PRODUCT SPECIFICATION	No. DSP-03952	Date Issued: May 01, 2003
Customer:	Revised: Revision 4	Date Revised: October 31, 2006
Title Subject: **HCM CONNECTOR SERIES**		Issued by: Detroit Engineering Center

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Modification Record of Product Specification

Customer: ______________________

No,	DSP-03952 Rev.4	Product Name	HCM Connector Series
Note			

Rev. No,	Reason	Place	Date	Engineer
0	Released		5/ 1/03	P.C.
1	5.4.4 TPA Engage/Disengage Force Changed.	5.4.4	8/ 14/03	P.C.
2	5.6.4 Resistance to Soldering Heat, By soldering iron Added	5.6.4	9/29/03	S.M.
3	2. P/N 3. Material 4. Characteristics Temperature Range Changed	2. 3. 4.	11/4/03	S.M.
4	2. P/N changed	2.	10/30/06	A.F.

1. Scope

This document specifies the product specification and performance information of the HCM connector series complied with the standard below.

TEST STANDARD: SAE/USCAR-2, Performance Standard for Automotive Electrical Connector Systems Rev.3,
Temperature Class: Class 2 (-40°C~100°C)

2. Part Name, Part Construction

Table 2.1 HCM Common Assembly Components

No.	Part Name	P/N
1	HCM M-HSG Assy	(#)(##)B( )-( )HCM( )( )-( )
	Male Housing	(#) (##)( )-( )HCM( )( )
	Male Pin	PS0.64T-( )
2	HCM F-HSG Assy	HCM( )PB-( )(##)-( )
	Female Housing	HCM( )P-( )(##)-( )
	Retainer	HCM( )S-(##)-E
3	HCM F-Terminal	SHCM-A03T-P025

Note: (#) denotes the top entry (B) or Side entry (S)
(##) denotes the number of circuits.

3. Material, and Surface Finish

Table 3.1 Materials, and Surface Finish

No.	Part Name	Material	Finish, Flame Class
1	Male Housing	PBT-G15	Black / Natural, UL94-HB
	Male Pin	Brass	Tin-Plating
2	Female Housing	PBT	Black / Natural, UL94-HB
	Retainer	PBT	Blue, UL94-HB
3	HCM F-Terminal	Phosphor Bronze	Tin-Plating

4. Characteristics

Table 4.1 SPECIFICATIONS

Items	Specification
Current Rating	5A DC max
Voltage Rating	14V DC
Temperature Range	-40°C~100°C
Insulation Resistance	20MΩ min
Dielectric Withstand Voltage	1,000 V/minute AC
Applicable Cable	SAE/AVSS/CAVS: AWG 22-20 (0.3 ~0.5 sq)

Table 4.2 Summary of Test Results

Measurement / Test		TERMINAL TEST				CONNECTOR TEST							ENVIRONMENTAL TEST				
		All	5.2.1	5.2.2	5.3.3	5.3.4	5.4.1	5.4.2	5.4.3	5.4.4	5.4.5	5.5.1	5.5.2	5.6.1	5.6.2	5.6.3	5.6.4
Visual Inspection	5.1.6	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O
1st Engaging Force (Terminal)	5.2.1		O														
10th Disengaging Force (Terminal)	5.2.1		O														
Crimp Height & Width	5.2.2	O	O	O	O	O	O	O	O		O	O					
Terminal Bend Resistance	5.2.2			O													
Dry Circuit Resistance	5.3.1	O				O					O			O	O	O	
Voltage Drop	5.3.2	O			O	O					O			O	O	O	
Temperature Rise (55 C)	5.1.4				O	O											
Insertion Force (Terminal to Connector)	5.4.1						O										
Terminal Extraction Force w/o Terminal Lock	5.4.1						O										
Terminal Extraction Force w/ Terminal Lock	5.4.1						O								O	O	
Connector Mating Force	5.4.2							O									
Connector Unmating Force (w/ Primary Lock Disabled)	5.4.2							O									
Connector Unmating Force (w/ Primary Lock Engaged)	5.4.2							O									
Disengaging Primary Lock	5.4.2							O									
Polarizing Feature Resistance	5.4.3								O								
Engaging Force (Misc. Component)	5.4.4									O							
Disengaging Force (Misc. Component)	5.4.4									O							
Electrical Continuity	5.4.5										O			O	O	O	
Insulation Resistance	5.5.1											O				O	

NOTE: O=Pass, X=Fail

5. Performance

Performance should satisfy the default value of each test complied with USCAR Standard. (Temperature Class: Class 2)

Also evaluation tests shall proceed in the default tolerances and condition unless specified.

Default Test Tolerances

Temperature:	±3°C
Voltage:	±2%
Current:	±1%
Resistance:	±1%
Length:	±1%
Time:	±5%
Force:	±5%
Frequency:	±5%
Distance:	±1%
Flow Rate:	±5%

Test Default Conditions

Room Temperature:	23 ± 5°C
Relative Humidity:	25~75%

5.1 Visual Inspection

No defects such as cracks, transformation, and tarnish have ever been noticed.

5.2 Terminal Mechanical Tests

5.2.1 Terminal Engage/Disengage Force

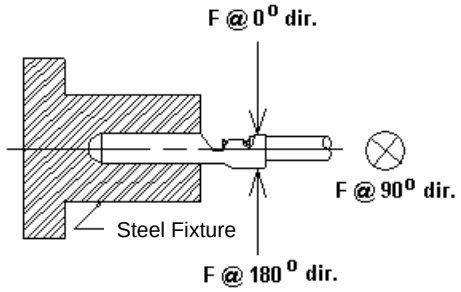
Test method: Engage and disengage the crimped terminals. The force shall be applied parallel to the centerlines of the terminals. Then measure the 1st engaging force and the 10th disengaging force. (Test Speed: 50mm/min)

Requirement:

Test Item	Requirement
1st Engagement	1.5~5.5N
10th Disengagement	1.5~5.5N

5.2.2 Terminal Bend Resistance

Test method: Force is to be applied until terminal sample is bent to the angle of 30° ± 5 from the centerline. Record the peak force of terminal bend resistance. Samples shall be tested at three different directions as described in figure below.



(Test Speed: 50mm/min)

Figure 5.2.2 Female Terminal Bend Resistance

Requirement:

Test Item	Direction	Requirement
20 AWG	0 degree	Min10N
	90 degree	
	180 degree	
22 AWG	0 degree	
	90 degree	
	180 degree	

5.3 Terminal Electrical Tests

5.3.1 Dry Circuit Resistance

Test method: Measure and record the resistance between T1 and T2, as shown in the figure below.Then deduct the 75mm conductor resistance to find the total connection dry circuit resistance.

Test Current: 100mA(DC)

Voltage: 20mV

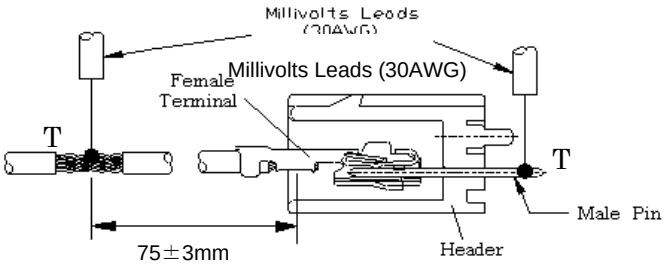


Figure 5.3.1 Dry Circuit Resistance

5.3.2 Voltage Drop

Test method: Using the test setup shown below, measure and record the millivolt drop (mVD) readings between test points T1 and T2. Volt drop shall be calculated from the entire resistance after 75mm conductor residence is deducted.

Test Current: 20 AWG=2.5A
20 AWG=1.5A

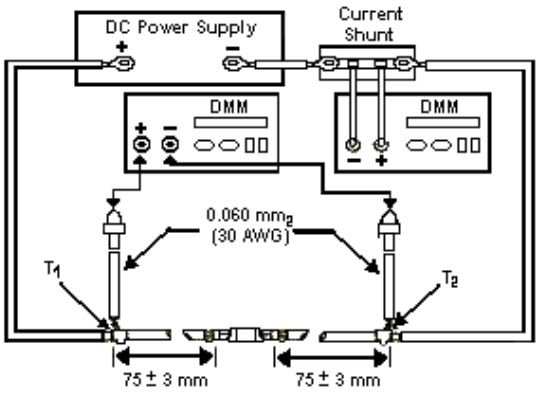


Figure 5.3.2 Measuring Volt Drop

5.3.3 Terminal Maximum Test Current Capability

Test method: Completely mate and unmate each terminal pair a total of 10 times and then mate them again for testing. Apply the current according to the table below. After the stability of temperature (minimum 15 minutes), measure and record terminal temperature reading and volt drop. Then record the current reading when the condition satisfies either one of each requirement below. 90% of the current reading shall be called Terminal Maximum Current Capability (Note).

Note: This current is NOT indicative of the capability of the terminal in an actual vehicle application. It is NOT to be used as guidance for any actual application (per USCAR-2 standard).

Requirements: 1.The measured temperature of the terminal exceeds a 55 °C rise.
2.The Total Connection Resistance of terminal exceeds 20mΩ.

Table 5.3.3-1 Testing of Terminal Maximum Test Current Capability

Size of Cable	Applied Current	Current Increment
20 AWG	5A to 12A	1A per test
	From 12A	0.5A per test
22 AWG	6A to 10A	1A per test
	From 10A	0.5A per test

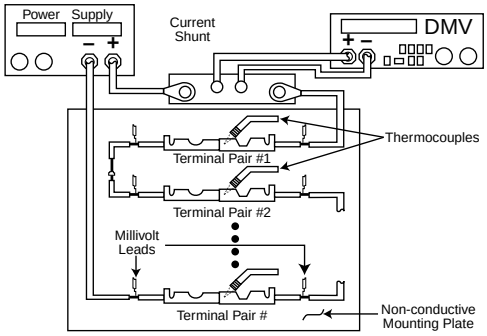


Figure 5.3.3-2 Set-Up for Terminal Maximum Current Capability

5.3.4 1008 Hour Terminal Current Cycling

Test method: Completely mate and unmate each terminal sample a total of 10 times and then mate again for testing. Set the power supply and a timer to provide 45 minutes 'ON' and 15 minutes 'OFF' at the maximum test current. Cycle for 1008 hours. Measure the contact resistance before and after the sample test according to 5.3.1 and 5.3.2. Also measure the voltage drop and the terminal temperature rise at max test current at least once daily.

Requirement:

Dry Circuit Resistance

Test Item	Requirement
Initial	Max 20mΩ
Post	

Voltage Drop

Test Item	Requirement
Initial	Max 20 mΩ
Post	

Temperature Rise

Test Item	Requirement
Temperature Rise	Max 55 ^{o}C

5.4 Connector Mechanical Tests

5.4.1 Terminal-Connector Insertion/Extraction Force

Test Method: Record the force required to insert the terminals (one terminal at a time) into the connector and to extract them out of the connector. A test speed of 50 mm/min maximum shall be applied.

Requirement:

Test Item	Test Condition	Requirement
Initial Insertion force	(20 AWG)	15N Max
	(22 AWG)	
Extraction Force (20AWG)	Initial w/o TPA	30N Min
	Initial w/ TPA	75N Min
	Post 95-98% humidity at 40°C for 6 hours	
	Post Temp. / Humid. Cycling	48 N Min
	Post High Temperature	

5.4.2 Connector-Connector Mating/Un-mating Force, Lock lever Releasing force

Test method: Mate and un-mate crimped Female-terminal (outfitting housing) with male header on the parallel line to the centerline. Then measure the initial mating force, un-mating force with/without primary lock, and disengaging primary lock force. (Test speed: 50mm/min)

Requirement:

Test Item	Test Condition	Requirement
Mating Force	--	75N Max
Unmating Force	W/ Fully Assembled Connector	110N Min
	w/o Primary lock	75N Max
Primary Lock Releasing Force	--	70N Max *

Note: * indicates that criteria are per HCM connector design specifications

5.4.3 Polarization Feature Effectiveness

Test method: Orient the female housing 180 degree with respect to the securely fixed male housing. Engage Female housing halves to the Male header at a uniform rate of 50 mm/min until the force of 220N is applied.

Requirement:

Test Item	Applied Force	Result
Polarization Feature Resistance	220N Min	1. Not be inserted 2. No pin deformed

5.4.4 TPA Engage/Disengage Force

Test Method: Measure TPA insertion force to Female housing and TPA extraction force from Female housing. (Test speed: 50mm/min)

Requirement:

Test Item	Requirement
TPA Insertion Force	>10N and ≤ 30N*
TPA Extraction Force	>15N and ≤ 30N

Note: * indicates that criteria are per HCM connector design specifications.

5.4.5 Vibration/Mechanical Shock Test

Test method: Test method: Serially connected connector samples shall be mounted on a fixture as shown in the figure below. Apply the mechanical shock and vibration requirement shown in Figure 5.4.5-1 below, and monitor if the resistor current drops below 95mA for more than 1 microsecond for current continuity. In addition to this, measure the contact resistance before and after the test.

Mechanical Shock: 10 times Half SIN Wave (10 mSec duration at 35Gs force) in each of the three axis.

Table 5.4.5-1 Vibration Profile (Not Coupled to Engine)

Vibration Profile	
Frequency (Hz)	Power Spectral Density (g^2 /hz)
5.0	0.00200
12.5	0.24800
77.5	0.00320
145.0	0.00200
200.0	0.01180
230.0	0.00032
1000.0	0.00002
Grms= 1.81	

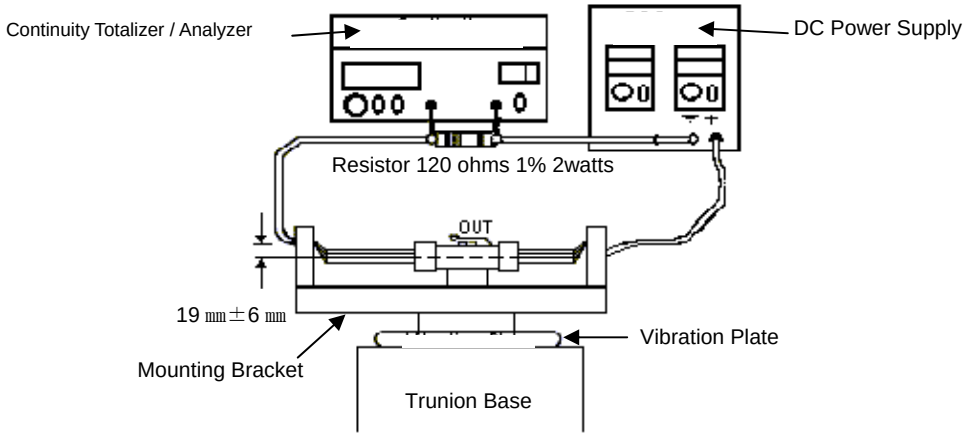


Figure 5.4.5-2 Setting of Vibration Test

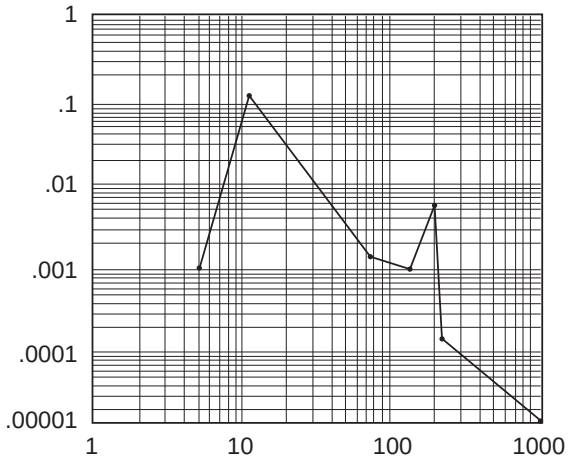


Figure 5.4.5-3 Vibration Profile

Requirement:

Current Continuity

Test Item	Requirement
Entire Testing	No Discontinuity

Dry Circuit Resistance

Test Item	Requirement
Initial	Max 20mΩ
Post	

Voltage Drop

Test Item	Requirement
Initial	Max 20mΩ
Post	

5.5 Connector Electrical Tests

5.5.1 Isolation Resistance

Test method: Apply DC500V to measure the resistance between the adjacent terminals (no solder for Male-Pin) in fully assembled connector.

Requirement:

Test Item	Requirement
Isolation Resistance	20 MΩ Min

5.5.2 Dielectric Withstanding Voltage

Test method: Test voltage specified below shall be applied between adjacent pins of a mated specimen (connector shall not be soldered) for one minute.

Test Item	Test voltage	Requirement
Dielectric Withstanding Voltage	AC 1,000 V	No breakdown nor flash-over

5.6 Connector Environmental Tests

5.6.1 Thermal Shock

Test method: Completely mate and unmate connector samples a total of 10 times and mate them again for testing. Place those samples in a chamber for 30minutes at -40^{o} C and another 30 minutes at 100^{o} C. Repeat the cycle for 100 times. Measure the current resistance before and after the test, and monitor if the resistor current drops below 95mA for more than 1 microsecond for current continuity.

Requirement:

Current Continuity

Test Item	Requirement
Entire Testing	No Discontinuity

Dry Circuit Resistance

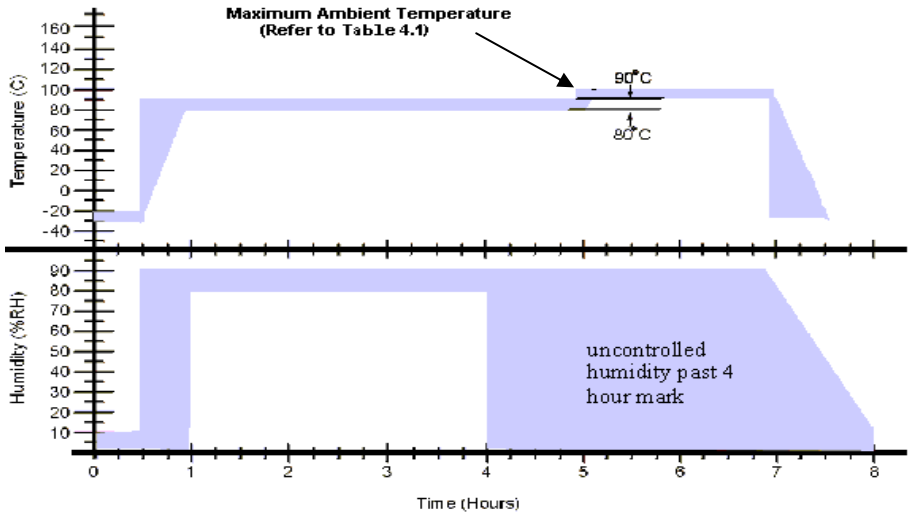
Test Item	Requirement
Initial	Max 20mΩ
Post	

Voltage Drop

Test Item	Requirement
Initial	Max 20mΩ
Post	

5.6.2 Temperature/Humidity Cycling

Test method: Completely mate and unmate connector samples a total of 10 times and mate them again for testing. Place those samples in a chamber for 40 cycles of as described in the figure below. Measure terminal extraction force after the test, and monitor if the resistor current drops below 95mA for more than 1 microsecond for current continuity.



NOTE: Test Parameters must remain within shaded regions

Figure 5.6.2 Temperature/Humidity Cycling Test

Requirement:

Current Continuity

Test Item	Requirement
Entire Testing	No Discontinuity

Dry Circuit Resistance

Test Item	Requirement
Initial	Max 20mΩ
Post	

Voltage Drop

Test Item	Requirement
Initial	Max 20mΩ
Post	

Notes: For the result of terminal extraction force after the Temperature/Humidity Cycling test, refer to 5.4.1.

5.6.3 High Temperature Exposure

Test method: Completely mate and unmate connector samples a total of 10 times and mate them again for testing. Place the samples in a chamber for 1008 hours at 100°C. Then measure initial/post resistance and voltage drop.

Test Spec:

Dry Circuit Resistance

Test Item	Requirement
Initial	Max 20mΩ
Post	

Voltage Drop

Test Item	Requirement
Initial	Max 20mΩ
Post	

Notes: For the result of terminal extraction force after the High Temperature Exposure test, refer to 5.4.1.

5.6.4. Resistance to Soldering Heat

Test method: The specimen mounted on a PCB shall be soldered by soldering iron of the following conditions. Flux and solder shall be used.

Requirement: There shall be no deformation nor damage which may affect the connector performance.

[By Dip soldering]

Temperature of the tip: 260 ±5°C
Period of soldering: 5±0.5 seconds
Apply PCB: 1.6mm/Through Hole

[By soldering iron]

Temperature of the tip: 350 ±10°C
Soldering: 3 seconds Max.
Apply PCB: 1.6mm/Through Hole

Note: No abnormal load such as lateral load shall be applied to the pins soldering.

Test Item	Requirement
Resistance to Soldering Heat	No deformation nor damage which may affect The connector performance.