

Phasing Meters and Ground



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Once again we visit the concept of using an approved testing device in a manner in which it was perceived to be designed only to discover a misapplication after the smoke clears. And as we all know, waiting for the smoke to clear is not the preferred way to learn valuable safety lessons. Fortunately in this case there were no personal injuries. The incident certainly created questions such as how it came to be used in an unacceptable situation and how we prevent it from happening again.

The task that created this safety article was to verify the correct phasing between a 6.6 kV generator and the similar utility voltage. This process involves physically touching the energized 6.6 kV bus with a contact type voltmeter of the appropriate voltage rating. The phasing voltmeter used during this test required the use of fiberglass hot sticks with the meter attached at one end and the user holding the other.

The phasing checks were being taken off of the bus inside a medium-voltage breaker cubicle with the cubicle door open and the primary drawout contact shutters open. The operator placed one lead on the A-phase load side (generator) cubicle bus and the other lead was positioned on the line side (utility) A-phase cubicle stab. During this test, when the panelboard mounted synchroscope was at twelve o'clock (zero) there should be zero volts between the line and load A-phase connections. The meter in question was set up exactly as it should have been.

During the phasing verification operation one of the medium-voltage phasing meters arced to ground causing a significant amount of damage to the meter.

This particular distribution voltage voltmeter was designed for lines and substations. These units are intended to be used with hot sticks outfitted with a universal chuck adapter. They are capable of measuring voltage phase-to-phase, phase-to-ground, and at regulator tap settings. The manufacturer of this particular meter states that their equipment offers advantages over the traditional methods. This meter has an accuracy rating of ± 2 percent, while most phasing sets can only boast of reading the approximate voltage. This meter has a wide range of uses where the traditional voltage phasing set is typically only used for hot phasing.

All of the above is true; however, like any piece of equipment there are situations in which it was not designed to be used.

Did this meter do its job or did it fail? It failed, in this application.


The key to this failure was the lack of physical clearance phase-to-ground inside the cubicle. The digital meter in contact with the generator voltage was positioned too close to the side panel of the switchgear. By meter we are referring to the meter faceplate itself, near the point where the meter attaches to the hot stick, not the probe that extends out of the meter and contacts the energized bus. The result was an arc from ground to the actual meter. The photograph attached clearly shows signs of an arc in the upper right of the meter screw.

One contributing factor to the meter being placed too close to the ground plane is that with this design it is very difficult to read the meter when positioned in a horizontal fashion inside a cubicle. A person must be close to the meter to monitor the voltage level.

Not every piece of safety equipment manufactured will work in every application that one can conceive it being used. As trained professionals we need to be aware of how each device can be safely applied and be on the lookout for the hidden hazards. Inspecting each piece of equipment prior to use and consulting the manufacturer's instruction manual are a couple of ways us to keep safety skills.



The ideal meter for phasing generators is an analog meter similar to the one in the photograph. This meter can be read while looking straight down the hot stick allowing the operator to easily watch the needle as it sweeps to the zero position. The test was performed again using a different meter without incident.

In conclusion, the meter used was not the correct one for the application. It failed because the instrument requires a ground clearance that was not maintained during the test. This meter has been used countless times in open air measurement situations without incident. 

Paul Hartman has over 20 years experience in start-up, commissioning, maintenance, and training in power generation, including international projects in Pakistan, Indonesia, Thailand, Brazil, and Korea. He has been an instructor for state certified continuing education programs. Paul is currently Project Manager for Power Testing and Energization. He is a regular contributor to *NETA World* and a frequent speaker at NETA's Annual Technical Conference.