ATRT-01 S2, ATRT-01B S2, and ATRT-01D S2 SINGLE PHASE TRANSFORMER TURNS-RATIO METERS

USER'S MANUAL





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SAFETY SUMMARY

This manual applies to the ATRT-01 S2, ATRT-01B S2, and ATRT-1D S2 current transformer turns-ratio meters. The operating procedures are virtually the same for all three models, and any differences are clearly described where applicable.

FOLLOW EXACT OPERATING PROCEDURES

Any deviation from procedures described in this User's Manual may create one or more safety hazards, damage the ATRT-01/01B/01D S2, damage the test transformer, or cause errors in the test results. Vanguard Instruments Company, Inc. assumes no liability for unsafe or improper use of the ATRT-01/01B/01D S2.

SAFETY WARNINGS AND CAUTIONS

The ATRT-01/01B/01D S2 shall be used only by **trained operators**. All transformers under test shall be **off-line** and **fully isolated**. Do not perform test procedures or service unless another person is also present who is capable of rendering aid and resuscitation.

DO NOT MODIFY TEST EQUIPMENT

To avoid the risk of introducing additional or unknown hazards, do not install substitute parts or perform any unauthorized modification to any ATRT-01/01B/01D S2 test unit. To ensure that all designed safety features are maintained, it is highly recommended that repairs be performed only by Vanguard Instruments Company factory personnel or by an authorized repair service provider. Unauthorized modifications can cause safety hazards and will void the manufacturer's warranty.

WARNING

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

TABLE OF CONTENTS

CONVENTIONS USE	D IN THIS DOCUMENT	1
1.0 INTRODUCTION	ON	2
1.1 General De	escription and Features	2
1.2 Technical S	Specifications	4
1.2.1. ATRT-	-01 S2 Technical Specifications	4
1.2.2. ATRT-	-01B S2 Technical Specifications	5
1.2.3. ATRT-	-01D S2 Technical Specifications	6
1.3 Controls a	nd Indicators	7
2.0 PRE-TEST SET	TUP 1	1
2.1 ATRT-01 S	2 Operating Voltages1	1
2.2 ATRT-01B	S2 Operating Power1	3
2.3 ATRT-01D	S2 Operating Power 1	3
2.4 LCD Screer	n Contrast Control1	3
3.0 OPERATING I	PROCEDURES1	4
3.1 ATRT Tran	sformer Connection Diagrams1	4
3.2 Setting the	e Test Voltage1	8
3.3 Enabling tl	he Computer Interface1	9
3.4 Setting the	e Date and Time2	0
3.5 Performin	g Tests 2	1
	ng a Single Phase Transformer 2	
	ng a Three Phase Transformer2	
3.5.3. Perfo	rming a Quick Test 2	8
APPENDIX A - TRAN	ISFORMER VECTOR GROUP CODES 3	2
APPENDIX B - Comr	mon ANSI Transformer Descriptions 3	2
APPENDIX C - CEI/I	EC 60076-1 Transformer Descriptions 4	1
APPENDIX D – Austr	ralian Std.2374 Transformer Descriptions 4	8

LIST OF TABLES

Table 1. ATRT-01 S2 Technical Specifications	4
Table 2. ATRT-01B S2 Technical Specifications	5
Table 3. ATRT-01D S2 Technical Specifications	6
Table 4. Functional Descriptions of ATRT-01 S2 Controls and Indicators	8
Table 5. Functional Descriptions of ATRT-01B S2 Controls and Indicators	9
Table 6. Functional Descriptions of ATRT-01D S2 Controls and Indicators	10
Table 7. ATRT-01 S2 Voltage Selection Jumper Settings	11
Table 8. Pre-programmed Nameplate Voltages	31

LIST OF FIGURES

Figure 1. ATRT-01 S2 Controls and Indicators	8
Figure 2. ATRT-01B S2 Controls and Indicators	9
Figure 3. ATRT-01D S2 Controls and Indicators	10
Figure 4. ATRT-01 S2 Voltage Selection Jumper Location	11
Figure 5. ATRT-01 S2 100 – 120 Vac Jumper Settings	12
Figure 6. ATRT-01 S2 200 – 240 Vac Jumper Settings	12
Figure 7. Typical Single-Phase Transformer Connection	14
Figure 8. Typical Auto Transformer Connection	15
Figure 9. Typical CT Connection	16
Figure 10. Typical Bushing CT Connection on a Single Transformer	17
Figure 11. Test Results Elements	30

CONVENTIONS USED IN THIS DOCUMENT

This document uses the following conventions:

- The general term "ATRT" is used in this manual to refer to any of the ATRT-01 S2 models (ATRT-01 S2, ATRT-01B S2, and ATRT-1D S2).
- A key, switch, or knob on the ATRT is indicated as [KEY], [SWITCH], [KNOB].
- Menu names are referenced as "MENU NAME"
- ATRT screen output is shown as:

TEXT	LINE	l	
TEXT	LINE	2	
TEXT	LINE	З	
TEXT	LINE	4	

• Warning messages are indicated as:



• Important notes are indicated as:



1.0 INTRODUCTION

1.1 General Description and Features

The ATRT-01 S2 is Vanguard's third-generation micro-processor-based, single-phase, automatic, transformer-turns-ratio tester. This portable test equipment is offered in three models: the ATRT-01 S2, ATRT-01B S2, and ATRT-01D S2. The ATRT-01 S2 is ac-line powered; the ATRT-01B S2 is ac-line or rechargeable-battery powered, and the ATRT-01D S2 is powered by six D-cells.

The ATRT-01 S2 determines the transformer turns-ratio using the IEEE C57.12.90 measurement method. The transformer turns-ratio is determined by precisely measuring the voltages across the unloaded transformer windings. The ATRT-01 S2's measuring circuitry self calibrates before each measurement to ensure turns-ratio accuracy.

The ATRT-01 S2 measures turns-ratios ranging from 0.800 to 15,000 and can be used to test voltage regulators, power transformers, current transformers (CT), and Potential Transformers (PT). The ATRT-01 S2 also measures and displays transformer-winding excitation current, and winding polarity. Test results are displayed on a back-lit LCD screen (4 lines by 20 characters).

In addition to measuring a transformer's turns-ratio, nameplate voltages can also be entered via the keypad, and the ATRT-01 S2 will then display the turns-ratio error as a percentage. This convenient feature eliminates any user-calculation error when testing transformers.

If a 3-phase transformer is being tested, the ATRT-01 S2 will also provide connection information (H and X test probes to transformer bushings) for phases A, B, and C tests. Three-phase test results (turns-ratio, excitation current, winding polarity, and percentage error) are displayed on the LCD screen at the end of each test.

User Interface

The ATRT-01 S2 features a back-lit LCD screen (4 lines by 20 characters) that is viewable in both bright sunlight and low-light levels. Displayed test results include turns-ratio, winding polarity, excitation current, and percentage error calculation.

The ATRT-01 S2's rugged, 16-key membrane keypad is used to select a test and enter the nameplate voltages for turns-ratio percentage error calculation.

Computer Interface

The ATRT-01 S2, ATRT-01B S2 and the ATRT-01D S2 can be used with a PC via the RS-232C interface. Windows[®] XP/Vista-based software is provided with each unit and can be used to test transformers and to store the test results on the computer. The test results can be retrieved later, in the office for example, for analysis and for printing on an office printer. The test results can also be exported in text or Microsoft[®] Excel format, thus allowing the results to be used with other PC applications.

The included PC software can also be used to create test plans for specific transformers. A test plan is comprised of the transformer nameplate voltages for each tap setting. Computed turnsratio is based on the nameplate voltages which can be compared to the measured ratio to derive percentage error.

Battery Power for Exceptional Portability

The ATRT-01B S2 is powered by a 6-Volt, 7 Ampere-hour, lead-acid battery. The high capacity battery, coupled with the ATRT-01B S2's low power consuming circuitry, allows the unit to be used continuously for up to 6 hours between re-charges. A built-in charger lets the unit be used while the battery is being charged.

The ATRT-01D S2 uses 6 D-cell batteries. Up to 250 tests can be performed with one set of D-cell batteries.

1.2 Technical Specifications

1.2.1. ATRT-01 S2 Technical Specifications

Table 1. ATRT-01 S2 Technical Specifications

TYPE	Portable, automatic, single-phase transformer turns ratio meter
INPUT POWER	120 or 240Vac (Selectable), 50/60Hz (See section 2.1)
MEASUREMENT METHOD	ANSI/IEEE C57.12.90
RATIO MEASURING RANGE	0.8 – 15,000 (5-digit resolution)
TURNS-RATIO ACCURACY	0.800 - 1,999 (±0.1%), 2,000 - 3,999 (±0.25%), 4,000 - 15,000 (±1%)
TEST VOLTAGES	8 Vac @ 1.0 Amp, 40 Vac @ 0.6 Amp
EXCITATION READING RANGE	0 – 2 Amperes
CURRENT READING ACCURACY	±1 milli-amp, ±2% of reading (±1-digit)
DISPLAY	Back-lit LCD screen (4 lines by 20 characters), viewable in bright sunlight and low-light levels
COMPUTER INTERFACE	One RS-232C (19,200 baud) port
PC SOFTWARE	Windows [®] XP/Vista-based, included with purchase price
SAFETY	Designed to meet IEC61010 (1995), UL61010A-1, CSA-C22.2 standards
ENVIRONMENT	Operating: -10°C to 50°C (15°F to 122°F); Storage: -30° C to 70°C (-22°F to 158°F)
HUMIDITY (MAX)	90% RH @ 40° C (104° F) non-condensing
ALTITUDE (MAX)	2000m (6562 ft) to fully safety specifications
CABLES	One 15-foot single-phase cable, one cable-carrying duffel bag included
OPTIONS	Transportation case
WARRANTY	One year on parts and labor



The above specifications are valid at nominal operating voltage and at a temperature of 25°C (77°F). Specifications may change without prior notice.

NOTE

1.2.2. ATRT-01B S2 Technical Specifications

Table 2. ATRT-01B S2 Technical Specifications

TYPE	Portable, automatic, single-phase transformer turns ratio meter
INPUT POWER	SLA battery (90–240Vac, 50/60Hz). Delivers up to 6-hours of operation.
MEASUREMENT METHOD	ANSI/IEEE C57.12.90
RATIO MEASURING RANGE	0.8 – 15,000 (5-digit resolution)
TURNS-RATIO ACCURACY	0.800-1,999 (±0.1%), 2,000-3,999 (±0.25%), 4,000-15,000 (±1.5%)
TEST VOLTAGES	8 Vac @ 350 mA, 40 Vac @ 70 mA
EXCITATION READING RANGE	0 – 2 Amperes
CURRENT READING ACCURACY	±1 Milli-amp, ±2% of reading (±1-digit)
DISPLAY	Back-lit LCD screen (4 lines by 20 characters), viewable in bright sunlight and low-light levels
COMPUTER INTERFACE	One RS-232C (19,200 baud) port
PC SOFTWARE	Windows $^{\otimes}$ XP/Vista-based, included with purchase price
SAFETY	Designed to meet IEC61010 (1995), UL61010A-1, CSA-C22.2 standards
ENVIRONMENT	Operating: -10°C to 50°C (15°F to 122°F); Storage: -30° C to 70°C (-22°F to 158°F)
HUMIDITY (MAX)	90% RH @ 40° C (104° F) non-condensing
ALTITUDE (MAX)	2000m (6562 ft) to fully safety specifications
CABLES	One 15-foot single-phase cable, one cable-carrying duffel bag included
OPTIONS	Transportation case
WARRANTY	One year on parts and labor



The above specifications are valid at nominal operating voltage and at a temperature of 25°C (77°F). Specifications may change without prior notice.

NOTE

1.2.3. ATRT-01D S2 Technical Specifications

Table 3. ATRT-01D S2 Technical Specifications

TYPE	Portable, automatic, single-phase transformer turns ratio meter
INPUT POWER	6 D Cells (250-test capacity)
MEASUREMENT METHOD	ANSI/IEEE C57.12.90
RATIO MEASURING RANGE	0.8 – 15,000 (5-digit resolution)
TURNS-RATIO ACCURACY	0.800-1,999 (±0.1%), 2,000-3,999 (±0.25%), 4,000-15,000 (±1.5%)
TEST VOLTAGES	8 Vac @ 350 mA, 40 Vac @ 70 mA
EXCITATION READING RANGE	0 – 2 Amperes
CURRENT READING ACCURACY	±1 Milli-amp, ±2% of reading (±1-digit)
DISPLAY	Back-lit LCD screen (4 lines by 20 characters), viewable in bright sunlight and low-light levels
COMPUTER INTERFACE	One RS-232C (19,200 baud) port
PC SOFTWARE	Windows $^{\otimes}$ XP/Vista-based, included with purchase price
SAFETY	Designed to meet IEC61010 (1995), UL61010A-1, CSA-C22.2 standards
ENVIRONMENT	Operating: -10°C to 50°C (15°F to 122°F); Storage: -30° C to 70°C (-22°F to 158°F)
HUMIDITY (MAX)	90% RH @ 40° C (104° F) non-condensing
ALTITUDE (MAX)	2000m (6562 ft) to fully safety specifications
CABLES	One 15-foot single-phase cable, one cable-carrying duffel bag included
OPTIONS	Transportation case
WARRANTY	One year on parts and labor



The above specifications are valid at nominal operating voltage and at a temperature of 25°C (77°F). Specifications may change without prior notice.

NOTE

1.3 Controls and Indicators

The ATRT-01 S2, ATRT-01B S2, and ATRT-01D S2 controls and indicators are shown in Figure 1, Figure 2, and Figure 3, respectively. A leader line with an index number points to each control and indicator, which is cross-referenced to a functional description in the corresponding table. The purpose of the controls and indicators may seem obvious, but users should familiarize themselves with them before using the ATRT. Accidental misuse of the controls will usually cause no serious harm. Users should also familiarize themselves with the safety summary information found on the front page of this User's Manual.

ATRT-01 S2, ATRT-01B S2, AND ATRT-01D S2 USER'S MANUAL REV 2



Figure 1. ATRT-01 S2 Controls and Indicators

ltem Number	Panel Markings	Functional Description
1	RS-232C	RS-232C computer interface port. Data rate is set to 19,200 baud, 1 start bit, 8 data bits, 2 stop bits, and no parity bit.
2		Back-lit LCD screen (20 characters by 4 lines), viewable in bright sunlight and low-light levels.
3		Rugged alpha-numeric keypad.
4		H and X lead connector; 16-pin male.
5	120 Vac, 2A, 50-60Hz	Input power connector and fused power switch with third-wire safety ground.

Table 4. Functional Descriptions of ATRT-01 S2 Controls and Indicators
--



Figure 2. ATRT-01B S2 Controls and Indicators

ltem Number	Panel Markings	Functional Description
1	RS-232C	RS-232C computer interface port. Data rate is set to 19,200 baud, 1 start bit, 8 data bits, 2 stop bits, and no parity bit.
2		Back-lit LCD screen (20 characters by 4 lines), viewable in bright sunlight and low-light levels.
3		Rugged alpha-numeric keypad.
4		H and X lead connector; 16-pin male.
5	120 Vac, 2A, 50-60Hz	Input power connector and fused power switch with third-wire safety ground.
6	POWER	Power switch, momentary contact.
7	CHARGER	Battery charging indicator. LED lights up when battery is being charged.

Table 5. Functional Descriptions of ATRT-01B S2 Controls and Indicators



Figure 3. ATRT-01D S2 Controls and Indicators

ltem Number	Panel Markings	Functional Description
1	RS-232C	RS-232C computer interface port. Data rate is set to 19,200 baud, 1 start bit, 8 data bits, 2 stop bits, and no parity bit.
2		Back-lit LCD screen (20 characters by 4 lines), viewable in bright sunlight and low-light levels.
3		Rugged alpha-numeric keypad.
4		H and X lead connector; 16-pin male.
5	POWER	Power switch, momentary contact.

Table 6. Functional Descriptions of ATRT-01D S2 Controls and Indicators

2.0 PRE-TEST SETUP

2.1 ATRT-01 S2 Operating Voltages

The ATRT-01 S2 is powered by ac line voltage only. The operating voltage is preset at the factory and is selectable between 100-120 Vac, 50/60 Hz or 200-240 Vac, 50/60 Hz. Only the reference transformer requires voltage selection for the different operating voltages. The voltage is set by placing jumper(s) on the transformer (part number 200466-1) as shown in Figure 5 and Figure 6.

Voltage Selection	Transformer Jumpers
100 – 120 Vac	Pin 1 and 3, Pin 2 and 4
200 – 240 Vac	Pin 2 and 3

Table 7. ATRT-01 S2 Voltage Selection Jumper Settings

Figure 4. ATRT-01 S2 Voltage Selection Jumper Location

ATRT-01 S2, ATRT-01B S2, AND ATRT-01D S2 USER'S MANUAL REV 2

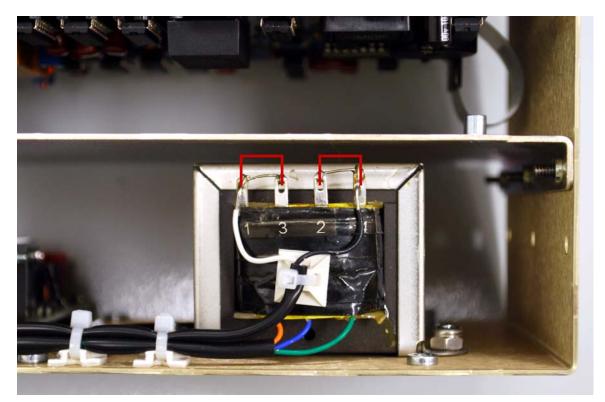


Figure 5. ATRT-01 S2 100 – 120 Vac Jumper Settings

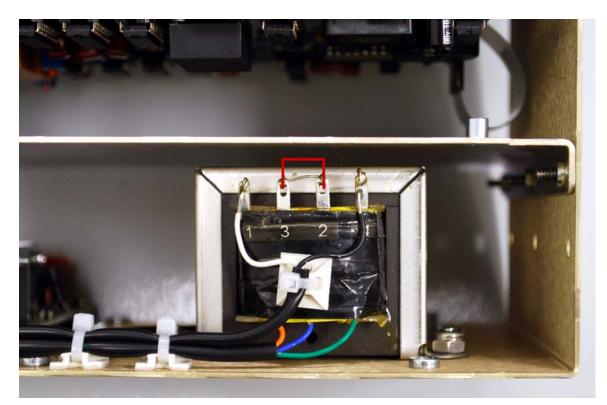


Figure 6. ATRT-01 S2 200 – 240 Vac Jumper Settings

2.2 ATRT-01B S2 Operating Power

The ATRT-01B S2 is powered by a rechargeable (6 Vdc / 7 AH) sealed lead acid gel battery. The unit can operate continuously for up to 6 hours between charges. It can also be used while charging. Plugging the ATRT-01B S2 into an ac power outlet after the battery is fully charged will not damage the battery.

- It is recommended that the ATRT-01B S2 be plugged into an ac outlet when it is not in use.
- The ATRT-01B S2 battery can be replaced with the Enersys Genesis NP7-6 6V, 7.0Ah battery.

2.3 ATRT-01D S2 Operating Power

The ATRT-01D S2 is powered by six standard D cell batteries. We recommend industrial (1.5 volts) D cells such as the Duracell 1300.

To turn the unit on or off, press and hold the **[POWER]** switch for 2 seconds.

2.4 LCD Screen Contrast Control

To increase the LCD screen contrast, press and hold the [\land **Contrast**] key for two seconds. Release the button when the desired contrast level has been reached.

To decrease the LCD screen contrast, press and hold the [\lor **Contrast**] key for two seconds. Release the button when the desired contrast level has been reached.

For the ATRT-01B S2 and ATRT-01D S2, the back-light turns off after 30 seconds of operation to conserve power. Press any key on the keypad to re-light the back-light.

3.0 OPERATING PROCEDURES

3.1 ATRT Transformer Connection Diagrams

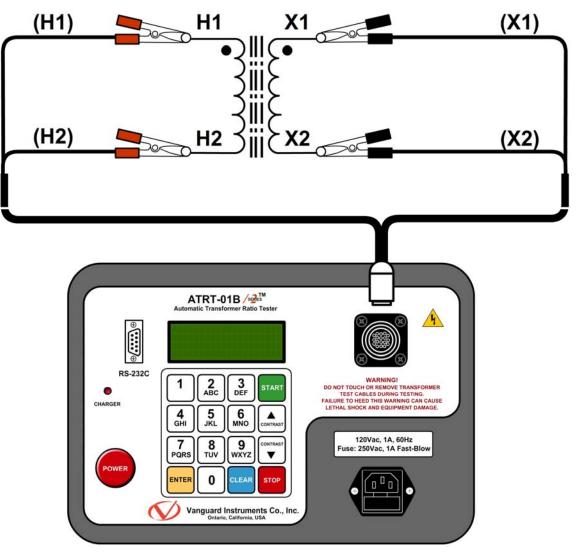


Figure 7. Typical Single-Phase Transformer Connection

REV 2 ATRT-01 S2, ATRT-01B S2, AND ATRT-01D S2 USER'S MANUAL

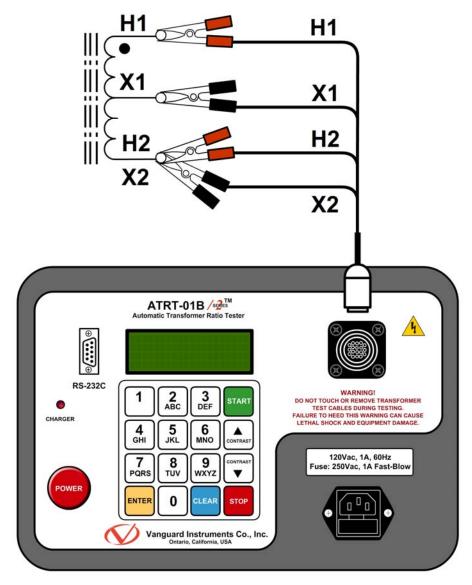


Figure 8. Typical Auto Transformer Connection

ATRT-01 S2, ATRT-01B S2, AND ATRT-01D S2 USER'S MANUAL REV 2

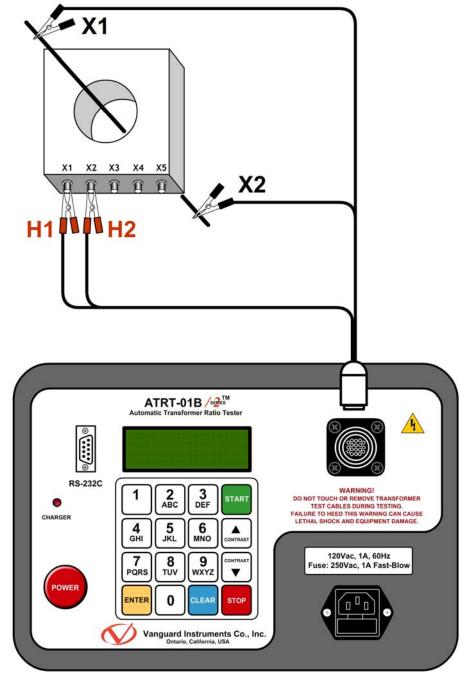


Figure 9. Typical CT Connection

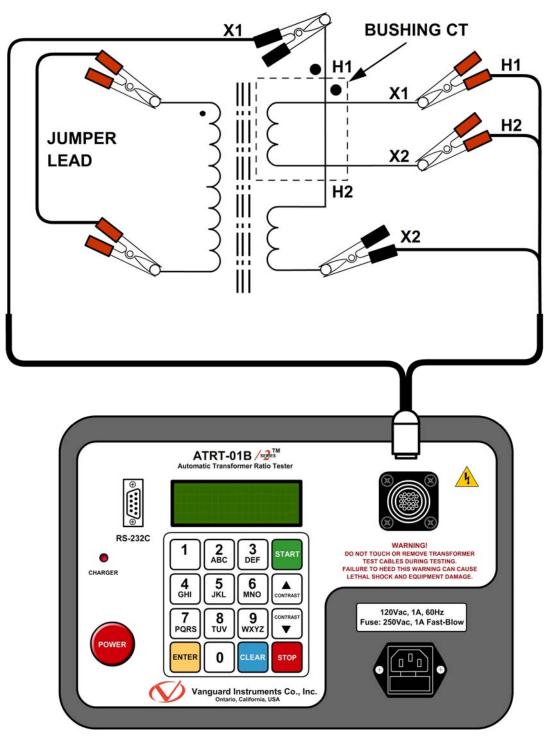


Figure 10. Typical Bushing CT Connection on a Single Transformer

3.2 Setting the Test Voltage

The ATRT offers two test voltages, 8 Vac and 40 Vac. The unit always defaults to 40 Vac at power-on. The 8 Vac test voltage can be used in situations where the 40 Vac excitation voltage may saturate the CT's. To set the test voltage:

a. Turn on the unit and start from the "START-UP" menu:



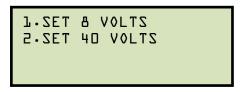
Press the [2] key (SETUP).

b. The following screen will be displayed:



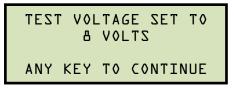
Press the [2] key (SET TEST VOLTAGE).

c. The following screen will be displayed:



Press the **[1]** key (*SET 8 VOLTS*) to select 8 volts as the test voltage ore press the **[2]** key (*SET 40 VOLTS*) to select 40 volts as the test voltage.

d. The voltage will be set and the following confirmation message will be displayed:



Press any key to return to the "START-UP" menu.

3.3 Enabling the Computer Interface

The ATRT can be connected to a computer via the RS-232C interface port. In order to remotely control the unit using the provided Transformer Turns Ratio Analysis (TTRA) software, the unit must be placed in Computer Control mode. Use the steps below to place the unit in Computer Control mode:

a. Start from the "START-UP" menu:

```
1.TEST XFMR 06/02/10
2.SETUP
           15:33:10
J.CALCULATOR
```

Press the [2] key (SETUP).

b. The following screen will be displayed:



Press the [3] key (COMPUTER CONTROL).

c. The following screen will be displayed confirming that the unit has been placed in Computer Control mode:



You can now use the Transformer Analysis software to remotely control the unit from the PC. Please see the software User's Manual for further information.

Press the **[STOP]** key to abort Computer Control mode and return to the "START-UP" menu.



The TTRA software only supports the single phase transformer test when used with the ATRT-01 S2.

3.4 Setting the Date and Time

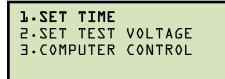
To set the date and time:

a. Start from the "START-UP" menu:



Press the **[2]** key (SETUP).

b. The following screen will be displayed:



Press the [2] key (SET TIME)

c. The following screen will be displayed:



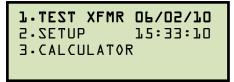
Type in the date and time using the alpha-numeric keypad. When the complete date and time has been entered, you will be immediately returned to the "START-UP" menu.

3.5 Performing Tests

3.5.1. Testing a Single Phase Transformer

Follow the steps below to test a single phase transformer:

a. Start from the "START-UP" menu:



Press the **[1]** key (*TEST XFMR*).

b. The following screen will be displayed:

```
XFMR CONFIGURATION:

1.SNGL PHS 2.dT-Y

3.Y-dT 4.dT-dT

5.Y-Y
```

Press the **[1]** key (SNGL PHS).

c. The following screen will be displayed:



1. YES

Press the **[1]** key (*YES*) if you would like to enter the transformer name plate voltage values. The following screen will be displayed:

```
ENTER H WINDING
NAME-PLATE VOLTAGE:
V
```

Type the H winding name plate voltage value using the numeric keypad. The screen will be updated as shown:

```
ENTER H WINDING
NAME-PLATE VOLTAGE:
500 V
```

Press the [ENTER] key. The following screen will be displayed:

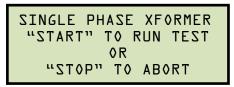
Type the X winding name plate voltage value using the numeric keypad. The screen will be updated as shown:

Press the [ENTER] key. Continue to step d.

2. NO

Press the **[2]** key (*NO*) if you do not want to enter the transformer name plate voltage. **Continue to step d.**

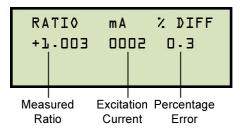
d. The following screen will be displayed:



Press the **[START]** key to start the test.

e. The following screen will be displayed while the test is being performed:

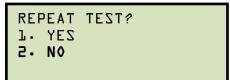
The test results will be displayed on the LCD screen when testing has finished:



The polarity is displayed as either a plus sign (+) for "in-phase" or a minus sign (-) for "out-of-phase". The value listed under "% DIFF" is the percentage error.

Press any key to continue.

f. The following screen will be displayed:

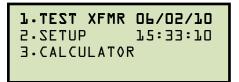


Press the **[2]** key (*NO*). You will be returned to the "START-UP" screen.

3.5.2. Testing a Three Phase Transformer

Follow the steps below to test a three phase transformer:

a. Start from the "START-UP" menu:



Press the [1] key (TEST XFMR).

b. The following screen will be displayed:

```
XFMR CONFIGURATION:
1.SNGL PHS 2.dT-Y
3.Y-dT 4.dT-dT
5.Y-Y
```

Select a three-phase transformer test by pressing the corresponding key ([2] to [5]). For this example, press the [2] key (dT-Y) to select the Delta to Y phase transformer test.

c. The following screen will be displayed:

dT-Y	XFMR	CONFIG:
l.Dynl		Z∙Dyn∃
∃∙Dyn5		4.Dyn7
5∙Dyn9		ե∙Dynll

Select the transformer configuration by pressing the corresponding key ([1] to [6]). For this example, press the [1] key (*Dyn1*).

d. The following screen will be displayed:



1. YES

Press the **[1]** key (*YES*) if you would like to enter the transformer name plate voltage values. The following screen will be displayed:



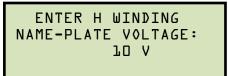
Type the H winding name plate voltage value using the numeric keypad. The screen will be updated as shown:

```
ENTER H WIN⊅ING
NAME-PLATE VOLTAGE∶
500 V
```

Press the [ENTER] key. The following screen will be displayed:

```
ENTER X WINDING
NAME-PLATE VOLTAGE:
V
```

Type the X winding name plate voltage value using the numeric keypad. The screen will be updated as shown:



Press the [ENTER] key. Continue to step e.

2. NO

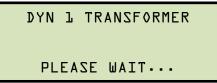
Press the **[2]** key (*NO*) if you do not want to enter the transformer name plate voltage. **Continue to step e.**

e. The following screen will be displayed showing the Phase A cable connections for the selected test (this will differ depending on the test):

CABLE	A-2H9	XFMR
X1'X5	to	Xl¬XO
Hľ'H5	to	Hl,H3
"START"	TO RU	IN TEST

Make the cable connections per the instructions and then press the **[START]** key to run the Phase A test.

f. The following screen will be displayed while the test is being performed:



The Phase A test results will be displayed on the LCD screen when testing has finished:

RATI0	m A	% DIFF
+15.003	D D L	0.02
"ENTER"	TO (CONTINUE

Press the **[ENTER]** key to continue.

g. The following screen will be displayed showing the Phase B cable connections for the selected test:

CABLE	PHS-B	XFMR
Xl ₁ X2	to	X2,X0
H1,H2	to	H5'H7
"START"	' TO RL	IN TEST

Make the cable connections per the instructions and then press the **[START]** key to run the Phase B test.

h. The following screen will be displayed while the test is being performed:

The Phase A and B test results will be displayed on the LCD screen when testing has finished:

mA % DIFF
007 0.05
001 0.10
TO CONTINUE

Line 1 of the results shows the Phase A test results, and line 2 shows the Phase B test results.

Press the [ENTER] key to continue.

i. The following screen will be displayed showing the Phase C cable connections for the selected test:

CABLE	PHS-C	XFMR
Xl'X5	to	XJ'ZO
H1'45	to	H3,H2
"START"	' TO RI	JN TEST

Make the cable connections per the instructions and then press the [START] key to run the Phase C test.

j. The following screen will be displayed while the test is being performed:

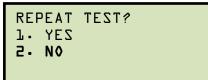
```
DYN 1 TRANSFORMER
Please Wait...
```

The Phase A, B, and C test results will be displayed on the LCD screen when testing has finished:

RATIO		% DIFF	
+15.003	001	0.02	— Phase A Results
			— Phase B Results
+15.000	001	0.00	— Phase C Results

Press any key to continue.

k. The following screen will be displayed:

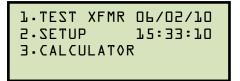


Press the [2] key (NO). You will be returned to the "START-UP" menu.

3.5.3. Performing a Quick Test

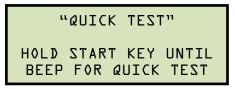
The ATRT provides a Quick Test mode that can be used to measure a transformer's turns ratio by only pressing a single button. To initiate a Quick Test:

a. Start from the "START-UP" menu:



Press and hold down the [START] key.

b. The following screen will be displayed:



Continue to hold down the **[START]** key until the unit beeps again, and then release the **[START]** key.

c. The following screen will be displayed while the test is being performed:



The test results will be displayed on the LCD screen when testing has finished:



Press the **[STOP]** key to return to the "START-UP" menu.

3.5.4. Performing a Single Phase Transformer Test Using Preset Voltage Table

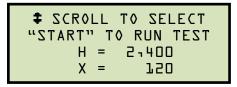
The ATRT is pre-programmed with 46 transformer name plate voltages. These pre-programmed values can be used to quickly test a single phase transformer's turns ratio and compare the test results against the name plate voltage. Please see Table 8 for a list of the pre-programmed name plate voltages. Follow the steps below to perform a single phase transformer test using a pre-programmed name plate voltage:

a. Start from the "START-UP" menu:

```
L.TEST XFMR OL/O2/10
2.SETUP 15:33:10
3.CALCULATOR
```

Press the [CLEAR] key.

b. The following screen will be displayed:



Press either the [^ Contrast] key or the [> Contrast] key to scroll through the preprogrammed name plate voltage values.

Continue to press the [\land **Contrast**] key or the [\lor **Contrast**] key until the desired name plate voltage values are displayed on the screen.

Press the **[START]** key when the desired name plate voltage values are displayed.

c. The following screen will be displayed while the test is being performed:

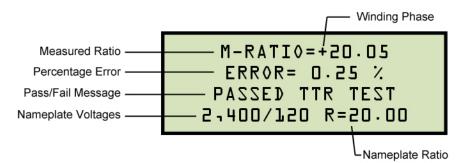
SINGLE	PHASE	XFORMER			
PLEASE WAIT TEST IN PROGRESS					

The test results will be displayed on the LCD screen when testing has finished (multiple examples shown:

Example results from a passed test using nameplate voltages.

Example results from a failed test using nameplate voltages.

Please see Figure 11 below for a description of the test results elements.







In order for a test to pass, the error reading must be less than or equal to 0.5% and the winding must be in-phase (+).

No	H Voltage	X Voltage
1	2400	120
2	2400	240
3	2400	277
4	2400	480
5	4160	120
6	4160	240
7	4160	277
8	4160	480
9	4800	120
10	4800	240
11	6930	120
12	6930	240
13	7200	2400
14	9430	120
15	9430	240
16	12000	120
17	12000	240
18	12000	277
19	12000	480
20	12000	2400
21	13800	120
22	13800	240
23	13800	277
24	13800	480
25	14400	120
26	14400	240
27	14400	277
28	14400	480
29	16340	120
30	16340	240
31	16340	277
32	16340	480
33	16340	2400
34	24900	120
35	24900	240
36	24900	277
37	34400	120
38	34400	240
39	34400	277
40	34400	480
41	34400	2400
42	34400	4800
43	34400	6930
44	34400	7200
45	34400	9430

Table 8. Pre-programmed Nameplate Voltages

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 phasedisplacement 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:

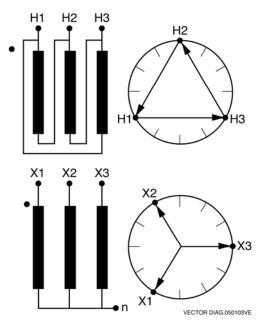
D indicates that the high-voltage windings are connected in a Delta configuration

(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 ANSI Transformer Descriptions

	TRANSF CONFIGL			WINDING	TESTED			
STD TEST NO.	HIGH-VOLTAGE WINDING (H)	LOW-VOLTAGE WINDING (X)	PHASE	HIGH VOLTAGE WINDING	LOW VOLTAGE WINDING	TURNS RATIO	VECTOR GROUP	NOTES
1	н ₁ 0Он ₂	x ₁ 00x ₂	1Ø	H ₁ – H ₂	x ₁ -x ₂	V _H	1ph0	SNG – PHS
	₽°Q	2 b 0 ^x 2	А	н ₁ – н ₃	x ₁ -x ₀	V ₁₁ , V ₂		
2	B C	$x_1 O_{c} O_{c} X_0 X_0 X_3$	B C	H ₂ -H ₁ H ₃ -H ₂	$x_{2} - x_{0}$ $x_{3} - x_{0}$	$\frac{V_{H} \cdot V_{3}}{V_{x}}$	D _{yn1}	d t – Y
	H ₁ O A H ₃							
	H ₂ O	a X ₂	A	H ₁ -H ₀	x ₁ -x ₂	v _H		
3	A A	×10	В	H ₂ -H ₀	x ₂ -x ₃	$\frac{V_{H}}{V_{x} \cdot V_{3}}$	YNd1	y – d t
	H ₁ CO _{H3}	د مح x ³	С	н ₃ – н ₀	x ₃ -x ₁			
	н _о с	×2 0	А	H ₁ -H ₃	x ₁ -x ₃			
4	в	b/Cc	в	H ₂ -H ₁	X ₂ -X ₁	$\frac{v_{H}}{v_{x}}$	Dd0	dt-dt
	H ₁ H ₃ H ₃	$x_1 \xrightarrow{a} x_3$	С	H ₃ -H ₂	x ₃ -x ₂	×		
	H ₂	×2 0	А	H ₁ -H ₀	x ₁ -x ₀	V		
5	BHO		В	H ₂ -H ₀	x ₂ -x ₀		YNyn0	у — у
	H ₁ CO _{H3}	X ₁ 0 ^{°°} C ₀ X ₃	С	H ₃ -H ₀	x ₃ -x ₀	×		

VANGUARD.050207V1

	TRANSF CONFIGL	ORMER JRATION			WINDING	TESTED			
SPEC TEST NO.	HIGH-VOLTAGE WINDING (H)	LOW-VOLTAGE WINDING (X)	EXT. JUMPER	PHASE	HIGH VOLTAGE WINDING	LOW VOLTAGE WINDING	CAL. TURN RATIO	VECTOR GROUP	NOTES
	н ₂ 8	$x_3 x_1$		А	H ₁ – H ₃	$x_{3} - x_{1}$	V		
1	В	c b	—	В	$H_2 - H_1$	$x_{1} - x_{2}$	$\frac{V_{H}}{V_{x}}$	Dd6	
	H ₁ C A H ₃	×2		С	H ₃ – H ₂	x ₂ -x ₃	Ŷ		
	н ₂ Я	×2 8		А	H ₁ – H ₃	$x_{1} - x_{3}$	V.		
37	в	b/ C		В	H ₂ – H ₁	x ₂ -x ₁	$\frac{V_{H}}{V_{x}}$	Dd0	
	H ₁ O A H ₃	х ₁ осон ₃		С	H3 – H2	x ₃ -x ₂			
	н ₁ Д	$X_3 $		А	H ₁ – H ₂	X ₃ – X ₂	v		
38	C/A	a c	—	В	H ₂ – H ₃	X ₁ – X ₃	<u></u>	Dd2	
	H ₃ H ₂ H ₂	×2		С	H3 – H1	$X_2 - X_1$			
	н ₁ Я	×3 A		А	H ₁ -H ₂	X ₃ – X ₁	v		
39	C/ A	c/a		В	H ₂ – H ₃	X ₁ – X ₂	$\frac{V_{H}}{V_{x}}$	Dd4	
	н ₃ б _в он ₂	x ₂ d b x ₁		С	H ₃ – H ₁	X ₂ – X ₃	Â		
	н ₁ А	×2 8		А	H ₁ – H ₂	$x_2 - x_3$	v		
40	C/ A	c a	—	В	H ₂ – H ₃	x ₃ -x ₁	V _H	Dd8	
	н ₃ с В Н ₂	x ₁ d b x ₃		С	H ₃ – H ₁	$x_1 - x_2$			
	н ₁ А	X ₁ X ₂ X ₂		А	H ₁ – H ₂	X ₁ – X ₃	v		
41	C/ A	a c	—	В	H ₂ – H ₃	X ₂ -X ₁	$\frac{v_{H}}{v_{x}}$	Dd10	
	н ₃ бон ₂	×3		С	H3 – H1	X3 - X2	Â		
	н ₁ А	2 ^{x1}		А	H ₁ – H ₃	$X_1 - X_0$			
42	A B	$x_3 \circ \circ$		В	H ₂ – H ₁	$x_2 - x_0$	$\frac{V_{H} \cdot V_{3}}{V_{X}}$	Dyn1	
	H ₃ d _C _D H ₂	× ₃ 0 (× ₀ b b x ₂		С	H3 – H2	$x_3 - x_0$			
	н ₂ Я	b 2 x 2	н ₃ -н ₂	А	H ₁ – H ₃	$x_{1} - x_{3}$	v _{H ●} v ₃		NO
2	в	x ₁ o a η c	^H 1 ^{-H} 3	В	H ₂ – H ₁	x ₂ -x ₁	$\frac{v_{\rm H} \bullet v_3}{V_{\rm X}}$	Dy1	ACCESSIBLE NEUTRAL ON
	H ₁ O A H ₃	د ک׳	^н 2 ^{-н} 1	С	H3 – H2	x ₃ -x ₂			WYE WINDING
	^н 2 8	X ₁ Q _c	н ₃ -н ₂	А	H ₁ – H ₃	X ₁ – X ₂	N. 15		NO
61	BC	$b x_0^{a} o x_2$	н ₁ -н ₃	В	H ₂ – H ₁	X ₂ – X ₃	$\frac{V_{H} \cdot V_{3}}{V_{x}}$	Dy3	ACCESSIBLE NEUTRAL ON
	H ₁ O A H ₃	x ₃ d °	^н 2 ^{-н} 1	С	H3 – H2	$X_3 - X_1$			WYE WINDING
	н ₂ Q	X10, c		А	H ₁ – H ₃	$x_0 - x_2$			
62	в	$b \sum_{x} a o x_2$	_	В	$H_2 - H_1$	$x_0 - x_3$	$\frac{V_{H} \cdot V_{3}}{V_{x}}$	Dyn3	
	H ₁ O A H ₃	×30 ~0		С	H3 – H2	$X_0 - X_1$			

	TRANSF CONFIGL				WINDING	TESTED			
SPEC TEST NO.	HIGH-VOLTAGE WINDING (H)	LOW-VOLTAGE WINDING (X)	EXT. JUMPER	PHASE	HIGH VOLTAGE WINDING	LOW VOLTAGE WINDING	CAL. TURN RATIO	VECTOR GROUP	NOTES
	н ₂	_ه ک ^۲		А	H ₁ – H ₃	$x_3 - x_0$			
3	в	$x_3 $		в	H ₂ – H ₁	$X_1 - X_0$	$\frac{V_{H} \cdot V_{3}}{V}$	Dyn5	
	H ₁ O _A H ₃	° b×2		С	H3 – H2	$X_2 - X_0$	vx		
	н ₂ 0	, p ^X 1	$H_{3}-H_{2}$	Α	H ₁ – H ₃	$x_3 - x_2$			NO
4	в	x ₃ o a t	н ₁ -н ₃	в	$H_2 - H_1$	$X_1 - X_3$	$\frac{V_{H} \cdot V_{3}}{V_{x}}$	Dy5	ACCESSIBLE NEUTRAL ON
	H ₁ O A H ₃	° b×2	^н 2 ^{-н} 1	С	H3 – H2	$X_2 - X_1$	۴x		WYE WINDING
	H ² Q	X ₃ Q _c		А	H ₁ – H ₃	$x_0 - x_1$			
5	в	$X_0 - a_0 X_1$	—	В	$H_2 - H_1$	$x_0 - x_2$	$\frac{V_{H} \cdot V_{3}}{V_{x}}$	Dyn7	
	H ₁ O A H ₃	x ₂ o °		С	$H_{3} - H_{2}$	$x_0 - x_3$	Â		
	H ² Q	×3 Q c	н ₃ -н ₂	А	H ₁ – H ₃	$x_{3} - x_{1}$			NO
6	в		^H 1 ^{-H} 3	В	$H_2 - H_1$	$x_{1} - x_{2}$	$\frac{V_{H} \cdot V_{3}}{V_{x}}$	Dy7	ACCESSIBLE NEUTRAL ON
	H ₁ \leftarrow A H ₃	x20 b	^н 2 ^{-н} 1	С	H3 – H2	$x_{2} - x_{3}$			WYE WINDING
	н ₂ О	_b ρ ^{x₃}	н ₃ -н ₂	А	H ₁ – H ₃	$X_2 - X_1$			NO
63	в	x ₂ o a x ₀	H ₁ -H ₃	В	$H_2 - H_1$	$X_3 - X_2$	$\frac{V_{H} \cdot V_{3}}{V_{x}}$	Dy9	ACCESSIBLE NEUTRAL ON
	H ₁ O A H ₃	ͻϧϫ	н ₂ -н ₁	С	H3 – H2	$X_1 - X_3$	٧X		WYE WINDING
	H ₂ Q	ρ ^x 3		А	H ₁ – H ₃	$X_2 - X_0$			
64	BCC	$x_2 o^{a} o^{b} x_0$	—	В	$H_2 - H_1$	$x_3 - x_0$	$\frac{V_{H} \cdot V_{3}}{V_{x}}$	Dyn9	
	H ₁ O A H ₃	°Ъ×₁		С	H3 – H2	$X_1 - X_0$	*x		
	H ₂ O	×2 Q c		А	H ₁ – H ₃	$X_0 - X_3$			
7	в	$x_0 \rightarrow a \rightarrow x_3$	—	В	H ₂ – H ₁	X ₀ – X ₁	$\frac{V_{H} \cdot V_{3}}{V_{V}}$	Dyn11	
	H ₁ O A H ₃	x ₁ 0 ^b		С	H ₃ – H ₂	$X_0 - X_2$	• *		
	H ² Q	×2 Q c	н ₃ -н ₂	А	H ₁ – H ₃	$X_2 - X_3$	V VE		NO
8	в	$\eta = 0 x_3$	^н 1- ^н 3	В	$H_2 - H_1$	$X_{3} - X_{1}$	$\frac{V_{H} \bullet V_{3}}{V_{x}}$	Dy11	ACCESSIBLE NEUTRAL ON
	H ₁ O A H ₃	x10 ^b	^н 2 ^{-н} 1	С	H3 – H2	X ₁ – X ₂			WYE WINDING
	н ^т Q	×q	H ₂ -H ₃	А	H ₁ – H ₂	$x_{1} - x_{0}$	V		
45	C A		н ₃ -н ₁	В	H ₂ – H ₃	x ₂ -x ₀	$\frac{3}{2} \cdot \frac{V_{H}}{V_{X}}$	Dzn0	
	н ₃ с В Н ²	x ₃	H ₁ -H ₂	С	H ₃ – H ₁	$x_{3} - x_{0}$	x		
	D I	x ₃ × 2 ^b × 1	н ₂ -н ₃	А	H ₁ -H ₂	$X_0 - X_2$	3 ^V H		
46	C/A	$a X_0^{c}$	^н з- ^н 1	В	$H_2 - H_3$	$x_0 - x_3$	$\frac{3}{2} \cdot \frac{^{\circ}H}{V_{\chi}}$	Dzn2	
	н ₃ фВн ₂	bx ₂	H ₁ -H ₂	С	H3 – H1	$X_0 - X_1$	Ŷ		

	TRANSF				WINDING	TESTED			
SPEC TEST NO.	HIGH-VOLTAGE WINDING (H)	LOW-VOLTAGE WINDING (X)	EXT. JUMPER	PHASE	HIGH VOLTAGE WINDING	LOW VOLTAGE WINDING	CAL. TURN RATIO	VECTOR GROUP	NOTES
	H ¹ Q	$X_3 \xrightarrow{b} n \xrightarrow{X_1} 1$		А	H ₁ – H ₂	$X_3 - X_2$	v		NO
47	C A		—	В	H ₂ – H ₃	X ₁ – X ₃	$\frac{V_{H}}{V_{x}}$	Dz2	ACCESSIBLE
	H ₃ O _B O _{H2}	bx2		С	H3 – H1	$X_2 - X_1$	Â		NEUTRAL
	H ¹ Q	2 ^{×3}	H ₂ -H ₃	А	H ₁ – H ₂	$x_{3} - x_{0}$	з ^V н		
48	C A		^Н 3 ^{-Н} 1	В	H ₂ – H ₃	$x_{1} - x_{0}$	$\frac{3}{2} \cdot \frac{V_H}{V_x}$	Dzn4	
	H ₃ G B H ₂	$x_2^{O} - c x_1^{O}$	^H 1 ^{-H} 2	С	H ₃ – H ₁	$x_{2} - x_{0}$	~		
	H ₁ O	۶ [×] 3		А	H ₁ -H ₂	$X_3 - X_1$	v		NO
49	C A	a n b	—	В	H ₂ – H ₃	X ₁ – X ₂	$\frac{V_{H}}{V_{x}}$	Dz4	ACCESSIBLE
	H ₃ d B H ₂	x_2^{O-c} x_1^{O}		С	H3 – H1	$X_2 - X_3$	^		NEUTRAL
	H ₂ Q	X2 0		А	H ₁ – H ₃	$X_1 - X_3$	V.,		NO
9	в	a η b v		В	H ₂ – H ₁	X ₂ – X ₁	$\frac{v_{H}}{v_{x}}$	Dz0	ACCESSIBLE NEUTRAL
	H ₁ O A H ₃	x ⁰ ₁ ² ³ ₂		С	H3 – H2	$X_3 - X_2$			
	н ₂ Я	×30° ×1		А	H ₁ – H ₃	$x_{3} - x_{1}$			NO
10	в	υ _b η ^a		в	H ₂ -H ₁	$x_{1} - x_{2}$	V _H	Dz6	ACCESSIBLE NEUTRAL
	H ₁ O A H ₃	bx2		С	$H_3 - H_2$	$x_{2} - x_{3}$	^		
	н ₁ Q	$x_2^{O} \xrightarrow{b} p^{X_3}$	$H_{2}-H_{3}$	А	H ₁ – H ₂	$x_0 - x_1$	a Vu		
50	C/A	$a \begin{pmatrix} X_0 \\ X_0 \end{pmatrix}^c$	^Н 3 ^{-Н} 1	в	H ₂ – H ₃	x ₀ - x ₂	$\frac{3}{2} \cdot \frac{V_H}{V_x}$	Dzn6	
	H ₃ G _B H ₂	ک×1	^H 1 ^{-H} 2	С	$H_3 - H_1$	$x_0 - x_3$	~		
	н ₁ Q	٩ ^{×2}	^н 2- ^н 3	А	H ₁ – H ₂	$x_2 - x_0$. V.,		
51	C A		^Н 3 ^{-Н} 1	В	H ₂ – H ₃	$x_{3} - x_{0}$	$\frac{3}{2} \cdot \frac{V_H}{V_x}$	Dzn8	
	H ₃ d B H ₂	$X_1^{\text{d}} \xrightarrow{b} 0^{3}$	^H 1 ^{-H} 2	С	H3 – H1	$X_1 - X_0$	Â		
	^н 1 Я	٩ ۲۲		А	H ₁ – H ₂	$x_2 - x_3$			NO
52	C/A	°, → ° × °		в	H ₂ – H ₃	$X_3 - X_1$	V _H	Dz8	ACCESSIBLE
	н ₃ фрн ₂	x ₁ b X ₃		С	H3 – H1	$X_1 - X_2$	Ŷ		
	H ₁ Q	$X_1 C^{-0}$	H ₂ -H ₃	А	H ₁ – H ₂	$x_{0} - x_{3}$	V		
53	C/A	b A a	н ₃ -н ₁	В	H ₂ – H ₃	$x_0 - x_1$	$\frac{3}{2} \cdot \frac{V_{H}}{V_{X}}$	Dzn10	
	н ₃ с В Н ²	׳Q	^н 1 ^{-н} 2	С	H ₃ – H ₁	x ₀ - x ₂	x		
	н ₁ Q	Q ¹ c Q ²		А	H ₁ – H ₂	$X_{1} - X_{3}$	V		NO
54	C/A	b a	—	В	H ₂ – H ₃	$X_2 - X_1$	<u></u>	Dz10	ACCESSIBLE
	H ₃ d B H ₂	x ₃ 0		С	H3 – H1	$x_3 - x_2$	x		HEO HINE

	TRANSF CONFIGL				WINDING	TESTED			
SPEC TEST NO.	HIGH-VOLTAGE WINDING (H)	LOW-VOLTAGE WINDING (X)	EXT. JUMPER	PHASE	HIGH VOLTAGE WINDING	LOW VOLTAGE WINDING	CAL. TURN RATIO	VECTOR GROUP	NOTES
	H ₂	X ₃ Q c		А	H ₁ -H ₀	$X_2 - X_1$			
11			—	в	$H_2 - H_0$	$x_3 - x_2$	$\frac{V_{H}}{V_{X} \cdot V_{3}}$	YNd7	
	H ₁ 0 C OH ₃	X ₂ a		С	H3 – H0	$X_1 - X_3$	• • • • •		
	н ₂ О	a X2		А	H ₁ – H ₀	$x_{1} - x_{2}$	N.		
44		X ₁ C	—	в	H ₂ – H ₀	$x_{2} - x_{3}$	$\frac{V_{H}}{V_{X} \bullet V_{3}}$	YNd1	
	H ₁ O ^C OH ₃	ت ک _{لاع}		С	H3 – H0	$x_{3} - x_{1}$	~ 0		
	н ₂ О	a X ₂	н ₃ -н ₂	A	H ₁ – H ₃	$X_1 - X_2$			NO
12	ABN	X ₁ C b	н ₁ -н ₃	в	$H_2 - H_1$	$x_2 - x_3$	$\frac{V_H}{V_X} \cdot \frac{V_3}{2}$	Yd1	ACCESSIBLE NEUTRAL ON
	H ₁ O C OH ₃	^ر که _{۲3}	^н 2 ^{-н} 1	С	H3 – H2	$X_3 - X_1$	~		WYE WINDING
	н ₂ О	a A X1		A	H ₁ - H ₀	$x_{3} - x_{2}$	¥		
13		X ₃ C b	—	в	$H_2 - H_0$	$X_1 - X_2$	$\frac{V_{H}}{V_{X} \bullet V_{3}}$	YNd5	
	H ₁ 0 C OH ₃	° 🍾 x ₂		С	H3 – H0	$x_2 - x_3$	X * 0		
	H ₂	a A ^X 1	H ₃ -H ₂	Α		$x_{3} - x_{1}$			NO
14	B N	× ₃ b	H ₁ -H ₃	В	$H_2 - H_1$	x ₁ - x ₂	$\frac{V_{H}}{V_{X}} \cdot \frac{V_{3}}{2}$	Yd5	ACCESSIBLE NEUTRAL ON
	H ₁ O C OH ₃	° \ X2	^Н 2 ^{-Н} 1	С	$H_{3} - H_{2}$	$x_{2} - x_{3}$			WYE WINDING
	H ² O	×3 of o	н ₃ -н ₂	Α	H ₁ – H ₃	$x_{2} - x_{1}$			NO
15	^B N		^н 1- ^н 3	в	H ₂ – H ₁	$x_{3} - x_{2}$	$\frac{V_{H}}{V_{X}} \cdot \frac{V_{\overline{3}}}{2}$	Yd7	ACCESSIBLE NEUTRAL ON
	H ₁ 0 [°] COH ₃	X ₂ a	^н 2 ^{-н} 1	С	H3 – H2	$x_{1} - x_{3}$	· · · ·		WYE WINDING
	H ² O	X ₂ C c		А	H ₁ – H ₀	$X_1 - X_3$			
16	^B H ₀	▶ → × ₃	—	в	H ₂ – H ₀	X ₂ -X ₁	$\frac{V_{H}}{V_{X} \cdot V_{3}}$	YNd11	
	H10 C OH3	x ₁ a		С	H ₃ – H ₀	$X_3 - X_2$			
	H ² O	X ₂ Q 0	н ₃ -н ₂	Α	H1-H3	$X_1 - X_3$			NO
17	, ^B N	▶ × × 3	н ₁ -н ₃	в	$H_2 - H_1$	$X_2 - X_1$	$\frac{V_{H}}{V_{x}} \cdot \frac{V_{\overline{3}}}{2}$	Yd11	ACCESSIBLE NEUTRAL ON
	H10 C OH3	x ₁ a	^н 2 ^{-н} 1	С	$H_3 - H_2$	X3 - X2			WYE WINDING
	H ₂	$X_3 $ a X_1		А	H ₁ – H ₀	$X_0 - X_1$			
18		b X ₀	—	В	$H_2 - H_0$	x ₀ -x ₂	<u></u>	YNyn6	
	H10 C OH3	x ₂		С	H ₃ – H ₀	$x_0 - x_3$	×		
	H ₂	×2 Q	H ₂ -H ₀	A	H ₁ – H ₀	X ₁ – X ₂			NO
19	, B H	μ	н ₃ -н ₀	В	$H_2 - H_0$	$X_2 - X_3$	V _H V _x	YNy0	ACCESSIBLE NEUTRAL ON
_	H10 C OH3	x ₁ 0 ^a c O X ₃	H ₁ -H ₀	С	H ₃ – H ₀	$X_3 - X_1$	×		LOW VOLTAGE WINDING

	TRANSF CONFIGL				WINDING	TESTED			
SPEC TEST NO.	HIGH-VOLTAGE WINDING (H)	LOW-VOLTAGE WINDING (X)	EXT. JUMPER	PHASE	HIGH VOLTAGE WINDING	LOW VOLTAGE WINDING	CAL. TURN RATIO	VECTOR GROUP	NOTES
	H ₂	×2	x ₃ -x ₀	А	H ₁ – H ₃	$X_{1} - X_{0}$			
20	B	^b X ₀	x ₁ -x ₀	в	$H_2 - H_1$	$X_2 - X_0$	<u></u>	Yyn0	ACCESSIBLE NEUTRAL ON
	H10 C OH3	x ₁ 0 ^a c ox ₃	x ₂ -x ₀	С	H3 – H2	$X_3 - X_0$	X		HIGH VOLTAGE WINDING
	H ₂ O	×2		А	H ₁ – H ₀	$X_1 - X_0$	V		
43	^B H ₀	a b X ₀	—	В	H ₂ – H ₀	$X_2 - X_0$	<u></u>	YNyn0	
	H10 C OH3	x ₁ 0 c ox ₃		С	H ₃ – H ₀	$x_3 - x_0$	-		
	H ² O	×2		А	H ₁ – H ₃	$X_1 - X_3$			NO
21	B	b∬η		В	H ₂ – H ₁	$X_2 - X_1$	V _H	Yy0	ACCESSIBLE
	H ₁ 0 C OH ₃	X ₁ 0°°°X ₃		С	H3 – H2	$X_3 - X_2$	X		NEOTINE
	H ² O	$X_3 a x_1$	H ₂ -H ₀	А	H ₁ – H ₀	$X_2 - X_1$	V		NO
22	_ ^B ∐ _{H₀}	bη	н ₃ -н ₀	В	$H_2 - H_0$	X3 - X2	V _H	YNy6	ACCESSIBLE NEUTRAL ON
	H ₁ OCOH ₃	x ₂ 0	H ₁ -H ₀	С	H3 – H0	X ₁ – X ₃	Â		LOW VOLTAGE WINDING
	H ² C	$X_3 \circ a \circ X_1$	x ₃ -x ₀	А	H ₁ – H ₃	$x_0 - x_1$			NO ACCESSIBLE
23	A N		x ₁ -x ₀	В	$H_2 - H_1$	$x_0 - x_2$	V _H V _x	Yyn6	NEUTRAL ON HIGH VOLTAGE
	H10 C OH3	x20	x ₂ -x ₀	С	H ₃ – H ₂	$x_0 - x_3$	×		WINDING
	H ² O	$x_3 a x_1$		А	H ₁ – H ₃	$x_{3} - x_{1}$			NO
24	^B N	σcψη	—	В	H ₂ – H ₁	$x_{1} - x_{2}$	$\frac{v_{H}}{v_{Y}}$	Yy6	ACCESSIBLE
	H10 C OH3	x20		С	H3 – H2	$x_{2} - x_{3}$	^		
	H ₂	9 [×] 2		А	H ₁ – H ₃	$x_{1} - x_{0}$			
65			—	В	H ₂ – H ₁	$x_{2} - x_{0}$	$\frac{V_{H} \cdot V_{\overline{3}}}{V_{x}}$	YNzn1	
	H10 C OH3	° ~ ×3		С	H3 – H2	$x_{3} - x_{0}$	Ŷ		
	H ₂ O	ρ^{2}		А	H ₁ – H ₃	$X_{1} - X_{0}$			NO ACCESSIBLE
25	A N		—	В	$H_2 - H_1$	$X_2 - X_0$	$\frac{V_{H} \cdot V_{\overline{3}}}{V_{X}}$	Yzn1	NEUTRAL ON WYE WINDING
	H10 C OH3	° 20 X3		С	H ₃ – H ₂	$x_{3} - x_{0}$			WTE WINDING
	H ₂ O	$\overset{X_2}{\rho}$	H ₃ -H ₂	А	H ₁ – H ₃	X ₁ – X ₂			NO
26	A N	X1 b	^н 1- ^н 3	В	$H_2 - H_1$	$X_2 - X_3$	$\frac{V_{H}}{V_{X}} \cdot \frac{V_{\overline{3}}}{2}$	Yz1	ACCESSIBLE
	H ₁ OCOH ₃	° SX3	н ₂ -н ₁	С	H3 – H2	$X_3 - X_1$			
	H ² O			А	H ₁ – H ₃	$x_{3} - x_{0}$			NO
27	_A B∐ _N	X ₃ X ₀ b	—	В	H ₂ -H ₁	$x_{1} - x_{0}$	$\frac{V_{H} \cdot V_{3}}{V_{x}}$	Yzn5	ACCESSIBLE NEUTRAL ON
	H10 C OH3			С	H ₃ – H ₂	$x_2 - x_0$	~		WYE WINDING

	TRANSF CONFIGL	ORMER JRATION			WINDING	TESTED			
SPEC TEST NO.	HIGH-VOLTAGE WINDING (H)	LOW-VOLTAGE WINDING (X)	EXT. JUMPER	PHASE	HIGH VOLTAGE WINDING	LOW VOLTAGE WINDING	CAL. TURN RATIO	VECTOR GROUP	NOTES
	H ₂	ρ ^X 1	H ₃ -H ₂	А	H ₁ – H ₃	$X_3 - X_1$			
28	, ^B N		H ₁ -H ₃	В	$H_2 - H_1$	X ₁ – X ₂	$\frac{V_{H}}{V_{X}} \cdot \frac{V_{\overline{3}}}{2}$	Yz5	NO ACCESSIBLE
	H10 C OH3	° ~ ×2	^H 2 ^{-H} 1	С	H ₃ – H ₂	X ₂ – X ₃	VX Z		NEUTRAL
	H ₂	X ₃ Q		А	H ₁ – H ₃	$X_0 - X_1$			
66	A DHO	$ \begin{bmatrix} X_0 \\ X_0 \end{bmatrix} = \begin{bmatrix} X_0 \\ X_0 \end{bmatrix} = \begin{bmatrix} X_0 \\ X_1 \end{bmatrix} $	—	В	H ₂ – H ₁	$X_0 - X_2$	$\frac{V_{H}}{V_{v}} \cdot \frac{V_{\overline{3}}}{V_{\overline{3}}}$	YNzn7	
	H10 C OH3	x ₂ 0 ° °		С	H3 – H2	$x_0 - x_3$	٧x		
	H ₂	X ₃ Q _C		А	H ₁ – H ₃	$X_0 - X_1$			NO
29	BN	$ \begin{bmatrix} A \\ X_0 \end{bmatrix} = \begin{bmatrix} X_1 \\ X_0 \end{bmatrix} $	—	В	$H_2 - H_1$	$X_0 - X_2$	$\frac{V_{H} \cdot V_{3}}{V_{x}}$	Yzn7	ACCESSIBLE NEUTRAL ON
	H10 C OH3	x ₂ 0 ° °		С	H3 – H2	$X_0 - X_3$			WYE WINDING
	H ₂	X ₃ Q _C	H ₃ -H ₂	А	H ₁ – H ₃	x ₂ -x ₁			NO
30	^B N		^н 1- ^н 3	В	$H_2 - H_1$	x ₃ -x ₂	$\frac{V_{H}}{V_{x}} \cdot \frac{V_{\overline{3}}}{2}$	Yz7	ACCESSIBLE
	H10 C OH3	x ₂ d "	^H 2 ^{-H} 1	С	H3 – H2	$x_{1} - x_{3}$	· ^ -		NEOTRAL
	H ₂	X ₂ Q °		А	H ₁ – H ₃	$X_0 - X_3$			
67			—	В	$H_2 - H_1$	$X_0 - X_1$	$\frac{V_{H} \cdot V_{\overline{3}}}{V_{X}}$	YNzn11	
	H10 C OH3	x ₁ o [°]		С	H3 – H2	$X_0 - X_2$			
	H ² O	X20~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~		А	H ₁ – H ₃	$x_0 - x_3$			NO
31	^B N		—	В	H ₂ – H ₁	$X_0 - X_1$	$\frac{V_{H} \cdot V_{\overline{3}}}{V_{x}}$	Yzn11	ACCESSIBLE NEUTRAL ON
	H10 C OH3	x ₁ 0 ° °		С	H3 – H2	$X_0 - X_2$	vx		WYE WINDING
	H ₂	X ₂ Q ₂ ° v	н ₃ -н ₂	А	H ₁ – H ₃	$X_1 - X_3$			NO
32	A N	b n 0^3	^H 1 ^{-H} 3	В	$H_2 - H_1$	X ₂ – X ₁	$\frac{V_{H}}{V_{X}} \cdot \frac{V_{\overline{3}}}{2}$	Yz11	ACCESSIBLE NEUTRAL
	H10 C OH3	x ₁ 0	^н 2 ^{-н} 1	С	H3 – H2	$X_3 - X_2$			
	H ¹ م	×1 Q	x ₂ -x ₃	А	H ₁ – H ₀	$x_{1} - x_{2}$	- V.,		
55		c a	x ₃ -x ₁	В	$H_2 - H_0$	$x_2 - x_3$	$\frac{2}{3} \cdot \frac{V_H}{V_x}$	ZNd0	
	H ₃ B H ₂	x ₃ d b x ₂	x ₁ -x ₂	С	$H_{3} - H_{0}$	$x_{3} - x_{1}$	Ŷ		
	Q ^{H1}	^X 1		А	H ₁ – H ₂	$x_{1} - x_{2}$	V		NO
56		c/a	—	В	H ₂ – H ₃	$x_2 - x_3$	<u></u>	Zd0	ACCESSIBLE NEUTRAL ON
	H ₃ B H ₂	x ₃ x ₂ x ₂		С	H3 – H1	$x_{3} - x_{1}$	Â		HIGH VOLTAGE
	H ¹ م	x ₂ Q b x ₃	x ₂ -x ₃	А	H ₁ – H ₀	$X_2 - X_1$	V		
57		a	x ₃ -x ₁	В	H ₂ – H ₀	$x_3 - x_2$	$\frac{2}{3} \cdot \frac{V_{H}}{V_{X}}$	ZNd6	
	H ₃ B B H ₂	0 ×1	x ₁ -x ₂	С	H ₃ – H ₀	$X_1 - X_3$	- X		

	TRANSF CONFIGL				WINDING	TESTED			
SPEC TEST NO.	HIGH-VOLTAGE WINDING (H)	LOW-VOLTAGE WINDING (X)	EXT. JUMPER	PHASE	HIGH VOLTAGE WINDING	LOW VOLTAGE WINDING	CAL. TURN RATIO	VECTOR GROUP	NOTES
	q ^H 2	" Q ^{×1}		Α	$H_1 - H_0$	$X_3 - X_1$			NO
33		X ₃ 0 ^c η	—	В	$H_2 - H_0$	X ₁ – X ₂	$\frac{V_{H}}{V_{x} \cdot V_{3}}$	ZNy5	ACCESSIBLE NEUTRAL ON
		^ь Ъ ^X 2		С	$H_3 - H_0$	$X_2 - X_3$			WYE WINDING
	Q ^H 2	${}_{a}\rho^{x_{1}}$	н ₃ -н ₂	Α	H ₁ – H ₃	$x_{3} - x_{1}$	V. VE		NO
34	A B	× ₃ o ⊂ qη	H ₁ -H ₃	В	H ₂ -H ₁	x ₁ - x ₂	$\frac{V_{H}}{V_{X}} \cdot \frac{V_{\overline{3}}}{2}$	Zy5	ACCESSIBLE NEUTRAL
	н <mark>б с</mark> -он _з	⊳p _x 5	^H 2 ^{-H} 1	С	H ₃ – H ₂	x ₂ -x ₃			
	q^{H_2}	X ₂ Q n		А	H ₁ – H ₀	$x_1 - x_3$	Vu		NO
35			—	В	$H_2 - H_0$	$X_2 - X_1$	$\frac{V_{H}}{V_{X} \cdot V_{3}}$	ZNy11	ACCESSIBLE NEUTRAL ON
		x ₁ o		С	$H_3 - H_0$	$X_3 - X_2$			WYE WINDING
	HQ	×29	$H_{3}-H_{2}$	Α	H ₁ – H ₃	$X_1 - X_3$			NO
36	A B N	$a \rightarrow c \circ x_3$	^н 1- ^н 3	в	$H_2 - H_1$	$X_2 - X_1$	$\frac{V_{H}}{V_{X}} \cdot \frac{V_{\overline{3}}}{2}$	Zy11	ACCESSIBLE NEUTRAL
	н <mark>б с</mark> —он _з	x ₁ 0	^H 2 ^{-H} 1	С	H ₃ – H ₂	$X_3 - X_2$			
	Р ^н 2	β^{x_2}		А	H ₁ – H ₂	$x_{1} - x_{2}$	v		
58	A	a b	H ₁ -H ₂				$\frac{V_{H}}{V_{x}}$	T-T 0	
	HO OH3	x ₁ ^o	x ₁ -x ₂	В	H ₁ – H ₃	x ₁ - x ₃		Ŭ	
	^H ₂Q	a 0 ^{X2}	H ₂ -H ₃	A	H ₁ – H ₃	$X_{1} - X_{2}$	$\frac{V_{H}}{V_{X}} \frac{V_{\overline{3}}}{2}$	T-T	
59	A B H	x 0 b					V _{H 2}	30	
	H ^O b ^H 3	b _{x3}	x ₁ -x ₂	В	$H_2 - H_3$	$x_{1} - x_{3}$	v _x •v ₃	Lag	
	H ₂ Q	X ₂ Q b x	^н 2 ^{-н} 3	A	H ₁ – H ₃	$x_{1} - x_{3}$	$\frac{V_{H}}{V_{X}} \cdot \frac{V_{\overline{3}}}{2}$	T-T	
60	A B H ₃	2 ^{0³}					V _X 2	30	
	HO 0''3	x ₁ 0 ^a	x ₁ -x ₃	В	H ₂ – H ₃	$x_2 - x_1$	$\overline{V_{H}}^{\bullet}\overline{V_{\overline{3}}}$	Lead	

APPENDIX C – CEI/IEC 60076-1 Transformer Descriptions

	TRANSF CONFIGL				WINDING	TESTED			
SPEC TEST NO.	HIGH-VOLTAGE WINDING (H)	LOW-VOLTAGE WINDING (X)	EXT. JUMPER	PHASE	HIGH VOLTAGE WINDING	LOW VOLTAGE WINDING	CAL. TURN RATIO	VECTOR GROUP	NOTES
	¹∨ A	2W 0 2U		А	1U – 1W	2W – 2U			
1	ВС	c b	—	В	1V – 1U	2U – 2V	U1 U2	Dd6	
	1U O O 1W	2V		С	1W – 1V	2V – 2W			
	nv R	2V 8		A	1U – 1W	2U – 2W	U1		
37	B C	b/ \c		В	1V – 1U	2V – 2U	U2	Dd0	
	1U O A D1W	2U Ob 2W		С	1W – 1V	2W – 2V			
	10	2W 0 2U		А	1U – 1V	2W – 2V	U1		
38		a c 2V		В	1V – 1W	2U – 2W	U2	Dd2	
	в			С	1W – 1U	2V – 2U			
	1U R	2W R		Α	1U – 1W	2W – 2U	U1		
39	C/ A	c/a		В	1V – 1U	2U – 2V	U2	Dd4	
	1WO B 01V	2V d b 2U		С	1W – 1U	2V – 2W			
	1∪ R	Å Å		A	1U – 1V	2V – 2W	U1		
40	C/ A	c a		В	1V – 1W	2W – 2U	U2	Dd8	
	1WO B 1V	2U O b2W		С	1W – 1U	2U – 2V			
	1U R	2U C b 2V		A	1U – 1V	2U – 2W			
41	C/ \^	a C	—	В	1V – 1W	2V – 2U	U1 U2	Dd10	
	1W O B 0 1V	2W		С	1W – 1U	2W – 2V			
	1∪ 8	م ^{2U}		А	1U – 1W	2U – 2N			
42	A B	2WO-C-()		В	1V – 1U	2V – 2N	$\frac{U1 \cdot V_3}{U2}$	Dyn1	
	1W OO 1V	b 2V		С	1W – 1V	2W – 2N			
	¹∨ A	ь Р ^{2V}	1W – 1V	А	1U – 1W	2U – 2V			NO
2	в	2U Ο a η	1U – 1W	В	1V – 1U	2V – 2W	U1 • V3 U2	Dy1	ACCESSIBLE NEUTRAL ON
	1U O A01W	čδ _{2W}	1V – 1U	С	1W – 1V	2W – 2U			WYE WINDING
	1V 8	2U Q C	1W – 1V	А	1U – 1W	2U – 2V			NO
61	ВСС	b a 0 2V	1U – 1W	В	1V – 1U	2V – 2W	$\frac{V_{U1} \bullet V_3}{U2}$	Dy3	ACCESSIBLE NEUTRAL ON
	1U O A01W	2W d	1V – 1U	С	1W – 1V	2W – 2U			WYE WINDING
	1V 8	20 9 م		А	1U – 1W	2N – 2V			
62	в	b 2N 2V	—	В	1V – 1U	2N – 2W	$\frac{U1 \bullet V_3}{U2}$	Dyn3	
	1U 0 A 1W	2W O		С	1W – 1V	2N – 2U			

	TRANSF CONFIGL	ORMER JRATION			WINDING	TESTED			
SPEC TEST NO.	HIGH-VOLTAGE WINDING (H)	LOW-VOLTAGE WINDING (X)	EXT. JUMPER	PHASE	HIGH VOLTAGE WINDING	LOW VOLTAGE WINDING	CAL. TURN RATIO	VECTOR GROUP	NOTES
	1V 8	b ^{2∪}		А	1U– 1W	2W – 2N			
3	в	2W 0 a 2N	—	в	1V – 1U	2U – 2N	$\frac{U1 \cdot V_3}{U2}$	Dyn5	
	1U 0 A 1W	čδ₂v		С	1W – 1V	2V – 2N	02		
	1V 8	²⁰ 20	1W – 1V	A	1U– 1W	2W – 2V			NO
4	B/C	2W 0 a	1U-1W	в	1V – 1U	2U – 2W	$\frac{U1 \bullet V_3}{U2}$	Dy5	ACCESSIBLE NEUTRAL ON
	1U 0 01W	° b 2v	1V _ 1U	С	1W – 1V	2V – 2U			WYE WINDING
	1V 8	^{2W} Q _c a		А	1U – 1W	2N – 2U			
5	B/C	2N O - O 2U	-	В	1V – 1U	2N –2V	$\frac{U1 \bullet V_3}{U^2}$	Dyn7	
	1UOO1W	2V 0 b		С	1W – 1V	2N– 2W			
	1V Q	2WQ _c	1W-1V	А	1U – 1W	2W – 2U			NO
6	в		1U-1W	в	1V – 1U	2U – 2V	$\frac{U1 \cdot V_3}{U2}$	Dy7	ACCESSIBLE NEUTRAL ON
	1U 0 1W	2V O ^B	1V–1U	С	1W – 1V	2V – 2W			WYE WINDING
	1V O	_b 2 ^{2W}	1W-1V	Α	1U– 1W	2V – 2U			NO
63	В	2V 0 a 2N	1U–1W	В	1V – 1U	2W – 2V	$\frac{U1 \bullet V_3}{U2}$	Dy9	ACCESSIBLE NEUTRAL ON
	1U 0 1W	ς ρ 5η	1V-1U	С	1W – 1V	2U – 2W	02		WYE WINDING
	1V Q	, P ^{2W}		A	1U– 1W	2V – 2N			
64	в	2V 0 a 2N	—	в	1V – 1U	2W – 2N	$\frac{U1 \bullet V_3}{U2}$	Dyn9	
		° 🖌 2U		С	1W – 1V	2U – 2N	02		
	1V 0	2V Q c		А	1U – 1W	2N – 2W			
7	в	2N a 0 2W	—	в	1V – 1U	2N– 2U	$\frac{U1 \bullet V_3}{U2}$	Dyn11	
	1U 0 1W	2U O ^b		С	1W – 1V	2N – 2V	61		
	1V X	2V Q c	1W-1V	Α	1U – 1W	2V – 2W			NO
8	в	a 0 2W	1U–1W	В	1V – 1U	2W – 2U	$\frac{U1 \bullet V_3}{U2}$	Dy11	ACCESSIBLE NEUTRAL ON
	1U 0 01W	2U O ^b	1V–1U	С	1W – 1V	2U – 2V			WYE WINDING
	1U Q	2U Q	1V–1W	А	1U – 1V	2U – 2N			
45	C A		1W-1U	в	1V – 1W	2V – 2N	$\frac{3}{2} \cdot \frac{U1}{U2}$	Dzn0	
	1W 0 B 1V	2W b 2V	1U-1V	С	1W – 1U	2W – 2N			
	1U Q		1V-1W	A	1U– 1V	2N – 2V			
46	C A	2W $2N$ c $2N$ c	1W-1U	В	1V – 1W	2N – 2W	$\frac{3}{2} \cdot \frac{U1}{U2}$	Dzn2	
	1W 0 B 1V	b _{2V}	1U–1V	С	1W – 1U	2N – 2U			
									CEI/IEC.050108C2

	TRANSF CONFIGL				WINDING	TESTED			
SPEC TEST NO.	HIGH-VOLTAGE WINDING (H)	LOW-VOLTAGE WINDING (X)	EXT. JUMPER	PHASE	HIGH VOLTAGE WINDING	LOW VOLTAGE WINDING	CAL. TURN RATIO	VECTOR GROUP	NOTES
	1U Q			Α	1U – 1V	2W – 2V			NO
47	C A		—	В	1V – 1W	2U – 2W	U1 U2	Dz2	ACCESSIBLE
	1W 0 B 1V	6 _{2V}		С	1W – 1U	2V – 2U			NEOTRAL
	1U Q	2W	1V_1W	А	1U – 1V	2W – 2N	2 111		
48	C/A		1W-1U	В	1V – 1W	2U – 2N	$\frac{3}{2} \cdot \frac{U1}{U2}$	Dzn4	
	1WO B 1V	<u>ک</u> 20	1U-1V	С	1W – 1U	2V – 2N			
	1U Q	0 2W		А	1U – 1V	2W – 2U			NO
49	C A	2V b	—	В	1V – 1W	2U – 2V	U1 U2	Dz4	ACCESSIBLE
	1W 0 B 1V			С	1W – 1U	2V – 2W			NEUTHAL
	1V Q	2V Q		A	1U – 1W	2U – 2W	U1		NO
9	в	a n b 2W	—	В	1V – 1U	2V – 2U	U2	Dz0	ACCESSIBLE NEUTRAL
	1U 0 01W			С	1W – 1V	2W – 2V			
	1V R	2W C 2U		А	1U – 1W	2W – 2U			NO
10	в	b ² νν _b ² η ^a		В	1V – 1U	2U – 2V	U1 U2	Dz6	ACCESSIBLE NEUTRAL
		6 2V		С	1W – 1V	2V – 2W			
	1U Q		1V-1W	А	1U – 1V	2N – 2U	3 U1		
50	C/A	2V $_{2N}$ C	1W –1 U	В	1V – 1W	2N – 2V	$\frac{3}{2} \cdot \frac{01}{02}$	Dzn6	
	1W 0 B 1V	b 2U	1U-1V	С	1W – 1U	2N – 2W			
	1U Q	2V Q a	1V-1W	А	1U – 1V	2V – 2N			
51	C/A	°(2N	1W-1U	В	1V - 1W	2W – 2N	$\frac{3}{2} \cdot \frac{U1}{U2}$	Dzn8	
	1WO B 1V	0 ↓ 02W	1U-1V	С	1W – 1U	2U – 2N			
	1∪ 8	2V Q a		А	1U– 1V	2V – 2W			NO
52	C/A	°		В	1V – 1W	2W – 2U	U1 U2	Dz8	ACCESSIBLE NEUTRAL
	1W 0 B 1V	∂		С	1W – 1U	2U – 2V			
	1U A	^{2U} c 2V	1V–1W	А	1U – 1V	2N – 2W			
53	C/A		1W-1U	В	1V – 1W	2N – 2U	$\frac{3}{2} \cdot \frac{U1}{U2}$	Dzn10	
	1WO B 1V	2W 0	1U-1V	С	1W – 1U	2N – 2V			
	1U R	2U c 2V		А	1U – 1V	2U – 2W			NO
54	C/A	b a	—	В	1V - 1W	2V– 2U	U1 U2	Dz10	ACCESSIBLE
	1W 0 B 1V	2W 0		С	1W –1U	2W – 2V			

	TRANSF CONFIGU	ORMER JRATION			WINDING	TESTED			
SPEC TEST NO.	HIGH-VOLTAGE WINDING (H)	LOW-VOLTAGE WINDING (X)	EXT. JUMPER	PHASE	HIGH VOLTAGE WINDING	LOW VOLTAGE WINDING	CAL. TURN RATIO	VECTOR GROUP	NOTES
11		2W c 2U		A B C	1U – 1N 1V – 1N 1W – 1N	2V – 2U 2W – 2V 2U – 2W	U1 U2 • V3	YNd7	
44			_	A B C	1W - 1N $1V - 1N$ $1W - 1N$ $1W - 1N$	2U - 2V 2V - 2W 2W - 2U	$\frac{U1}{U2 \bullet \sqrt{3}}$	YNd1	
12		2U C C 2W	1W-1V 1U-1W 1V-1U	A B C	$\frac{1U - 1W}{1V - 1U}$ $\frac{1W - 1V}{1W - 1V}$	2W - 2V 2V - 2W 2W - 2U	$\begin{array}{c} U1 \sqrt{3} \\ U2 2 \end{array}$	Yd1	NO ACCESSIBLE NEUTRAL ON WYE WINDING
13		2W C C 2V		A B C	1U– 1N 1V – 1N 1W – 1N	2W – 2U 2U – 2V 2V – 2W	U1 U2 • V3	YNd5	
14	1V B A C 0 1W	2WO C 2V	1W-1V 1U-1W 1V-1U	A B C	1U – 1W 1V – 1U 1W – 1V	2W – 2U 2U – 2V 2V – 2W	$\frac{U1}{U2} \cdot \frac{V_3}{2}$	Yd5	NO ACCESSIBLE NEUTRAL ON WYE WINDING
15		2W c 2U	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	1V B 1U C O 1W	^{2V} b _{2U} a ^c _a _{2W}	_	A B C	1U– 1N 1V – 1N 1W – 1N	2U – 2W 2V– 2U 2W – 2V	U1 U2 • V3	YNd11	
17	1V B A C 01W	2V b 2U a a	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		2WO a 2U c 2N b 2N 2V		A B C	1U – 1N 1V – 1N 1W – 1N	2N – 2U 2N – 2V 2N – 2W	U1 U2	YNyn6	
19	1V B 1N C 01W	2V b 2U 0 c 0 2W	1V–1N 1W–1N 1U–1N	A B C	1U – 1N 1V – 1N 1W – 1N	2U – 2V 2V – 2W 2W – 2U	U1 U2	YNy0	NO ACCESSIBLE NEUTRAL ON LOW VOLTAGE WINDING CEI/IEC.050108C4

	CONFIGU	ORMER JRATION			WINDING	TESTED			
SPEC TEST NO.	HIGH-VOLTAGE WINDING (H)	LOW-VOLTAGE WINDING (X)	EXT. JUMPER	PHASE	HIGH VOLTAGE WINDING	LOW VOLTAGE WINDING	CAL. TURN RATIO	VECTOR GROUP	NOTES
	1V O	2V O	2W-2N	А	1U – 1W	2U – 2N			NO ACCESSIBLE
20	B	^b _{2N}	2U-2N	В	1V – 1U	2V– 2N	U1 U2	Yyn0	NEUTRAL ON HIGH VOLTAGE
1	1U O C O1W	2U 0 C 02W	2V-2N	С	1W – 1V	2W – 2N			WINDING
	1U O	2V O		А	1U – 1N	2U – 2W			
43		a A	—	В	1V – 1N	2V – 2N	U1 U2	YNyn0	
1	1WO C 01V	2U 0 0 2W		С	1W – 1N	2W – 2N			
	1V Q	2V O		А	1U – 1W	2U – 2W			NO
21	B	b a	—	В	1V – 1U	2V – 2U	U1 U2	Yy0	ACCESSIBLE NEUTRAL
1	1U O C O 1W	2U 0 c 0 2W		С	1W - 1V	2W – 2V			
	1V Q	2WO a 2U	1V-1N	А	1U – 1N	2V – 2U			NO ACCESSIBLE
22	^B _{1N}	b	1W-1N	В	1V - 1N	2W – 2V	U1 U2	YNy6	NEUTRAL ON
1	1U O C O 1W	0 2V	1U-1N	С	1W – 1N	2U – 2W			WINDING
	1V O	2W 0 a 0 2U	2W-2N	А	1U – 1W	2N – 2U			NO ACCESSIBLE
23	A N		2U-2N	в	1V – 1U	2N - 2V	U1 U2	Yyn6	NEUTRAL ON HIGH VOLTAGE
1	1U O C O 1W	0 2V	2V-2N	С	1W - 1V	2N – 2W			WINDING
	1V	2W 0 a 0 2U		А	1U – 1W	2W – 2U			NO
24	B	c b	—	В	1V – 1U	2U – 2V	U1 U2	Yy6	ACCESSIBLE NEUTRAL
1	1UO C 01W	0 2V		С	1W – 1V	2V – 2W			
	1V Q	Q 2V		А	1U – 1W	2U – 2N			
65		2U 2N b	—	В	1V – 1U	2V – 2N	$\frac{V_{H} V_{3}}{V_{x}}$	YNzn1	
1	1U O C O 1W	2 ° 2 2W		С	1W - 1V	2W – 2N	ĥ		
	1V O	a O ^{2V}		А	1U – 1W	2U – 2N			NO ACCESSIBLE
25	B	2U 2N b	—	В	1V – 1U	2V – 2N	$\frac{U1 \cdot \sqrt{3}}{U2}$	Yzn1	NEUTRAL ON WYE WINDING
1	1U O C O 1W	° 2W		С	1W - 1V	2W – 2N			WTE WINDING
	1V O	a O 2V	1W–1V	А	1U – 1W	2U – 2V			NO
26	B A	2U b	1U–1W	В	1V– 1U	2V – 2W	$\frac{U1}{U2} \cdot \frac{V_3}{2}$	Yz1	ACCESSIBLE
1	1U 0 C 01W	° > 2W	1V-1U	С	1W – 1V	2W – 2U			
	1V O	a O ^{2U}		А	1U – 1W	2W – 2N			NO
27	B A	2W 2N b	—	В	1V – 1U	2U – 2N	$\frac{U1 \cdot V_3}{U2}$	Yzn5	ACCESSIBLE NEUTRAL ON
1	1U O C O 1W	° 2V		С	1W – 1V	2V – 2N			WYE WINDING

	TRANSF CONFIGU				WINDING	TESTED			
SPEC TEST NO.	HIGH-VOLTAGE WINDING (H)	LOW-VOLTAGE WINDING (X)	EXT. JUMPER	PHASE	HIGH VOLTAGE WINDING	LOW VOLTAGE WINDING	CAL. TURN RATIO	VECTOR GROUP	NOTES
	1V O	a Q 2U	1W-1V	А	1U – 1W	2W – 2U			NO
28	B	2W 0 b	1U-1W	В	1V – 1U	2U – 2V	$\frac{U1}{U2} \cdot \frac{V_3}{2}$	Yz5	NO ACCESSIBLE
	1U O C O1W	° 2V 2V	1V-1U	С	1W – 1V	2V – 2W			NEUTRAL
	1V O	2W 0 C		А	1U – 1W	2N – 2U			
66				в	1V – 1U	2N – 2V	$\frac{V_{H}}{V_{v}} \cdot \frac{V_{3}}{V_{3}}$	YNzn7	
	1U O C O 1W	200		С	1W - 1V	2N – 2W	۰x		
	1V 0	2W 0 C		А	1U – 1W	2N – 2U			NO
29	A N	b 2N 2U	-	В	1V – 1U	2N – 2V	$\frac{U1 \bullet V_3}{U2}$	Yzn7	ACCESSIBLE NEUTRAL ON
	1U 0 C 01W	200		С	1W – 1V	2N – 2W			WYE WINDING
	1V O	2W 0 0	1W-1V	А	1U– 1W	2V – 2U			NO
30	в	b 0 2U	1U-1W	В	1V – 1U	2W – 2V	$U_1 \cdot \frac{V_3}{2}$	Yz7	ACCESSIBLE
	1UO C 01W	2V 0	1V-1U	С	1W – 1V	2U – 2W			NEOTHAE
	1° Q	2V Q C		А	1U – 1W	2N – 2W	V VE		
67		b 2N 2W	-	В	1V – 1U	2N – 2U	$\frac{V_{H} \cdot V_{3}}{V_{X}}$	YNzn11	
	1U O C O 1W	200		С	1W – 1V	2N – 2V			
	1V 0	2V Q C		А	1U – 1W	2N – 2W			NO
31	B			В	1V – 1U	2N – 2U	$\frac{U1 \cdot \sqrt{3}}{U2}$	Yzn11	ACCESSIBLE NEUTRAL ON
	1U 0 C 01W	2U O		С	1W – 1V	2N – 2V	02		WYE WINDING
	1V O	2V 0 C	1W-1V	Α	1U – 1W	2U – 2W	111 1/5		NO
32	A N	b a O2W	1U-1W	В	1V – 1U	2V – 2U	$\frac{U1}{U2} \cdot \frac{V_3}{2}$	Yz11	ACCESSIBLE NEUTRAL
	1UO C 01W	200	1V-1U	С	1W – 1V	2W - 2V			
	1∪ QA	2U Q	1V-1W	А	1U – 1N	2U– 2V			
55		c a	1W-1U	В	1V – 1N	2V - 2W	$\frac{2}{3} \cdot \frac{U1}{U2}$	ZNd0	
	δ _B −−0 1V	2W 0 b 2V	1U-1V	С	1W – 1N	2W – 2U			
	10 Q	2U Q		А	1U – 1V	2U – 2V			NO
56	^^	c a	—	В	1V - 1W	2V – 2W	U1 U2	Zd0	ACCESSIBLE NEUTRAL ON
	1WO B-01V	2W0 b 2V		С	1W – 1U	2W – 2U			HIGH VOLTAGE
	1U Q	2VQ b 2W	1V-1W	А	1U – 1N	2V – 2U			
57		a c	1W-1U	В	1V – 1N	2W – 2V	$\frac{2}{3} \cdot \frac{U1}{U2}$	ZNd6	
	1WO B 01V	8 2U	1U-1V	С	1W – 1N	2U – 2W			

	TRANSF CONFIGU				WINDING	TESTED			
SPEC TEST NO.	HIGH-VOLTAGE WINDING (H)	LOW-VOLTAGE WINDING (X)	EXT. JUMPER	PHASE	HIGH VOLTAGE WINDING	LOW VOLTAGE WINDING	CAL. TURN RATIO	VECTOR GROUP	NOTES
	1V Q B	a p 2U		Α	1U – 1N	2W – 2U			NO
33	A(1N	2W 0- C	—	В	1V – 1N	2U – 2V	$\frac{U1}{U2 \bullet V_3}$	ZNy5	ACCESSIBLE NEUTRAL ON
	d C 0 1₩	^D ∂ 2V		С	1W – 1N	2V – 2W			WYE WINDING
	1VQ B	a /2 2U	1W-1V	A	1U – 1W	2W – 2U			NO
34	^	2W 0 C	1U-1W	В	1V – 1U	2U – 2V	$\frac{U1}{U2}$ $\frac{V_3}{2}$	Zy5	ACCESSIBLE NEUTRAL
	0 C 0 1W	^в b 2V	1V-1U	С	1W – 1V	2V – 2W			
	1V QB	2V Q		A	1U – 1N	2U – 2W			NO
35	A(1N	a c 0 2W	—	В	1V – 1N	2V – 2U	$\frac{U1}{U2 \bullet V_3}$	ZNy11	ACCESSIBLE NEUTRAL ON
	d C 0 1₩	2U O		С	1W – 1N	2W – 2V			WYE WINDING
	1V QB	2V Q	1W-1V	А	1U – 1W	2U – 2W	–		NO
36		a c O2W	1U–1W	в	1V – 1U	2V – 2U	U1 V3 U2 2	Zy11	ACCESSIBLE NEUTRAL
	0 C 01W	б 2U	1V-1U	С	1W – 1V	2W – 2V			
	₽1V	₽ 2V		A	1U – 1V	2U – 2V		т-т	
58	B	a b					U1 U2	0	
	0 1W	0 2U 02W	1U-1V 2U-2V	В	1U – 1W	2U – 2W			
	1V Q	a 2V	1V-1W	А	1U – 1W	2U – 2V	$-U1 \cdot \sqrt{3}$ U2 $\cdot \sqrt{2}$	Т-Т	
59	A	O b						30	
	0 0 1U 1W	20 b 2W	2U-2V	В	1V - 1W	2U – 2W	$\frac{U1}{U2}$ $\frac{2}{\sqrt{3}}$	Lag	
	140	0 2V b 2W	1V-1W	А	1U – 1W	2U – 2W	$-\frac{U1}{U2} \cdot \frac{\sqrt{3}}{2}$	T-T	
60	AB							30	
	0 0 1U 1W	2U O a	2U-2W	В	1V - 1W	2V – 2U	$\frac{U1}{U2} \cdot \frac{2}{\sqrt{3}}$	Lead	

APPENDIX D – Australian Std.2374 Transformer Descriptions

	TRANSF CONFIGL	ORMER JRATION			WINDING	TESTED			
SPEC TEST NO.	HIGH-VOLTAGE WINDING (H)	LOW-VOLTAGE WINDING (X)	EXT. JUMPER	PHASE	HIGH VOLTAGE WINDING	LOW VOLTAGE WINDING	CAL. TURN RATIO	VECTOR GROUP	NOTES
	B	° a a		А	A – C	c – a			
1	B C	b c	—	В	B – A	a – b		Dd6	
	AO A O C	b		С	С – В	b – c			
	Å	Å		A	A – C	a – c	ну		
37			—	В	B – A	b-a	LV	Dd0	
				С	C – B A – B	c – b c – b			
	Â	correction a		A	B-C		HV	Ddo	
38				B	<u>Б-С</u> С-А	a – c b – a	LV	Dd2	
		b c		C		b-а с-а			
	Â	Å.		A	A – B B – C	a-b	нv		
39		b o a	_	B C	C – A	a – b b – c	LV	Dd4	
		b		A	A – B	b - c			
40	د گ	Å.		B	B-C	c – a	н	Dd8	
40	с С В В	a o c		Б С	C – A	a – b	LV	Duo	
	A	a Q b D b		Α	A – B	a – c			
41	C A	a c		В	B-C	b–a		Dd10	
, , , , , , , , , , , , , , , , , , ,	с од в	c		С	C – A	c-b	LV		
	A	p ^a		Α	A – C	a – η			
42	AB	c o_c_{b}^{a}	—	В	B – A	b-η	$\frac{HV \bullet \sqrt{3}}{LV}$	Dyn1	
	с о в	ծ _b		С	C – B	c-η			
	∎ R	bPb	С – В	Α	A – C	a – c			NO
2	B	ao-	A – C	В	B – A	b-a	$\frac{HV \bullet \sqrt{3}}{LV}$	Dy1	ACCESSIBLE NEUTRAL ON
	A O A C	్రి	B – A	С	C – B	c – b			WYE WINDING
	вQ	^a ۹	С – В	А	A – C	a – b			NO
61	B	_b ^a o b	A – C	В	B – A	b-c	$\frac{V_{H} \cdot V_{3}}{V_{x}}$	Dy3	ACCESSIBLE NEUTRAL ON
		دم	B – A	С	C – B	c-a			WYE WINDING
	вQ	^a Q _د		Α	A – C	$\eta-b$			
62	B	$b \eta^{a} \circ b$	-	В	B – A	$\eta-c$	HV • V3 LV	Dyn3	
		رم د		С	C – B	η – a			

	TRANSF CONFIGL	ORMER JRATION			WINDING	TESTED			
SPEC TEST NO.	HIGH-VOLTAGE WINDING (H)	LOW-VOLTAGE WINDING (X)	EXT. JUMPER	PHASE	HIGH VOLTAGE WINDING	LOW VOLTAGE WINDING	CAL. TURN RATIO	VECTOR GROUP	NOTES
	В	_ه ۶ª		Α	A – C	$c-\eta$			
3	B	۰۰ <u>°</u> م		В	B – A	a-η	$\frac{HV \bullet \sqrt{3}}{LV}$	Dyn5	
		ίδ¤		С	C – B	$b-\eta$	Lv		
	в Q	ء م	С – В	Α	A – C	c-b			NO
4	B C	° • • •	A - C	В	B – A	a-c	$\frac{HV \bullet V_3}{LV}$	Dy5	ACCESSIBLE NEUTRAL ON
		۹ C	B – A	С	C – B	b – a	2.		WYE WINDING
	B Q	٥ <i>م</i> ر د		Α	A – C	η – a			
5	B C	$h^{\frac{a}{b}}h^{\frac{a}{b}}$	—	В	B-A	η-b	$\frac{HV \cdot \sqrt{3}}{LV}$	Dyn7	
	A C A C	ьŐ		С	C – B	η– c			
	в Q	۹ م _د	С – В	A	A – C	c – a			NO
6	B C	$\eta \overset{a}{\underset{b}{\overset{a}{\overset{a}{\overset{a}{\overset{a}{\overset{a}{\overset{a}{\overset{a}{\overset$	A – C	В	B-A	a – b	$\frac{HV \cdot \sqrt{3}}{LV}$	Dy7	ACCESSIBLE NEUTRAL ON
		۳Q <i>و</i>	B – A	С	C – B	b – c			WYE WINDING
	В	ہ م	С – В	A	B – C	b – a			NO
63	B	b O a	A – C	В	B – A	c – b	$\frac{HV \cdot \sqrt{3}}{LV}$	Dy9	ACCESSIBLE NEUTRAL ON
		ິ ໄ a	B – A	С	С – В	a – c			WYE WINDING
	B Q	ړې		A	A – C	b-η			
64	B C	₀ ૦ <u>″</u> ϕຶη	—	В	B – A	c – η	$\frac{HV \cdot \sqrt{3}}{LV}$	Dyn9	
	A O A C	်ပဲ a		С	С – В	a-η			
	B Q	b Q _c		A	A – C	η – c			
7	B C		—	В	B – A	η-a	$\frac{HV \bullet \sqrt{3}}{LV}$	Dyn11	
		a O ⁰		С	С – В	η– b			
	B A	ь Q _с	С-В	A	A – C	b – c	HV •V3		NO
8	B C	$\eta = \sigma \circ$	A – C	В	B – A	c – a		Dy11	ACCESSIBLE NEUTRAL ON
		a O ^b	B – A	С	C – B	a – b			WYE WINDING
	٩Q	a Q	B-C	A	A – B	a – η			
45	C/A	دq h	C – A	В	B – C	$b-\eta$	$\frac{3}{2} \cdot \frac{HV}{LV}$	Dzn0	
	с од в	со <u>р</u> ов	A – B	С	C – A	c – η			
	٨Q	°ODa	B-C	С	A – B	η – b			
46	C/A	a n c	C – A	A	B – C	η-c	$\frac{3}{2} \cdot \frac{HV}{LV}$	Dzn2	
	с о в	40	A – B	В	C – A	η– a			

	TRANSF CONFIGL	ORMER JRATION			WINDING	TESTED			
SPEC TEST NO.	HIGH-VOLTAGE WINDING (H)	LOW-VOLTAGE WINDING (X)	EXT. JUMPER	PHASE	HIGH VOLTAGE WINDING	LOW VOLTAGE WINDING	CAL. TURN RATIO	VECTOR GROUP	NOTES
47	Â	۰ <u>۰</u> ۴ ۶ ۴		А	A – B	c – b	нv	D -0	NO
47	$C \xrightarrow{C} \xrightarrow{A} B$		_	B C	B – C C – A	a – c b – a	LV	Dz2	ACCESSIBLE NEUTRAL
	Â	۶۹	B-C	Α	A – B	c-η			
48	c A	^a \ η	C – A	В	B – C	a – η	$\frac{3}{2} \cdot \frac{HV}{LV}$	Dzn4	
	с б в	ьО—/ _с О а	A – B	С	C – A	$b-\eta$			
	Â	2°		A	A – B	c – a	ну		NO
49			-	В	B – C	a – b	LV	Dz4	ACCESSIBLE NEUTRAL
	B	c a		C	C – A	b-c a-c			
	_β ^β _ζ	b O b		A B	A – C B – A	b-a	HV	Dz0	NO ACCESSIBLE
9		a 0 _ 0 c	-	C B	С-В	c – b	LV		NEUTRAL
	B	co—, ^c Qa		A	A – C	c – a			
10	BC		_	В	B – A	a – b		Dz6	NO ACCESSIBLE
		٩٩		С	С – В	b-c	LV		NEUTRAL
	Â	ہوٹ کو	B-C	А	A – B	η – a			
50	c/ A	a (n c	C – A	В	B – C	$\eta-b$	$\frac{3}{2} \cdot \frac{HV}{LV}$	Dzn6	
	с б в	Q a	A – B	С	C – A	η-c			
	Â	▶ Q a	B – C	Α	A – B	b-η	3 HV		
51		, ć- dn	C-A	B	B-C	c – η	$\frac{3}{2} \cdot \frac{HV}{LV}$	Dzn8	
		с с _b	A – B	C	C – A	a – η			
50	Â			A B	A – B B – C	b-c c-a	HV	D-0	NO ACCESSIBLE
52		a 0 0 c		D C	В-0 С-А	a-b	LV	Dz8	NEUTRAL
	B A	a	B-C	A	A – B	η – c			
53	C A	$\int_{b}^{c} \eta$	C – A	В	B – C	η – a	$\frac{3}{2} \cdot \frac{HV}{LV}$	Dzn10	
	с од в	• • • •	A – B	С	C – A	η – b	2 LV		
	Â	аQ ^с _Оь		Α	A – B	a – c			NO
54	C A	b a	-	В	B – C	b – a	HV LV	Dz10	ACCESSIBLE
	с о́ в в	۰Ó		С	C – A	c-b		AI	

	TRANSF CONFIGU	ORMER JRATION			WINDING	TESTED			
SPEC TEST NO.	HIGH-VOLTAGE WINDING (H)	LOW-VOLTAGE WINDING (X)	EXT. JUMPER	PHASE	HIGH VOLTAGE WINDING	LOW VOLTAGE WINDING	CAL. TURN RATIO	VECTOR GROUP	NOTES
11	B B A D N	b c a	_	A B	A – N B – N	b – a c – b	$\frac{HV}{LV \bullet V_3}$	YNd7	
	AO COC	a		С	C – N	a-c	LV ••3		
	В	°		Α	A – N	a – b	HV		
44	A	a C b	—	В	B – N	b-c	LV • V3	YNd1	
	AO (OC	200		С	C – N	c – a			
	B B		С – В	A	A – C	a – b	HV V3	Yd1	NO ACCESSIBLE
12	A O C O C		A – C B – A	B C	B – A C – B	b – c	LV 2		NEUTRAL ON WYE WINDING
	в	۵a	D-A	A	A – N	с-а с-а			
13	β			B	B – N	a-b	ни	YNd5	
13	A O C O C	c b		C	C – N	b – c	LV •V3		
	В	a A a	С-В	Α	A – C	c – a			NO
14	B	• C b	A – C	В	B – A	a – b	$\frac{HV}{LV} \cdot \frac{V_3}{2}$	Yd5	ACCESSIBLE NEUTRAL ON
	A O C O C	<u>م</u>	B – A	С	C – B	b-c			WYE WINDING
	B	م حر ذ	С-В	A	A – C	b – a			NO
15	A	b a	A – C	В	B – A	c – b	$\frac{HV}{LV} \cdot \frac{\sqrt{3}}{2}$	Yd7	ACCESSIBLE NEUTRAL ON
	AO COC	b o "	B – A	С	С – В	a – c			WYE WINDING
	в Q	• • · ·		A	A– N	a – c	нν		
16	A N	b a °		В	B – N	b – a		YNd11	
	AO COC	a O		C	C – N	c – b			
	B O B	^b ^c	C-B	A	A – C	a-c	HV √3		NO ACCESSIBLE
17	A O C O C		A – C B – A	B C	B – A C – B	b – a c – b	LV 2	Yd11	NEUTRAL ON WYE WINDING
		a 🖉 👘	D-A		С-В А-N				
18	B O B	ο η		A B	B-N	η – a η – b	HV LV	YNyn6	
10	AO COC	Ь		Б С	C – N	η_c	LV		
	В	b	B – N	A	A – N	a-b			NO
19	B	b	C-N	В	B – N	b-c	<u></u>	YNy0	ACCESSIBLE NEUTRAL ON
19	A O C O C	a O C O C	A – N	С	C – N	c – a	LV		LOW VOLTAGE WINDING

	TRANSF CONFIGL	ORMER JRATION			WINDING	TESTED			
SPEC TEST NO.	HIGH-VOLTAGE WINDING (H)	LOW-VOLTAGE WINDING (X)	EXT. JUMPER	PHASE	HIGH VOLTAGE WINDING	LOW VOLTAGE WINDING	CAL. TURN RATIO	VECTOR GROUP	NOTES
20	B B B B C C C		c – h a – h b – h	A B C	A – C B – C C – B	a – η b – η c – η	HV LV	Yyn0	NO ACCESSIBLE NEUTRAL ON HIGH VOLTAGE WINDING
43	B B N A O C O C		_	A B C	A – N B – N C – N	a – η b – η c – η	HV LV	YNyn0	
21	B B B B B C C C C	b a a c c c c		A B C	A – C B – A C – B	a – c b – a c – b	HV	Yy0	NO ACCESSIBLE NEUTRAL
22	B B B A C C C C C C	c o a b b b	B – N C – N A – N	A B C	A – N B – N C – N	b – a c – b a – c	HV LV	YNy6	NO ACCESSIBLE NEUTRAL ON LOW VOLTAGE WINDING
23	B A A C C C C C	co b b b b	c – h a – h b – h	A B C	A – C B – A C – B	η – a η – b η – c	HV LV	Yyn6	NO ACCESSIBLE NEUTRAL ON HIGH VOLTAGE WINDING
24	B B B B B C C C C	c o a a b b b b b b b b b b b b b b b b b	_	A B C	A – C B – A C – B	c – a a – b b – c	HV LV	Yy6	NO ACCESSIBLE NEUTRAL
65	B B B A C C C C C C			A B C	A – C B – A C – B	a – η b – η c – η	$\frac{V_{H\bullet}V_{\bar{3}}}{V_{X}}$	YNzn1	
25	B A A C C C C		_	A B C	A – C B – A C – B	a – η b – η c – η	$\frac{V_{H \bullet} V_{3}}{LV}$	Yzn1	NO ACCESSIBLE NEUTRAL ON WYE WINDING
26	B B B B B C C C C	a O b c O c	C – B A – C B – A	A B C	A – C B – A C – B	a – b b – c c – a	$\frac{HV}{LV} \cdot \frac{V_3}{2}$	Yz1	NO ACCESSIBLE NEUTRAL
27	B B B B B C C C C	contraction of the second seco	_	A B C	A – C B – A C – B	c – η a – η b – η	HV •V3 LV	Yzn5	NO ACCESSIBLE NEUTRAL ON WYE WINDING

	TRANSF CONFIGL	ORMER JRATION			WINDING	TESTED			
SPEC TEST NO.	HIGH-VOLTAGE WINDING (H)	LOW-VOLTAGE WINDING (X)	EXT. JUMPER	PHASE	HIGH VOLTAGE WINDING	LOW VOLTAGE WINDING	CAL. TURN RATIO	VECTOR GROUP	NOTES
	в	a O a	C – B	Α	A – C	c – a			NO
28	A	c O V	A – C	В	B – A	a – b	$\frac{HV}{LV} \cdot \frac{V_3}{2}$	Yz5	ACCESSIBLE
	AO COC	۹ م	B – A	С	С – В	b – c			
	в Q	° مر _س		A	A – C	η – a			
66	A N			В	B – A	η–b	$\frac{V_{H}}{V_{X}} \cdot \frac{V_{3}}{V_{3}}$	YNzn7	
	AO COC	ьÓ		С	С – В	η – c			
	в Q	° Q _n		A	A – C	η – a	111/2/2		NO ACCESSIBLE
29	A		-	В	B – A	η–b	$\frac{HV \bullet V_3}{LV}$	Yzn7	NEUTRAL ON WYE WINDING
	AO COC	ьÓ		С	С – В	η– c			
	в Q	° م_ _`	C – B	A	A– C	b-a			NO
30	A		A – C	В	B – A	c – b	$\frac{HV}{LV} \cdot \frac{V_3}{2}$	Yz7	ACCESSIBLE NEUTRAL
	AO COC	ьĢ	B – A	С	С – В	a-c			
	в Q	° olin		A	A – C	η – c	V _H • V ₃		
67			-	В	B – A	η-a	Vx	Yzn11	
	AO (OC	ьÓ		С	С – В	η– b			
	в Q	۳ م ر		A	A – C	η – c		V-11	
31	B A		-	В	B – A	η-a	$\frac{HV \bullet V_3}{LV}$	Yz11	ACCESSIBLE NEUTRAL ON
	AO COC	a Q		С	С – В	η– b			WYE WINDING
	B	۵ م	С – В	A	A – C	a – c	н∨ ∨3	V-11	NO
32	A N	b a °	A – C	В	B – A	b – a	LV 2	Yz11	ACCESSIBLE NEUTRAL
	AO (OC	aÓ	B – A	С	С – В	c – b			
	A	Å	b – c	Α	A – N	a – b	2 HV		
55	C-QN		с – а	В	B – N	b-c	$\frac{2}{3} \cdot \frac{HV}{LV}$	ZNd0	
	со _в ов	¢ О́́ о́ ь	a – b	С	C – N	с – а			
	Â,	Å		Α	A – B	a – b	HV	7.10	NO ACCESSIBLE
56			—	В	B-C	b-c	LV	Zd0	NEUTRAL ON HIGH VOLTAGE
	сб _в —ов	с О́О в		С	C – A	c – a			. Harr FoerAde
	ŜA	^b c	b – c	A	A – N	b – a	нv	71.10	
57		a C	c – a	B	B – N	c – b	LV	ZNd6	
	со́ _в ⊶ов	a	a – b	С	C – N	a – c			ISTRALIAN 050108A6

	TRANSF CONFIGL	ORMER JRATION			WINDING	TESTED			
SPEC TEST NO.	HIGH-VOLTAGE WINDING (H)	LOW-VOLTAGE WINDING (X)	EXT. JUMPER	PHASE	HIGH VOLTAGE WINDING	LOW VOLTAGE WINDING	CAL. TURN RATIO	VECTOR GROUP	NOTES
	в	a Qa	C – B	Α	A – C	c – a			NO
28	A	c o o b	A – C	В	B – A	a – b	$\frac{HV}{LV} \cdot \frac{V_3}{2}$	Yz5	ACCESSIBLE
	AO COC	٩٩٦	B – A	С	С – В	b-c			NEOTRAL
	B O	۰ مر _د		Α	A – C	η – a			
66		b ano a	—	В	B – A	η–b	$\frac{V_{H}}{V_{x}} \cdot \frac{V_{3}}{V_{3}}$	YNzn7	
	AO COC	ьО		С	С – В	$\eta-c$	• *		
	В	ه مې ز		Α	A – C	η – a			NO
29	B		—	В	B – A	η–b	$\frac{HV \bullet V_3}{LV}$	Yzn7	ACCESSIBLE NEUTRAL ON
	AO COC	٥Ğ		С	С – В	η– c			WYE WINDING
	B O	ه مېږ	С – В	Α	A– C	b–a			NO
30	A		A – C	В	B – A	c – b	$\frac{HV}{LV} \cdot \frac{V_3}{2}$	Yz7	ACCESSIBLE NEUTRAL
	AO COC	ъQ	B – A	С	С – В	a-c			
	в Q	۰مر		A	A – C	η – c	V _{H ●} V ₃		
67			—	В	B – A	η-a	Vx	Yzn11	
	AO COC	ьÓ		С	С – В	η–b			
	в Q	» مر _د		Α	A – C	η – c			NO
31	B A	b d n o c	—	В	B – A	η-a	$\frac{HV \bullet V_3}{LV}$	Yz11	ACCESSIBLE NEUTRAL ON
	AO COC	aO		С	С – В	η– b			WYE WINDING
	в Q	۵ م	С – В	A	A – C	a – c	н∨ ∨₃		NO
32	A N	b c c	A – C	В	B – A	b–a	LV • 2	Yz11	ACCESSIBLE NEUTRAL
	AO COC	aO	B – A	С	C – B	c – b			
	A	Å	b-c	А	A – N	a – b	2 HV		
55	<u></u> Q_N	c/a	с-а	В	B – N	b-c	$\frac{2}{3} \cdot \frac{HV}{LV}$	ZNd0	
	со _в —ов	¢́́ ⊳́оь	a-b	С	C – N	c – a			
	A	Å		Α	A – B	a – b	ну		
56	<u> </u>	c/a	—	В	B – C	b-c		Zd0	ACCESSIBLE NEUTRAL ON
	со _в — ов	с О́Ъ Ъ Þ		С	C – A	c – a			HIGH VOLTAGE
	Â _A	b	b-c	Α	A – N	b – a	ци		
57	∫{		с-а	В	B – N	c – b		ZNd6	
	сб _в ∽_ов	a	a-b	С	C – N	a – c			JSTRALIAN.050108A6



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