

68 Position Heavy Duty Commercial Hybrid Connector

DESIGN OBJECTIVES

The product described in this document has not been fully tested to ensure conformance to the requirements outlined below. Therefore Tyco Electronics makes no representation or warranty, express or implied, that the product will comply with these requirements. Further, Tyco Electronics may change these requirements based on the results of additional testing and evaluation. Contact Tyco Electronics Engineering for further details.

1. SCOPE

1.1. Content

This specification covers performance, tests and quality requirements for the Tyco Electronics 68 position heavy duty commercial hybrid connector used in engine control modules. The connector consists of 60 size 20 contacts and 8 size 16 contacts. The header is specific to Motorola AIEG, while the plug is available to all customers. There are 4 different keys to differentiate between connector systems.

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.

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 Series: Test Specifications as indicated in Figure 1
- 109-197: AMP Test Specifications vs EIA and IEC Test Methods
- 114-6066: Application Specification (Size 16 Socket Contact Assembly)
- 114-6071: Application Specification (ECU-1, 1 mm Socket Contact)
- 114-13053: Application Specification (68 Position Heavy Duty Commercial Hybrid Connector)
- 501- : Qualification Test Report

2.2. Commercial Standard

EIA-364: Electrical Connector/Socket Test Procedures Including Environmental Classifications

2.3. Industrial Standards

- Motorola 0944083L: Material or Method Specification
- SAE/USCAR Revision 3 (04/01): Performance Standard for Automotive Electrical Connector Systems
- SAE J1455: Surface Vehicle Recommended Practice

DESIGN OBJECTIVES 24Feb03

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:
 - Maximum: 1000 volts DC
 - Continuous: 48 volts DC
- Current: See Figure 3 for applicable current carrying capability
- Temperature:
 - Operating: -40 to 125°C
 - Storage: -40 to 125°C
- Reflow solder profile maximum temperature: 225°C for 30 seconds, see Figure 4

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 per EIA-364.

3.5. Test Requirements and Procedures Summary

Test Description	Requirement	Procedure
Examination of product.	Meets requirements of product drawings.	SAE/USCAR-2, Rev 3, 5.1.6.
ELECTRICAL		
Connector system maximum current.	20°C maximum temperature rise at specified current.	SAE/USCAR-2, Aug 1997, 6.5.2. Do connector system maximum current test.
Connector system 504 hour current cycle.	15.0 milliohms maximum final for size 20 terminal. 12.0 milliohms maximum final for size 16 terminal.	SAE/USCAR-2, Aug 1997, 6.5.3. Perform with current that produced a 20°C temperature rise from maximum current testing.
Dielectric withstanding voltage.	1000 volts.	EIA-364-20B.
Dry circuit contact resistance.	15.8 milliohms maximum final for size 20 terminal. 8.8 milliohms maximum final for size 16 terminal.	SAE/USCAR-2, Rev 3, 5.3.1.
Voltage drop.	15.0 milliohms maximum final for size 20 terminal. 12.0 milliohms maximum final for size 16 terminal.	SAE/USCAR-2, Rev 3, 5.3.2.

Figure 1 (cont)

DESIGN OBJECTIVES 24Feb03

Test Description	Requirement	Procedure
Isolation resistance.	≥ 100.0 megohms (100.0×10^6).	SAE/USCAR-2, Rev 3, 5.5.1. Apply 500 volts DC across adjacent terminals.
MECHANICAL		
Pin retention force.	7.5 lbs minimum pull-out. 10 lbs minimum push-through for 30 seconds after thermal shock testing is complete.	Motorola 0944083L, Section III. E. Using a pin vise, grip a pin and pull it back towards the front of the housing 0.025 inch (or push it using a flat-headed fixture from the opposite side of the housing). Using a flat-headed fixture, push a header pin 0.025 inch further through the housing.
Insertion durability.	No mechanical damage.	Completely mate and unmate connector pair a total of 50 times and then mate them again for testing.
Terminal retention force.	10 lbs minimum without secondary lock. 18 lbs minimum with secondary lock.	SAE/USCAR-2, Rev 3, 5.4.1. Extraction force only.
Vibration.	SAE/USCAR-2, Rev 3, 5.4.5.4. No loss of electrical continuity.	SAE/USCAR-2, Rev 3, 5.4.5. Use vibration profile in Motorola 0944083L, Section VI. H. Use 72 hour test sequence.
Threaded insert retention force.	No movement or change in the insert or header	Motorola 0944083L, Section VI. K. Attach mating bolts to 10 headers, apply an axial 150 lbf in the direction of bolt removal.
Connector mating break torque.	All connectors > 100 in-lb.	AMP Spec 109-183. Perform leakage (reflow) first.
ENVIRONMENTAL		
High temperature exposure.	No physical damage.	SAE/USCAR-2, Rev 3, 5.6.3. 125°C for 100 hours.
Temperature/humidity cycling.	No physical damage.	SAE/USCAR-2, Rev 3, 5.6.2. Do 15 cycles only.
Thermal shock.	No physical damage.	SAE/USCAR-2, Rev 3, 5.6.1. Use 1 hour cycle time minimum, 500 cycles, Class 3 connector (-40 to 125°C).
Fluid resistance.	No physical damage.	Motorola 0944083L, Section VI. C. Fluids shall be 25°C. Spray fluids on all exposed surfaces of the connector. Let sit for 1 hour. Dry with towel.

DESIGN OBJECTIVES 24Feb03

Figure 1 (cont)

Test Description	Requirement	Procedure
Steam cleaning.	Connector shall have no leaks.	Motorola 0944083L, Section VI. D., Test Condition B.
Pressurized spray.	Connector shall have no leaks.	Motorola 0944083L, Section VI. D., Test Condition A.
Liquid thermal shock.	No water intrusion through the mated pair or perimeter seal.	Motorola 0944083L, Section VI. E.
Salt spray.	No loss of continuity at 0.1 microsecond with 100 milliamperes applied, 28 volts.	SAE J1455, Aug 1994. Subject mated assemblies to 5% NaCl (salt) solution atomized at 35°C for 96 hours.
Pressure/vacuum leak	SAE/USCAR-2, Rev 3, 5.6.6.4. Connector shall withstand 50 kPa [7 psi] before heat age, and 34.5 kPa [5 psi] after heat age.	SAE/USCAR-2, Rev 3, 5.6.6.
Reflow (heat age) process.	No mechanical deformities.	Mount header assembly using ONLY two middle screws. Place box lid with header assemblies into a heat age chamber and raise the temperature to 175°C, and when stabilized, leave in for 7 minutes. Switch quickly to another chamber that has been pre-heated to 225°C and leave in for 5 minutes. Ramp down to 50°C and remove specimens when the oven has stabilized. After test, screw the remaining 4 screws into the header.

Figure 1 (end)

DESIGN OBJECTIVES 24Feb03

3.6. Product Qualification and Requalification Test Sequence

Test or Examination	Test Group (a)						
	1(b)	2(c)(d)	3(e)	4(d)(f)	5(d)(f)	6(e)	7(g)
	Test Sequence (h)						
Reflow (heat age) process	1	1	1	1	1	1	
Examination of product	2,13,20	2,9,16	2,9,16,20	2,13,17	2,8,12	2,6	
Dry circuit contact resistance	4,7,10,15,18		4,7,11,14,18				
Voltage drop	5,8,11,16,19		5,8,12,15,19				
Isolation resistance		4,7,10,12,14		4,7,9,12,15	4,7,10		
Dielectric withstanding voltage		5,15		5,10,16	5,11		
Connector system maximum current						4	
Connector system 504 hour current cycle						5	
Pin retention force		17					
Insertion durability	3,12,(i)	3	3,10(i)	3	3	3	
Terminal retention force			21				
Vibration			13				
High temperature exposure					6		
Temperature-humidity cycling			6				
Thermal shock	9	8					
Fluid resistance				11			
Steam cleaning				6			
Pressurized spray	17	13		8,14(j)			
Liquid thermal shock		11			9		
Salt spray			17				
Pressure/vacuum leak	6,14	6					
Connector mating break torque							X
Threaded insert retention force							X
Number of test specimens	6	10	6	6	6	6	

- NOTE**
- (a) See paragraph 4.1.A.
 - (b) Test group 1 is for signal applications, testing electrical continuity using dry circuit resistance readings and voltage drop.
 - (c) Test group 2 is for signal applications, testing sealing capabilities using isolation resistance readings and dielectric withstanding voltage.
 - (d) Do not open mated connectors in test groups 2, 4 and 5 until completion of entire sequence.
 - (e) Test groups 3 and 6 are for power applications, testing electrical continuity using dry circuit resistance readings and voltage drop.
 - (f) Test groups 4 and 5 are for both signal and power applications, and are to be tested with isolation resistance readings and dielectric withstanding voltage.
 - (g) Test group 7 is for groups of individual, non-sequential tests, applicable to both signal and power applications.
 - (h) Numbers indicate sequence in which tests are performed.
 - (i) Test groups 1 and 3, insertion durability, will be 25 cycles instead of 50 cycles. For test group 3, do item 6 before dry circuit resistance and voltage drop from vibration test.
 - (j) Item 14 will do pressurized spray without the 1 hour heat age.

Figure 2

DESIGN OBJECTIVES 24Feb03

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. All tests shall be performed using production modules from Motorola.

Test Group 1 shall consist of a minimum of 6 mated connectors, PN 776312 and 776315, with at least 3 mated pairs each of the -1 vehicle connectors and -2 engine connectors. Load all 68 circuits with terminals crimped on 18 inches of wire (60, PN 776326-4 with 18 AWG GXL wire; and 8, PN 776093-1 with 16 AWG GXL wire). These specimens shall be prepared in order to take readings for dry circuit resistance and voltage drop.

Test Group 2 shall consist of a minimum of 10 mated connectors, PN 776312 and 776315, with at least 5 mated pairs each of the -1 vehicle connectors and -2 engine connectors. Load all 68 circuits with terminals crimped on 18 inches of wire (60, PN 776326-4 with 18 AWG GXL wire; and 8, PN 776093-1 with 16 AWG GXL wire). These specimens shall be prepared in order to take readings for bulk isolation resistance and dielectric withstanding voltage.

Test Group 3 shall consist of a minimum of 6 mated connectors, PN 776312 and 776315, with at least 3 mated pairs each of the -1 vehicle connectors and -2 engine connectors. Load all 68 circuits with terminals crimped on 18 inches of wire (60, PN 776326-4 with 18 AWG GXL wire; and 8, PN 776093-1 with 14 AWG GXL wire). These specimens shall be prepared in order to take readings for dry circuit resistance and voltage drop.

Test Groups 4 and 5 shall each consist of a minimum of 6 mated connectors, PN 776312 and 776315, with at least 3 mated pairs each of the -1 vehicle connectors and -2 engine connectors. Load all 68 circuits with terminals crimped on 18 inches of wire (60, PN 776326-4 with 18 AWG GXL wire; and 8, PN 776093-1 with 16 AWG GXL wire). These specimens shall be prepared in order to take readings for bulk isolation resistance and dielectric withstanding voltage.

Test Group 6 shall consist of a minimum of 6 mated connectors, PN 776312 and 776315, with at least 3 mated pairs each of the -1 vehicle connectors and -2 engine connectors. Load all 68 circuits with terminals crimped on 18 inches of wire (60, PN 776326-4 with 18 AWG GXL wire; and 8, PN 776093-1 with 14 AWG GXL wire). These specimens shall be prepared in order to take readings for dry circuit resistance and voltage drop.

Test Group 7 is made up of individual, non-sequential tests. Use 30 full assemblies with wires (60, PN 776326-4 with 18 AWG GXL wire; and 8, PN 776093-1 with 16 AWG GXL wire) for the maximum connector mating torque test, and 10 header assemblies for threaded insert retention force.

All specimens in Test Groups 1-6 shall use wire dress covers, PN 776320-1, properly installed, mated to the plug assembly and torque down to the sealed box using 2 bolts at 35 ± 5 in-lbs. Use a wire conduit to shield the wires, and clamp to the wire dress cover using a wire tie. For test group 3, use reference pictures from Motorola to determine other tie-down points during vibration. Mating torque for the plug and header assemblies is 50 ± 5 in-lbs. Screw hole torque for the 6 screws holding the header to the rigidizer is 20 ± 3 in-lbs. Circuit boards, if used, are to be soldered after completing the reflow (heat age) process test.

DESIGN OBJECTIVES 24Feb03

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.

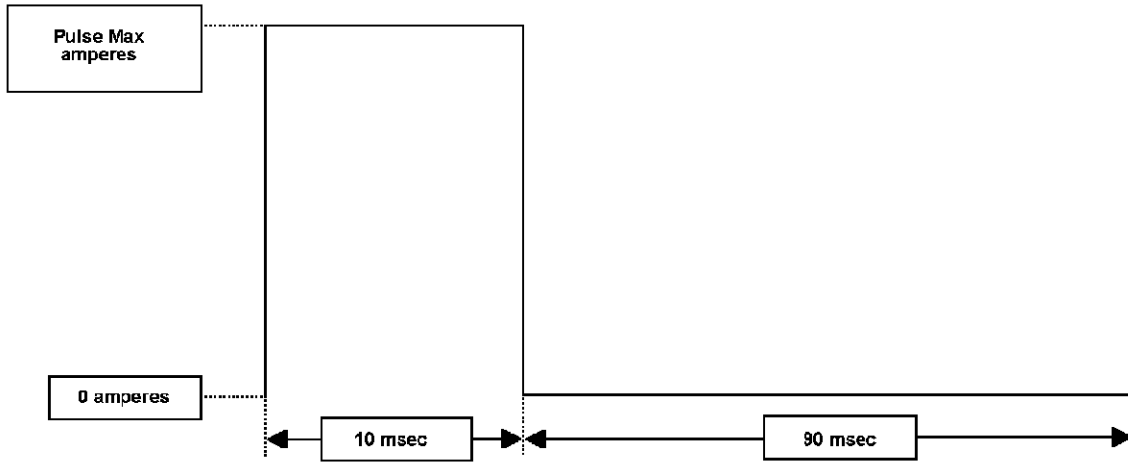
4.3. Acceptance

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.

DESIGN OBJECTIVES 24Feb03



Current Pulse Profile

Contacts	Size 20	Size 16
All size 20 pulsed simultaneously	12	
All size 16 pulsed simultaneously		30
All size 20 and size 16 pulsed simultaneously	12	28
All size 20 simultaneous DC current	4	
All size 16 simultaneous DC current		11
All size 20 and size 16 simultaneous DC current	3.75	11

NOTE Pulse profile continually repeats itself upon waveform completion.

Connector Current Rating (amperes)

Figure 3
Current Carrying Capability

DESIGN OBJECTIVES 24Feb03

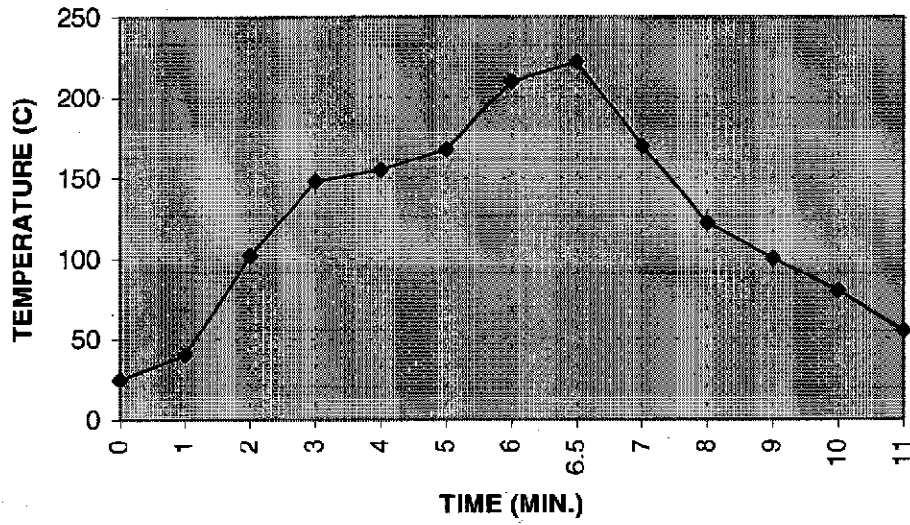


Figure 4
Reflow Solder Profile

DESIGN OBJECTIVES 24Feb03