SRC - Sealed Rectangular Connector

1. INTRODUCTION

1.1. Purpose

Product qualification testing of SRC connector system as per TEC-108-160018.

1.2. Scope

This report covers the electrical and environmental performance of the Sealed Rectangular Connector (SRC) system.

1.3. Conclusion

All part numbers listed in paragraph 4 conformed to the electrical, mechanical, and environmental performance requirements of TEC-108-160018.

1.4. Product Description

The Sealed Rectangular Connector (SRC) is designed to meet the need for a rugged, environmentally sealed connector system supporting power and low-level signal applications. The system is comprised of a wire-to-wire configuration and is based upon the MX150L and MX150 blade and receptacle type terminals. The design features all-in-one plug and receptacle housings with pre-assembled wire and interfacial seals with a Terminal Position Assurance (TPA) component to aid assembly.

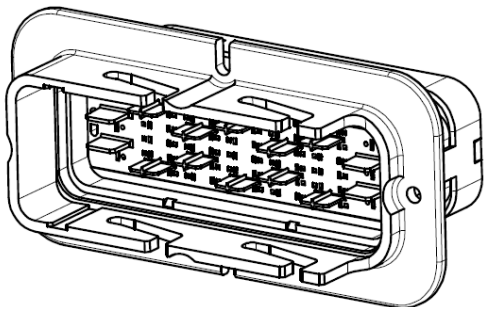

Figure 1: SRC 60+6 Mixed Power Blade Assembly Housing Mating Interface

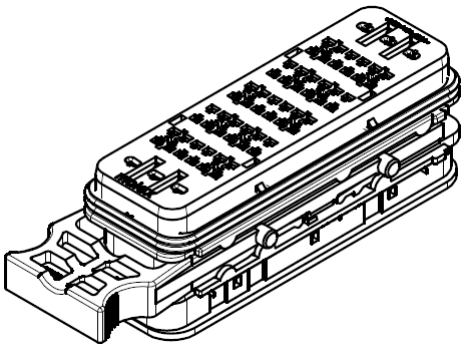

Figure 2: SRC 60+6 Mixed Power Female Receptacle Assembly Housing Mating Interface

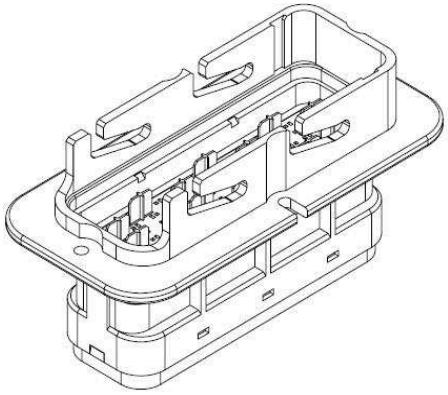

Figure 3:SRC84 Pin Mixed Power Female Receptacle Housing Mating Interface

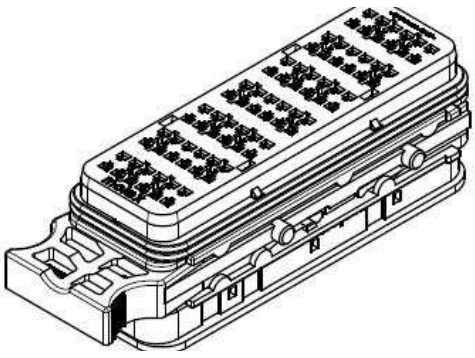

Figure 4: SRC Female 84 Pin Receptacle Housing Assembly

1.5. Test Specimens

The test specimens were representative of normal production lots, and the following part numbers were used for testing.

Test Group	Quantity	Description
TG A	30	30 mated signal terminals
TG B	6	SRC 60+6 mated 2500021-1 Male & 2500005-1 Female pair
TG C	8	SRC 60+6 mated 2500021-1 Male & 2500005-1 Female pair
TG D	6	SRC 60+6 mated 2500021-1 Male & 2500005-1 Female pair
TG E	6 1	SRC 84 mated 2500024-1 Male & 2500008-1 Female pair SRC 60+6 mated 2500021-1 Male & 2500005-1 Female pair
TG F	5	SRC 60+6 mated 2500021-1 Male & 2500005-1 Female pair
TG G	18	SRC 60+6 Male Power Terminals inserted into 2500021-1 Male housings Female Power Terminals inserted into 2500005-1 Female housings
TG H	8	SRC 60+6 mated 2500021-1 Male & 2500005-1 Female pair
TG J & K	1+1(J) 1+1 (K)	**Sample 1** SRC 0+20 way mated connector populated with Nissei Denki EFN-2 (150°C High Temperature cable) 5.5mm² power cables terminated to MX150L Male/Female terminals (P/Ns 194310016/194340003) **Sample 2** SRC 84 way mated connector populated with Nissei Denki EFN-2 (150°C High Temperature cable) 0.5mm² signal cable terminated to MX150 Signal Blade/Receptacle terminals (P/Ns 330000004/330122004)

Table 1: Quantities Tested

1.6. Qualification Test Sequence

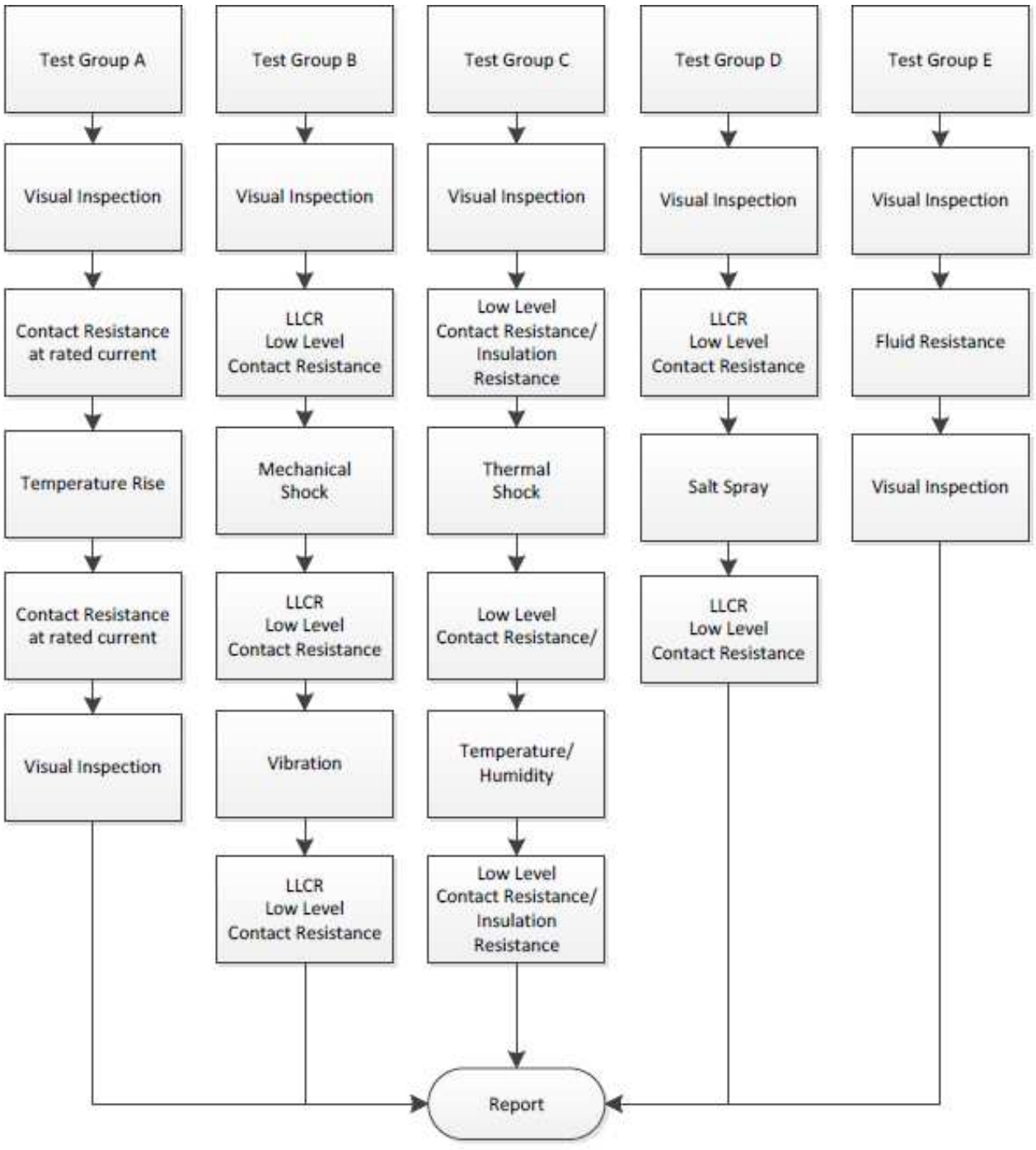

Figure 5: Test Sequence Part 1 of 2

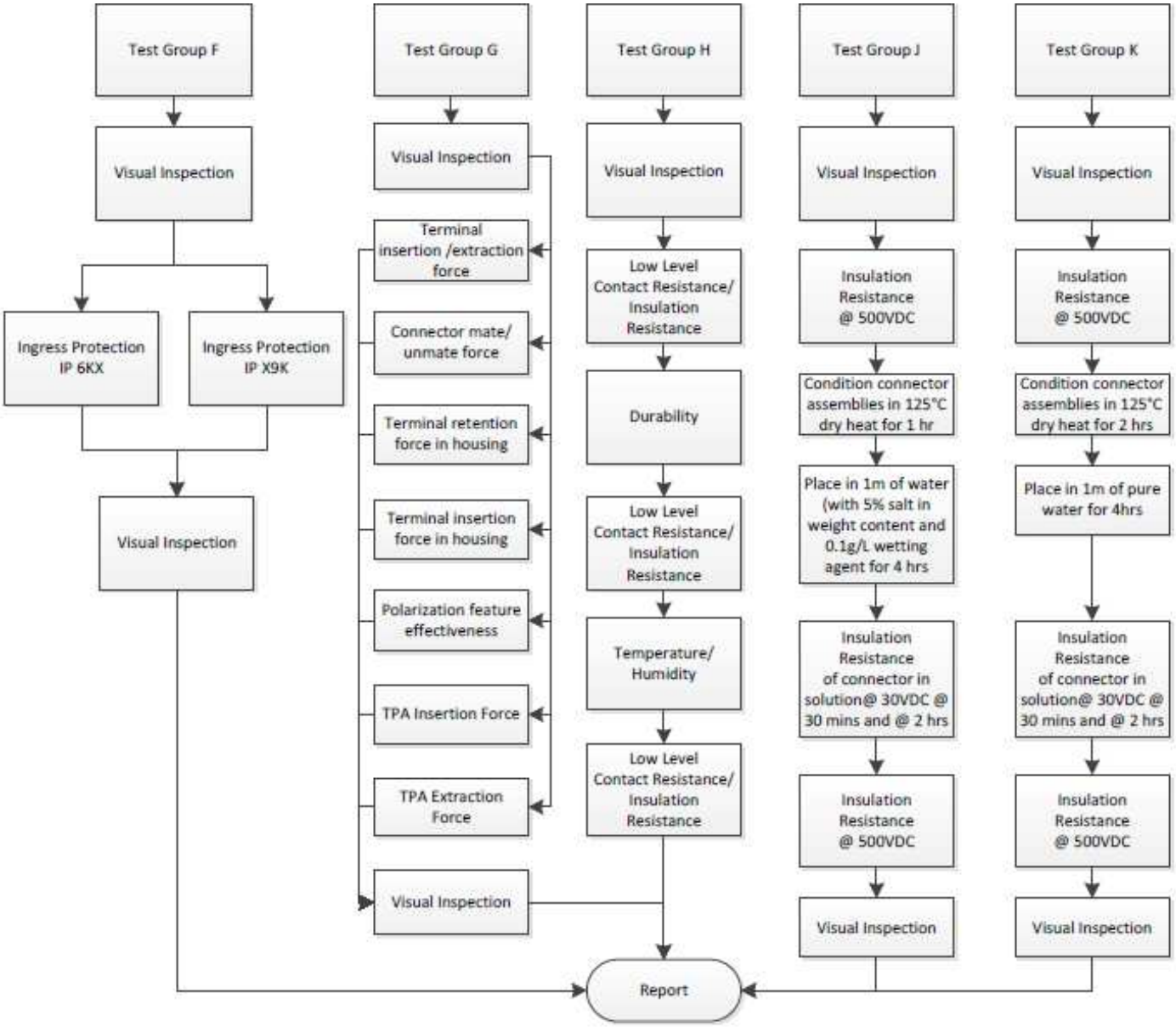

Figure 6: Test Sequence Part 2 of 2

1.7. Environmental Conditions

Unless otherwise stated, the following environmental conditions prevailed during testing:

Temperature: 15°C to 35°C
Relative Humidity: 20% to 80%

2. SUMMARY OF TESTING

2.1. Test Group TGA

Test Ref	Item	Specification	Results			Comment
			Max	Mean	Min	
5.1.1	Visual Inspection	No Damage	No damage visible			Pass
5.2.3	Contact Resistance @ Rated Current	**Signal (MX150)** 10mΩ Maximum Initial After current cycling Parts were wired with 0.33mm² cable, measurements taken at 10 Amps **Power (MX150L)** 30mΩ Maximum Initial After current cycling Parts were wired with 6.0mm² cable, measurements taken at 30 Amps	[mΩ] 9.47 9.54 1.43 2.83	[mΩ] 8.57 8.61 1.27 1.37	[mΩ] 8.01 8.11 1.20 1.20	 Pass Pass Pass Pass
5.2.5	Temperature Rise (via Current Cycling)	Temperature rise over Ambient: 55°C Maximum **Signal (MX150)** Initial Final Parts were wired with 0.33mm² cable, measurements taken at 10 Amps **Power (MX150L)** Initial Final Parts were wired with 6.0mm² cable, measurements taken at 30 Amps	[°C] 43.74 45.00 48.87 47.03	[°C] 34.43 31.17 38.14 37.89	[°C] 27.78 22.52 22.55 28.41	 Pass Pass Pass Pass
5.1.1	Visual Inspection	No Damage	No damage visible			Pass

Table 2: Test Results for Test Group A

2.2. Test Group TGB

Test Ref	Item	Specification	Results			Comment
			Max	Mean	Min	
5.1.1	Visual Inspection	No Damage	No damage visible			Pass
5.2.2	Initial LLCR (Low Level Contact Resistance)	10 mΩ (MX150) 30mΩ (MX150L) Maximum [Initial]	[mΩ]	[mΩ]	[mΩ]	
		Signal MX150*	9.2	5.9	4.9	Pass
		Power MX150L*	11.4	6.0	3.4	Pass
5.3.13	Mechanical Shock	10 mΩ MAXIMUM (change from initial contact resistance)	Delta [mΩ]	Delta [mΩ]	Delta [mΩ]	
		Signal MX150	1.6	0.2	-1.1	Pass
		Power MX150L	1.4	-1.3	-5.7	Pass
		No Discontinuity > 1ms with a current of 100 mA	No Discontinuity > 1ms with a current of 100 mA			Pass
5.3.14	Vibration	10 mΩ MAXIMUM (change from initial contact resistance)	Delta [mΩ]	Delta [mΩ]	Delta [mΩ]	
		Signal MX150	0.7	-0.3	-3.3	Pass
		Power MX150L	0.3	-3.0	-8.4	Pass
		No Discontinuity > 1ms with a current of 100 mA	No Discontinuity > 1ms with a current of 100 mA			Pass
5.1.1	Visual Inspection	No Damage	No damage visible			Pass

Table 3: Test Rersults for Test Group B

* Bulk Signal Resistance 6.7mΩ, Bulk Power Resistance 1.2mΩ for 215mm length.

2.3. Test Group TGC

Test Ref	Item	Specification	Results			Comment
			Max	Mean	Min	
5.1.1	Visual Inspection	No Damage	No damage visible			Pass
5.2.2	Initial LLCR (Low Level Contact Resistance	30mΩ (MX150L) 10 mΩ (MX150) Maximum [Initial]	[mΩ]	[mΩ]	[mΩ]	
		Power MX150L	6.0	4.2	3.2	Pass
		Signal MX150	8.9	8.0	7.3	Pass
5.2.4	Insulation Resistance	20MΩ Minimum @ 500VDC	IR > 50,000MΩ			Pass
5.4.16	Thermal Shock	20mΩ Maximum (change from initial contact resistance)	[mΩ]	[mΩ]	[mΩ]	
		Power MX150L	12.4	5.2	1.9	Pass
		Signal MX150	1.0	0.2	-0.9	Pass
		Visual: No Damage	No Damage visible			Pass
5.4.17	Temperature Humidity	20mΩ Maximum (change from initial contact resistance)	[mΩ]	[mΩ]	[mΩ]	
		Power MX150L	15.1	8.7	2.8	Pass
		Signal MX150	6.4	0.9	-0.9	Pass
		Insulation Resistance 20MΩ Minimum @ 500VDC	IR > 50,000MΩ			Pass
		Visual: No Damage	No Damage visible			Pass

Table 4:Test Results for Test Group C

2.4. Test Group TGD

Test Ref	Item	Specification	Results			Comment
			Max	Mean	Min	
5.1.1	Visual Inspection	No Damage	No damage visible			Pass
5.2.2	Initial LLCR (Low Level Contact Resistance)	10 mΩ (MX150) 30mΩ (MX150L) Maximum [Initial]	[mΩ]	[mΩ]	[mΩ]	
		Signal MX150*	5.85	5.11	3.77	Pass
		Power MX150L*	5.79	3.67	1.99	Pass
5.4.18	Salt Spray	20 mΩ MAXIMUM (change from initial contact resistance)	Delta [mΩ]	Delta [mΩ]	Delta [mΩ]	
		Signal MX150*	1.72	-0.07	-2.12	Pass
		Power MX150L*	1.23	-0.56	-2.61	Pass
5.1.1	Visual Inspection	No Damage	No damage visible			Pass

Table 5: Test Results for Test Group D

* Bulk Signal Resistance 2.35mΩ for 73mm length, Bulk Power Resistance 0.37mΩ for 65mm length.

2.5. Test Group TGE

Test Ref	Item	Specification	Results			Comment
			Max	Mean	Min	
5.1.1	Visual Inspection	No Damage	No damage visible			Pass
5.4.19	Fluid Resistance	Visual : No Damage	Reference Section 9.0 for Fluid Resistance results			Pass
5.1.1	Visual Inspection	No Damage	No damage visible			*Pass

Table 6: Test Results for Test Group E

***** The following observation was noted that during the Fluid Immersion Test for diesel that lifting of the edge of the rear cover feature from the female housing occurred. This was due to diesel impregnating the seal.

2.6. Test Group TGF

Test Ref	Item	Specification	Results			Comment
			Max	Mean	Min	
5.1.1	Visual Inspection	No Damage	No damage visible			Pass
5.4.20	IP 69K ISO 20653	IP 6KX - expose mated connectors to suspended dust	"No infiltrated dust could be visually detected inside the plug connectors" Reference Fraunhofer Institute Test Report US 06993/2014			Pass
		IP X9K - expose mated connectors to water from any direction at high temperature and pressure	Reference Fraunhofer Institute Test Report US 06775/2014			Pass
5.1.1	Visual Inspection	No Damage	No damage visible			Pass

Table 7: Test Results for Test Group F

2.7. Test Group TGG

Test Ref	Item	Specification	Results			Comment
			Max	Mean	Min	
5.3.1	Visual Inspection	No Damage	No damage visible			Pass
5.3.6	Terminal Insertion/Extraction	**Maximum Insertion** Signal MX150: 5N Max Power MX 150L: 15N Max **Minimum Withdrawal** Signal MX150: 1N Min Power MX 150L: 9N Min	[N] 2.8 14.7 2.2 20.4	[N] 2.2 12.5 2.0 16.2	[N] 1.72 10.2 1.64 16.2	 Pass Pass Pass Pass
5.3.7	Connector Mate/Unmate	250N Maximum Mating Force Unmating Force	[N] 247 207	[N] 225 189.75	[N] 211 161	 Pass Pass
5.3.8	Terminal Retention Force in Housing	**Signal MX150: 50N Min** Female Male **Power MX 150L :111N Min** Female Male	[N] 96 90 325 220	[N] 92 88 303 216	[N] 86 85 289 205	 Pass Pass Pass Pass
5.3.9	Terminal Insertion Force Into Housing	**30N Maximum** Male Power MX150L terminals into male housing Female Power MX150L terminal into Female housings	[N] 19.10 23.50	[N] 14.09 14.19	[N] 10.90 9.67	 Pass Pass
5.3.10	Polarization Feature Effectiveness	220N maximum Sample should not mate	No mating			Pass
5.3.11	TPA Insertion Force	130N Maximum Female Male	[N] 92.7 28.9	[N] 83.8 23.0	[N] 73.8 16.6	 Pass Pass
5.3.12	TPA Extraction Force	130N Maximum Female Male	[N] 92.9 15.5	[N] 68.6 13.8	[N] 54.4 13.0	 Pass Pass
5.3.1	Visual Inspection	No Damage	No damage visible			Pass

Table 8: Test Results for Test Group G

2.8. Test Group TGH

Test Ref	Item	Specification	Results			Comment
			Max	Mean	Min	
5.1.1	Visual Inspection	No Damage	No damage visible			Pass
5.2.2	Initial LLCR (Low Level Contact Resistance)	30mΩ (MX150L) 10 mΩ (MX150) Maximum [Initial] **Power MX150L** **Signal MX150**	[mΩ] 6.5 9.9	[mΩ] 4.5 8.3	[mΩ] 2.9 7.7	 Pass Pass
5.2.4	Insulation Resistance	20MΩ Minimum @ 500VDC	> 50,000MΩ			Pass
5.3.15	Durability	20mΩ Maximum (change from initial contact resistance) **Power MX150L** **Signal MX150**	[mΩ] -0.0 2.76	[mΩ] -1.3 0.4	[mΩ] -3.4 -1.7	 Pass Pass
		Visual: No Damage	No Damage visible			Pass
5.4.17	Temperature/ Humidity	20mΩ Maximum (change from initial contact resistance) **Power MX150L** **Signal MX150**	[mΩ] 13.2 6.1 19.1 4.1	[mΩ] 0.9 -0.6	[mΩ]	 Pass Pass
		20MΩ Minimum @ 500VDC	IR > 50,000MΩ			Pass
		Visual: No Damage	No Damage visible			Pass

Table 9: Test Results for Test Group H

2.9. Test Group TGJ

Test Ref	Item	Specification	Results			Comment
5.1.1	Visual Inspection	No Damage	No damage visible			Pass
5.2.4	Insulation Resistance	20 MΩ Minimum at 500VDC SRC84way SRC 0+20way	IR > 50,000MΩ IR > 50,000MΩ			Pass Pass
N/A	Precondition	Dry heat for 1hr @125°C	Completed			N/A
5.4.21	Water Immersion	Placed in water at a depth of 1m with a 5% salt in weight content and 0.1g/L wetting agent for 4hrs	Completed			N/A
	Insulation Resistance (Test Sample in Solution)	5000MΩ Minimum @ 30VDC SRC84way SRC 0+20way	**@30mins** IR>5000MΩ IR>5000MΩ	**@2hrs** IR>5000MΩ IR>5000MΩ	**@4hrs** IR>5000MΩ IR>5000MΩ	Pass Pass
	Insulation Resistance (Post Water Immersion)	1000 MΩ Minimum at 500VDC SRC84way SRC 0+20way	IR > 50,000MΩ IR > 50,000MΩ			Pass Pass
	Visual Inspection	SRC84way SRC 0+20way	No Moisture Present No Moisture Present			Pass Pass
5.1.1	Visual Inspection	No Damage	No damage/deformation to cable visible			Pass

Table 10: Test Results for Test Group J

All connector samples that underwent immersion test were bussed so that all adjacent cables could be tested at once to reduce testing time between individual adjacent terminals (see Figure 26).

Insulation Resistance test pre/post immersion occurred on mated connectors, while the TEC-108-160018 Item 5.2.4 Insulation Resistance requirement is on the unmated connector.

Item 5.4.21(Water Immersion) calls for Insulation resistance testing at 1000MΩ Minimum @ 500VDC while test 5.2.4 (Insulation Resistance) calls for 20MΩ Minimum @ 500VDC. The Insulation Resistance test was carried out in aqueous solution (5000MΩ Minimum @ 30VDC) at the 30th minute, 2 hour & 4 hour intervals between the connector system & solution.

2.10. Test Group TGK

Test Ref	Item	Specification	Results			Comment
5.1.1	Visual Inspection	No Damage	No damage visible			Pass
5.2.4	Insulation Resistance	20 MΩ Minimum at 500VDC SRC84way SRC 0+20way	IR > 50,000MΩ IR > 50,000MΩ			Pass Pass
N/A	Precondition	Dry heat for 2hr @125°C	Completed			N/A
5.4.22	Pure Water Immersion	Placed in "pure" water at a depth of 1m for 4hrs	Completed			N/A
	Insulation Resistance (Test Sample in Solution)	5000MΩ Minimum @ 30VDC SRC84way SRC 0+20way	**@30mins** IR>5000MΩ IR>5000MΩ	**@2hrs** IR>5000MΩ IR>5000MΩ	**@4hrs** IR>5000MΩ IR>5000MΩ	Pass Pass
	Insulation Resistance (Post Pure Water Immersion)	1000 MΩ Minimum at 500VDC SRC84way SRC 0+20way	IR > 50,000MΩ IR > 50,000MΩ			Pass Pass
	Visual Inspection	SRC84way SRC 0+20way	No Moisture Present No Moisture Present			Pass Pass
5.1.1	Visual Inspection	No Damage	No damage/deformation to cable visible			Pass

Table 11: Test Results for Test Group K

3. EQUIPMENT USED

Item	Equipment used
Contact Resistance	HP Milliohm meter Cal No.1650
Insulation Resistance	Omnia Cal No. 3010
Force Testing	Zwick Force Tester Cal No. 3711
Fluid Resistance	Smithers Rapra Test Report 49085
	Aqueous Urea test conducted at Molex Ireland Sanyo Gallenkamp Cal No. 2137 RS Timer Cal No. 2658
Salt Spray	WEISS TECHNIK SC/KWT 450 Cal No. 2505
Mechanical Shock & Vibration	Contech Research Inc. Reference Test Report # 214361A
IP69K	IP6KX Fraunhofer Institute Reference Test Report No. US 06993/2014
	IPX9K Fraunhofer Institute Reference Test Report No. US 06775/2014
Temperature Rise	Agilent Data Acquisition unit, Cal No. 3136 Xantrex Power Supply Unit Cal No. 3508
Thermal Shock	CTS Thermal Shock Cal No. 3849
Temperature/Humidity	CTS Temperature/Humidity Cal No. 3189
Insulation Resistance in Aqueous solution	Kikusui TOS7200 Cal No.3948
Water/Pure Water Immersion	Rabone 1m Rule Cal#2911 RS Timer Cal#2658
Precondition stage prior to Water Immersion	Genlab Oven OVI26SF
	Extech 421501 Type K Thermocouple Cal No. 3215

4. APPENDICES

4.1. Appendix A: Test Set-ups TGB & TGD

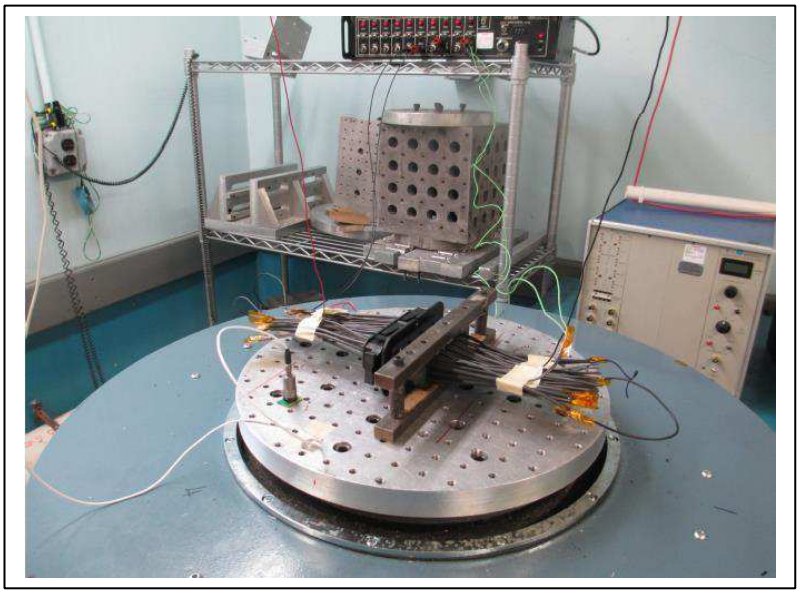

Figure 7: Test Group B : Contech Research Inc.: Mechanical Shock/Vibration Typical Test Setup

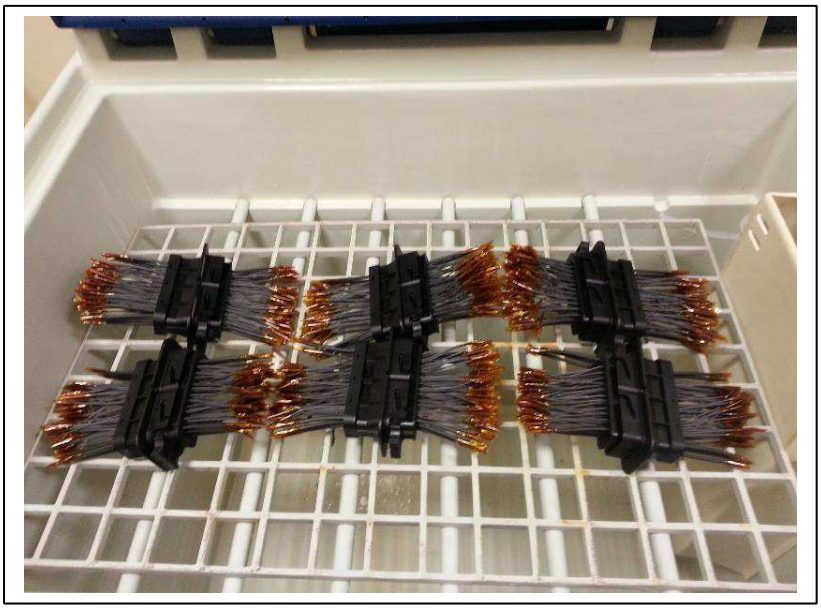

Figure 8: Test Group D : Setup of Samples in Salt Spray chamber

4.2. Appendix B: Fluid Resistance Test Set-up TGE

Fluid Required	Concentration	Temperature	Fluid Brand Used
Motor Oil 30 wt	100%	85±3°C	IRM 902
Brake Fluid	100%	85±3°C	Morris Dot 3 & 4
Diesel Fuel	90/10%	60±3°C	IRM 903/Xylene
50/50 Antifreeze Mix	50/50	85±3°C	ES Compleat Fleetguard
Roundup Original	7.50%	23±3°C	Round Up GC Concentrate
Gear Oil 90 wt	100%	85±3°C	Morris EP90W/90
Aqueous Urea	32.5%	23±3°C	Purchem AdBlue

Table 12: List of fluids used at External Test Laboratory

Figure 9:Observation that lifting of the edge of the rear cover feature from the female housing part occurred. This was due to diesel impregnating the seal

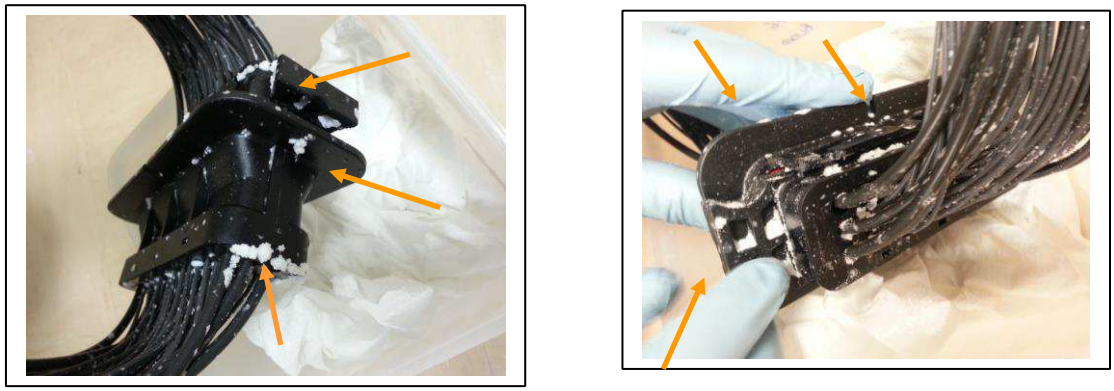

Figure 10:Fluid Resistance test: ADBLUE, formation of Urea crystals on part as water evaporates from ADBLUE solution during 24 Hour air dry cycles.

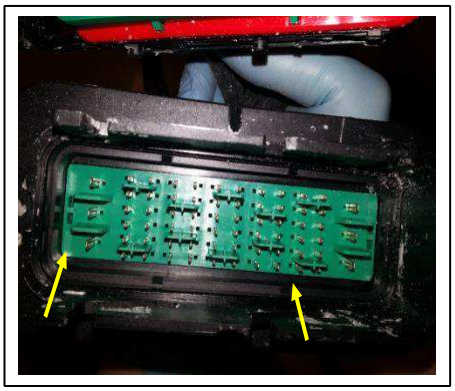

Figure 11: No Urea crystals on mating surface of part

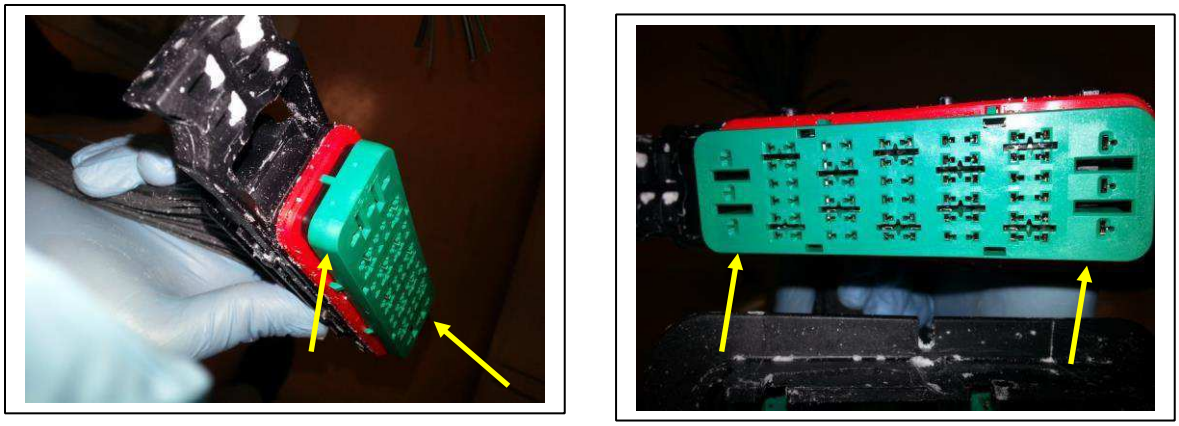

Figure 12: No Urea crystals on mating surface of part

4.3. Appendix C: (IP69K) SET-UPS TGF

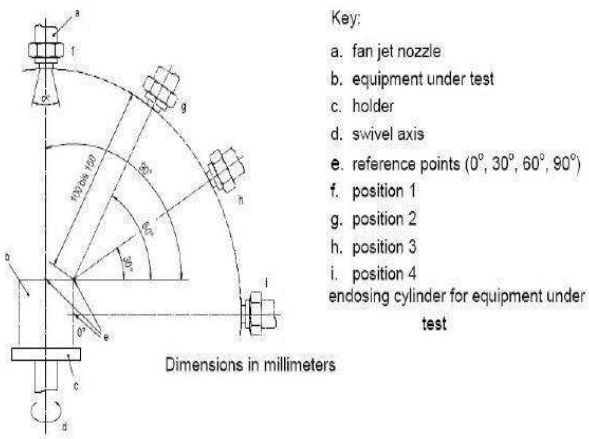

Figure 13: : IPX9K Test setup for determining protection against high pressure/steam jet cleaning

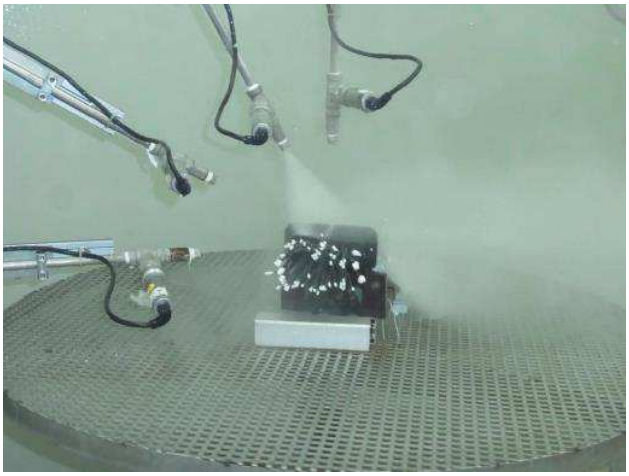

Figure 14: specimen during the steam jet test (30° angle)

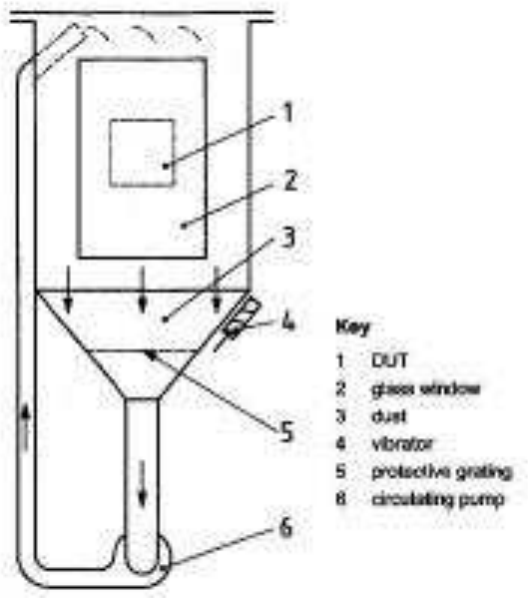

Figure 15: Test set-up for IP6KX (example of a dust chamber with vertical flow of the air/dust mixture

Figure 16: Specimens in the dust test chamber for IP6KX (after test)

4.4. Appendix D: Terminal Insertion Set-up TGG

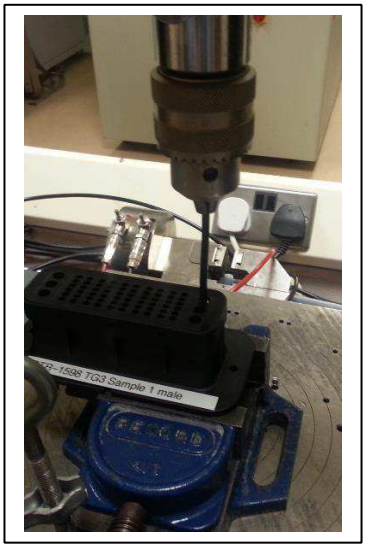

Figure 17: Setup of Zwick/Roell force tester for male terminal insertion into male housing

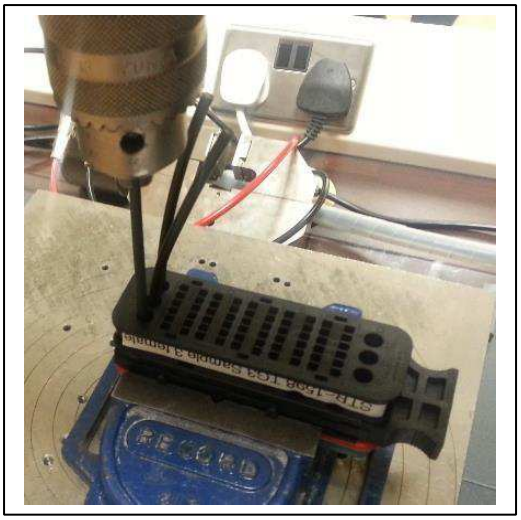

Figure 18: Setup of Zwick/Roell force tester for female terminal insertion into female housing

4.5. Appendix E: Water Immersion Test Set-Up TGJ & TGK

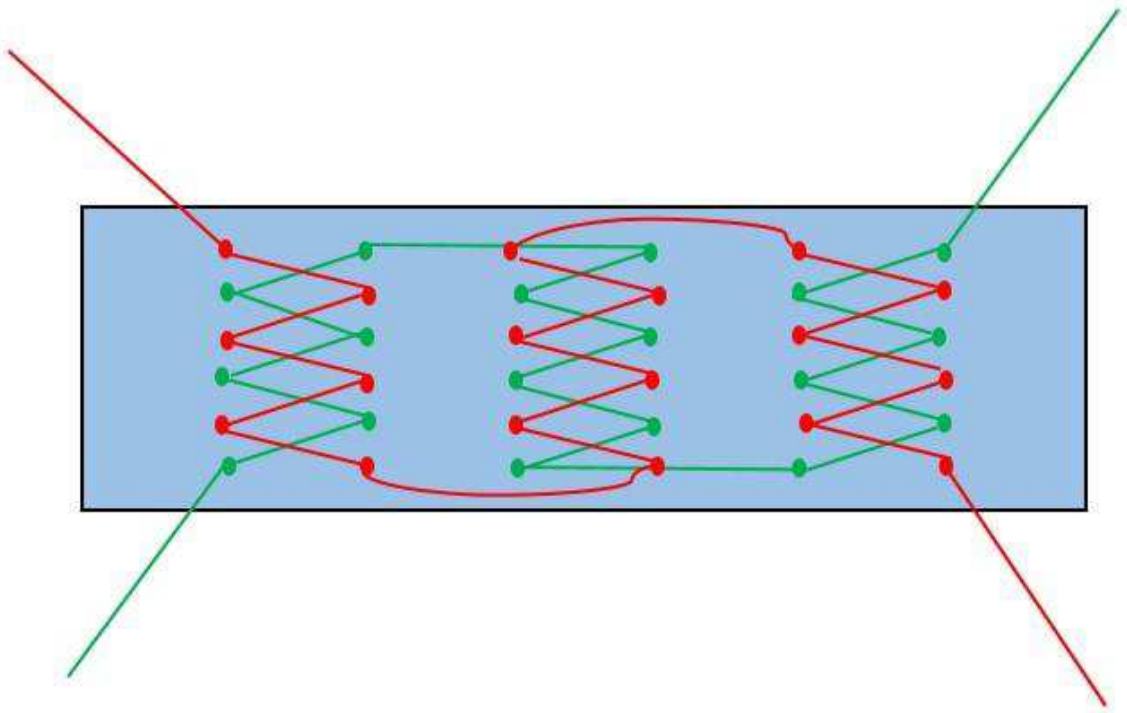

Figure 19: demonstrates the wiring diagram used to bus the connector harness

Harnesses were bussed in this way so that all terminals were wired opposite to its neighboring terminals, Note: only 3 pockets are shown in the wiring diagram as the diagram repeats itself across the connector

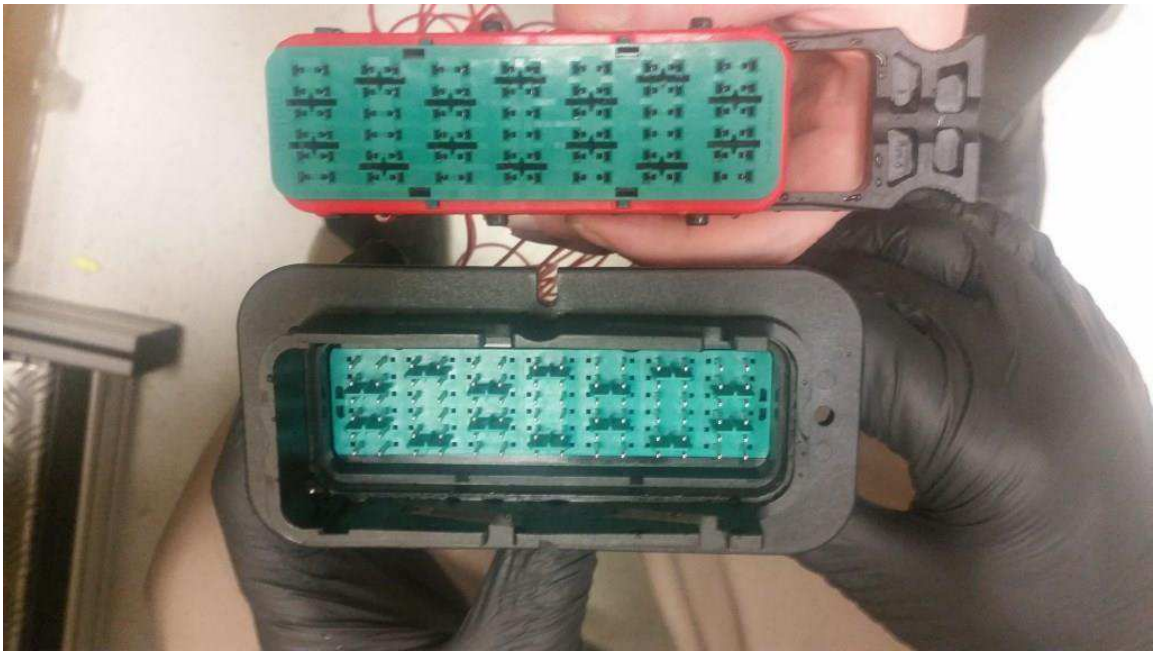

Figure 20: Visual Inspection Post Insulation Resistance/Immersion Test, No ingress of solution

5. REVISION HISTORY

Rev Ltr	Brief Description of Change	Date	Dwn	Apvd
A	Initial Release	15-Apr-21	JF	DM