

Purpose of this Continuity test on underground cable, is to test any underground cable used at site installation has no OPEN LINE fault (or broken conductor inside).

There are two(2) types of fault in underground cable:

1. Open line or 'broken conductor '
2. Conductor cross due to wrong label or wrong color of the UG cable.

#### Basic armour underground cable

1. Refer to figure 1 below is an armoured UG cable.
2. Identify each conductor label or color on the UG cable.
3. On the side of the UG cable have ground which is either galvanized wire (GWA) or steel wire (SWA), these are protections against mechanical impact depending on the site the cable is to be buried. These GWA can be used as grounding purpose or earth conductor.

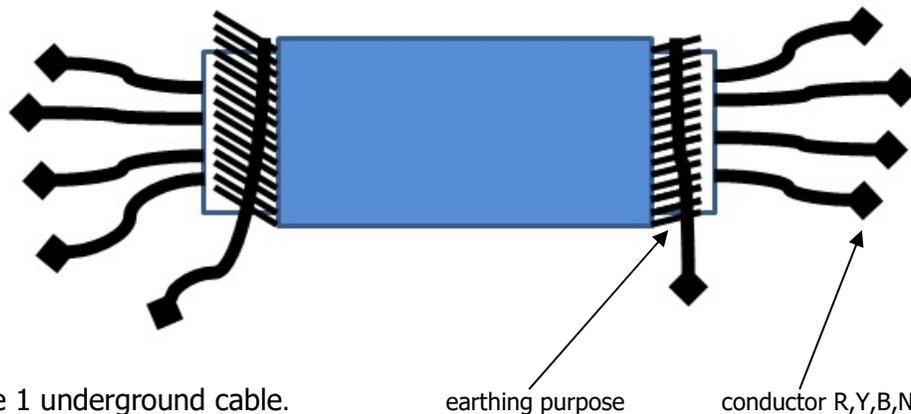


Figure 1 underground cable.

#### Precaution:

- Before handling any underground cable just arrived from factory production.
- The surface of the UG cable can be coated with chemical compound, use gloves when handling the new fresh cable.

Perform Tests on UG cable

Basically there are two(2) types of test for UG cable.

1. Continuity test
2. Insulation test
3. Pressure test - usually done at factory

1. Continuity test (Part A)

Basically this continuity test is to find out if the UG cable has any fault.

- Open line
- Phase crossing - means that the color or label of the conductor is not correct.

This continuity tests requires the following test instruments either using analog multi-meter or digital multi-meter.

Example of continuity test are shown below figure 2. One side of the UG cable requires an jumper cable and good communication with the other side which is the tester. The length of the UG cable can be several kilometre away from both cable end. Therefore must have good communication between the tester and the cable jumper person.

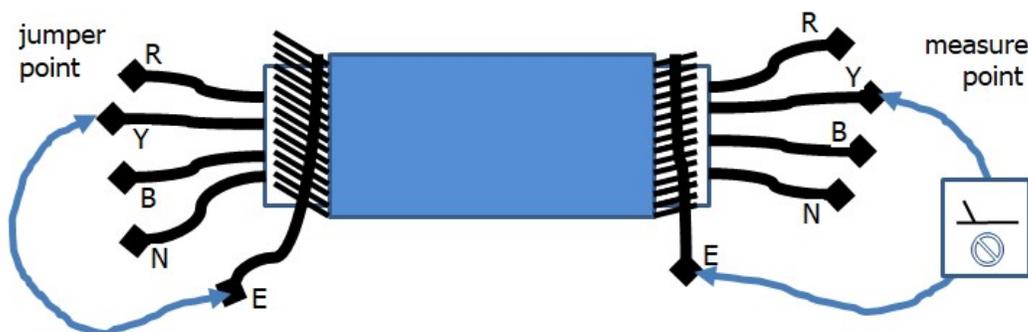


Figure 2 continuity test on underground cable.

Begin test.

1. Inform the jumper site to clamp the cable jumper on the label, he must inform of the color or label of the conductor.
2. Test person shall set multi-meter to ohm range (example  $\times 10\Omega$ ) if you are using analog multi-meter. For digital multi-meter you can set to Ohm  $\Omega$  range or beep sound, look for sound symbol on your meter.

3. If UG cable result should be  $0\Omega$  or some ohm value, (or sound beep) when two test point is correct.

The table test result should be according to standard sequence.

- RYBN to E
- RYBE to N
- RY, YB and RB (for phase to phase)

If there is only three conductor (without a neutral) UG cable, the RN shall be skipped.

### Example of good results

Refer to figure below, the jumper point is between Y-E.

The tester should also place meter test leads onto Y-E, the meter should read some value example  $1.4\Omega$ . If the label is wrong or color of the conductor is mismatch, the result should infinity (symbol like this  $\infty$  on the analog type meter.) When using digital meter, set to sound beep, there will be no sound coming out from the meter. This means that the conductor is open line or having phase cross fault.

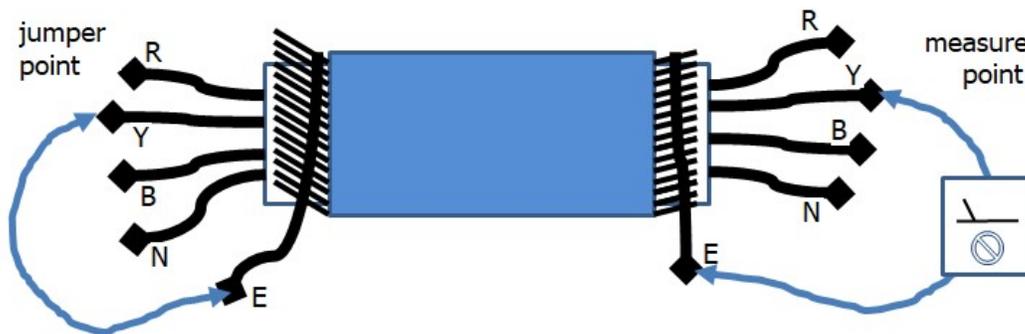


Figure 3 example of test

## Table test sequence standard

RYBN to E	Measure point			
Jumper point	R - E	Y - E	B - E	N - E
R - E				
Y - E				
B - E				
N - E				

RYBE to N	Measure point			
Jumper point	R - N	Y - N	B - N	E - N
R - N				
Y - N				
B - N				
E - N				

Phase to phase	Measure point		
Jumper point	R - Y	Y - B	B - R
R - Y			
Y - B			
R - B			

## Writing the results conditions

- If cable is OK condition or sound beep heard, write as  $0\Omega$ .
- If cable is NOT OK condition or NO beep sound beep, write as  $\infty$  or OL.

## Tips:

Good practise during test

When jumper R-E, measure all the point R-E, Y-E, B-E, N-E at same time.

When jumper R-N, measure all the point R-N, Y-N, B-N, E-N at same time.

## 2. Insulation Resistance test (or 'meggar') (Part B)

Basically this test is to find out if the UG cable has the following faults.

- Short between conductor

This IR tests requires the insulation resistance test set.

Begin test.

1. Set the IR selector test to **500 volt** (do not touch the test leads)
2. Place the test lead according to testing sequence and press test button about 1~2 seconds.
3. Look at the test instrument result should be **>200 M $\Omega$**  or infinity  $\infty$  .



Insulation resistance test equipment.

Example of IR test are shown below figure 4.

1. Inform the jumper site to remove any jumper cable. Remind to inform not to touch any conductor during this test begin.

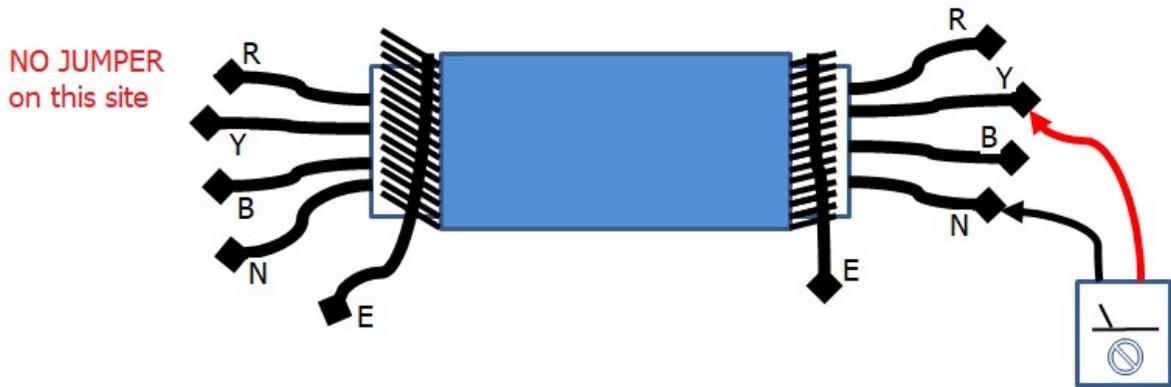


Figure 4 insulation resistance test on underground cable.

2. Example figure 4, UG cable is test between Y-N, the test is press and result showing  $> 1$  M $\Omega$ . (sometime if analog IR testset needle is not moving, press test button again.)
3. When result reads 50M $\Omega$ , this means that the UG insulation is good conditions and not fault detected.

Insulation test sequence test is shown below.

Phase to earth	Phase to neutral	Between phase
1. R - E	1. R - N	1. R - Y
2. Y - E	2. Y - N	2. Y - B
3. B - E	3. B - N	3. R - B
4. N - E	4. E - N	

Part C : Final test result ( continuity and insulation resistance).

To understand cable condition to summarized and concludes that the cable are safe to be put in supply (cable energized with supply).

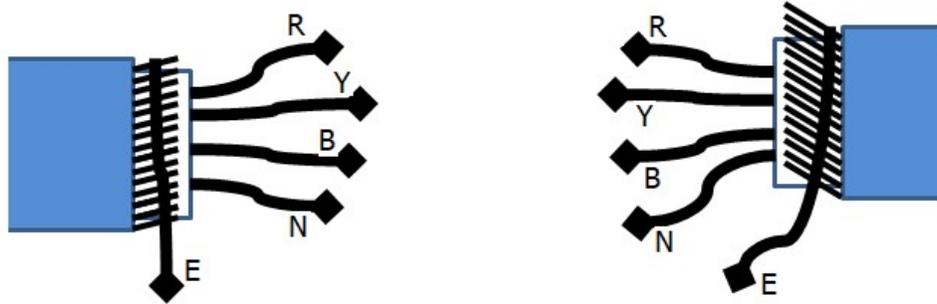


Figure 5 cable conditions.

No fault on UG cable, continuity NO broken line fault.

Review on your test results from continuity test, if NO OPEN LINE FAULT on the UG cable. Draw straight line across each phase conductor as shown below.

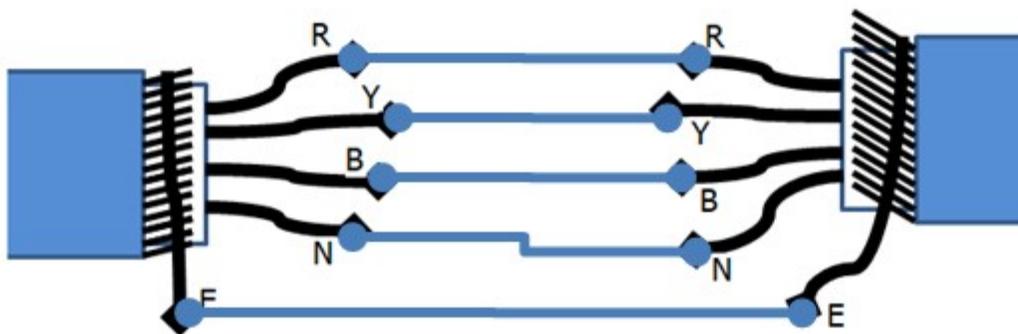


Figure 6 All lines are drawn straight across phase on same label.

FAULT on UG cable, continuity have OPEN LINE FAULT.

After done your continuity test, found that one of the phase conductor is OPEN LINE or no  $\Omega$  value on the meter. Draw straight line across each phase conductor if other has good  $\Omega$  value. Example below is Line 3 or BLUE phase detected open line during measurement then it shall be drawn like this below in figure 7.

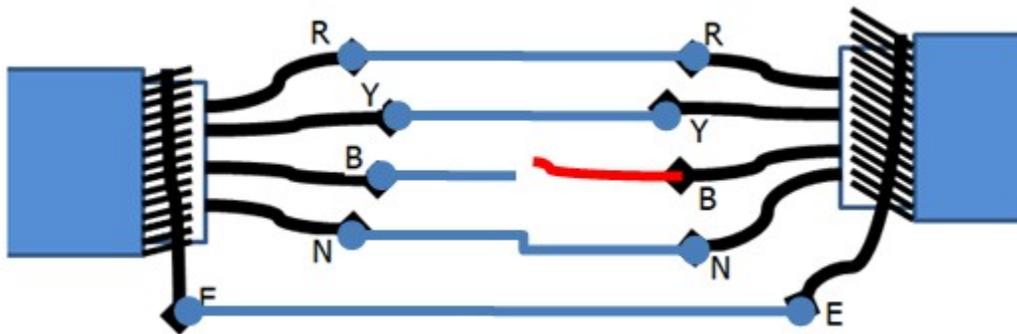


Figure 7 example B phase have open line fault detected.

FAULT on UG cable, continuity have phase crossing FAULT.

During continuity test, if the phase is not matching with the point where you have tested this means that phase crossing is found. Example of phase crossing fault Y to B is clearly identify when earlier perform continuity test on Y-E and B-E. Therefore the lines shall be drawn like this in figure 8.

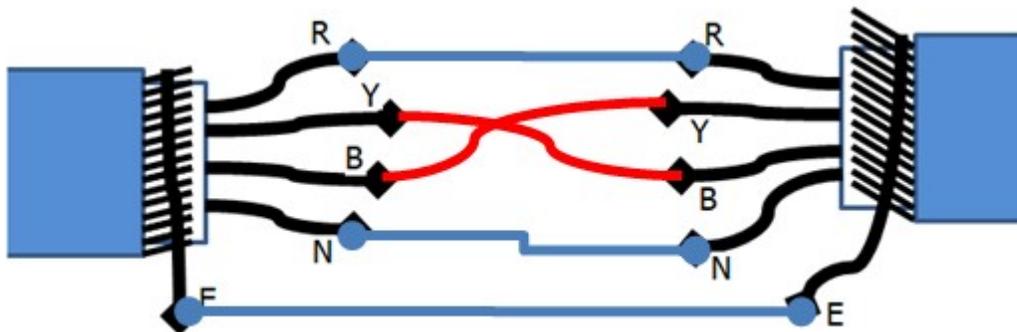


Figure 8 example of phase crossing fault.

Insulation test showing short fault between Y-N.

Insulation test result can show direct if a UG cable has short circuit fault.

Example insulation test reading:

R-N : 200 M $\Omega$

Y-N : 0 M $\Omega$

B-N : 200 M $\Omega$

E-N : 200 M $\Omega$

Result readings above detected short between Y-N where the result in meggar reads '0  $\Omega$ '. Therefore the fault is identified and fault shall be drawn like this in figure 9 below.

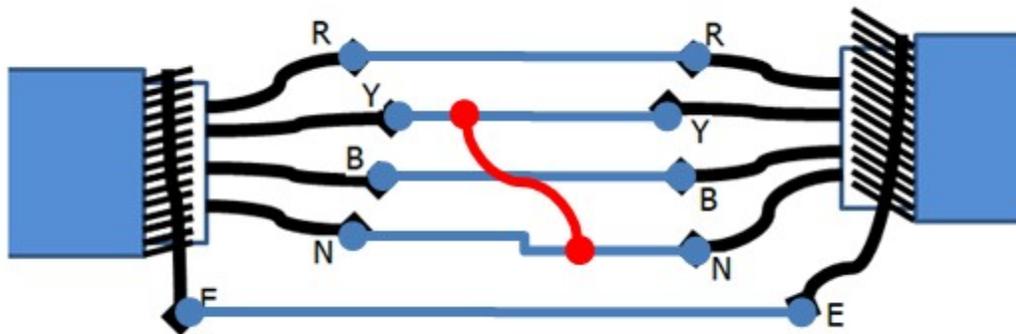


Figure 9 a line jump between Y-N is drawn to indicate fault on the UG cable.