



HMN-HD1-48 Insert Series

1. INTRODUCTION

1.1 Purpose

This document provides the qualification summary of TE Connectivity HMN-HD1-48 series insert of HDC connector.

1.2 Scope

This specification covers the electrical, mechanical, and environmental performance of HMN-HD1-48 series insert.

1.3 Conclusion

Based on the test results, all meet the requirements according to TE Connectivity Product Specification 108-140152.

1.4 Product Description

| Name | Remarks |
|--------------|---------|
| HMN-HD1-48-M | |
| HMN-HD1-48-F | |

1.5 Qualification Test Sequence

| Test and Examination | Test Group | | | | | | |
|--|-----------------------------|-----|-----|------|-----|-----|--|
| | A | B | C | D | E | F | |
| | Test Sequence ¹⁾ | | | | | | |
| Visual and dimensional examination | 1,6 | 1,6 | 1,3 | 1,11 | 1,8 | 1,6 | |
| Durability of marking | 2 | | | | | | |
| Polarisation and coding (If application) | 3 | | | | | | |
| Pull out force of terminations Only for Crimped connections | 7 ^a | | | | | | |
| Contact retention force in insert | 4 | | | | | | |
| Mechanical strength impact | 5 | | | | | | |
| Mating and Un-mating force of full loaded connector | | 3 | | | | | |
| Mechanical Operation (Durability) | | 4 | | | | | |
| Vibration, Random | | | | | | 3 | |
| Shock | | | | | | 4 | |
| Contact Resistance | | 2,5 | | 2,8 | 2,5 | 2,5 | |
| Temperature Rise Test | | | 2 | | | | |
| Dielectric Voltage Withstand Test | | | | 3,9 | 6 | | |
| Insulation Resistance | | | | 4,10 | 7 | | |
| Cold | | | | 5 | | | |
| Dry Heat | | | | 6 | | | |
| Damp Heat, cyclic | | | | | 4 | | |
| Rapid Change of temperature (Temperature Cycle) | | | | | 3 | | |
| Corrosion | | | | 7 | | | |

* Notes:

- 1) Numbers indicate the sequence in which the tests are performed.
- 2) ^a test items are for themselves separate tests and are performed on new specimens.

2. TEST PROCEDURE

| General | | | |
|-------------------|---|---|--|
| No. | Test Items | Requirement | Condition according to |
| 2.1 | Visual and dimensional examination | Meets requirements of product drawing | Visual and dimensional examination IEC 60512-1-1/-2, Test 1a and 1b 6.2 of EN 61984 |
| Mechanical | | | |
| 2.2 | Durability of marking | Marking shall be still readable according to 6.2 of EN61984 (If marking made by impression, molding, pressing or engraving or the like are not subjected to this test) | Test piston: Size 1 Wet test with liquid: water Duration: 10 cycles Force:5N IEC 60068-2-70 Test Xb, 7.3.2 of EN61984 |
| 2.3 | Polarisation and coding | For multi-pole connector, require provision against incorrect mating according to 6.3 & 6.9.1 of EN 61984 No damage likely to impair function | For unenclosed connector (internal connections) 20N For enclosed connector (external connections) 1.5 x Mating force, but not higher than 80N Test 13e of IEC 60512-13-5 |
| 2.4 | Pull out force of terminations | See 6.6 of EN 61984 | See 6.6 of EN 61984 |
| | ^a for Crimped connections | The conductor shall not slip out of crimp barrel and pull out force as specified in Table 2 | Visual tests on the crimp barrel and tensile strength test of the crimp connection as specified in IEC 60352-2. |
| 2.5 | Contact retention force in insert | No axial displacement likely to impair normal operation, min 14.7N force for each pin or socket 6.18.2 of EN 61984 | Test load applied in axial direction, Test speed:20mm/min, permissible shift contacts of 1.0mm, Test 15a of IEC 60512-15-1 |
| 2.6 | Mechanical strength impact | Connector and internal insulation shall no damage to impair normal use. A reduction of clearance and creepage distance is not allowed. 6.18.1 & 6.18.3 of EN 61984 | Dropping height: - 750mm for specimens of mass≤250g - 500mm for specimens of mass>250g Dropping cycles:8 positions in 45°step, one cycles per position IEC 60512-7-2 Test 7b |
| 2.7 | Mating and Un-mating force of full loaded connector | Mating force: 64.8N Max. Un-mating force: 3.84N Min. | The specified force shall be applied in axial direction with the speed of 20mm/min. IEC 60512-13-1 Test 13a |
| 2.8 | Mechanical Operation (Durability) | 500 operation cycles without load No damage likely to impair normal use 6.14.1 of EN 61984 | Shall be engaged and disengaged by means of A) a device simulating normal operating conditions at the speed of approximately 50mm/min B) manual mating/un-mating 300 Max. cycle per hour IEC 60512-9-1 Test 9a, 7.3.9 of EN 61984 |

| | | | |
|------|-------------------|--|--|
| 2.9 | Vibration, Random | No damage likely to impair function No discontinuities greater than $t > 1\mu s$ | Frequency: 5~150Hz Per EN 61373, Category 1, Class B (IEC60068-2-6 Test Fc) |
| 2.10 | Shock | No damage likely to impair function No discontinuities greater than $t > 1\mu s$ | Acceleration: 50m/s ² Duration: 30ms Total 18 shocks (three positive and three negative in each of the three orthogonal axes), Per EN 61373 |

| Electrical | | | | |
|-------------------|-----------------------------------|--|-------------------|---|
| 2.11 | Contact Resistance | Initial | Max. 10m Ω | Test current: 1A Measure points ^b at the end of the termination IEC 60512-2-2 Test 2b |
| | | Final | Max. 20m Ω | |
| 2.12 | Temperature Rise Test | The sum of the ambient temperature and the temperature rise (ΔT) of a connector shall not exceed the upper limiting temperature 6.16 of EN 61984 | | Length of test cable see table 7 of 7.3.8 of EN 61984 Carry its rated current Upper limiting temperature: 125°C (Table 5b) IEC 60512-5-2 Test 5a |
| 2.13 | Dielectric Voltage Withstand Test | No flashover or breakdown of voltage 6.13 of EN 61984 | | Impulse test voltage according to Table 8, applied three impulses of each polarity and interval of at least 1s between impulses. 7.3.12 of EN 61984 |
| 2.14 | Insulation Resistance | Not less than 100M Ω | | Test voltage 500V DC Time: 60s IEC 60512-3-1 Test 3a Method B |

| Environmental | | | | |
|----------------------|-------------------|-------------------------------------|--|--|
| 2.15 | Cold | No damage likely to impair function | | Subject mated specimen to -40°C Duration time: 16h, Test Ab Per IEC 60512-11-10 Test 11j (IEC 60068-2-1) |
| 2.16 | Dry Heat | No damage likely to impair function | | Subject mated specimen to +125°C Duration time: 168h Test Bb Per IEC 60512-11-9 Test 11i (IEC 60068-2-2) |
| 2.17 | Damp Heat, cyclic | No damage likely to impair function | | Subject mated specimen to Min ambient temperature: 25°C Max ambient temperature: 45°C Number of cycles: 21 Duration time: 12h+12h Variant 1 IEC 60512-11-12 Test 11m |

| | | | |
|--|---|---|--|
| 2.18 | Rapid Change of temperature (Temperature Cycle) | No damage likely to impair function | Subject mated specimen to Ta=-40±2°C to Tb=+125±2°C, duration t1: 1h each extreme, 100 cycles IEC 60512-11-4 Test 11d (IEC 60068-2-14 Test Na) |
| 2.19 | Corrosion (Alternative) | No damage likely to impair function Per 6.21 of EN 61984 | <p>Test 1: Flowing mixed gas corrosion according to test 11g, method 1 or method 4 (Table 1) Duration time: 4day (96h) IEC 60512-11-7 Test 11g 7.3.14 of EN 61984</p> <p>Test 2: Sulphur dioxide test with general condensation of moisture according to EN ISO 6988 Duration time:24h (1 test cycle) 7.3.14 of EN 61984</p> |
| <p>^a test items are for themselves separate tests and are performed on new specimens. ^b measuring point: at the conductors as close as possible to the termination, if this is not possible, the conductor resistance shall be recalculated.</p> | | | |

Pull out force as below table 2:

| Table 1 – Pull out force | | |
|---------------------------------|-------|-----------------------------|
| Wire size | | Pull out force(Min.) |
| mm ² | (AWG) | N |
| 0.05 | 30 | 4.9 |
| 0.09 | 28 | 9.8 |
| 0.14 | 26 | 19.6 |
| 0.22 | 24 | 29.4 |
| 0.34 | 22 | 44.1 |

3. SUMMARY OF TEST RESULTS:

Examination of product – all test group

| Test Group | Test Item | Test Result | Requirement | Judgment |
|------------|---|---|---|----------|
| Group A | Visual and dimensional examination | No physical damage | Meets requirements of product drawing | passed |
| | Durability of marking | Marking shall be readable | Marking shall be readable | passed |
| | Polarisation and coding | No physical damage | require provision against incorrect mating | passed |
| | Contact retention force in insert | No axial displacement likely to impair normal operation | Axial displacement <1.0mm when test speed: 20mm/min, min 14.7N force for each pin or socket | passed |
| | Mechanical strength impact | No physical damage | No damage likely to impair function | passed |
| | Visual and dimensional examination | No physical damage | Meets requirements of product drawing | passed |
| | Terminations and connection methods -(Pull force) | For crimped connections 0.05mm ² contact: 13.5N 0.09mm ² contact: 14.2N 0.14mm ² contact: 36.3N 0.22mm ² contact: 60.2N 0.34mm ² contact: 80.2N | 0.05mm ² : 4.9N Min 0.09mm ² : 9.8N Min 0.14mm ² : 19.6N Min 0.22mm ² : 29.4N Min 0.34mm ² : 44.1N Min | passed |
| Group B | Visual and dimensional examination | No physical damage | Meets requirements of product drawing | passed |
| | Contact Resistance | 5.2mΩ Max. | Max.10mΩ | passed |
| | Mating and Un-mating force of full loaded connector | Mating force:25.5N Un-mating force:16.5N | Mating force: 64.8N Max. Un-mating force: 3.84N Min | passed |
| | Mechanical Operation (Durability) | No physical damage | After 500 operations cycles. No damage likely to impair normal use | passed |
| | Contact Resistance | 4.3mΩ Max. | Max.20mΩ | passed |
| | Visual and dimensional examination | No physical damage | Meets requirements of product drawing | passed |
| Group C | Visual and dimensional examination | No physical damage | Meets requirements of product drawing | passed |
| | Temperature Rise Test | 91.3°C | The sum of the ambient temperature and the temperature rise≤125°C Ambient temperature: 40°C | passed |
| | Visual and dimensional examination | No physical damage | Meets requirements of product drawing | passed |

| | | | | |
|------------------------------------|---|---------------------------------------|--|--------|
| Group D | Visual and dimensional examination | No physical damage | Meets requirements of product drawing | passed |
| | Contact Resistance | 7.4mΩ Max. | Max.10mΩ | passed |
| | Dielectric Voltage Withstand Test | No physical damage | No damage likely to impair function | passed |
| | Insulation Resistance | >1.1x10 ¹² Ω | Not less than 100MΩ | passed |
| | Cold | No physical damage | No damage likely to impair function | passed |
| | Dry Heat | No physical damage | No damage likely to impair function | passed |
| | Corrosion | No physical damage | No damage likely to impair function | passed |
| | Contact Resistance | 6.76mΩ Max. | Max.20mΩ | passed |
| | Dielectric Voltage Withstand Test | No breakdown or flashover | No breakdown or flashover | passed |
| | Insulation Resistance | >3.7x10 ¹¹ Ω | Not less than 100MΩ | passed |
| | Visual and dimensional examination | No physical damage | Meets requirements of product drawing | passed |
| Group E | Visual and dimensional examination | No physical damage | Meets requirements of product drawing | passed |
| | Contact Resistance | 4.7mΩ Max. | Max.10mΩ | passed |
| | Rapid Change of temperature (Temperature Cycle) | No physical damage | No damage likely to impair function | passed |
| | Damp Heat, cyclic | No physical damage | No damage likely to impair function | passed |
| | Contact Resistance | 4.4mΩ Max. | Max.20mΩ | passed |
| | Dielectric Voltage Withstand Test | No breakdown or flashover | No breakdown or flashover | passed |
| | Insulation Resistance | >1.05x10 ¹² Ω | Not less than 100MΩ | passed |
| Visual and dimensional examination | No physical damage | Meets requirements of product drawing | passed | |
| Group F | Visual and dimensional examination | No physical damage | Meets requirements of product drawing | passed |
| | Contact Resistance | 4.7mΩ Max. | Max.10mΩ | passed |
| | Vibration, Random | No breakdown or flashover | No damage likely to impair function No discontinuities greater than t>1μs | passed |
| | Shock | No breakdown or flashover | No damage likely to impair function No discontinuities greater than t>1μs | passed |
| | Contact Resistance | 6.4mΩ Max. | Max.20mΩ | passed |
| | Visual and dimensional examination | No physical damage | Meets requirements of product drawing | passed |