Qualification Test Report Of EP.200 Connector

1. INTRODUCTION

Test was performed on EP.200 connector to qualify the part which was developed for Whirlpool.

Test was performed at TE Shanghai Electrical Test Laboratory per Whirlpool C4 test requirement.

(Test item: 7.5.3.1, 7.5.3.2, 7.5.3.4, 7.5.3.5, 7.11, 7.12.2)

Customer
requirement

2. TEST SPECIMENS

Description	P/N	Part Revision
EP.200 Header Assembly	3-1744037-6	1
EP.200 Plug Housing	2-1744036-6	1
EP.200 Receptacle Contact	1123721-1	T

3. TEST CONDITIONS

Unless otherwise specified, all the test shall be performed in any combination of the following test conditions.

Temperature	15 ~ 35ºC
Relative Humidity	25 ~ 75%

4. TEST RESULT

4.1 Mating Force / Un-mating Force

Spec:

7.5.3.1 Mating force: 15.6N max. per contact ;

7.5.3.2 Un-mating force: 8.9N min. per contact

7.5.3.1 First Connect Force: The force required to mate the plug or connector shall not exceed 15.6 N (3.5 lbs.) per terminal. If the first connect force does exceed 133N (30 lbs.) a process tool should be used.

7.5.3.2 Disconnect Strength: The minimum force required to disengage a mating pair of fully loaded connectors (w/o positive locking features in connector block) after complete engagement is 8.9 N (2 lbs.) per terminal with a maximum of 89 N (20 lbs.) for the entire connector. For connectors with less than 3 terminals a minimum force of 22.2 N (5 lbs.) to disconnect the entire connector. In the case of connectors that utilize an external-locking device that provides a minimum 89 N (20 lbs.) disengagement force, the disengagement force requirements for the terminals may be waived. Positive locking devices of mating parts shall be designed to permit unlocking with ease.

Test Result: (Unit: N)

sample	mating force	unmating force
1	44.66	33.68
2	45.78	34.05
3	44.67	34.38
4	42.05	35.83
5	42.23	32.97
Max	45.78	35.83
Min	42.05	32.97
Ave	43.88	34.18
Spec	93.6N Max.	53.4N~89N
Judged	Meet spec	Don't meet spec

From the test result, all samples can meet the mating force spec, but can not meet un-mating force spec. We suggest to follow TE specification. (2.1N min. per contact)

4.2 Terminal Retention Force

7.5.3.4 Spec : (80N min.)

7.5.3.4 Terminal Retention Force: The minimum force allowed to disengage a terminal from its housing is 80N (18 lbs.)

Test Result: (Unit: N)

sample	extraction force
1	73.59
2	72.57
3	78.90
4	72.63
5	72.74
6	74.01
Max	78.90
Min	72.63
Ave	74.07

From the test result, all samples can not meet the retention force spec. We suggest to follow TE specification (29.4N min. per contact)

4.3 Terminal insertion Force

7.5.3.5 Spec : (13.35N max.)

7.5.3.5 Terminal Engagement Force: The maximum force allowed to engage a terminal into its housing is 13.35N (3.0 lbs.) Exceptions will be made for dual terminated wires and terminals in which the smallest allowable conductor size is 18-ga. wire. The maximum force allowed for these exceptions is 27N (6 lbs.)

Test Result: (Unit: N)

sample	insertion force
1	6.30
2	6.24
3	6.30
4	6.86
5	6.73
6	6.76
Max	6.86
Min	6.24
Ave	6.53

From the test result, all samples can meet the insertion force spec.

4.4 Terminal Resistance

7.11 Spec: (3 milliohms initial and 4.5 milliohms max. after 10 cycles durability.)

7.11 Mating Terminal Resistance for Refrigeration and Room Air Applications

7.11.1 The initial terminal resistance of a pair of mating terminals is expected to be near 3 milliohms, but shall not be greater than 4.5 milliohms. This is a dry circuit resistance.

7.11.2 The maximum resistance of a pair of mating terminals after the tenth engagement shall not be greater than 4.5 milliohms.

7.11.3 This resistance shall be measured from points three inches from the wire crimp of the terminals along the associated wires. Subtract the conductor resistance by checking the resistance of one foot of the test sample wire. The connector resistance can be calculated by subtracting the calculated wire resistance (1/2 of the resistance of one foot of wire) from the overall measured resistance.

Initial LLCR

	3-1	3-2	3-3	3-4	3-5
1	1.11	1.30	1.16	1.15	1.52
2	0.98	1.20	1.12	1.14	1.38
3	0.98	0.98	1.05	1.09	1.36
4	1.04	1.10	1.06	0.99	1.35
5	1.24	1.12	1.04	1.02	1.17
6	1.14	1.03	1.11	1.08	1.17
max	1.24	1.30	1.16	1.15	1.52
min	0.98	0.98	1.04	0.99	1.17
ave	1.08	1.12	1.09	1.08	1.32
max	1.52				
min	0.98				
ave	1.14				

Final LLCR

UNIT:(mΩ)	3-1	3-2	3-3	3-4	3-5
1	1.28	1.24	1.35	1.15	1.27
2	1.09	1.15	1.24	1.02	1.35
3	1.17	1.15	1.19	1.29	1.34
4	1.39	1.17	1.11	1.10	1.53
5	1.07	1.27	1.06	1.11	2.32
6	1.41	1.58	1.40	1.24	2.31
max	1.41	1.58	1.40	1.29	2.32
min	1.07	1.15	1.06	1.02	1.27
ave	1.23	1.26	1.22	1.15	1.69
max	2.32				
min	1.02				
ave	1.31				

From the test result, all samples can meet the LLCR spec.

4.5 Environment Test

7.12.2 Spec: (LLCR meet spec after environment test.)

7.12.2 Environmental Test for Refrigeration and Room Air Applications:

7.12.2.1 Samples of the terminal under test with leads attached shall be subjected to the following environmental tests. An initial milliohm measurement will be taken. This initial measurement shall use the method outlined in section 7.11.

A) 96 hours at 70°C and 0 to 10% R.H.
B) 96 hours at -40°C.
C) 96 hours at 40°C and 96 ± 2 % R.H. (Current leakage shall be measured between any two adjacent terminals at the end of this test and connectors with greater than 0.5 mA @ 120 VAC should not be used in moist areas. This should be noted in the report).

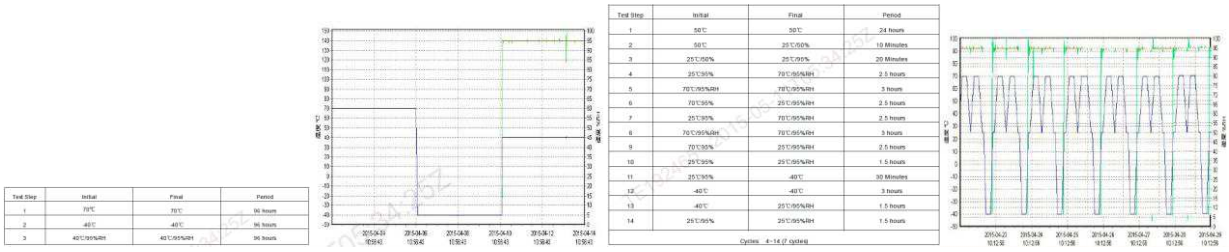
7.12.2.2 Samples of the terminal under test with leads attached shall be subjected to the following environmental cycling test for 7 complete cycles.

A) Transition from 25°C to 70°C / 96 ±2 % R.H. 2.5 hours
B) Steady state at 70°C / 96 ±2 % R.H. 3.0 hours
C) Transition from 70°C to 25°C / 96 ±2 % R.H. 2.5 hours
D) Transition from 25°C to 70°C / 96 ±2 % R.H. 2.5 hours
E) Steady state at 70°C / 96 ±2 % R.H. 3.0 hours
F) Transition from 70°C to 25°C / 96 ±2 % R.H. 2.5 hours
G) Steady state at 25°C / 96 ±2 % R.H. 1.0 hours
H) Transition from 25°C to -40°C uncontrolled R.H. 1.5 hours
I) Steady state at -40°C uncontrolled R.H. 3.0 hours
J) Transition from -40°C to 25°C uncontrolled R.H. 1.5 hours
K) Steady state at 25°C / 96 ±2 % R.H. 1.0 hours

7.12.2.3 Following the tests outlined in sections 7.12.2.1 and 7.12.2.2, the terminal resistance shall not exceed 4.5 milliohms (see Section 7.11 for measurement procedure). The connectors shall not be damaged electrically or mechanically.

Initial LLCR

Unit:(mΩ)	4-1	4-2	4-3	4-4	4-5
1	1.20	1.19	1.08	1.30	1.14
2	1.13	1.27	1.09	1.15	1.11
3	1.05	1.18	1.07	1.00	1.03
4	1.17	0.83	0.99	1.15	1.08
5	1.11	1.12	1.17	1.11	1.12
6	1.31	1.19	0.78	1.24	1.06
max	1.31	1.27	1.17	1.30	1.14
min	1.05	0.83	0.78	1.00	1.03
ave	1.16	1.13	1.03	1.16	1.09
max	1.31				
min	0.78				
ave	1.11				



Final LLCR

Pin	4-1	4-2	4-3	4-4	4-5
1	1.32	1.28	1.79	1.30	1.34
2	1.28	1.35	1.38	1.38	1.20
3	1.38	1.30	1.55	1.42	1.24
4	1.41	1.34	1.36	1.36	1.27
5	1.51	1.73	1.66	1.66	1.40
6	1.48	1.57	1.41	1.44	1.16
max	1.51	1.73	1.79	1.66	1.40
min	1.28	1.28	1.36	1.30	1.16
ave	1.39	1.43	1.53	1.43	1.27
max	1.79				
min	1.16				
ave	1.41				

From the test result, all samples can meet the LLCR spec after environment test and no visual change or breakdown was found after the test.

5. Summary

Most of test item can meet customer requirement, only item 7.5.3.2 and 7.5.3.4 failed, we suggest customer to follow TE specification for this connector

Item	Content	Customer C4 test requirement	Result	Remark
7.5.3.1	Mating force	15.6N max.per contact	Pass	
7.5.3.2	Un-mating force	8.9N min.per contact	Fail	Suggest to follow TE specification(108-5609), spec:2.1N min
7.5.3.4	Terminal retention force	80N min.	Fail	Suggest to follow TE specification(108-5609), spec:29.4N min
7.5.3.5	Terminal insertion force	13.35N max.	Pass	
7.11	Terminal resistance	3 milliohms initial and 4.5 milliohms max. after 10 cycles durability.	Pass	
7.12.2	Environment test	3 milliohms initial and 4.5 milliohms max. after Environment test.	Pass	