The General-purpose Tester Design of the Disconnector

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Abstract: In order to solve a fever problem caused by improper place of the disconnector, interval between the contact terminal and contact finger, and asynchronous three-phase switch on, and reduce load losses caused by non-scheduled outage, this project studies the general-purpose tester of the disconnector. The general-purpose tester of the disconnector is composed of two modules: hardware system and software system. The hardware system includes the measuring unit of the disconnector and wireless data transmission unit. The software system contains the ultrasonic ranging software algorithm based on NUC472, DSP combined algorithm design, as well as analysis and display terminal design based on the virtual instrument.

1. Introduction

The fault of the disconnector includes insulator fracturing, operational failure, fail-to-break, fail-to-close, improper divide-shut brake, component damage of drive disk assembly, corrosion and overheating of galvanic circle. Overheating of galvanic circle is an unsettled problem in the high voltage isolator. According to operating experience, the general high voltage isolator only can be operated to 60% of rated operational current. If it exceeds 70%, it will result in overheating to a considerable degree. With the rapid development of China's state grid, the fault caused by overheating contact is increasingly prominent. According to statistics, the main reasons for overheating the disconnector include improper place of the disconnector, interval between the contact terminal and contact finger and asynchronous three-phase switch on. However, the small interval in the overhauling process of the disconnector can't be observed by naked eyes. Adjusting switch on of the disconnector costs more time, thus it brings a great difficult to the overhauling process.

In order to solve a fever problem caused by improper place of the disconnector, interval between the contact terminal and contact finger, and asynchronous three-phase switch on and reduce time consumed by adjusting disconnecting link by maintainers in the overhauling process, the author studies the general-purpose tester of the disconnector. This system can be used to measure opening interval of the disconnector and interval between the disconnector's contact terminal and contact finger, analyzes and displays data. This not only reduces the fever fault in the contact terminal of the disconnector, but also greatly decreases synchronous adjustment time of the disconnector, thus installation of the disconnector will put in place, guaranteeing safe and sTable operation of the disconnector.

2. The general-purpose test system design of the disconnector

In this thesis, the author studies the general-purpose tester of the disconnector. This study is involved in measurement of the disconnector's opening interval based on ultrasonic wave, opening interval with the asynchronous value, asynchronous components, processing method of measuring signals, wireless transmission system, and general-purpose test analysis terminal of the disconnector.

(1) Measurement of the disconnector's opening interval based on ultrasonic wave, opening interval with the asynchronous value, and asynchronous sensor components include the ultrasonic probe to measure opening interval, ultrasonic probe for asynchronous test of separating brake, and ultrasonic probe for asynchronous test of switch on.

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(2) Processing components of measuring signals contain signal amplifiers and signal comparators or other signal processing modules.

(3) Transmission components of measuring signals contain wireless signal transmission system based on Zigbee and the general-purpose test analysis terminal of the disconnector that transfers signals collected by sensors to the backstage after passing through the signal processing components and wireless transmission system.

(4) Measuring signal analysis components are composed of ultrasonic ranging signal processing based on DSP, synchronism and opening interval.

(5) Measuring signal display components include the display terminal based on virtual instruments and can display and store measured data and analytical data.

3. The general-purpose tester of the disconnector

In this thesis, the author designs the general-purpose tester of the disconnector, which is composed of the interval test module between the contact terminal and contact finger, opening interval, asynchronous test module of separating brake and switch on, and data analysis terminal. The tester developed has the functions insertion depth, synchronism of separating brake and switch on and triple test of opening interval.

Opening interval and synchronous modules of separating brake and switch on include devices, respectively installed on A, B and C three-phase contact finger conductive arms of the disconnector. After clamping on the conductive arms, the gradienter on the module is used for correction. Next, the thrust bolt is twisted to fix. The sensor is shown in Figure 1. It can be observed from the figure that this module has three groups of ultrasonic probes with different perspectives. By measuring three groups of probes with different angles, the sensing range is covered to the entire separating brake and switch on. It also can supervise three-phase degree of unbalance under the any control state to realize accurate measurement for separating brake and switch on.

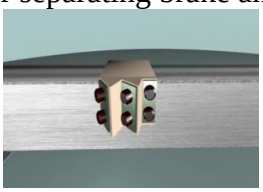

Figure 1: Schematic Diagram of Installing the Opening Interval and Asynchronous Modules of Separating Brake and Switch on

Two groups of GW4 disconnectors are selected to install this general-purpose tester. Insertion depth, synchronism of separating brake and switch on, and opening interval of the disconnector are tested and compared with the manual test results. The results are shown in Table 1. It can be observed from the Table that the general-purpose tester is extremely close to the artificial detection results. Moreover, the measurement accuracy is improved to ±0.01mm from the former ±1mm. Moreover, in artificial measurement, because the measurement point is not identical, each measuring result may be not identical. The measured data by using the general-purpose tester of the disconnector are not affected, showing that data results are more reliable.

Table 1 Test Result Comparison

	The general-purpose tester of the disconnector		Artificial measurement	
	No.1 disconnecting link	No.2 disconnecting link	No.1 disconnecting link	No.2 disconnecting link
Opening interval(mm)	A:1356.31 B:1361.52 C:1358.67	A:1366.25 B:1363.34 C:1365.58	A:1357 B:1362 C:1359	A:1367 B:1364 C:1367
Synchronism of switch on(mm)	A:0 B:1.35 C:3.25	A:0 B:4.87 C:2.51	A:0 B:1 C:3	A:0 B:5 C:2
Insertion depth of contact terminal (mm)	A:69.89 B:72.86 C:74.35	A:73.58 B:70.24 C:72.35	A:70 B:73 C:75	A:73 B:70 C:73

4. Conclusions

The three-angle ultrasonic test method was proposed by the tester of the disconnector to realize the accurate test for the synchronism of separating brake and switch on for the disconnector.

The tester of the disconnector with the functions of insertion depth, synchronism of separating brake and switch on and triple test of opening interval was firstly invented. This study solved a fever problem caused by improper place of the disconnector, interval between the contact terminal and contact finger, and asynchronous three-phase switch on and reduce load losses caused by non-planned outage.

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