

產品規格書
[**TW-T09-002(EN)**]

Specification of Triple Insulated Winding Wire

產品名稱：三層絕緣線 (TIWW-F)

Product Name: Triple insulated winding wire (TIWW-F)

Class F 155°C

ITEM : Ø0.20mm ~ Ø1.00mm

Date :2018/03/01

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	Product Name : TIWW-F Triple insulated winding wire				
<p>I. 適用範圍 Scope</p> <p>該規格書是有關用于電氣機器繞組線和配線的三層絕緣線 TIWW-F 的規定。 This specification covers Triple insulated winding wire: TEAMWORK “TIWW-F”, which is used for windings and wirings of electrical machines and apparatus, hereinafter referred to as the “wires”.</p> <p>II. 種類及表示符號 Kinds and Symbol</p> <p>根據電線導體與皮膜的種類，電線的種類與表示符號如表 a 所示。 The kind and symbol shall be as given in Table a.</p> <p style="text-align: center;">表 a Table a</p> <table border="1" data-bbox="341 835 1206 1003"> <thead> <tr> <th data-bbox="341 835 762 920">種類 Kinds</th> <th data-bbox="762 835 1206 920">表示符號 Symbol</th> </tr> </thead> <tbody> <tr> <td data-bbox="341 920 762 1003">三層絕緣電線 Triple insulated winding wire</td> <td data-bbox="762 920 1206 1003">TIWW-F</td> </tr> </tbody> </table> <p>III. 導體 Conductor</p> <p>導體是按 GB3953-83 規定的軟銅線，或以此為標準的軟銅線。 The conductor shall be the annealed copper wire specified in GB3953-83 or similar wire.</p> <p>IV. 溫度指數、絕緣皮膜及特性 Temperature Index, Insulation Covering and Characteristics</p> <p>a. 溫度指數 Temperature Index</p> <p>155°C</p> <p>b. 絕緣皮膜與構造 Insulation Covering and Construction</p> <p>絕緣皮膜的第一層與第二層是變性聚酯類耐熱樹脂，第三層是變性聚酰胺類樹脂，由於以相同方式被覆在導體表面，不會對導體產生有害作用，皮膜具有耐久性，不去除皮膜也可以直接進行焊錫。 TIWW-F 的顏色為粉紅色，外觀以樣品為準。 The insulation covering shall consist of triple layer (1st and 2nd layer: Modified polyester, 3rd layer: Modified Polyamide) which are at least equivalent thereto in quality, extruded on the surface of the conductor uniformly. The insulation films so applied shall have no detrimental effect to the conductor, and shall show no flaws or dirt. Further, the wires shall be such that the soldering is possible without removing of films. The color of wires is pink. The appearance shall be as given in the standard.</p>		種類 Kinds	表示符號 Symbol	三層絕緣電線 Triple insulated winding wire	TIWW-F
種類 Kinds	表示符號 Symbol				
三層絕緣電線 Triple insulated winding wire	TIWW-F				

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<div data-bbox="558 436 1021 750" data-label="Image"> <p>The diagram illustrates the cross-section of a TIWW-F Triple insulated winding wire. It features a central 'Bare Copper' core, followed by three concentric layers of insulation labeled '1st Layer', '2nd Layer', and '3rd Layer'. The entire wire is labeled 'TIWW-F' at the top.</p> </div> <p>V. 產品檢驗標準 Test of triple insulated winding wire 本標準參考 UL2353 標準，適用於使用在電子變壓器上的三層絕緣線之檢驗。 The test condition is referred to UL2353, it can be applied to test of triple insulated winding wire , which is used for electric transformer.</p> <p>1. 外觀檢查 Appearance Inspection</p> <ol style="list-style-type: none"> 有無傷痕或污損。 The insulation of the wire shall be free from crack and blot. 表面之光滑度，光澤，顏色是否均勻。 The surface of the wire shall be smooth, sheen and colored evenly. 有無粘連。 The insulation of the wire shall be clean. 是否為指定顏色。 The color shall be specified. 線軸是否完整，有沒有損傷。 The reels shall be free from damage. <p>2. 成品外徑 The overall Diameter 成品外徑的測量需要使用精度為 1/1000mm 的測量器，如：雷射外徑測量儀等，成品外徑的測量採用下面的方法：截取長約 15cm 的試樣，在與試樣垂直的面上，以間隔幾乎等角處測三點直徑，並以這些測量值的平均值表示成品外徑，其檢驗標準如表 7。 Measure the overall diameter with micrometer equipment, and the division of a width that facilitates estimation of each measurement to 0.001mm, such as laser scan micrometer. Cut a piece of wire 15cm, measure the conductor diameter with micrometer at least three times, and the distance are same between those three points of measuring on the wire. Then take the average of the three or more measurements, the range shall be as specified in Table 7.</p>	

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<p>3. 導體外徑 Conductor Diameter</p> <p>導體外徑的測量需要使用精度為 1/1000mm 的測量器，如：雷射外徑測量儀等，以適當不傷及導體的方法去除絕緣層，以測量成品外徑的同樣方法測定導體直徑，並求其平均值為導體外徑，其檢驗標準見表 7</p> <p>Measure the diameter of conductor with micrometer equipment, and the division of a width that facilitates estimation of each measurement to 0.001mm, such as laser scan micrometer. Remove the insulation by proper method, it can not make any damage to conductor, and measure the conductor diameter with micrometer at least two times and take the average of the two or more measurements, The range shall be as specified in Table 7.</p> <p>4. 絕緣層厚度 Thickness of Insulation</p> <p>以成品外徑及導體直徑的差的 1/2 來表示，但其厚度應均勻披覆在導體上，其檢驗標準見表 7.</p> <p>The average of the two recorded measurements over the conductor or any separator is to be subtracted from the average measurement over the insulation, and the result is to be divided by two. The insulation shall be coated on the conductor evenly. The range shall be as specified in Table 7.</p> <p>5. 導體電阻 Conductor Resistance</p> <p>取長 1m 的試樣，採用以下的方法測量：電阻的測量採用雙電橋或電位差計，在 5°C ~35°C 範圍內，在恒定的溫度下測量，電阻的測量，必須不使測量電流對測定結果有所影響，測定值有公式 1 換算到 20°C 時線長一公里的值，其檢驗標準見表 7</p> <p>Electrical resistance is the D.C. resistance at 20°C of 1m of wire, the measurement is taken by Double electric bridge or Potentiometer methods in the temperature range from 5°C ~35°C. The test electric current can not make any influence on the result of resistance measurement. The result shall be calculated by means of the formula 1, temperature 20°C and 1 km length, The result is shown on Table 7.</p> <p>公式 1 Formula 1</p> $R_{20} = R_t \times \alpha_t / L \times 10^3$ <p>R₂₀: 換算為 20°C 下每 1 公里的導體電阻 (Ω/km)</p> <p>R₂₀ is the resistance of 1km length, which is converted at temperature 20°C.</p> <p>R_t t°C 下的測定值 (Ω)</p> <p>R_t is the resistance, which is measured at a temperature t°C.</p> <p>α_t 將測定溫度 t°C 下的電阻換算為 20°C 的電阻的表 2 所示的導體電阻溫度換算係數。</p> <p>α_t is the temperature coefficient of convert the resistance from t°C to 20°C.</p> <p>L: 測定長度 (m)</p> <p>L is the wire length of test.</p>	

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表 2 Table 2

測量時導體溫度 Temperature t/°C	換算係數 Coefficient α_t	測量時導體溫度 Temperature t/°C	換算係數 Coefficient α_t	測量時導體溫度 Temperature t/°C	換算係數 Coefficient α_t
5	1.064	16	1.016	27	0.973
6	1.059	17	1.012	28	0.969
7	1.055	18	1.008	29	0.965
8	1.050	19	1.004	30	0.962
9	1.046	20	1.000	31	0.958
10	1.042	21	0.996	32	0.954
11	1.037	22	0.992	33	0.951
12	1.033	23	0.988	34	0.947
13	1.029	24	0.984	35	0.943
14	1.025	25	0.980		
15	1.020	26	0.977		

6. 耐電壓試驗 Electric Strength Test

6.1 採用對絞法 Twisted Sample

由同一軸線上截取長約 400mm 的試樣 5 根，各對折，施加如表 3 所示張力扭絞成麻花狀，長度約 125±5mm 的扭絞數如表 3 所示。去掉張力，切掉扭絞的頂端對折部分，並使兩端保持最大間距，在以不傷及導體的方法去除絕緣層，接著在去除絕緣層的兩導體間外加適當的 50 或 60HZ 的交流正弦波電壓，電壓以約 500V/S 的上升速度勻速上升，在規定電壓下保持測試時間為 60S（按 UL2353 規定），其檢驗標準見表 7

5 straight pieces of the final wire construction, approximately 400 mm in length, with the insulation removed at both ends, is to be twisted back on itself for a distance of 125±5mm with a load applied to the wire pair, and the number of twists, as provided in loads applied to the wire pairs and number of twists, see table 3. The loop at the end of the twisted section is to be cut at two places to provide a maximum spacing between the cut ends. Any bending to ensure an adequate separation between the two wire ends is to be arranged to avoid sharp bends or damage to the coating. Then the wire is to be subjected to a test voltage, substantially in form, having a frequency of either 50Hz or 60Hz. The voltage applied between the conductors of wires shall be raised from zero to the prescribed voltage at a rate of 500V per second and held at that value for 60 seconds. See Table 3.

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表 3 Table 3

導體直徑 (mm) Nominal conductor dia.	張力 lbf (N) Load	長度 125mm 中的絞數 Number of twists
0.10~0.25	0.19 (0.85)	33
0.251~0.355	0.38 (1.7)	23
0.356~0.500	0.76 (3.4)	16
0.501~0.710	1.57 (7)	12
0.711~1.060	3.03 (13.5)	8
1.061~1.400	6.06 (27)	6
1.401~2.000	12.14 (54)	4
2.001~2.500	24.27 (108)	3

6.2 採用直線法 Straight Sample

取一根至少 305mm 的試樣，中間 152mm 緊密纏繞在導體圓棒上，捲繞過程中需避免試樣伸長、重疊、破損，然後將試樣的一端以不傷及導體的原則去除絕緣層，在導體與圓棒上加適當的 50 或 60HZ 的交流正弦波電壓，電壓以約 500V/S 的上升速度勻速上升，在規定電壓下保持測試時間為 60S（按 UL2353 規定），其檢驗標準見表 7

A straight length of wire at least 305mm is wound for continuous and adjacent turns around a polished mandrel. The voltage shall be applied between the conductor and foil wrapped in intimate contact with the center 152mm of the sample. Strip off the coating of wire one end, and it can't make any damage to conductor. Then the wire is subjected to the test voltage, substantially in form, having a frequency of either 50Hz or 60Hz. The voltage shall be raised from zero to the prescribed voltage at a rate of 500V per second and held at that value for 60 seconds. See Table 7.

7. 熱衝擊試驗 Heat Shock Test

取一根至少 305mm 的試樣，緊密纏繞在如表 4 所示的光滑圓棒上 10 圈，其捲繞速度為每秒 1~3 圈，並施加 118Mp/mm² 的張力線上，使其緊密地貼在圓棒上，捲繞過程中需避免試樣伸長、重疊、破損，從圓棒上取下試樣並放入如表 5 所示溫度的烘箱中 30 分鐘，烘箱溫度的誤差為 5°C，將試樣從烘箱中取出試樣，使其自然冷卻到室溫，然後使用表 6 所規定放大倍數的放大鏡觀察試樣表面是否有開裂現象。

A straight length of wire at least 305mm is wound for 10 continuous and adjacent turns around a polished mandrel of the diameter specified in Mandrel diameter, Table 4. The mandrel is to be rotated with a rate of 1-3 revolutions per second (r/s) with a tension of 118 Mp/mm² applied to the wire that is sufficient to keep it in contact with the mandrel. Elongating or twisting of the wire is to be avoided,

The specimen is placed into an oven with forced air circulation for a period of 30 minutes and at a temperature within 5°C of the temperature specified in oven temperature, Table 5. After removing from the oven, the specimen is to be allowed to cool to room temperature, and after cooling is to be examined for cracks under a magnification level as specified in Table 6. There shall be no cracking of the insulation.

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表 4 Table 4

導體直徑 Nominal conductor diameter		圓棒直徑 Mandrel diameter	
mm	inch	mm± 0.2mm	inch± 0.01inch
0.05~0.34	0.002~0.014	4.0	0.16
0.35~0.49	0.014~0.019	6.0	0.24
0.50~0.74	0.019~0.029	8.0	0.31
0.75~2.49	0.029~0.099	10.0	0.39

表 5 Table 5

溫度等級 Thermal Class	變壓器耐溫等級 Transformer classification				
	classA(105°C)	classE(120°C)	classB(130°C)	classF(155°C)	classH(180°C)
烘箱溫度 (°C) Oven temperature	200	215	225	240	260

表 6 Table 6

導體直徑 (mm) Wire dimension	放大鏡倍數 Magnification level, times
0.040~0.500	5~10
0.501 以上	0~6

8. 彎曲耐熱後耐壓試驗 Retention of Electric Strength After Bending and Heat Shock Test

取一根至少 305mm 的試樣，緊密纏繞在如表 4 所示的光滑圓棒上 10 圈，其捲繞速度為每秒 1~3 圈，並施加 118Mp/mm² 的張力線上，使其緊密地貼在圓棒上，捲繞過程中需避免試樣伸長、重疊、破損，從圓棒上取下試樣並放入如表 5 所示溫度的烘箱中 30 分鐘，烘箱溫度的誤差為 5°C，將試樣從烘箱中取出試樣，使其自然冷卻到室溫，施加第 8 節所述的電壓在試樣上，其破壞電壓如表 7 所示

The Sample is to be prepared as specified in the Heat Shock Test, Section 7. And the sample is subjected to the test voltage, the voltage applied is same to Electric Strength Test, Section 6. See Table 7.

9. 火花試驗 Spark Test

每一軸線必須經過 100% 的火花試驗，其試驗電壓為 5000V.

One hundred percent of production of each reel or transformer winding wire shall be subjected to an electric strength test in accordance with test voltages for electric strength tests. The test voltage is 5000V.

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表 7 Table 7 (三層絕緣線規格表) Triple insulated winding wire TIWW-F						
導體 (mm) Conductor		絕緣層 (mm) Insulation			最大導體電阻 Max. Conductor Resistance	最小絕緣擊穿電壓 Min. BDV
直徑 Diameter	允許公差 Tolerance	最小被膜 厚度 Min. Film Thickness	標準成品 外徑 Target Overall Diameter	最大成品 外徑 Max. Overall Diameter	20°C · Ω/km	對絞法 (V) Twisted Sample
0.20	±0.008	0.090	0.40	0.43	607.5	7000
0.22	±0.008	0.090	0.42	0.45	498.4	
0.25	±0.008	0.090	0.45	0.48	382.5	
0.28	±0.008	0.090	0.48	0.51	307.3	
0.30	±0.010	0.090	0.50	0.53	262.9	
0.32	±0.010	0.090	0.52	0.55	230.0	
0.35	±0.010	0.090	0.55	0.58	191.2	
0.37	±0.010	0.090	0.57	0.60	170.6	
0.40	±0.010	0.090	0.60	0.63	145.3	
0.45	±0.010	0.090	0.65	0.68	114.2	
0.50	±0.010	0.090	0.70	0.73	91.43	
0.55	±0.020	0.090	0.75	0.78	78.15	
0.60	±0.020	0.090	0.80	0.83	65.26	
0.65	±0.020	0.090	0.85	0.88	55.31	
0.70	±0.020	0.090	0.90	0.93	47.47	
0.75	±0.020	0.090	0.95	0.98	41.19	
0.80	±0.020	0.090	1.00	1.03	36.08	
0.85	±0.020	0.090	1.05	1.08	31.87	
0.90	±0.020	0.090	1.10	1.13	28.35	
0.95	±0.020	0.090	1.15	1.18	25.38	
1.00	±0.030	0.090	1.20	1.23	23.33	

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<p>VI. 檢查 Inspection</p> <p>檢查分為抽樣檢查與出貨檢查，根據 V 的檢查方法與表 1 的項目進行。 但是，根據當事雙方的協定，可簡化一部分出貨檢查。</p> <p>The inspection is divided into the delivery inspection and type inspection and shall be carried out, using the test methods referred to in Clause 5, on the items specified in Table 1. However part of the delivery inspection may be omitted by the agreement between the parties concerned with the acceptance.</p> <p>VII. 包裝及實際長度 Packaging and Length</p> <p>a. 包裝 Packaging</p> <p>根據 TIWW-F 導體的直徑，確定適當的線軸大小，採取防止鬆散，糾結在一起的方法，進行繞線。運輸過程中，為防止電線受傷，鬆散和糾結在一起，採取了適當的包裝方法。</p> <p>According to TIWW-F conductor diameter, the wires shall be wound on suitable bobbin without loosening and tangle, and adequately packaged to avoid scratch or tangle during transportation.</p> <p>b. 長度 Length</p> <p>1 卷的標準長度如表 8 所示。出貨時，可以混入長度從 1000 米到不足最小標準長度的線軸，限度是交貨總軸數的 30%。但是，如有特殊要求，則不能滿足以上條件。 對於訂貨長度的允許範圍為+5%-0%。</p> <p>The length of one coil shall be as given in Table 8. The number of short coil bobbin allowed in a shipment shall be less than 30% of the total number of bobbins. The short coil bobbin shall have from greater than 1000m to less than minimum standard length. However, divided or adjusted coil for order may not be fulfilled the above requirement. Also, if agreed between the parties concerned with the acceptance, the above requirement may not be fulfilled. Tolerance for order shall be from -0% to +5%.</p>	

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表 8 Table 8 (三層絕緣線包裝表) Packaging and Length		
線軸 Bobbin	PT-10	PT-15
導體直徑(m/m) Conductor diameter	標準長度(m) Standard Length	標準長度(m) Standard Length
0.20	6000M	
0.25	6000M	
0.30	6000M	
0.32	6000M	
0.35	6000M	
0.37	5000M	
0.40	3000M	
0.45		3000M
0.50		3000M
0.55		4000M
0.60		4000M
0.65		3000M
0.70		3000M
0.75		2000M
0.80		2000M
0.85		2000M
0.90		2000M
0.95		1500M
1.00		1500M

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VIII. 產品名稱 Designation of Product			
<p>產品名稱可根據種類與導體直徑，或根據表示符號及導體直徑決定。 The product shall be designated by conductor diameter (size) and the symbol.</p>			
<p>例：三層絕緣線 TEAMWORK 0.50mm 或 TIWW-F 0.50mm Example: Triple Insulated Winding Wire; TEAMWORK 0.50mm or TIWW-F 0.50mm</p>			
IX. 標記 Marking			
<p>線軸及包裝的適當地方，必須標記出以下事項。 The following items shall be marked on each bobbin at an appropriate position.</p>			
<p>(1) 種類或表示符號 Kinds or Symbol (2) 顏色(著色的情況下) Color (If Coloring) (3) 導體直徑 Conductor diameter (4) 製造編號 Manufacturing number (5) 長度 Length (6) 製造商名稱或略稱 Manufacturer's name or abbreviation (7) 製造日期 Year and month of manufacture or their abbreviation</p>			
X. 客戶保管時的注意事項 Notes of storage by customer			
<p>建議客戶在以下的保管條件下進行 TIWW-F 的保管 打開包裝後，必須將 TIWW-F 盡快使用。 保管包裝好的 TIWW-F 時，應避開高溫潮濕，日光直射的場所，同時應防止灰塵。 When the wire is storage by the customer, the following storage conditions are recommended. The unpacked wire should be used promptly. The packed wire should be stored avoiding high humidity, high temperature, sunshine, and dust.</p>			
溫度 Temperature	溼度 Relative Humidity	保管期限 Storage Term	備註 Note
- 25 ~ 45°C	5 ~ 75%	出貨日期後 1 年 1 year after shipment	超過保管期限後，建議進行耐電壓，絕緣擊穿，可繞性的檢查。 Please check the withstand voltage, breakdown voltage, flexibility when storage is over the term.

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File Name : Specification	Product Name : TIWW-F Triple insulated winding wire									
A. 改訂記錄 Document of the revised edition										
<table border="1"> <thead> <tr> <th>日期 Date</th> <th>規格書編號 No. Spec. No.</th> <th>原因 Cause</th> </tr> </thead> <tbody> <tr> <td>2009.10.01</td> <td>TW-T09-001(EN)</td> <td>發行 Publication</td> </tr> <tr> <td>2018.03.01</td> <td>TW-T09-002(EN)</td> <td>修正 Modification</td> </tr> </tbody> </table>		日期 Date	規格書編號 No. Spec. No.	原因 Cause	2009.10.01	TW-T09-001(EN)	發行 Publication	2018.03.01	TW-T09-002(EN)	修正 Modification
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2009.10.01	TW-T09-001(EN)	發行 Publication								
2018.03.01	TW-T09-002(EN)	修正 Modification								
B. 規格書的生效日期 Effective date of this specification										
<p>自客戶在規格書上簽字蓋章後返還給我公司起，或規格書送達客戶後 1 個月以內沒有聯繫的情況下，視同客戶默認，該規格書生效。</p> <p>This specification is applied when there return to us with your agreement or there are not any replies within one month.</p>										
C. 注意事項 General notes										
<p>若規格書出現中文與英文不一致的情況下，以中文為準。</p> <p>In case of inconsistencies between the English and the Chinese, the Chinese shall prevail.</p>										
D. 規格書的變更與廢止 Revision and repeal of this specification										
<p>當該產品特性發生大的改變時，例如：原材料的改變，還有終止使用該規格書時，當事雙方協商解決。</p> <p>該規格書中未規定的項目，以相關文件為準。</p> <p>The agreement between the parties concerned shall be necessary when this specification was revised such as major changing in the characteristic of the product, for example, change in raw material.</p> <p>The agreement between the parties concerned shall be necessary when this specification was repealed.</p> <p>The item without the provided item in this specification shall be requested in writing.</p>										