15	6 15	6 16
5.4.4.	Einfügungsdämpfung Attenuation				7 16				7 16					6			7 16	7 16	7 17
5.4.5.	Rückflußdämpfung Return Loss				8 17				8 17				7				8 17	8 17	8 18
5.4.6.	Übersprechen Cross Talk				9 18				9 18					5			9 18	9 18	9 19
5.4.7.	Schirmungseffizienz Shielding Effectiveness														4				
5.5.1.	Temperaturschock Thermal Shock																12		
5.5.2.	Temperatur-Feuchte-Zyklus Temperature Humidity Cycling									5									12
5.5.3.	Hitzebeständigkeit High Temperature Exposure																		12

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

Note: Cable related values only valid for cable Leoni Dacar 535 (cable class 1a reg. TEC 108-94106)
Anmerkung: Leitungsbezogene Kennwerte nur für Leitung Leoni Dacar 535 (Klasse 1a gemäß TEC 108-94106)

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.

3.5.1 Additional Test Matrix for Qualification of waterproof HSD-Connector System

Zusatzprüfungs-Matrix zur Qualifikation von wasserdichten HSD-Steckverbinder-Systemen

- refer to Product-spec, 108-94546, for HSD90°-sealed
siehe Produktspezifikation, 108-94546, für HSD90°-gedichtet

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 Re-Qualifikationstest 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 re-submitted 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.

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.