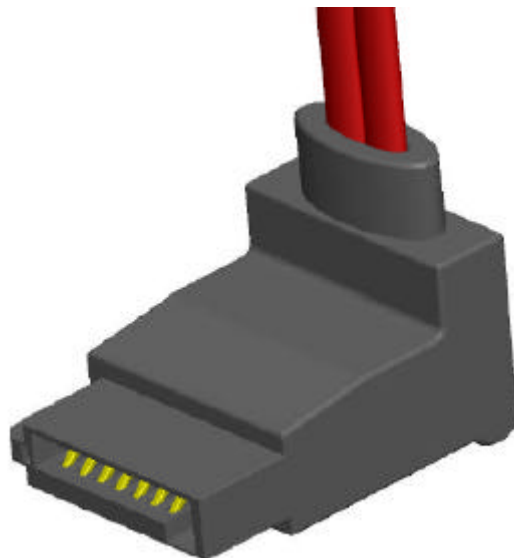
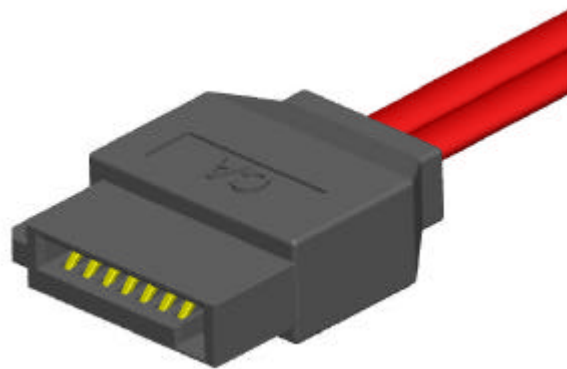


SPECIFICATION AND PERFORMANCE CHARACTERISTICS OF SERIAL ATA CABLE ASSEMBLIES



CONTENTS:

1.0 SCOPE.....	3
2.0 APPLICABLE DOCUMENTS.....	3
2.1 Regulatory Requirements.....	3
2.2 Industry Standards.....	3
CA-Drawing & Part Number Nomenclature.....	4
3.0 APPLICATION FEATURES	
3.1 Environmental.....	5
3.2 Mechanical.....	5
3.3 Electrical.....	5
4.0 CABLE ASSEMBLY REQUIREMENTS AND TEST PROCEDURES.....	5
Table 4.1 – Signal Integrity Requirements & Test Procedures.....	6 & 7
Table 4.2 – Housing & Contact Electrical Parameters, Test Procedures, and Requirements.....	7
Table 4.3 – Mechanical Test Procedures and Requirements.....	8
Table 4.4 – Environmental Parameters, Test Procedures and Requirements.....	8
Table 4.5 – Additional Requirements.....	9
5.0 SAMPLE SELECTION	
Table 5.1 – Connector Sequence.....	9
APPROVAL BLOCK, AND REVISION CHANGES.....	10

1.0 SCOPE

This specification defines the physical interface of the Serial ATA (Attach Technology) Connector. Serial ATA is a high-speed serial link replacement for the parallel ATA attachment of mass storage devices interfacing with no need of changes with its current system. The serial link employed is a high-speed differential layer that utilizes Gigabit technology and 8b/10b encoding.

The Serial ATA connector is compatible with the Serial ATA cable, consisting of 2 parallel pair, available in 26AWG and 30AWG, each pair shielded with a flex PVC jacket.

2.0 APPLICABLE DOCUMENTS

Reference documents listed below shall be the latest revision unless otherwise specified. Should a conflict occur between this specification and any of the listed documents then this specification shall prevail

2.1 Regulatory Requirements

- Be an UL, C-UL Recognized Component
- Housing plastics must be rate UL 94V0

2.2 Industry Standards

- Serial ATA High Speed Serialized AT Attachment, Revision 1.0
- EIA-364, Electrical Connector Test Procedures
- CA Serial ATA Drawings

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CA - U709000 -X X - X - XXX

**SERIAL ATA
CABLE ASSEMBLY**

CONNECTOR STYLE

- 0 = STRAIGHT, BOTH ENDS
- 1 = STRAIGHT TO RIGHT ANGLE (KEY IN)
- 2 = RIGHT ANGLE, SAME DIRECTION
- 3 = STRAIGHT TO RIGHT ANGLE (KEY OUT)
- 4 = RIGHT ANGLE, UP & DOWN (KEY IN)
- 5 = RIGHT ANGLE, UP & DOWN (KEY OUT)

CONTACT PLATING

- A = GOLD FLASH
- D = .000005" AU
- C = .000015" AU
- F = .000030" AU

CABLE TYPE 

- 0 = 26 AWG (HCM-40405-4)
- 1 = 30 AWG (HCM-40404-4)


LENGTH

DIM 'A'

UNIT

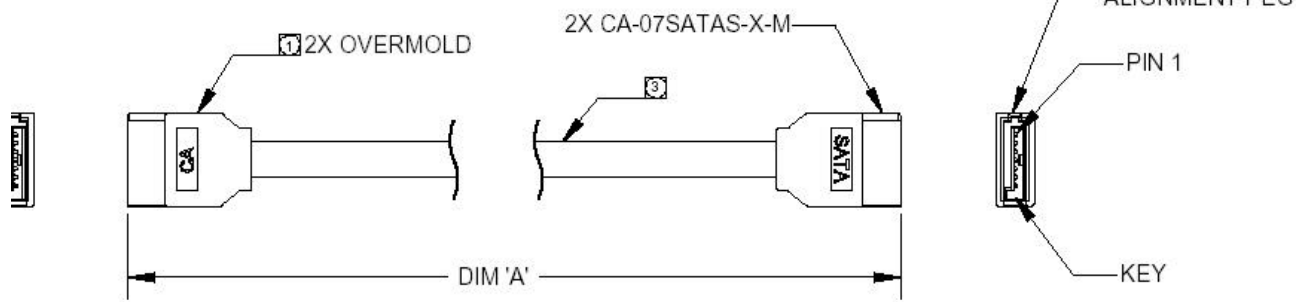
- BLANK = INCHES
- M = METERS

2. TOLERANCE: $\pm 1"$ [.025M] FOR CABLE LENGTH UP TO 30" [.76M]

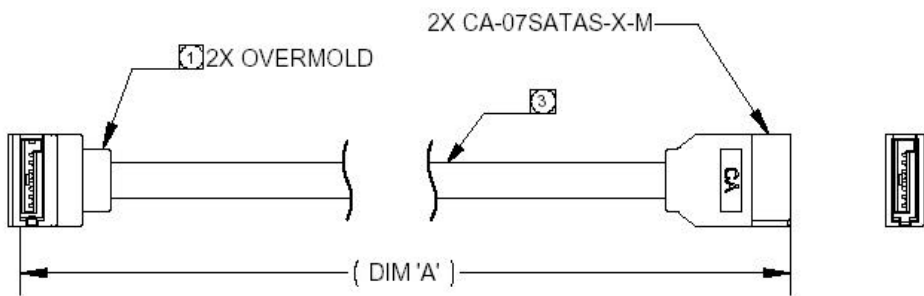
 REFER TO CA DWG. NO. T610110 FOR CONNECTOR ASSEMBLY,
CA DWG. NO. 10766 FOR OVERMOLD DETAILS.

NOTES : UNLESS OTHERWISE SPECIFIED

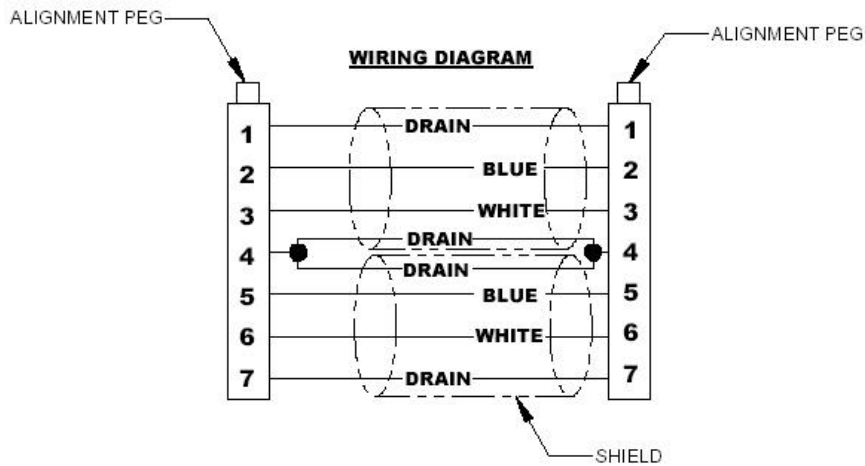
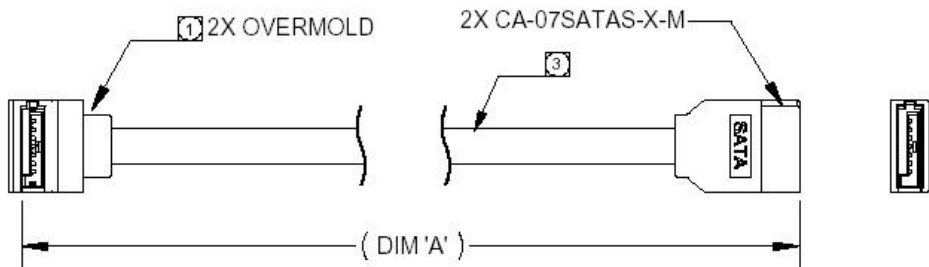
CA-U709000-0X-0 STRAIGHT, BOTH ENDS SHOWN



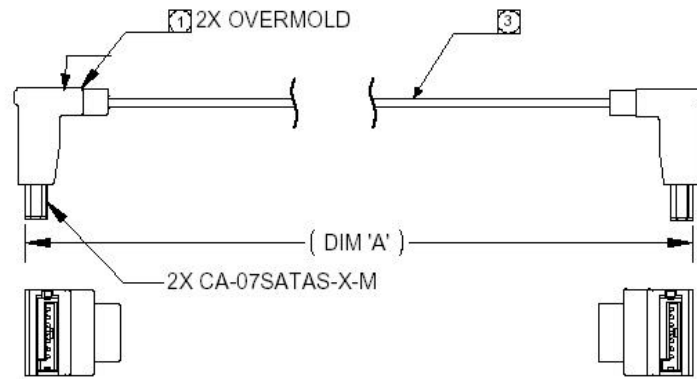
CA-U709000-1X-0 STRAIGHT TO RIGHT ANGLE (KEY IN) SHOWN



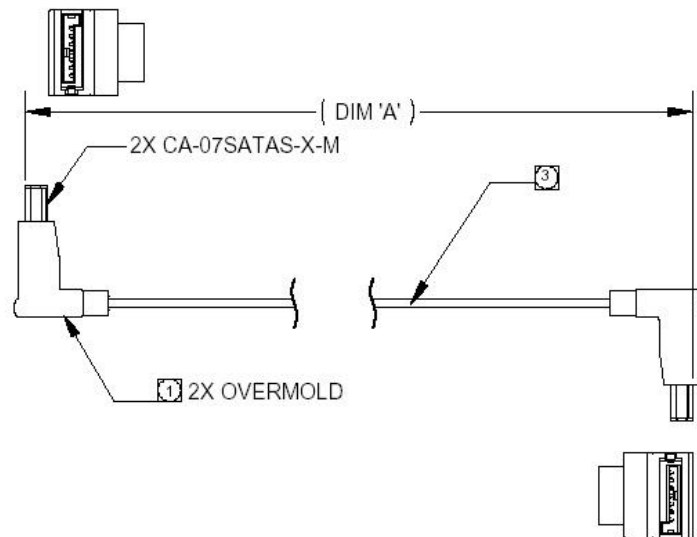
CA-U709000-3X-0 STRAIGHT TO RIGHT ANGLE (KEY OUT) SHOWN



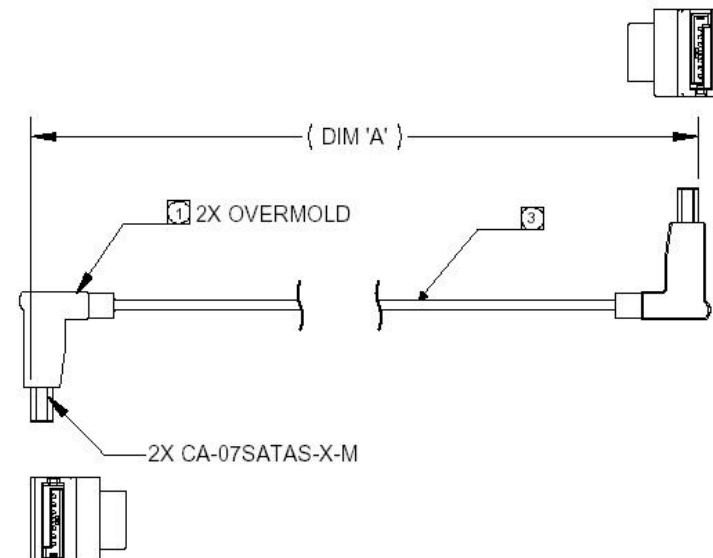
CA-U709000-2X-0 RIGHT ANGLE, SAME DIRECTION SHOWN



CA-U709000-4X-0 RIGHT ANGLE, UP & DOWN (KEY IN) SHOWN



CA-U709000-5X-0 RIGHT ANGLE, UP & DOWN (KEY OUT) SHOWN



3.0 APPLICATION FEATURES

3.1 Environmental

Temperature Range: -20° to +85°C

3.2 Mechanical

Durability: 50 Cycles

Insulator Material: Thermoplastic compounds, UL94V-0

Contact Material: Copper Alloy

Contact Plating: C = Contact Area: .000015" Gold

D = Contact Area: .000005" Gold

A = Contact Area: .000001" Gold

F = Contact Area: .000030" Gold

All With: Solder Area: .000150", 90/10 Tin/Lead Alloy

Underplate: .000075" Nickel

3.3 Electrical

Current Rating: 1 Amp

Insulation Resistance: >1000 MΩ

Contact Resistance: <30 mΩ (<45mΩ after stress)

4.0 CONNECTOR AND CABLE ASSEMBLY REQUIREMENTS AND TEST PROCEDURES:

Unless otherwise specified, all measurements shall be performed within the following lab conditions:

- Mated
- Temperature 15° to 35° C
- Relative Humidity 20% to 80%
- Atmospheric Pressure 650mm to 800mm of Hg

Table 4.1 – Signal Integrity Requirements and Test Procedures

Parameter	Procedure	Requirements
Mated Connector Impedance	<ol style="list-style-type: none"> 1. Minimize skew (see NOTE 1). 2. Set the Time Domain Reflectometer (TDR) pulsers in differential mode with a positive going pulse (V+) and a negative going pulse (V-). Define a reflected differential trace: $V_{diff} = V_+ - V_-$. 3. With the TDR connected to the risetime reference trace, verify an input risetime of 70ps (measured 20%-80% Vp). Filtering may be used to slow the system down (see NOTE 2). 4. Connect the TDR to the sample measurement traces. Calibrate the instrument and system (see NOTE 3). 5. Measure and record the maximum and minimum values of the near end connector impedance. 	100 $\Omega \pm 15\%$
Cable Absolute Impedance	<ol style="list-style-type: none"> 1. Minimize skew (see NOTE 1) 2. Set the Time Domain Reflectometer (TDR) pulsers in differential mode with a positive going pulse (V+) and a negative going pulse (V-). Define a reflected differential trace: $V_{diff} = V_+ - V_-$. 3. With the TDR connected to the risetime reference trace, verify an input risetime of 70ps (measured 20%-80% Vp). Filtering may be used to slow the system down (see NOTE 2). 4. Connect the TDR to the sample measurement traces. Calibrate the instrument (see NOTE 3). 5. Measure and record maximum and minimum cable impedance values in the first 500 ps of cable response following any vestige of the connector response 	100 $\Omega \pm 10\%$
Cable Pair Matching	<ol style="list-style-type: none"> 1. Set the Time Domain Reflectometer (TDR) to differential mode. 2. With the TDR connected to the risetime reference traces verify an input risetime of 70 ps (measured 20%-80% Vp). Filtering may be used to slow the system down (see NOTE 2). 3. Connect the TDR to the sample measurement traces. Calibrate the instrument and system (see NOTE 3). 4. Measure and record the single-ended cable impedance of each cable within a pair. Measure and record maximum and minimum cable impedance values in the first 500 ps of cable response following any vestige of the connector response. 5. The parameter then equals $Line\ 1_{imp} - Line\ 2_{imp}$. 	$\pm 5\ \Omega$
Common Mode Impedance	<ol style="list-style-type: none"> 1. Set two TDR pulsers to produce a differential signal. 2. Minimize skew (see NOTE 1). 3. With the TDR connected to the risetime reference trace verify an input risetime of 70 ps (measured 20-80%). Filtering may be used to slow the system down (see NOTE 2). 4. Calibrate the TDR (see NOTE 3). 5. Set both TDR pulsers to produce positive going pulses. 6. Measure the even mode impedance of the first pulser. Divide this by 2 to get the common mode impedance. 7. Do the same for the other pulser. Both values shall meet the requirement 	25 to 40 Ω
Insertion Loss	<ol style="list-style-type: none"> 1. Produce a differential signal with the signal source (see NOTE 4). 2. Assure that skew between the pairs is minimized. (see NOTE 1). 3. Measure and store the insertion loss (IL) of the fixturing, using the IL reference traces provided on the board, over a frequency range of 10 to 4500 MHz. 4. Measure and record the IL of the sample, which includes fixturing IL, over a frequency range of 10 to 4500 MHz. 5. The IL of the sample is then the results of procedure 4 minus the results of procedure 3. 	6 dB max.
Crosstalk: NEXT	<ol style="list-style-type: none"> 1. Produce a differential signal with the signal source (see NOTE 1). 2. Connect the source to the risetime reference traces. Assure that skew between the pairs is minimized. (see NOTE 1). 3. Terminate the far ends of the reference trace with loads of characteristic impedance. 4. Measure and record the system and fixturing crosstalk. This is the noise floor. 5. Terminate the far ends of the drive and listen lines with loads of characteristic impedance. 6. Connect the source to the drive pair and the receiver to the near-end of the listen pair. 7. Measure the NEXT over a frequency range of 10 to 4500 MHz. 8. Verify that the sample crosstalk is out of the noise floor. 	-26dB
Rise Time	<ol style="list-style-type: none"> 1. Minimize skew (see NOTE 1). 2. Set the Time Domain Reflectometer (TDR) pulsers in differential mode with a positive going pulse (V+) and a negative going pulse (V-). Define a reflected differential trace on the receive channels as: $V_{diff} = V_+ - V_-$. 	85 ps

	<ol style="list-style-type: none"> 3. With the TDR connected to the risetime reference trace measure and record the input risetime. Verify that the input risetime is between 25-35 ps (measured 20% - 80% Vp) see NOTE 2. 4. Remove the reflected trace definition. 5. Connect the TDR to the sample measurement traces. 6. Define a differential trace on the receive channels as: $V_{diff} = V_+ - V_-$. 7. Measure (measured 20%-80% Vp) and record the output risetime. 	
Inter-symbol Interface	<ol style="list-style-type: none"> 1. K – 28.5 signal source running at 1.5 Gb/sec. The average position of zero crossing should not move more than specified value. 	50 ps maximum
Intra-Pair Skew	<ol style="list-style-type: none"> 1. Set one of the Time Domain Reflectometer (TDR) pulsers in differential mode with a positive going pulse (V+) and a negative going pulse (V-). 2. With the TDR connected to the risetime reference trace verify an input risetime of 70ps (measured 20%-80% Vp). Filtering may be used to slow the system down (see NOTE 2). 3. Measure propagation delay (50% of Vp) of each line in a pair single-endedly. The skew equals the difference between each single ended propagation delay. 	10 ps max

NOTES:

1. Skew must be minimized. Time domain measurement equipment allows for delay adjustment of the pulses so launch times can be synchronized. Frequency domain equipment will require the used of phase matched fixturing. The fixturing skew should be verified to be <1 ps on a TDR
2. The system risetime is to be set via equipment filtering techniques. The filter risetime is significantly close to the stimulus risetime. Therefore the filter programmed equals the square root of $(t_{r(observable)})^2 - (t_{r(stimulus)})^2$. After filtering, verify the risetime is achieved using the risetime reference traces on the PCB fixture.
3. Calibrate the system by substituting either precision 50 Ω loads for the test fixture. This places the calibration plane directly at the input interface of the test fixture.
4. A network analyzer is preferred. If greater dynamic range is required a signal generator/spectrum analyzer may be used. Differential measurements require the used of a four port network analyzer although baluns or hybrid couplers may be used.

Table 4.2 – Housing and contact electrical parameters, test procedures, and requirements

Parameter	Procedure	Requirement
Insulation Resistance	EIA 364-21 After 500 VDC for 1 minute, Measure the insulation resistance between the adjacent contacts of mated and unmated connector assemblies	1000 M Ω Minimum
Dielectric Withstanding Voltage	EIA 364-20 Method B Test between adjacent contacts of mated and unmated connector assemblies	Dielectric shall withstand 500 VAC for 1 minute at sea level
Low Level Contact Resistance (LLCR)	EIA 364-23 Subject mated contacts assembled in housing to 20 mV maximum open circuit at 100 mA maximum	<ul style="list-style-type: none"> ▪ Initially 30mΩ maximum ▪ Resistance increase 15 mΩ maximum after stress
Contact Current Rating (Power Segment)	<ul style="list-style-type: none"> ▪ Mount the connector to a test PCB ▪ Wire power pins P1, P2, P8, & P9 in parallel for power ▪ Wire ground pins P4, P5, P6, P10 & P12 in parallel for return ▪ Supply 6A total DC current to the power pins in parallel, returning from the parallel ground pins (P4, P5, P6, P10 & P12) ▪ Record temperature rise when thermal equilibrium is reached 	1.5A per pin minimum The temperature rise above ambient shall not exceed 30 $^{\circ}$ C at any point in the connector when contact positions are powered. The ambient condition is still air at 25 $^{\circ}$ C

Table 4.3 – Mechanical Test Procedures, and Requirements

Parameter	Procedure	Requirement
Visual and Dimensional Inspections	EIA 364-18 Visual, dimensional and functional per applicable quality inspection plan	Meets product drawing requirements
Cable Pull-Out	EIA 364-38 Condition A Subject a Serial ATA cable assembly to a 40 N axial load for a minimum of 1 minute while clamping one end of the cable plug	No physical damage
Cable Flexing	For round cable: EIA 364-41 Condition I Dimension $x=3.7 \times$ cable diameter, 100 cycles in each of two planes. For flat cable: EIA 364-41 Condition II 250 cycles using either Method 1 or 2	No physical damage. No discontinuity over 1 μ s during flexing
Insertion Force	EIA 364-13 Measure the force necessary to mate the connector assemblies at a maximum rate of 12.5 mm (0.492") per min.	45 N maximum
Removal Force	EIA 364-13 Measure the force necessary to unmate the connector assemblies at maximum rate of 12.5 mm (0.492") per minute	10 N minimum
Durability	EIA 364-09 50 cycles for internal cabled application; 500 cycles for backplane/blindmate application. Test done at a maximum rate of 200 cycles per hour	No physical damage. Meet requirements of additional tests as specified in the test sequence in section 5.1

Table 4.4 – Environmental Parameters, Test Procedures, and Requirements

Parameter	Procedure	Requirement
Physical Shock	EIA 364-27 Condition H Subject mated connectors to 30 g's half sine shock pulses of 11msec. duration. Three shocks in each direction applied along three mutually perpendicular planes for a total of 18 shocks. See NOTE 2.	No discontinuities of 1 μ s or longer duration. No physical damage
Random Vibration	EIA 364-28 Condition V, Test letter A Subject mated connectors to 5.35g's RMS. 30 minutes in each of three mutually perpendicular planes. See NOTE 2.	No discontinuities of 1 μ s or longer duration.
Humidity	EIA 364-31 Method II, Test Condition A. Subject mated connectors to 96 hours at 40° C with 90% RH	See NOTE 1
Temperature Life	EIA 364-17 Test Condition III, Method A. Subject mated connectors to temperature life at +85° C.	See NOTE 1
Thermal Shock	EIA 364-32 Test Condition I. Subject mated connectors to 10 cycles between -55° C & +85° C	See NOTE 1
Mixed Flowing Gas	EIA 364-65, Class 2A Half of the samples are exposed unmated for seven days, then mated for remaining seven days. Other half of the samples are mated during entire testing.	See NOTE 1
<p>NOTES:</p> <ol style="list-style-type: none"> Shall meet EIA 364-18 Visual Examination requirements, show no physical damage, and shall meet requirements of additional tests as specified in the test sequence in Table 5.1 Shock and Vibration test fixture is to be determined by each user with connector vendors 		

Table 4.5 – Additional Requirements

Parameter	Procedure	Requirement
Flammability	UL 94V-0	Material certification or certificate of compliance required with each lot to satisfy the Underwriters Laboratories follow-up service requirements

5.0 SAMPLE SELECTION:

Samples shall be prepared in accordance with applicable manufacturer’s instructions and shall be selected at random from current production. Each test group shall provide 100 data points for a good statistical representation of the test result. For a connector with greater than 20 pins, a test group shall consist of a minimum of five connector pairs. From these connector pairs, a minimum of 20 contact pairs per mated connector shall be selected and identified. For connectors with less than 20 pins, choose the number of connectors sufficient to provide 100 data points.

Test Sequence

Table 5.1 shows the connector test sequences for five groups of tests.

Table 5.1 – connector Sequence

Test Group	A	B	C	D	E
Test or Examination					
Examination of Connector(s)	1, 5	1, 9	1, 8	1,8	1,7
Low Level Contact Resistance (LLCR)	2, 4	3, 7	2, 4, 6		4, 6
Insulation Resistance				2, 6	
Dielectric Withstanding Voltage (DWV)				3, 7	
Current Rating			7		
Insertion Force		2			
Removal Force		8			
Durability	3	4 ^(a)			2 ^(a)
Physical Shock		6			
Vibration		5			
Humidity				5	
Temperature Live			3		
Reseating (manually unplug/plug three times)			5		5
Mixed Flowing Gas					3
Thermal Shock				4	
NOTE: (a) Preconditioning, 20 cycles for the 50 durability cycle requirement, 50 cycles for the 500 durability cycle requirement. The insertion and removal cycle is at the maximum rate of 200 cycles per hour.					

For example, in Test Group A, one would perform the following tests:

1. Examination of the connector(s)
2. LLCR
3. Durability
4. LLCR
5. Examination of the connector(s)

Initiated by: Carmen Long	Date: 08/02/02	Engineering Approval: Art Jochen	Date: 08/02/02	Quality Approval: Ian Morrell	Date: 08/02/02
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REV.	DESCRIPTION	DATE	INITIALS
A	INITIAL RELEASE, SEE DO 4816	08/02/02	C.C.L.
B	SEE DO 5136	03/24/03	I.M.