TR 100

Single Phase Transformer Turns Ratio Test Instrument

QUICK START GUIDE

POWER DIAGNOSTIC INSTRUMENT COMPANY

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Safety Guidelines and Precautions

The following Safety Guidelines and Precautions must be observed during all phases of testing, including setup, test hookups, testing, and test lead disconnection.

Do Not Service or Test Alone

The TR 100 shall be used only by trained operators. All transformers under test must be off-line and fully isolate. Do not perform test procedures or service unless another person is also present who is capable of rendering aid and resuscitation.

Do Not Remove Test Leads During a Test

Do not remove test leads during a test. Failure to heed this warning can results in electrical shock to personnel and damage to the equipment.

Do Not Modify Test Equipment

Do not install substitute parts or perform any unauthorized modifications to the TR 100 as they can add the risk of introducing additional or unknown hazards. To ensure that designed safety features are maintained, it is recommended that all TR 100 repairs are performed by Power Diagnostic Instrument Company or by an authorized repair center. Unauthorized TR 100 modifications can create unknown safety hazards and will void the manufacturer's warranty.

Follow the Manufacturer’s Operating Procedures

Please do not deviate from the operating procedures provided in this manual. Any deviations may create safety hazards, damage the TR 100, or cause test errors. Power Diagnostic Instrument Company assumes no liability for unsafe or improper use of the TR 100.

Power Supply

Always connect the TR 100 to an AC receptacle with protective ground.

Replacement Fuses

The TR 100 uses a 250V/3A Fast Blow fuse (F3A 250V).

Accessories and Replacement Parts

The TR 100 must be used with genuine Power Diagnostic Instrument Company cables and accessories.

1. Introduction

1.1. Applicability

This manual applies to the Power Diagnostic Instrument Company model TR 100. This manual is the basic issue for the TR 100 and does not supersede any published document.

1.2. General Description and Features

The TR 100 is a micro-processor based, single phase, automatic transformer turns-ratio tester that uses the IEEE C57.12.90 measuring method to determine the transformer turns-ratio. The transformer turns-ratio is determined by precisely measuring the voltages across the unloaded transformer windings. The TR 100's measuring circuitry self-adjusts before each measurement to ensure turns-ratio accuracy. Three selectable test voltages, 4 Vac, 40 Vac and 100 Vac, offer flexibility in testing different types of transformers.

The TR 100 can measure turns-ratios ranging from 0.8 to 30,000 and can be used to test voltage regulators, power transformers, current transformers (CT's), and potential transformers (PT's). The TR 100 also measures and displays transformer-winding excitation current, winding polarity, and winding phase angle. Test results are displayed on a back-lit color LCD screen (800 x 480 pixels) that is viewable in bright sunlight and low-light conditions.

In addition to measuring a transformer's turns-ratio, the transformer's name plate voltages can also be entered, and the TR 100 will then display the turns-ratio percentage error. This convenient feature eliminates any user-calculation errors when testing transformers.

When testing a 3-phase transformer, the TR 100 provides connection information (H and X test leads to the transformer bushings) for phase A, B and C tests. The three phase test results (turns-ratio, excitation current, winding polarity, phase-angle, and percentage error) are displayed on the LCD screen.

1.3. User Interface

The TR 100 features a back-lit color touch enabled LCD screen (800 x 480 pixels) that is viewable in direct sunlight and low-light levels. A rugged full "QWERTY" keypad is used to enter test information and to operate the unit.

1.4. Test Record Storage

The TR 100 can store 128 records of 33 readings internally, and up to 999 test records on an external USB Flash drive. Test records can be recalled using the included Transformer Analysis PC software.

1.5. Computer Interface

A Windows®-based Transformer Analysis Software is provided with each unit and can be used to remotely control the TR 100 via the USB port. Using the Transformer Analysis software, the user can retrieve test records from the TR 100's memory or a USB Flash drive, analyze test

results, and print test results on a desktop printer. Test results are automatically exported to PDF and Excel formats

1.6. Battery Power for Exceptional Portability

The TR 100 is powered by a 12-volt, 7 ampere-hour, sealed lead acid battery. This high-capacity battery, coupled with the TR 100's low power consuming circuitry, allows the unit to be used continuously for up to 4 hours per charge. A built-in charger allows the unit to be used during charging.

2. Technical Specifications

Physical Specifications	**Dimensions:** 14"W x 6"H x 11" D (31.3 cm x 15.2 cm x 27.9 cm) **TR 100 Weight without Battery:** 12 lbs. (5.4 Kg) **TR 100 Weight with Battery:** 15 lbs. (6.8 Kg)
Operating Voltage	90 ¬ 240 Vac, 50/60 Hz
Measuring Method	ANSI/IEEE C57.12.90
Turns Ratio Accuracy	**4 Vac:** Typical accuracy ±0.05%, Max ±0.16% **40 Vac:** Typical accuracy ±0.05%, Max ±0.16% **100 Vac:** Typical accuracy ±0.05%, Max ±0.16%
Phase Angle Measurement	0 ¬ 360 degrees
Accuracy	±0.2 degree (±1 digit)
Polarity Reading	In-phase or out-of-phase indication
Display	800 x 480 pixels back-lit color LCD; touch screen;viewable in direct sunlight and low light
Computer Interface	USB 2.0
Internal Data Storage	128 records of 33 readings
PC Software	Windows®-based transformer analysis software is included
Safety	IEC/EN 61010-1, EN 61326-1, EN 61000-3, and EN 61000-4 UL 61010A-1, and CSA-C22.2 standards.
External Data Storage	USB flash drive interface (drive not included)
Humidity	90% RH @ 40°C (104°F) non-condensing
Temperature	**Operating:** -10°C to +50°C (+15°F to +122°F) **Storage:** -30°C to +70°C (-22°F to +158°F)
Altitude	2,000 m (6,562 ft)
Included Cables	One 16' (4.6m) single phase cable, one power cord, one USB cable, one cable bag.
Warranty	Two years on parts and labor
Options	Shipping case (can hold unit and cables), test cable extension 25’

3. Interface Overview

Below is an overview of the interface components of the TR 100. Please take some time to familiarize yourself with these components before using the TR 200.

Figure 1:
TR 100 Interface Overview

4. TR 100 Cable Connections

Figure 2:
Typical Single-Phase Transformer Connection

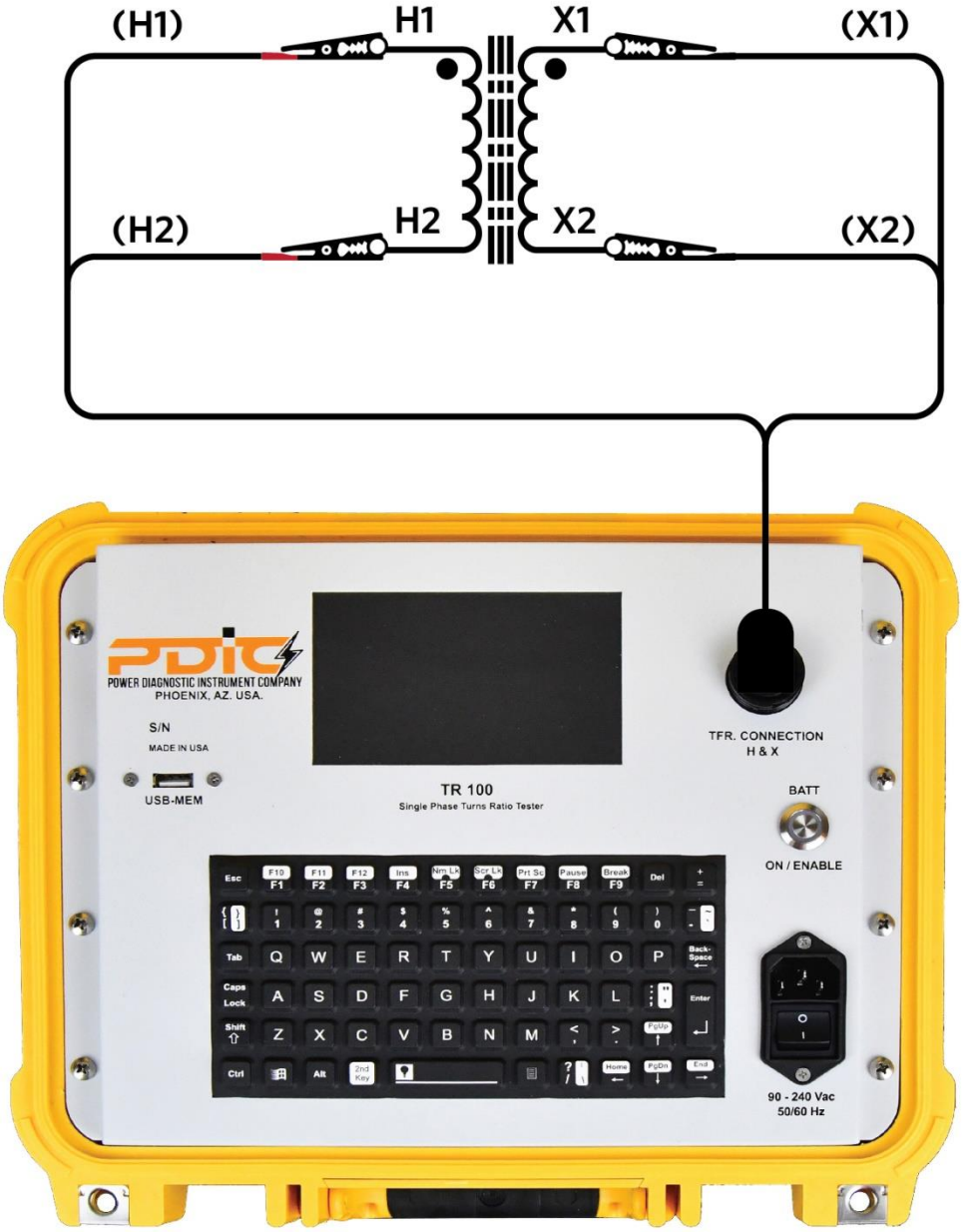


Figure 3:
Typical Current Transformer Connection

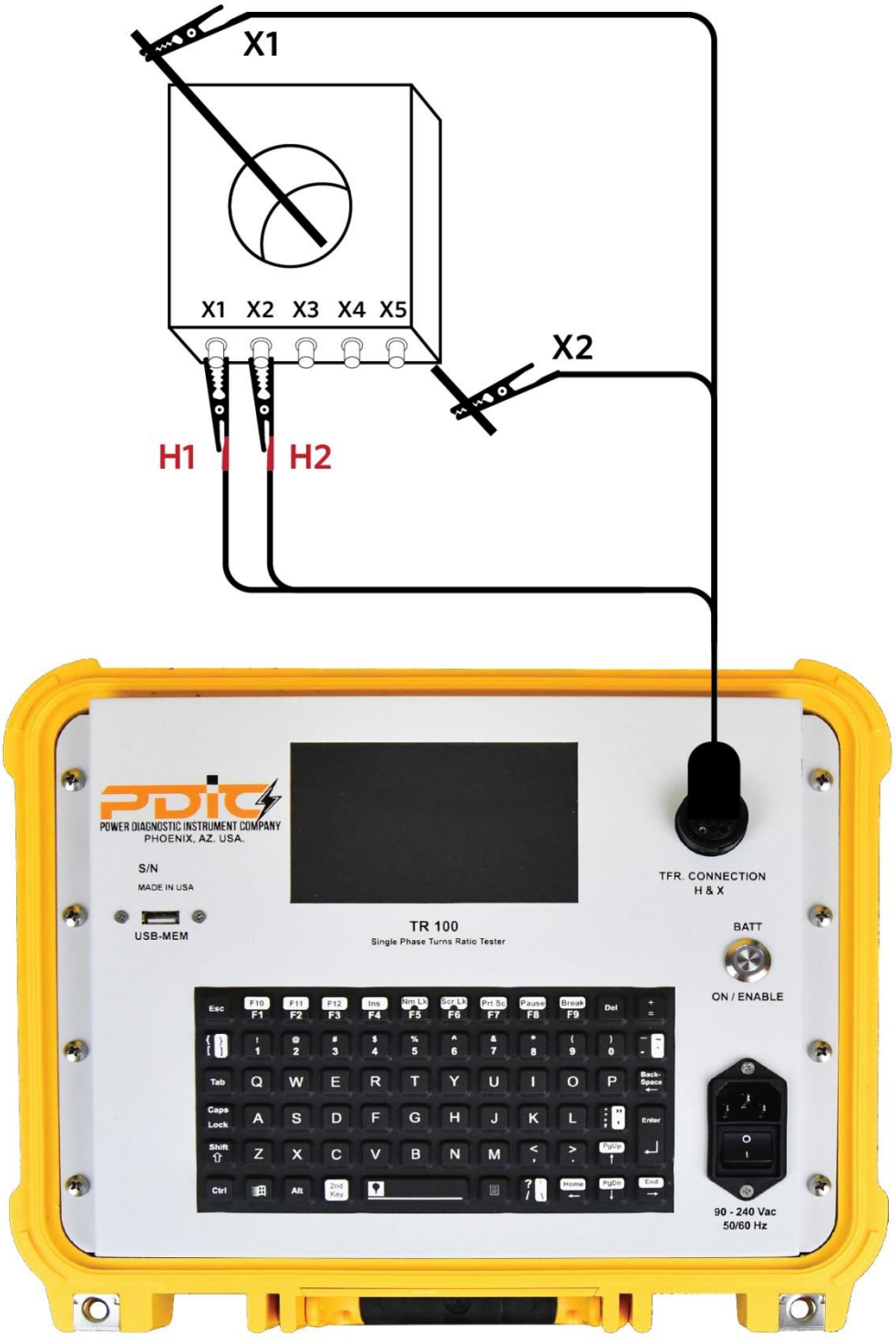
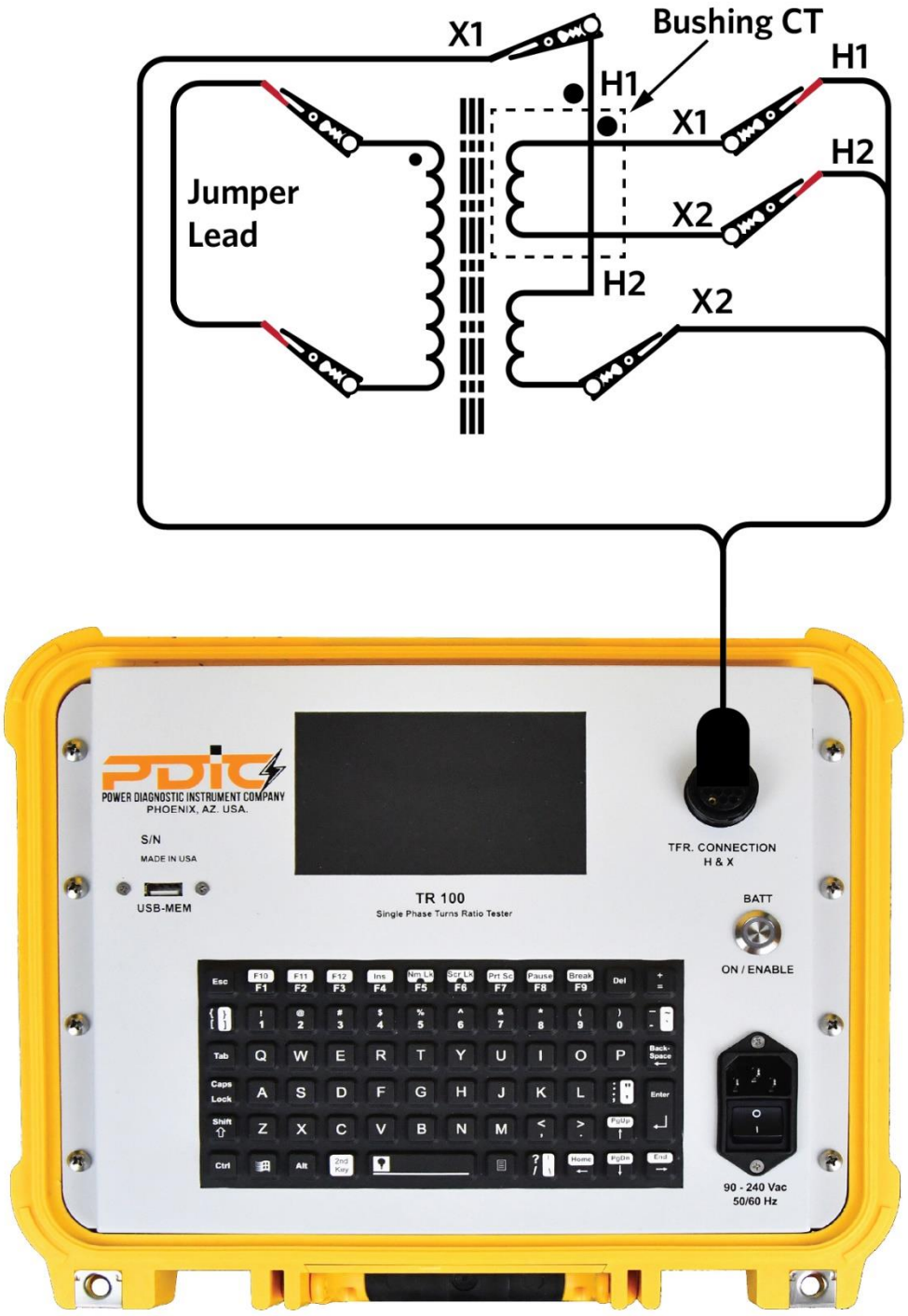
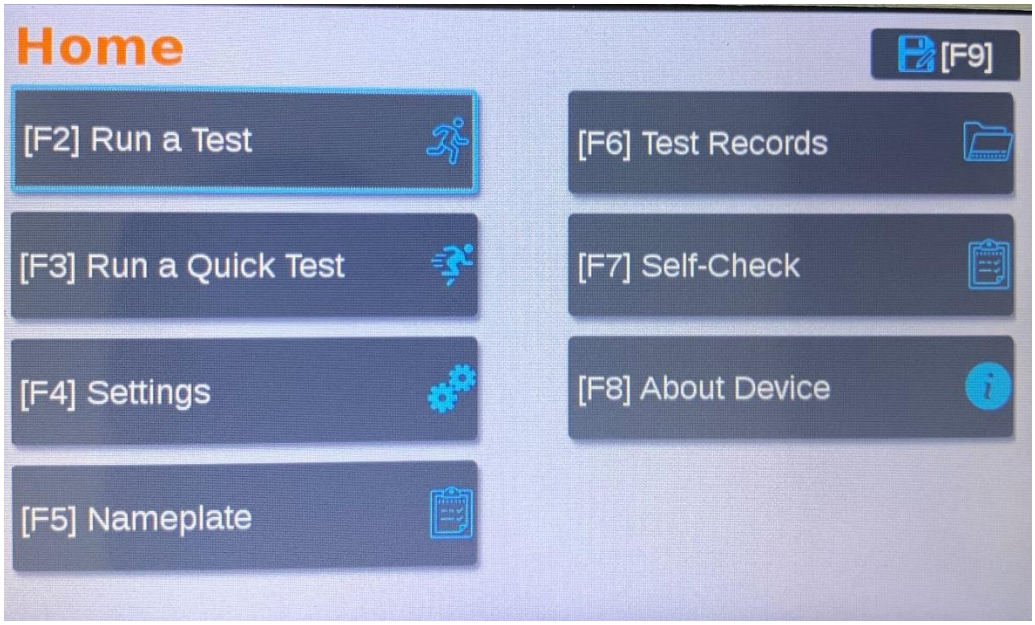


Figure 4:
Typical Bushing CT Connection



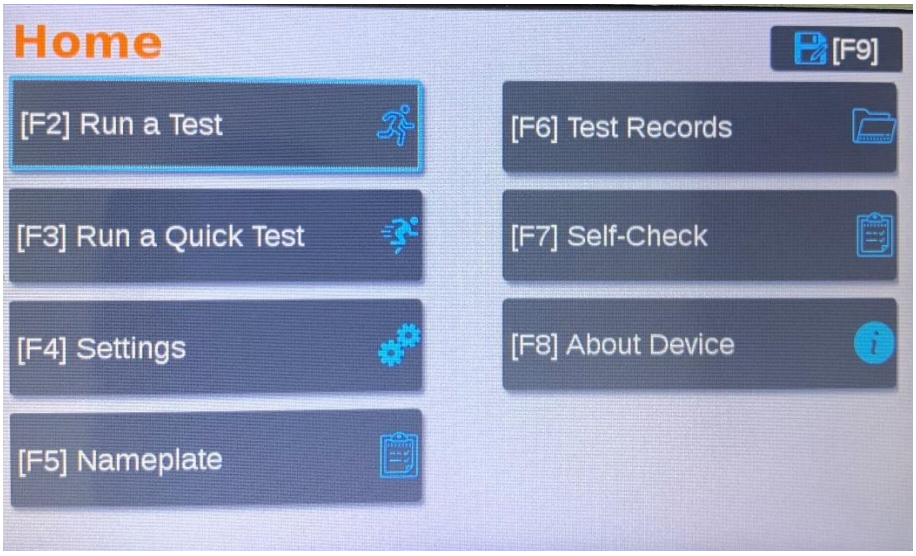
5. Operating Instructions

On power up, the Main Menu of the TR 100 will be displayed as shown below:



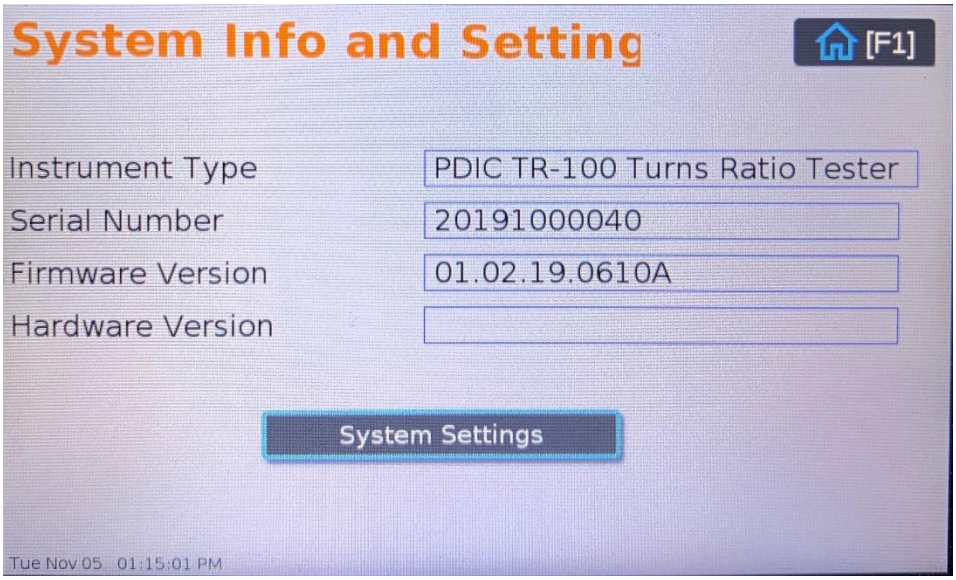
5.1. Setting the Current Date and Time

a. Start from the Main Menu:



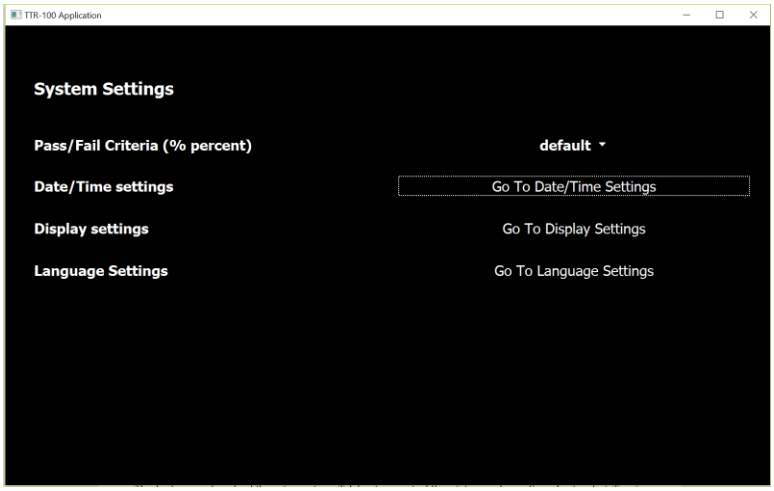
Press the **[F8]** key for the system info and settings menu.

b. The following screen will be displayed:



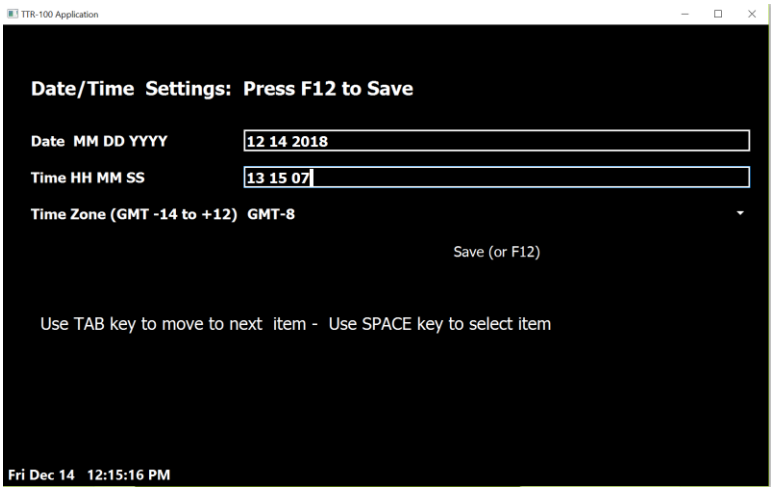
Touch or Press the **[TAB]** key until "System Settings" is highlighted, and then press the **[SPACEBAR]**.

c. The following screen will be displayed:



Touch or Press the **[TAB]** key to move to "Go to Date/Time settings" and then press the **[SPACEBAR]**.

d. The following screen will be displayed:

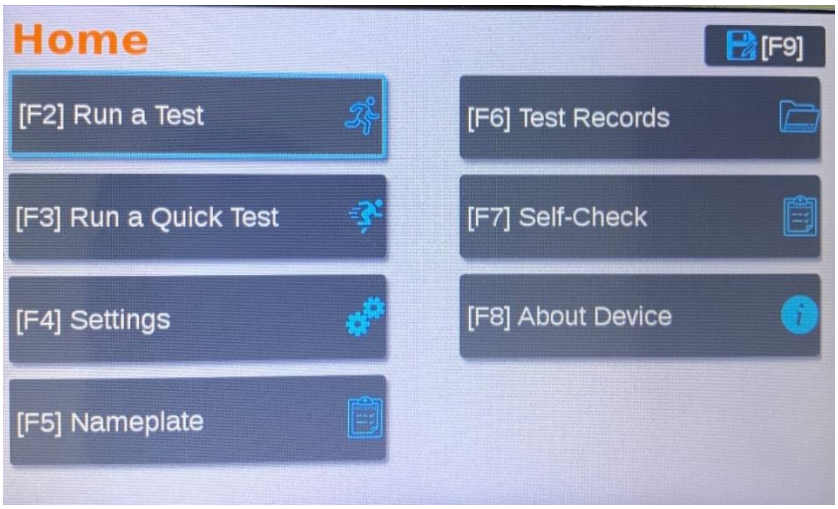


Use the **[TAB]** key to move to the item that you would like to change and press the **[SPACEBAR]**. Make any changes using the keypad and then press the **[F12]** key to save.

NOTE: To select the* [F12] *key, first hold down the* [2nd Key] *and then press the* [F3] *key.

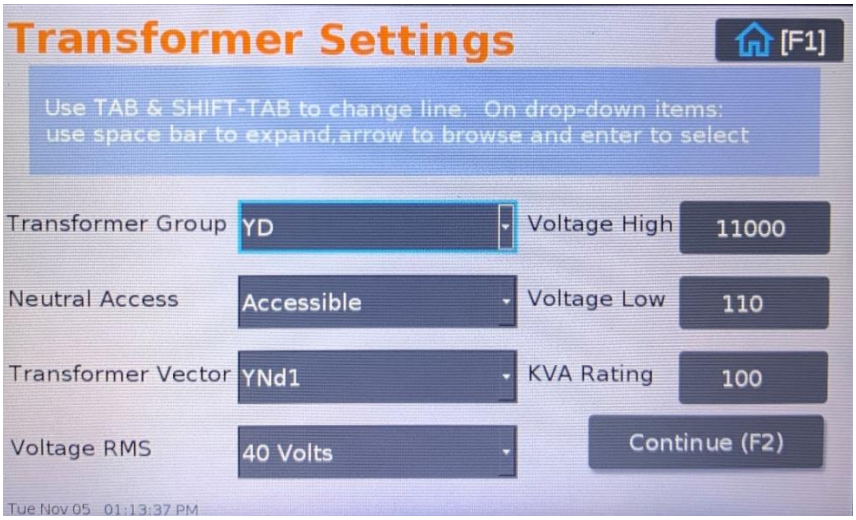
5.2. Setting Test Parameters

a. To set the test parameters, start from the Main Menu:



Press the [F4] key or Touch the settings menu.

b. The following screen will be displayed:



From this screen, first select the transformer type by pressing the [TAB] key to navigate to “Transformer Group” [SPACEBAR] to select either “Single Phase” or “Three Phase”.

If “Three Phase” is selected from the “Transformer Group”, then you must also select the accessibility of the neutral on the high side or low side.

Next, enter the low and high voltage ratings of the transformer in Volts.

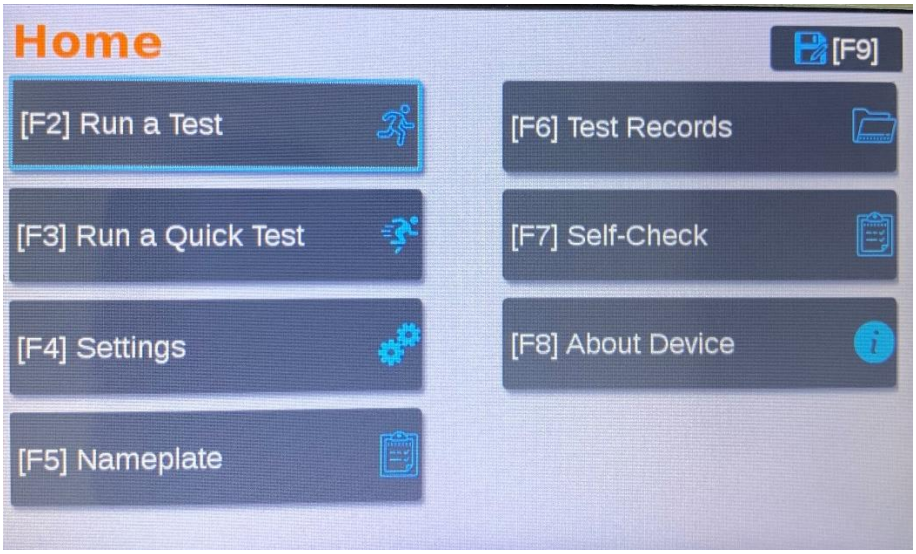
Lastly, select the desired test voltage, either 4V, 40V, or 100V.

After setting the test parameters, press the [F1] key to return to the Main Menu.

5.3. Running a Quick Test

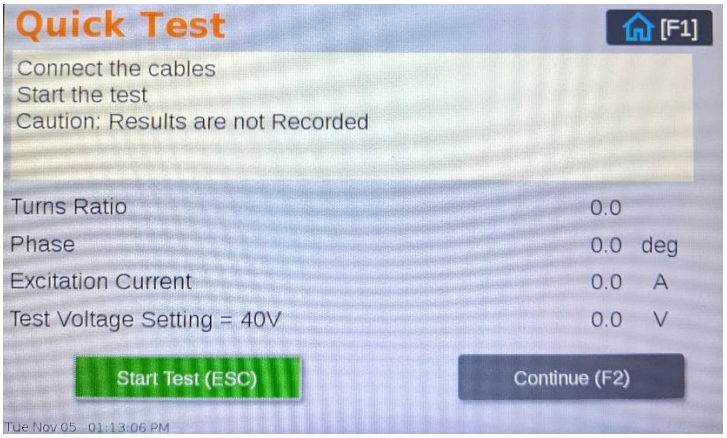
A quick test is used to make sure all the connections are made correctly. Follow the steps below to perform a quick test.

a. Start from the Main Menu:



Press the [F3] key.

b. The following screen will be displayed:



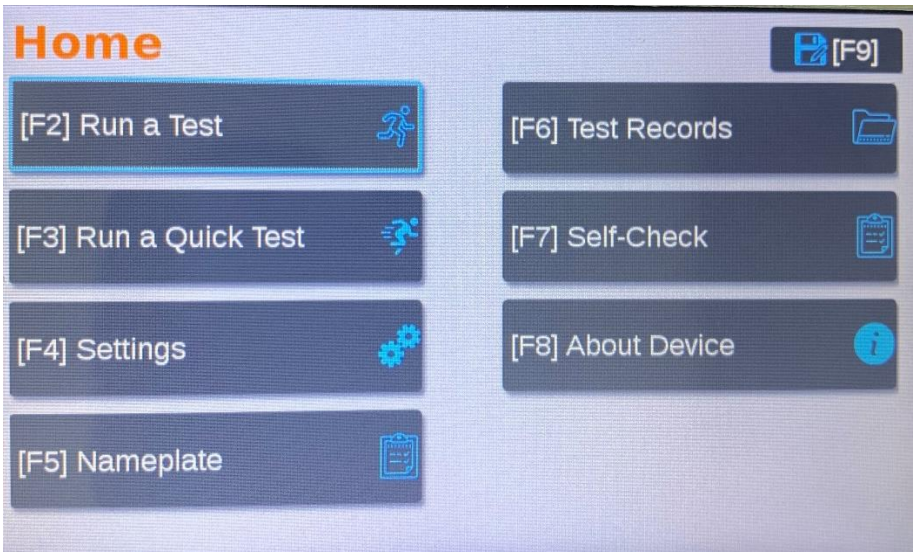
Press the [SPACEBAR] to start and end the test. Once stopped, the test can be re-started by pressing the [SPACEBAR] again.

Press the [F1] key to return to the Main Menu.

5.4. Setting Nameplate Information

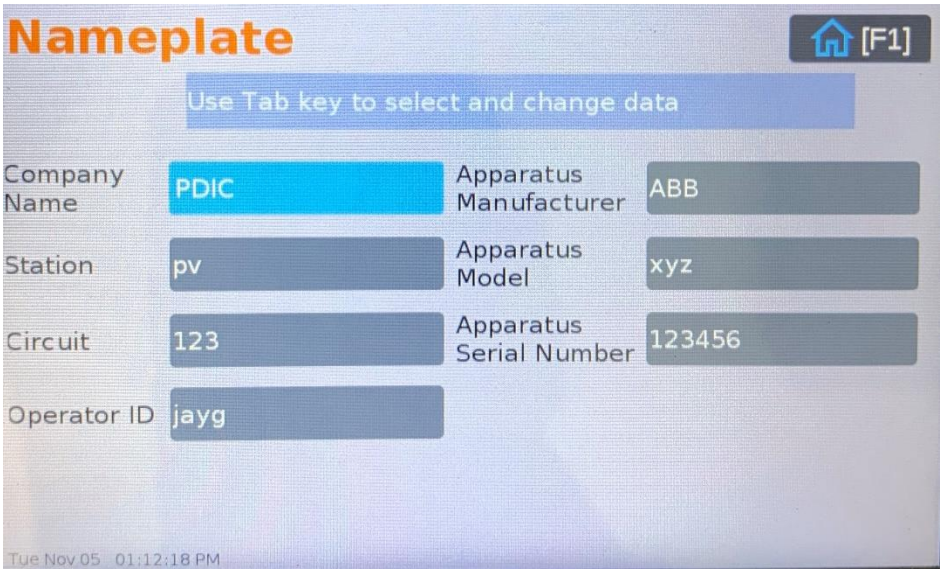
Before running a test, you should set the nameplate information to make sure the right apparatus information is stored with the test results. Follow the steps below to set the nameplate information:

a. Start from the Main Menu:



Press the [F5] key.

b. The following screen will be displayed:

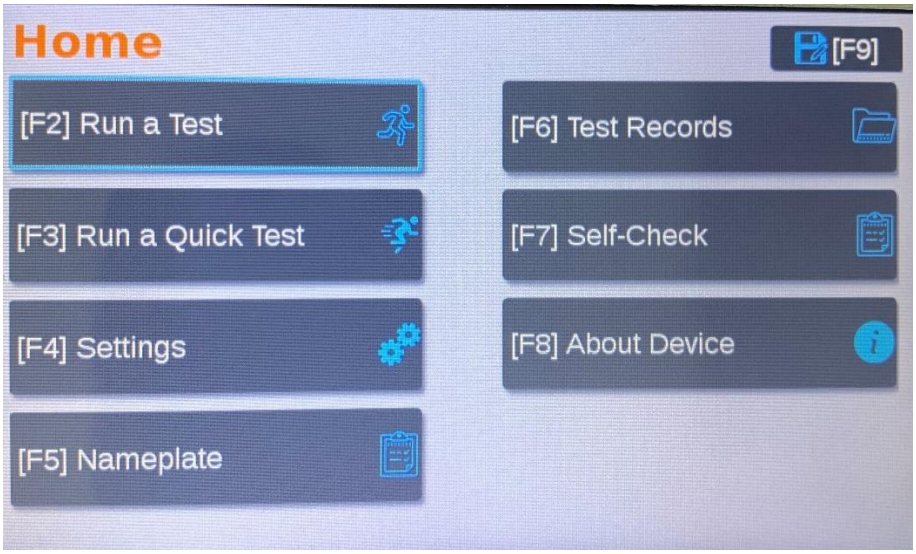


Press the [TAB] key to navigate between the different fields and use the keypad to change the information. Once done, press the [F1] key to return to the Main Menu.

5.5. Running a Test

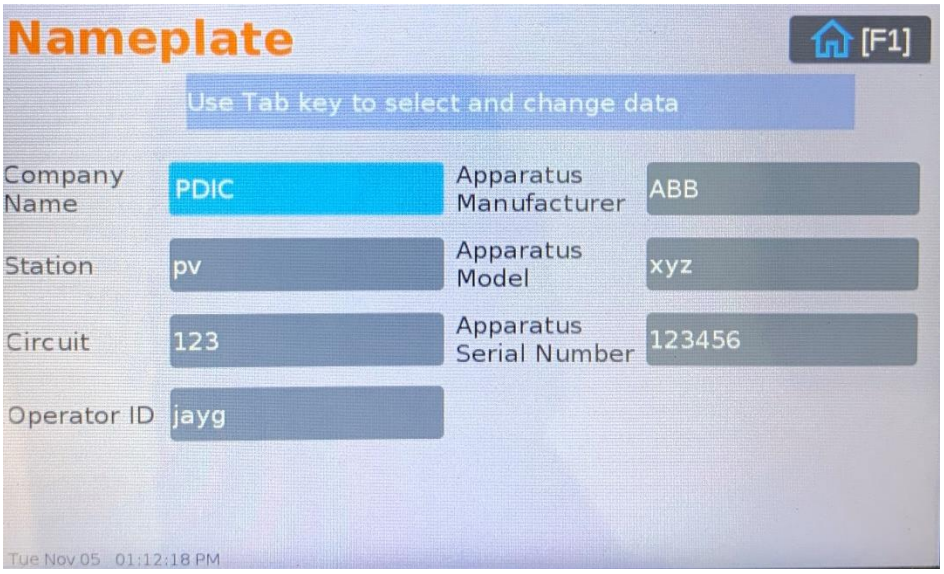
To run a test, first configure the test parameters as outlined in section 5.2, then follow the steps below:

a. Start from the Main Menu:



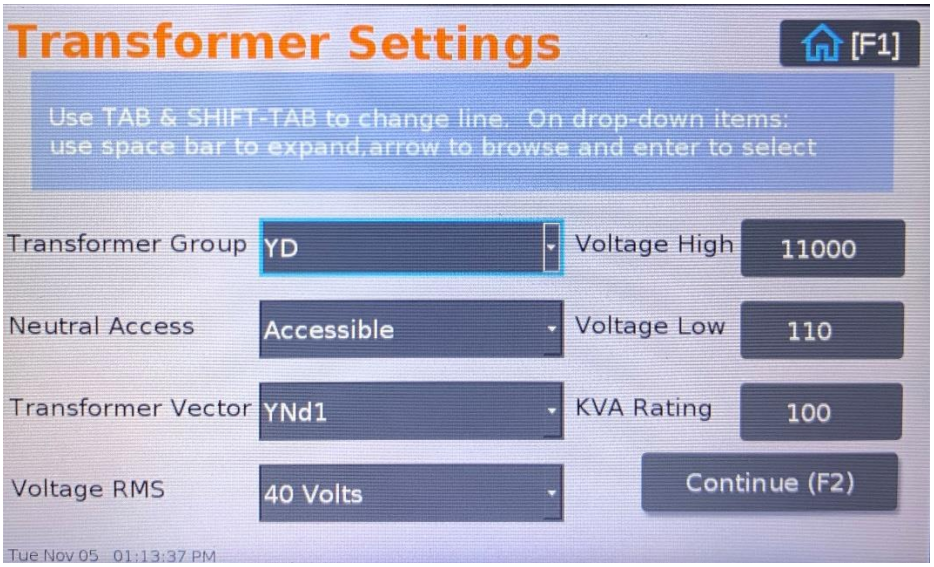
Press the [F2] key to run a test.

b. The following screen will be displayed:



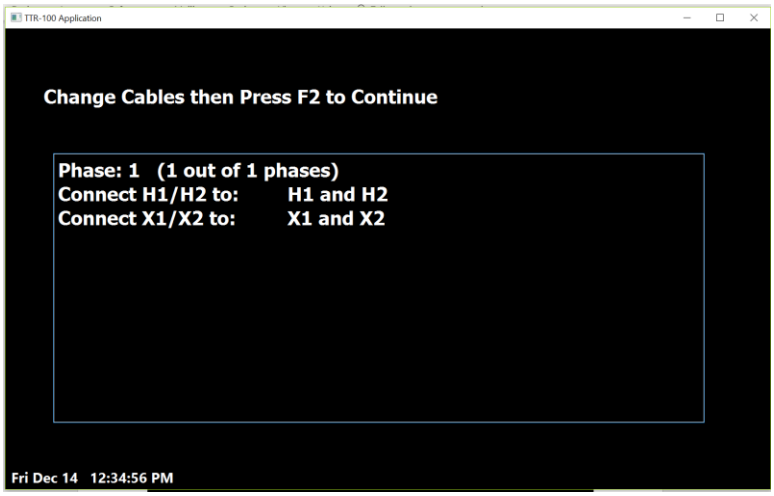
This screen is used to set the apparatus information. Use the [TAB] key to navigate between the fields and use the keypad to make any necessary changes, then press the [F2] key to continue.

c. The following screen will be displayed:



The test parameters can be changed here by pressing the [TAB] key and navigating to the setting that needs to be changed. Press the [F2] key to run the test.

d. The following screen will be displayed:



Depending on the type of transformer, the instruments will direct the user to connect the cables accordingly. Once the cables are connected, press the [F2] key to continue the test.

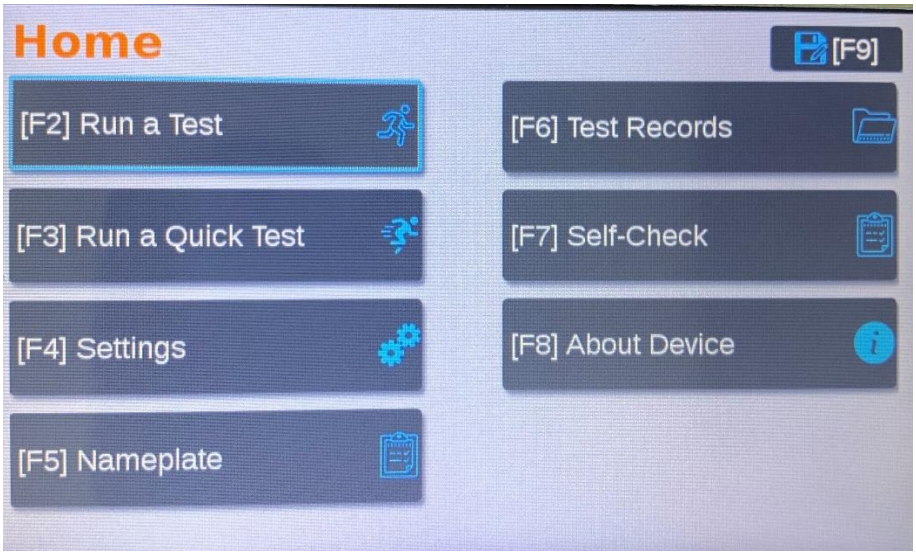
If a three-phase test is selected, the user will be prompted to change the cables till all phases have been tested.

Once the test is complete, press the [F9] key to save the test results to the instrument's internal memory.

5.6. Working with Test Records

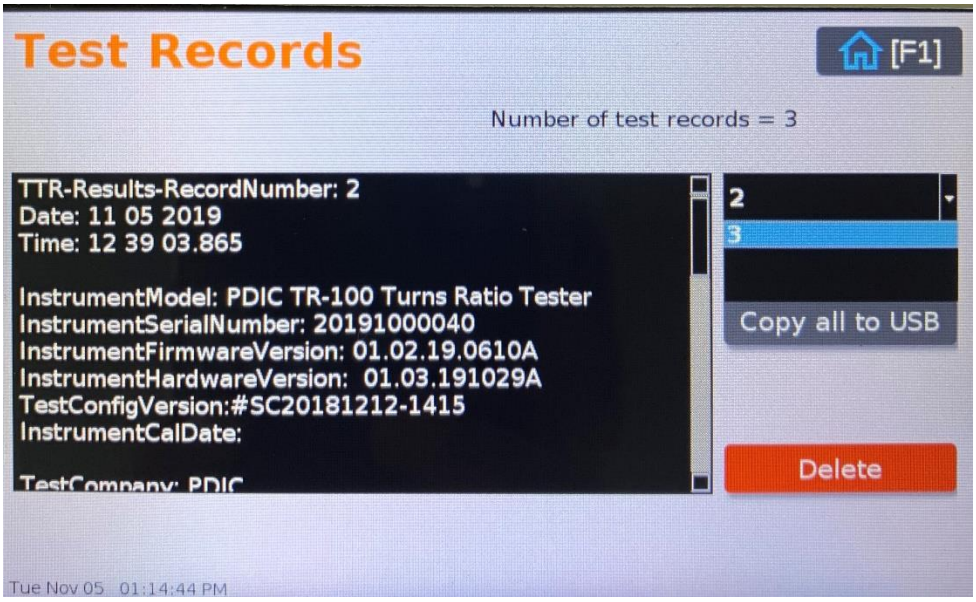
Follow the steps below to work with test records stored in the unit's memory:

a. Start from the Main Menu:



Press the [F6] key to access the Test Records menu.

b. The following screen will be displayed:



The number of test records will be displayed on this screen. Select the test record from the drop-down menu then press the [TAB] key to select one of the functions on the right. Then press the [SPACEBAR] to execute the selected command. The following commands are available:

Copy all to USB – This command will copy all test records from the unit's internal memory to a USB Flash drive that is inserted in the unit's USB Mem port.

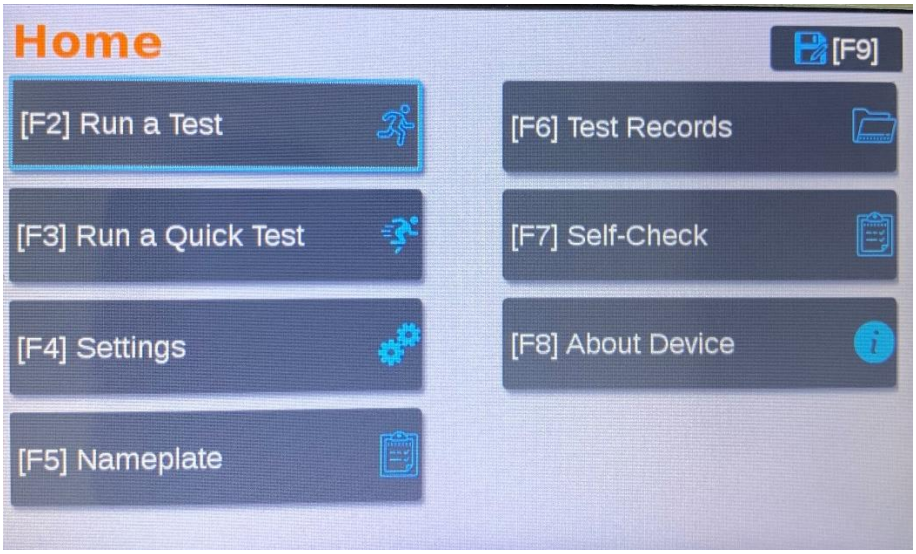
Delete – This command will delete the selected test record from the unit's internal memory.

Save to USB – This command will copy the selected test record from the unit's internal memory to a USB Flash drive that is inserted in the unit's USB Mem port.

5.7. Perform a Self-Check

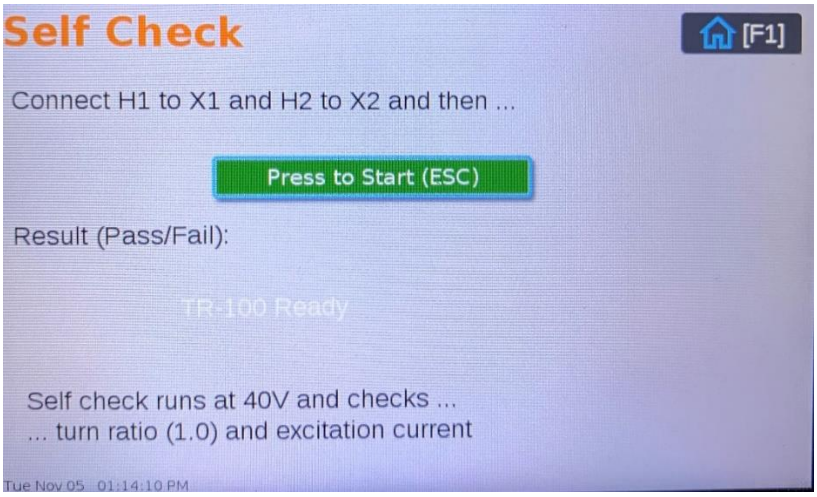
The TR 100 has a self-check feature that can check the instrument to make sure that it is functioning properly. Follow the steps below to perform a self-check:

a. Start from the Main Menu:



Press the [F7] key.

b. The following screen will be displayed:



The screen prompts the user to short the H1 cable to the X1 cable and the H2 cable to the X2 cable. Once connected, press the [SPACEBAR]. If the instrument detects a turns ratio of 1, a “Pass” message will be displayed; otherwise, a “Fail” message will be displayed.

If the instrument fails this test, please contact the manufacturer for re-calibration or repair.

Appendix A – Transformer Vector Group Codes

Utility power transformers manufactured in accordance with IEC specifications have a Rating Plate attached in a visible location. This plate contains a list of the transformer's configuration and operating specifications. One such rating is the winding configuration and phase-displacement code. This code follows a convention that comprises letter and number sets that denote three-phase winding configurations (i.e., Wye, delta, or zig-zag). Letter symbols for the different windings are noted in descending order of their rated voltages. That is, symbols denoting higher voltage ratings will be in upper-case letters and symbols denoting lower or intermediate voltage ratings will be in lower-case letters. If the neutral point of either a wye or zig-zag winding is brought out, the indication will be an N (high voltage) or n (lower voltage). The end numeral is a 300 multiplier that indicates phase lag between windings.

Accordingly, the following standard practice applies:

Wye (or star) = Y (high voltage) or y (low voltage)

Delta = D (high voltage) or d (low voltage)

Zig-zag = Z (high voltage) or z (low voltage)

For example, **Dyn11** decodes as follows:

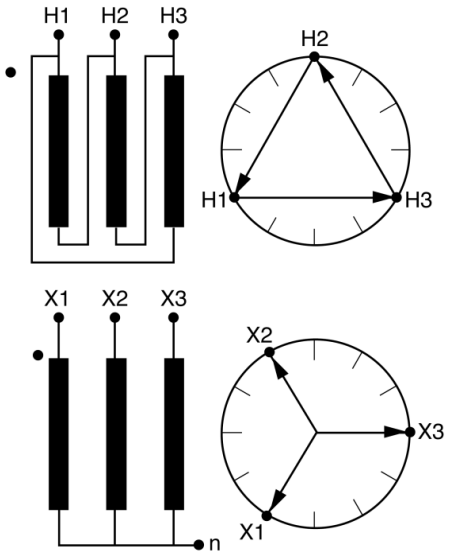
D indicates that the high-voltage windings are connected in a Delta configuration

(Since delta windings do not have a neutral point, the N never appears after a D).

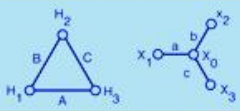
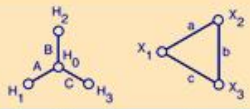
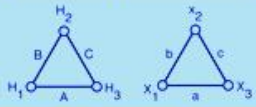
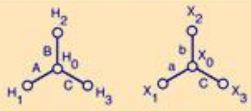
y indicates that the lower voltage winding is in a wye (or star) configuration.

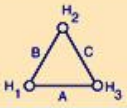
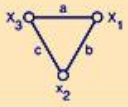
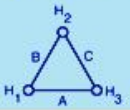
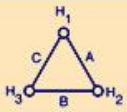
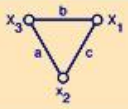
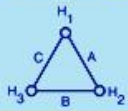
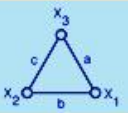
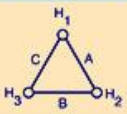
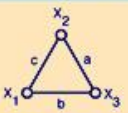
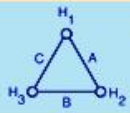
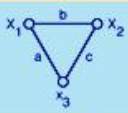
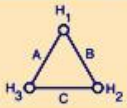
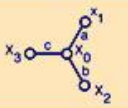
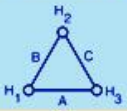
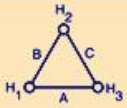
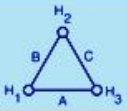
n indicates that the lower voltage windings have the neutral point brought out.

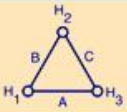
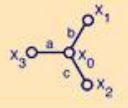
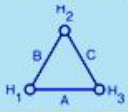
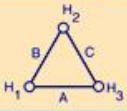
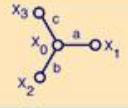
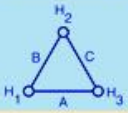
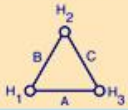
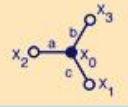
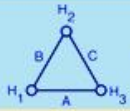
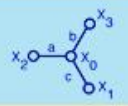
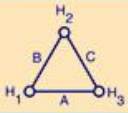
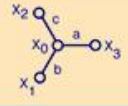
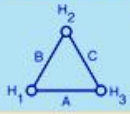
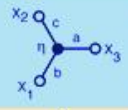
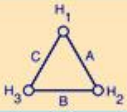
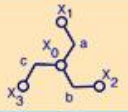
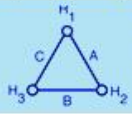
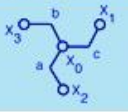
11 indicates a phase-displacement lag of 330 degrees between the Wye and the Delta winding.

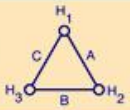
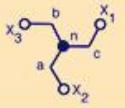
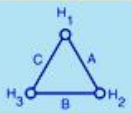
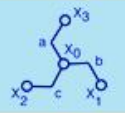
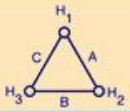
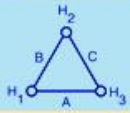
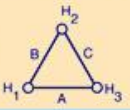
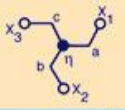
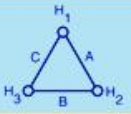
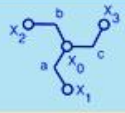
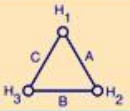
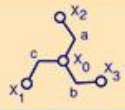
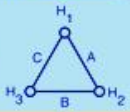
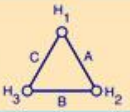
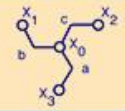
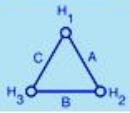
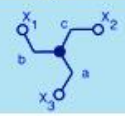


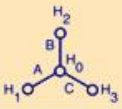
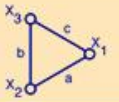
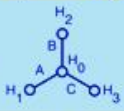
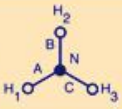
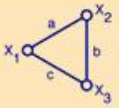
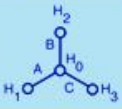
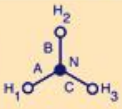
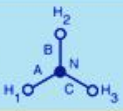
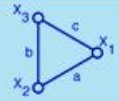
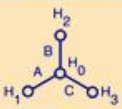
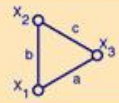
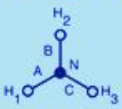
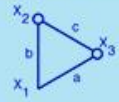
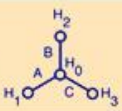
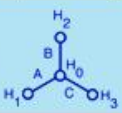
Appendix B – Common Transformer Descriptions

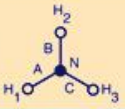
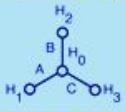
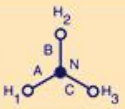
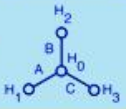
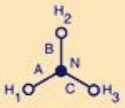
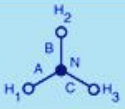
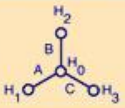
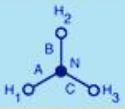
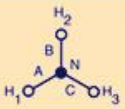
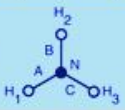
STD TEST NO.	TRANSFORMER CONFIGURATION: HIGH-VOLTAGE WINDING (H)	TRANSFORMER CONFIGURATION: LOW-VOLTAGE WINDING (X)	PHASE	WINDING TESTED: HIGH VOLTAGE WINDING	WINDING TESTED: LOW VOLTAGE WINDING	TURNS RATIO	VECTOR GROUP	NOTES
1			1 Ø	$H_1 - H_2$	$X_1 - X_2$	$\frac{V_H}{V_x}$	1ph0	SNG – PHS
2			A B C	$H_1 - H_3$ $H_2 - H_1$ $H_3 - H_2$	$X_1 - X_0$ $X_2 - X_0$ $X_3 - X_0$	$\frac{V_H \cdot \sqrt{3}}{V_x}$	Dyn1	d t – Y
3			A B C	$H_1 - H_0$ $H_2 - H_0$ $H_3 - H_0$	$X_1 - X_2$ $X_2 - X_3$ $X_3 - X_1$	$\frac{V_H}{V_x \cdot \sqrt{3}}$	YNd1	y – d t
4			A B C	$H_1 - H_3$ $H_2 - H_1$ $H_3 - H_2$	$X_1 - X_3$ $X_2 - X_1$ $X_3 - X_2$	$\frac{V_H}{V_x}$	Dd0	d t – d t
5			A B C	$H_1 - H_0$ $H_2 - H_0$ $H_3 - H_0$	$X_1 - X_0$ $X_2 - X_0$ $X_3 - X_0$	$\frac{V_H}{V_x}$	YNyn0	y – y

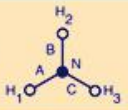
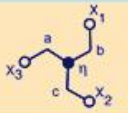
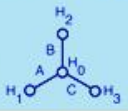
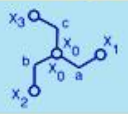
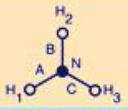
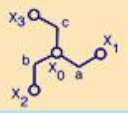
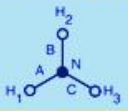
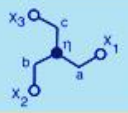
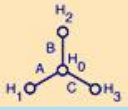
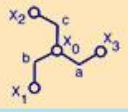
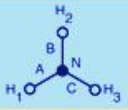
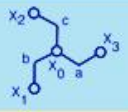
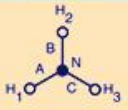
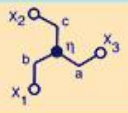
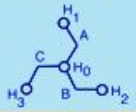
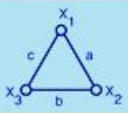
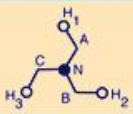
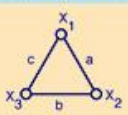
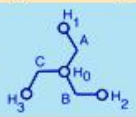
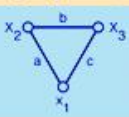
SPEC TEST NO.	TRANSFORMER CONFIGURATION: HIGH-VOLTAGE WINDING (H)	TRANSFORMER CONFIGURATION: LOW-VOLTAGE WINDING (X)	EXT. JUMPER	PHASE	WINDING TESTED: HIGH VOLTAGE WINDING	WINDING TESTED: LOW VOLTAGE WINDING	CAL. TURN RATIO	VECTOR GROUP	NOTES
1			—	A B C	$H_1 - H_3$ $H_2 - H_1$ $H_3 - H_2$	$X_3 - X_1$ $X_1 - X_2$ $X_2 - X_3$	$\frac{V_H}{V_x}$	Dd6	
37			—	A B C	$H_1 - H_3$ $H_2 - H_1$ $H_3 - H_2$	$X_1 - X_3$ $X_2 - X_1$ $X_3 - X_2$	$\frac{V_H}{V_x}$	Dd0	
38			—	A B C	$H_1 - H_2$ $H_2 - H_3$ $H_3 - H_1$	$X_3 - X_2$ $X_1 - X_3$ $X_2 - X_1$	$\frac{V_H}{V_x}$	Dd2	
39			—	A B C	$H_1 - H_2$ $H_2 - H_3$ $H_3 - H_1$	$X_3 - X_1$ $X_1 - X_2$ $X_2 - X_3$	$\frac{V_H}{V_x}$	Dd4	
40			—	A B C	$H_1 - H_2$ $H_2 - H_3$ $H_3 - H_1$	$X_2 - X_3$ $X_3 - X_1$ $X_1 - X_2$	$\frac{V_H}{V_x}$	Dd8	
41			—	A B C	$H_1 - H_2$ $H_2 - H_3$ $H_3 - H_1$	$X_1 - X_3$ $X_2 - X_1$ $X_3 - X_2$	$\frac{V_H}{V_x}$	Dd10	
42			—	A B C	$H_1 - H_3$ $H_2 - H_1$ $H_3 - H_2$	$X_1 - X_0$ $X_2 - X_0$ $X_3 - X_0$	$\frac{V_H \cdot \sqrt{3}}{V_x}$	Dyn1	
2			$H_3 - H_2$ $H_1 - H_3$ $H_2 - H_1$	A B C	$H_1 - H_3$ $H_2 - H_1$ $H_3 - H_2$	$X_1 - X_3$ $X_2 - X_1$ $X_3 - X_2$	$\frac{V_H \cdot \sqrt{3}}{V_x}$	Dy1	NO ACCESSIBLE NEUTRAL ON WYE WINDING
61			$H_3 - H_2$ $H_1 - H_3$ $H_2 - H_1$	A B C	$H_1 - H_3$ $H_2 - H_1$ $H_3 - H_2$	$X_1 - X_2$ $X_2 - X_3$ $X_3 - X_1$	$\frac{V_H \cdot \sqrt{3}}{V_x}$	Dy3	NO ACCESSIBLE NEUTRAL ON WYE WINDING
62			—	A B C	$H_1 - H_3$ $H_2 - H_1$ $H_3 - H_2$	$X_0 - X_2$ $X_0 - X_3$ $X_0 - X_1$	$\frac{V_H \cdot \sqrt{3}}{V_x}$	Dyn3	

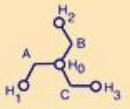
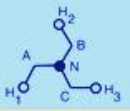
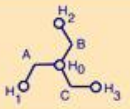
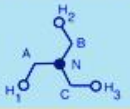
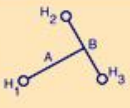
SPEC TEST NO.	TRANSFORMER CONFIGURATION: HIGH-VOLTAGE WINDING (H)	TRANSFORMER CONFIGURATION: LOW-VOLTAGE WINDING (X)	EXT. JUMPER	PHASE	WINDING TESTED: HIGH VOLTAGE WINDING	WINDING TESTED: LOW VOLTAGE WINDING	CAL. TURN RATIO	VECTOR GROUP	NOTES
3			—	A B C	$H_1 - H_3$ $H_2 - H_1$ $H_3 - H_2$	$X_3 - X_0$ $X_1 - X_0$ $X_2 - X_0$	$\frac{V_H \cdot \sqrt{3}}{V_x}$	Dyn5	
4			$H_3 - H_2$ $H_1 - H_3$ $H_2 - H_1$	A B C	$H_1 - H_3$ $H_2 - H_1$ $H_3 - H_2$	$X_3 - X_2$ $X_1 - X_3$ $X_2 - X_1$	$\frac{V_H \cdot \sqrt{3}}{V_x}$	Dy5	NO ACCESSIBLE NEUTRAL ON WYE WINDING
5			—	A B C	$H_1 - H_3$ $H_2 - H_1$ $H_3 - H_2$	$X_0 - X_1$ $X_0 - X_2$ $X_0 - X_3$	$\frac{V_H \cdot \sqrt{3}}{V_x}$	Dyn7	
6			$H_3 - H_2$ $H_1 - H_3$ $H_2 - H_1$	A B C	$H_1 - H_3$ $H_2 - H_1$ $H_3 - H_2$	$X_3 - X_1$ $X_1 - X_2$ $X_2 - X_3$	$\frac{V_H \cdot \sqrt{3}}{V_x}$	Dy7	NO ACCESSIBLE NEUTRAL ON WYE WINDING
63			$H_3 - H_2$ $H_1 - H_3$ $H_2 - H_1$	A B C	$H_1 - H_3$ $H_2 - H_1$ $H_3 - H_2$	$X_2 - X_1$ $X_3 - X_2$ $X_1 - X_3$	$\frac{V_H \cdot \sqrt{3}}{V_x}$	Dy9	NO ACCESSIBLE NEUTRAL ON WYE WINDING
64			—	A B C	$H_1 - H_3$ $H_2 - H_1$ $H_3 - H_2$	$X_2 - X_0$ $X_3 - X_0$ $X_1 - X_0$	$\frac{V_H \cdot \sqrt{3}}{V_x}$	Dyn9	
7			—	A B C	$H_1 - H_3$ $H_2 - H_1$ $H_3 - H_2$	$X_0 - X_3$ $X_0 - X_1$ $X_0 - X_2$	$\frac{V_H \cdot \sqrt{3}}{V_x}$	Dyn11	
8			$H_3 - H_2$ $H_1 - H_3$ $H_2 - H_1$	A B C	$H_1 - H_3$ $H_2 - H_1$ $H_3 - H_2$	$X_2 - X_3$ $X_3 - X_1$ $X_1 - X_2$	$\frac{V_H \cdot \sqrt{3}}{V_x}$	Dy11	NO ACCESSIBLE NEUTRAL ON WYE WINDING
45			$H_2 - H_3$ $H_3 - H_1$ $H_1 - H_2$	A B C	$H_1 - H_2$ $H_2 - H_3$ $H_3 - H_1$	$X_1 - X_0$ $X_2 - X_0$ $X_3 - X_0$	$\frac{3}{2} \cdot \frac{V_H}{V_x}$	Dzn0	
46			$H_2 - H_3$ $H_3 - H_1$ $H_1 - H_2$	A B C	$H_1 - H_2$ $H_2 - H_3$ $H_3 - H_1$	$X_0 - X_2$ $X_0 - X_3$ $X_0 - X_1$	$\frac{3}{2} \cdot \frac{V_H}{V_x}$	Dzn2	

SPEC TEST NO.	TRANSFORMER CONFIGURATION: HIGH-VOLTAGE WINDING (H)	TRANSFORMER CONFIGURATION: LOW-VOLTAGE WINDING (X)	EXT. JUMPER	PHASE	WINDING TESTED: HIGH VOLTAGE WINDING	WINDING TESTED: LOW VOLTAGE WINDING	CAL. TURN RATIO	VECTOR GROUP	NOTES
47			—	A B C	$H_1 - H_2$ $H_2 - H_3$ $H_3 - H_1$	$X_3 - X_2$ $X_1 - X_3$ $X_2 - X_1$	$\frac{V_H}{V_x}$	Dz2	NO ACCESSIBLE NEUTRAL
48			$H_2 - H_3$ $H_3 - H_1$ $H_1 - H_2$	A B C	$H_1 - H_2$ $H_2 - H_3$ $H_3 - H_1$	$X_3 - X_0$ $X_1 - X_0$ $X_2 - X_0$	$\frac{3}{2} \cdot \frac{V_H}{V_x}$	Dzn4	
49			—	A B C	$H_1 - H_2$ $H_2 - H_3$ $H_3 - H_1$	$X_3 - X_1$ $X_1 - X_2$ $X_2 - X_3$	$\frac{V_H}{V_x}$	Dz4	NO ACCESSIBLE NEUTRAL
9			—	A B C	$H_1 - H_3$ $H_2 - H_1$ $H_3 - H_2$	$X_1 - X_3$ $X_2 - X_1$ $X_3 - X_2$	$\frac{V_H}{V_x}$	Dz0	NO ACCESSIBLE NEUTRAL
10			—	A B C	$H_1 - H_3$ $H_2 - H_1$ $H_3 - H_2$	$X_3 - X_1$ $X_1 - X_2$ $X_2 - X_3$	$\frac{V_H}{V_x}$	Dz6	NO ACCESSIBLE NEUTRAL
50			$H_2 - H_3$ $H_3 - H_1$ $H_1 - H_2$	A B C	$H_1 - H_2$ $H_2 - H_3$ $H_3 - H_1$	$X_0 - X_1$ $X_0 - X_2$ $X_0 - X_3$	$\frac{3}{2} \cdot \frac{V_H}{V_x}$	Dzn6	
51			$H_2 - H_3$ $H_3 - H_1$ $H_1 - H_2$	A B C	$H_1 - H_2$ $H_2 - H_3$ $H_3 - H_1$	$X_2 - X_0$ $X_3 - X_0$ $X_1 - X_0$	$\frac{3}{2} \cdot \frac{V_H}{V_x}$	Dzn8	
52			—	A B C	$H_1 - H_2$ $H_2 - H_3$ $H_3 - H_1$	$X_2 - X_3$ $X_3 - X_1$ $X_1 - X_2$	$\frac{V_H}{V_x}$	Dz8	NO ACCESSIBLE NEUTRAL
53			$H_2 - H_3$ $H_3 - H_1$ $H_1 - H_2$	A B C	$H_1 - H_2$ $H_2 - H_3$ $H_3 - H_1$	$X_0 - X_3$ $X_0 - X_1$ $X_0 - X_2$	$\frac{3}{2} \cdot \frac{V_H}{V_x}$	Dzn10	
54			—	A B C	$H_1 - H_2$ $H_2 - H_3$ $H_3 - H_1$	$X_1 - X_3$ $X_2 - X_1$ $X_3 - X_2$	$\frac{V_H}{V_x}$	Dz10	NO ACCESSIBLE NEUTRAL

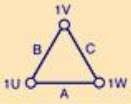
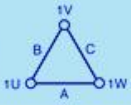
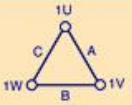
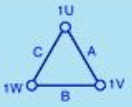
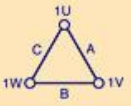
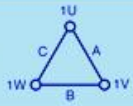
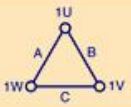
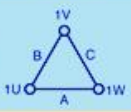
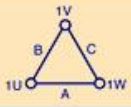
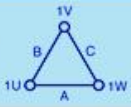
SPEC TEST NO.	TRANSFORMER CONFIGURATION: HIGH-VOLTAGE WINDING (H)	TRANSFORMER CONFIGURATION: LOW-VOLTAGE WINDING (X)	EXT. JUMPER	PHASE	WINDING TESTED: HIGH VOLTAGE WINDING	WINDING TESTED: LOW VOLTAGE WINDING	CAL. TURN RATIO	VECTOR GROUP	NOTES
11			—	A B C	$H_1 - H_0$ $H_2 - H_0$ $H_3 - H_0$	$X_2 - X_1$ $X_3 - X_2$ $X_1 - X_3$	$\frac{V_H}{V_X \cdot \sqrt{3}}$	YNd7	
44			—	A B C	$H_1 - H_0$ $H_2 - H_0$ $H_3 - H_0$	$X_1 - X_2$ $X_2 - X_3$ $X_3 - X_1$	$\frac{V_H}{V_X \cdot \sqrt{3}}$	YNd1	
12			$H_3 - H_2$ $H_1 - H_3$ $H_2 - H_1$	A B C	$H_1 - H_3$ $H_2 - H_1$ $H_3 - H_2$	$X_1 - X_2$ $X_2 - X_3$ $X_3 - X_1$	$\frac{V_H}{V_X} \cdot \frac{\sqrt{3}}{2}$	Yd1	NO ACCESSIBLE NEUTRAL ON WYE WINDING
13			—	A B C	$H_1 - H_0$ $H_2 - H_0$ $H_3 - H_0$	$X_3 - X_1$ $X_1 - X_2$ $X_2 - X_3$	$\frac{V_H}{V_X \cdot \sqrt{3}}$	YNd5	
14			$H_3 - H_2$ $H_1 - H_3$ $H_2 - H_1$	A B C	$H_1 - H_3$ $H_2 - H_1$ $H_3 - H_2$	$X_3 - X_1$ $X_1 - X_2$ $X_2 - X_3$	$\frac{V_H}{V_X} \cdot \frac{\sqrt{3}}{2}$	Yd5	NO ACCESSIBLE NEUTRAL ON WYE WINDING
15			$H_3 - H_2$ $H_1 - H_3$ $H_2 - H_1$	A B C	$H_1 - H_3$ $H_2 - H_1$ $H_3 - H_2$	$X_2 - X_1$ $X_3 - X_2$ $X_1 - X_3$	$\frac{V_H}{V_X} \cdot \frac{\sqrt{3}}{2}$	Yd7	NO ACCESSIBLE NEUTRAL ON WYE WINDING
16			—	A B C	$H_1 - H_0$ $H_2 - H_0$ $H_3 - H_0$	$X_1 - X_3$ $X_2 - X_1$ $X_3 - X_2$	$\frac{V_H}{V_X \cdot \sqrt{3}}$	YNd11	
17			$H_3 - H_2$ $H_1 - H_3$ $H_2 - H_1$	A B C	$H_1 - H_3$ $H_2 - H_1$ $H_3 - H_2$	$X_1 - X_3$ $X_2 - X_1$ $X_3 - X_2$	$\frac{V_H}{V_X} \cdot \frac{\sqrt{3}}{2}$	Yd11	NO ACCESSIBLE NEUTRAL ON WYE WINDING
18			—	A B C	$H_1 - H_0$ $H_2 - H_0$ $H_3 - H_0$	$X_0 - X_1$ $X_0 - X_2$ $X_0 - X_3$	$\frac{V_H}{V_X}$	YNyn6	
19			$H_2 - H_0$ $H_3 - H_0$ $H_1 - H_0$	A B C	$H_1 - H_0$ $H_2 - H_0$ $H_3 - H_0$	$X_1 - X_2$ $X_2 - X_3$ $X_3 - X_1$	$\frac{V_H}{V_X}$	YNy0	NO ACCESSIBLE NEUTRAL ON LOW VOLTAGE WINDING

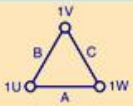
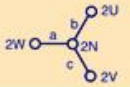
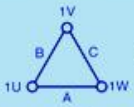
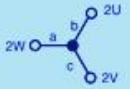
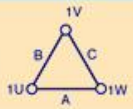
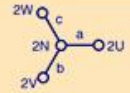
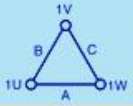
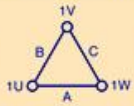
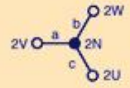
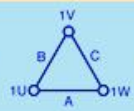
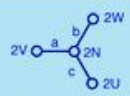
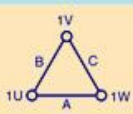
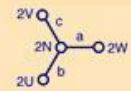
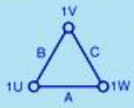
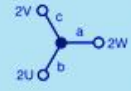
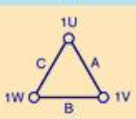
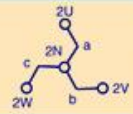
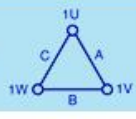
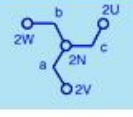
SPEC TEST NO.	TRANSFORMER CONFIGURATION: HIGH-VOLTAGE WINDING (H)	TRANSFORMER CONFIGURATION: LOW-VOLTAGE WINDING (X)	EXT. JUMPER	PHASE	WINDING TESTED: HIGH VOLTAGE WINDING	WINDING TESTED: LOW VOLTAGE WINDING	CAL. TURN RATIO	VECTOR GROUP	NOTES
20			X_3-X_0 X_1-X_0 X_2-X_0	A B C	H_1-H_3 H_2-H_1 H_3-H_2	X_1-X_0 X_2-X_0 X_3-X_0	$\frac{V_H}{V_x}$	Yyn0	NO ACCESSIBLE NEUTRAL ON HIGH VOLTAGE WINDING
43			—	A B C	H_1-H_0 H_2-H_0 H_3-H_0	X_1-X_0 X_2-X_0 X_3-X_0	$\frac{V_H}{V_L}$	YNyn0	
21			—	A B C	H_1-H_3 H_2-H_1 H_3-H_2	X_1-X_3 X_2-X_1 X_3-X_2	$\frac{V_H}{V_x}$	Yy0	NO ACCESSIBLE NEUTRAL
22			H_2-H_0 H_3-H_0 H_1-H_0	A B C	H_1-H_0 H_2-H_0 H_3-H_0	X_2-X_1 X_3-X_2 X_1-X_3	$\frac{V_H}{V_x}$	YNy6	NO ACCESSIBLE NEUTRAL ON LOW VOLTAGE WINDING
23			X_3-X_0 X_1-X_0 X_2-X_0	A B C	H_1-H_3 H_2-H_1 H_3-H_2	X_0-X_1 X_0-X_2 X_0-X_3	$\frac{V_H}{V_x}$	Yyn6	NO ACCESSIBLE NEUTRAL ON HIGH VOLTAGE WINDING
24			—	A B C	H_1-H_3 H_2-H_1 H_3-H_2	X_3-X_1 X_1-X_2 X_2-X_3	$\frac{V_H}{V_x}$	Yy6	NO ACCESSIBLE NEUTRAL
65			—	A B C	H_1-H_3 H_2-H_1 H_3-H_2	X_1-X_0 X_2-X_0 X_3-X_0	$\frac{V_H \bullet \sqrt{3}}{V_x}$	YNzn1	
25			—	A B C	H_1-H_3 H_2-H_1 H_3-H_2	X_1-X_0 X_2-X_0 X_3-X_0	$\frac{V_H \bullet \sqrt{3}}{V_x}$	Yzn1	NO ACCESSIBLE NEUTRAL ON WYE WINDING
26			H_3-H_2 H_1-H_3 H_2-H_1	A B C	H_1-H_3 H_2-H_1 H_3-H_2	X_1-X_2 X_2-X_3 X_3-X_1	$\frac{V_H}{V_x} \bullet \frac{\sqrt{3}}{2}$	Yz1	NO ACCESSIBLE NEUTRAL
27			—	A B C	H_1-H_3 H_2-H_1 H_3-H_2	X_3-X_0 X_1-X_0 X_2-X_0	$\frac{V_H \bullet \sqrt{3}}{V_x}$	Yzn5	NO ACCESSIBLE NEUTRAL ON WYE WINDING

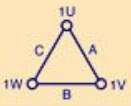
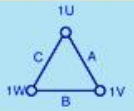
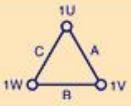
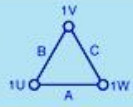
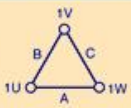
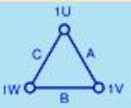
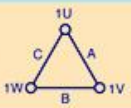
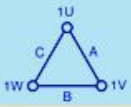
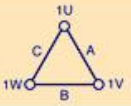
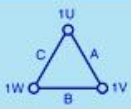
SPEC TEST NO.	TRANSFORMER CONFIGURATION: HIGH-VOLTAGE WINDING (H)	TRANSFORMER CONFIGURATION: LOW-VOLTAGE WINDING (X)	EXT. JUMPER	PHASE	WINDING TESTED: HIGH VOLTAGE WINDING	WINDING TESTED: LOW VOLTAGE WINDING	CAL. TURN RATIO	VECTOR GROUP	NOTES
28			H_3-H_2 H_1-H_3 H_2-H_1	A B C	H_1-H_3 H_2-H_1 H_3-H_2	X_3-X_1 X_1-X_2 X_2-X_3	$\frac{V_H}{V_X}\cdot\frac{\sqrt{3}}{2}$	Yz5	NO ACCESSIBLE NEUTRAL
66			—	A B C	H_1-H_3 H_2-H_1 H_3-H_2	X_0-X_1 X_0-X_2 X_0-X_3	$\frac{V_H\cdot\sqrt{3}}{V_X}$	YNzn7	
29			—	A B C	H_1-H_3 H_2-H_1 H_3-H_2	X_0-X_1 X_0-X_2 X_0-X_3	$\frac{V_H\cdot\sqrt{3}}{V_X}$	Yzn7	NO ACCESSIBLE NEUTRAL ON WYE WINDING
30			H_3-H_2 H_1-H_3 H_2-H_1	A B C	H_1-H_3 H_2-H_1 H_3-H_2	X_2-X_1 X_3-X_2 X_1-X_3	$\frac{V_H}{V_X}\cdot\frac{\sqrt{3}}{2}$	Yz7	NO ACCESSIBLE NEUTRAL
67			—	A B C	H_1-H_3 H_2-H_1 H_3-H_2	X_0-X_3 X_0-X_1 X_0-X_2	$\frac{V_H\cdot\sqrt{3}}{V_X}$	YNzn11	
31			—	A B C	H_1-H_3 H_2-H_1 H_3-H_2	X_0-X_3 X_0-X_1 X_0-X_2	$\frac{V_H\cdot\sqrt{3}}{V_X}$	Yzn11	NO ACCESSIBLE NEUTRAL ON WYE WINDING
32			H_3-H_2 H_1-H_3 H_2-H_1	A B C	H_1-H_3 H_2-H_1 H_3-H_2	X_1-X_3 X_2-X_1 X_3-X_2	$\frac{V_H}{V_X}\cdot\frac{\sqrt{3}}{2}$	Yz11	NO ACCESSIBLE NEUTRAL
55			X_2-X_3 X_3-X_1 X_1-X_2	A B C	H_1-H_0 H_2-H_0 H_3-H_0	X_1-X_2 X_2-X_3 X_3-X_1	$\frac{2}{3}\cdot\frac{V_H}{V_X}$	ZNd0	
56			—	A B C	H_1-H_2 H_2-H_3 H_3-H_1	X_1-X_2 X_2-X_3 X_3-X_1	$\frac{V_H}{V_X}$	Zd0	NO ACCESSIBLE NEUTRAL ON HIGH VOLTAGE
57			X_2-X_3 X_3-X_1 X_1-X_2	A B C	H_1-H_0 H_2-H_0 H_3-H_0	X_2-X_1 X_3-X_2 X_1-X_3	$\frac{2}{3}\cdot\frac{V_H}{V_X}$	ZNd6	

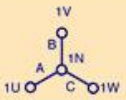
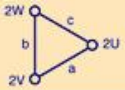
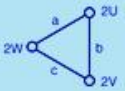
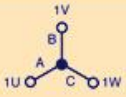
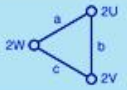
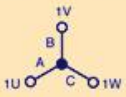
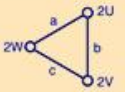
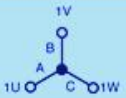
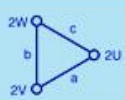
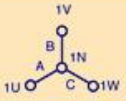
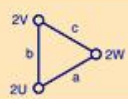
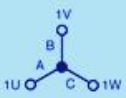
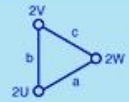
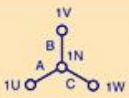
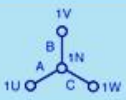
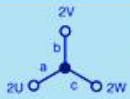
SPEC TEST NO.	TRANSFORMER CONFIGURATION: HIGH-VOLTAGE WINDING (H)	TRANSFORMER CONFIGURATION: LOW-VOLTAGE WINDING (X)	EXT. JUMPER	PHASE	WINDING TESTED: HIGH VOLTAGE WINDING	WINDING TESTED: LOW VOLTAGE WINDING	CAL. TURN RATIO	VECTOR GROUP	NOTES
33			—	A B C	$H_1 - H_0$ $H_2 - H_0$ $H_3 - H_0$	$X_3 - X_1$ $X_1 - X_2$ $X_2 - X_3$	$\frac{V_H}{V_x \bullet \sqrt{3}}$	ZNy5	NO ACCESSIBLE NEUTRAL ON WYE WINDING
34			$H_3 - H_2$ $H_1 - H_3$ $H_2 - H_1$	A B C	$H_1 - H_3$ $H_2 - H_1$ $H_3 - H_2$	$X_3 - X_1$ $X_1 - X_2$ $X_2 - X_3$	$\frac{V_H}{V_x} \bullet \frac{\sqrt{3}}{2}$	Zy5	NO ACCESSIBLE NEUTRAL
35			—	A B C	$H_1 - H_0$ $H_2 - H_0$ $H_3 - H_0$	$X_1 - X_3$ $X_2 - X_1$ $X_3 - X_2$	$\frac{V_H}{V_x \bullet \sqrt{3}}$	ZNy11	NO ACCESSIBLE NEUTRAL ON WYE WINDING
36			$H_3 - H_2$ $H_1 - H_3$ $H_2 - H_1$	A B C	$H_1 - H_3$ $H_2 - H_1$ $H_3 - H_2$	$X_1 - X_3$ $X_2 - X_1$ $X_3 - X_2$	$\frac{V_H}{V_x} \bullet \frac{\sqrt{3}}{2}$	Zy11	NO ACCESSIBLE NEUTRAL
58			$H_1 - H_2$ $X_1 - X_2$	A B	$H_1 - H_2$ $H_1 - H_3$	$X_1 - X_2$ $X_1 - X_3$	$\frac{V_H}{V_x}$	T-T 0	
59			$H_2 - H_3$ $X_1 - X_2$	A B	$H_1 - H_3$ $H_2 - H_3$	$X_1 - X_2$ $X_1 - X_3$	$\frac{V_H}{V_x} \bullet \frac{\sqrt{3}}{2}$ $\frac{V_H}{V_x} \bullet \frac{2}{\sqrt{3}}$	T-T 30 Lag	
60			$H_2 - H_3$ $X_1 - X_3$	A B	$H_1 - H_3$ $H_2 - H_3$	$X_1 - X_3$ $X_2 - X_1$	$\frac{V_H}{V_x} \bullet \frac{\sqrt{3}}{2}$ $\frac{V_x}{V_H} \bullet \frac{2}{\sqrt{3}}$	T-T 30 Lead	

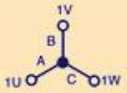
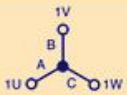
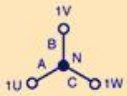
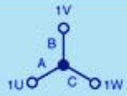
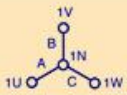
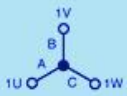
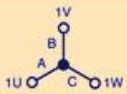
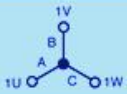
Appendix C – CEI/IEC 60076-1 Transformer Descriptions

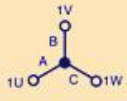
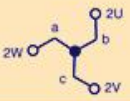
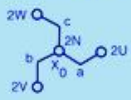
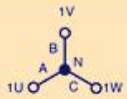
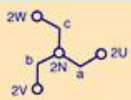
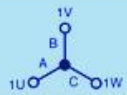
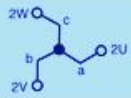
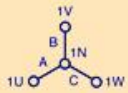
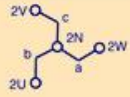
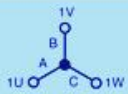
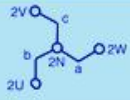
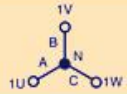
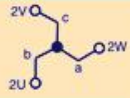
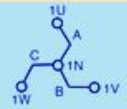
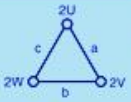
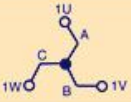
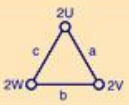
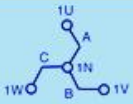
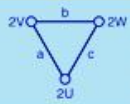
SPEC TEST NO.	TRANSFORMER CONFIGURATION: HIGH-VOLTAGE WINDING (H)	TRANSFORMER CONFIGURATION: LOW-VOLTAGE WINDING (X)	EXT. JUMPER	PHASE	WINDING TESTED: HIGH VOLTAGE WINDING	WINDING TESTED: LOW VOLTAGE WINDING	CAL. TURN RATIO	VECTOR GROUP	NOTES
1			—	A B C	1U – 1W 1V – 1U 1W – 1V	2W – 2U 2U – 2V 2V – 2W	$\frac{U1}{U2}$	Dd6	
37			—	A B C	1U – 1W 1V – 1U 1W – 1V	2U – 2W 2V – 2U 2W – 2V	$\frac{U1}{U2}$	Dd0	
38			—	A B C	1U – 1V 1V – 1W 1W – 1U	2W – 2V 2U – 2W 2V – 2U	$\frac{U1}{U2}$	Dd2	
39			—	A B C	1U – 1W 1V – 1U 1W – 1U	2W – 2U 2U – 2V 2V – 2W	$\frac{U1}{U2}$	Dd4	
40			—	A B C	1U – 1V 1V – 1W 1W – 1U	2V – 2W 2W – 2U 2U – 2V	$\frac{U1}{U2}$	Dd8	
41			—	A B C	1U – 1V 1V – 1W 1W – 1U	2U – 2W 2V – 2U 2W – 2V	$\frac{U1}{U2}$	Dd10	
42			—	A B C	1U – 1W 1V – 1U 1W – 1V	2U – 2N 2V – 2N 2W – 2N	$\frac{U1 \cdot \sqrt{3}}{U2}$	Dyn1	
2			1W – 1V 1U – 1W 1V – 1U	A B C	1U – 1W 1V – 1U 1W – 1V	2U – 2V 2V – 2W 2W – 2U	$\frac{U1 \cdot \sqrt{3}}{U2}$	Dy1	NO ACCESSIBLE NEUTRAL ON WYE WINDING
61			1W – 1V 1U – 1W 1V – 1U	A B C	1U – 1W 1V – 1U 1W – 1V	2U – 2V 2V – 2W 2W – 2U	$\frac{V_{U1} \cdot \sqrt{3}}{U2}$	Dy3	NO ACCESSIBLE NEUTRAL ON WYE WINDING
62			—	A B C	1U – 1W 1V – 1U 1W – 1V	2N – 2V 2N – 2W 2N – 2U	$\frac{U1 \cdot \sqrt{3}}{U2}$	Dyn3	

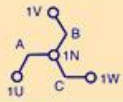
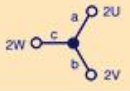
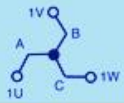
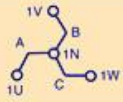
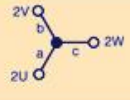
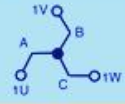
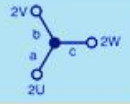
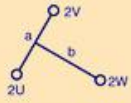
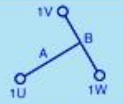
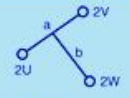
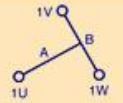
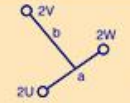
SPEC TEST NO.	TRANSFORMER CONFIGURATION: HIGH-VOLTAGE WINDING (H)	TRANSFORMER CONFIGURATION: LOW-VOLTAGE WINDING (X)	EXT. JUMPER	PHASE	WINDING TESTED: HIGH VOLTAGE WINDING	WINDING TESTED: LOW VOLTAGE WINDING	CAL. TURN RATIO	VECTOR GROUP	NOTES
3			—	A B C	1U– 1W 1V – 1U 1W – 1V	2W – 2N 2U – 2N 2V – 2N	$\frac{U1 \cdot \sqrt{3}}{U2}$	Dyn5	
4			1W – 1V 1U – 1W 1V – 1U	A B C	1U– 1W 1V – 1U 1W – 1V	2W – 2V 2U – 2W 2V – 2U	$\frac{U1 \cdot \sqrt{3}}{U2}$	Dy5	NO ACCESSIBLE NEUTRAL ON WYE WINDING
5			—	A B C	1U – 1W 1V – 1U 1W – 1V	2N – 2U 2N –2V 2N– 2W	$\frac{U1 \cdot \sqrt{3}}{U2}$	Dyn7	
6			1W – 1V 1U – 1W 1V – 1U	A B C	1U – 1W 1V – 1U 1W – 1V	2W – 2U 2U – 2V 2V – 2W	$\frac{U1 \cdot \sqrt{3}}{U2}$	Dy7	NO ACCESSIBLE NEUTRAL ON WYE WINDING
63			1W – 1V 1U – 1W 1V – 1U	A B C	1U– 1W 1V – 1U 1W – 1V	2V – 2U 2W – 2V 2U – 2W	$\frac{U1 \cdot \sqrt{3}}{U2}$	Dy9	NO ACCESSIBLE NEUTRAL ON WYE WINDING
64			—	A B C	1U– 1W 1V – 1U 1W – 1V	2V – 2N 2W – 2N 2U – 2N	$\frac{U1 \cdot \sqrt{3}}{U2}$	Dyn9	
7			—	A B C	1U – 1W 1V – 1U 1W – 1V	2N – 2W 2N– 2U 2N – 2V	$\frac{U1 \cdot \sqrt{3}}{U2}$	Dyn11	
8			1W – 1V 1U – 1W 1V – 1U	A B C	1U – 1W 1V – 1U 1W – 1V	2V – 2W 2W – 2U 2U – 2V	$\frac{U1 \cdot \sqrt{3}}{U2}$	Dy11	NO ACCESSIBLE NEUTRAL ON WYE WINDING
45			1V – 1W 1W – 1U 1U – 1V	A B C	1U – 1V 1V – 1W 1W – 1U	2U – 2N 2V – 2N 2W – 2N	$\frac{3}{2} \cdot \frac{U1}{U2}$	Dzn0	
46			1V – 1W 1W – 1U 1U – 1V	A B C	1U– 1V 1V – 1W 1W – 1U	2N – 2V 2N – 2W 2N – 2U	$\frac{3}{2} \cdot \frac{U1}{U2}$	Dzn2	

SPEC TEST NO.	TRANSFORMER CONFIGURATION: HIGH-VOLTAGE WINDING (H)	TRANSFORMER CONFIGURATION: LOW-VOLTAGE WINDING (X)	EXT. JUMPER	PHASE	WINDING TESTED: HIGH VOLTAGE WINDING	WINDING TESTED: LOW VOLTAGE WINDING	CAL. TURN RATIO	VECTOR GROUP	NOTES
47			—	A B C	1U – 1V 1V – 1W 1W – 1U	2W – 2V 2U – 2W 2V – 2U	$\frac{U1}{U2}$	Dz2	NO ACCESSIBLE NEUTRAL
48			1V–1W 1W–1U 1U–1V	A B C	1U – 1V 1V – 1W 1W – 1U	2W – 2N 2U – 2N 2V – 2N	$\frac{3}{2} \cdot \frac{U1}{U2}$	Dzn4	
49			—	A B C	1U – 1V 1V – 1W 1W – 1U	2W – 2U 2U – 2V 2V – 2W	$\frac{U1}{U2}$	Dz4	NO ACCESSIBLE NEUTRAL
9			—	A B C	1U – 1W 1V – 1U 1W – 1V	2U – 2W 2V – 2U 2W – 2V	$\frac{U1}{U2}$	Dz0	NO ACCESSIBLE NEUTRAL
10			—	A B C	1U – 1W 1V – 1U 1W – 1V	2W – 2U 2U – 2V 2V – 2W	$\frac{U1}{U2}$	Dz6	NO ACCESSIBLE NEUTRAL
50			1V–1W 1W–1U 1U–1V	A B C	1U – 1V 1V – 1W 1W – 1U	2N – 2U 2N – 2V 2N – 2W	$\frac{3}{2} \cdot \frac{U1}{U2}$	Dzn6	
51			1V–1W 1W–1U 1U–1V	A B C	1U – 1V 1V – 1W 1W – 1U	2V – 2N 2W – 2N 2U – 2N	$\frac{3}{2} \cdot \frac{U1}{U2}$	Dzn8	
52			—	A B C	1U– 1V 1V – 1W 1W – 1U	2V – 2W 2W – 2U 2U – 2V	$\frac{U1}{U2}$	Dz8	NO ACCESSIBLE NEUTRAL
53			1V–1W 1W–1U 1U–1V	A B C	1U – 1V 1V – 1W 1W – 1U	2N – 2W 2N – 2U 2N – 2V	$\frac{3}{2} \cdot \frac{U1}{U2}$	Dzn10	
54			—	A B C	1U – 1V 1V – 1W 1W –1U	2U – 2W 2V– 2U 2W – 2V	$\frac{U1}{U2}$	Dz10	NO ACCESSIBLE NEUTRAL

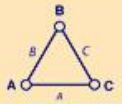
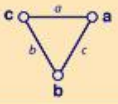
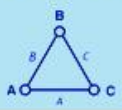
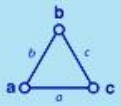
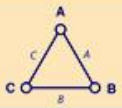
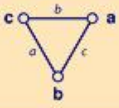
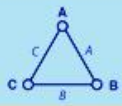
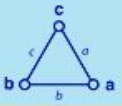
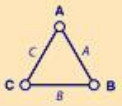
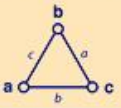
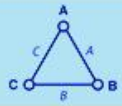
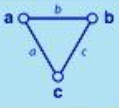
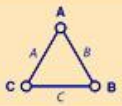
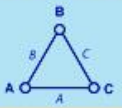
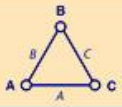
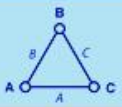
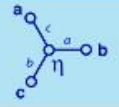
SPEC TEST NO.	TRANSFORMER CONFIGURATION: HIGH-VOLTAGE WINDING (H)	TRANSFORMER CONFIGURATION: LOW-VOLTAGE WINDING (X)	EXT. JUMPER	PHASE	WINDING TESTED: HIGH VOLTAGE WINDING	WINDING TESTED: LOW VOLTAGE WINDING	CAL. TURN RATIO	VECTOR GROUP	NOTES
11			—	A B C	1U – 1N 1V – 1N 1W – 1N	2V – 2U 2W – 2V 2U – 2W	$\frac{U1}{U2 \cdot \sqrt{3}}$	YNd7	
44			—	A B C	1U – 1N 1V – 1N 1W – 1N	2U – 2V 2V – 2W 2W – 2U	$\frac{U1}{U2 \cdot \sqrt{3}}$	YNd1	
12			1W–1V 1U–1W 1V–1U	A B C	1U – 1W 1V – 1U 1W – 1V	2U – 2V 2V – 2W 2W – 2U	$\frac{U1}{U2} \cdot \frac{\sqrt{3}}{2}$	Yd1	NO ACCESSIBLE NEUTRAL ON WYE WINDING
13			—	A B C	1U– 1N 1V – 1N 1W – 1N	2W – 2U 2U – 2V 2V – 2W	$\frac{U1}{U2 \cdot \sqrt{3}}$	YNd5	
14			1W–1V 1U–1W 1V–1U	A B C	1U – 1W 1V – 1U 1W – 1V	2W – 2U 2U – 2V 2V – 2W	$\frac{U1}{U2} \cdot \frac{\sqrt{3}}{2}$	Yd5	NO ACCESSIBLE NEUTRAL ON WYE WINDING
15			1W–1V 1U–1W 1V–1U	A B C	1U – 1W 1V – 1U 1W – 1V	2V – 2U 2W – 2V 2U – 2W	$\frac{U1}{U2} \cdot \frac{\sqrt{3}}{2}$	Yd7	NO ACCESSIBLE NEUTRAL ON WYE WINDING
16			—	A B C	1U– 1N 1V – 1N 1W – 1N	2U – 2W 2V– 2U 2W – 2V	$\frac{U1}{U2 \cdot \sqrt{3}}$	YNd11	
17			1W–1V 1U–1W 1V–1U	A B C	1U– 1W 1V – 1U 1W – 1V	2U – 2W 2V – 2U 2W – 2V	$\frac{U1}{U2} \cdot \frac{\sqrt{3}}{2}$	Yd11	NO ACCESSIBLE NEUTRAL ON WYE WINDING
18			—	A B C	1U – 1N 1V – 1N 1W – 1N	2N – 2U 2N – 2V 2N – 2W	$\frac{U1}{U2}$	YNyn6	
19			1V–1N 1W–1N 1U–1N	A B C	1U – 1N 1V – 1N 1W – 1N	2U – 2V 2V – 2W 2W – 2U	$\frac{U1}{U2}$	YNy0	NO ACCESSIBLE NEUTRAL ON LOW VOLTAGE WINDING

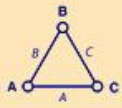
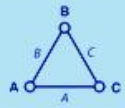
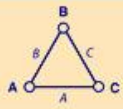
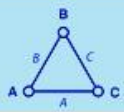
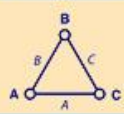
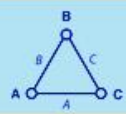
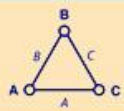
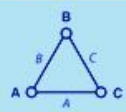
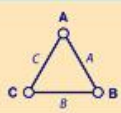
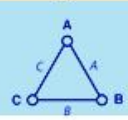
SPEC TEST NO.	TRANSFORMER CONFIGURATION: HIGH-VOLTAGE WINDING (H)	TRANSFORMER CONFIGURATION: LOW-VOLTAGE WINDING (X)	EXT. JUMPER	PHASE	WINDING TESTED: HIGH VOLTAGE WINDING	WINDING TESTED: LOW VOLTAGE WINDING	CAL. TURN RATIO	VECTOR GROUP	NOTES
20			2W–2N 2U–2N 2V–2N	A B C	1U – 1W 1V – 1U 1W – 1V	2U – 2N 2V– 2N 2W – 2N	$\frac{U1}{U2}$	Yyn0	NO ACCESSIBLE NEUTRAL ON HIGH VOLTAGE WINDING
43			—	A B C	1U – 1N 1V – 1N 1W – 1N	2U – 2W 2V – 2N 2W – 2N	$\frac{U1}{U2}$	YNyn0	
21			—	A B C	1U – 1W 1V – 1U 1W – 1V	2U – 2W 2V – 2U 2W – 2V	$\frac{U1}{U2}$	Yy0	NO ACCESSIBLE NEUTRAL
22			1V–1N 1W–1N 1U–1N	A B C	1U – 1N 1V – 1N 1W – 1N	2V – 2U 2W – 2V 2U – 2W	$\frac{U1}{U2}$	YNy6	NO ACCESSIBLE NEUTRAL ON LOW VOLTAGE WINDING
23			2W–2N 2U–2N 2V–2N	A B C	1U – 1W 1V – 1U 1W – 1V	2N – 2U 2N – 2V 2N – 2W	$\frac{U1}{U2}$	Yyn6	NO ACCESSIBLE NEUTRAL ON HIGH VOLTAGE WINDING
24			—	A B C	1U – 1W 1V – 1U 1W – 1V	2W – 2U 2U – 2V 2V – 2W	$\frac{U1}{U2}$	Yy6	NO ACCESSIBLE NEUTRAL
65			—	A B C	1U – 1W 1V – 1U 1W – 1V	2U – 2N 2V – 2N 2W – 2N	$\frac{V_H \cdot \sqrt{3}}{V_x}$	YNzn1	
25			—	A B C	1U – 1W 1V – 1U 1W – 1V	2U – 2N 2V – 2N 2W – 2N	$\frac{U1 \cdot \sqrt{3}}{U2}$	Yzn1	NO ACCESSIBLE NEUTRAL ON WYE WINDING
26			1W–1V 1U–1W 1V–1U	A B C	1U – 1W 1V– 1U 1W – 1V	2U – 2V 2V – 2W 2W – 2U	$\frac{U1}{U2} \cdot \frac{\sqrt{3}}{2}$	Yz1	NO ACCESSIBLE NEUTRAL
27			—	A B C	1U – 1W 1V – 1U 1W – 1V	2W – 2N 2U – 2N 2V – 2N	$\frac{U1 \cdot \sqrt{3}}{U2}$	Yzn5	NO ACCESSIBLE NEUTRAL ON WYE WINDING

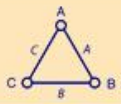
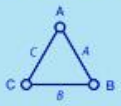
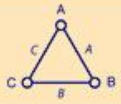
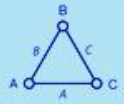
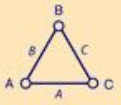
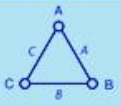
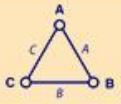
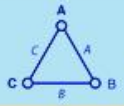
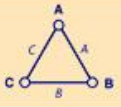
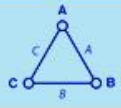
SPEC TEST NO.	TRANSFORMER CONFIGURATION: HIGH-VOLTAGE WINDING (H)	TRANSFORMER CONFIGURATION: LOW-VOLTAGE WINDING (X)	EXT. JUMPER	PHASE	WINDING TESTED: HIGH VOLTAGE WINDING	WINDING TESTED: LOW VOLTAGE WINDING	CAL. TURN RATIO	VECTOR GROUP	NOTES
28			1W–1V 1U–1W 1V–1U	A B C	1U – 1W 1V – 1U 1W – 1V	2W – 2U 2U – 2V 2V – 2W	$\frac{U1}{U2} \cdot \frac{\sqrt{3}}{2}$	Yz5	NO ACCESSIBLE NEUTRAL
66			—	A B C	1U – 1W 1V – 1U 1W – 1V	2N – 2U 2N – 2V 2N – 2W	$\frac{V_H \cdot \sqrt{3}}{V_X}$	YNzn7	
29			—	A B C	1U – 1W 1V – 1U 1W – 1V	2N – 2U 2N – 2V 2N – 2W	$\frac{U1 \cdot \sqrt{3}}{U2}$	Yzn7	NO ACCESSIBLE NEUTRAL ON WYE WINDING
30			1W–1V 1U–1W 1V–1U	A B C	1U– 1W 1V – 1U 1W – 1V	2V – 2U 2W – 2V 2U – 2W	$\frac{U1}{U2} \cdot \frac{\sqrt{3}}{2}$	Yz7	NO ACCESSIBLE NEUTRAL
67			—	A B C	1U – 1W 1V – 1U 1W – 1V	2N – 2W 2N – 2U 2N – 2V	$\frac{V_H \cdot \sqrt{3}}{V_X}$	YNzn11	
31			—	A B C	1U – 1W 1V – 1U 1W – 1V	2N – 2W 2N – 2U 2N – 2V	$\frac{U1 \cdot \sqrt{3}}{U2}$	Yzn11	NO ACCESSIBLE NEUTRAL ON WYE WINDING
32			1W–1V 1U–1W 1V–1U	A B C	1U – 1W 1V – 1U 1W – 1V	2U – 2W 2V – 2U 2W – 2V	$\frac{U1}{U2} \cdot \frac{\sqrt{3}}{2}$	Yz11	NO ACCESSIBLE NEUTRAL
55			1V–1W 1W–1U 1U–1V	A B C	1U – 1N 1V – 1N 1W – 1N	2U– 2V 2V – 2W 2W – 2U	$\frac{2}{3} \cdot \frac{U1}{U2}$	ZNd0	
56			—	A B C	1U – 1V 1V – 1W 1W – 1U	2U – 2V 2V – 2W 2W – 2U	$\frac{U1}{U2}$	Zd0	NO ACCESSIBLE NEUTRAL ON HIGH VOLTAGE
57			1V–1W 1W–1U 1U–1V	A B C	1U – 1N 1V – 1N 1W – 1N	2V – 2U 2W – 2V 2U – 2W	$\frac{2}{3} \cdot \frac{U1}{U2}$	ZNd6	

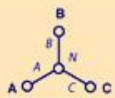
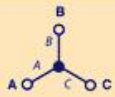
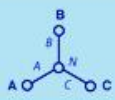
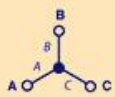
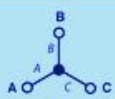
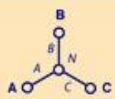
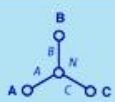
SPEC TEST NO.	TRANSFORMER CONFIGURATION: HIGH-VOLTAGE WINDING (H)	TRANSFORMER CONFIGURATION: LOW-VOLTAGE WINDING (X)	EXT. JUMPER	PHASE	WINDING TESTED: HIGH VOLTAGE WINDING	WINDING TESTED: LOW VOLTAGE WINDING	CAL. TURN RATIO	VECTOR GROUP	NOTES
33			—	A B C	1U – 1N 1V – 1N 1W – 1N	2W – 2U 2U – 2V 2V – 2W	$\frac{U1}{U2 \cdot \sqrt{3}}$	ZNy5	NO ACCESSIBLE NEUTRAL ON WYE WINDING
34			1W – 1V 1U – 1W 1V – 1U	A B C	1U – 1W 1V – 1U 1W – 1V	2W – 2U 2U – 2V 2V – 2W	$\frac{U1}{U2} \cdot \frac{\sqrt{3}}{2}$	Zy5	NO ACCESSIBLE NEUTRAL
35			—	A B C	1U – 1N 1V – 1N 1W – 1N	2U – 2W 2V – 2U 2W – 2V	$\frac{U1}{U2 \cdot \sqrt{3}}$	ZNy11	NO ACCESSIBLE NEUTRAL ON WYE WINDING
36			1W – 1V 1U – 1W 1V – 1U	A B C	1U – 1W 1V – 1U 1W – 1V	2U – 2W 2V – 2U 2W – 2V	$\frac{U1}{U2} \cdot \frac{\sqrt{3}}{2}$	Zy11	NO ACCESSIBLE NEUTRAL
58			1U – 1V 2U – 2V	A B	1U – 1V 1U – 1W	2U – 2V 2U – 2W	$\frac{U1}{U2}$	T-T 0	
59			1V – 1W 2U – 2V	A B	1U – 1W 1V – 1W	2U – 2V 2U – 2W	$\frac{U1}{U2} \cdot \frac{\sqrt{3}}{2}$ $\frac{U1}{U2} \cdot \frac{2}{\sqrt{3}}$	T-T 30 Lag	
60			1V – 1W 2U – 2W	A B	1U – 1W 1V – 1W	2U – 2W 2V – 2U	$\frac{U1}{U2} \cdot \frac{\sqrt{3}}{2}$ $\frac{U1}{U2} \cdot \frac{2}{\sqrt{3}}$	T-T 30 Lead	

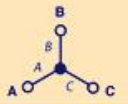
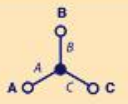
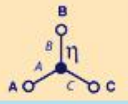
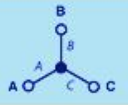
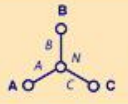
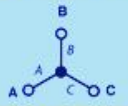
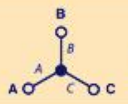
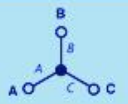
Appendix D – Australian Std.2374 Transformer Descriptions

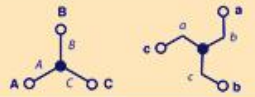
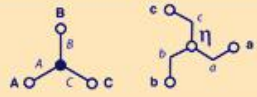
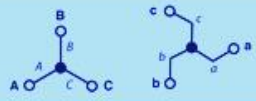
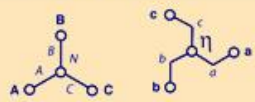
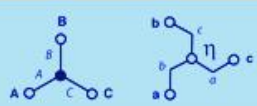
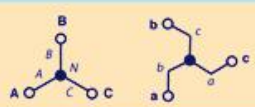
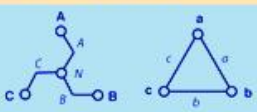
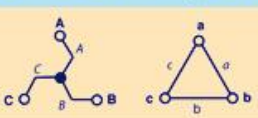
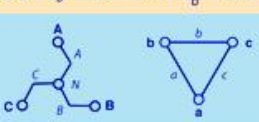
SPEC TEST NO.	TRANSFORMER CONFIGURATION: HIGH-VOLTAGE WINDING (H)	TRANSFORMER CONFIGURATION: LOW-VOLTAGE WINDING (X)	EXT. JUMPER	PHASE	WINDING TESTED: HIGH VOLTAGE WINDING	WINDING TESTED: LOW VOLTAGE WINDING	CAL. TURN RATIO	VECTOR GROUP	NOTES
1			—	A B C	A – C B – A C – B	c – a a – b b – c	$\frac{HV}{LV}$	Dd6	
37			—	A B C	A – C B – A C – B	a – c b – a c – b	$\frac{HV}{LV}$	Dd0	
38			—	A B C	A – B B – C C – A	c – b a – c b – a	$\frac{HV}{LV}$	Dd2	
39			—	A B C	A – B B – C C – A	c – a a – b b – c	$\frac{HV}{LV}$	Dd4	
40			—	A B C	A – B B – C C – A	b – c c – a a – b	$\frac{HV}{LV}$	Dd8	
41			—	A B C	A – B B – C C – A	a – c b – a c – b	$\frac{HV}{LV}$	Dd10	
42			—	A B C	A – C B – A C – B	a – η b – η c – η	$\frac{HV \bullet \sqrt{3}}{LV}$	Dyn1	
2			C – B A – C B – A	A B C	A – C B – A C – B	a – c b – a c – b	$\frac{HV \bullet \sqrt{3}}{LV}$	Dy1	NO ACCESSIBLE NEUTRAL ON WYE WINDING
61			C – B A – C B – A	A B C	A – C B – A C – B	a – b b – c c – a	$\frac{V_H \bullet \sqrt{3}}{V_x}$	Dy3	NO ACCESSIBLE NEUTRAL ON WYE WINDING
62			—	A B C	A – C B – A C – B	η – b η – c η – a	$\frac{HV \bullet \sqrt{3}}{LV}$	Dyn3	

SPEC TEST NO.	TRANSFORMER CONFIGURATION: HIGH-VOLTAGE WINDING (H)	TRANSFORMER CONFIGURATION: LOW-VOLTAGE WINDING (X)	TRANSFORMER CONFIGURATION: EXT. JUMPER	WINDING TESTED: PHASE	WINDING TESTED: HIGH VOLTAGE WINDING	WINDING TESTED: LOW VOLTAGE WINDING	CAL. TURN RATIO	VECTOR GROUP	NOTES
3			—	A B C	A – C B – A C – B	c – η a – η b – η	$\frac{HV}{LV} \cdot \sqrt{3}$	Dyn5	
4			C – B A – C B – A	A B C	A – C B – A C – B	c – b a – c b – a	$\frac{HV}{LV} \cdot \sqrt{3}$	Dy5	NO ACCESSIBLE NEUTRAL ON WYE WINDING
5			—	A B C	A – C B – A C – B	η – a η – b η – c	$\frac{HV}{LV} \cdot \sqrt{3}$	Dyn7	
6			C – B A – C B – A	A B C	A – C B – A C – B	c – a a – b b – c	$\frac{HV}{LV} \cdot \sqrt{3}$	Dy7	NO ACCESSIBLE NEUTRAL ON WYE WINDING
63			C – B A – C B – A	A B C	B – C B – A C – B	b – a c – b a – c	$\frac{HV}{LV} \cdot \sqrt{3}$	Dy9	NO ACCESSIBLE NEUTRAL ON WYE WINDING
64			—	A B C	A – C B – A C – B	b – η c – η a – η	$\frac{HV}{LV} \cdot \sqrt{3}$	Dyn9	
7			—	A B C	A – C B – A C – B	η – c η – a η – b	$\frac{HV}{LV} \cdot \sqrt{3}$	Dyn11	
8			C – B A – C B – A	A B C	A – C B – A C – B	b – c c – a a – b	$\frac{HV}{LV} \cdot \sqrt{3}$	Dy11	NO ACCESSIBLE NEUTRAL ON WYE WINDING
45			B – C C – A A – B	A B C	A – B B – C C – A	a – η b – η c – η	$\frac{3}{2} \cdot \frac{HV}{LV}$	Dzn0	
46			B – C C – A A – B	C A B	A – B B – C C – A	η – b η – c η – a	$\frac{3}{2} \cdot \frac{HV}{LV}$	Dzn2	

SPEC TEST NO.	TRANSFORMER CONFIGURATION: HIGH-VOLTAGE WINDING (H)	TRANSFORMER CONFIGURATION: LOW-VOLTAGE WINDING (X)	EXT. JUMPER	PHASE	WINDING TESTED: HIGH VOLTAGE WINDING	WINDING TESTED: LOW VOLTAGE WINDING	CAL. TURN RATIO	VECTOR GROUP	NOTES
47			—	A B C	A – B B – C C – A	c – b a – c b – a	$\frac{HV}{LV}$	Dz2	NO ACCESSIBLE NEUTRAL
48			B – C C – A A – B	A B C	A – B B – C C – A	c – η a – η b – η	$\frac{3}{2} \cdot \frac{HV}{LV}$	Dzn4	
49			—	A B C	A – B B – C C – A	c – a a – b b – c	$\frac{HV}{LV}$	Dz4	NO ACCESSIBLE NEUTRAL
9			—	A B C	A – C B – A C – B	a – c b – a c – b	$\frac{HV}{LV}$	Dz0	NO ACCESSIBLE NEUTRAL
10			—	A B C	A – C B – A C – B	c – a a – b b – c	$\frac{HV}{LV}$	Dz6	NO ACCESSIBLE NEUTRAL
50			B – C C – A A – B	A B C	A – B B – C C – A	η – a η – b η – c	$\frac{3}{2} \cdot \frac{HV}{LV}$	Dzn6	
51			B – C C – A A – B	A B C	A – B B – C C – A	b – η c – η a – η	$\frac{3}{2} \cdot \frac{HV}{LV}$	Dzn8	
52			—	A B C	A – B B – C C – A	b – c c – a a – b	$\frac{HV}{LV}$	Dz8	NO ACCESSIBLE NEUTRAL
53			B – C C – A A – B	A B C	A – B B – C C – A	η – c η – a η – b	$\frac{3}{2} \cdot \frac{HV}{LV}$	Dzn10	
54			—	A B C	A – B B – C C – A	a – c b – a c – b	$\frac{HV}{LV}$	Dz10	NO ACCESSIBLE NEUTRAL

SPEC TEST NO.	TRANSFORMER CONFIGURATION: HIGH-VOLTAGE WINDING (H)	TRANSFORMER CONFIGURATION: LOW-VOLTAGE WINDING (X)	EXT. JUMPER	PHASE	WINDING TESTED: HIGH VOLTAGE WINDING	WINDING TESTED: LOW VOLTAGE WINDING	CAL. TURN RATIO	VECTOR GROUP	NOTES
11			—	A B C	A – N B – N C – N	b – a c – b a – c	$\frac{HV}{LV \cdot \sqrt{3}}$	YNd7	
44			—	A B C	A – N B – N C – N	a – b b – c c – a	$\frac{HV}{LV \cdot \sqrt{3}}$	YNd1	
12			C – B A – C B – A	A B C	A – C B – A C – B	a – b b – c c – a	$\frac{HV}{LV} \cdot \frac{\sqrt{3}}{2}$	Yd1	NO ACCESSIBLE NEUTRAL ON WYE WINDING
13			—	A B C	A – N B – N C – N	c – a a – b b – c	$\frac{HV}{LV \cdot \sqrt{3}}$	YNd5	
14			C – B A – C B – A	A B C	A – C B – A C – B	c – a a – b b – c	$\frac{HV}{LV} \cdot \frac{\sqrt{3}}{2}$	Yd5	NO ACCESSIBLE NEUTRAL ON WYE WINDING
15			C – B A – C B – A	A B C	A – C B – A C – B	b – a c – b a – c	$\frac{HV}{LV} \cdot \frac{\sqrt{3}}{2}$	Yd7	NO ACCESSIBLE NEUTRAL ON WYE WINDING
16			—	A B C	A– N B – N C – N	a – c b – a c – b	$\frac{HV}{LV \cdot \sqrt{3}}$	YNd11	
17			C – B A – C B – A	A B C	A – C B – A C – B	a – c b – a c – b	$\frac{HV}{LV} \cdot \frac{\sqrt{3}}{2}$	Yd11	NO ACCESSIBLE NEUTRAL ON WYE WINDING
18			—	A B C	A – N B – N C – N	η – a η – b η – c	$\frac{HV}{LV}$	YNyn6	
19			B – N C – N A – N	A B C	A – N B – N C – N	a – b b – c c – a	$\frac{HV}{LV}$	YNy0	NO ACCESSIBLE NEUTRAL ON LOW VOLTAGE WINDING

SPEC TEST NO.	TRANSFORMER CONFIGURATION: HIGH-VOLTAGE WINDING (H)	TRANSFORMER CONFIGURATION: LOW-VOLTAGE WINDING (X)	EXT. JUMPER	PHASE	WINDING TESTED: HIGH VOLTAGE WINDING	WINDING TESTED: LOW VOLTAGE WINDING	CAL. TURN RATIO	VECTOR GROUP	NOTES
20			c – h a – h b – h	*A* *B* *C*	A – C B – C C – B	a – η b – η c – η	$\frac{HV}{LV}$	Yyn0	NO ACCESSIBLE NEUTRAL ON HIGH VOLTAGE WINDING
43			—	*A* *B* *C*	A – N B – N C – N	a – η b – η c – η	$\frac{HV}{LV}$	YNyn0	
21			—	*A* *B* *C*	A – C B – A C – B	a – c b – a c – b	$\frac{HV}{LV}$	Yy0	NO ACCESSIBLE NEUTRAL
22			B – N C – N A – N	*A* *B* *C*	A – N B – N C – N	b – a c – b a – c	$\frac{HV}{LV}$	YNy6	NO ACCESSIBLE NEUTRAL ON LOW VOLTAGE WINDING
23			c – h a – h b – h	*A* *B* *C*	A – C B – A C – B	η – a η – b η – c	$\frac{HV}{LV}$	Yyn6	NO ACCESSIBLE NEUTRAL ON HIGH VOLTAGE WINDING
24			—	*A* *B* *C*	A – C B – A C – B	c – a a – b b – c	$\frac{HV}{LV}$	Yy6	NO ACCESSIBLE NEUTRAL
65			—	*A* *B* *C*	A – C B – A C – B	a – η b – η c – η	$\frac{V_H \cdot \sqrt{3}}{V_X}$	YNzn1	
25			—	*A* *B* *C*	A – C B – A C – B	a – η b – η c – η	$\frac{V_H \cdot \sqrt{3}}{LV}$	Yzn1	NO ACCESSIBLE NEUTRAL ON WYE WINDING
26			C – B A – C B – A	*A* *B* *C*	A – C B – A C – B	a – b b – c c – a	$\frac{HV}{LV} \cdot \frac{\sqrt{3}}{2}$	Yz1	NO ACCESSIBLE NEUTRAL
27			—	*A* *B* *C*	A – C B – A C – B	c – η a – η b – η	$\frac{HV \cdot \sqrt{3}}{LV}$	Yzn5	NO ACCESSIBLE NEUTRAL ON WYE WINDING

SPEC TEST NO.	TRANSFORMER CONFIGURATION: HIGH-VOLTAGE WINDING (H)	TRANSFORMER CONFIGURATION: LOW-VOLTAGE WINDING (X)	EXT. JUMPER	PHASE	WINDING TESTED: HIGH VOLTAGE WINDING	WINDING TESTED: LOW VOLTAGE WINDING	CAL. TURN RATIO	VECTOR GROUP	NOTES
28			C – B A – C B – A	A B C	A – C B – A C – B	c – a a – b b – c	$\frac{HV}{LV} \cdot \frac{\sqrt{3}}{2}$	Yz5	NO ACCESSIBLE NEUTRAL
66			—	A B C	A – C B – A C – B	η – a η – b η – c	$\frac{V_H \cdot \sqrt{3}}{V_X}$	YNzn7	
29			—	A B C	A – C B – A C – B	η – a η – b η – c	$\frac{HV \cdot \sqrt{3}}{LV}$	Yzn7	NO ACCESSIBLE NEUTRAL ON WYE WINDING
30			C – B A – C B – A	A B C	A – C B – A C – B	b – a c – b a – c	$\frac{HV}{LV} \cdot \frac{\sqrt{3}}{2}$	Yz7	NO ACCESSIBLE NEUTRAL
67			—	A B C	A – C B – A C – B	η – c η – a η – b	$\frac{V_H \cdot \sqrt{3}}{V_X}$	Yzn11	
31			—	A B C	A – C B – A C – B	η – c η – a η – b	$\frac{HV \cdot \sqrt{3}}{LV}$	Yz11	NO ACCESSIBLE NEUTRAL ON WYE WINDING
32			C – B A – C B – A	A B C	A – C B – A C – B	a – c b – a c – b	$\frac{HV}{LV} \cdot \frac{\sqrt{3}}{2}$	Yz11	NO ACCESSIBLE NEUTRAL
55			b – c c – a a – b	A B C	A – N B – N C – N	a – b b – c c – a	$\frac{2}{3} \cdot \frac{HV}{LV}$	ZNd0	
56			—	A B C	A – B B – C C – A	a – b b – c c – a	$\frac{HV}{LV}$	Zd0	NO ACCESSIBLE NEUTRAL ON HIGH VOLTAGE
57			b – c c – a a – b	A B C	A – N B – N C – N	b – a c – b a – c	$\frac{HV}{LV}$	ZNd6	