



HCM650 Insert Series

1. INTRODUCTION

1.1 Purpose

This document provides the qualification summary of TE Connectivity HCM650 insert series of HDC connector.

1.2 Scope

This specification covers the electrical, mechanical, and environmental performance of HCM650 inserts. Testing was performed at the TE Shanghai Electrical Components Test Laboratory.

1.3 Conclusion

Based on the test results, all meet the requirements according to TE Connectivity Design Objectives 108-137074.

1.4 Product Description

Name	Remarks
HCM650-MC	Crimp termination
HCM650-FC	Crimp termination

1.5 Qualification Test Sequence

Test or Examination	Test Group						
	A	B	C	D	E	F	G
	Test Sequence ¹⁾						
Visual and dimensional examination	1,6	1,5	1,3	1,11	1,3	1,8	1,6
Durability of marking	2						
Polarization and coding (If application)	3						
Pull out force of terminations	7 ^a						
Only for Crimped connections							
Contact retention force in insert	4						
Mechanical strength impact	5						
Mechanical Operation (Durability)		3					
Vibration, Random							3
Shock							4
Contact Resistance		2,4		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 (Alternative)				7			
Protection against electric shock					2		

*** 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	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: 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 80Ns 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 Only for crimp contact connection	The conductor shall not slip out of crimp barrel and pull out force as specified in 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	Test load shall be three times the specified insertion force (mating) of one contact, whichever is less. The minimum test load shall not be less than 50 N. No axial displacement likely to impair normal operation. 6.18.2 of EN 61984	Test load applied in axial direction, test speed:20mm/min 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, 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)
2.9	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				
2.10	Contact Resistance	Initial	Max.0.3mΩ	Test current: 1A Measure points 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 m. The higher value is permissible	
2.11	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 60512-5-1 Test 5a

2.12	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
2.13	Insulation Resistance	Not less than 10^{10} MΩ	Test voltage 1000V DC Time:60s IEC 60512-3-1 Test 3a Method B

Environmental

2.14	Cold	No damage likely to impair function 6.6.3;6.8;6;15;6.18.3 of EN 61984	Subject mated specimen to -40°C Duration time:16h, Test Ab Per IEC 60512-11-10 Test 11j (IEC 60068-2-1)
2.15	Dry Heat	No damage likely to impair function 6.6.3;6.8;6;15;6.18.3 of EN 61984	Subject mated specimen to +125°C Duration time:168h Test Bb Per IEC 60512-11-9 Test 11i (IEC 60068-2-2)
2.16	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 Variant 1 IEC 60512-11-12 Test 11m
2.17	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)
2.18	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: 4days (96h) IEC 60512-11-7 Test 11g 7.3.14 of EN 61984
			Alternative: 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
2.19	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 themselves separate tests and are performed on new specimens.

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 still readable	Passed
	Polarisation and coding	require provision against incorrect mating	No damage likely to impair function	Passed
	Contact retention force in insert	No axial displacement likely to impair normal operation when test. Test speed: 20mm/min, min 50N force for each pin or socket. No axial displacement likely to impair normal operation, min 300N 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
	Pull out force of terminations	70mm ² : Minimum 3900N 95mm ² : Minimum 4600N 120mm ² : Minimum 5200N	70mm ² : >6000N 95mm ² : >8000N 120mm ² : >8000N	Passed
	For crimp contact connection	150mm ² : Minimum 6500N 185mm ² : Minimum 8000N	150mm ² : >14000N 185mm ² : >19000N	
Group B	Visual and dimensional examination	Meets requirements of product drawing	No physical damage	Passed
	Contact Resistance	Max. 0.3mΩ	0.053mΩ Max.	Passed
	Mechanical Operation (Durability)	After 500 operation cycles No damage likely to impair normal use	No physical damage	Passed
	Contact Resistance	Deviation of the contact resistance shall be no more than 50% of the initial reference value or 5mΩ	0.079mΩ 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 $\leq 125^{\circ}\text{C}$: 70mm ² current rating: 300A 95mm ² current rating: 340A 120mm ² current rating: 380A 150mm ² current rating: 425A 185mm ² current rating: 440A	70mm ² ΔT : Max 57.92 $^{\circ}\text{C}$ 95mm ² ΔT : Max 42.00 $^{\circ}\text{C}$ 120mm ² ΔT : Max 43.60 $^{\circ}\text{C}$ 150mm ² ΔT : Max 39.60 $^{\circ}\text{C}$ 185mm ² ΔT : Max 45.35 $^{\circ}\text{C}$	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. 0.3m Ω	0.071 m Ω Max.	Passed
	Dielectric Voltage Withstand Test	No breakdown or flashover	No breakdown or flashover	Passed
	Insulation Resistance	Not less than 10 ¹⁰ M Ω	>8.41x10 ¹⁰ 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	Deviation of the contact resistance shall be no more than 50% of the initial reference value or 5m Ω	0.03 m Ω Max.	Passed
	Dielectric Voltage Withstand Test	No breakdown or flashover	No breakdown or flashover	Passed
	Insulation Resistance	Not less than 10 ¹⁰ M Ω	>5.88x10 ¹¹ Ω	Passed
Group E	Visual and dimensional examination	Meets requirements of product drawing	No physical damage	Passed
	Protection against electric shock	No live part shall be accessible	No live parts was accessible.	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. 0.3mΩ	0.039 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	Deviation of the contact resistance shall be no more than 50% of the initial reference value or 5mΩ	0.03 mΩ Max.	Passed
	Dielectric Voltage Withstand Test	No breakdown or flashover	No breakdown or flashover	Passed
	Insulation Resistance	Not less than 10 ¹⁰ MΩ	>10.08x10 ¹⁰ 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. 0.3mΩ	0.68 mΩ Max. [Include additional resistances from 1.5m cable volume resistance and two contact crimping resistances.]	Passed
	Vibration, Random	No damage likely to impair function; No discontinuities greater than t>1μs	No physical damage; No electrical discontinuity greater than 1 μs	Passed
	Shock	No damage likely to impair function; No discontinuities greater than t>1μs	No physical damage; No electrical discontinuity greater than 1 μs	Passed
	Contact Resistance	Deviation of the contact resistance shall be no more than 50% of the initial reference value or 5mΩ	0.88 mΩ Max. [Include additional resistances from 1.5m cable volume resistance and two contact crimping resistances.] ΔR: 0.2 mΩ	Passed
	Visual and dimensional examination	Meets requirements of product drawing	No physical damage	Passed