PRODUCT SPECIFICATION

Size 16 Crimped Pins and Socket

1.0 SCOPE

This Product Specification relates to the size 16 solid pins and sockets for use with the XRC and ML-XT Commercial Vehicle, (CV), Power and/or Signal wire-to-wire connector system. The product terminals terminate with 20 to 14AWG wires using crimp technology.

2.0 PRODUCT DESCRIPTION

2.1 PRODUCT NAME AND SERIES NUMBER(S)

936400012	16-20AWG Nickel Plated ML-XT/XRC Solid Pin Contact
936400014	16-20AWG Gold Plated ML-XT/XRC Solid Pin Contact
936400022	14AWG Nickel Plated ML-XT/XRC Solid Pin Contact
936400024	14AWG Gold Plated ML-XT/XRC Solid Pin Contact
936410012	16-20AWG Nickel Plated ML-XT/XRC Solid Socket Contact
936410014	16-20AWG Gold Plated ML-XT/XRC Solid Socket Contact
936410022	14AWG Nickel Plated ML-XT/XRC Solid Socket Contact
936410024	14AWG Gold Plated ML-XT/XRC Solid Socket Contact

2.2 DIMENSIONS, MATERIALS, PLATINGS AND MARKINGS

Female Receptacle Terminal:	Copper Alloy, Plating with Nickel only option or Hard Gold over Nickel
Male Pin Terminal:	Copper Alloy, Plating with Nickel only option or Hard Gold over Nickel

2.3 SAFETY AGENCY APPROVALS

Not Applicable

3.0 APPLICABLE DOCUMENTS AND SPECIFICATIONS

936400010 PSD	Solid Pin Sales Drawing
936400020 PSD	Solid Socket Sales Drawing
934430010 PSA	Application Specification
SAE AS39029	General Specification for Contacts & Electrical Connectors
SAE J2030	Heavy Duty Electrical Connector Performance Standard
SAE USCAR 2	Performance Specification for Automotive Electrical Connector Systems
ISO 8092-2	Road Vehicles – Connections for On-Board Electrical Wiring Harnesses

4.0 RATINGS

4.1 CURRENT AND APPLICABLE WIRES

AWG	mm²	Amps
20	0.5	7.5
18	0.8	10
16	1.0	13
14	2.0	13

4.2 TEMPERATURE

Operating: - 55°C to + 125°C
Non-operating: - 55°C to + 125°C

5.0 PERFORMANCE

5.1 GENERAL REQUIREMENTS

ITEM	DESCRIPTION	TEST CONDITION	REQUIREMENT
1	**Visual Inspection SAE USCAR-2, 5.1.8**	Parts shall be initially checked for defects or non-functionality. Post test, detail any observable changes.	No evidence of deterioration, cracks, deformities etc. that could affect functionality.

5.2 ELECTRICAL REQUIREMENTS

ITEM	DESCRIPTION	TEST CONDITION	REQUIREMENT
2	**Low voltage Resistance IEC 60512-2-1,test2a**	Test with applied voltage not exceeding 20mV open circuit and the test current shall be limited to 100mA.	10mOhms Maximum
3	**Insulation Resistance SAE USCAR-2, 5.5.1**	Apply a voltage of **500** VDC between adjacent terminals and between terminals to ground.	100 MegaOhms Minimum
4	**Connection Resistance @ Rated Current SAE J2030, 6.4**	Mate connectors: Measurements shall be taken after thermal equilibrium at rated current level.	Voltage Drop not to Exceed levels in Table 1 of Section 6.0
5	**Maximum Test Current Capability SAE USCAR 2, 5.3.3**	Apply a test current to the terminal and cable assembly until a 55°C rise over ambient is recorded.	No Pass/Fail Criteria Applies. Data is used to establish maximum test current condition.
6	**Current Cycling Test SAE USCAR 2, 5.3.4**	**a.** 1008 off/on cycles, at maximum test current, each cycle to consist of 45 min on, 15 min off. **b.** Record terminal crimp and interface millivolt drop readings 30 minutes into the first on cycle. Record the temperature readings for each terminal pair. **c.** Take readings once daily 30 minutes into the on cycle and 30 minutes into the final on cycle. **d.** Calculate the Total Connection Resistance.	1. Voltage Drop not to Exceed levels in Table 1 of Section 6.0 2. The temperature of any terminal interface must not exceed a 55°C rise over ambient.

5.3 MECHANICAL REQUIREMENTS

ITEM	DESCRIPTION	TEST CONDITION	REQUIREMENT
7	**Plating Porosity SAE AS39029, 3.5.16**	Parts shall be placed in containers and covered with Nitric acid (Specific Gravity 1.376 at 75.6°C) at 25°C +/-3°C. Parts are observed for 30 seconds.	No bubbling observed on the Gold plated contacts during the 30 second test.
8	**Connector and/or Terminal Cycling. SAE USCAR 2, Per 5.1.7**	Mate and un-mate the connectors or terminals along their centerlines for 10 cycles.	Parts to be validated as part of test sequence requirements.
9	**Terminal to Terminal Engage/Disengage Force SAE USCAR 2, 5.2.1**	Engage and disengage the terminals on axis at a uniform rate of 50mm/min. Repeat 9 times. Record the first engage and last disengage force.	Visual examination to USCAR 2, per 5.1.8. Post conditioning check for plating wear, physical distortions, cracks or loss of mechanical function.
10	**Circuit Continuity Monitoring, SAE USCAR 2, 5.1.9**	The connector assemblies are daisy chained and monitored using a 100mA circuit to a continuity meter.	No loss of electrical continuity for more than 1 microsecond. Resistance ≤ 7Ω for more than 1 microsecond.
11	**Vibration** **SAE J2030, 6.15**	Mate connectors; Sine sweep of **10** Hz to **2,000** Hz, back to **10** Hz in 20min, Test duration **24**hrs **1.78** mm displacement, **20** g acceleration. 12 cycles in each of the 3 mutually perpendicular axis. Apply the rated current per table 3 of SAE J2030 for the first 3 hours in each axis.	10 Ohms Maximum No discontinuity > 1 microsecond at 100 mA for the last hour of vibration in each axis.
12	**Shock (Mechanical)** **SAE J2030, 6.16**	Mate connectors and shock at **50** g with ½ sine wave (11 milliseconds) shocks in the X,Y,Z axes (**10** shocks per axis, 30 total).	10 Ohms Maximum No discontinuity > 1 microsecond at 100 mA
13	**Tensile Strength for Crimp Connections ISO8092-2, 4.4**	The tensile strength of the crimped connection shall be tested within the range of 25 mm to 100 mm/ min.	(20AWG) 0.5mm^2 – 60N min (18AWG) 0.8mm^2 – 90N min (16AWG) 1.0mm^2 – 100N min (14AWG) 2.0mm^2 – 175N min
14	**Maintenance Aging SAE J2030, 6.6**	Subject 10% of the cavities to ten cycles of inserting and removing its respective contact. The ten cycles shall also include any disassembly required to remove the contacts. The connectors shall be mated and unmated during each cycle.	Parts to be validated as part of test sequence requirements.

5.4 ENVIRONMENTAL REQUIREMENTS

ITEM	DESCRIPTION	TEST CONDITION	REQUIREMENT
15	**Thermal Shock SAE USCAR 2, 5.6.1**	1. Cold soak the samples for 30 minutes at the specified minimum temperature class(-40°C). 2. Transfer the samples to soak 30 minutes at the specified maximum temperature class (+125°C) transfer in under 30 seconds. 3. Transfer the samples to soak 30 minutes at the specified minimum temperature class(-40°C). Make the transfer in under 30 seconds. 4. This completes one 90-minute Thermal Shock Cycle. 5. Repeat the cycle another 99 times.	Parts to be validated as part of test sequence requirements.
16	**High Temperature Exposure SAE USCAR 2, 5.6.3**	+125°C for 1008 hours	Parts to be validated as part of test sequence requirements.
17	**Submersion SAE USCAR 2, 5.6.5**	Submerse the mated connector assembly under 30 – 40cm of a soapy and salty solution at 0°C. The samples shall remain submersed at this depth for 30 minutes.The assemblies are held at 125°C for 2 hours prior to immediate soak.	Parts to be validated as part of test sequence requirements.
18	**Temperature/Humidity Cycling SAE USCAR 2, 5.6.2**	40 cycles of; 30min at -40°C uncontrolled Relative Humidity (R.H.), 5 hours at +85°C & 90% ±5% R.H. 2 hours at 125°C uncontrolled R.H., 1 hour at -40°C uncontrolled R.H.	Parts to be validated as part of test sequence requirements.

6.0 CONNECTION RESISTANCE

CABLE SIZE (MM^2)	TEST CURRENT (AMPS)	MAXIMUM MILLIVOLT DROP (mV)
0.5 (20AWG)	7.5	100
0.8 (18AWG)	10	100
1.0 (16AWG)	13	100
2.0 (14AWG)	13	100

Table 1. Millivolt Drop at Specified Test Current

7.0 QUALIFICATION TEST GROUPS AND SEQUENCES

No	Item	Test Group						
		A	B	C	D	E	F	G
1	Visual Inspection	1, 3	1, 4	1, 8	1, 7	1, 8	1, 7	1, 7
2	Low-Voltage Resistance**			3, 6	3, 5	3*, 5*	3, 5	
3	Insulation Resistance					7*		4, 6
4	Connection Resistance**			7	6	6*	6	
5	Maximum Test Current Capability		2					
6	Current Cycling		3					
7	Plating Porosity	2						
8	Connector/Terminal Cycling			2	2	2	2	2
9	Terminal to Terminal Engage/Disengage Force	2						
10	Circuit Continuity Monitoring**				4			
11	Vibration			4				
12	Mechanical Shock			5				
13	Terminal Crimp Strength	2						
14	Maintenance Aging							3
15	Thermal Shock				4			
16	High Temperature Exposure						4	
17	Submersion							5
18	Temperature/Humidity Cycling					4		

**It is permissible to use separate sample sets for Low Voltage Resistance, Connection Resistance and Insulation Resistance*

***It is permissible to divide the test samples into two groups. The first group shall be used for Low Voltage resistance measurement. The second group shall be used for Connection Resistance and Circuit continuity Monitoring. NOTE: DO NOT measure Low Voltage Resistance on samples monitored for continuity*

Groups A & C relate to terminal/connector electrical and mechanical testing for Gold over Nickel and Nickel only plated contacts for signal and power level connectors.

Group B terminal and connector test group relates to Nickel only plated contacts for power level connectors.

Groups D, E, F and G relate to connector system electrical sequence for Gold over Nickel and Nickel only plated contacts for signal and power level connectors.

8.0 PACKAGING

Parts shall be packaged to protect against damage during handling, transit and storage; reference Packaging Specification 936400010 PSK.