



**Power Key (PK) 5.0mm Cap Housing Using Additive Manufacturing Process**

**1. SCOPE**

1.1. Content

This specification covers performance tests and quality requirements for the TE Connectivity Power Key (PK) 5.0mm Cap housing using additive manufacturing process. The PK 5.0 cap housing is a wire-to-wire (WTW) application featuring crimp termination technology on 5.0mm centerlines. The 3D printed housing is designed to mate with the existing injection molded PK 5.0 Plug system and integrates the use of specifically designed tab and receptacle contacts for 20-16 AWG wire range. This printed cap housing is available in a multiple single row and double row configuration with universal keying. The PK 5.0 Cap housing is compliant to glow wire standards.

1.2. Qualification

When tests are performed on the subject product line, procedures specified in Figure 2 shall be used. All inspections shall be performed using the applicable inspection plan and product drawing.

**2. APPLICABLE DOCUMENTS AND FORMS**

The following documents form a part of this specification to the extent specified herein. Unless otherwise specified, the latest edition of the document applies. In the event of conflict between the requirements of this specification and the product drawing, the product drawing shall take precedence. In the event of conflict between the requirements of this specification and the referenced documents, this specification shall take precedence.

2.1. TE Connectivity Specifications

- [114-5292](#) PK Application Specification
- [114-5175](#) Power Double Lock (PDL) Application Specification
- [501-134148](#) Qualification Test Report

2.2. Commercial Standards and Specifications

- EIA-364 Electrical Connector/Socket Test Procedures Including Environmental Classifications
- IEC 60335 Household and similar electrical appliances

2.3. Reference Documents

- [102-950](#) Qualification of Separable Interface Connectors
- [109-1](#) General Requirements for Testing
- [108-5699](#) Power Key (PK) 5.0 Wire-To-Board Product Specification

**3. REQUIREMENTS**

3.1. Design and Construction

Product shall be of the design, construction, materials, and physical dimensions specified on the applicable product drawing.

3.2. Materials

Materials used in the construction of this product shall be as specified on the applicable TE drawing.

3.3. Ratings

- A. Voltage Rating: 300V AC
- B. Current Rating: See Figure 1 for applicable current carrying capability. Maximum rated current that can be carried by this product is limited by maximum operating temperature of the housings (105°C) and temperature rise of the housings (30°C). Variables to be considered for each application are wire size, connector size, contact material, and ambient temperature.

Tab Contact: 177917-1, Receptacle Contact: 1376347-1	Cap Housing: 2407038-3/4, 2408508-6		
Wire Size	16awg	18awg	20awg
3P	9A	7A	6A
4P	9A	7A	6A
6P (Dual Row)	9A	7A	6A

**Figure 1 Regular PK 5.0 Current Rating**

Values are based on initial Temperature Rise versus Current Testing and are intended to be a guide in the selection of a connector family. All applications should be tested by the end user. The values listed are per circuit for fully loaded housings being 100% energized. Note: All combinations were not tested, and this chart contains interpolated and extrapolated values. Wire length follow EIA-364-70. The customer should fully test all applications.

- C. Temperature Rating: -40°C to +105°C (The upper limit of the temperature includes the temperature rising by energized current.)

3.4. Performance Requirements and Test Description

The product should meet the electrical, mechanical, and environmental performance requirements specified in Figure 2. All tests shall be performed at ambient environmental conditions otherwise specified.

3.5. Test Requirements and Procedure Summary

Test Description	Requirement	Procedure
Initial Examination of Product	Meets requirements of product drawing and Application Specification 114-5175 (PDL) and Application Specification 114-5292 (PK)	EIA-364-18. Visual and dimensional inspection per product drawing.
Final Examination of Product	Meets visual requirements.	EIA-364-18. Visual examination.
<b>Electrical</b>		
Low Level Contact Resistance (LLCR)	10 milliohms maximum initial. 20 milliohms maximum final.	EIA-364-23. Subject mated contacts assembled in housing to 100 milliamperes and 20 millivolts maximum open circuit voltage. Subtract bulk wire resistance from measurements
Insulation Resistance	1000 MΩ minimum initial. 500 MΩ minimum final.	EIA-364-21. Apply voltage 500 V DC. Test between adjacent circuits, between the surface of housing, and contact of mated connectors.

Test Description	Requirement	Procedure
Dielectric Withstanding Voltage	2.2k VAC for 1 minute hold with no creeping discharge nor flashover shall occur. 5.0 milliamperes maximum leakage current.	EIA-364-20, Condition I. Test between adjacent circuits, between the surface of housing, and contact of mated connectors.
Temperature Rise vs. Current	30°C maximum temperature rise.	EIA-364-70, Method 1. With DC. Measure temperature rising by energized current. Subject measurement must be taken at the place of no influence from convection of air. Contacts to be assembled in housing with all circuits connected. Stabilize at a single current level until 3 readings at 5 minutes intervals are within 1°C. See Figure 1.
<b>Mechanical</b>		
Sinusoidal Vibration	No discontinuities of 1 microsecond or longer duration. No physical damage that would impair product performance.	EIA-364-28, Test Condition I Subject mated specimens to 10 to 55 to 10Hz traversed in 1 minute with 1.52 mm maximum total excursion. Two hours in each of 3 mutually perpendicular planes. 100 mA applied. Mounting: See Fig. 4
Mechanical Shock	No discontinuities of 1 microsecond or longer duration. No physical damage that would impair product performance.	EIA-364-27, Test Condition A Accelerated Velocity: 490 m/2 (50G) Waveform: Half sine curve Duration: 11 m sec. Velocity Change: 3.4 m/s Number of Drops: 3 drops each to normal and reversed directions of X.Y and Z axes, totally 18 drops.
Durability	No physical damage that would impair product performance.	EIA-364-9. Mate and unmate specimens for 25 cycles at a maximum rate of 500 cycles per hour.
Connector Mating Force	9.8×Pos N Max.	EIA-364-13, Method A Measure force necessary to mate specimens with latch disengaged. Operation Speed: 100 mm/min.
Connector Unmating Force	1.47×Pos N Min.	EIA-364-13, Method A. Measure force necessary to unmate specimens with latch disengaged. Operation Speed: 100 mm/min.
Connector Locking Strength	29.4N (3.0 kgf) minimum.	EIA-364-98. Measure connector locking strength. Operation Speed: 100 mm/min.

Test Description	Requirement	Procedure
Contact Insertion Force	12N (0.9kgf) maximum per Contact	EIA-364-5 Measure the force required to insert contact into housing. Operation Speed: 100 mm/min.
Contact Retention Force	39.2N (4Kgf) Minimum per Contact	EIA-364-29 Apply an axial pull-off load to crimped wire. Use the wire of AWG #16 or AWG #18. Operation Speed: 100 mm/min.
<b>Environmental</b>		
Thermal Shock	No physical damage that would impair product performance.	EIA-364-32, Test Condition I. Subject mated specimens to 25 cycles between -55°C and 85°C with 30 minutes dwells at temperature extremes and 15 minute manual transition between temperatures.
Humidity/temperature Cycling	No physical damage that would impair product performance.	EIA-364-31, Method IV. Subject specimens to 10 cycles (10 days) between 25° and 65°C at 90 to 95% RH. Cold Shock not performed. The measurement is held after being left at ambient temperature for 3 hours. 1 cycle is 24 hours.
Temperature Life (Heat aging)	No physical damage that would impair product performance.	EIA-364-17, Method A, Test Condition 4, Test Time Condition A. Subject mated specimens to 105±2°C for 96 hours.
Salt Spray	No corrosion influence performance.	EIA-364-26. Subject mated specimens to 5±1% salt concentration for 48 hours. The measurement is held after being left indoor for 3 hours.
Resistance to Cold	No physical damage that would impair product performance.	EIA-364-59 Mated connectors, -40±2°C, 96 hours
Glow Wire Test 750°C	Perform visual check and take picture after the test.	IEC 60695-2-11 and IEC 60335-1 No flame or Te-Ti<2s. Temperature: 750. Duration of glow tip application, energize 30s. Total test time: 60s.

**Figure 2**



**NOTE**

*Shall meet visual requirements, show no physical damage, and meet requirements of additional tests as specified in the Product Qualification and Requalification Test Sequence shown in Figure 2 & 3.*

3.6. Product Qualification and Requalification Test Sequence

TEST OR EXAMINATION	1	2	3	4	5	6	7	8
	Initial examination of product	1	1	1	1	1	1	1
LLCR	3,7				2,5(c),7(c),9		2,4	2,4
Dielectric withstanding Voltage		3,7						
Insulation resistance		2,6						
Temperature Rise vs. current					3,10			
Sinusoidal vibration	5				8			
Mechanical shock	6							
Durability	4							
Connector Mating force	2			3				
Connector Un-mating force	8			4				
Connector locking strength						2		
Contact insertion force				2				
Contact retention force				5	11			
Glow wire test			2					
Thermal shock		4						
Humidity/temperature cycling		5			4			
Temperature life (Heat Aging)					6			
Salt spray							3	
Resistance to Cold								3
Final examination of product	9	8	3	6	12	3	5	5

Figure 3



**NOTE**

- (a) See paragraph 4.2.
- (b) Numbers indicate sequence in which tests are performed.
- (c) Optional measurements used for verification/failure identification purposes.

**4. QUALITY ASSURANCE PROVISIONS**

4.1. Test Conditions

Unless otherwise specified, all the tests shall be performed in any combination of the following test conditions shown in Figure 6.

Temperature	15°C – 35°C
Relative Humidity	45% – 75%
Atmospheric Pressure	86.6 – 106.6 kPa

**Figure 6**

4.2. Qualification Testing

A. Specimen Selection

Specimens shall be prepared in accordance with applicable instruction sheets and shall be selected at random from current production.

B. Test Sequence

Qualification inspection shall be verified by testing specimens as specified in Figure 2 and 3.

4.3. Requalification Testing

If changes significantly affecting form, fit, or function are made to the product or manufacturing process, product assurance shall coordinate requalification testing, consisting of all or part of the original testing sequence as determined by development/product, quality and reliability engineering.

4.4. Acceptance

Acceptance is based on verification that the product meets the requirements in Figure 2. Failures attributed to equipment, test setup, or operator deficiencies shall not disqualify the product. If product failure occurs, corrective action shall be taken, and specimens resubmitted for qualification. Testing to confirm corrective action is required before resubmittal.

4.5. Quality Conformance Inspection

The applicable quality inspection plan shall specify the sampling acceptable quality level to be used. Dimensional and functional requirements shall be in accordance with the applicable product drawing and this specification.