

Appalachian Power Company Policy No. 12:
Phasing Circuits

1) Statement of policy:

As part of the preparation of a construction work order where phasing will be effected, the Electrical Engineer responsible for the circuit or their designee shall look at the circuit configuration in advance of construction and provide the construction crew a drawing showing the proper electrical connections to maintain correct phasing at the new normal open points.

Before completing the installation of switches between two distribution circuits, a test for phasing shall be performed to ensure that both circuits are 'in phase' with one another. If the phasing shows the circuits to be out of phase, the phasing shall be corrected before the job is finished. If it is necessary for the crew performing this work to leave the job site and return at a future date to correct an out of phase condition, the switches being worked on shall be "hold" tagged for the DDC. The DDC shall be notified and an entry made by the DDC in the Abnormal Equipment Database denoting the condition of these switches.

When, due to system configuration, this correction cannot be made, such as when circuits are fed from sources that do not allow the circuits to be in phase, the switch pole shall be tagged with a permanent "Danger Out of Phase" sign before the job is completed. In addition, the graphics group shall be notified to identify this out of phase condition on the Smallworld maps.

When two circuits are to be tied at a point where a switch is not available, a phasing check shall be made to assure that the circuits are 'in phase' before they are tied together.

Field personnel shall relay the actual voltage readings taken during phasing checks to the engineer responsible for the project for verification that readings are as expected. If the engineer is not available, the DDC shall be contacted to assist with this verification.

2) Discussion:

Phasing 'Wye' connected circuits

In order to properly 'phase' two adjacent circuits together, one should first test the phasing sticks for proper functionality **before** and **after** each use. Given the sticks are functioning properly, one should place the hook of one phasing stick onto the phase of the first circuit and then make contact with the other hook (or probe) to all three phases of the second circuit one at a time. One set of readings between these conductors should yield a 'zero' voltage reading and the other 'two' combinations should yield a value greater than 'zero' and less than or equal to the rated phase-to-phase voltage of the line under test. The two phases of the opposite circuits that yield a 'zero' indication can be identified as 'like' phases and may be tapped or connected together, usually through a cutout or switch. **

This procedure should then be repeated by moving to the next phase of the first circuit and determine which of the remaining phases of the second circuit displays a zero voltage indication. Having identified these two 'like' phases, they can then be considered 'in phase' and connected through the switch device. The remaining phases of each circuit must also be tested and should also yield a zero voltage. This being the case, these phases may then be connected together.

Once this process is completed, both phasing sticks should then be connected to the primary neutral to bleed off any residual voltage.

Warning! – NEVER assume the last two conductors are 'in phase' and connect them without checking first and verifying this to be the case with the phasing sticks.

**Note – Some voltage difference may be observed between the same phases of two different circuits. This situation can occur in part due to differences in the voltage levels at the source (or station), one circuit being loaded more than the other, varying conductor sizes, etc. However, by testing each phase of one circuit against each phase of the adjacent circuit and each phase to the common primary neutral (of a wye configuration), then a positive match will result.

Phasing 'Delta' connected circuits

When phasing 'Delta' connected circuits, you must connect the phase indicator between each phase combination (A to B, A to C, and B to C) of each circuit. Both circuits must be energized to make a proper phase match. (Remember that a delta circuit may have one phase grounded without circuit failure.) This must be verified and understood before matching phases. In making these contacts, limit the contacts to just long enough to obtain these readings.

Prior to connecting any phases together between the two circuits, test between one phase of the first circuit to each phase of the second circuit. A zero reading should be obtained on at least one of these readings. There may, however, be more than one combination that results in a zero reading because there is no common tie between them.

Connect the first two phases together that result in a zero reading with a 'temporary' jumper. This may be necessary with closed delta circuits from two sources in order to obtain voltage readings on the remaining phases.

Then test between the next phase of the first circuit and the two untied phases of the second circuit to find a zero reading. With this accomplished, you may then connect this second set of phases together.

Then phase test between the final two conductors. If a zero reading is obtained, you may connect them. If a potential difference exists, disconnect the first (temporary) jumper and recheck from circuit to circuit. Once a zero reading is confirmed the two conductors may be tied together. With all phases confirmed and 'in phase' with each other, the temporary jumpers may then be replaced with permanent ones.

3) Definitions:

'Phasing' is performed to verify that all phases of one circuit are at like potential with a corresponding phase of the adjacent circuit. In many cases the DDC or possibly the District Engineer will be able to advise field personnel as to the phasing

characteristics between two adjacent circuits, but if there is any doubt as to this status, then a phasing test must be performed.

4) Attachments:

5). OSHA / Safety Manual References:

Safety Manual: G4.10.

Only approved equipment shall be used in phasing-out circuits and transformers and in testing for potential.

OSHA Reference:

1910.334(c)(2):

"Visual inspection." Test instruments and equipment and all associated test leads, cables, power cords, probes, and connectors shall be visually inspected for external defects and damage before the equipment is used. If there is a defect or evidence of damage that might expose an employee to injury, the defective or damaged item shall be removed from service, and no employee may use it until repairs and tests necessary to render the equipment safe have been made.

6) Date Adopted: May 2, 2006