



# PRODUCT SPECIFICATION

## ML-XT COMMERCIAL VEHICLE CONNECTOR SERIES

### 1.0 SCOPE

This Product Specification relates to the ML-XT Commercial Vehicle, (CV), Power and/or Signal wire-to-wire connector system. This system consists of 7 circuit sizes, 2, 3, 4, 6, 8, 12 and 18cct. The product terminals terminate with 20 to 12AWG wires using crimp technology (Please Contact Molex Sales representative for 12 & 20 AWG options).

### 2.0 PRODUCT DESCRIPTION

#### 2.1 PRODUCT NAME AND SERIES NUMBER(S)

ML-XT Receptacle Assembly:	93444
ML-XT Plug Assembly:	93445
ML-XT Receptacle Terminal (Male Pin):	84524
ML-XT Plug Terminal (Female Socket):	84525
ML-XT Receptacle Wedgelock:	93447
ML-XT Plug Wedgelock:	93448
ML-XT Receptacle W/Heat Shrink Assembly:	93444 Variation
ML-XT Plug W/Heat Shrink Assembly:	93445 Variation

#### 2.2 DIMENSIONS, MATERIALS, PLATINGS AND MARKINGS

Housings:	Nylon, 30% Glass filled, UL 94 HB
Plug Seal:	Liquid Silicone Rubber
Back Seal:	High Consistency Rubber
Wedgelocks:	Nylon, 30% Glass filled, UL 94 HB
Female Receptacle Terminal:	Copper Alloy, Nickel plating and Hard Gold over Nickel option
Male Pin Terminal:	Copper Alloy, Nickel plating and Hard Gold over Nickel option

#### 2.3 SAFETY AGENCY APPROVALS

UL File Number:	Not Applicable
CSA File Number:	Not Applicable
TÜV License Number:	Not Applicable

### 3.0 APPLICABLE DOCUMENTS AND SPECIFICATIONS

934430010 PSD	ML-XT 2cct Assembly Sales Drawing
934430020 PSD	ML-XT 3cct Assembly Sales Drawing
934430030 PSD	ML-XT 4cct Assembly Sales Drawing
934430040 PSD	ML-XT 6cct Assembly Sales Drawing
SD-93443-005	ML-XT 8cct Assembly Sales Drawing
SD-93443-006	ML-XT 12cct Assembly Sales Drawing
SD-93443-007	ML-XT 18cct Assembly Sales Drawing
PK-93443-001	ML-XT Packaging Specification
SD-84524-001	Male Pin Terminal 16-18AWG Sales Drawing
SD-84524-002	Male Pin Terminal 14-18AWG Thin Wall Sales Drawing
SD-84524-003	Male Pin Terminal 14-18AWG Sales Drawing
SD-84525-001	Female Socket Terminal 16-18AWG Sales Drawing
SD-84525-005	Female Socket Terminal 14-18AWG Thin Wall Sales Drawing
SD-84525-007	Female Socket Terminal 14-18AWG Sales Drawing

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## 4.0 RATINGS

### 4.1 CURRENT AND APPLICABLE WIRES

AWG	Amps
20	7.5
18	10
16	13
14	13

### 4.2 TEMPERATURE

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

## 5.0 PERFORMANCE

### 5.1 VISUAL REQUIREMENTS

ITEM	DESCRIPTION	TEST CONDITION	REQUIREMENT
1	Examination of Product SAE J2030, 6.1	Parts checked for: Identification, Workmanship Finish, Markings, Cosmetic issues, Tool marks, Torn seals etc.	Meets requirements of product drawing. All parts shall be free of hazardous substances. All parts to be free of dirt and grease. No Defects
2	Visual Examination SAE J2030, 6.27	Conduct a visual examination for identification of product such as torn seals, cracked plastic, evidence of fluid or dust ingress in sealed connector systems, arcing, charring, melting, or anything that could affect the performance and serviceability of the product.	No Visual Defects as per Section 6.27 SAE J2030

### 5.2 ELECTRICAL REQUIREMENTS

ITEM	DESCRIPTION	TEST CONDITION	REQUIREMENT
3	Low voltage Resistance SAE J1614, 4.3.6	Test with applied voltage not exceeding 20mV open circuit and the test current shall be limited to 100mA.	Maximum Resistance 10.0mOhms initial 20.0mOhms post endurance testing
4	Insulation Resistance SAE J2030, 6.3	Apply a voltage of 1000 VDC between adjacent terminals and between terminals to ground.	20 MegaOhms Minimum
5	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 (See Appendix 3)

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<b>6</b>	<b>Current Test @ Rated Current SAE J2030, 6.22</b>	Apply maximum rated current to all terminals. Ambient temperature: 125°C +/-3°C for 24H	Voltage Drop not to Exceed levels in Table 3 of Section SAE J2030 6.4.1 (Use PS Rated Current: See Appendix 3)
<b>7</b>	<b>Current Cycling Test @Rated Current SAE J2030, 6.25</b>	<p>a. 200 off/on cycles, at ambient of 125 °C ± 3 °C, each cycle to consist of 45 min on, 15 min off.</p> <p>b. 50 cycles of following: 20 min on at 125 °C ± 3 °C, 60 off at 21 °C ± 1 °C. Transition rate is to be 3 °C/ min +3/-0 °C/min without current applied.</p> <p>c. Repeat a. and b. to complete 500 cycles</p>	Acceptance criteria per section 6.4 of SAE J2030. (Use PS Rated Current: See Appendix 3)

## 5.3 MECHANICAL REQUIREMENTS

ITEM	DESCRIPTION	TEST CONDITION	REQUIREMENT
<b>8</b>	<b>Connector Mating Force SAE J2030, 6.9</b>	Mate the male and female connectors. (Latches included)	135 N Maximum
<b>9</b>	<b>Connector Unmating Forces SAE J2030, 6.10</b>	Unmate the male and female connector. (Latches disengaged)	135 N Maximum
<b>10</b>	<b>Terminal Retention in Connector SAE J2030, 6.18</b>	Apply 110N load to the terminals in the connector housing for 1 minute.	No Terminal Unmating
<b>11</b>	<b>Shock (Mechanical) SAE J2030, 6.16</b>	Mate connectors and shock at <b>50 g</b> with ½ sine wave (11 milliseconds) shocks in the X,Y,Z axes ( <b>10 shocks per axis total</b> ).	10 Ohms Maximum No discontinuity > 1 microsecond at 100 mA
<b>12</b>	<b>Vibration SAE J2030, 6.15</b>	Mate connectors; Sine sweep of <b>10 Hz to 2,000 Hz</b> , back to <b>10 Hz</b> in 20min, Test duration <b>24hrs 1.78 mm displacement, 20 g acceleration</b> . 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.

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13	<b>Drop Test</b> SAE J2030, 6.17	8 Drops from a height of 750 +/-25mm onto a concrete floor while attached to a cord 1500 +/- 25mm long. Rotate the connector through 45 degrees for each drop.	See Section 6.17 of SAE J2030
14	<b>Durability between Male and Female connectors</b> SAE J2030, 6.11	Mate and unmate the connectors by hand at 10 cycles per minute for 50 cycles.	See Section 6.11 of SAE J2030
15	<b>Connector Retention</b> SAE J2030, 6.20	Apply an axial pulling force to the mated connectors for 30s.	222N applied to the 2cct
			333N applied to the 3cct
			350N applied to the 4cct and 6cct. Deviation from SAE J2030, 6.20 due to plug design constraints.
			444N applied to the 8cct, 12cct and 18cct.
16	<b>Connector Mismatching</b> SAE J2030, 6.21	Apply an axial force to same circuit size connectors with various keying options	Polarization to resist 178N minimum mating force without change.
17	<b>Terminal Crimp Strength</b> SAE J2030, 6.26.	The tensile strength of the crimped connection shall be tested within the range of 20 mm to 100 mm/ min. If the terminal has a cable insulation crimp it shall be rendered mechanically ineffective.	See Table 6 of SAE J2030, 6.26.

## 5.4 ENVIRONMENTAL REQUIREMENTS

ITEM	DESCRIPTION	TEST CONDITION	REQUIREMENT
18	<b>Thermal Shock</b> SAE J2030, 6.13	Cabled & mated connectors subjected to 10 cycles of thermal shock (soak @ -55°C ambient then transition within 2 minutes to 125°C ambient & soak before transition back to -55°C. Soak time to ensure internal connector temp is within 5 C of ambient. No evidence of cracking or chipping or other damage / impaired operation allowed.	No evidence of cracking, chipping or other detrimental damage to normal operation.

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19	<p><b>Temperature/ Humidity (Cyclic)</b></p> <p><b>SAE J2030, 6.24</b></p>	See Appendix 2	<p>Tested per <b>SAE J2030 6.4</b> (Use PS Rated Current: See Appendix 3) for power circuit, <b>SAE J1614 4.3.6</b> for signal circuits (dependent upon power level requirements of contacts), and insulation resistance per <b>SAE J2030 6.3</b>. Visual: No Damage</p>
20	<p><b>Salt Spray</b></p> <p><b>SAE J2030, 6.12</b></p>	<p>Mated connectors Duration: <b>96</b> hours exposure; Atmosphere: salt spray from a <b>5%</b> by weight solution; Temperature: <b>35 +/-3°C</b>; Allow to dry for 4 hours.</p>	Visual: No Detrimental evidence of corrosion on the connector or contacts.
21	<p><b>Fluid Resistance</b></p>	Submerge mated connectors for <b>5</b> cycles of <b>5</b> minutes at the specified temperature in the following fluids: motor oil, brake fluid, diesel fuel, 50/50 anti-freeze mixture, Roundup original and aqueous urea.	Visual: No Damage Post Test
22	<p><b>Water Immersion</b></p> <p><b>SAE J2030, 6.19</b></p>	Place wired connectors in oven at 125 <sup>0</sup> C +/- 3 <sup>0</sup> C for 1H and immediately place in 5% salt solution by weight content and 0.1g/L wetting agent to 1m for 4H. Water temp 23 <sup>0</sup> C +/-3 <sup>0</sup> C. Test for insulation resistance.	Insulation Resistance 20 MegaOhms Minimum. Visual: No moisture inside.
23	<p><b>Dust Test</b></p> <p><b>SAE J2030, 6.23</b></p>	Expose mated connectors to dust equivalent to air cleaner fine dust defined by SAEJ726. Minimum suspension concentration: 0.88g/m <sup>3</sup> for 24H.	No impairment of function, performance and serviceability per Severity Level 2 of ASABE EP455 Item 5.3.1
24	<p><b>Pressure Washing</b></p> <p><b>SAE J2030, 6.5</b></p>	The test apparatus should be designed to provide 100% coverage of the exposed surface of the mated and cabled connectors using flat fan spray nozzles located 20 cm to 30 cm away. The test should be run at 40 °C	An Insulation Resistance test (see SAE J2030 section 6.3) shall be conducted after this test.
25	<p><b>Maintenance Aging</b></p> <p><b>SAE J2030, 6.6</b></p>	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.	See Section 6.6 of SAE J2030
26	<p><b>Temperature Life</b></p> <p><b>SAE J2030, 6.7</b></p>	The cabled-mated connectors shall be subject to 1000 h at 125 °C ± 3 °C without current flowing.	There shall be no evidence of cracking, distortion, or detrimental damage.
27	<p><b>Ultraviolet Effects</b></p> <p><b>SAE J2030, 6.8</b></p>	Expose the mated connectors for 1000 h per ASTM G 155 with extended U.V filter or ASTM G 154 using an unfiltered UVA 340 lamp with 20 h UV and 4 h of condensation for each cycle.	See section 6.8 of SAE J2030

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## 6.0 QUALIFICATION TEST GROUPS AND SEQUENCES

No	Item	Test Group				
		1	2	3	4	5
1	Examination of Product	1	1	1	1	1
3	Low-Voltage Resistance	2,14	2,11,16			
4	Insulation Resistance	3,6,8,17,19	3,14	2		2, 13
5	Connection Resistance	4	4	3		3, 15
24	Pressure Washing	5				
25	Maintenance Aging				2	
26	Temperature Life		5	4		4
27	Ultraviolet Effects				3	
8	Mating Forces		6		4	5
9	Unmating Forces		7		5	6
14	Durability		8		6	7
20	Salt Fog	7				
18	Thermal Shock	9	9	5		8
21	Fluid Immersion	10				
12	Vibration	12	10			9
11	Shock	13	12			10
13	Drop Test	15		6		
10	Terminal Retention in Connector				7	
22	Water Immersion	16				
15	Connector Retention			7	8	
16	Mismating				9	
6	Current Test					11

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23	Dust Test		15			16
19	Temperature /Humidity	18	13			12
7	Current Cycling					14
17	Terminal Crimp Strength				10	
2	Visual Examination	11, 20	17	8	11	17

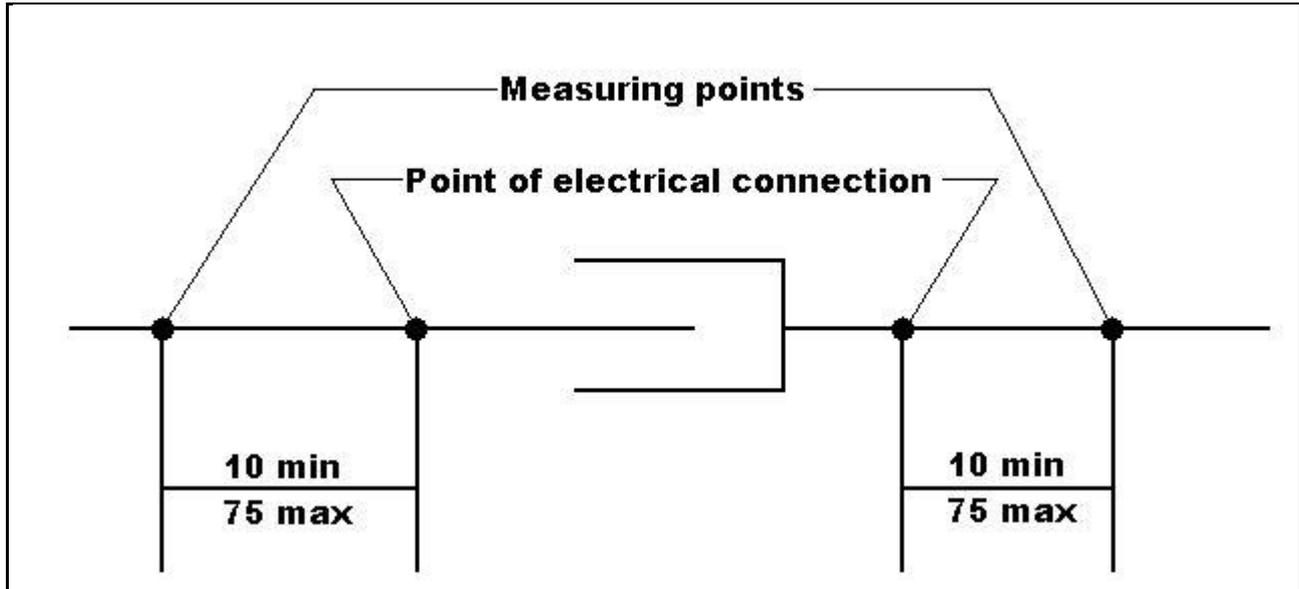
Test Groups 1, 2, 3, and 4 are for sealed signal level connectors.  
 Test Groups 3, 4 and 5 are for sealed power level connectors.  
 Test Groups 2, 3, and 4 are for unsealed signal level connectors.  
 Test Groups 3, 4, and 5 are for unsealed power level connectors

## 7.0 PACKAGING

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

## APPENDIX 1

### CONTACT RESISTANCE MEASUREMENT



#### Notes:

1. All dimensions are in millimetres
2. Measuring points are on the cable
3. Points of electrical connection are typically the joint of the cable to the terminal

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## APPENDIX 2

Test samples to be placed in a temperature/humidity chamber and shall be subjected to 42 cycles described as follows:

- a. Chamber temperature raised to + 55°C at 3°C/min ± 1°C/min.
- b. Chamber held for 16 hours at a relative humidity of 95 % ± 5%
- c. Chamber temperature lowered to - 55°C at 3°C/min ± 1°C/min.
- d. Chamber held for 2 hours
- e. Chamber temperature raised to + 125°C at 3°C/min ± 1°C/min.
- f. Chamber held for 2 hours
- g. Chamber temperature lowered to + 25°C at 3°C/min ± 1°C/min.
- h. Chamber held for remainder of 24 hour cycle

## APPENDIX 3

Measurements at specified Current:

Cable Size mm <sup>2</sup> (AWG)	Test Current Amps	Maximum Millivolt Drop (cable to device) (cable to cable)
14	13	100
16	13	100
18	10	100
20	7.5	100

Table 1: Measurements at Specified Current

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