Connector, AMP* ECU-1

1. INTRODUCTION

1.1. Purpose

Testing was performed on the AMP* ECU1 connector to determine its conformance to the requirements of AMP Product Specification 108-1715 Revision A.

1.2. Scope

This report covers the electrical, mechanical, and environmental performance of the ECU1 connector. Testing was performed at the Americas Global Automotive Division Product Reliability Center between Aug98 and Jun99. The test file numbers for this testing are ACL 48150190a and 19990202ACL. This documentation is on file at and available from the Americas Global Automotive Division Product Reliability Center.

1.3. Conclusion

The ECU1 connector listed in paragraph 1.5., conformed to the electrical, mechanical, and environmental performance requirements of AMP Product Specification 108-1715 Revision A.

1.4. Product Description

The ECU1 104 position connector consists of a plug and a header and is available only to Ford Motor Company or Ford approved buyers where it is known as the Enhanced EEC connector.

1.5. Test Samples

Test samples were representative of normal production lots. Samples identified with the following part numbers were used for test:

Test Group	Quantity	Part Number	Revision	Description
1,2	4 each	770750-1	F	Header
N	67			
1,2	104 each	770753-1	N	Male terminal
1,2	104 each	770753-2	N	Male terminal
1,2	104 each	770753-3	N	Male terminal
1,2	104 each	770753-4	N	Male terminal
N	60	770753-7	R	Male terminal
1,2	4 each	770760-1	U	Plug
N	137			
N	6	770761-1	AD	Plug housing
1,2	4 each	770763-1	G	Spacer
1,2	4 each	770768-1	E	Wire press
N	840	776235-1	E	Socket
1,2	4 each	776237-1	A	Gasket

Figure 1

TENTATIVE 20Sep99
EXPIRATION DATE 18Jan00

* Trademark
I Indicates change

LOC B

1.6. Environmental Conditions

Unless otherwise stated, the following environmental conditions prevailed during testing:

Temperature: 15 to 35°C
Relative Humidity: 20 to 80%

1.7. Qualification Test Sequence

Test or Examination	Test Group (a)		
	1(b)	2(c)	N(d)
	Test Sequence (e)		
Examination of product	1,14	1,10	
Termination resistance	2,5,7,9,11,13	2,4,6,9	
Temperature rise vs current	3,12		
Current cycling	8		
Vibration, random	10	8	
Durability	4	3	
Temperature life		7	
Mixed flowing gas	6	5	
Low energy electrical load durability			1
Terminal insertion force			2
Terminal retention force			3
Force to seat secondary lock			4
Force to remove secondary lock			5
Push nut, push out and turning force			6
Solderability			7
Pin contact, push through and push or pull back			8
Threaded insert retention			9
Maximum connector mating torque			10
Over torque			11
Submergible air leak			12
Retainer plate retention			13

NOTE

(a) See Para 4.1.A.
(b) Test Group 1 is for power applications.
(c) Test Group 2 is for signal applications.
(d) Test Group N is for groups of individual, non-sequential tests which are applicable to both power and signal applications.
(e) Numbers indicate sequence in which tests are performed.

The above testing was established during the product's development phase and reflects agreement between AMP and Ford Motor Company. It does not comply with AMP's typical product evaluation format as defined in AMP Specification 102-6, Preparation of Product Specification.

Figure 2

2. SUMMARY OF TESTING

2.1. Examination of Product - Test Groups 1 and 2

All samples submitted for testing were representative of normal production lots. A Certificate of Conformance was issued by the Product Assurance Department. Samples were visually and dimensionally examined per the product drawing and no evidence of physical damage detrimental to product performance was observed.

2.2. Termination Resistance - Test Groups 1 and 2

All termination resistance measurements, taken at 100 milliamperes maximum and 20 millivolts maximum open circuit voltage were less than 20 after testing.

2.3. Temperature Rise vs Current - Test Group 1

All samples had a temperature rise of less than 30°C above ambient when tested using a baseline rated current of 7.45 amperes and the correct derating factor value based on the samples wiring configuration.

2.4. Current Cycling - Test Group 1

No evidence of physical damage was visible as a result of current cycling.

2.5. Vibration - Test Groups 1 and 2

No discontinuities were detected during vibration testing. Following vibration testing, no cracks, breaks, or loose parts on the samples were visible.

2.6. Durability - Test Groups 1 and 2

No physical damage occurred as a result of mating and unmating the plug from the header assembly 10 times.

2.7. Temperature Life - Test Group 2

No evidence of physical damage was visible as a result of temperature life testing.

2.8. Mixed Flowing Gas - Test Groups 1 and 2

No evidence of physical damage was visible as a result of exposure to the pollutants of mixed flowing gas.

2.9. Low Energy Electrical Load Durability - Test Group N

ΔR was less than 100 milliohms.

2.10. Terminal Insertion Force - Test Group N

All readings were less than 1.65 pounds.

2.11. Terminal Retention Force - Test Group N

Terminal retention force was greater than 10 pounds without the secondary lock, and greater than 18 pounds with the secondary lock.

2.12. Force to Seat Secondary Lock - Test Group N

All samples withstood a 5 pound minimum push-in force. The force required to fully seat the samples was less than 12.5 pounds.

2.13. Force to Remove Secondary Lock - Test Group N

The force required to remove the secondary latch from the pre-set position was greater than 3 pounds and less than 12.5 pounds.

2.14. Push Nut, Push Out and Turning Force - Test Group N

All samples withstood a force of 600 pounds. The clips did not move more than ± 0.5 mm from their original position.

2.15. Solderability - Test Group N

All samples exhibited less than 5% dewetting.

2.16. Pin Contact, Push Through and Push or Pull Back - Test Group N

The average force required to push a pin through the housing was greater than 15 pounds while the average force required to move the pin back in the housing was greater than 7.5 pounds.

2.17. Threaded Insert Retention - Test Group N

Average push out force was greater than 800 pounds. Average push through force was greater than 1600 pounds. Average torsion resistance force was greater than 175 inch pounds.

2.18. Maximum Connector Mating Torque - Test Group N

All samples were fully mated with no space between the stop and the header at 48.8 inch pounds.

2.19. Over Torque - Test Group N

No samples had more than an 8% increase in bolt diameter after being subjected to a force of 60 inch pounds.

2.20. Submergible Air Leak - Test Group N

There was no evidence of leakage when subjected to 7 psi for 15 seconds.

2.21. Retainer Plate Retention - Test Group N

Average force to remove the retainer plate was greater than 2.5 pounds.

3. TEST METHODS

3.1. Examination of Product

Where specified, samples were visually and dimensionally examined per the product drawing for evidence of physical damage detrimental to product performance.

3.2. Termination Resistance

Termination resistance measurements at low level current were made using a 4 terminal measuring technique. The test current was maintained at 100 milliamperes maximum with a 20 millivolt maximum open circuit voltage.

3.3. Temperature Rise vs Current

Temperature rise curves were produced by measuring individual contact temperatures at 5 different current levels. These measurements were plotted to produce a temperature rise vs current curve. Thermocouples were attached to individual contacts to measure their temperatures. The ambient temperature was then subtracted from this measured temperature to find the temperature rise. When the temperature rise of 3 consecutive readings taken at 5 minute intervals did not differ by more than 1°C, the temperature measurement was recorded.

3.4. Current Cycling

Testing consisted of 1008 cycles of current cycling, with each cycle having current ON for 45 minutes and current OFF for 15 minutes. The test current was 7.45 amperes. Temperature and millivolt drop measurements were taken at cycles 1, 24, 47, 72, 194, 384, 744 and 1008.

3.5. Vibration, Random

Mated samples were subjected to a random vibration test, specified by a random vibration spectrum, with excitation frequency bounds of 5 and 500 Hz. The power spectral density at 5 Hz was 0.000312 G^2/Hz. The spectrum sloped up at 6 dB per octave to a PSD of 0.02 G^2/Hz at 14 Hz. The spectrum was flat at 0.02 G^2/Hz from 14 to 500 Hz. The root-mean square amplitude of the excitation was 3.13 GRMS. This was performed for 8 hours in each of 3 mutually perpendicular planes for a total vibration time of 24 hours. Samples were monitored for discontinuities of 1 microsecond or greater using a current of 100 milliamperes DC.

3.6. Durability

Samples were manually mated and unmated 10 times using a torque wrench.

3.7. Temperature Life

Mated samples were exposed to a temperature of 125°C for 1008 hours (42 days).

3.8. Mixed Flowing Gas, Class III

Mated samples were exposed for 20 days to a mixed flowing gas Class III exposure. Class III exposure is defined as a temperature of 30°C and a relative humidity of 75% with the pollutants of Cl_2 at 20 ppb, NO_2 at 200 ppb and H_2S at 100 ppb.

3.9. Low Energy Electrical Load Durability

Initial dry circuit readings were taken on samples placed in a temperature cycling chamber at -40 to 125°C. Each cycle was 2 hours at hot and 1 hour at cold temperature including transition time. Dry circuit readings were taken at 50 cycle intervals in both the hot and cold cycles.

3.10. Terminal Insertion Force

A chuck was attached to the crosshead of an Instron machine to hold the terminated socket contact while the plug was held in an L-vise at the base of the Instron machine. The terminated contact was inserted into the plug at a rate of 50 mm per minute.

3.11. Terminal Retention Force

The sample was held in an L-vise attached to the crosshead of an Instron machine. A second L-vise attached to a floating table which was attached to the base of the Instron machine was used to hold the wire. The terminal was pulled from the plug at a rate of 50 mm per minute. There was no difference of setup for primary or secondary latch retention.

3.12. Force to Seat Secondary Lock

The plug was held in an L-vise attached to a free floating table attached to the base of the Instron machine. A second L-vise attached to the crosshead was used to press the secondary lock into the plug housing at a rate of 50 mm per minute.

3.13. Force to Remove Secondary Lock

The plug was held in an L-vise attached to a stationary table attached to the base of the Instron machine. A chuck attached to the crosshead was used to remove the TPA at a rate of 2 inches per minute.

3.14. Push Nut, Push Out and Turning Force

The housing was held in an L-vise attached to the base of the Instron machine. A 0.15 inch diameter steel dowel pin mounted in a chuck attached to the crosshead was used to push each pin through or back into the housing at a rate of 25 mm per minute.

3.15. Solderability

All samples were subjected to 15 hours of steam aging at 155°C prior to testing. Samples were immersed in a non-activated rosin flux for 5 to 10 seconds, immersed in the molten solder at a rate of approximately 1 inch per minute, held for 3 to 5 seconds, then withdrawn. After cleaning, the samples were visually examined for dewetting.

3.16. Pin Contact, Push Through and Push or Pull Back

The housing was held in an L-vise attached to the base of the Instron machine. A 0.15 inch diameter steel dowel pin mounted in a chuck attached to the crosshead was used to push each pin through or back into the housing at a rate of 25 mm per minute.

3.17. Threaded Insert Retention

The housing was held in an L-vise attached to the base of the Instron machine. A 0.15 inch diameter steel dowel pin mounted in a chuck attached to the crosshead was used to push the threaded insert through the housing. A hex screw was secured in the insert using Loctite and torqued until failure.

3.18. Maximum Connector Mating Torque

Samples were torqued to the maximum mating torque (48.8 inch pounds) and then inspected to ensure they were fully mated.

3.19. Over Torque

Samples were held in a vise and torqued to 60 inch pounds and then measured to ensure the diameter of the tower of the plug did not increase by more than 8%.

3.20. Submergible Air Leak

A stainless steel tube connected to a hose coming from an air regulator was inserted into a vacant cavity of the plug connector. The connector was then immersed in a clear container filled with ambient tap water. Seven psi was introduced into the connector and maintained for 15 seconds while observing for air bubbles.

3.21. Retainer Plate Retention

The header was held in an L-vise attached to the base of the Instron machine. Fixture PN 92-660452-000 was attached to the crosshead by means of a chuck was used to pull the retainer plate out of the header at a rate of 50 mm per minute.