

**Sample Tag No.:** F240873616  
**Labware Project No.:** 1002270886  
**File No.:** E363753  
**Vol No.:** 1  
**Issued Date:** 2024-06-17

## Follow-Up Sample Test Report

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**Applicant:** LIOA ELECTRIC EQUIPMENT CO LTD  
**Address:** DINH DU COMMUNE  
VAN LAM DISTRICTHUNGYEN  
160000  
Vietnam  
**Party Site Number:** 543191

**Manufacturer:** LIOA ELECTRIC EQUIPMENT CO LTD  
**Address:** DINH DU COMMUNE  
VAN LAM DISTRICTHUNGYEN  
160000  
Vietnam  
**Party Site Number:** 543191

**Product Category:** OBMW2  
**Category Name:** Magnet Wire - Component  
**Model Number(s):** EI/AIW

**Sample Selection Date:** 2024-03-27

**UL Contact:** VICKY KUO via email at [Vicky.Kuo@ul.com](mailto:Vicky.Kuo@ul.com)

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<b>Sample Number:</b>	7100261	<b>Description:</b>	(OBMW2) EI/AIW
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**Information:**

<b>Name</b>	<b>Value</b>
Model No.	EI/AIW
Color	Natural Color
Form	Wire
IR Reference Date	TC26131/ T08-23-13

**Test Summary:**

<b>Name</b>	<b>Value</b>
UL746A Infrared Spectroscopy (IR)	Yes

**Identification Test**

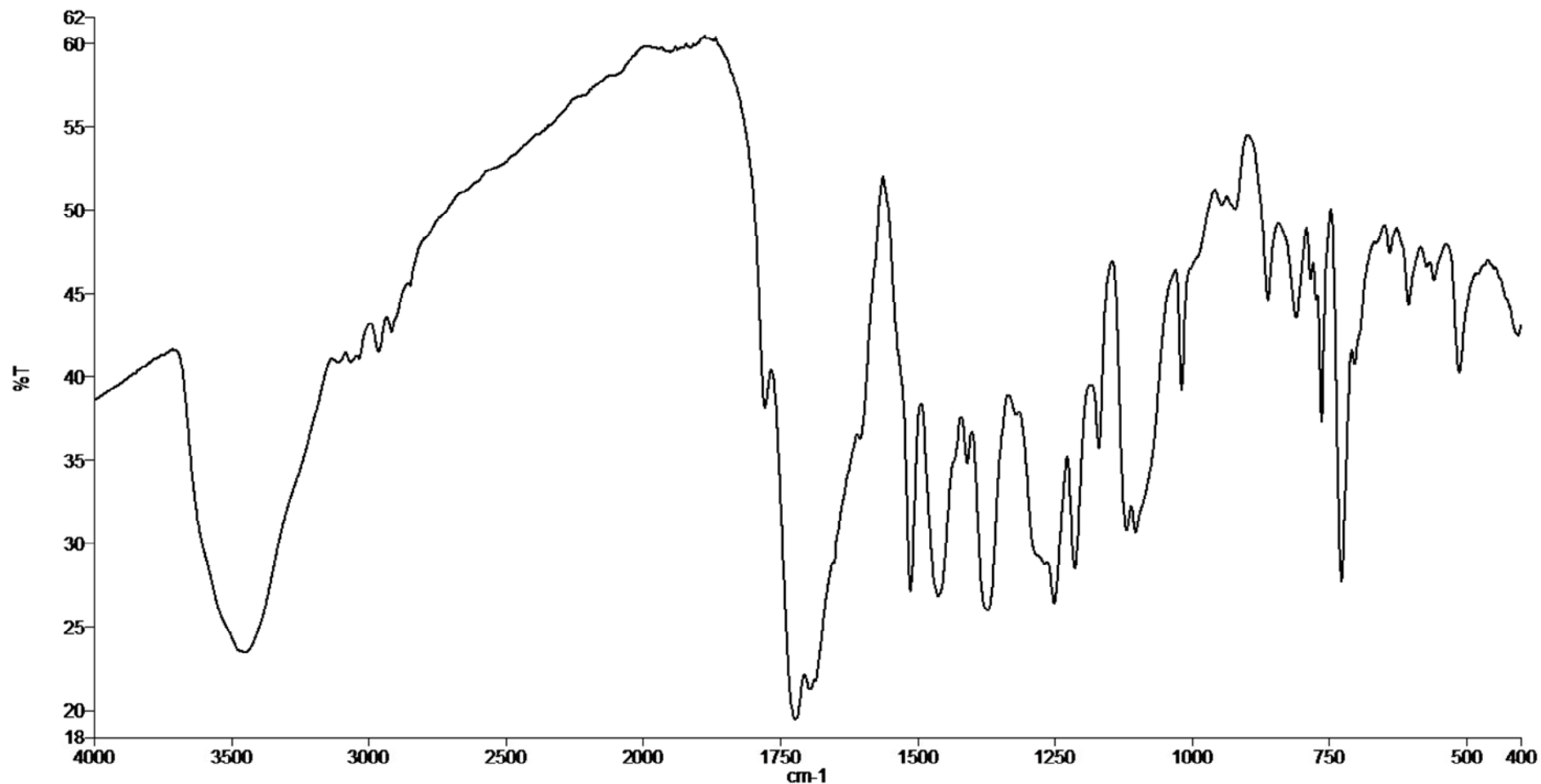
<b>Sample Number:</b>	7100261-1	<b>Material Designation:</b>	EI/AIW
<b>Color:</b>	NC	<b>Thickness:</b>	- mm

<b>IR Reference Date:</b>	TC26131/ T08-23-13
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<b>Infrared Spectroscopy Data Analysis</b>	<b>UL746A Paragraph 43</b>
<b>Conformance:</b>	Yes

# IR

Sample filings ground and mixed with KBr,  
pressed into pellet.



Filename F240873616T

Description E363753,EI/AIW,04,N,F,NC,W,22.1/56.2,KPL.

Creation Date 5/10/2024 1:24:50 PM

Instrument Model Spectrum 100

Instrument Serial Number 80294

Resolution 4

Number of Scans 16

Number of pages in this package \_\_\_\_\_ [ including additional pages \_\_\_\_\_ ]  
(Fill in when using printed copy as record)

CLIENT INFORMATION (Optional)	
Manufacturer Name	LIOA ELECTRIC EQUIPMENT CO LTD
Manufacturer Subscriber No. /Party Site No.	543191

AUDIT INFORMATION:			
Description of Tests	[ ] Per Standard No.	UL 1446	Edition/ 8 <sup>th</sup> / Issue Date 2019-11-13
[X] Tests Conducted by <sup>1</sup> Tim Chen			

TESTS TO BE CONDUCTED:		
Test No.	Test Name	<input type="checkbox"/> Comments/Parameters <input type="checkbox"/> Tests Conducted by <sup>2</sup> <input type="checkbox"/> Comply/Does Not Comply <sup>3</sup> <input type="checkbox"/> Link to separate data files <sup>4</sup>
1	INSULATION THICKNESS MEASUREMENT TR1910 (MISC)	
2	DIELECTRIC STRENGTH TEST, TWIST PAIR METHOD (Round wire 10-37 AWG) TR1669	
3	HEAT SHOCK TEST: (Round wire, 4-44 AWG; Square or rectangular 4-9 AWG) TR434	

**Instructions -**

- 1 - When all tests are conducted by one person, name can be inserted here instead of including name on each page containing data.
- 2 - When test conducted by more than one person, name of person conducting the test can be inserted next to the test name instead of including name on each page containing data. Test dates may be recorded here instead of entering test dates on the individual datasheet pages.
- 3 - Indication of compliance is optional. See the datasheet for each test for compliance.
- 4 - Link to separate data files for a test can be inserted here. The link must be to a server that is accessible to UL staff, that provides for backup, required retention periods and a path, including file name that does not change and result in a broken link. Not applicable to DAP.

**If noncompliant test results are obtained, provide this data to a qualified project handler for further processing.**

Special Instructions -

☐ Unless specified otherwise in the individual Methods, the tests shall be conducted under the following ambient conditions. Confirmation of these conditions shall be recorded at the time the test is conducted.

Ambient Temperature, C ± Relative Humidity, % ± Barometric Pressure, mBar ±

☒ No general environmental conditions are specified in the Standard(s) or have been identified that could affect the test results or measurements.

RISK ANALYSIS RELATED TO TESTING PERFORMANCE:

The following types of risks have been identified. Take necessary precautions. This list is not all inclusive.

<input type="checkbox"/> Electric shock	<input type="checkbox"/> Radiation
<input type="checkbox"/> Energy related hazards	<input type="checkbox"/> Chemical hazards
<input type="checkbox"/> Fire	<input type="checkbox"/> Noise
<input type="checkbox"/> Heat related hazards	<input type="checkbox"/> Vibration
<input type="checkbox"/> Mechanical	<input type="checkbox"/> Other (Specify)___

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 Tested by: Tim Chen Date 2024-06-16

TEST LOCATION: (To be completed by Staff Conducting the Testing)	
<input checked="" type="checkbox"/> UL or Affiliate	<input type="checkbox"/> WTDP <input type="checkbox"/> TPTDP
Company Name: Underwriters Laboratories Taiwan Co., Ltd	
Address: No. 260, Daye Rd., Beitou Dist., Taipei City 112, Taiwan	

#### TEST EQUIPMENT INFORMATION

☒ UL test equipment information is recorded on Meter Use.

☐ UL test equipment information is recorded on <<insert location and local laboratory equipment system identification.>>

Inst. ID No.	Instrument Type	Test Number +, Test Title or Conditioning	Function /Range	Last Cal. Date	Next Cal. Date

+ - If Test Number is used, the Test Number must be identified on the data sheet pages or on the Data Sheet Package cover page.

The following additional information is required when using client's or rented equipment. The Inst. ID No. below corresponds to the Inst. ID No. above.

Inst. ID No.	Make/Model/Serial Number/Asset No.

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TEST SAMPLE IDENTIFICATION:

The table below is provided to establish correlation of sample numbers to specific product related information. Refer to this table when a test identifies a test sample by "Sample No." only.

Sample Card No.	Date Received	<input checked="" type="checkbox"/> Test No. +	Sample No.	Manufacturer, Product Identification and Ratings
7061950	2024/4/9	1-3	1	LIOA ELECTRIC EQUIPMENT CO LTD Wire Designation Cat. No.: EI/AIW

+ - If Test Number is used, the Test Number or Numbers the sample was used in must be identified on the data sheet pages or on the Data Sheet Package cover page.  
++ - If the samples are from a manufacturer or location other than the testing location.

[ ] This document contains data or information using color and if printed, should be printed in color to retain legibility and the information represented by the color.



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INSULATION THICKNESS MEASUREMENT

(ANSI NEMA MW 1000-2016,  
Clause 3.2)

METHOD

Note: Required only when wire gauge and build type are NOT noted on the FUS tag. When the wire gauge and build type are noted on the FUS tag, the values should be noted.

Measurements are to be made using a machinist's micrometer caliper having flat surfaces both on the anvil and on the end of the spindle and calibrated to read directly to at least 0.001 inch (0.0254mm), with each division of a width that facilitates estimation of each measurement to 0.0001 inch (0.00254mm).

The insulated wire shall be measured at four points along the length of the wire. Beginning at one end of the wire, each of the four points shall be spaced approximately 3 inches (75mm) apart and rotated approximately 45 degrees. The four measurements of the wire shall be recorded to the nearest 0.0001 inch (0.00254mm) and the average of the minimum and maximum of those readings shall be identified as the overall thickness.

The enamel shall then be removed from the wire at approximately the same four points where the measurements for the insulated wire were made. The enamel shall be removed by a means not to scratch or otherwise damage the conductor, such as using a chemical stripper or by burning off the enamel with an open flame and then immediately immersing the bare wire into a low-boiling alcohol, such as methyl or denatured ethyl alcohol, or mixtures of these and water. The four measurements of the bare wire shall be recorded to the nearest 0.0001 inch (0.00254mm) and the minimum and maximum measurements averaged and identified as the average bare conductor thickness.

The difference between the bare wire's thickness and the insulated wire's thickness is calculated by subtracting the average recorded bare conductor thickness from the average recorded overall thickness.

RESULTS

Magnet Wire Designation	EI/AIW
Magnet Wire Manufacturer	LIOA ELECTRIC EQUIPMENT CO LTD
UL File No.	E363753
ANSI Type	MW 37-C
Conductor Type	<input checked="" type="checkbox"/> Copper; <input type="checkbox"/> Aluminum

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INSULATION THICKNESS MEASUREMENT: (CONT'D)  
 (Round Conductors)

	Measurement No.							
	1	2	3	4	Minimum Diameter Measurement D(min)	Maximum Diameter Measurement D(max)	Avg. of Minimum and Maximum Measurements: $\frac{D(\min) + D(\max)}{2}$	From Table 1 (Attached)
Unvarnished, Enamel- coated Wire Diameter, [in.] <del>mm</del>	0.047 75	0.047 8	0.047 8	0.047 75	0.0478	0.0478	Avg. Overall Diameter _0.0478_	
Bare Wire Diameter, [in.] <del>mm</del>	0.045 45	0.045 5	0.045 55	0.045 55	0.0455	0.0456	Avg. Bare Conductor Diameter 0.0455	Conductor Size: __17__ AWG
Difference between the bare wire diameter and the unvarnished, enamel-coated wire diameter, [in.] <del>mm</del>							Measured Build 0.0023	Build Type: [X] Single; [ ] Heavy

\* If the build is not noted on the FUS tag, then assume the build is single.

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Date 2024-06-16

TWISTED PAIR SAMPLE FABRICATION:

**[X]** Magnet Wire Twisted Pair samples fabricated by UL lab with customer supplied wire shall be fabricated in accordance with ASTM D1676 or ASTM D2307. The twisted pair samples shall be prepared under the tension corresponding to the gauge size of the wire with the number of twists and length specified. Be sure to include TP maker in equipment use log.

UL Twisted Pair Sample Fabrication Record - Date Fabricated: 2024-06-16

Magnet Wire Designation	ANSI/NEMA Type	AWG Size	Winding Load	Number of Twists	Length of Twisted section
EI/AIW	MW 37-C	17	6 lbs	6	121 mm

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DIELECTRIC STRENGTH TEST, TWISTED PAIR METHOD: ANSI NEMA MW 1000-2016,  
(Round wire, 10-37 AWG) Clause 3.8.3

#### METHOD

Five twisted pairs of the magnet wires were used in this test.

Starting at zero, an increasing voltage was applied between each wire of the twisted pair at a rate of 500V per sec until breakdown occurred, except that if the breakdown occurred in less than 5 sec, the rate of rise was reduced sufficiently so that breakdown did not occur in less than 5 sec.

#### RESULTS

Magnet Wire Designation	EI/AIW
Magnet Wire Manufacturer	LIOA ELECTRIC EQUIPMENT CO LTD
Conductor Type	<input checked="" type="checkbox"/> Copper; <input type="checkbox"/> Aluminum
Conductor Size*	<u>17</u> AWG
Build Thickness*	<input checked="" type="checkbox"/> Single; <input type="checkbox"/> Heavy
Build Type#	<input type="checkbox"/> Standard (Basecoat); <input checked="" type="checkbox"/> With Topcoat

\* This information should be obtained from the Insulation Thickness Measurement in this data package.

# This information should be obtained from PCD.

Sample No.	Breakdown Voltage, kV
1	10.26
2	10.27
3	8.11
4	8.90
5	8.26
Minimum Breakdown Voltage	8.11

## - This value is invalid and was disregarded when determining compliance because as it was determined to be an outlier in accordance with ASTM E178, Standard Practice for Dealing with Outlying Observations.

#### Compliance Criteria for Minimum Breakdown Voltage:

1. Use AWG Size, insulation build and magnet wire construction (Standard or Polyamide Topcoat) refer to Table 35 (attached) to determine the minimum dielectric breakdown voltage.

Minimum Dielectric Breakdown Voltage: 2930 V

2. The test samples ~~[did not exceed]~~ [exceeded] the minimum Dielectric Breakdown Voltage.

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HEAT SHOCK TEST: ANSI NEMA MW 1000-  
(Round wire, 4-44 AWG; Square or rectangular 4-9 AWG) 2016, Clause 3.5

#### METHOD

3 samples having an effective length of 10 in (250 mm) shall be elongated to the minimum elongation percentage and at the rate given in Table II.

Round elongated samples are then wound not more than ten turns around a mandrel having the diameter given in Table II. The specimen shall be removed from the mandrel and placed in a circulating air oven for 1/2 h at not less than the temperature specified in Table I.

The specimen shall be allowed to cool to room temperature and shall then be examined in accordance with Table II.

TABLE I

Magnet Wire Designation	ANSI Type	or	Test Temperature, °C
EI/AIW	MW 37-C		240

## HEAT SHOCK TEST: (CONT'D)

TABLE II

AWG Size	Elongation Rate	Minimum Elongation, Percent	Mandrel # Diameter	Examined With
Copper Wire				
All rectangular	12 in $\pm$ 1 in per min++	15	None	Unaided vision
4-9 round	12 in $\pm$ 1 in per min++	30	None	Unaided vision
10-13 round	12 in $\pm$ 1 in per min++	25	5X	Unaided vision
14-30 round	Sudden jerk @	20	3X	Unaided vision
31-44 round	Sudden jerk @	20+	3X	6X-10X magnification
Aluminum Wire				
All rectangular	12 in $\pm$ 1 in per min++	10	None	Unaided vision
4-9 round	12 in $\pm$ 1 in per min++	15	None	Unaided vision
10-15 round	12 in $\pm$ 1 in per min++	15	5X	Unaided vision
16-20 round	Sudden jerk @	15+	3X	Unaided vision
21-25 round	Sudden jerk @	10+	3X	Unaided vision

+ Or to the breaking point, whichever is less.

++ 300 mm  $\pm$  25 mm.

@ When a "sudden jerk" is specified, elongate a wire specimen having an effective length of 10 in to a predetermined length at the rate 12 to 15 ft/s (3.7 to 4.9 m/s).

# Exception - Use 6X mandrel when evaluating all sizes of MW2, MW3 and MW75 wire types.

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HEAT SHOCK TEST: (CONT'D)

## RESULTS

Wire Diameter/cross-section (from the Insulation Thickness Measurement), <del>{mm}</del> [in]	0.0455
Mandrel Diameter, if applicable <del>{mm}</del> [in]	0.1365
Elongation Rate	12-15 ft/s
Minimum Elongation Percent	20

Oven Temperature °C	Time/Date In	Time/Date Out
240	2024-06-16 14:00	2024-06-16 14:30

Magnet Wire Designation	Heat Shock Temperature, °C	ANSI Type	Sample No.		
			1 CVD / NCVD	2 CVD / NCVD	3 CVD / NCVD
EI/AIW	240	MW 37-C	NCVD	NCVD	NCVD

## Compliance Criteria:

1. CVD - Cracks Visibly Detected
2. NCVD - No Cracks Visibly Detected
3. Compliance Criteria:
  - ☒ The results are compliant: visible cracks were not detected.
  - ☐ the results are non-compliant: visible cracks were detected on one or more samples.

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ULS-01446-OBMW2-DataSheet-2003  
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Form Issued: 2007-10-23  
Form Revised: 2018-10-16

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