

Research on Universal SF₆ Gas Sampling Interface Device

Wang Miao¹, Hai Tianshu¹, Li Bo¹, Liu Guobin¹, Liu Bo¹, Wang Liu¹, Liu Chenyang¹, Li Xinyu¹, Wang Qinghao¹, Pang Yanjun¹, Guan Chunmei¹, Wang Ning²

¹Fushun Power Supply Company, Liaoning Electric Power Company Limited, State Grid, China

²Liaoning Electric Power Company Limited, State Grid, China

fushunpowersupply@163.com

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Abstract. This paper introduces a universal SF₆ gas sampling interface device. When we test the SF₆ gas, it was easy to choose a wrong joint or take fewer joints on spot. Due to the variety of the tested device valve, through the field usage situation, this device solves the defects of different type or manufacturer equipment sampling valves, which don't have a unified specification, and implements the standardization SF₆ gas sampling interface.

Introduction

(1)Importance of SF₆ gas testing

SF₆ is colorless, odorless, non-toxic and non-burning and non-burst inert gas. SF₆ has arc extinguishing ability(100 times of air), and also has high insulation performance characteristics(two times greater than air). It is widely used currently. the SF₆ electrical equipment which is in the normal operation(below 80 degrees)will not products decomposition. When partial discharge, spark and ARC discharge happened in the equipment, it will cause decomposition of SF₆ gas react with other insulation materials. The different defects inside the equipment (different temperature) can cause different type of discharges, and produce different decomposition products. When the device fails and the temperature reaches the point temperature, it will produce different decomposition products[1, 2].

When SF₆ gas exists in the water, it will seriously affect its insulating properties. Moisture inside the device, may be brought by the SF₆ and equipment components, or because the joint is not seal, air vapor intrusion, and invasion of water will reduce the insulation characteristics of electrical equipment, also indirectly cause equipment corrosion[3].

So the detection of the decomposition and moisture content of SF₆ gas can judge the type, property, and degree and development trend of equipment insulation.

(2) The distribution of equipment which is be filled with SF₆ gas in Fushun Power Supply Company. In recent years, with the renovation project of launching Fushun Power Supply Company 220kV GIS substation. There are 8 of 13 substations with 220kV under the jurisdiction have been successful transformed into a GIS substation, and have been successfully put into use. But only twelve substations with 66kV transformed into GIS substation, accounting for only 13.2 percent of the total. Most of the 66kV substation is open substation and circuit breakers are SF₆ circuit breakers[4].

(3)Type of SF₆ connector

Before we test the SF₆ gas, it is very important to choose the matching joint which connects the instrument and the gas chamber valve of the test equipment. Now connector manufacturers which Fushun Power Company commonly used are from many different factories, as shown in Figure 1.

Because there are a lot of lines in 220kV open type substation, the number of the SF₆ circuit breaker equipment is large. Furthermore, since the establishment of the substation, due to the aging equipment and insulation defects, many SF₆ circuit breakers had been replaced. Resulting in many kinds of SF₆ circuit breakers being used, models are not uniform. The forms of the air chamber are many and varied[5].



Fig.1 The physical figure of joints

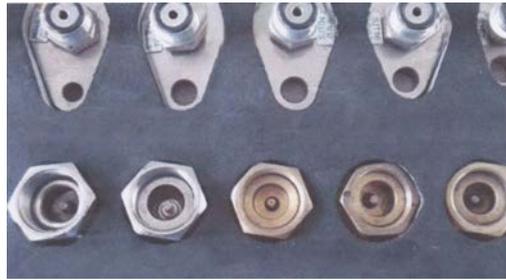


Fig.2 Indistinguishable to the naked eye connector

Problems in field test

Because joints are produced by different manufacturers, the plenum valve diameter of SF₆ circuit breakers has different sizes. For example, there are 14 groups SF₆ circuit breakers with 220kV in Lishizhai substations. And we required three kinds of connectors. In the field test, because of the similar joint interference, we often choose joints by errors or omissions. On September 16, 2014, the working team members drove 100 kilometers outside to the substation for carrying out SF₆ circuit breaker gas micro water transfer test. When the testing car arrived at the scene, the staff found that the joint and the SF₆ circuit breaker gas chamber valve did not match. So we stopped the work. Eventually, because workers carried the wrong joint, the vehicle should return to change. Not only the efficiency is low, but also it wasted a lot of manpower and material resources. Since then, in order to prevent such incidents from happening again, test personnel usually need to carry all the joints (more than 40 species) when we test the SF₆ gas. It is inconvenience to prepare work; test work, finishing work, and also can not meet two substations at the same time to carry out SF₆ gas related tests. So the equipment utilization and work efficiency is very low.

Typically, SF₆ gas testing (that is, water testing, product testing, purity testing) process shown in Figure 3.

Solution

In view of the problem that we can't correctly choose the joint when field testing, the author developed an universal SF₆ gas sampling interface device. The end of the universal SF₆ gas sampling interface is connected with the valve of the measuring device, and both are consistent in size, and remain sealed. At the other end, the standard diameter is used. In the test, the universal SF₆ gas sampling interface is installed on the valve of the test equipment, and then the gas sampling is carried out by using the uniform joint which is matched with the common type SF₆ gas sampling interface. Such design, effectively solves the problem of choosing the joint difficult, and omits the most time-consuming part in Figure 4.

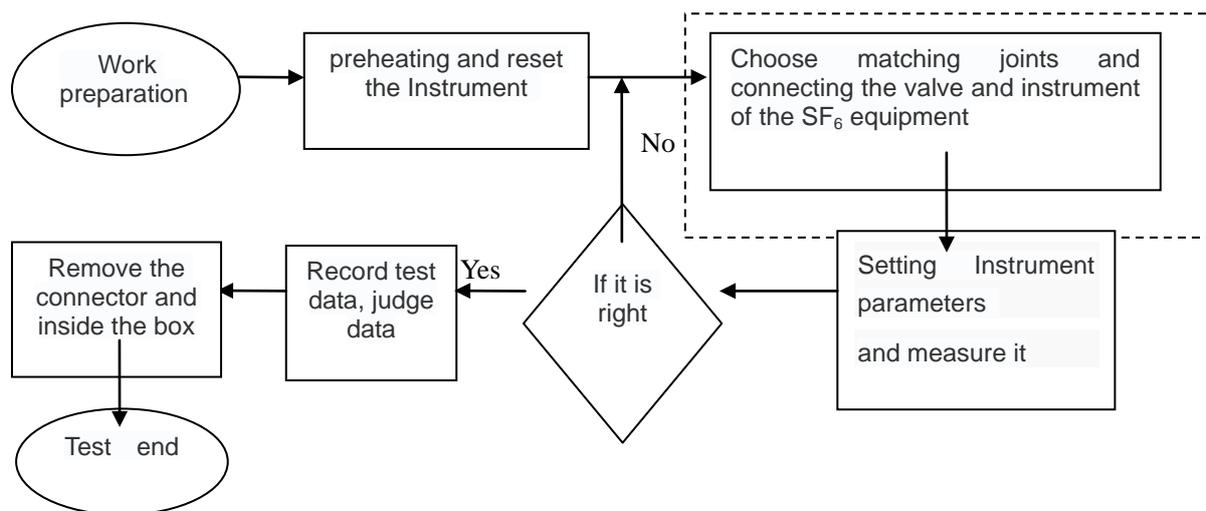


Fig.3 SF₆ gas test flow char



Fig.4 The universal SF₆ gas sampling interface device

Field application

Universal SF₆ gas sampling interface has been developed, and applied in the 220kV Li Shizhai substation Li Shun line and other 14 sets of SF₆ circuit breaker micro water test in October 15, 2014.

In order to improve the working efficiency, the universal SF₆ gas sampling interface is applied to the above 14 sets of SF₆ circuit breakers. The inner diameter of 28 mm universal sampling interface applied to ABB valve, inner diameter is 74 mm universal sampling interface is applied to Shen Gao air valve and inner diameter of 45 mm universal sampling interface is applied to the west open valve. And all of these on September 5, 2014 were installed in 10 groups switch sampling valve. During the October 15th micro water test, Test personnel save the installation of the joint and the replacement of the time, In just 60 minutes to complete the testing of the circuit breaker 14 groups. This approach not only improves the efficiency of the work, but also to be consistent with the test personnel.

Summary

In the past year, the device has been widely used in the open type substation with the old equipment. The test personnel are not affected by the choice of the joints, which can save the working time, and it will play a positive role in promoting the SF₆ gas testing in Fushun power supply company.

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