

1. Purpose

The purpose of this commissioning standard is to confirm that Kiosk transformers are placed into service reliably and safely.

2. Description of applicable equipment

All kiosk type transformers; for pole, ground & indoor transformers, see standard CB011.

3. Tests required

- Continuity test
- Insulation Resistance test (Megger)
- Voltage test
- Phase sequence test

This test shall be carried out in the following situations when dealing with three phase kiosk transformers:

- Where the kiosk transformer cannot be paralleled with any other three phase kiosk transformers, or
- Where the kiosk transformer can be paralleled with another three phase kiosk transformer but for specific reasons such as load considerations, the final Phase Out test is not to be carried out at the substation.

- Phase Out test

This test shall be carried out in all cases where:

- A three phase kiosk transformer can be paralleled with another three phase kiosk transformer, or
- Where a single phase kiosk transformer can be paralleled with another single phase kiosk transformer by means of LV isolators.

- Earth Resistance test
- For dual HV Voltage (11/6.6kV) transformers ensure that the Ratio Changer is set to the desired Voltage. Refer CP4726 / 2031 Ration Testing 6.6/11kV Dual Voltage Transformers Operation Procedure.
- HV Metal Clad Switchgear testing (if applicable) – refer to CB021
- Check and record oil levels

4. Tools and Equipment

- Continuity tester
- 1, 2.5 or 5kV Megger
- Voltmeter
- Phase Identification tester
- Earth resistance tester

5. Test Procedures

Ensure correct Operational authorities are issued by an authorised operator prior to starting any tests.

All transformer tests are to be carried out through the HV switchgear where applicable.

5.1. Continuity (Ohms range) HV rotary switches. (Not done for kiosks with RM6 switchgear or for loop through or radial kiosks). For kiosk substations with RM6 switchgear refer to CB021 – HV Metal Clad Switchgear.

- Confirm all earth switches are open.
- Confirm all load switches are closed.
- HV Bayonet Fuses must be removed.
- Check HV continuity of each phase from active to active on each switch.
- Check insulation resistance on each phase.
- Repeat the HV continuity test with the load switch open. The continuity test must be done for each of the following conditions.

Double Switched Kiosk		Triple Switched Kiosk		
Switch 1	Switch 2	Switch 1	Switch 2	Switch 3
Open	Closed	Open	Closed	Closed
Closed	Open	Closed	Open	Closed
		Closed	Closed	Open

- This test may be carried out in depot prior to delivery to site.
- Reinsert HV Bayonet Fuses.

5.2. Continuity Test. For kiosk substations with RM6 switchgear refer to CB021 – HV Metal Clad Switchgear.

- Confirm HV Bayonet fuses are inserted.
- Confirm HV rotary switches are CLOSED.
- Perform HV continuity test from phase to phase across one set of HV bushings.
- Check LV continuity from each active to active and red to Neutral.

5.3. Insulation and Resistance test (Megger set up to 5kV for HV and up to 2.5kV for LV)

- Lift the neutral connection off the main LV earth bus.
- Test the HV phase A to the HV earth bus.
- Test the LV phase A to the HV earth bus.
- Confirm LV is connected to the transformer bushing, test between the HV and LV same phase.
- This test may be carried out in depot prior to delivery to site.
- Reconnect the neutral back to the LV Bus.

5.4. Voltage test

- Three phase

Using a voltmeter that has a range from zero to at least 600 volts measure

- the voltage of each phase to neutral, and
- each phase to the next phase until all phases have been tested.

- Single phase (including SWER and SWER Iso)

Please note that test must be taken at the transformer side of the transformer open LV isolator/fused isolators or fuses.

Using a voltmeter that has a range from zero to at least 600 volts measure

- actives to neutral, and
- active to active

5.5. Phase sequence test

Using the phase identification tester connect the red, white and blue leads of the instrument and to the respective phases at the transformer LV isolators/fused isolators.

5.6. Phase Out test

Using a voltmeter the test is to be conducted between the two live circuits at the transformer LV isolators/fused isolators or, where this is not considered appropriate, at the normal paralleling (open) point and in the following manner:

- Ensure that both circuits are alive by conducting phase to phase voltage checks on each circuit separately.
- Carry out a test from one circuit to the other across the open point

5.7. Earth Resistance test

Conduct earth resistance test as per current earthing test procedures, refer to DG211.

5.8. HV Metal Clad Switchgear testing

Refer to CB021 for testing procedure required

5.9. Ratio Changer test (for dual voltage substations only)

Refer to CitiPower Operational Procedure CP4723 / 2031

5.10. Tap Changer (Confirm tap changer is operational)

5.11. Vector Group (11 or 11/6.6kV units only)

A visual inspection of the name plate to confirm the transformer is suitable for the location.

6. Test Result Pass Criteria

When recording these values, an accurate measurement must be recorded. Values with ranges (e.g. 55+MΩ) will not be acceptable. The test results will form the baseline for future maintenance purposes.

6.1. Continuity and Insulation and resistance tests

Three-Phase

Test type	Test result
HV Load Switch Closed	
A-B, A-C, B-C	0 Ω *
A to transformer tank/earth	> 1000 MΩ (1GΩ)
HV Load Switch Open	
A-B, A-C, B-C	> 1000MΩ (1GΩ)
LV	
a-b, a-c, b-c, a-n	0 Ω
a to transformer tank/earth	> 10 MΩ
HV-LV	
A-a	> 1000 MΩ (1GΩ)

SWER. Refer to Transformer SWER test report 06-F453

Test type	Test result
HV	
SW-ER	0 Ω *
SW to transformer tank/earth	> 10 MΩ
LV	
a1-a4, a1-neutral	0 Ω
a1 to transformer tank	> 1000 MΩ (1GΩ)
HV-LV	
SW-a1	> 1000 MΩ (1GΩ)

* Test with tap changer in required in-service position.

6.2. Voltage Test

Three-Phase

Test	22kV	6.6/11kV & 11kV
Phase to Neutral	240 – 245	235 – 240
Phase to Phase	415 – 424	407 – 415

Single-Phase (including SWER and SWER Iso)

Test type	Test result
Actives to Neutral	240 – 245 V
Active to Active	490 – 500 V

6.3. Phase Sequence Test

The test is considered satisfactory when the tester indicates “correct sequence”.

6.4. Phase Out Test

Test type	Test result
Red to Red	< 10 V
White to White	< 10 V
Blue to Blue	< 10 V

7. Supporting documents

7.1. Test Report Forms

For CitiPower/Powercor employees the commissioning test reports are to be completed via the ClickMobile application, for further details refer to guideline “Testing Form” (Document No. JEQA4UJ443MT-1864305901-228).

The commissioning test report is available in the appendix:

- Transformers–Kiosk – Three Phase Test Report

The commissioning standards and test reports can also be found on CitiPower/Powercor’s external website from:

- Home/Industry/Supplier Resources/Forms, Reports and Bulletins/Commissioning Standards and Test Reports.

7.2. Standard Works Practices

Related works practices are available from Source:

- SWP High Voltage Underground Cable and Plant Commissioning

Appendix A - Transformers-Kiosk - Three Phase - Test Report

Job Title:

Test Instrument Model		Instrument No.	
Test Instrument Model		Instrument No.	
Tested by		Date	

DSM (location) Number	
Make	
Serial Number	
Rating	
Voltage	
Tap Setting	

NOTE: When recording these values, an accurate measurement must be recorded. Values with ranges (e.g. 55+MΩ) will not be acceptable. The test results will form the baseline for future maintenance purposes.

CONTINUITY TESTS on SWITCHES (HV Fuses Removed) ALL SWITCHES CLOSED (Not applicable for kiosks with RM6 Switchgear).

		Switch 2			Switch 3		
		A	B	C	A	B	C
Switch 1	A	(0Ω)			(0Ω)		
	B		(0Ω)			(0Ω)	
	C			(0Ω)			(0Ω)

CONTINUITY TESTS on SWITCHES (HV Fuses Removed) (Not applicable for kiosks with RM6 Switchgear).

		Switch 2 (closed)			Switch 3 (closed)		
		A	B	C	A	B	C
Switch 1 (open)	A	(0Ω)			(0Ω)		
	B		(0Ω)			(0Ω)	
	C			(0Ω)			(0Ω)

CONTINUITY TESTS on SWITCHES (HV Fuses Removed) (Not applicable for kiosks with RM6 Switchgear).

		Switch 2 (open)			Switch 3 (closed)		
		A	B	C	A	B	C
Switch 1 (closed)	A	(0Ω)			(0Ω)		
	B		(0Ω)			(0Ω)	
	C			(0Ω)			(0Ω)

CONTINUITY TESTS on SWITCHES (HV Fuses Removed) (Not applicable for kiosks with RM6 Switchgear).

		Switch 2 (closed)			Switch 3 (open)		
		A	B	C	A	B	C
Switch 1 (closed)	A	(0Ω)			(0Ω)		
	B		(0Ω)			(0Ω)	
	C			(0Ω)			(0Ω)

Appendix A - Transformers-Kiosk - Three Phase - Test Report (Continues)

INSULATION RESISTANCE TESTS on SWITCHES (HV Fuses Removed)		
	Test on Switch 1	Results
Switch 1, 2 and 3 are Closed	A-B	(>1GΩ)
	A-C	(>1GΩ)
	B-C	(>1GΩ)

INSULATION RESISTANCE TESTS on SWITCHES (HV Fuses Removed)			
		Switch 2 CLOSED	
		A	B
Switch 1 OPEN	A	(>1GΩ)	
	B		(>1GΩ)
	C		(>1GΩ)

INSULATION RESISTANCE TESTS on SWITCHES (HV Fuses Removed)			
		Switch 3 CLOSED	
		A	B
Switch 2 OPEN	A	(>1GΩ)	
	B		(>1GΩ)
	C		(>1GΩ)

INSULATION RESISTANCE TESTS on SWITCHES (HV Fuses Removed)			
		Switch 1 CLOSED	
		A	B
Switch 3 OPEN	A	(>1GΩ)	
	B		(>1GΩ)
	C		(>1GΩ)

CONTINUITY AND INSULATION RESISTANCE TESTS on TRANSFORMER					
Three Phase					
HV Load Switch Closed		A-B	A-C	B-C	Expected Value
	Service Tap	Ω	Ω	Ω	0Ω
		A	B	C	
	A - transformer tank	MΩ			>1000 MΩ (1GΩ)
LV	Red-neutral	A-B	A-C	B-C	
	0Ω	0Ω	0Ω	0Ω	0Ω
		A	B	C	
	a - transformer tank	MΩ	MΩ	MΩ	>10 MΩ
HV-LV	HV - LV	MΩ	MΩ	MΩ	>1000 MΩ (1GΩ)

Appendix A - Transformers-Kiosk - Three Phase - Test Report (Continues)

VOLTAGE TEST	
Three Phase	
Red to Neutral	V
White to Neutral	V
Blue to Neutral	V
Red to White	V
White to Blue	V
Blue to Red	V

PHASE IDENTIFICATION TEST	
Phase Checked	

PHASE OUT TEST	
Three Phase	
Red to Red	
White to White	
Blue to Blue	

EARTH RESISTANCE TEST	
Substation Type (tick type applicable)	
Kiosk	

Earthing System (tick system applied)		Earthing arrangement (tick applied arrangement)	
CMEN		Common	
MEN		Bonded HV/LV	
IMEN		Separate HV/LV	

Maximum Resistance			
Earth System to Ground		Allowed (Refer to CB011)	Measured
	HV	Ω	Ω
	LV	Ω	Ω
	Common	Ω	Ω
Neutral to Ground		Ω	Ω

Ratio Changer Test Passed	
Tap Changer Operational	
Vector Group Correct.	

Appendix A - Transformers-Kiosk - Three Phase - Test Report (Continues)

CHECKLIST		
Items	Checked	Comment (if any)
All required tests satisfactorily completed as per CB012		
HV metalclad switchgear tests satisfactorily completed as per CB021, if applicable		
Substation and complete installation complies with the work instruction requirements a) Is the transformer the correct polarity? b) Correct Vector Group? c) Correct Rating?		
No visible damage		
Is the correct earthing system installed		
Is the appropriate earth conductor size used		
Fuses appropriate for substation size are correctly installed where applicable		
Have all breather caps been removed as required		
Is the transformer oil level correct		
Insulating caps placed on unused bushings (kiosk substation only)		
Checked and recorded oil level		
Check kiosk is level with respect to ground plane		
Signs and Labels		
Ensure all signage and labelling complies with DS411		

Commissioning Test Passed Yes - No -

Comments _____

Signed: _____ **Date:** _____

Appendix B - Transformers-Kiosk - Three Phase (RMU type) - Test Report

Job Title:

Test Instrument Model		Instrument No.	
Test Instrument Model		Instrument No.	
Tested by		Date	

DSM (location) Number	
Make	
Serial Number	
Rating	
Voltage	
Tap Setting	

NOTE: When recording these values, an accurate measurement must be recorded. Values with ranges (e.g. 55+MΩ) will not be acceptable. The test results will form the baseline for future maintenance purposes.

Tests for HV Metal Clad Switchgear

Continuity Tests:

CONFIRM HV FUSES REMOVED OR HV CB OPEN.

CONTINUITY TESTS HV switches to earth: All load carrying switches <u>open</u> , all earth switches <u>closed</u> . Short circuit/ Buzz = PASS.									
Switch 1			Switch 2			Switch 3			
A	B	C	A	B	C	A	B	C	
Earth									
CONTINUITY TESTS HV switches to earth: All load carrying switches <u>open</u> , all earth switches <u>open</u> . Open circuit/ No Buzz = PASS.									
Switch 1			Switch 2			Switch 3			
A	B	C	A	B	C	A	B	C	
Earth									

Load Switch Tests:

CONTINUITY TESTS on load switches (phase to phase): All HV load switches <u>closed</u> , all earth switches <u>open</u> . Short circuit/ Buzz = PASS.							
		Switch 2			Switch 3		
		A	B	C	A	B	C
Switch 1	A						
	B						
	C						

**Appendix B - Transformers-Kiosk - Three Phase (RMU type) - Test Report
(Continues)**

Load Switch Tests (Continues):

CONTINUITY TESTS on load switches (phase to phase):							
All load carrying switches <u>open</u>, all earth switches <u>open</u>. Open circuit/ No Buzz =PASS.							
		Switch 2			Switch 3		
		A	B	C	A	B	C
Switch 1	A						
	B						
	C						

Insulation resistance tests- 5kV

CONFIRM HV FUSES REMOVED OR HV CB OPEN.

INSULATION RESISTANCE TESTS- 5kV Single phase to earth								
(Earth 2 of the 3 actives and IR test one phase to earth at a time):								
All HV load switches <u>closed</u>, all earth switches <u>open</u>. >5000MΩ (5GΩ) =PASS.								
Switch 1			Switch 2			Switch 3		
A	B	C	A	B	C	A	B	C
	Earthed	Earthed		Earthed	Earthed		Earthed	Earthed
A	B	C	A	B	C	A	B	C
Earthed		Earthed	Earthed		Earthed	Earthed		Earthed
A	B	C	A	B	C	A	B	C
Earthed	Earthed		Earthed	Earthed		Earthed	Earthed	

**Appendix B - Transformers-Kiosk - Three Phase (RMU type) - Test Report
(Continues)**

Transformer Tests

Continuity and Insulation and resistance tests

CONFIRM HV FUSES CLOSED OR HV CB CLOSED.

Lift the transformer neutral connection off the main LV earth bar

Remove GPO fuses

CONTINUITY TESTS HV			
HV load switch <u>closed</u>, all earth switches <u>open</u>. Buzz = PASS.			
	A-B	A-C	B-C
HV SWITCH (1,2 OR 3)			
HV load switch <u>open</u>, all earth switches <u>open</u>. > No Buzz= PASS.			
	A-B	A-C	B-C
HV SWITCH (1,2 OR 3)			

CONTINUITY TESTS LV			
HV load switches open, all earth switches open, LV Isolator closed. Buzz= PASS			
a-n	a-b	a-c	b-c

HV INSULATION RESISTANCE TESTS – 5kV HV to Transformer tank/earth	
All HV load switches closed, all earth switches open. >1000MΩ (1GΩ) = PASS	
	TRANSFORMER TANK/EARTH
HV “A” PHASE ON HV SWITCH (1,2 OR 3)	

LV INSULATION RESISTANCE TESTS – 2.5kV	
All HV load switches open, all earth switches open. >10MΩ = PASS	
	TRANSFORMER TANK/EARTH
LV “a” PHASE	

**Appendix B - Transformers-Kiosk - Three Phase (RMU type) - Test Report
(Continues)**

HV-LV INSULATION RESISTANCE TESTS – 2.5kV HV to LV	
All HV load switches closed, all earth switches open. >1000MΩ (1GΩ) = PASS	
	LV “a” PHASE
HV “A” PHASE ON HV SWITCH (1,2 OR 3)	

- *Reconnect transformer neutral connection on the main LV earth bar*
- *Reinstate GPO fuses*

VOLTAGE TEST	
Three Phase	
Red to Neutral	V
White to Neutral	V
Blue to Neutral	V
Red to White	V
White to Blue	V
Blue to Red	V

PHASE IDENTIFICATION TEST	
Phase Checked	

PHASE OUT TEST	
Three Phase	
Red to Red	
White to White	
Blue to Blue	

EARTH RESISTANCE TEST	
Substation Type (tick type applicable)	
Kiosk	

Earthing System (tick system applied)		Earthing arrangement (tick applied arrangement)	
CMEN		Common	
MEN		Bonded HV/LV	
IMEN		Separate HV/LV	

Maximum Resistance			
Earth System to Ground		Allowed (Refer to CB011)	Measured
	HV	Ω	Ω
	LV	Ω	Ω
	Common	Ω	Ω
Neutral to Ground		Ω	Ω

**Appendix B - Transformers-Kiosk - Three Phase (RMU type) - Test Report
(Continues)**

CHECKLIST		
Items	Checked	Comment (if any)
All required tests satisfactorily completed as per CB012		
HV metalclad switchgear tests satisfactorily completed as per CB021, if applicable		
Substation and complete installation complies with the work instruction requirements a) Is the transformer the correct polarity? b) Correct Vector Group? c) Correct Rating?		
No visible damage		
Is the correct earthing system installed		
Is the appropriate earth conductor size used		
Fuses appropriate for substation size are correctly installed where applicable		
Have all breather caps been removed as required		
Is the transformer oil level correct		
Insulating caps placed on unused bushings (kiosk substation only)		
Checked and recorded oil level		
Checked HV Gas switch has sufficient SF6/insulant		
Check kiosk is level with respect to ground plane		
Check that the switchgear and complete installation complies with the work instruction requirements		
Mechanical operation checks all carried out with all sources of supply disconnected		
Check all switches open/close correctly		
Check all breakers open/close correctly		
Check all earth switches open/close correctly		
Ensure that interlocks preventing the closure of an earth switch, on a closed switch circuit, operate		
Switchgear body is correctly earthed		
Cables are correctly terminated		
Cable screen wires are earthed		
Cable phasing is correct		

**Appendix B - Transformers-Kiosk - Three Phase (RMU type) - Test Report
(Continues)**

CHECKLIST (Continues)		
Items	Checked	Comment (if any)
Cable terminations are correctly installed on the terminations		
Cables are fixed below the terminations		
Current transformers where required are fitted, including fault indicator CTs		
Unused bushings have the dust cover removed and an insulating cap fitted		
Panel mounted fault indicators are on the correct setting		
Units fitted with Circuit Breaker		
HV CB protection settings are complete		
Protection Setting Number		
Protection relay correctly set		
Trip supply correct & connected		
Test trip		
Signs and Labels		
Ensure all signage and labelling complies with DS411		
Labels identifying each circuit are correct		
Labels identifying the switchgear by unique number and name are correct		

Commissioning Test Passed Yes - No -

Comments _____

Signed: _____ **Date:** _____