

## Study on the Grounding Line of the Standard Transformer Stage

Liu Chenyang, Li Xinyu, Liu Bo, Liu Guobin, Zhang Ning, Su Yang, Yang Rui, Han Lin  
Fushun Power Supply Company, Liaoning Electric Power Company Limited, State Grid, China,  
fushunpowersupply@163.com

**Keywords:** surface effect; grounding line; standard transformer stage; current capacity; working efficiency

**Abstract.** This paper's aiming at the standard transformer stage that they don't have the obvious position for hanging a grounding line. For solving the problem, and develop a kind of special grounding line for the standard transformer stage. The grounding line is the copper mesh structure of three layer hollow circle, and it achieved the whole weight of a grounding line is less than the normal regulations grounding line. This paper also expounds the method of use for the special grounding line for the standard transformer stage. It proved that the special grounding line for the standard transformer stage not only solved the problem that could not hang a grounding line causing the range of power outages, also proved that the use of the special grounding line can shorten the operation time, achieving the purpose of saving time and effort.

### Introduction

A grounding method by grounding the shell of electric equipments is called protective grounding. Its purpose is to ensure personal safety. When shell of electrical equipment is charged by insulation damage, it will produce the distributed capacitance between power lines and ground. At this point, if one person is standing on the ground with his hand touch the shell, current will go through the person body which causes electrical shock. If we use the device to take protective grounding measures, the shell will contact the earth through wiring. It is the equal of a human body resistance in parallel beside the protective grounding line. As to "human body resistance" is much greater than grounding resistance, therefore the current through the human body is very small, so we avoid the electric shock accidents[1, 2].

The purpose of taking the grounding line when we working on power cut equipments are to protect workers. It is the reliable security measures in the work place to prevent coming electricity suddenly. At the same time, equipment cut off parts of the residual charge is gone with the grounding, which prevents the induced voltage. When we installing grounding line, we must install the earthing terminal, followed by the conductor[3]. The contacting Must be well. The order of destuffing grounding line is contrast, to ensure the safety of grounding line installation personnel. We must use insulation rod and wear insulating gloves when we install or destuffing the grounding line.



Fig.1 The red turn part is an insulator



Fig.2 The red turn part is bare part of high voltage line

The safe regulations provisions: When the transformer maintenance, it must hang a ground line in two sides .On account of the standard transformer stage didn't have the obvious position for hanging a ground line, it didn't hang a ground line, as shown in the figure below. Figure 1 is the red turn part is an insulator; it can't hang a ground line. Figure 2 is the red turn part is bare part of high voltage line which is very thin, and it can not bear the weight of the normal regulations ground line. So we develop a kind of special ground line for the standard transformer stage for the transformer maintenance work[4, 5].

### Design scheme

According to the surface effect, most of the current go through the conductor by the external surface, thus we develop a dedicated grounding line of the standard transformer stage. Grounding line is a three layer hollow round made by copper mesh structure, Based on the test, we choose the layer, which make it equal to the current capacity of the routine grounding line. It is shown in figure 3. At the point of contacting wiring of the low voltage side in the transformer, we install the grounding ring. Installation location (red circle) as shown in figure 1. At the arrester on the high voltage side of the transformer, we install a homemade ground lug. Installation location (red circle) as shown in figure 2. When we use it, we contact the bottom of the dedicated grounding line of the standard transformer stage with the ground strip, and then we use wire clip to clip a set of dedicated grounding line of the standard transformer stage to the ground lug which is on the high voltage side of the transformer, another group of clip on the grounding ring of the low voltage side the transformer.

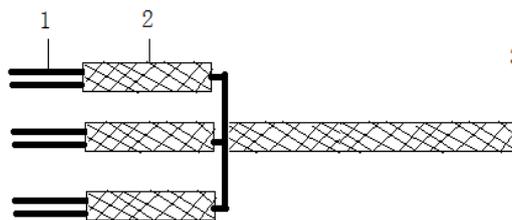


Fig.3 A sketch of the dedicated grounding line used on the standard transformer stage

Note: 1--wire clip (length of 0.1 m)

2--a dedicated net grounding line (length of 1.5 m)

3--the end of grounding line (length of 8 m)

### The effect and advantages of the development

The dedicated grounding line of the standard transformer stage is developed successfully on March 11, 2014. Figure 4 is the cross-sectional view of the dedicated grounding line used on the standard transformer stage and figure 5 is the dedicated grounding line of the standard transformer stage. From the figure 4 and figure 5, special grounding line adopts three layer hollow round copper mesh structure, compare with the same length, same cross-sectional with the conventional

grounding line, the weight is only 2/5 of the conventional grounding line and the current capacity is very close with them. Its advantages are as follows:

1)The weight is small, the weight is only 2/5 of the conventional grounding line with the same length and same cross-sectional.

2)Solve the problem that the standard transformer stage can't hang grounding line, ensure the safety of operation.

3)Solve the problem that we could not hang grounding line for expanding the scope of the power outage.

4)Shorten the operation time, reduce manpower.

5)Easy to use and reliable, to achieve the requirement of time.



Fig.4 The cross-sectional view of the dedicated grounding line



Fig.5 The dedicated grounding line of the standard transformer stage

### Application on field

After successful development, the special ground line for the standard transformer stage is applied on April 15, 2014 ,in the No.19 standard transformer stage in the 10 kV YouZhan GanXian .At 9:00 A.M,the run-maintenance staffs received the outage maintenance command from the scheduling , and the operators used the insulating operative rod for disconnecting the low voltage load switch ,and then disconnected the high voltage drop switch .After checked the electricity ,the operators would smoothly hang the special ground line for the standard transformer stage on the high voltage drop switch's below , and the operation added up to for 3 minutes .

Before the special ground line for the standard transformer stage was developed, the run-maintenance staffs needed to do the power outage range from No.1 to No.35 in the YouZhan GanXian, and hanged the ground line in the head of No.1 and the end of No.19 to ensure the No.19 standard transformer stage to set in the protection range of power outage .This method not only expanded the work range, increasing the customers in power outage , but also prolong the operation time, and bring the negative influence to the company .The special ground line for the standard transformer stage can effectively solve the above problems, with the consistent good opinion of front-line workers.



Fig.6 Application of the dedicated grounding line

### Summary

In nearly one year time, the dedicated grounding line of the standard transformer stage is widely used in standard variable machine maintenance and repair work. Because of the three layer hollow round copper ground wire mesh structure, through the selection of test layer number, equal to that of the conventional flow capacity of the ground wire, solve the problem of standard variable table can't hang ground wire. To ensure the safety of operation, shorten the operation time, reduce the manpower, it has widely popularization value and application prospect.

### References

- [1] Zhou Zecun. High voltage technology. Water Conservancy Power Press, 1996
- [2] Chen Huagang. Electric power equipment preventive test method and diagnostic technique. Beijing science and technology Press, 2001
- [3] Chen Jiabin. Grounding technology and device. China Power Press, 2010
- [4] Wang Changyu. Grounding technology security. China Power Press, 2008
- [5] Zhang Xiaohui. Electrical test. China Power Press, 2010