AMPACT* Permanent Grounding Copper Taps

1. SCOPE

1.1. Content

This specification covers performance, tests and quality requirements for AMPACT* copper taps used on generating plants, transmission or distribution substation grounding. This specification particularly addresses connectors used within grid systems, connections to join ground leads to grid system and connectors used to join ground leads to equipment and structures. Taps are designed to accommodate combinations of conductors from 8 AWG through 500 kcmil (10 mm^2 through 253 mm^2) copper or COPPERWELD® conductor with appropriate part number selection to related conductor diameters in inches or millimeters. Requirements of this specification shall meet or exceed those of IEEE 837: 1989 for conductor sizes up to 4/0 AWG. Taps shall also be approved to UL 467: 1993 for conductor sizes up to 500 kcmils.

1.2. Definitions

For the purpose of this specification, the following definitions shall apply:

- AMPACT copper tap: Consists of "C" member and wedge installed on appropriate conductors.
- "C" member: Consists of copper alloy such as A1 bronze or chrome copper with spring characteristics and is intended to accept a wedge.
- Wedge: Consists of copper alloy with high ductility and conductivity and is intended to be inserted into "C" member along with appropriate conductors to form AMPACT copper tap.

1.3. Qualification

When tests are performed on the subject product line, procedures specified in Figure 1 shall be used. All inspections shall be performed using the applicable inspection plan and product drawing.

1.4. Qualification Test Results

Successful qualification testing on the subject product line was completed in Dec98. The Qualification Test Report number for this testing is 501-47007. This documentation is on file at and available from Engineering Practices and Standards (EPS).

2. APPLICABLE DOCUMENTS

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 (TE) Documents

- 109-1: General Requirements for Test Specifications
- 109 Series: Test Specifications as indicated in Figure 1
- 501-47007: Qualification Test Report

2.2. Commercial Standards

- IEEE 837; 1989: Qualifying Permanent Connections Used in Substation Grounding
- UL 467; 1993: Grounding and Bonding Equipment

3. REQUIREMENTS

3.1. Design and Construction

Product shall be of the design, construction 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 product drawing.

3.3. Ratings

Limited by rating of cable used.

3.4. Performance and Test Description

Product is designed to meet the electrical, mechanical and environmental performance requirements specified in Figure 1. Unless otherwise specified, all tests are performed at ambient environmental conditions per AMP Specification 109-1.

3.5. Test Requirements and Procedures Summary

Test Description	Requirement	Procedure
Examination of product.	Meets requirements of product drawing.	Visual, dimensional and functional per applicable quality inspection plan.
ELECTRICAL		
Termination resistance.	Shall show stability and shall not increase by more than 150% from initial value.	TE Spec 109-25. Measurements shall be made with conductor temperature at ambient and taken across each tap between potential points located in the center of the equalizer adjacent to the connector or at measurement point on the solid conductor. Current level shall be of sufficient low magnitude dc to avoid heating of the test sample. Ambient temperature shall be measured concurrently with each set of resistance measurements and resistance shall be corrected to 20°C.

Figure 1 (continued)

Test Description	Requirement	Procedure
Current-temperature cycling.	Temperature of the tap shall not exceed the temperature of the control conductor. See Note.	TE Spec 109-13012. Subject taps to 25 cycles at sufficient current to raise the temperature of the control conductor to 350°C for 60 minutes ON followed by current OFF until the sample temperature returns to room ambient. Temperature measurements shall be taken on all taps and control conductor near the end of the current ON cycle initially and every 5 cycles thereafter. Termination resistance shall be measured initially and after every 5 cycles during the OFF cycle after samples have returned to room ambient.
Fault current.	See Note.	TE Spec 109-13016-1. Subject samples to 3, 10 second fault current surges at 90% of the fusion current established in accordance with IEEE 837: 1989.
Electromagnetic withstanding strength.	See Note.	TE Spec 109-13016-2. Subject samples to 3, 0.2 second fault current surges at 80% of the fusion current established in accordance with IEEE 837: 1989.
MECHANICAL		
Mechanical pullout.	See Figure 4.	TE Spec 109-13015. Subject samples to mechanical pullout at rate of 1/4 inch per minute per foot of sample length.
ENVIRONMENTAL		
Freezing, thawing.	See Note.	TE Spec 109-13013. Subject samples submerged a minimum of 1/2 inch under water to 10 cycles between -10 and 20°C with 2 hours at each extreme. After cycling, samples shall be subjected to 100°C for 1 hour and then returned to room ambient.
Corrosion, salt spray.	See Note.	TE Spec 109-13010. Subject samples to 5% salt spray atmosphere for 500 hours. After cycling, samples shall be washed in fresh water and subjected to 100°C for 1 hour prior to inspection.

Figure 1 (continued)

Test Description	Requirement	Procedure
Corrosion, nitric acid.	See Note.	TE Spec 109-13014. Submerge samples in 10% nitric acid solution until control conductor is reduced 20% from original cross section size. After submersion, samples shall be washed in fresh water and subjected to 100°C for 1 hour.

NOTE *Shall meet visual requirements, show no physical damage and shall meet requirements of additional tests as specified in the Test Sequence in Figure 2.*

Figure 1 (end)

3.6. Product Qualification and Requalification Test Sequence

Test or Examination	Test Group (a)			
	1	2	3	4
	Test Sequence (b)			
Examination of product	1,11	1,11	1,3	1,5
Termination resistance (c)	2,4,6,8,10	2,4,6,8,10		2,4
Current cycling	3	3		
Fault current	9	9		
Electromagnetic withstanding strength				3
Mechanical pullout			2	
Freezing, thawing	5	5		
Corrosion, salt spray		7		
Corrosion, nitric acid	7			

NOTE
(a) See paragraph 4.1.A.
(b) Numbers indicate sequence in which tests are performed.
(c) Measurements shall be made throughout current cycling per Figure 1.

Figure 2

4. QUALITY ASSURANCE PROVISIONS

4.1. Qualification Testing

A. Sample Selection

Taps shall be selected at random from current production and prepared in accordance with applicable Instruction Sheets and Figure 3. Test groups 1, 2 and 4 shall be assembled with current equalizers on each side of the tap at distances per Figure 3. Thermocouple shall be attached to the tap at the center of the wedge. Test group 3 shall be prepared with lead lengths per Figure 3. Control conductor shall be prepared with current equalizers and thermocouple attached.

Wire or Cable	Minimum Length (Inches) Test Group 1, 2 and 4	Minimum Length (Inches) Test Group 3
2/0 AWG	12	14
Over 2/0 to 4/0 AWG	24	18

Figure 3

B. Test Sequence

Qualification inspection shall be verified by testing samples as specified in Figure 2.

4.2. 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.

4.3. Acceptance

Acceptance is based on verification that the product meets the requirements of Figure 1. Failures attributed to equipment, test setup or operator deficiencies shall not disqualify the product. When product failure occurs, corrective action shall be taken and samples resubmitted for qualification. Testing to confirm corrective action is required before resubmittal.

4.4. Quality Conformance Inspection

The applicable quality inspection plan will 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.

Wire or Cable Size	Minimum Pullout Strength (Lbs)
8 AWG	150
6 AWG	300
5 AWG	300
4 AWG	300
3 AWG	300
2 AWG	300
1 AWG	300
1/0 AWG	300
2/0 AWG	500
3/0 AWG	500
4/0 AWG	500

Figure 4