



PRODUCT SPECIFICATION  
**HPS40 4+2**  
**Male Blade**

EPS-100184



HIRSCHMANN  
AUTOMOTIVE



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# 1 General

## 1.1 Introduction

This product specification is valid for the HPS40 4+2 MALE CONNECTOR Blade, assembled according to the process specification listed below, and contains the product design and the condition upon delivery, the technical characteristics as well as the qualification inspections performed. In the case of improper application or deviation from specification that results in quality issues, the right of complaint is void.

## 1.2 Other valid documents

A	Hirschmann product drawing	809-490-...00
B	Interface drawing	809-981-...00
C	Product specification female	EPS-100108
D	Operating guideline	t.b.d.
E	Working committee directive LV214 (cf. TLF 0214)	Working committee test specification for motor vehicle plug-in connector – version March 2010
F	Working committee directive LV215 (cf. TLF 0214)	Electrics/ electronic requirements of HV-plug-in connectors – version March 2017
G	German norm DIN EN 60352-2	Solderless electric connections Part 2: crimp connections
H	DIN EN 60664-1	Insulation coordination for electronic equipment in low voltage systems. Part 1: principles, requirement, and tests
I	2000/53/EG	Directive of the European Parliament and of the council on end-of life vehicles incl. attachments; European Union
J	ISO 6469-3	Electric road vehicles – safety specifications Part 3: protection of persons against electric hazards
K	ISO 26053	Road vehicles; degrees of protection (IP-Code); protection against foreign objects, water, and access; electrical equipment;

## 1.3 Product design

### 1.3.1 Description

The HPS40-4 4+2 MALE CONNECTOR Blade can only be ordered assembled.

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### 1.3.2 Versions

#### **Blade version (809-490-...00)**

- Weight. 137g
- IL contacts are optional
- All blade versions are audited without a blade counterpart.

#### **High-performance blade version (810-343-...00)**

- Weight. 140g
- IL contacts are optional
- All blade versions are audited without a blade counterpart.



## 2 Technical product information

The connector can be placed in the entire vehicle if the specified characteristics will not be exceeded. The characteristics are determined by tests (see verification plan) and material datasheets.

### 2.1 Current class

The connector system fulfills the class 1 and 2.

### 2.2 Operating condition

Nominal voltage	1,000 VDC
Maximum altitude	acc. to OEM specification or the device manufacturer
Insulating material group:	1 (CTI $\geq 600$ ) – for components with direct contact to HV
Degree of contamination:	acc. to OEM specification or the device manufacturer
Overvoltage category:	1
Rated impulse voltage:	acc. to OEM specification or the device manufacturer
Test voltage for electric strength:	acc. to OEM specification or the device manufacturer
Real min. distance in mated condition:	The clearance and creepage distances at the transition of the connector to the unit interface is not considered and must be considered additional – e.g. when using bade versions.
Min. clearance distance:	HV-HV: 3.9 mm HV-HVIL: 13.5 mm HV-Shield: 6.0 mm
Min. creepage distance:	HV-HV: 5.0 mm HV-HVIL: > 13.5 mm HV-Shield: 6.5 mm

#### 2.2.1 Calculation Example

Clearance and creepage distance based on the exemplary following requirements according to DIN EN 60664-1.

Max. operating voltage:	1,000 VDC
Insulating material group:	1
Degree contamination:	2
Altitude:	5,600 m
Rated impulse voltage:	2,500 VDC
Test voltage for electric strength:	2,150 VDC/ 1,500 VAC (basic insulation) 4,300 VDC/ 3,000 VAC (reinforced-, double insulation)

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## 2.3 Voltage class

Class B according to ISO 6469-3

60 VDC < U ≤ 1,000 VDC

25 VAC < U<sub>eff</sub> ≤ 707 VAC (15-150 Hz)

## 2.4 Ambient condition

Permissible temperature range for the plastic used:

-40° C to +140° C according to “temperature collective 4” for 8,000 h

The details of the changes in the properties of the plastics can be found in the plastics data sheets.

**“Temperature collective 4” of MBN 10306, 2020-06 or GS 95024-3-1, 2013-07)**

Temperature in ° C	Distribution in %
-40	6
23	20
85	65
135	8
140	1

## 2.5 EMC performance

Delta transfer impedance of the HV connector system.

Until 2 MHz: < 2.5 mΩ/m Until 30 MHz: < 5 mΩ/m
Shielding attenuation:
> 50 dB (30 MHz to 300 MHz)

## 2.6 Shield area

Shield transfer: 360° circumferential

Shield contact resistance R < 2 mΩ (total from sheathed cable until the aggregate housing)

## 2.7 IP-Degree of protection

IPxxD (plugged female connector)

IPxxB (unplugged female connector)

min. air distance HV contact to shock-proof protection finger male connector interface at IPxxB: 1.7 mm

## 2.8 Technical cleanliness

Inside the connector and on the connector, there are no metallic particles > 1,000 μm allowed

For metallic particles at each connector: CCC = N (J4/ K0) acc. to VDA Band 19

For all other particles at each connector: CCC = N (J10/ K0) acc. to VDA Band 19

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## 2.9 Ampacity (derating)

The derating in the housing shows exemplary values. Requirement related to the current capability of the connector has also to be considered with the derating.

### 2.9.1 Calculation

Calculation for t- / I-curve determination

$$I(t, T_u)_{x \text{ mm}^2 \text{ Material}} = \sqrt{\frac{(T_{grenz} - T_u)}{k_1 * (1 - e^{-\frac{t}{\tau}})}} + \sqrt{\frac{(T_{grenz} - T_u) * (1 - e^{-\frac{t}{\tau}})}{k_2}}$$

T= time [s]

T<sub>u</sub> = ambient temperature [° C]

T<sub>grenz</sub> = limit temperature connector system [° C]

k<sub>1</sub> = constant heat capacity (dynamic time domain) [K/A<sup>2</sup>]

k<sub>2</sub> = constant heat conduction (quasi-statical time domain) [K/A<sup>2</sup>]

t = time constant [s]

x mm<sup>2</sup> Material = used cross section incl. Material (for example: 35 mm<sup>2</sup> Cu)

For details see the derating in housing

#### **Blade version**

- 4x 6.0 mm<sup>2</sup> female connector – HCT4short male contact
- 2x 6.0 mm<sup>2</sup> female connector – HCT4short male contact

#### **High-performance blade version**

- 4x 6.0 mm<sup>2</sup> female connector – HCT4short male blade contact
- 2x 6.0 mm<sup>2</sup> female connector – HCT4short male blade contact

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## 3 Performed tests

Tests acc. to LV214 / LV215 (cf. TLF 0214)

Details see DVP-Plan HPS40 4+2 female connector MCC Blade

Vers.	Test/ Audit	Result	Wired version	Blade version	High-performance blade version
1.1	PG 0 – Receiving inspection and testing (contacts + shield)	Shield contact resistance: <math><2\text{m}\Omega</math>; Insulation resistance: > 200 M $\Omega$ at 1,000 VDC; Withstand voltage: 3,000 VAC for 1 min (acc. to DIN EN 1987-3 and LV 215);	DVP-101447 DVP-101955*	DVP-101956 DVP-101957*	DVP-101986 DVP-101987*
1.2	PG 1 – Dimensions	Min. air distance: 3.9 mm Min. creepage distance: 5.0 mm	DVP-101447 DVP-101955*	DVP-101956 DVP-101957*	DVP-101986 DVP-101987*
1.3	PG 2 – Material and surface analysis (ontacts)	All metal parts	DVP-101955*	DVP-101956 DVP-101957*	DVP-101986 DVP-101987*
1.4	PG 3 – Material and surface analysis (Housing and single-wire seals)	All plastic parts and seals	DVP-101955*	DVP-101957*	
1.5	PG 4 – Contact overlap	Contact overlap: min. 1mm (HV / IL / Shielding) Contact free space: > 0mm; Lead: min. 1mm (IL to HV at opening)	DVP-101447 DVP-101955*		
1.6	PG 5 – Mechanical and thermal relaxation behaviour		DVP-101955*		DVP-101987*
1.7	PG 6 – Interaction between contact and housing		DVP-101955*	DPV-101957*	
1.8	PG 7 – Handling and functional reliability of the housing		DVP-101447 DVP-101955*		
1.9	PG 8 – Insertion and retention forces of the contact parts in the housing		DVP-101447 DVP-101955*		
1.10	PG 9 – Insertion indication (scoop proofness)		DVP-101955*		
1.11	PG 11 – Insertion and removal forces, mating cycle frequency	50 mating cycles	DVP-101955*		
1.12	PG 13 – Housing influence on the derating	Tmax: 180° C at contacting area	DVP-101447	DVP-101956	DVP-101986 DVP-101987*

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			DVP-101955*	DVP-101957*	
1.13	PG 14 – Thermal time constant	Up to 5 times nominal current	DVP-101447 DVP-101955*	DVP-101956 DVP-101957*	DVP-101986 DVP-101987*
1.14	PG 15 – Electrical stress test		DVP-101447 DVP-101955*		DVP-101986 DVP-101987*
1.15	PG 17 – Dynamic stress	Shield contact > 2mΩ: Vibration severity 2, temp.severity 4	DVP-101447 DVP-101955*	DVP-101956 DVP-101957*	DVP-101986 DVP-101987*
1.16	PG 19 – Environmental simulation	Max. test temperature: 140° C	DVP-101955*		DVP-101986-01 DVP-101987-00*
1.17	PG 20 – Climate load of the housing	Max. test temperature: 140° C	DVP-101447 DVP-101955*		
1.18	PG 21 – long-term-temperature	1,000h/ 140° C	DVP-101447 DVP-101955*		
1.19	PG 22B – Chemical resistance, extended test		DVP-101955*		
1.20	PG 23 – water leak tightness	Wire cross sections and types: 4.0 mm <sup>2</sup> / 6.0 mm <sup>2</sup> Coroplast	DVP-101447 DVP-101955*		
1.21	PG 28 – locking noise		DVP-101955*		
1.22	PG 50 – EMC-testing		DVP-101955*		
1.23	PG 51 – Contact protection	IPxxB and IPxxB	DVP-101447 DVP-101955*		
1.24	K-15B – Condensation and climatic test	Acc. to LV124: 2013	DVP-101447 DVP-101955*		
1.25	ISO 9227 – salt spray tests 720 hours		DVP-101955*		

\*Validation not performed yet

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## 4 Result of performed tests

### 4.1 Ampacity (I/t) measurement results

#### Blade version

4x 6.0 mm<sup>2</sup> female connector – HCT4short male contact

Ambient temperature	38.2	107.1	161.4
Current (A)	45.6	32	16

2x 6.0 mm<sup>2</sup> female connector – HCT4short male contact

Ambient temperature	35	77.8	130.1	167.9
Current (A)	57.6	4	32	16

#### High-performance blade version

4x 6.0 mm<sup>2</sup> female connector – HCT4short male blade contact

Ambient temperature	45.7	86.0	135.5	167.4
Current (A)	56.8	48	32	16

2x 6.0 mm<sup>2</sup> female connector – HCT4short male blade contact

Ambient temperature	74.1	103.6	137.1	160.6	174.4
Current (A)	74.4	64	48	32	16

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## 4.2 Insulation resistance

Over complete lifetime: >150 MΩ  
 Lowering during humidity load: >75 MΩ  
 In plugged condition between HV contacts, HV contacts and shield.

## 4.3 Contact resistance HV and HVIL

Acc. to LV215-1: 2017-03 (cf. TLF 0214)

wire cross section mm <sup>2</sup>	contact resistance (total resistance incl. Crimp)	
	new condition mΩ	after aging mΩ
4	0,72	1,44
6	0,68	1,36
acc. to LV215		

wire cross section mm <sup>2</sup> / contact size mm	0,35	0,5
	contact resistance (total resistance incl. Cimp)	
1,2	15 mΩ	15 mΩ

## 4.4 Watertightness

IP6K9K and IPx8

PG23 acc. to working group inspection guideline LV214 and LV215 (cf. TLF 0214)

This data is only valid with mated female connector and assembly opening executed according to Hirschmann Automotive system drawing.

## 4.5 Vibration load

Vibration stability: PG17 acc. to working group inspection guideline LV214 and LV215 (cf. TLF 0214)

Fixing length: free cable length between connector and first cable fixing point where the cable is fixed with the same oscillation as the connector. The cable fixing must be designed for every operation mode.

**Vibration class severity level 2** fixing point 1: 200 mm/ fixing point 2: 250 mm,  
 Shield contact, HV and IL contact

## 4.6 Amount of mating cycles

Max. 50 cycles (Ag)

## 4.7 Polarization/ Koshiri-safety

Failed insertion force min. 225 N (3 times assembly force)

Koshiri-safety is given

## 4.8 Retention force of the contact in the housing

HV contacts: F > 120 N

IL contacts: F > 50 N

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## 5 Table of change

Change description	Change date	Editor
First version	30.09.2020	Gohm M.
Update of design from specification	14.06.2023	Jussel E-M.
Adjusting data of the bottom line	08/ 2023	Jussel E-M.
Adjusting data "Ambient Condition"	10/ 2023	Jussel E-M.