Z1 Power Connector For ATCA

1. SCOPE

1.1. Content

This specification covers performance, tests and quality requirements for the Tyco Electronics Zone 1 (Z1) power connectors designed for Advanced Telecommunications Computer Architecture (ATCA™).

1.2. Qualification

When tests are performed on the subject product line, procedures specified in Figure 1 shall be used. All inspections shall be performed using the applicable inspection plan and product drawing.

1.3. Qualification Test Results

Successful qualification testing on the subject product line was completed on 20Jun06. Additional | testing was completed on 18Sep06 and 27Dec06. The Qualification Test Report number for this testing is 501-637. This documentation is on file at and available from Engineering Practices and Standards (EPS).

2. APPLICABLE DOCUMENTS

The following documents form a part of this specification to the extent specified herein. Unless otherwise specified, the latest edition of the document applies. In the event of conflict between the requirements of this specification and the product drawing, the product drawing shall take precedence. In the event of conflict between the requirements of this specification and the referenced documents, this specification shall take precedence.

2.1. Tyco Electronics Documents

- 109-197: Test Specification (AMP Test Specifications vs EIA and IEC Test Methods)
- 114-13156: Application Specification (Zone 1 (Z1) Power Connectors Designed for Advanced Telecommunications Computer Architecture (ATCA))
- 501-637: Qualification Test Report (Z1 Power Connector For ATCA)

2.2. Commercial Standards

- IEC 60512: Electromechanical Components For Electronic Equipment; Basic Testing Procedures and Measuring Methods Part 1: General
- PICMG 3.0 R2.0 18Mar05: AdvancedTCA Base Specification

3. REQUIREMENTS

3.1. Design and Construction

Product shall be of the design, construction and physical dimensions specified on the applicable product drawing.

3.2. Materials

Materials used in the construction of this product shall be as specified on the applicable product drawing.

3.3. Ratings

- Voltage Proof:
  - Positions 1 to 16: 1000 volts rms
  - Positions 17 to 34: 2000 volts rms
- Contact Current Rating:
  - Size 16 contact: 20 amperes each when fully loaded (all 8 power positions); 30 amperes each when only 2 power positions (contacts 28 and 33) are loaded
  - Size 22 contact: 1 ampere each

  Test boards consist of a 2 ounce copper power plane for each contact
- Temperature: -55 to 125˚C

3.4. Performance and Test Description

Product is designed to meet the electrical, mechanical and environmental performance requirements specified in Figure 1. Unless otherwise specified, all tests shall be performed at ambient environmental conditions.

3.5. Test Requirements and Procedures Summary

Test Description	Requirement	Procedure
Visual examination.	There shall be no defect that would impair normal operation.	IEC 60512-1-1.
ELECTRICAL		
Contact resistance.	Size 16 contacts: 2.2 milliohms maximum initial, 2.6 milliohms maximum final. Size 22 contacts: 20 milliohms maximum initial, ΔR 10 milliohms maximum final.	IEC 60512-2-2, size 16 contacts, 16 amperes. Connection points per Figure 3. Six contacts each of size 16 and size 22 contacts. IEC 60512-2-1, size 22 contacts. Subject specimens to 100 milliamperes maximum and 20 millivolts maximum open circuit voltage.
Insulation resistance.	10^{10} ohms minimum initial. 10^{8} ohms minimum final.	IEC 60512-3-1, mated specimens. Test voltage 100 ± 15 volts DC. Method B. Eight contacts/specimen per Figure 4.
Voltage proof.	No breakdown or flashover.	IEC 60512-4-1, mated specimens. Contact/contact per Figure 4.
Current overload.	See Note.	IEC 60512-10-4. Energize positions 28 and 33 at 10 amperes DC; positions 29 and 34 at 60 amperes DC. Allow to stabilize for 1 hour, then dwell for 4 additional hours at the same current.

Figure 1 (continued)

Test Description	Requirement	Procedure
Current carrying capacity.	30˚C maximum temperature rise at specified current.	IEC 60512-5-1. Energize size 22 contacts at 1 ampere DC; size 16 contacts at 16 amperes DC. Measure thermocouple temperatures at the mating interface 1 hour after temperature stabilization at 16 amperes DC.
Temperature rise vs current.	30˚C maximum temperature rise at specified current.	EIA-364-70, Method 2. Increment through a minimum of 4 current levels, stabilizing each until 3 readings at 5 minute intervals are within 1˚C. See Figure 5.
MECHANICAL		
Insertion/withdrawal forces.	67 N [15.06 lbf] maximum insertion force. 10 N [2.25 lbf] minimum withdrawal force.	IEC 60512-13-2. Measure connector insertion and withdrawal forces at a maximum rate of 12.7 mm [.5 in] per minute.
Gage retention force.	Gage shall be retained.	IEC 60512-16-5. Female contacts only, 10 contacts size 16, and 10 contacts size 22. Sizing and retention force gages per Figure 6.
Vibration, sinusoidal.	No discontinuities of 1 microsecond or longer duration. See Note.	IEC 60512-6-4, 20g. Subject mated and mounted specimens to 10 to 2000 to 10 Hz traversed in 12 minutes with 3.0 mm [.12 in] maximum total excursion. Two hours in each of 3 mutually perpendicular planes.
Mechanical shock.	No discontinuities of 1 microsecond or longer duration. See Note.	IEC 60512-6-3. Subject mated and mounted specimens to 50 G's half-sine shock pulses of 11 milliseconds duration. Five shocks in each direction applied along 3 mutually perpendicular planes, 30 total shocks.
Mechanical operation.	See Note.	IEC 60512-9-1. Manually mate and unmate specimens for 250 cycles. Rest for 10 seconds in the unmated position.
Contact retention in insert.	Maximum displacement shall be 0.25 mm [.010 in] after removal of test force.	IEC 60512-15-1. Pre-load and test force requirements per Figure 7.

Figure 1 (continued)

Test Description	Requirement	Procedure
Connector press-fit retention.	400 N [90 lbf] minimum.	IEC 60512-13-2. Measure force necessary to unseat the entire specimen assembly from its printed circuit board hole pattern at a maximum rate of 12.7 mm [.5 in] per minute.
Probe damage.	Gage shall be retained.	IEC 60512-16-1. Female contacts only, 10 contacts size 16, and 10 contacts size 22. See Figure 8.
Polarizing method.	It shall be possible to correctly align and mate the appropriate mating connectors. It shall not be possible to mate the connectors in any other than the correct manner.	IEC 60512-13-5. Attempt to mate mis-matched specimens by applying a force of 100.5 N [22.6 lbf].
Static load, transverse.	There shall be no displacement of the connector on the printed board which could impair normal operation.	IEC 60512-8-1. Apply force of 100 N [22.5 lbf] to point F1; 75 N [16.9 lbf] to point F2; and 50 N [11.2 lbf] to point F3 using a 3.2 mm [.125 in] diameter rounded probe. See Figure 9.
Restricted entry.	Test gage shall not enter the contact.	IEC 60512-16-2. Female contacts only, 10 contacts size 16, and 10 contacts size 22. Attempt to insert gage into contact by applying a force of 22 N [5 lbf]. See Figure 10.
Contact bending strength.	Permanent set shall not exceed values specified in Figure 10.	IEC 60512-16-3. Male contacts only, 10 contacts size 16, and 10 contacts size 22. Apply specified torque to contacts and hold for 1 minute. See Figure 11.
Flammability.	10 second maximum post burning time.	IEC 60512-20-1. Expose unmated specimen to flame for 10 seconds. See Figure 12.
Insertion force of mounted virgin right angle connector.	67 N [15.06 lbf] maximum.	IEC 60512-13-2. Measure force necessary to mate a mounted vertical connector with a virgin mounted right angle connector at a maximum rate of 12.7 mm [.5 in] per minute.
Insertion of unmounted virgin right angle connector.	See Note.	Mate an unmounted vertical connector with a virgin unmounted right-angle connector.

Figure 1 (continued)

Test Description	Requirement	Procedure
Withdrawal force.	10 N [2.25 lbf] minimum.	IEC 60512-13-2. Measure force necessary to unmate a mounted connector at a maximum rate of 12.7 mm [.5 in] per minute.
ENVIRONMENTAL		
Rapid change in temperature.	See Note.	IEC 60512-11-4. Subject mated specimens to 5 cycles between -55 and 125˚C. Thirty minute dwell at temperature extremes.
Damp heat, steady state.	See Note.	IEC 60512-11-3. Subject unmated specimens to 55˚C and 90 to 95% RH for 21 days.
Electrical load and temperature.	See Note.	IEC 60512-9-2. Subject mated and mounted specimens to 500 hours at 80˚C with current specified in paragraph 3.3. applied.
Temperature, no electrical load.	See Note.	IEC 60512-9-2. Subject mated specimens to 500 hours at 80˚C.
Dry heat.	Insulation resistance at high temperature.	IEC 60512-11-9. Subject mated specimens to 125˚C for 16 hours.
Damp heat, cyclic (first cycle).	See Note.	IEC 60512-11-12. Subject mated specimens to 1 cycle between 25 to 55˚C with high humidity.
Damp heat, cyclic (remaining cycles).	See Note.	IEC 60512-11-12. Subject mated specimens to 5 cycles between 25 to 55˚C with high humidity.
Cold.	See Note.	IEC 60512-11-10. Subject mated specimens to -55˚C for 2 hours.
Temperature life, no electrical load.	See Note.	EIA-364-17, Method A, Test Condition 4, Test Time Condition D. Subject mated specimens to 105˚C for 1000 hours.

Figure 1 (continued)

Test Description	Requirement	Procedure
Mixed flowing gas.	See Note.	EIA-364-65, Class IIA (4 gas). Subject specimens to environmental Class IIA for 20 days (10 days unmated, then 10 days mated). Measure contact resistance after 5, 10, 14 and 20 days exposure.

NOTE *Shall meet visual requirements, show no physical damage, and meet requirements of additional tests as specified in the Product Qualification and Requalification Test Sequence shown in Figure 2.*

Figure 1 (end)

3.6. Product Qualification and Requalification Test Sequence

Test or Examination	Test Group (a)																	
	1(b)	2	3	4	5	6	7(c)	8	9	10	11	12	13	14	15	16	17	18
	Test Sequence (d)																	
Visual examination	1	5,8,16	3,6,10	4	4	4	1	2,4,15	2,6,9	4	5	1,3	1,3	1,3	1,4,10	1,4,7	1,8	1,6
Contact resistance	3	4,7,14	4,7	2	3										2,6,8		2,6	2,5
Insulation resistance							3	6,9,13	3,7	2	3							
Voltage proof							4	7,14	4,8	3	4					2,6		
Current overload															3	3		
Current carrying capacity															7			
Temperature rise vs current																	3,7	
Insertion/withdrawal forces		1,15		3														
Gage retention force		2	1,8			2												
Vibration, sinusoidal		3						1										
Mechanical shock		6						3										
Mechanical operation			2(e),5(e)		1(e)				1(e),5(e)		1(e)						4(f)	3(f)
Contact retention in insert												2						
Connector press-fit retention				5														
Probe damage						1												
Polarizing method	2						2											
Static load, transverse			9															
Restricted entry						3												
Contact bending strength													2					
Flammability														2				
Insertion force of mounted virgin right angle connector															5			
Insertion of unmounted virgin right angle connector																5		
Withdrawal force															9			
Rapid change in temperature		9						5										
Damp heat, steady state				1						1								
Electrical load and temperature					2													
Temperature, no electrical load											2							
Dry heat		10						8										
Damp heat, cyclic (first cycle)		11						10										
Damp heat, cyclic (remaining cycles)		13						12										
Cold		12						11										
Temperature life, no electrical load																	5	
Mixed flowing gas																		4

NOTE

(a) See paragraph 4.1.A.
(b) Completed specimens from this test group were evenly distributed between test groups 2 through 6.
(c) Completed specimens from this test group were evenly distributed between test groups 8 through 11.
(d) Numbers indicate sequence in which tests are performed.
(e) Half the specified number of operations.
(f) Five cycles only.

Figure 2

4. QUALITY ASSURANCE PROVISIONS

4.1. Qualification Testing

A. Specimen Selection

Specimens shall be prepared in accordance with applicable Instruction Sheets and shall be selected at random from current production. Test group 1 shall consist of 25 specimens mounted on test boards prepared for contact resistance test. Test groups 2, 3, 4, 5 and 6 shall each consist of 5 specimens taken from completed test group 1. Test group 7 shall consist of 20 specimens mounted on test boards prepared for insulation resistance and voltage proof tests. Test groups 8, 9, 10 and 11 shall each consist of 5 specimens taken from completed test group 7. Test groups 12 and 13 shall each consist of 5 unmounted specimens. Test group 14 shall consist of 1 unmated and unmounted specimen. Test group 15 shall consist of 2 mounted right angle and 1 mounted vertical specimen. Test group 16 shall consist of 2 unmounted right angle and 1 unmounted vertical specimen. Test group 17 shall consist of 8 mounted specimens. Test group 18 shall consist of 3 mounted specimens.

B. Test Sequence

Qualification inspection shall be verified by testing specimens as specified in Figure 2.

4.2. Requalification Testing

If changes significantly affecting form, fit or function are made to the product or manufacturing process, product assurance shall coordinate requalification testing, consisting of all or part of the original testing sequence as determined by development/product, quality and reliability engineering.

4.3. Acceptance

Acceptance is based on verification that the product meets the requirements of Figure 1. Failures attributed to equipment, test setup or operator deficiencies shall not disqualify the product. If product failure occurs, corrective action shall be taken and specimens resubmitted for qualification. Testing to confirm corrective action is required before resubmittal.

4.4. Quality Conformance Inspection

The applicable quality inspection plan shall specify the sampling acceptable quality level to be used. Dimensional and functional requirements shall be in accordance with the applicable product drawing and this specification.

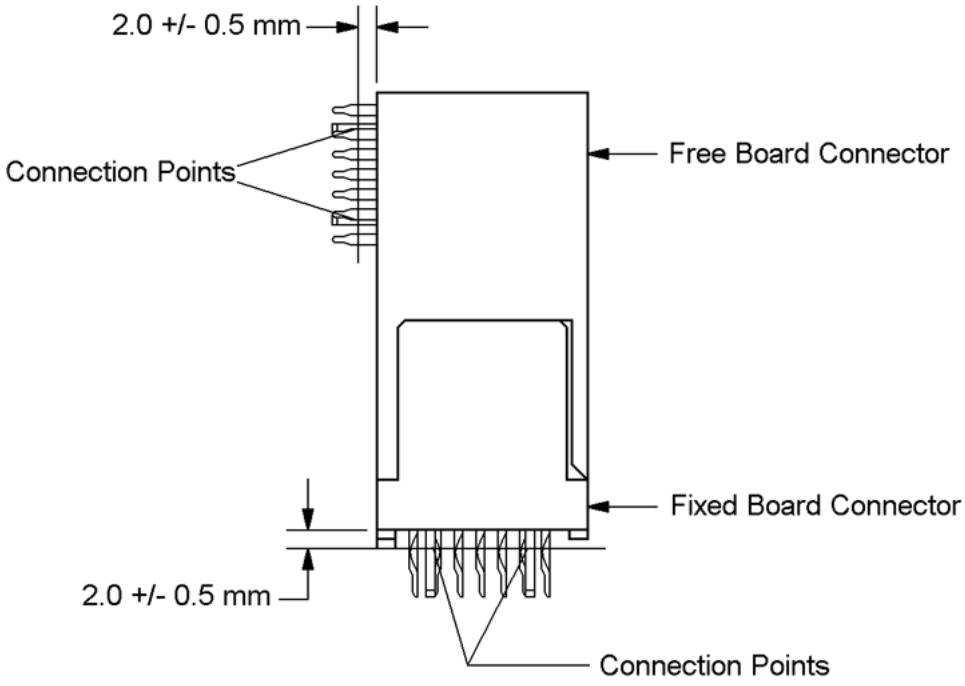


Figure 3
Contact Resistance Connection Points

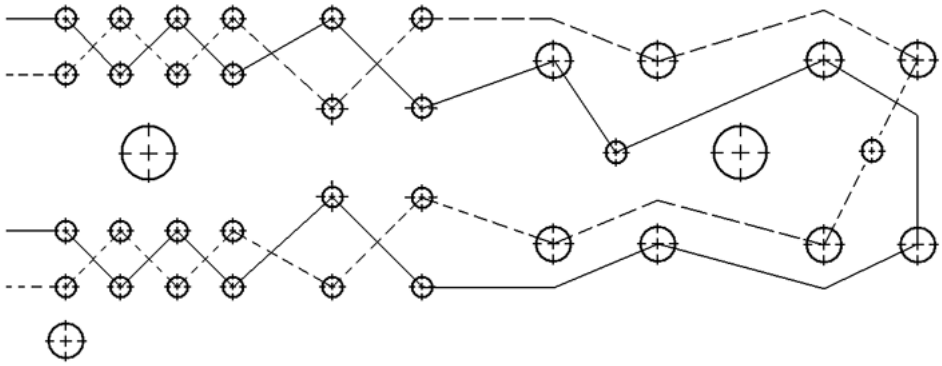
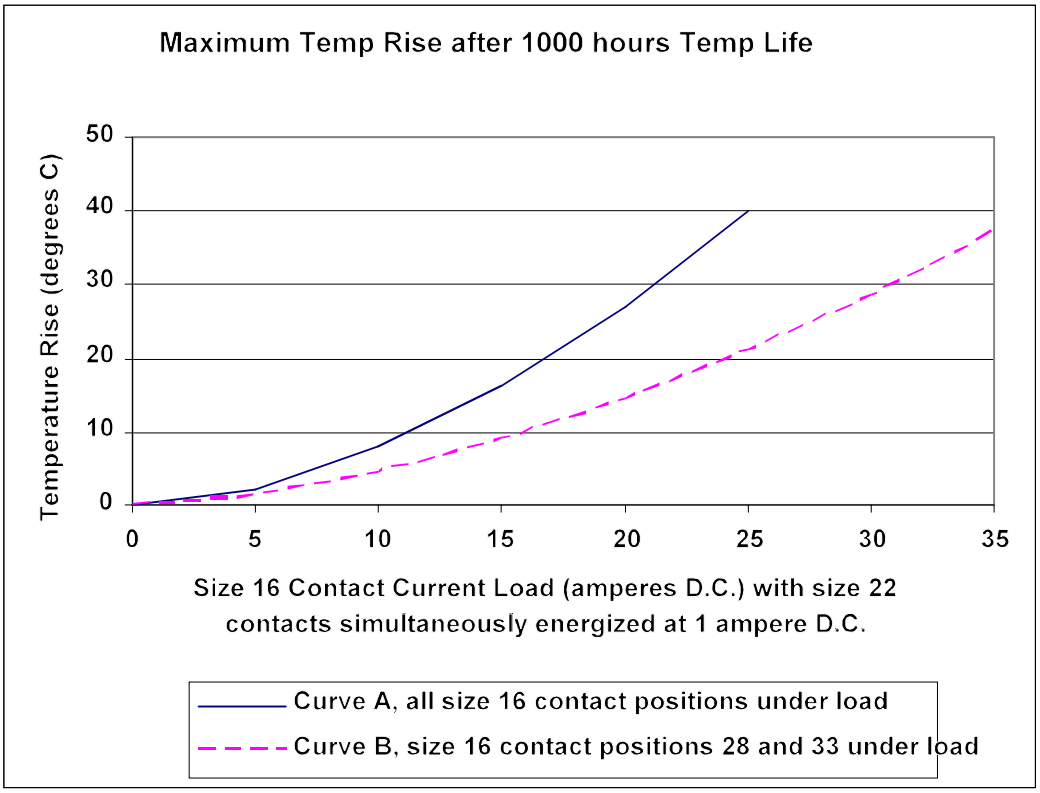


Figure 4
Insulation Resistance and Voltage Proof Measurement Points



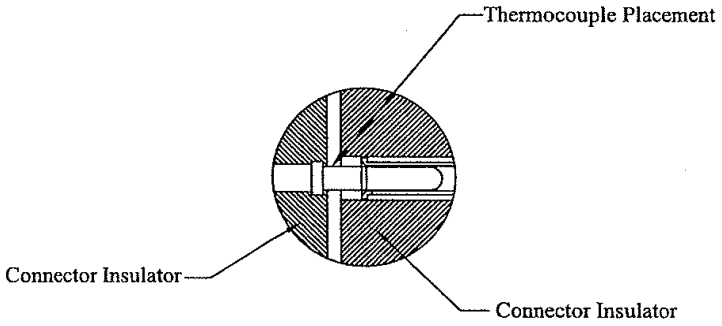
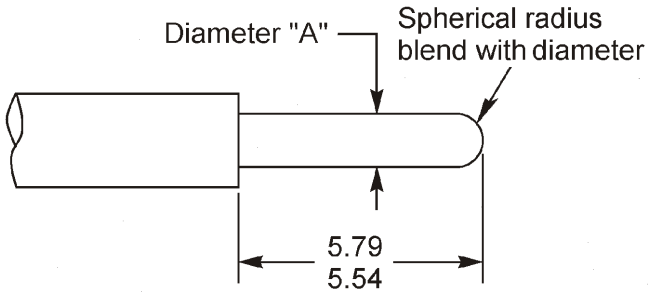


Figure 5
Temperature Rise vs Current and Thermocouple Placement



Contact Size	Sizing Gage		Retention Force Gage		
	⌀A (mm max)	⌀A (mm min)	⌀A (mm max)	⌀A (mm min)	Mass (g)
16	1.613	1.608	1.567	1.562	56.0 ± 0.5
22	0.775	0.770	0.754	0.749	19.8 ± 0.5

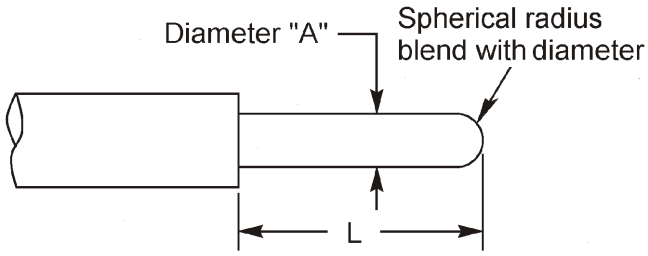
NOTE

1. *Material: Hardened tool steel*
2. *Surface Roughness: ISO Standard 468*
3. *Ra = 0.15 to 0.25 µm*

Figure 6
Sizing and Retention Force Gages

Contact Size	Connector Type	Direction of Force	Test Force (N [lbf])	Preload Force (N [lbf] max)
16	Vertical	Push out	31 [7.0]	8.8 [2.0]
	Vertical	Push in	31 [7.0]	8.8 [2.0]
	Right angle	Push out	31 [7.0]	18 [4.0]
22	Right angle	Push out	25 [5.6]	18 [4.0]
	Vertical	Push in	25 [5.6]	2.2 [0.5]
	Vertical	Push out	6.7 [1.5]	2.2 [0.5]

Figure 7
Contact Retention In Insert



Contact Size	¾ Depth		½ Depth		Test Pin For Probe Damage	
	L (mm max)	L (mm min)	L (mm max)	L (mm min)	⌀A (mm max)	⌀A (mm min)
16	13.630	13.370	9.130	8.870	1.600	1.575
22	4.521	4.267	3.048	2.794	0.775	0.762

NOTE

1. *Material: Hardened tool steel*
2. *Surface Roughness: ISO Standard 468*
3. *Ra = 0.15 to 0.25 µm*
4. *Bending Moment: Size 16 = 0.226 N•m; Size 22 = .020 N•m*

Figure 8
Test Pins for Probe Damage

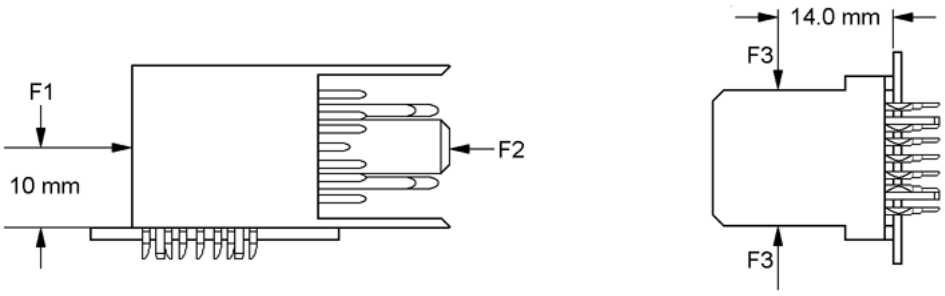
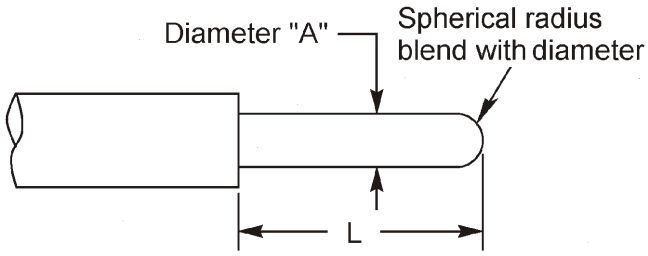


Figure 9
Force Application Points, Transverse Static Load



Contact Size	Test Pin For Restricted Entry		
	⌀A (mm max)	⌀A (mm min)	L (mm min)
16	1.892	1.867	12.7
22	1.125	1.1	12.7

Figure 10
Test Pins For Restricted Entry

Contact Size	Torque (N•m [lbf-in])	Maximum Allowable Permanent Set (mm [in])
16	0.1 [.9]	0.127 [.005]
22	0.025 [.22]	0.127 [.005]

Figure 11
Contact Bending Strength

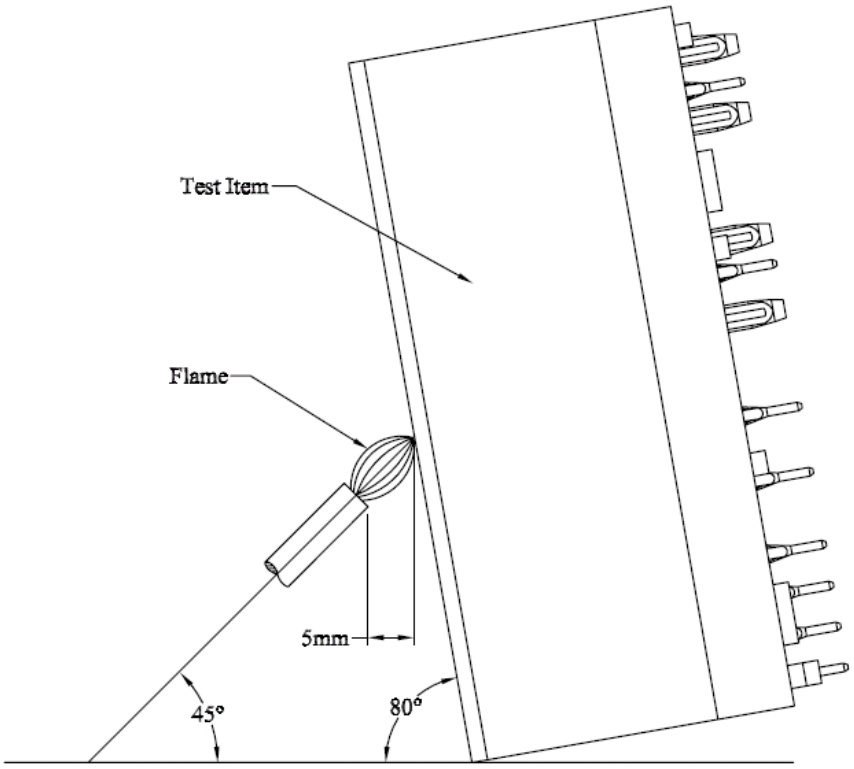


Figure 12
Flammability Test Setup