

## Research on Maintenance Process Optimization of GW4-126DW Disconnecting Switch

Ying Pei\*, Lin Niu, Shitao Wang, Haifeng Li, Qinghua Yin, Nannan Gao,  
Mengchao Ma, Ye Ai

State Grid of China Technology College, Jinan, China

Corresponding author's e-mail: peiyingee@163.com

**Abstract.** GW4-126DW disconnecting switch is a kind of switchgear commonly used in substations. When the disconnecting switch has defects or failures, it needs to be repaired. In this paper, the comparative analysis, system sorting, and summarization are used to optimize the maintenance process of the GW4-126DW disconnecting switch. After optimization, the overhaul process includes inspection before overhaul, dismantling of disconnecting switch, troubleshooting and elimination of defects, assembly and debugging, and inspection after overhaul. The research results have been applied to practice exercises for students majoring in electrical engineering. It has been proved that the maintenance process has clear logic, comprehensive operation steps and good practicality.

**Keywords:** GW4-126DW, disconnecter, maintenance process.

### 1. Research Background

The disconnecting switch is used to separate the equipment that needs to be repaired from the operating power grid, so that it has an obvious disconnection point to ensure the safety of the maintenance work. The disconnecting switch does not have a special arc extinguishing device, so it cannot be used to cut off the load current and short-circuit current. It should be used in conjunction with the circuit breaker.

GW4-126DW disconnecting switch is an outdoor three-phase AC switchgear with double-column horizontal rotating structure, the design number is 4, and the rated voltage is 126kV. The disconnecting switch mainly includes conductive elements, pillar insulators, transmission elements, grounding switch, operating mechanisms, pedestal, etc. The conductive system includes the terminal block, the conductive rod, the contact head, the contact finger, etc. The pillar insulator is mainly used to support the breaking element and ensure the safe distance between the conductive circuit and the ground. According to the using conditions, it is divided into ordinary type, anti-pollution type and plateau type. The anti-pollution disconnecting switch needs to meet the conditions of the heavily polluted area and solve the pollution flashover problem that occurs in the operation. Plateau disconnecting switches are mainly used in plateau areas, where the air is thin and the air insulation strength decreases. The disconnecting switch needs to strengthen the isolation distance of the pillar insulator to meet the insulation requirements. The transmission elements include the main switch connecting rod, the ground switch connecting rod, the cross connecting rod, the conductive elements and so on. The operating mechanism includes the main switch operating mechanism and the grounding switch operating mechanism.

At the substation, the dismantling and maintenance of the disconnecting switch needs to be carried out according to the specified technological process. However, the training and teaching environment is different from that of the production site. Due to the limitations of facilities and equipment, the maintenance process needs to be optimized, so that students or trainees can better and faster grasp the maintenance methods, steps, process requirements, precautions, etc. In this paper, the research methods such as comparative analysis, system sorting, and summarization are used to optimize the disassembly and maintenance process of the GW4-126DW disconnecting switch. The main contents include the disassembly of the conductive components, the disassembly of the transmission elements, the disassembly of the grounding switch, the installation and debugging of transmission components, the installation and debugging of grounding switch. The research results have been applied to practice

exercises for students majoring in electrical engineering. It has been proved that the maintenance process has clear logic, comprehensive operation steps and good practicality.

## 2. Disconnecting Switch Maintenance Process Optimization

By the research on the characteristics of training and teaching, the difference between practice training and working in the substation is analyzed, and the maintenance process of the GW4-126DW disconnecting switch is optimized. After optimization, the flowchart is shown in Figure 1, which mainly includes the inspection before overhaul, dismantling of disconnecting switch, troubleshooting and elimination of defects, assembly and debugging, and inspection after overhaul.

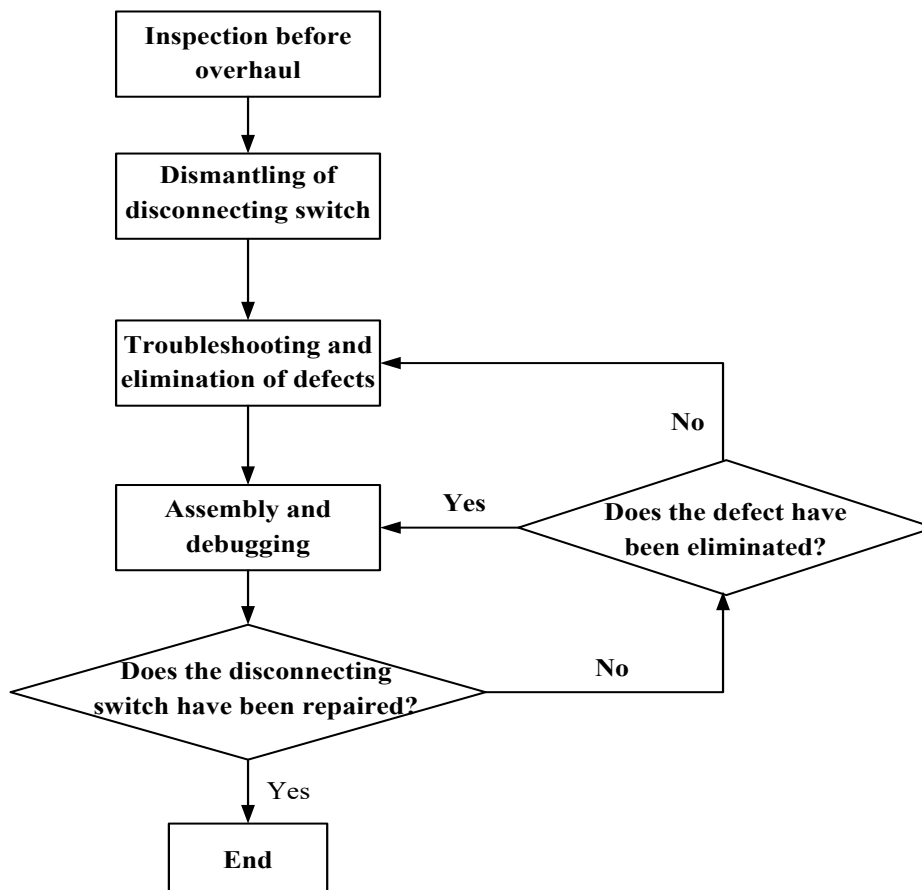


Figure 1. Maintenance Process of the Disconnecting Switch

### 2.1 Inspection before overhaul

Before dismantling and overhauling the GW4-126DW disconnecting switch, it is necessary to conduct a comprehensive inspection to understand the overall state of the disconnecting switch, and find the fault location. The inspection contents include: opening and closing action, conductive elements, pillar insulators, transmission elements, mechanical locking, etc.

The opening and closing action mainly checks whether the main switch and the grounding switch can be opened and closed normally, and whether the connecting rod rotates flexibly. The inspection of conductive components mainly checks whether the terminals are dirty or deformed. Whether the wiring base is damaged or deformed. Whether the connecting bolts are corroded, loose or fall off. Whether the conductive elements are damaged, deformed, or burred, etc. Whether there is any damage, discharge ablation, deformation or corrosion on the contacts, fingers and springs of the fingers. About the pillar insulator, it mainly checks whether the appearance of the porcelain insulator is clean, and whether the glaze is damaged, cracked, discharge traces, etc. Whether there is looseness, cracking and falling off at the pouring place of the metal flange and the porcelain column. The inspection of transmission components mainly includes whether there is corrosion, looseness, burr, deformation

and other phenomena in the main switch connecting rod, ground connecting rod, cross-link transmission connecting rod, crank arm, and universal joint. The mechanical locking is mainly checked whether the mechanical locking positions of the main switch and the ground switch are correct. Whether the mechanical locking plate, and locking pin are corroded, deformed or cracked. Finally, it is necessary to check whether the base is cracked or damaged, and whether the connecting bolts are rusted, loose, or fallen off.

## 2.2 Dismantling of disconnecting switch

The dismantling of the disconnecting switch includes disassembling the conductive arm, the cross link, the main switch connecting rod, the grounding switch conducting arm, and the ground switch connecting rod. For dismantling the conductive arm, at the actual substation, firstly the 4 bolts fixing the wiring base are loosen, then the wiring base, conductive arm, contacts or fingers are removed and placed on the work pad for disassembly and maintenance as a whole, to reduce work at heights as much as possible. In the training room, in order to be easy to work, you can firstly loosen the connecting bolts between the contact and the conductive arm, and loosen the connecting bolts between the conductive arm and the wiring base, then loosen the 4 bolts that fix the wiring base, and remove the conductive arm as a whole and place it on the work pad finally. The conductive arms and contacts can be disassembled without using tools such as wrenches on the work pad.

When disassembling the cross-link, first pull out the cotter pins at both ends of the cross-link, remove the cross-link, and place it on the maintenance work pad. When disassembling the main switch connecting rod, you need to use an open-end wrench and a ratchet wrench, take off the bolts at both ends of the main switch connecting rod, and place it on the work pad.

It is relatively simple to disassemble the conductive arm of the grounding switch. Loosen the two bolts of the hoop, remove the conductive arm and place it on the work pad. The method of disassembling the ground switch connecting rod is the same as the method of disassembling the main switch connecting rod, but before disassembling the ground switch connecting rod, it is necessary to disassemble the ground switch spindle and all the parts on it.

## 2.3 Troubleshooting and elimination of defects

Troubleshooting and eliminating defects is a very important link in the disconnecting switch maintenance process. In this link, there are many empirical practices, which are listed as follows:

(1) If the conductive arm is bent slightly, it should be corrected, and the oxide layer on the conductive contact surface should be removed with emery cloth. Note that the silver-plated layer of the contacts and fingers cannot be cleaned with emery cloth, but wiped with a rag dipped in alcohol. Vaseline can be applied to the contact and finger.

(2) If there is a slight burn on the contact surface of the contact and finger, it needs to be trimmed with emery cloth. If the silver plating layer falls off or the burn is serious, it should be replaced.

(3) Clean the surface of the insulator with water or detergent and wipe dry. If the insulator is slightly damaged, it can be repaired with epoxy resin or silicone rubber. If the damage is serious, it should be replaced.

(4) If there is rust on the connecting rod, it should be treated with anti-corrosion according to the situation.

## 2.4 Assembly and debugging

The isolation switch assembly and debugging includes two modules, namely the main switch assembly and debugging, the grounding switch assembly and debugging.

When assembling the main tool, it should assemble the cross link and the main switch link firstly. During the assembly process, it is forbidden to hold dangerous places such as universal joints and crooked arms. Install the contacts, contact fingers, conductive arms, etc. on the maintenance workbench, and then install the conductive arms as a whole. Before installing the conductive arm, make sure that the main switch is in the OFF position.

When debugging the main switch, it is necessary to adjust the level of the conductive arm. When the disconnecting switch is closing, the conductive arm should be adjusted to be on a straight line, and it cannot be buckled in or expanded outward. When the disconnecting switch is opening, the conductive arm rotates  $90\pm 2^\circ$ , and the rotation range cannot be too large or too small. The contact between the contact head and the contact finger should not be too early or too late. If it is closed too early, it is not smooth enough, and there is vibration. If it is closed too late, excessive arcing time may burn the contacts. Therefore, it is necessary to adjust the arc angle.

The adjustment method of the arc angle is as follows: you can make the left and right conductive arms contact, then adjust the cross link, the left and right conductive arms will be separated by a little distance. At the time, you can push and pull the cross link, and make the left and right conductive arms contact again, and check that the contact position is at the tangent of the arc to the line. If not, adjust repeatedly until it reaches the tangent position.

When assembling the grounding switch, it is necessary to assemble the grounding spindle firstly. The components on the main shaft are sequentially assembled with the ground switch driven arm, the opening limit ring, the blocking sector plate, and the closing limit ring. Next, the conductive arm of the ground switch needs to be installed. When installing, you need to pay attention to the insertion depth and the left and right positions. Finally, install the ground switch connecting rod. After installation, the locking sector plate needs to be adjusted. When the ground switch is closed, the left and right distance between the fan-shaped plate and the locking plate is 3-5mm. When the ground switch is switched off, the distance between the fan-shaped plate and the locking plate is 3-5mm.

## 2.5 Inspection after overhaul

After the installation and debugging of the disconnecting switch is completed, an inspection is required. The inspection contents mainly include: whether the main switch can be normally opened and closed, whether the grounding switch can be opened and closed normally, and whether the mechanical lock of the main switch and the ground switch can be locked correctly. If it is normal, the maintenance work is completed. If it is not normal, it needs to be checked and returned to the troubleshooting and eliminating defect step or the debugging step.

## 3. Conclusion

In this paper, the maintenance process optimization of GW4-126DW disconnecting switch is studied. The maintenance includes the disassembly of the conductive elements, the transmission element, the grounding switch, the installation and debugging of the conductive elements, the transmission element, and the grounding switch. The following three conclusions were drawn from the research:

(1) After optimization, the maintenance process includes inspection before overhaul, dismantling of disconnecting switch, troubleshooting and elimination of defects, assembly and debugging, and inspection after overhaul.

(2) In the training room, in order to be easy to work, you can firstly loosen the connecting bolts between the contact and the conductive arm, and loosen the connecting bolts between the conductive arm and the wiring base, then loosen the 4 bolts that fix the wiring base, and remove the conductive arm as a whole and place it on the work pad finally.

(3) After the installation and debugging of the disconnecting switch, it is necessary to focus on checking whether the switch can be opened and closed normally, whether the grounding switch can be normally switched on and off, and whether the mechanical locking of the main switch and the ground switch can be correctly locked, so as to ensure that the disconnecting switch is completely overhauled.

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