A further analysis of blocking action of the circuit breaker in the relay protection

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Abstract. With the development of the ages and social progress, our country has enormously developed in the field of smart power system. In most of the power systems, the hydraulic actuator, the operating mechanism and the spring energy storage operating mechanism are all the core issues in the current relay protection circuit breaker opening and closing. The effect of its operation will have a direct impact on the power system and circuit breaker performance. In this paper, by classifying the circuit breaker operating and analyzing the relationship between the blocking action and the relay protection, we can further analyze the blocking action of the circuit breaker in the relay protection, so that we can choose the better action position, and analyze and make researches by following the circuit wiring and dual configuration.

1. Introduction
Circuit breakers have been employed extensively as switching devices for making, carrying and interrupting electrical currents since the early 20th century [1]. They constitute a huge market because of their wide diversity of applications; such systems range from low-voltage domestic appliances to high-voltage power transmission networks [2,3].

Due to the gradual economic development and social progress, many cities and some large enterprises which use more electric power have encountered electric accidents, which have greatly threatened people's lives and property safety. To solve the frequent power accidents issues at this stage, it is necessary to effectively reduce the number of accidents on the technical level. The use of relay protection in the power system is a very effective way to ensure the stability and security of the power system, and avoid aging and deterioration of the circuit. In the current power system, the circuit breaker has become the most basic relay protection device. Once the circuit system fails, it can make a quick and effective response to the brake control, cut off the circuit system failure, and ensure that the power supply system run in more safe and effective ways. Circuit breakers have been employed extensively as switching devices for making, carrying and interrupting electrical currents since the early 20th century

In China's current power system, the most important part of the circuit breaker should be operating mechanisms, such as the spring energy storage, hydraulic and pneumatic, which, to some extent, has driven the development of circuit breaker power energy. In the process of development, there is a certain direct relationship between the working ability of the circuit breaker and the operation performance in the power system, and it can carry close cooperation with the relay protection to a certain extent. Its main function is that when the power system is in trouble, it can protect the inter circuit components. The effective and the nearest circuit breakers are combined to give instructions, which make sure that the components in the power system and other components are disconnected, and the degree of damage to the power components in the system is reduced, finally it is effective to ensure the safety of power
system. Many excellent review papers and books have been written about the properties of circuit breaker systems [1,4-7].

For power workers, a certain strategy should be taken to solve the existing problems at this stage, so as to boost the power system as a whole which has a higher quality of operation, to inspire outstanding power companies to create more economic benefits, and ensure power companies to operate safer and sound. For the manufacturers themselves, their production of circuit breaker control has some limitations. In fact, according to the actual situation in the power system, in order to achieve the complete dual blocker such as a better dual DC power gate, latch contacts and locking device, the circuit breaker manufacturers should also control two sets of pressure-lock relays in the circuit breaker, and then effective protection device and manufacturer's operating box should be provided within the two completely independent closed loops.

2. The Tasks of Relay Protection and the Classification of Circuit Breaker Operating mechanism

At this stage if the circuit components, which is under protection, get out of order, and the power components are also in the corresponding protection, then the relay protection device quickly, according to the corresponding distance and fault components from the nearest circuit, can accurately issue the corresponding trip command. Only in this way can the damage to the electrical component itself be minimized when the fault occurs, to effectively reduce the influence on the safe power supply of the power system.

In the current power system, in the normal circumstances, the circuit breaker operating mechanism, according to the power source, will be divided into four types: spring operating mechanism, hydraulic operating mechanism, electromagnetic operating mechanism and pneumatic operating mechanism. Spring energy storage operating mechanism in the power system is mainly based on the motor to pull the spring or the spring energy storage compression, closing the spring release, to ensure that the circuit breaker is equivalent. Pneumatic actuator and hydraulic actuator can effectively use the pressure or hydraulic energy storage function to open and close the circuit breaker. When the pressure is lower than the normal level, it is necessary to start pneumatic pump or pump motor for energy storage.

When installing the circuit breaker in the power system, it should be chosen to configure different operating mechanisms according to each different circuits, the mechanical load and the corresponding transmission mode. Pneumatic and hydraulic operating mechanism, based on the main working principles of the compressed air energy storage and transmission capacity, can carry out the corresponding closing and opening. In this case, the breaking actuator can have more power in the work, and the process can have a rapid response capability. This system device has a drawback, that is, its relatively complex structures. In the operation process of power system, only by configuring a certain actuator, the switch process of opening and closing can be running smoothly.

Once hydraulic and pneumatic actuator get out of order caused by its system in the power system operation process summary, it will lead to some of the liquid or air pressure within the organization to reduce, so that a lot of remaining pressure in the operating mechanism will bring about some situations like closing and tripping. This is better to ensure that the circuit breaker will carry out the normal opening and closing operation. Any complete circuit breaker operating mechanism should be able to effectively conduct such a complete cycle of operation, like open and close the sub-gate closing. If the hydraulic actuator and pneumatic actuator for some reason to make the pressure drop, it cannot guarantee the correct circuit breaker opening, closing, opening process, and some prohibited operation will be appeared in the power system.

3. Cooperation between Relay protection and Blocking Action

3.1. Prevent breakers from Damage

If the power system get out of order in its work process, the installation of relay protection by default will require the circuit breaker advanced reclosing pneumatic, and then perform the trip action. Breaker
in the sub-gate and trip implementation process summary, the pressure inside the operating mechanism of the cylinder pressure will rapidly decline, once the pressure reduction value checked the closing lock operating pressure range, the power system in all the circuit breaker Brake will automatically disconnect, eventually the relay is back to the initial situation. If the reclosing lock action contact is not connected to the relay protection device, the power system in the operating mechanism cylinder pressure value will gradually return to the original position, and then re-pneumatic relay, carry out a series of excitation action, and then conduct slowly closing behavior, and finally gradually become sub-gate closing sub-gate and other processes to work, which will in some degree do damage to the circuit.

3.2. Prevent three-phase trip fault
Under normal circumstances, most of power system circuit breaker are based on reclosing or single-phase recloser research when working in phases, and the blocking action and relay protection have a certain relationship and contact. If the access point in the reclosing lockout action is not connected to the protection device, then the actuator pressure in the circuit will be reduced within a certain range, eventually exceeding the reclosing range of the locking device, resulting in a three-phase tripping fault. Therefore, when carrying out relay protection wiring in the power system, the reclosing action of the access point must be connected to some relay protection device, if the circuit breaker cannot be closed and reclosing operation of the actuator to connect, then it will be a certain To the extent of the closing lock action access point and relay protection device to connect. If the circuit breaker actuator cannot relate to the reclosing lock action, the access point of the closing lock action and the relay protection device are connected to some extent. Therefore, if a permanent fault occurs within the power system, the circuit breaker will take some instructions after the trip of the protection device takes action. The circuit breaker reclosing pressure lock contact must be effectively connected to the coincidence blocking circuit. If the circuit breaker operation moving mechanism does not have a certain lock reclosing access point, then it will make the closing pressure lock contacts and protective devices more effective to combine.

4. Blocking action of circuit breaker

4.1. Optimal situation of blocking action
According to the hydraulic operating mechanism and the gas operating mechanism, if the operating mechanism of the cylinder pressure is so high, the operating mechanism should be effectively according to the residual pressure in the cylinder for a certain trip and blocking operation. In the internal operation of the power system, the remaining pressure should gradually achieve a certain blocking operation. So, at this stage the implementation of the blocking action should be carried out within the operating mechanism, on the one hand to some extent to reduce the connection in the loop and the power of some links, but also to some extent, increase the reliability of some of the locking action And stability. In the actual operation of the power system, if the operating mechanism in the circuit breaker lacks two kinds of reclosing and the related locking contacts of the tripping, it also needs to make the locking contact be effective in the circuit to some extent to carry on the research. And to ensure that the circuit breaker blocking action and alarm functions work together to ensure that the power system is more excellent and reliable.

4.2. Wiring problems of the lock circuit
There is a certain difference when circuit breaker voltage level and operating mechanism in the latch circuit. Under normal circumstances divided into working medium blocking circuit and the operation of the power lock circuit. Circuit breakers of the closed circuit in the power system should use some abnormal concentration of media in order to better prevent some dangerous situations when the power is working, resulting in the operation of some circuit breakers. Power circuit operation in the power block circuit breaker is prohibited operation. Breaker operation is prohibited in the operation power
lockout circuit of the power systems. Once the circuit breaker can be used in the screen saver operation, the reclosing lock contacts and the closing lock contacts need to be protected to a certain extent.

4.3. Double wiring configurations of the lock circuit

Nowadays our country's power grid is 220kv and such a voltage is high-voltage, the use of relay protection in the circuit system could ensure the previous reliability and sensitivity of the circuit, and to some extent to ensure its protective effect. Therefore, we should use the relay protection device and the dual configuration of internal settings under normal circumstances at this stage. On the one hand, the dual configuration can ensure that it can reduce the influence of the protective and reactive action of the circuit breaker in the relay protection to a certain extent, and it can also ensure the protection behavior in the closed circuit of the operating mechanism and the operating power supply. The circuit mainly applies the dual configuration in three important aspects of the circuit breaker: operating mechanism, the blocking circuit and the operation power supply, and it can design standards and arrangement numbers through certain wiring loops, consistent components and consistent operations, and finally achieve the control of two sets of latching relays.

5. Problems of circuit breaker pressure closed loop lock

5.1. Permanent failure within the power system

At present, most of the power systems in our country have a protection mechanism inside. Once the power system has a serious fault, its internal protection device can immediately work according to the environment and device characteristics, and then interrupt the circuit breaker to better ensure that the related circuit tripping action. And after the one-time reclosing moving is over, it can accelerate and then jump off the circuit breaker, so you can ensure that the circuit in the system can complete many separate merging circuit breaker cycle effectively. Under normal circumstances, in the daily power supply process, the circuit breaker operating pressure is always in the case of closing the lock, and the closing circuit needs to be automatically disconnected. At this stage, because most of the power system installations in our country are relay protection devices, when there is danger, the position of the circuit breaker can be judged to make the circuit reclose and then the protection device can be operated to make the circuit breaker in place.

If the power system circuit breaker working time is too long in the process of power system work, it will exceed the reclosing charging time, and it can ensure that reclosing automatic charging when the circuit breaker operating mechanism pressure recovers. In the power system, if the circuit breakers always appear some single-phase coincidence and comprehensive coincidence, the pressure trip and latch-up will eventually have some associated situation. Under normal circumstances, if the circuit breaker pressure reclosing operation based on the value. On the one hand, it will cause the reclosing to occur at the same time, on the other hand, it will also cause problems in the communication process of the three-phase tripping. Eventually, some faults will appear in the power system, causing adverse consequences eventually.

6. Problems of circuit breaker operation Pressure lockout circuit

At this stage, the grid voltage in China's urban power is 220kv, the power company meet the requirements of the relay protection device and make double the device settings in order to protect the power system more effectively to resist the protection of the situation. In addition, in order to prevent the occurrence of runaway protection of the circuit breaker, the power unit should be able to dualize the operation of the grid tripping operation element, the circuit breaker circuit box and the power supply in advance before the fault occurs the configuration. And, once circuit problems occur in the power circuit breaker components, then it is clear that it will on the one hand cause the first group of power failure, it can also ensure that it switches to the second group of power supply automatically. In order to better ensure the relay power supply, thus ensuring the second set of power failure. When the whole circuit breaker in the power system loses operation power, it will cause some accidental expansion if it
encounters fault rejection. In order to better ensure to reduce or avoid this situation, some closed circuits need to use one of two sets of power supply, and should be able to use a certain power supply relay pressure lock expansion and pressure lock control and circuit breaker internal components blocking situation, there will be some problems.

7. Circuit breaker lockout situation of relay protection

7.1. Circuit breaker lock valid position of relay protection
In the power system at this stage, the operating pressure of the circuit breaker will make the reclosing lock become an important means of protection circuit. In addition, the internal components of the circuit breaker should be blocked during the protection trip, and it can take some prohibited operating functions. At present, so many internal components of the circuit breaker have a very important significance as closing trip and closing of circuit breaker operating elements. On the one hand, it can effectively reduce some unnecessary intermediate links, in addition, the relevant cables can be connected in the circuit to implement simple operations in the loop. Power system pressure lock also has some higher reliability. Once there is a problem with the internal components of the circuit breaker, this can lead to a reduction in its pressure and then control the operating point and manage the blocking trips and the closing trips. In addition, to better protect the pressure lock function, it must be through a certain signaling system, promptly notify the internal duty staff and operators to ensure that timely introduction of three important contacts, and then protect the screen.

7.2. Research on circuit breaker blocking circuit in relay protection
In China's power system, in order to more effectively protect the internal pressure blocking circuit, the internal pressure of the circuit breaker needs to be effectively reduced during the operation of the screen, until the blocking trip, the reclosing and the closing of the circuit breaker appear. In actual operation, we directly reduce the internal pressure coincidence point, to ensure that it can make the closing of the closing contact timely connection, in order to achieve the purpose of prohibiting the operation of contacts and contacts between the joints. During operation, as long as we ensure that all the pressure-lock contacts can be connected, there should be an operation diagram inside the operating structure so that it will return due to the loss of some magnetic fields. In the power system, if its internal circuit breaker operating elements lock reclosing and closing are in the protective screen inside the operating box should be carried out in advance of the internal locking function of a certain amount of research and handling to ensure that the internal closing pressure lock of relay protection operating elements. The internal closing pressure lockout is in an executable state and allows pressure to be placed in the system's internal protection and the contacts are no longer able to perform the blocking task in the power system.

8. Achieve pressure lock of the circuit breaker operating mechanism effectively
In order to more effectively reduce the pressure on the circuit breaker operating mechanism, to realize the three important operation functions of the closing and the blocking trip effectively, which can not only reduce the connection of cables but also reduce the internal intermediate links to a certain extent and make the operation of the circuit breaker more simpler and safer, increasing the reliability of the internal pressure lockout. However, if there is a contact that can reduce the pressure inside the circuit breaker operating mechanism, a blocking trip and an operating prohibited contact, on the one hand, a pressure-lock is achieved to a certain extent. On the other hand, an effective signal can also be issued to inform staff for safety inspection and repair, it will only be effectively connected to the three points into the protection of the screen, then effectively complete the above functions.

To achieve a better dual DC power supply, trip circuit, pressure lock contacts and pressure lock several devices completely dualized, the circuit breaker manufacturers should also control the circuit breaker two groups of pressure lock relays should provide two completely independent lock loops to effectively protect the manufacturer's operating box internal device. In the process of power system operation, in order to better ensure the effectiveness and efficiency of its operation, it should be to some
extent more effective protection of its internal pressure lockout and circuit tripping, power supply pressure lock dualization, many manufacturers have to be based on Power relay protection requirements, the effective provision of spare latch contacts and latch-up circuit, such a system requires at least two or more sets to make the power system safe operation, better control of pressure lockout relay.

9. Conclusion
In summary, relay protection should be a problem that cannot be neglected in the daily operation and maintenance of power system. The phenomenon of pressure blockade often occurs in a variety of systems. This situation will lead to many circuits cannot be used normally, the quality of the power supply for the power companies themselves will also have some problems. Therefore, in this context, many related power workers must take some strategies to solve the above problems, in order to more effectively help the power system in the overall high-quality operation, to create more favorable power companies’ economic benefits, to ensure the healthy operation of power enterprises development.

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