

Design and analysis of high current heat cycles test set for underground cable

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The Heat cycles test set is the test equipment used for cables quality evaluation as required by several standards that equipment should be tested to ascertain that it is free from abnormality prior to the actual operation, especially, when the equipment is subjected to temperature change in cyclic manner. Heat cycle feeds current into the tested cable until heat is built up and then stop the feeding current. The cable will let cool itself down naturally in the set time period. The above mentioned action will be repeated in a number of cycles as required by the standard. The cable sample undergone the test will then be subjected to quality evaluation and shall still comply with all the requirements required by the standard.

In order to develop a highly reliable and efficient heat cycles test set that can satisfy the requirement of the standard. The heat cycle test is then desired to possess the following characteristic and ability :

1. Two sets of separate current controller that can be used to control the resulted temperature during on-cycle automatically.
2. Digital data recorder with 6 inputs (extendable to 12) to accommodate as many as temperature and other sensors, communicable via RS232 and RS485. The recorder can upload its contents to flash memory card, have 2 to 12 digital outputs for alarms, and a 5.5 inch LCD monitor.
3. Number of cycles and time period can be set.
4. Feedback controllable using constant current or temperature.
5. Fuzzy logic used in regulating current and temperature.
6. two selectable operation modes: manual and computer control. The heat cycles test set under the above mentioned design is believed to have high reliable result and cost effective when compares with the costly foreign product.

The heat cycles test set is designed and built in accordance with what is discussed in the article for high voltage cables testing. The test set feeds current periodically into the cable under testing. In on-cycle, the test set heats up the cable for at least 8 hours while in the off-cycle, it allows the cable to cool down for at least 16 hours until its conductor temperature is within 10°C above the ambient temperature. The current that is fed into the cable during the on-cycle is to be recorded for 2 consecutive hours when the conductor temperature remains constant as per the insulation standard (IEC 60840-2004).

The heat cycles test set has two separate current sources, which can be used independently. Programmable Logic Control (PLC) is used in controlling the operations of the test set, e.g. the two current sources can be programmed to work together, moreover, the number of testing cycles, feeding current, and also the resulted temperature of any on-cycle can be selected.

In conclusion, the test set built as described, can perform its functions satisfyingly while accomplishing cost reduction. This is because an imported test set of the same kind is more expensive. Besides, a digital recorder is installed for recording temperature and current during testing. An acceptable error of 1.45% to - 1.62% of the test set is obtained when undergone the calibration.

Key words

Cable, Calibration, Heat cycles test set, Programmable Logic Control (PLC), Thermocouple