HMN-012 insert series

1. INTRODUCTION

1.1 Purpose

This document provides the qualification summery of TE Connectivity HMN-012 series insert of HDC connector.

1.2 Scope

This specification covers the electrical, mechanical, and environmental performance of HMN-012 series insert. Testing was performed at the Shanghai Electrical Components Test Laboratory.

1.3 Conclusion

Based on the test results, all meet the requirements according to TE Connectivity Design Objectives 108-137121.

1.4 Product Description

Name	Remarks
HMN-012-M	
HMN-012-F	

1.5 Qualification Test Sequence

Test or Examination	Test Group							
	A	B	C	D	E	F	G	H
	Test Sequence[1)]							
Visual and dimensional examination	1,6	1,5	1,3	1,11	1,5	1,8	1,9	1,4
Durability of marking	2							
Polarisation and coding (If application)	3							
Pull out force of terminations for Crimped connections								3
Contact retention force in insert	4							
Mechanical strength impact	5							
Mechanical Operation (Durability)		3						
Vibration, Simulated long life random Category 1,Class B							3	
Vibration, Random, Category 1,Class B							4	
[a] Vibration, Simulated long life random Category 2							5[a]	
[a] Vibration, Random, Category 2							6[a]	
Shock							7	
Contact Resistance		2,4		2,8		2,5	2,8	
Contact Resistance (Crimped termination 0.05 to 10mm² not insulate)								2
Temperature Rise Test			2					
Dielectric Voltage Withstand Test				3,9	4	6		
Insulation Resistance				4,10		7		
Provision for earthing-Grounding contact resistance (if applicable)					3			
Cold				5				
Dry Heat				6				
Damp Heat, cyclic						4		
Rapid Change of temperature (Temperature Cycle)						3		
Corrosion				7				
Protection against electric shock					2			

*** Notes:**

1) Numbers indicate the sequence in which the tests are performed.
2) [a] test items are for the special application, for example: Rail application etc.

2. TEST PROCEDURE

General			
No.	**Test Items**	**Requirements**	**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: No. 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, whichever is higher 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
	for Crimped connections	Crimped termination 0.05 to 10mm² not insulated, the conductor shall not slip out of crimp barrel and pull out force as specified in Table 1 of EN 60352-2	Visual tests on the crimp barrel and tensile strength test of the crimp connection as specified in IEC 60352-2.
		Crimped termination >10mm² not insulated, the conductor shall not slip out of crimp barrel and pull out force as specified in Table 8 of NF F 00-363	Visual tests on the crimp barrel and tensile strength test of the crimp connection as specified in NF F 00-363
2.5	Contact retention force in insert	No axial displacement likely to impair normal operation, min 50N 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	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
2.8	Vibration, Simulated long life random at increased levels	No damage likely to impair function No discontinuities greater than t>1μs	Frequency:5~150Hz Per EN 61373, Category 1, Class B (IEC60068-2-6 Test Fc)
2.9	Vibration, Random	No damage likely to impair function No discontinuities greater than t>1μs	Frequency:5~150Hz Per EN 61373, Category 1, Class B, (IEC60068-2-6 Test Fc)
2.10[a]	[a] Vibration, Simulated long life random at increased levels	No damage likely to impair function No discontinuities greater than t>1μs	Frequency:5~150Hz Per EN 61373, Category 2, (IEC60068-2-6 Test Fc)
2.11[a]	[a] Vibration, Random	No damage likely to impair function No discontinuities greater than t>1μs	Frequency:5~150Hz Per EN 61373, Category 2, (IEC60068-2-6 Test Fc)
2.12	Shock	No damage likely to impair function No discontinuities greater than t>1μs	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				
2.13	Contact Resistance	Initial	Max.5mΩ	Test current: 1A Measure points[b] at the end of the termination Max three contacts per specimen plus protective earthing, if any IEC 60512-2-2 Test 2b
		Final	The change of contact resistance shall be no more than 50 % of the reference value or ⩽5 mΩ. The higher value is permissible	
2.14	Contact Resistance (Crimped termination 0.05 to 10mm² not insulate)	Contact resistance at crimping has to be lower than the one specified in EN60352-2, Figure 6		IEC 60512-2-2, Test 2b (Method of specified current): testing current = 1A / mm² of cable cross section EN 60352-2, 5.2.3.1 + Figure 5 for measuring points
2.15	Temperature Rise Test	The sum of the ambient temperature and the temperature rise (△T) 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℃ (Table 5b) IEC 60512-5-1 Test 5a
2.16	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
2.17	Insulation Resistance	Not less than 400MΩ		Test voltage 1000V DC Time:60s IEC 60512-3-1 Test 3a Method B
2.18	Provision for earthing-Grounding contact resistance **(if applicable)**	Resistance is less than or equal to 0.1 Ω 6.5.3 of EN 61984		Resistance between accessible metal parts and the earthing contact 7.3.13 of EN 61984

Environmental			
2.19	Cold	No damage likely to impair function	Subject mated specimen to -40℃ Duration time:16h, Test Ab Per IEC 60512-11-10 Test 11j (IEC 60068-2-1)
2.20	Dry Heat	No damage likely to impair function	Subject mated specimen to +125℃ Duration time:168h Test Bb Per IEC 60512-11-9 Test 11i (IEC 60068-2-2)
2.21	Damp Heat, cyclic	No damage likely to impair function	Subject mated specimen to Min ambient temperature: 25±2℃ Max ambient temperature: 40±2℃ Number of cycles:21 Duration time:12h+12h Variant 1 IEC 60512-11-12 Test 11m
2.22	Rapid Change of temperature (Temperature Cycle)	No damage likely to impair function	Subject mated specimen to Ta=-40±2℃ to Tb=+125±2℃, duration t1: 1h each extreme, 100 cycles IEC 60512-11-4 Test 11d (IEC 60068-2-14 Test Na)
2.23	Corrosion (Alternative)	No damage likely to impair function Per 6.21 of EN 61984	Test 1: Flowing mixed gas corrosion according to test 11g, method 1 or method 4 (Table 1) Duration time: 4 days (96h) IEC 60512-11-7 Test 11g 7.3.14 of EN 61984
			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
2.24	Protection against electric shock	no live parts shall be accessible by test finger, 6.4.2.2 or 6.4.2.3 of EN 61984	Unenclosed connector. Test finger or 50mm sphere pressed with 20N against the surface as specified by the manufacture Mated specimen and socket connector (if application) 7.3.6.1 of EN 61984

[a] test items are for the special application, for example: Rail application etc.
[b] measuring point: at the conductors as close as possible to the termination, if this is not possible, the conductor resistance shall be recalculated.

3. SUMMARY OF TEST RESULTS:

Examination of product – all test group

Test Group	Test Item	Requirement	Test Result	Judgment
Group A	Visual and dimensional examination	Meets requirements of product drawing	No physical damage	passed
	Durability of marking	Marking shall be readable	Marking shall be readable	passed
	Polarisation and coding	Require provision against incorrect mating	No physical damage	passed
	Contact retention force in insert	Axial displacement <1.0mm when test speed: 20mm/min, min 50N force for each pin or socket	No axial displacement likely to impair normal operation	passed
	Mechanical strength impact	No damage likely to impair function	No physical damage	passed
	Visual and dimensional examination	Meets requirements of product drawing	No physical damage	passed
Group B	Visual and dimensional examination	Meets requirements of product drawing	No physical damage	passed
	Contact Resistance	Max.5mΩ	2.67 mΩ Max.	passed
	Mechanical Operation (Durability)	After 500 operation cycles, No damage likely to impair normal use	No physical damage	passed
	Contact Resistance	The change of contact resistance shall be no more than 50 % of the reference value or ⩽5 mΩ. The higher value is permissible	2.95 mΩ Max.	passed
	Visual and dimensional examination	Meets requirements of product drawing	No physical damage	passed
Group C	Visual and dimensional examination	Meets requirements of product drawing	No physical damage	passed
	Temperature Rise Test	The sum of the ambient temperature and the temperature rise ≤125℃	41.60 ℃	passed
	Visual and dimensional examination	Meets requirements of product drawing	No physical damage	passed
Group D	Visual and dimensional examination	Meets requirements of product drawing	No physical damage	passed
	Contact Resistance	Max.5mΩ	2.80 mΩ Max.	passed
	Dielectric Voltage Withstand Test	No damage likely to impair function	No physical damage	passed
	Insulation Resistance	Not less than 400MΩ	>1.87x10^{11}Ω	passed
	Cold	No damage likely to impair function	No physical damage	passed
	Dry Heat	No damage likely to impair function	No physical damage	passed
	Corrosion	No damage likely to impair function	No physical damage	passed

	Contact Resistance	The change of contact resistance shall be no more than 50 % of the reference value or ⩽5 mΩ. The higher value is permissible	4.35 mΩ Max.	passed
	Dielectric Voltage Withstand Test	No breakdown or flashover	No breakdown or flashover	passed
	Insulation Resistance	Not less than 400MΩ	>1.72x10^{11}Ω	passed
	Visual and dimensional examination	Meets requirements of product drawing	No physical damage	passed
Group E	Visual and dimensional examination	Meets requirements of product drawing	No physical damage	passed
	Protection against electric shock	No electric shock occurred	No electric shock	passed
	Provision for earthing-Grounding contact resistance	Resistance is less than or equal to 0.1Ω	15.2 mΩ Max.	passed
	Dielectric Voltage Withstand Test	No breakdown or flashover	No breakdown or flashover	passed
	Visual and dimensional examination	Meets requirements of product drawing	No physical damage	passed
Group F	Visual and dimensional examination	Meets requirements of product drawing	No physical damage	passed
	Contact Resistance	Max.5mΩ	2.46 mΩ Max.	passed
	Rapid Change of temperature (Temperature Cycle)	No damage likely to impair function	No physical damage	passed
	Damp Heat, cyclic	No damage likely to impair function	No physical damage	passed
	Contact Resistance	The change of contact resistance shall be no more than 50 % of the reference value or ⩽5 mΩ. The higher value is permissible	4.14 mΩ Max.	passed
	Dielectric Voltage Withstand Test	No breakdown or flashover	No breakdown or flashover	passed
	Insulation Resistance	Not less than 400MΩ	>3.45x10^{11}Ω	passed
	Visual and dimensional examination	Meets requirements of product drawing	No physical damage	passed
Group G	Visual and dimensional examination	Meets requirements of product drawing	No physical damage	passed
	Contact Resistance	Max.5mΩ	2.31 mΩ Max.	passed
	Vibration, Simulated long life random Category 1, Class B	No damage likely to impair function No discontinuities greater than t>1µs	No breakdown or flashover	passed
	Vibration, Random, Category 1, Class B	No damage likely to impair function No discontinuities greater than t>1µs	No breakdown or flashover	passed
	[a] Vibration, Simulated long life random Category 2	No damage likely to impair function No discontinuities greater than t>1µs	No breakdown or flashover	passed
	[a] Vibration, Random, Category 2	No damage likely to impair function No discontinuities greater than t>1µs	No breakdown or flashover	passed

	Shock	No damage likely to impair function. No discontinuities greater than t>1µs	No breakdown or flashover	passed
	Contact Resistance	The change of contact resistance shall be no more than 50 % of the reference value or ⩽5 mΩ. The higher value is permissible	2.14 mΩ Max.	passed
	Visual and dimensional examination	Meets requirements of product drawing	No physical damage	passed
Group H	Visual and dimensional examination	Meets requirements of product drawing	No physical damage	passed
	Contact Resistance (Crimped termination 0.05 to 10mm² not insulate)	Contact resistance at crimping has to be lower than the one specified in EN60352-2, Figure 6	0.094 mΩ Max.	passed
	Pull out force of terminations for Crimped connections	0.14 mm²: 18N Min 2.5 mm²: 230N Min	0.14mm² contact: 28.46N 2.5mm² contact: 313.91N	passed
	Visual and dimensional examination	Meets requirements of product drawing	No physical damage	passed