



Terminal, MAG-MATE*, Standard Series, .500 Box Height

1. SCOPE

1.1. Content

This specification defines performance, tests, and quality requirements for the Mag-Mate .500 box terminals. These terminals are designed for general use as a magnet wire to external circuit interface and are compatible with copper wire in sizes 11AWG[2.30mm] through 23 AWG[0.57mm] or Al wire in Size 11AWG[2.30mm] through 23AWG[0.57mm]. Coating of organic polymer material having NEMA temperature rating of 105°–200°C.

1.2. 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.

1.3. Qualification Test Results

Successful Copper wire qualification testing on the subject product line was completed in May89. The Qualification Test Report number for this testing is 501-89.

Successful Aluminum wire qualification testing on the subject product line was completed in JULY 2018. The Qualification Test Report number for this testing is 501-106356.

Successful Strain relief slot qualification testing on the subject product line was completed in JULY 2018. The Qualification Test Report number for this testing is 501-134084.

Successful special leaf contact qualification testing on the subject product line was completed between 22Aug18 and 21Oct18. The Qualification Test Report number for this testing is 501-134087.

1.4. Revision Summary

Revisions to this release of the product specification include:

- Updated Figure 3.
- Update wire size range in Paragraph 1.1.

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

- 114-2066 Application Specification - Terminal, MAG-MATE Standard Series, .500 Box Height
- 501-89 Qualification Test Report for copper wire - Terminal, MAG-MATE Standard Series, .500 Box Height
- 501-106356 Qualification Test Report for Aluminum wire - Terminal, MAG-MATE Standard Series, .500 Box Height
- 501-134084 Qualification Test Report for Series 500 MAG-MATE Terminal with 12.7mm [.500 in.] Box height and strain relief slot
- 501-134087 Qualification Test Report for MAG-MATE 500 Series Special Leaf Contact

2.2. Commercial Standards and Specifications

- IEC 60512 International Standard – Connectors for Electronic Equipment – Tests and Measurements

EIA-364 Electrical Connector/Socket Test Procedures Including Environmental Classifications

2.3. Reference Documents

- 109-1 General Requirements for Testing
- 109-197 AMP Test Specifications vs. EIA and IEC Test Methods
- 109-Series TE Test Specifications as indicated in Figure 1

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.

- A. Terminal: Brass, post-tin plated, with or without varnish release coating
- B. Housing: Polyester, nylon or equivalent
- C. Wire: (1) Conductor: copper or Aluminum
(2) Insulation: polyester with poly-imide overcoat

3.3. Ratings

- A. Voltage: Meets all standard industry applied winding voltage rating requirements
- B. Current: Meets all standard industry applied wire size current rating requirements
- C. Temperature: -65°C up to +150°C (based on terminal material)

3.4. Performance Requirements and Test Description

The product should meet the electrical, mechanical and environmental performance requirements specified in Figure 1. All tests shall be performed at ambient environmental conditions otherwise specified.

3.5. Test Requirements and Procedure Summary

Test Description	Requirement	Procedure
Examination of Product	Meets requirements of product drawing and TE Specification 114-2066.	Visual, dimensional and functional per applicable inspection plan.
Electrical		
Termination Resistance, Dry Circuit	$\Delta R = 0.5 \text{ m}\Omega \text{ Max}$	EIA 364-23 Subject terminals assembled in housing to 20 mV open circuit at 100 mA maximum. See Figure 4.
Termination Resistance, Specified Current	$\Delta R = 0.5 \text{ m}\Omega \text{ Max}$	EIA 364-6 and IEC 60512-2-2 Measure potential drop of mated terminals assembled in housing. See Figure 3, Figure 4, and Figure 5.
Current Cycling	Termination resistance at stated test current. See Figure 3, Figure 4 and Figure 5.	EIA 364-55 Subject termination to 480 cycles, 15 minutes "ON" and 15 minutes "OFF". See Figure 3 for test current.

Figure 1 (continued)

Mechanical		
Insertion Force	130 pounds maximum for terminating into plastic housing. (Polyester 30% glass filled.)	109-41 Measure force to terminate terminal into plastic housing cavity.
Extraction Force	14 pounds minimum. (Polyester 30% glass filled.)	109-41 Measure force required to pull terminated terminal out of cavity.
Environmental		
Thermal Shock	Termination resistance, dry circuit, see Figure 3 and Figure 4. No physical damage.	EIA 364-32 and IEC 60512-11-4 Subject terminations to 25 cycles between -65° and 125°C.
Humidity-Temperature Cycling	Termination resistance, dry circuit, see Figure 3 and Figure 4. No physical damage.	EIA 364-31, IEC 60512-11-3, and IEC 60512-11-2 Subject terminations to 10 humidity temperature cycles between 25° and 65°C at 95% RH.
Temperature Life, Heat Age	Termination resistance, dry circuit, see Figure 3 and Figure 4. No physical damage.	EIA 364-17 and IEC 60512-11-9 Subject terminations to 118°C for 33 days.

Figure 1 (end)



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.

3.6. Product Qualification and Requalification Test Sequence

TEST OR EXAMINATION	TEST GROUP (a)		
	1 (c)	2	3
	TEST SEQUENCE (b)		
Examination of Product	1, 9	1, 5	1
Termination Resistance, Dry Circuit	2,4, 6,8		
Termination Resistance, Specified Current		2, 4	
Current Cycling		3	
Insertion Force			2
Extraction Force			3
Thermal Shock	3		
Humidity-Temperature Cycling	7		
Temperature Life, Heat Age	5		

Figure 2



NOTE

(a) See paragraph 4.2.

(b) Numbers indicate sequence in which tests are performed.

(c) Alternate sequence for Test Group 1: Examination of Product, Termination Resistance (Dry Circuit), Temperature Life, Humidity-Temperature Cycling, Thermal Shock, Termination Resistance (Dry Circuit), Examination of Product.

3.7. Current Cycling Test Currents

WIRE SIZE (AWG[mm])	Current Cycling			
	Copper		Aluminum	
	Resistance (milliohms max)	Test Current (amperes) See Note (a)	Resistance (milliohms max)	Test Current (amperes) See Note (a)
11[2.30]	—	—	—	37.5
12[2.05]	—	48.0	—	33.5
13[1.83]	—	42.0	—	29.0
14[1.63]	—	37.0	—	25.5
15[1.45]	—	32.0	—	22.0
16[1.29]	—	28.0	—	19.5
17[1.15]	1.4	22.0	2.9	15.0
18[1.02]	1.8	20.0	3.6	13.5
19[0.91]	2.2	18.0	4.4	12.0
20[0.81]	2.7	16.0	5.5	11.0
21[0.72]	3.5	14.0	7.0	9.5
22[0.64]	4.3	12.5	8.6	8.5
23[0.57]	4.6	11.0	9.1	7.5

Figure 3

i **NOTE**
 (a) Current which produces 100°C initial temperature on the magnet wire. Average reading from 3 thermocouples equally spaced on 12 inch length of magnet wire.

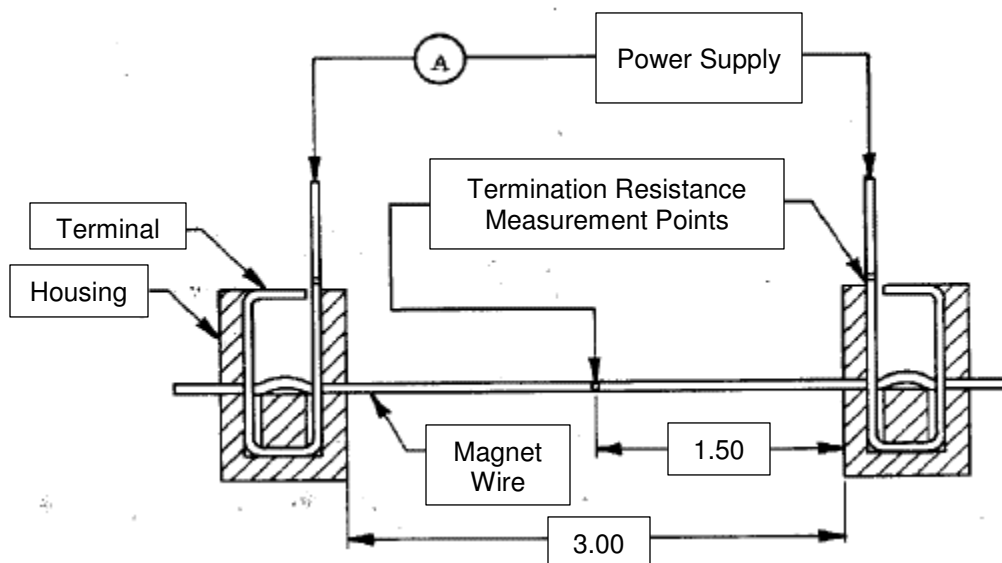


Figure 4: Temperature and Termination Resistance Measurement Points, Typical Standard Setup for Single Wire Terminations

i **NOTE**
 (a) Terminal resistance equals millivolts divided by test current.

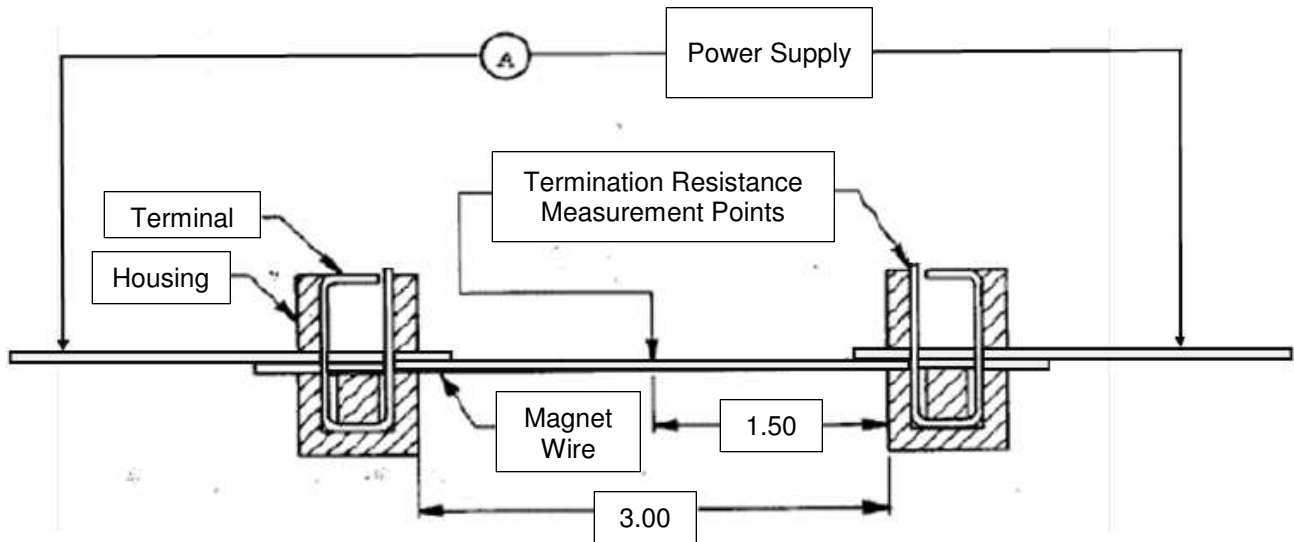


Figure 5: Alternate Setup for Double Wire Terminations

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. Each group shall consist of 10 interconnect termination assemblies per magnet wire size. All terminals shall be terminated in accordance with TE Specification 114-2066.

B. Test Sequence

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

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

- A. Test results from development on pre-qualification samples will be used to determine upper and lower one-sided statistical tolerance limits for 99% reliability at 95% confidence, as follows. Let \bar{X} and s denote the sample average and standard deviation, respectively, of the test data. Let k denote the normal distribution one-sided tolerance factor for 95% confidence and 99% reliability. The value of k varies with sample size. Values of k are given in various tables, for example, NBS Handbook 91, Factors for One-Sided Tolerance Limits for Normal Distribution. Suitability of the normal distribution for representing the data shall be verified with normal probability plots, goodness of fit tests, etc.

Then the upper one-sided tolerance limit for 99% reliability at 95% confidence is given by $\bar{X} + ks$. The interpretation of this tolerance limit is as follows: based on the test data, and assuming a normal distribution for the test data, we can be 95% confident that 99% of the population of values represented by the sample data will not exceed $\bar{X} + ks$. For any test parameter for which there is specified an upper requirement which is not to be exceeded, satisfactory performance of the product is achieved when the value of $\bar{X} + ks$ does not exceed the requirement value.

The lower one-sided tolerance limit for 95% confidence and 99% reliability is given by $\bar{X} - ks$. This has a similar interpretation and corresponding application to lower requirement values.

- B. 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.