TEST REPORT	Project no.	Requisition no.	**Report no.**
	162348 / (IDDO-002304 - V710 wire plug)	DVZ22-162348-715	**DRAFT**
		Rev. / date	**Rev. / date**
		0. / 11.10.2022	

SUBJECT OF TEST

Name	Cavity plug: FPN-6U5T-10C930-GA
Part number(s):	7158-9221-00

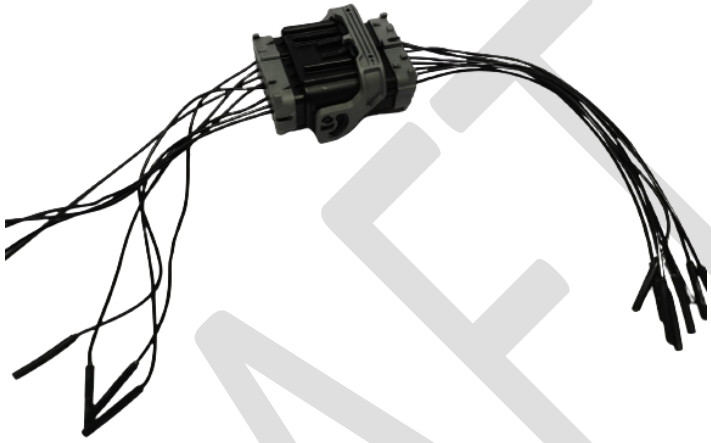


Figure 1 – Subject of test

REQUESTER

Campa Marko

PURPOSE

Specific customer request

CLASSIFICATION

Temperature class:	3
Sealing class:	3
Vibration class:	2

Prepared	Checked	Checked	Approved
Name	Name	Name	Name
Date (DD.MM.YYYY)	Date (DD.MM.YYYY)	Date (DD.MM.YYYY)	Date (DD.MM.YYYY)
YAZAKI EUROPE LTD. - Component Business Unit Branch Office Zagreb - Testing Laboratory Slavonska av. 26/6, 10000 Zagreb, Croatia			

TABLE OF CONTENTS

Test result explanation:
O=meets requirements
X=does not meet requirements
N/A=requirement not defined, evaluation not possible

TEST SPECIFICATIONS & APPLICABLE DOCUMENTS

Type	Name / no.	Revision
Design verification plan	DVZ22-10-073-715	0
Test specification	USCAR-2	8
Handing manual	N/A	N/A
Drawing	N/A	N/A

TEST SAMPLES

SUBJECT OF TEST

Part name	Supplier part number	Supplier	Material	YEL-Z stock ID
Cavity plugs	7158-9221-00	-	-	32227
34P Male Connector	N/A	-	-	32228
34P Female Connector	N/A	-	-	32229

EQUIPMENT LIST

ID	Equipment name	Manufacturer	Type	Cal. Due date
5	Digital Force Measuring device	Zwick/Roell	XFORCE P 10kN (software testXpert II V3.6.0)	10-2023
55	Vacuummeter	Festo	Pressure Vacummeter	07-2024
57	Pressure Gauge	Badotherm	Pressure Vacummeter	07-2024
255	Accelerometer	Bruel & Kjaer	4384	12-2022
288	Shaker	TIRA	S59355/AIT-340, 55kN	FRO
348	Oven	Memmert	UF110	06-2023
654	Humidity and Temperature Data logger	Lufft	OPUS 20 THIP PoE	03-2025

5.4.6 – VIBRATION/MECHANICAL SHOCK

Conducted by:	Goran Kirinic
Test period:	06.11.2022 – 17.11.2022
Ambient conditions:	23.3 °C, 49%RH
Test equipment:	255, 288, 654

TEST SPECIFICATION / REV.: SAE/USCAR-2 REVISION 8

Step	Test name	Requirements	Result
1.	Shock test	Conditioning only	N/A
2.	Vibration test	Conditioning only	N/A
3.	Visual inspection	No deterioration, cracks No fall out cavity blind plugs	O

O=meets requirements
X=does not meet requirements
N/A=requirement not defined, evaluation not possible

Test purpose: This test subjects a connector system to vibration, simulating accelerated exposure to actual vehicle conditions. Vibration and shock can cause wear of the terminal interfaces, intermittent electrical contact and failure of mechanical components of the connector system.

Number of DUTs: 10

1. Shock test

Vibration Class	Shocks per Axis	Wave Shape	Direction (±)	Duration (ms)	Acceleration (g)
V2	10	Half Sine Wave	Positive	5 to 10	35

Test results:

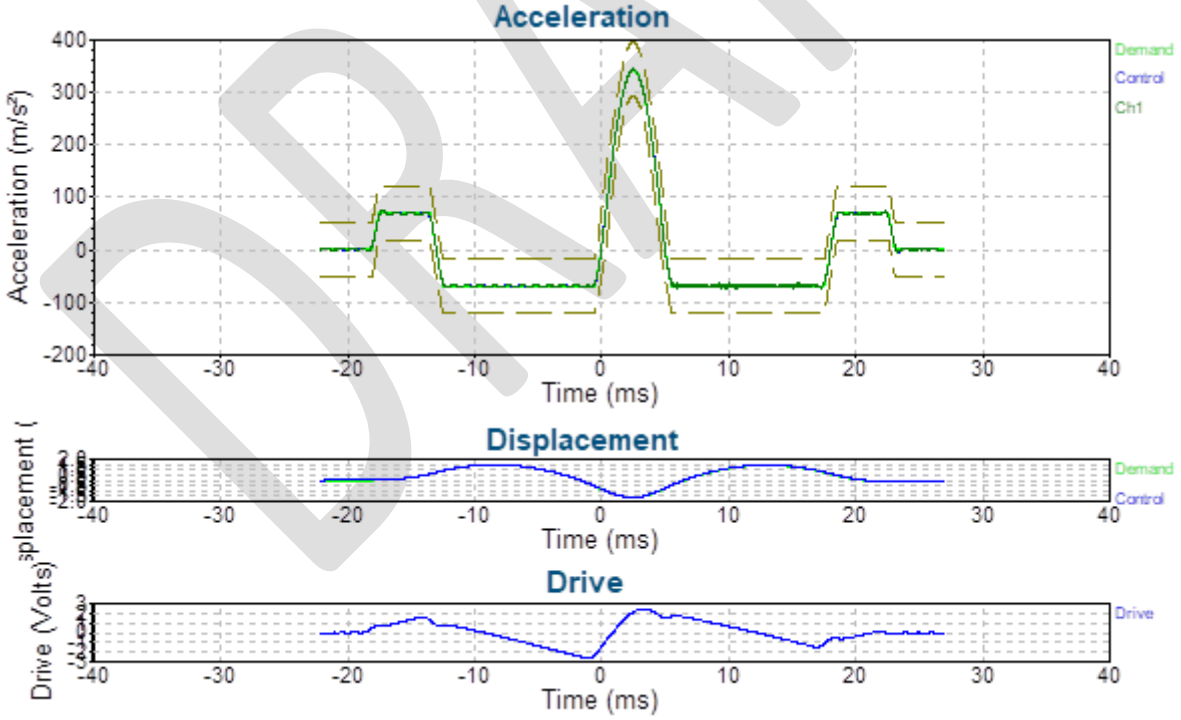


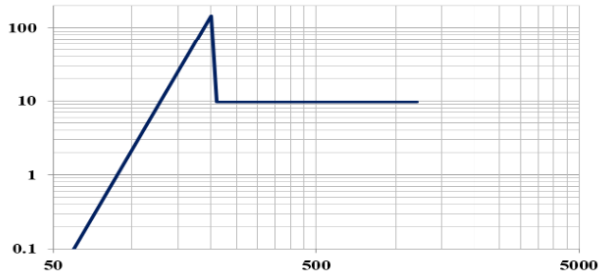
Figure 2

2. Vibration test

Vibration profile:

Vibration Class	Sine Duration (hours/axis)	Random Duration (hours/axis)	Total Vibration Time for each CUT (reference)	Chamber Temperature for Thermal Cycling
V2	N/A	8	24	N/A

Level	Random			Sine
	F (Hz)	PSD $(m/s^{2)2}/Hz$	PSD g^2/Hz	
V2	60.0	0.096	0.00100	Vibration schedule at this level does not have a sine component
	200.0	144	1.50000	
	210.0	9.60	0.10000	
	1200.0	9.60	0.10000	
	g (rms)	119	12.1 g	

Level	Random (PSD in (m/s2)2/Hz versus Frequency in Hz)	Sine (Acceleration in m/s^2 versus Frequency in Hz)
V2		Vibration schedule at this level does not have a sine component

2. Vibration test

Test setup:

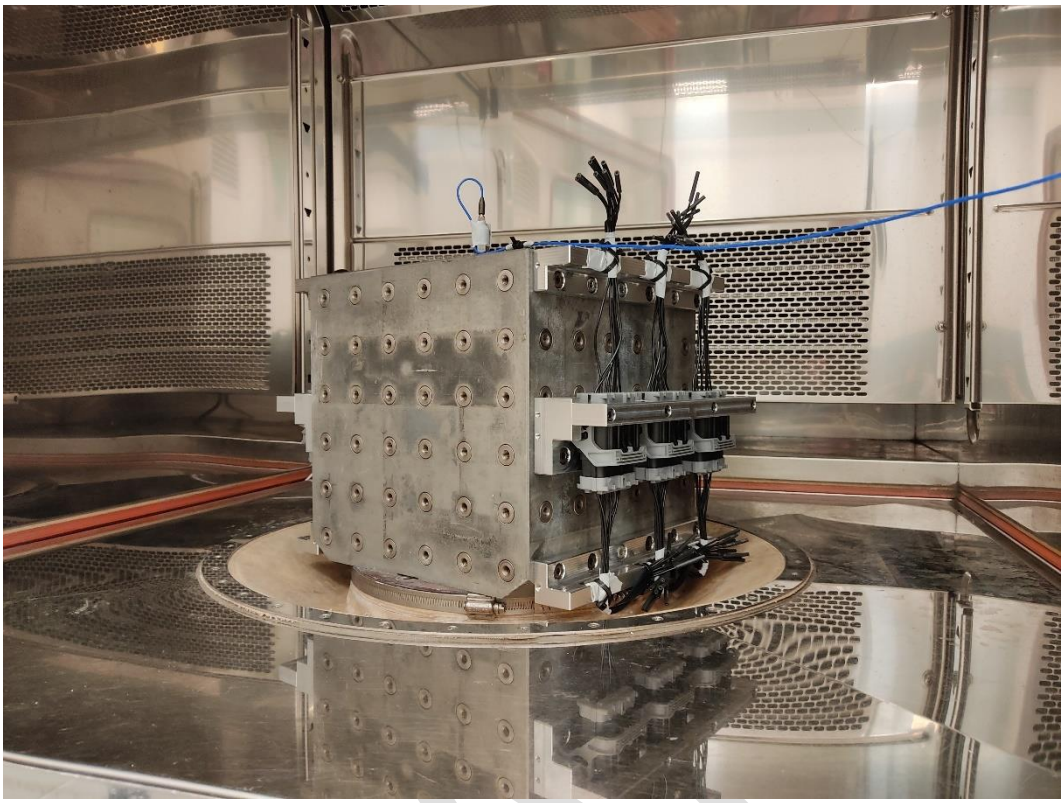


Figure 3 – X axis

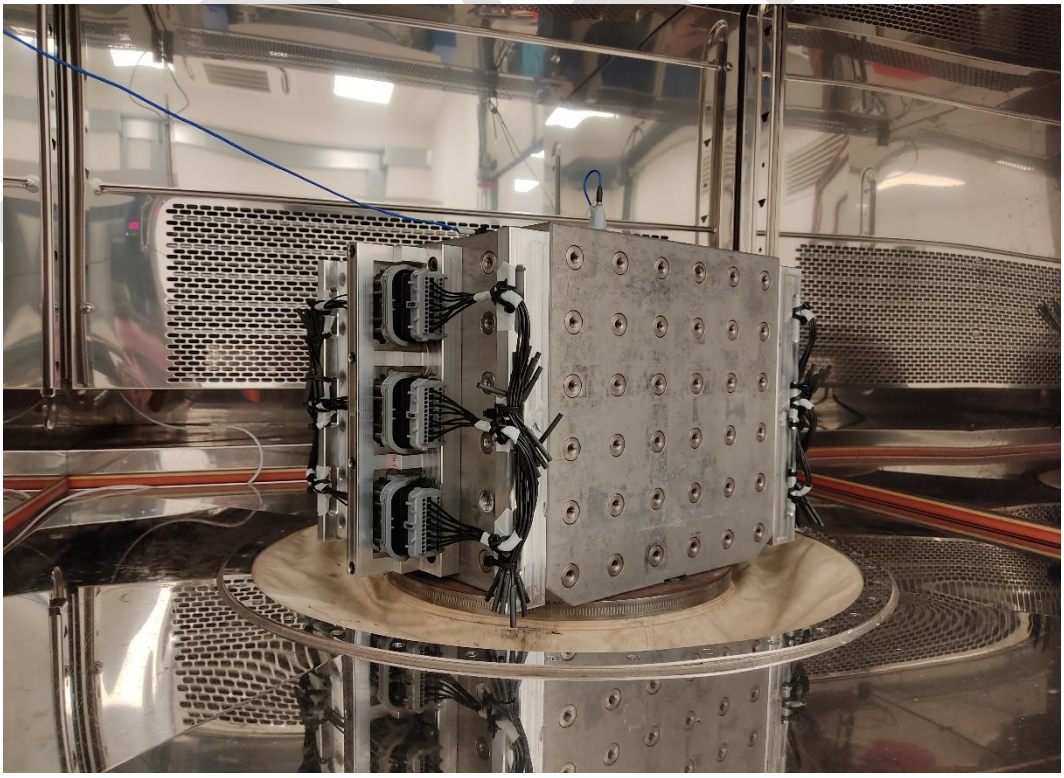


Figure 4– Y axis

2. Vibration test

Test setup:

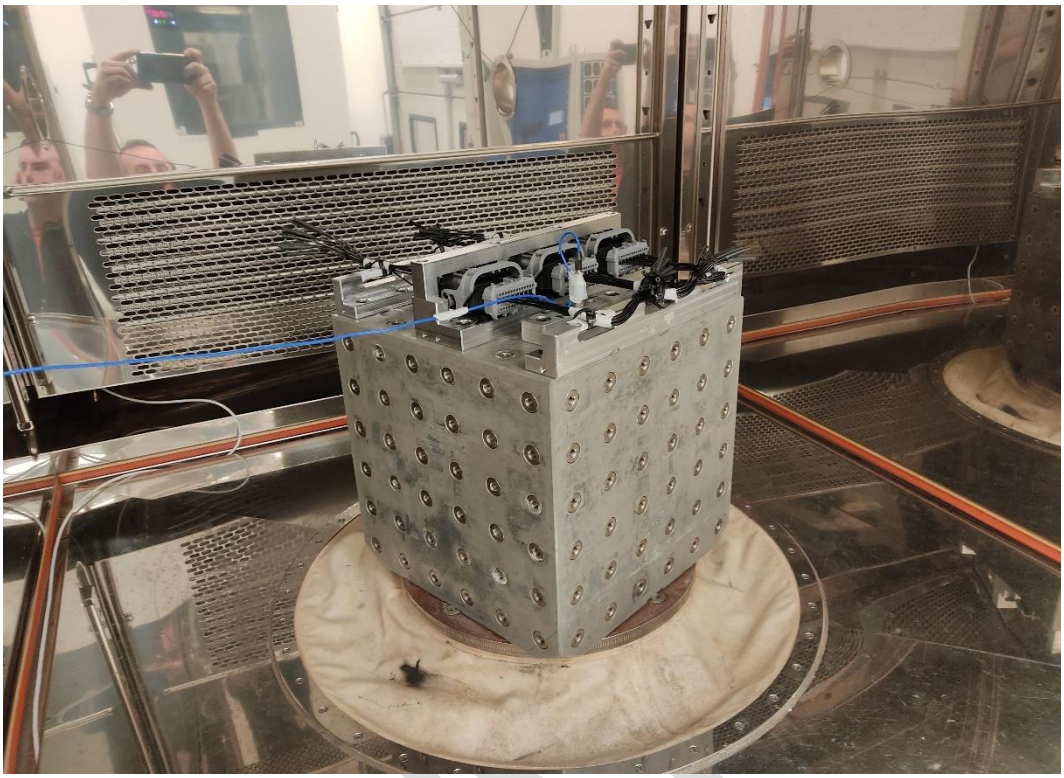


Figure 5– Z axis

2. Vibration test

Test results:

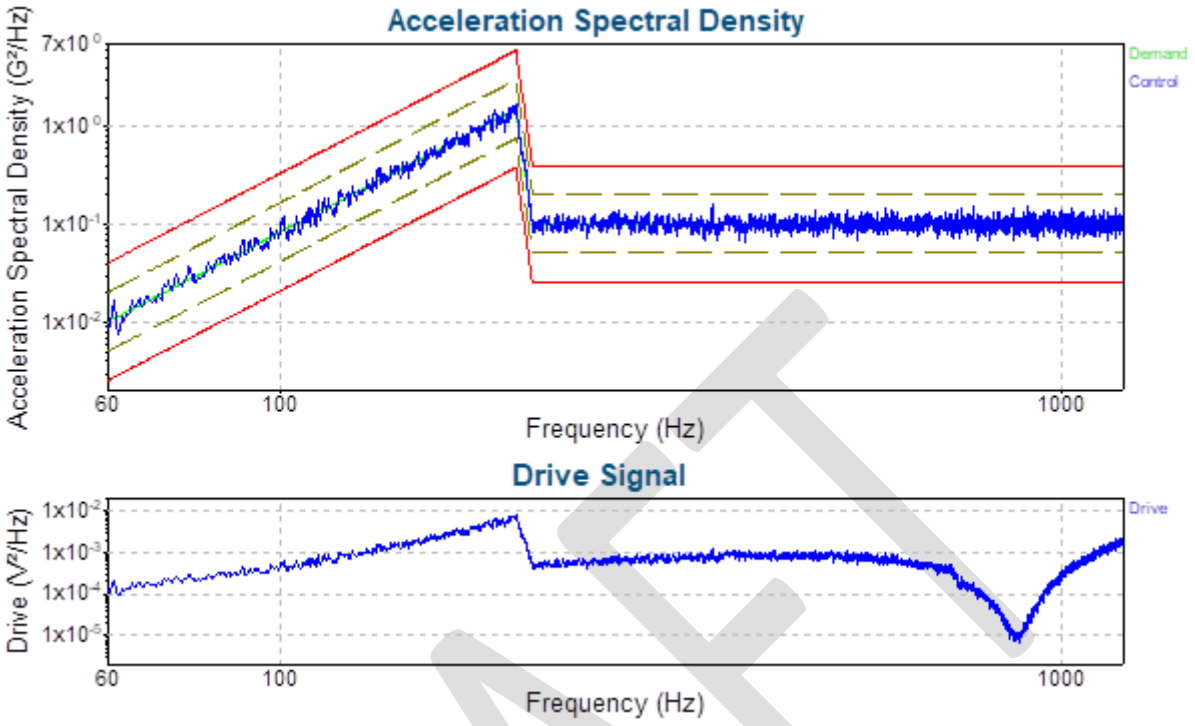


Figure 6 - X axis

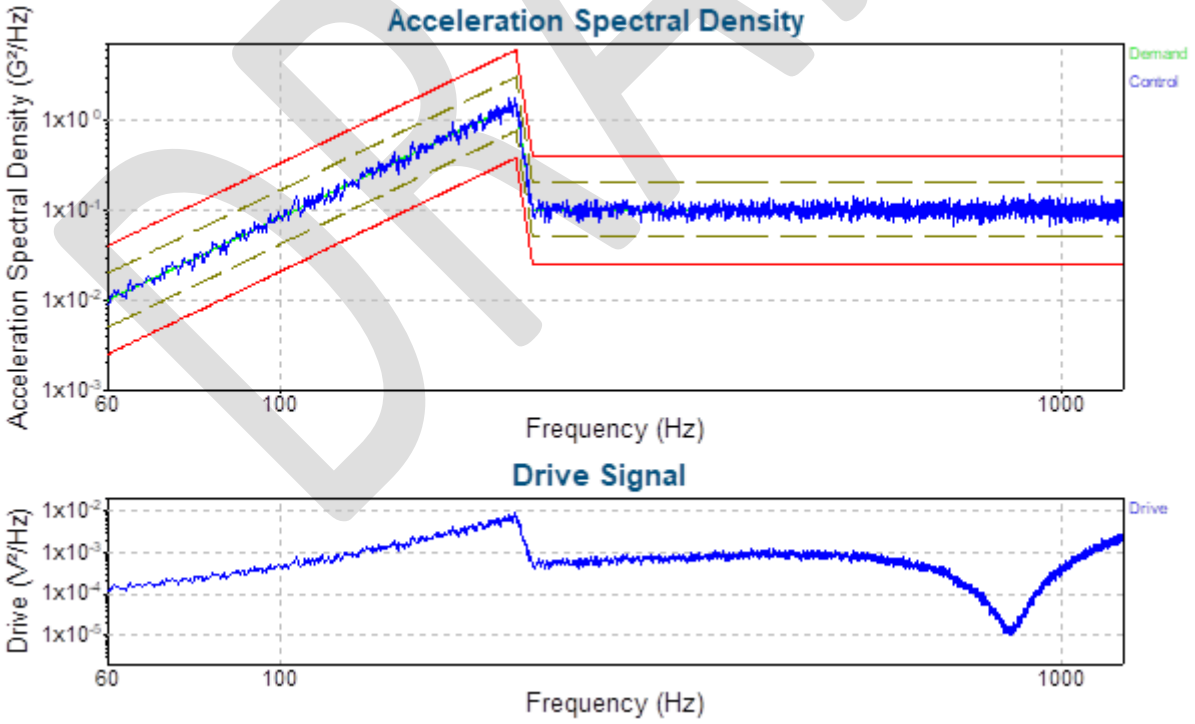


Figure 7 - Y axis

2. Vibration test

Test results:

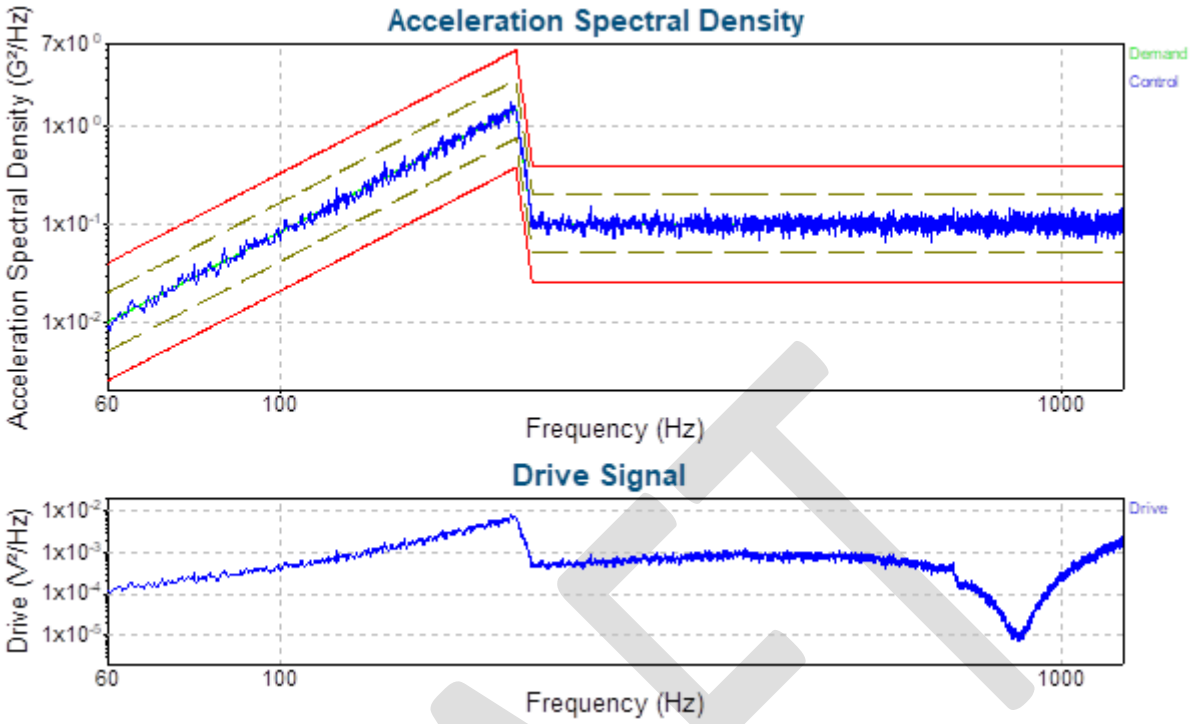


Figure 8 - Z axis

3. Visual inspection

Test results:

Figure 9

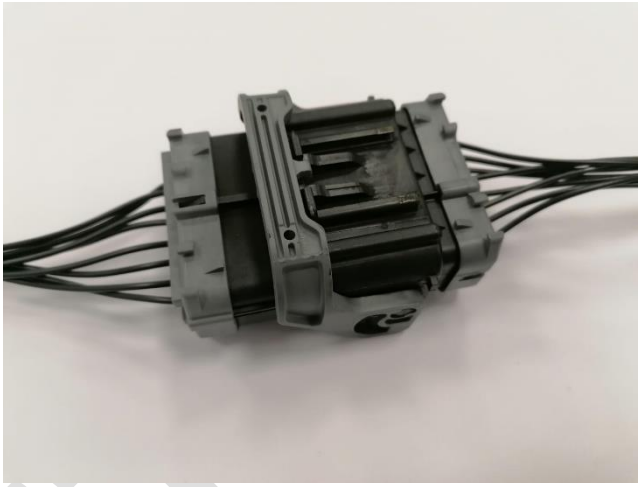


Figure 10

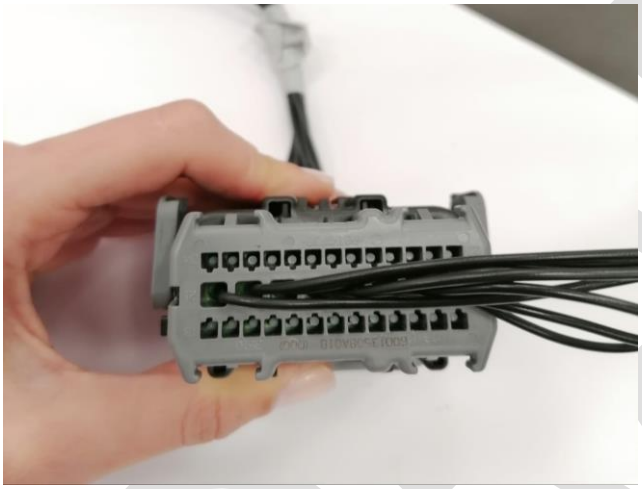


Figure 11

Figure 12

No deterioration on any of samples. No fall out cavity blind plugs on any of the samples.

5.4.9 – CAVITY DAMAGE SUSCEPTIBILITY

Conducted by:	Marko Kukec
Test period:	17.10.2022 – 18.10.2022
Ambient conditions:	23 °C, 53%RH
Test equipment:	5, 654

TEST SPECIFICATION / REV.: SAE/USCAR-2 REVISION 8

Step	Test name	Requirements	Result
1	Cavity damage susceptibility	Applied 80 N	X
2	Terminal retention after cavity damage susceptibility	> 50 N	O

O=meets requirements
X=does not meet requirements
N/A=requirement not defined, evaluation not possible

Test purpose: This test is intended to demonstrate resistance to damage when the connector TPA (or PLR or ISL as applicable) is forcefully inserted on a connector with one or more terminals in an incomplete (un-seated) position. The cavity and other plastic and metal parts must subsequently be able to be assembled correctly and retain full function following such an event.

1. Cavity damage susceptibility

Test setup:

Figure 13

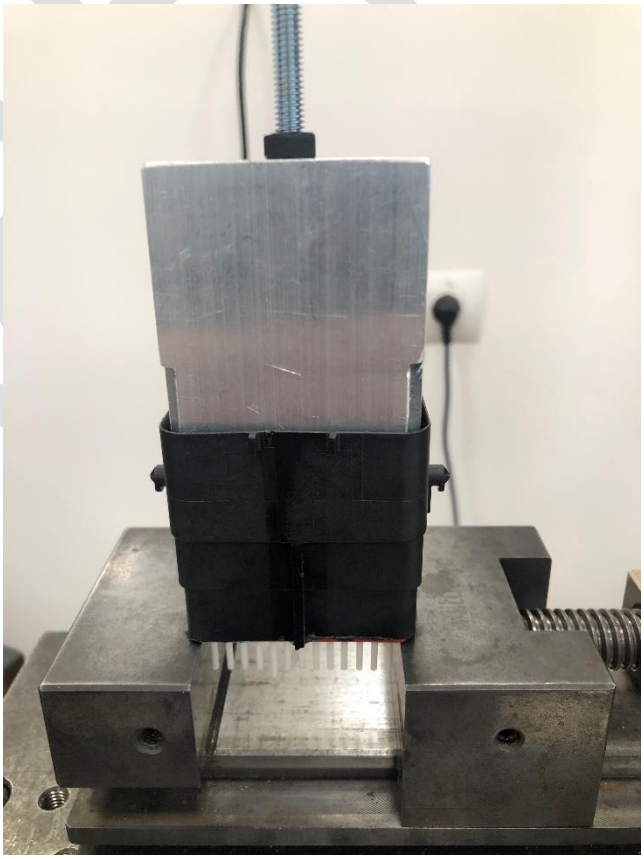


Figure 14

1. Cavity damage susceptibility

Test results:

Female				
Sample	**Terminal cavity**	**Applied force [N]**	**Requirement**	**Results**
1	5	80 N	TPA must not seat in its final position	X
2	3			X
3	25			X
4	31			X
5	26			X

**Insertion depth of cavity plug not same as terminal cavity plug lance locks before terminal lance.*
**Cavity plug is shorter than terminal.*

Male				
Sample	**Terminal cavity**	**Applied force [N]**	**Requirement**	**Results**
1	9	80 N	TPA must not seat in its final position	O
2	3			O
3	12			O
4	28			O
5	23			O

Test result explanation:
O=meets requirements
X=does not meet requirements
N/A=requirement not defined, evaluation not possible

2. Terminal retention after cavity damage susceptibility

Test setup:

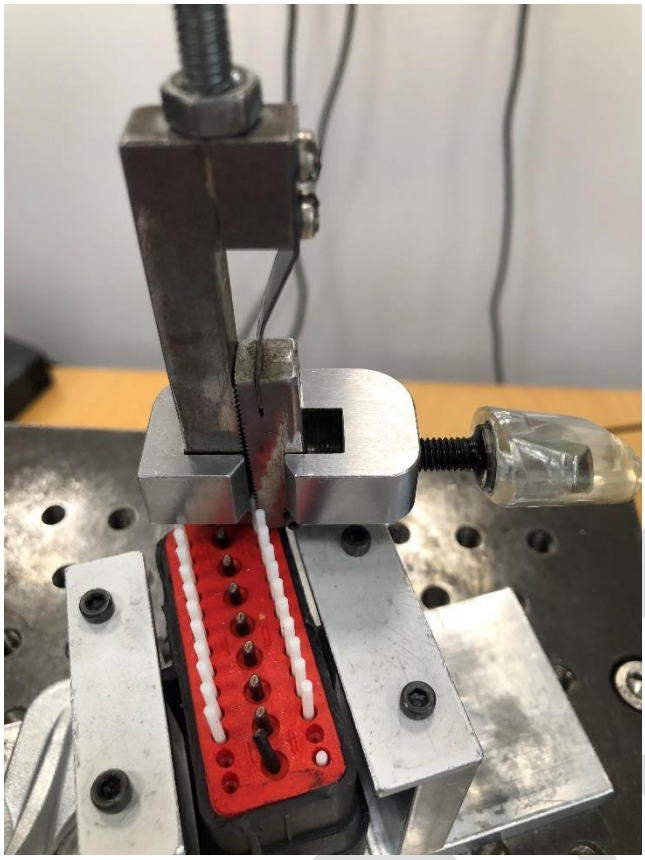


Figure 15

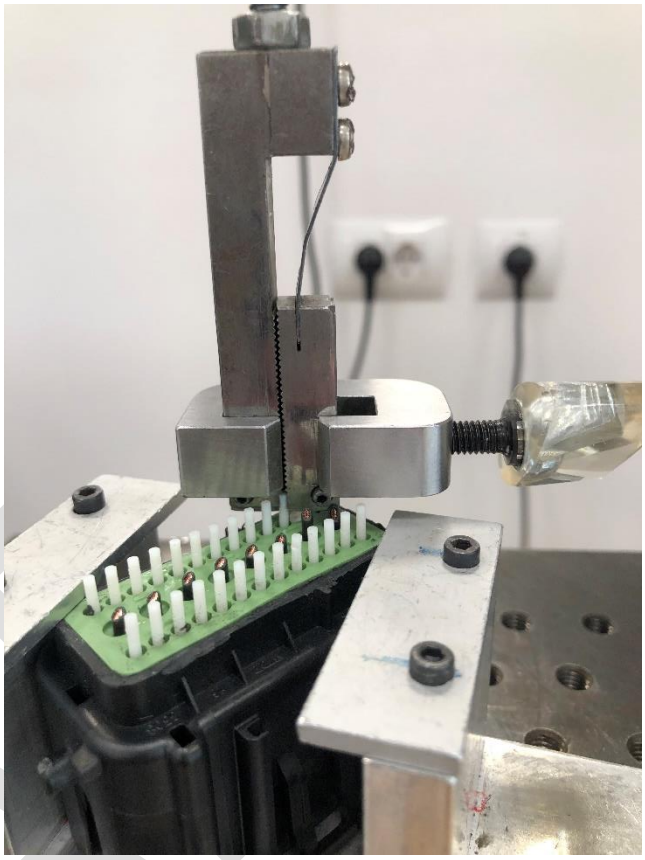


Figure 16

2. Terminal retention after cavity damage susceptibility

Test results:

Female			
Sample	**Force [N]**	**Requirement**	**Results**
1	96	> 50 N	O
2	84		O
3	87		O
4	87		O
5	91		O

Male			
Sample	**Force [N]**	**Requirement**	**Results**
1	127	> 50 N	O
2	132		O
3	118		O
4	139		O
5	137		O

Test result explanation:
O=meets requirements
X=does not meet requirements
N/A=requirement not defined, evaluation not possible

5.4.10 – TERMINAL/CAVITY POLARIZATION TEST

Conducted by:	Matija Jagar
Test period:	17.10.2022 – 18.10.2022
Ambient conditions:	23 °C, 53%RH
Test equipment:	5, 654

TEST SPECIFICATION / REV.: SAE/USCAR-2 REVISION 8

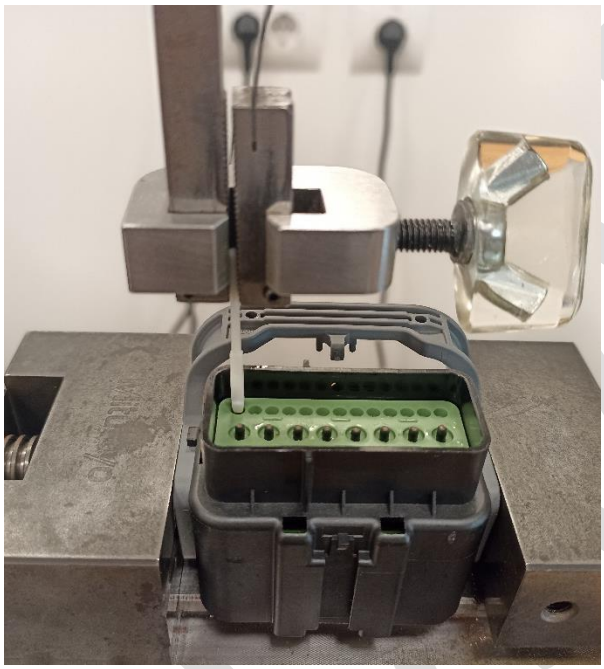
Step	Test name	Requirements	Result
1	Terminal/Cavity polarization test	> 15 N	O

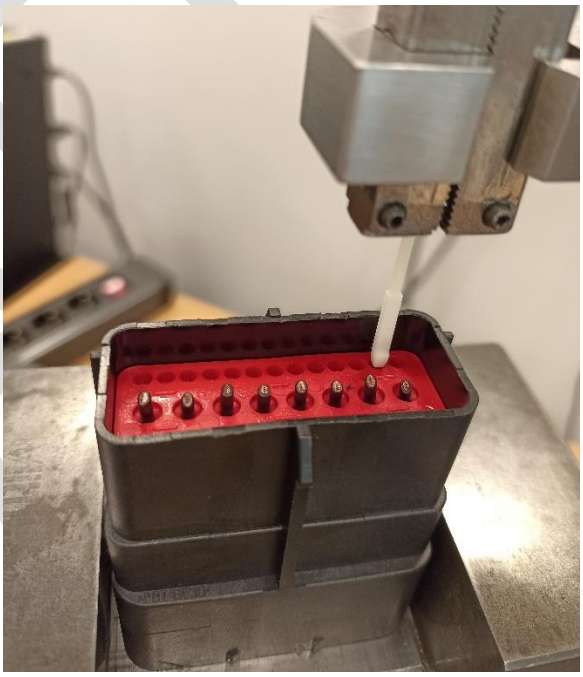
O=meets requirements
X=does not meet requirements
N/A=requirement not defined, evaluation not possible

Test purpose: This test is conducted to ensure that the design of the cavity and terminal polarization features will prevent insertion of the terminal in any incorrect orientation.

1. Terminal/Cavity polarization test

Test setup:





1. Terminal/Cavity polarization test

Test results:

Male				
Sample	**Orientation increment [º]**	**Force [N]**	**Requirement**	**Results**
1	180	>15	> 1.5 x Nominal insertion force[N] >15 [N]	O
2		>15		O
3		>15		O
4		>15		O
5		>15		O
6		>15		O
7		>15		O
8		>15		O
9		>15		O
10		>15		O
11	90	>15		O
12		>15		O
13		>15		O
14		>15		O
15		>15		O
16		>15		O
17		>15		O
18		>15		O
19		>15		O
20		>15		O
21	270	>15		O
22		>15		O
23		>15		O
24		>15		O
25		>15		O
26		>15		O
27		>15		O
28		>15		O
29		>15		O
30		>15		O

** The average maximal insertion force value is 4 N (force equaling 1.5 times the maximum force is 6 N).*

1. Terminal/Cavity polarization test

Test results:

Female				
Sample	**Orientation increment [º]**	**Force [N]**	**Requirement**	**Results**
1	180	6.8	> 1.5 x Nominal insertion force [N] >15 [N]	O
2		6.2		O
3		7.2		O
4		6.3		O
5		6.5		O
6		6.5		O
7		6.6		O
8		6.7		O
9		6.5		O
10		6.4		O
11	90	10.7		O
12		11.0		O
13		9.5		O
14		13.7		O
15		>15		O
16		14.5		O
17		>15		O
18		>15		O
19		>15		O
20		10.9		O
21	270	>15		O
22		>15		O
23		>15		O
24		14.4		O
25		>15		O
26		>15		O
27		12.6		O
28		>15		O
29		>15		O
30		>15		O

** The average maximal insertion force value is 4 N (force equaling 1.5 times the maximum force is 6 N).*

5.4.13 – CONNECTOR SEAL RETENTION – UNMATED CONNECTOR

Conducted by:	Marko Kukec
Test period:	18.10.2022
Ambient conditions:	23 °C, 53%RH
Test equipment:	654

TEST SPECIFICATION / REV.: SAE/USCAR-2 REVISION 8

Step	Test name	Requirements	Result
1	Connector seal retention – unmated connector	The connector seal shall be sufficiently retained in design position	O

O=meets requirements
X=does not meet requirements
N/A=requirement not defined, evaluation not possible

Test purpose This test is done to ensure that connector seals will be sufficiently retained during shipping and handling prior to being mated or assembled.

Rotate the table at a speed [rpm] to generate a minimum acceleration of 1960 m/s^2 [≈200g] for a minimum of 10 seconds. Direction is optional. Equation below is for calculate the required RPM.

$$N = \frac{\left(\sqrt{\frac{a}{R}} * 60\right)}{2\pi}$$

where:
a = acceleration in m/s²
R = the distance [meters] from the center of rotation to the nearest edge of the connector seal

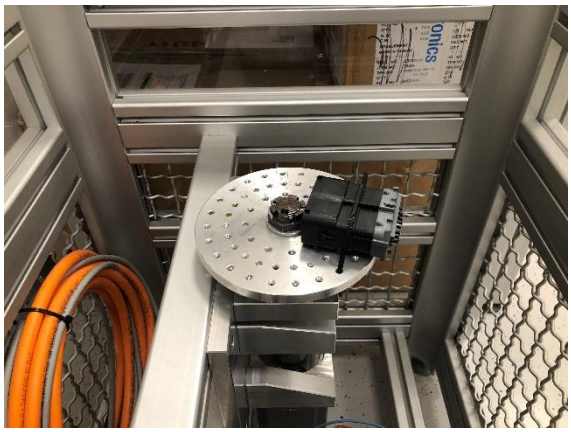
In case for male connector:

a = 1960 m/s^2 and R = 0.07 m → $N = \frac{\left(\sqrt{\frac{a}{R}} * 60\right)}{2\pi}$ → **N = 1598.71 rpm**

In case for female connector:

a = 1960 m/s^2 and R = 0.05 m → $N = \frac{\left(\sqrt{\frac{a}{R}} * 60\right)}{2\pi}$ → **N = 1891.62 rpm**

Test setup:



In both case the connector seal retained in design position.

5.4.14 – CONNECTOR SEAL RETENTION – MATED CONNECTOR

Conducted by:	Josip Stanusic
Test period:	18.10.2022
Ambient conditions:	23 °C, 53%RH
Test equipment:	654

TEST SPECIFICATION / REV.: SAE/USCAR-2 REVISION 8

Step	Test name	Requirements	Result
1	Connector seal retention – mated connector	Seal shall remain on the connector and in its intended position.	O

O=meets requirements
X=does not meet requirements
N/A=requirement not defined, evaluation not possible

Test purpose: This test is used to determine that the connector seal will retain during mating and unmating of the connector assembly.

Test results:

Sample size: 10 conn. pairs
Seal remains on the connector and in its intended position

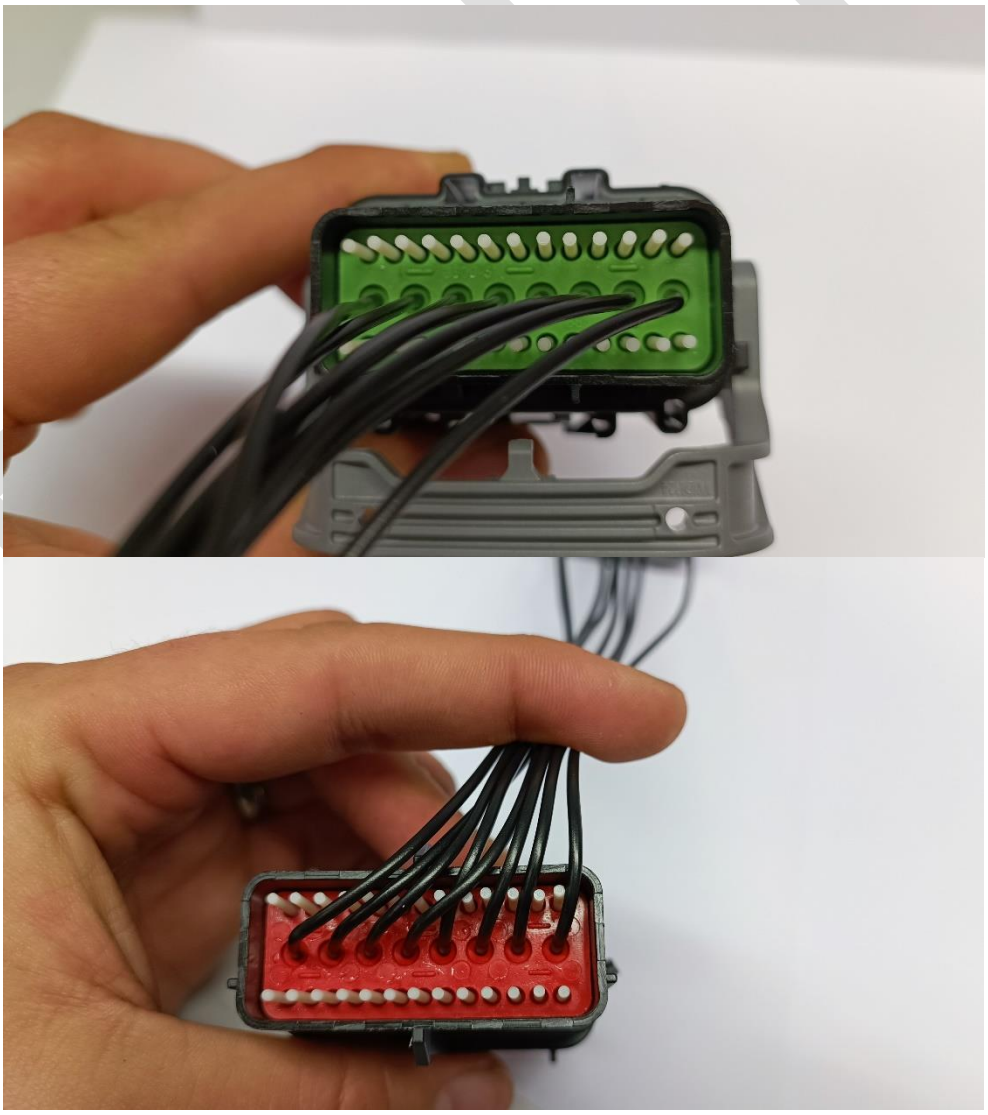


Figure 17

5.6.5- SUBMERSION

Conducted by:	Ivan Dugorepec
Test period:	18.10.2022-20.10.2022
Ambient conditions:	23°C, 54%RH
Test equipment:	284,346,654

TEST SPECIFICATION / REV.: SAE/USCAR-2 REVISION 8

Step	Test name	Requirements	Result
1	Submersion	No water ingress	O

O=meets requirements
X=does not meet requirements
N/A=requirement not defined, evaluation not possible

Test purpose: This test is an accelerated simulation of the "breathing" that may occur in a sealed connector system when it is heated and suddenly cooled by submersion in a cooler liquid. Salt water is used as the liquid to facilitate detection of any leakage into the connector.

Test setup:

Temp.: 0°C/30min. (salt water solution)

150°C/120min. (chamber)

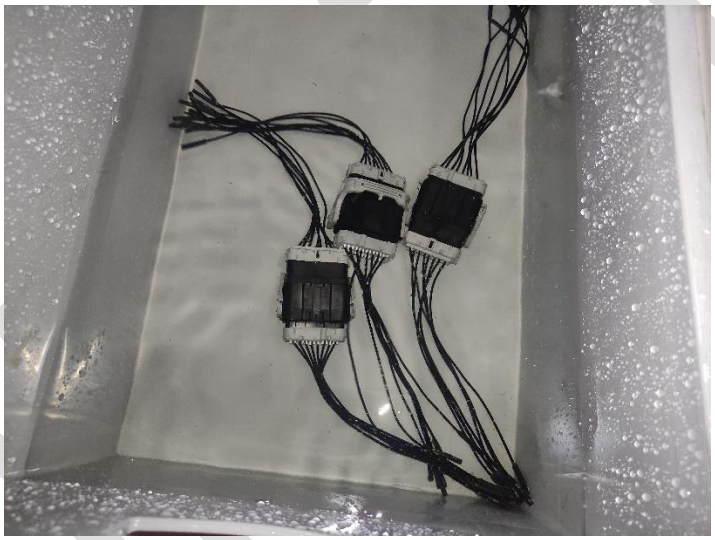


Figure 18

5.6.5 – SUBMERSION

Visual inspection after:

Figure 19

No water ingress of any sample.

5.6.6 – PRESSURE/VACUUM LEAK

Conducted by: Sasa Poznanovic
Test period: 17.10.2022-22.10.2022
Ambient conditions: 22°C, 47%RH
Test equipment: 55, 57, 348, 654

TEST SPECIFICATION / REV.: SAE/USCAR-2 REVISION 8

Step	Test name	Requirements	Result
1	Visual inspection before test standalone	No deterioration, cracks, deformities	O
2	Pressure/Vacuum leak	48kPa/15 sec., no bubbles visible	O
3	Visual inspection after P/V leak	No deterioration, cracks, deformities	O
4	High temperature exposure	Conditioning only	N/A
5	Visual inspection after HTE	No deterioration, cracks, deformities	O
6	Pressure/Vacuum leak	28kPa/15 sec., no bubbles visible	O
7	Visual inspection after P/V leak	No deterioration, cracks, deformities	O

O=meets requirements
X=does not meet requirements
N/A=requirement not defined, evaluation not possible

Test purpose: This test evaluates the sealing capability of sealed (S2, S2.5, and S3 sealing classification) connector systems when subjected to a specified pressure differential between the inside and outside of the sealed area.

1. Visual inspection before test standalone

Test results:

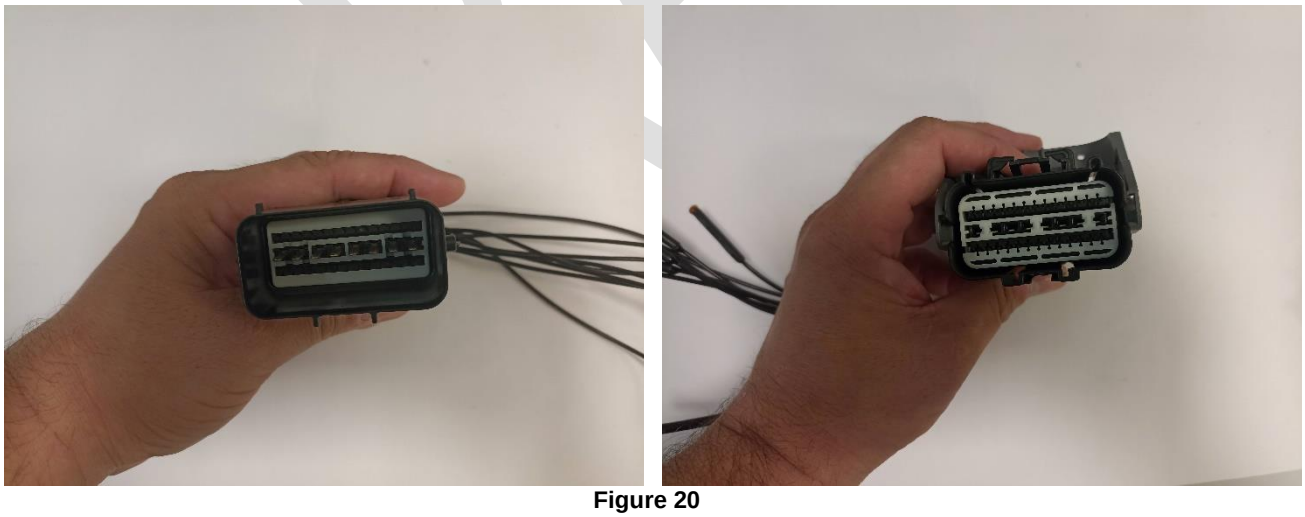


Figure 20

2. Pressure/Vacuum leak

- 48kPa/15 sec

Test setup:

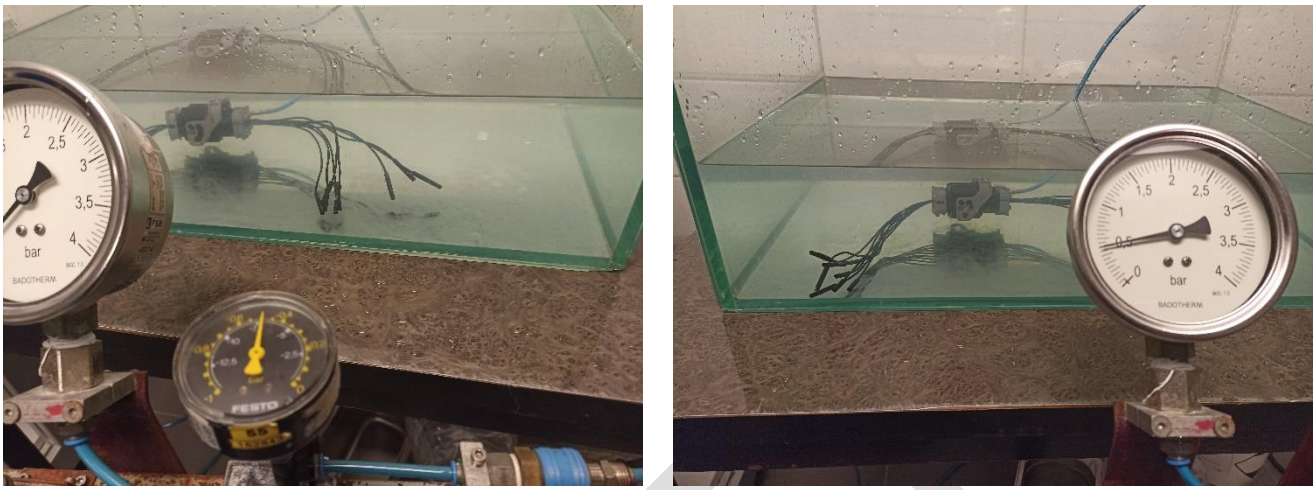


Figure 21

No bubbles visible.

3. Visual inspection after P/V leak

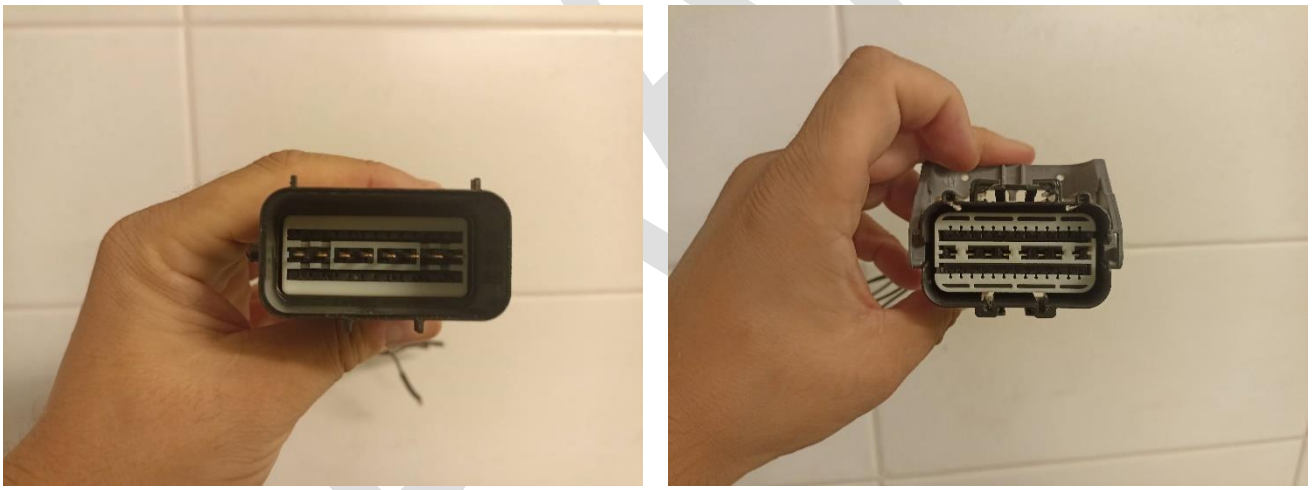


Figure 22

4. High temperature exposure

- Heat soak all samples for 70 hours at the maximum temperature 125 °C

Figure 23

5. Visual inspection after THE

Figure 24

6. Pressure/Vacuum leak

- 28kPa/15 sec

Figure 25

No bubbles visible.

7. Visual inspection after P/V leak

Figure 26

5.6.7 – HIGH PRESSURE SPRAY

Conducted by:	Ivan Dugorepec
Test period:	17.10.2022-18.10.2022
Ambient conditions:	21°C, 48%RH
Test equipment:	Water cabinet, 654

TEST SPECIFICATION / REV.: SAE/USCAR-2 REVISION 8

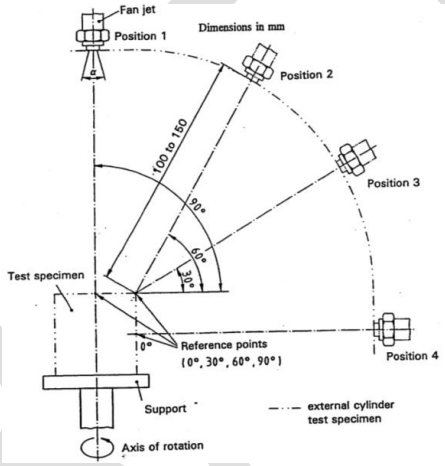
Step	Test name	Requirements	Result
1	High pressure spray	No water ingress	O

O=meets requirements
X=does not meet requirements
N/A=requirement not defined, evaluation not possible

Test purpose: The purpose of this test is to determine the ability of sealed connection systems to withstand high pressure spray. Such conditions may be encountered where there is direct road splash or where high pressure washing may be expected.

Test setup:

- Heated water 80 °C ± 5 °C
- Rotating table



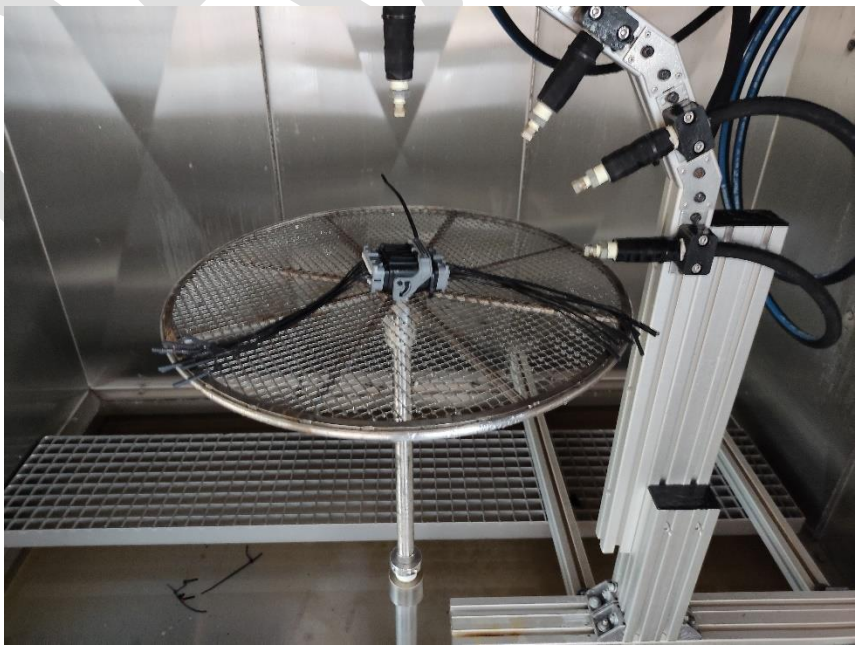


Figure 27

No water ingress of any sample.

5.9.7- SEALED CONNECTOR SYSTEM ENVIRONMENTAL TEST SEQUENCE - TUAB

Conducted by: Josip Stanusic
Test period: 17.10.2022-
Ambient conditions:
Test equipment:

TEST SPECIFICATION / REV.: SAE/USCAR-2 REVISION 8

Step	Test name	Requirements	Result
1	Visual inspection	No deterioration, cracks, deformities	O
2	Connector and/or terminal cycling	None (cycling step)	
3	Pressure/Vacuum leak	48kPa/15 sec., no bubbles visible	O
4	High temperature exposure	Conditioning only	N/A
5	Pressure/Vacuum leak	28kPa/15 sec., no bubbles visible	
6	Submersion	No water ingress	
7	High pressure spray	No water ingress	
8	Visual inspection	No deterioration, cracks, deformities	
9	Terminal-Connector retention force	1.5 system ≥50N	

O=meets requirements
X=does not meet requirements
N/A=requirement not defined, evaluation not possible

1. Visual inspection

Figure 28

2. Connector and/or terminal cycling

3. Pressure/Vacuum leak

Test setup:

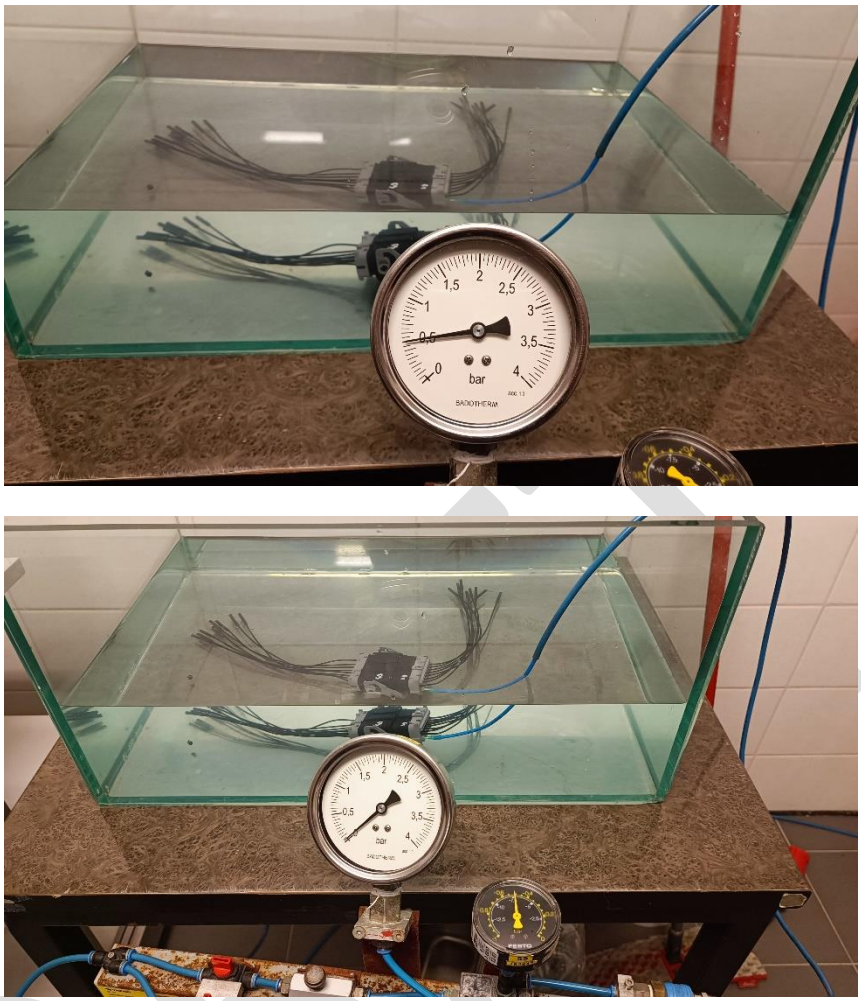


Figure 29

No bubbles visible exiting any test sample.

4. High temperature exposure

- Heat soak all samples for 1008 hours at the maximum temperature 125 °C

Test setup:

Figure 30

5. Pressure/Vacuum leak

6. Submersion

7. High pressure spray

8. Visual inspection

9. Terminal-Connector retention force

REVISION SHEET

Rev. no.	Revision date	Revision record
0	DD.MM.YYYY	NEW

END OF REPORT