

Operation Manual

Model TH2881A

Interturn Insulation Tester

Changzhou Tonghui Electronic Co., Ltd.

Address.: No.3 Tianshan Road, New District,
Changzhou, Jiangsu

Tel. : 0086 - 519 - 5132222, 5115008

Fax : 0086 - 519 - 5109972

<http://www.tonghui.com.cn>

<http://www.tonghui.cn>

Email: sales@tonghui.com.cn

tonghui@pub.cz.isinfo.net

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Chapter 1 Overview

1.1 Product Overview

TH2881A Interturn Insulation Tester, by using pulse wave comparison method, can apply the same pulse with specified peak and front time on both tested winding and standard winding of similar design. We can get their respective wave forms. By comparing the wave forms, we can judge the correctness of insulation between turns of motor winding. Any breakdown, such as electric corona discharge, local short-circuit, wrong termination and embedment, winding dissymmetry and short-circuit between phases etc., can all be judged directly. 【For details, refer to Test Methods.】

This tester adopts reliable measurement technology and circuit design, so that each performance and technical specifications are superior to similar products. It can be widely used for testing the products such as mini-type motor, small HP motor, micro & special motor, electric tool, transformer, and relay windings etc.

TH2881A Interturn Insulation Tester can be operated in a simple, reliable and safe manner. And also, it conforms to standards of GB755-87, JB/Z 294-87 and JB/Z 346-89.

1.2 Specifications

1.2.1 Technical Specifications

Pulse Voltage: 0~5000V (continuous adjustable)

Pulse Voltage Precision: $\pm 5\% \pm 2$ digits (From 1 kV to 5 kV)

Pulse Repeat Frequency: 50 Hz (or line frequency)

Pulse Capacity: 0.01 μ F

Front Time: 0.5 μ s

Power Consumption: 150 VA max

Power Supply: (198 ~ 242) Vac, 50 Hz

1.2.2 Operation Environment

Temperature: 0°C ~ 40°C

Humidity: ≤85% R.H.

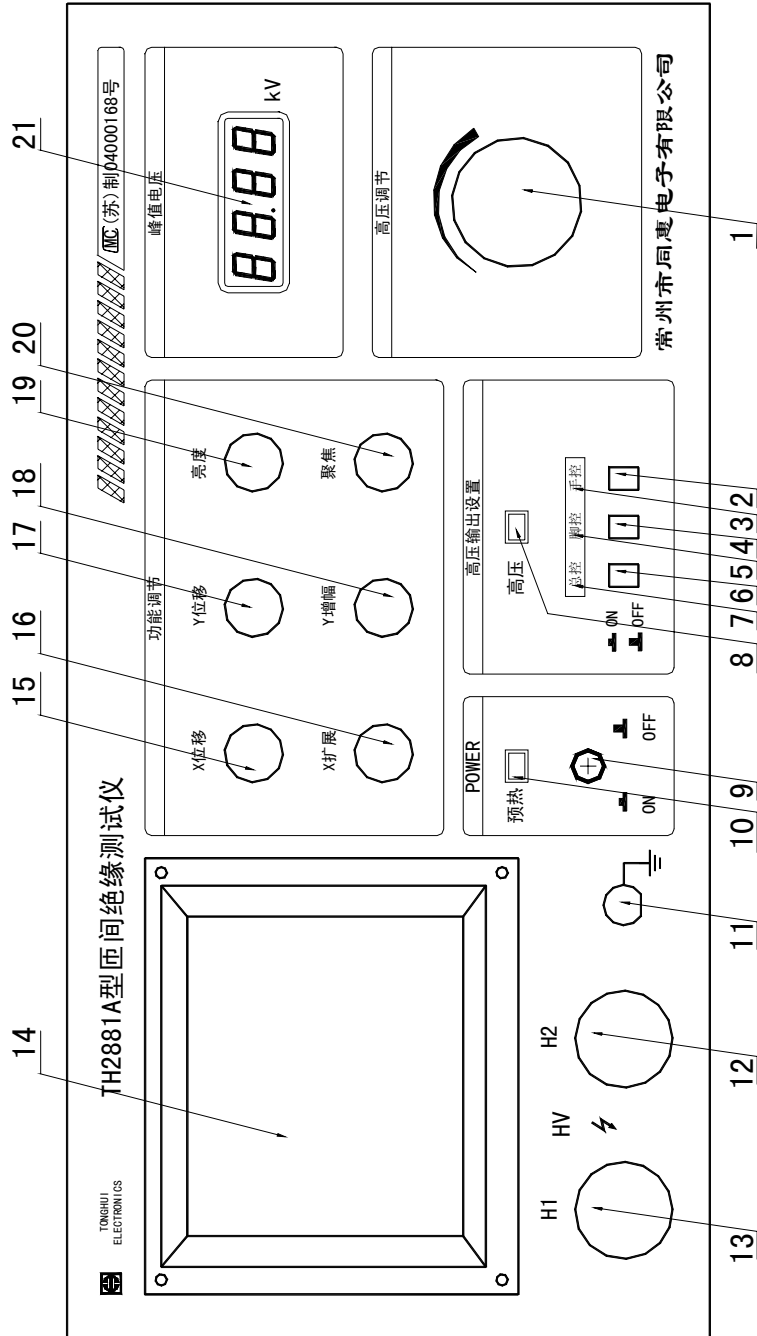
1.2.3 Dimensions and Weight

Dimensions : 445mm (Width) × 220mm (Height) × 470mm (Depth)

Weight: 23 kg

Chapter 2 Panel Description

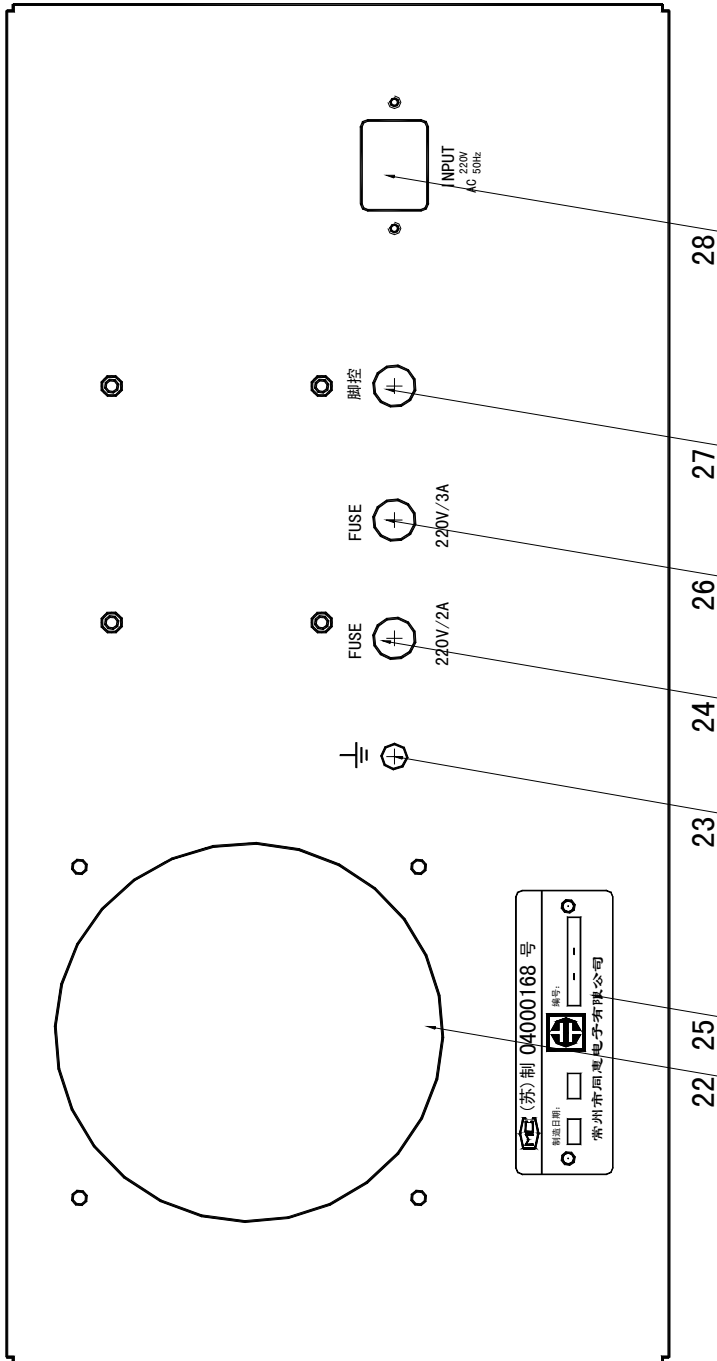
2.1 Front Panel



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2.2 Rear Panel



2.3 Front Panel Description

1) High-voltage Adjusting Knob(1)

Adjust this knob to get the required testing pulse peak voltage.

2) Hand Control Button(2)

After the main control button (6) is pressed and active **【the corresponding light (7) for main control is on】** , then press the hand control button, high voltage will be output.

3) Hand control Indicator(3)

If this light is on, it means hand control button (2) is active.

4) Foot Control Button(4)

After the main control button (6) is pressed and active **【the corresponding light (7) for main control is on】** , then press the foot control button(4), high voltage will be output as soon as the foot switch is stepped on.

5) Foot control Indicator(5)

If this light is on, it means foot control button (4) is active.

6) Main Control Button(6)

This button can work only when warm-up indicator (10) is off. Also the hand control button (2) and foot control button (4) can work only when this main control button (6) is pressed and active. **【the corresponding light (7) for main control is on】**

7) Main Control Indicator(7)

If this light is on, it means main control button (6) is active.

8) High-Voltage Indicator(8)

If this light is on, it means that high voltage is outputted from high voltage output terminal H1 and H2.

9) Power On/Off Switch(9)

It is used to turn on or off the power-supply.

10) Warm-up Indicator(10)

Press the power switch (9) when start the instrument, the warm-up indicator (10) turns on. After around 4 minutes delaying, this indicator turns off. The control switch buttons such as main control button (6), foot control button (4), and hand control button (2) can only be active after the warm-up indicator(10) is off. If this light doesn't turn off, above buttons won't be active. 【The corresponding lights won't be on also】 .

11) Ground Potential Output Terminal (11)

GND, to form the high voltage output circuit.

12) High Potential Output Terminal H2 (12)

H2, to output the high-voltage for pulse test.

13) High Potential Output Terminal H1 (13)

H1, to output the high-voltage for pulse test.

14) Wave Display Screen (14)

To display the oscillating attenuating wave forms.

15) X-Position Knob (15)

To make wave moved left or right horizontally by adjusting this knob.

16) X-Magnitude Knob (16)

To make wave properly extended horizontally by adjusting this knob.

17) Y-Position Knob (17)

To make wave moved up or down vertically by adjusting this knob.

18) Y-Magnitude Knob (18)

To make wave with proper amplitude by adjusting this knob.

19) Intensity Knob (19)

To make wave with proper intensity by adjusting this knob.

20) Focus Knob (20)

To make wave more clear by adjusting this knob.

21) Peak Voltage Display Screen (21)

To display the current output peak voltage numerically.

2.4 Rear Panel Description

22) Cooling Fan

23) Grounding Terminal

24) Fuse Holder, 2A Fuse

25) Name Plate

Which is used to mark the manufacturer, manufacture date and Serial No.

26) Fuse Holder, 3A Fuse

27) Foot switch Socket

To connect the foot switch.

28) Power Receptacle

220V 50Hz 3-cores standard power receptacle.

Chapter 3 Operation Instruction

3.1 Attentions

- a) After opening the shipping package, check if the contents are all available according to packing list.
- b) Read the operation manual clearly before operate the device, otherwise operate under the guidance of technician to avoid unnecessary question.
- c) The Line, Neutral and Earth cores of power plug shall be consistent with those marked on the power receptacle.
- d) There is high voltage in the instrument; the instrument covering should not be removed by non-qualified maintenance personnel.
- e) The frame of instrument shall be checked for reliable grounding prior to startup.
- f) This instrument has high-voltage, never locate it in the area where is high temperature and humidity, excessive dust and corrosive.
- g) If high-voltage output cable is worn, the new one with enough voltage endurance shall be replaced.
- h) When testing, safety must be considered. Every time, after test completed, the high-voltage adjusting knob (1) shall be turned to the minimum position count-clockwise, and turn the main control button (6) off, then turn off the power switch (9), to prevent accident from occurring for the careless when startup the machine at the next time.
- i) When abnormal waves such as electric corona discharge, sparkling appeared on display during the test, don't maintain high voltage for long time.
- j) When hearing abnormal noise, or smelling rare odor, or finding other abnormal phenomena, test shall be interrupted, and turn off the power. The instrument can't be used until the qualified maintenance personnel solved the troubles.

3.2 Testing Procedure

- a) Check the instrument frame for reliable grounding.
- b) Take out the foot switch and plug into the foot switch socket (27) on the rear Panel.

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- c) Adjust the high-voltage knob (1) to the minimum position counter-clockwise. Press the main control button (6) to OFF position.
- d) Insert the power plug, press the power switch on the front panel to ON, now the warm-up indicator (10) is on, and a level line (scan line) is visible on the wave display screen (14).
- e) Adjust the knobs on the front panel (15), (17), (19), (20) to make the scan line clear, with proper position and intensity.
- f) The warm-up indicator (10) will be off about 4 minutes after startup. This means high voltage is ready to carry out testing.
- g) Press the main control button (6) to ON position.
- h) Press the foot control button (4) to ON, and step on the foot switch. **【Or press the manual button (2) to ON.】** Now the high voltage indicator (8) is ON.
- i) Adjust the high voltage adjusting knob (1), meanwhile observe the peak voltage display screen (21) to obtain the required testing voltage value.
- j) Release the foot switch, meanwhile press the main control button (6) to OFF, connect the 3 test wires (11),(12),(13) to the test devices according to the test method. Repeat step g), h) to start up test.
- k) Observe the oscillating and attenuating waves on the screen, and proceed with breakdown analysis judgments. (For the details, refer to Testing Judgment and Breakdown Judgment). For the different loads, the peak voltage will be descending at different degrees.
- l) Release the foot switch, (or press the manual button (2) to OFF), now the high voltage indicator light (8) is off. **【It's suggested to press the main control button (6) to OFF, then the main control indicator light (7) and high voltage indicator light (8) are both off in case of foot switch misact.】**
- m) Remove the test device.
- n) If continue to test, please repeat the steps from g) to m).
- o) Test ends.

3.3 Testing Methods

3.3.1 Testing Preparation

Check the coincidences of the two display waves. Connect H1 and H2 test wires of instrument to the same winding. If the instrument works well, 2 oscillating and attenuating waves would be coincidence completely.

3.3.2 Necessary Notes

The display peak voltage is only sampled from high voltage terminal H1. H1 terminal shall be used in the testing, especially for the test for single-winding coil.

3.3.3 Testing of Three Phase Windings

[1] Φ (phase) Connection

This is the basic way to judge the breakdown of insulation between turns. It is applied to the winding with leads at both ends of each phase. When testing, user can pick up 1 phase winding (for example U phase) as reference winding, and another phase winding (V phase) as tested winding. Apply specified peak voltage pulse to phase U and V simultaneously and compare the differences of these 2 attenuating waves. Then switch the phase windings in turn and repeat the test. See figure 3-1.

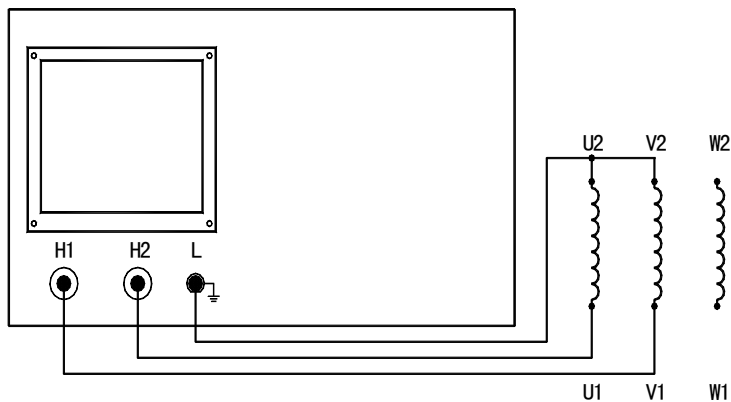


Figure 3-1 Φ (phase) Connection

[2] Y (line) Connection

This way is applied to the winding with formed Y connection or great power. When testing, user can pick up a group of 2 phase windings in series (for example U-W phases) as reference device, and another group of 2 phase windings in series (U-V phases) as tested device. Apply the same peak voltage pulse to U-W and U-V simultaneously and compare the differences of these 2 attenuating waves. Then switch the phase windings in turn and repeat the test. See figure 3-2.

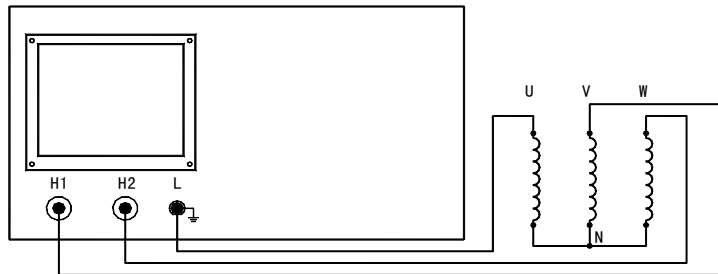


Figure 3-2 Y (line) Connection

[3] Δ (triangle) Connection

This way is applied to test the winding with formed Δ connection. When testing, user can pick up a group of 2 phase windings in series and then parallel with the third phase winding (for example U-W phase) as reference device, and another group of 2 phase winding in series and then parallel with another phase (V-U phase) as tested device. Apply the same specified peak voltage pulse to U-W and V-U simultaneously and compare the differences of these 2 attenuating waves. Then switch the phases in turn and repeat the test. See figure 3-3.

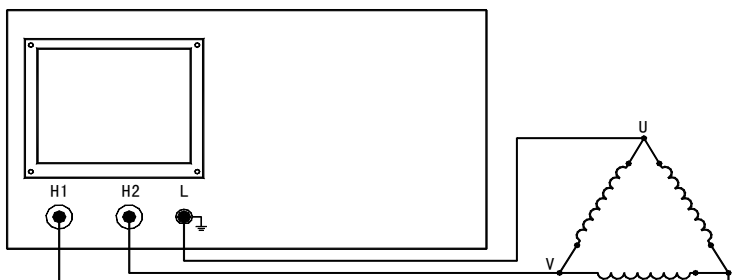


Figure 3-3 Δ (triangle) Connection

3.3.4 Testing of Single-phase Coil or Winding

For the single-phase coil with 2 same windings, it can be tested by the way similar to that of 3-phase windings, or tested with another winding of same type in contrastive way. When testing, the user can pick up a winding, which must have similar type and parameters to those of tested device with perfect insulation between turns, windings and to ground as well, as the reference device. Apply specified peak voltage pulse to the reference device and test device simultaneously, and compare the differences of these 2 attenuating waves.

3.4 Testing Judgment

In the duration of testing, the judgment is mainly made on basis of observation and analysis of waves displayed on screen, and the peak voltage shown on display screen.

3.4.1 Normal wave shapes

If the oscillating and attenuating waves displayed in 2 tests are basically coincidence or have no distinct differences (Coincidence for short), the waves shall be the normal wave without breakdown, i.e. insulation between turns of tested winding has no trouble. See Figure 3-4.



Figure 3-4 Normal wave shapes

Note 1: For the Y connection and Δ connection, when breakdown is located at common position in the comparative circuit, the waves displayed may superpose also. Therefore, the test shall be repeated again by switch the phase in turn. For the details, refer to Breakdown Judgment Chart.

3.4.2 Breakdown wave shapes

If the wave of tested device isn't conformance with the normal wave, it means breakdown occurred on insulation between turns of tested winding. The breakdown wave is usually displayed with noise of discharge, even visible sparkles and smell of ozonic. And also, the waves are displayed with discharge burs and wave bounce. Those phenomena can help the user judge the type and location of breakdowns. See figure 3-5.

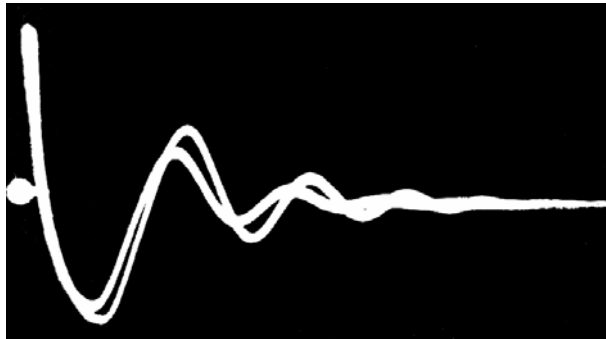


Fig 3-5 Breakdown Wave Shape

3.4.3 Typical Breakdown Waves

[1] Waves of Insulation Breakdowns Between Turns

The tested winding can be stricken to form a short-circuit between turns under a certain pulse voltage. The waves displayed here may have differences, which depend on the breakdown extent and positions. See figure 3-5.

[2] Waves of Breaking Circles for Tested Winding

If the winding circle of tested device is broken, i.e. open-circuit is formed, the wave displayed here are shown as an arc. And also, sometimes discharge is occurred at the breaking area. See figure 3-6.

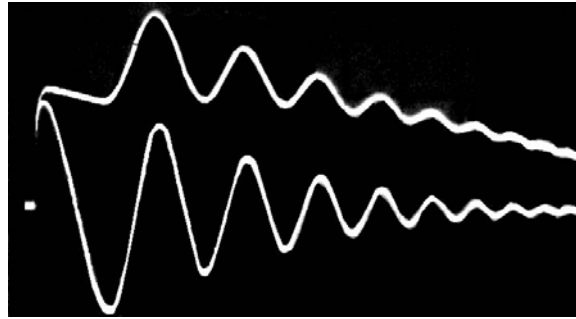


Fig 3-6 Broken Line Wave Shape

[3] Waves of Complete Short-Circuit for Tested Windings

If the winding of tested device is shorted out completely, the wave displayed will be shown as a horizontal line. See figure 3-7.

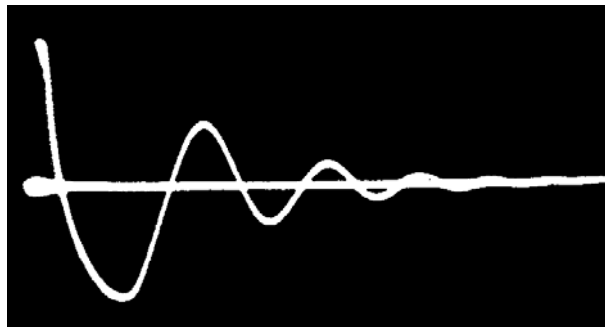


Fig 3-7 Short-circuit Wave Shape

3.5 Breakdown Judgment Table

In order to assist user on judging the breakdown and its location of circle winding in a prompt and convenience manner, these Breakdown Judgment Table are provided for reference to judge in the testing.

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Table 3-1

| Test Method | No. | Test Step | High Voltage Output Terminal Wire | | | Coincidence with Displayed Wave | Breakdown Judgment |
|---|-----|-----------|-----------------------------------|---------|---------|---------------------------------|-------------------------------|
| | | | H1 | H2 | GND | | |
| Breakdown Judgment of Φ Connection | 1 | 1 | U2 | V2 | U1 & V1 | Yes | |
| | | 2 | U2 | W2 | U1 & W1 | No | W Breakdown |
| | V2 | | W2 | V1 & W1 | No | | |
| | 2 | 1 | U2 | V2 | U1 & V1 | No | |
| | | 2 | U2 | W2 | U1 & W1 | Yes | V Breakdown |
| | | | V2 | W2 | V1 & W1 | Yes | U Breakdown |
| | 3 | 1 | U2 | V2 | U1 & V1 | No | |
| | | 2 | U2 | W2 | U1 & W1 | No | Test the 3 rd step |
| | | | V2 | W2 | V1 & W1 | No | |
| | | 3 | V2 | W2 | U1 & W1 | Yes | U Breakdown |
| | | | | | | No | Breakdown Above 2 Phases |
| | | | U2 | W2 | V1 & W1 | Yes | V Breakdown |
| | | | | | | No | Breakdown Above 2 Phases |

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Table 3-2

| Test Method | No. | Test step | High Voltage Output Terminal Wire | | | Coincidence with Displayed Wave | Breakdown Judgment | |
|------------------------------------|-----|-----------|-----------------------------------|-------------|--------------------------|---------------------------------|--------------------|-------------|
| | | | H1 | H2 | GND | | | |
| Breakdown Judgment of Y Connection | 1 | 1 | U | V | W | Yes | | |
| | | 2 | V | W | U | No | W Breakdown | |
| | | | U | W | V | No | | |
| | 2 | 1 | U | V | W | No | | |
| | | 2 | V | W | U | Yes | U Breakdown | |
| | | | U | W | V | Yes | V Breakdown | |
| | 3 | 1 | U | V | W | No | | |
| | | | V | W | U | No | Test the 3rd step | |
| | | U | W | V | No | | | |
| | | 3 | 3 | U | W | V | Yes | V Breakdown |
| | | | | No | Breakdown Above 2 Phases | | | |
| | | | Yes | U Breakdown | | | | |
| | No | | Breakdown Above 2 Phases | | | | | |

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Table 3-3

| Test Method | No. | Test Step | High Voltage Output Terminal Wire | | | Coincidence with Displayed Wave | Breakdown Judgment |
|---|-----|-----------|-----------------------------------|----|-----|---------------------------------|--------------------------|
| | | | H1 | H2 | GND | | |
| Breakdown Judgment of Δ Connection | 1 | 1 | U | V | W | Yes | |
| | | 2 | U | W | V | No | UV Breakdown |
| | | | V | W | U | No | |
| | 2 | 1 | U | V | W | No | |
| | | 2 | U | W | V | Yes | WU Breakdown |
| | | | V | W | U | No | Test the 3rd step |
| | | 3 | U | W | V | Yes | WU Breakdown |
| | | | | | | No | Breakdown Above 2 phases |
| | | 3 | 1 | U | V | W | No |
| | 2 | | U | W | V | No | Test the 3rd step |
| | | | V | W | U | Yes | VW Breakdown |
| | 3 | | V | W | U | Yes | VW Breakdown |
| | | | | | | No | Breakdown Above 2 phases |

Chapter 4 Incoming Inspection and Warranty

4.1 Incoming Inspection

Confirm the following items after opening the package:

[1] No defects such as damage and scratches etc. on the surface.

[2] Contents:

| Name | Quantities | Remarks |
|---|------------|-----------------------------------|
| Model TH2881A Interturn Insulation Tester | 1 | |
| Power Cable | 1 | |
| Test Wire | 1 set | |
| Foot Switch | 1 | |
| Fuse | 4 | 2 pieces of 2A and 2 pieces of 3A |
| Test Report | 1 | |
| Product Certificate | 1 | |
| Quality Assurance Certificate | 1 | |
| Operation Manual | 1 | |

If any damage and absence of accessories is found, contact our company or the shipper (dealer) ASAP is appreciated.

4.2 Warranty

Warranty Duration: One year, which takes effect from the date the product is shipped.

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Bring forth the Quality Assurance Certificate when warranty repair is needed. And our company provides lifetime maintenance for the products.

Within the duration of warranty, if the device is damaged due to improper operation by the operator, it shall be repaired at their own expense.

Changzhou Tonghui Electronic Co., Ltd.

June 2003