

Study of Relay Protection Fault Analysis and Treatment Measures for Power System

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Abstract

With the development of the power industry, people's demand for electricity is growing, there is a contradiction between the current power resources and user demand for electricity, the main reason is that the substation operation there are some problems, causing power resources hard work. Relay system has excellent features, it is effective and safe protection measures, it can not only reduce the time the error was found, but also narrow the scope of failure, to ensure the normal operation of the other components. The article first analyzes the role, composition, requirements of relay protection, and then analyzes the fault analysis of power system protection and treatment measures; the final analyzes the question of the relay protection substation operation. Substation operation on problems and shortcomings of relay protection were discussed, and put forward some countermeasures on how to improve relay protection. Relay protection device may shorten the time of cutting equipment, reduce the probability of non-faulty devices removed, and alert information via automation. Because of this strong utilization, deterministic, high reliability, it has become the most effective measures of relay protection. Modern technology can not do without electricity, people's social life is inseparable from power, and so strong relay protection system has become increasingly a major problem.

Keywords: power industries, operation, relay protection, strategic

1. Introduction

With the national economic development, electricity filled with every aspect of people's lives, and even some high-end industrial development is also inseparable from the support of the power system. And technology continues to develop, the power system is constantly updated sound, even so, there are some defects and shortcomings, the faults occasionally occur, which use a protection system for power automation protection. Relay system has excellent features which are effective and safe protection measures. It can not only reduce the time the error was found, you can narrow the scope of failure, to ensure the normal operation of the other components.

Protection is with the development of power systems and developed. Early 20th century with the development of power systems, relay protection of power systems have been widely applied, and this period is the beginning of relay technology. The first device is a fuse protection. From the 1950s to the late 1990s, more than 40 years time, protection completed four stages of development, from the electromagnetic protection device to the transistor-type protection device, the integrated circuit protection devices, then relay protection [1].

With the rapid development of electronic technology, computer technology, communication technology, artificial intelligence techniques such as artificial neural networks,

genetic algorithms, evolutionary scale, fuzzy logic have been used in research in the field of protection, protection of technology to computerize network, integrated, intelligent direction.

The last 25 years of the 19th century, as the first fuse protection devices have begun to use. Development of power system, the power grid structure is becoming more complex, increasing the short-circuit capacity. To the early 20th century it had a role in protection devices electromagnetic circuit breaker. While in 1928, it has begun to be applied to the electronic device protection device, but a lot of promotion and production of electronic type static relays, but after 50 years of rapid development of transistors and other solid-state components to be realized. Static relay has high sensitivity and operation speed, easy maintenance, long life, small size, power consumption, etc, but easily influenced by the ambient temperature and outside interference. In 1965 there has been the application of computer digital relay. The universal application of the rapid development of large scale integrated circuit technology, microprocessors and microcomputers, greatly promoted the development of digital protection technology, the current computer is in the ever-changing digital preservation research and test phase, and has a small unit official.

Relay means a huge role and influence in the protection of power systems, along with economic development and urban development, all walks of life to work on the power system power requirements are increasingly high, the power system related science and technology, scientific methods are constantly upgrading, rising, many problems will be followed by protection devices, the emergence of new changes in the new form, to carry out relay protection work, the need to constantly towards digital, information technology, network development, toward the intelligent forward, which requires the relay staff constantly learning new knowledge, new technology, and protecting relay protection, promotion of new technology applications, to enrich and improve the power system-related technology industry theoretical study provides a steady stream of power.

With the power system capacity is increasing more and more widely, setting only protection device for each element of the system, it can not prevent the occurrence of a serious accident the whole long-term large-scale power system blackouts. So we must start from the overall power system, Fault element is the corresponding action of removal protection device, the system will show what kind of conditions, what kind of features will appear when the system loses stability, how to restore normal operation and so on. The task is to protect the system when a large power system uptime is destroyed, as far as possible to limit its scope to a minimum, reduced to the minimum load power outages. In addition, machine, furnace, electric faults that affect any part of the power production safety, especially the interaction and coordination of large units and large power systems is becoming a major issue of power production safety. Therefore, configuration protection and security automatic equipment design and manufacturing systems should consider varying bearing capacity machines, stoves and other equipment, machine, furnace equipment should also fully consider the actual needs of the power system safe and economic operation. For security giant turbines, promotion failure prediction technology is not only to maintain a good protection, but also research.

2. The Fault Analysis and Treatment Measures of Power System Protection

2.1. The Basic Concept

Reliability of the device embodies all that has the ability under its operating conditions. The reliability of the device and the failure of the data have a direct relationship and its processing difficulty. Devices running situation, the cost situation determines the evaluation standard of reliability. If it is working under the conditions allowed and then fails, the relay

device should not have refused action; under other conditions should be protected without action, the relay device may not cause malfunction. Whether tripping or malfunction occurs, it will cause harm to the power system equipment. Because there is a difference between the structure of the power system and load capacity, it has the different nature of damage [2]. Tripping and malfunction of maintenance measures is often contradictory. Ample space within the system of rotation, many transmission lines, close links between the various systems, the link between the power supply and the load close, this state if the relay device malfunction occurs, directly to transmission lines and generators transformers removal, so the smaller the damage caused. In the state of transmission lines and generators, transformer failure, tripping relay device, it will cause huge damage to the power system, destabilizing power system, damage to electrical equipment. In this state, the relay device does not refuse to move with respect to the malfunction, have greater significance; however, if the rotation is not sufficient space within the system, power supply system carrying not closely linked, if malfunction occurs at this time phenomenon, transmission lines and transformer load power supply is cut will lead to failure of, or damage to the whole state. Losses is difficult to predict. At this event tripping, faults can be completely removed, and therefore, in this case, with respect to not refuse to move, take the lift means there will be no malfunction of greater significance *et al.*

2.2. The Role of Relay Protection

Protection generating element hysteresis, the relay device may be self-protection, automatically identify component failures, and then removed, the overall security protection. Element can not continue to cause damage, reduce the impact of power outages surface. Damage to protected components produced unusual situation occurs, the relay will respond quickly, in accordance with the transmitted signal, reducing its load, and then a trip at this time, does not require a protection action immediately, to the extent of damage to components, take the length of time necessary to ensure its security, stability stop. Target relay device can always get the voltage and current figures, in order to achieve the reaction of power system operation is important for a power system of regulation.

2.3. Composition and Requirements

Including some input protection devices, measurement, logic, output execution. Input refers to the signal pre-processing, to ensure that on-site physical appliance can effectively detect, such as isolation, level shifting, low-pass filtering. Measuring signal output according to the required output order, size, logic state, properties and the like, after a reasonable calculation, according to the final fixed logic to perform an action, into the final output by a logic signal[3]. Relay device has a fast, dynamic, selective, flexible and reliable features, specific objects can be removed to protect the rest of the circuit, to achieve the goal of reducing the damage, no part of the fault generating circuit can also continue to run, improve work efficiency, reduce the sheer scope of glitches and achieve standby equipment, automatic reclosing automatically put into effect. While the failure of response action in the first period is completed, the situation is not normal for sensitive and efficient manifestation of a very high reliability and stability.

2.4. Relay Protection Common Fault Analysis

Improper selection switch protective equipment. Because most of the high-load, densely populated areas are required to establish the distribution switching stations, substations that supply mode that is - switching stations - distribution transformers, switch choose effective

protection devices also have important meaning that some relay switching station does not yet have the ability to automate, you can take to protect the load switch on the power system.

Current transformer saturation fault. Since the load terminal equipment is increasing, short circuit current is generated when the generated also increases, so the relay device is subjected to saturation effects from the current transformer, also increased. Short circuit occurred near the location of the system terminal device, the current generation will be close to or more than 100 times the rated current of a single current transformer, the current transformer error and short circuit current is proportional to maintain multiple relationships, prevent action also due to the current quick break, when reduced sensitivity. Definite time over current protection devices will short-circuit caused by current transformer saturation, resulting in their perception of the secondary current is close to zero, and then the operation will not be issued. Position in the export line, over current protective devices reject action, thereby promoting the occurrence and distribution of imported line protection action, will cause the entire power system blackouts.

2.5. Relay Fault Handling Methods and Measures

Measures to ensure the normal operation of power system protection. To ensure the normal operation of the power system to ensure the smooth progress of the whole work, and the need to further improve the system, based on the work of the required content protection, rational targeted want to specify an effective management system, promote conservation coordination expand, science configuration of personnel and the rational allocation of tasks to staff and improve efficiency. Active protection equipment operation and maintenance, periodic calibration, defect treatment, accident analysis, strict examination by computer management system, follow-up inspection, the implementation of incentive measures. Achieve secondary equipment condition monitoring.

Common treatment failure protection. Replacement method: Using intact parts replacement of defective elements, and then determine the fault, is conducive to rapid narrowing the scope of failure. Reference method: the parameter stability of the device to control the parameters of the faulty device, then found fault lies, wiring mistakes or check the setting value and the expected value out of the test is large, this method is widely used. After the replacement, repair faulty components, after the second wiring, still there is a fault, then the control wiring similar devices need repair, testing for performance, you can replace the relay scale, or with reference to the same table and the same relay circuit[4].

Short connection: used to further identify failure range, which uses short-circuit to be short a period to detect the existence of this short range failures. General switching relay does not act, failure electromagnetic locks, current loop open fault has a valid application, you can quickly switch contacts to make a determination is intact.

3 Protection Devices within the Substation Operation Mode

3.1. The Basic Task of Protection

When the power system failure or abnormal operating conditions, in the shortest time possible and the minimum area is automatically removed from the system, faulty equipment, or signaled by the staff on duty to eliminate the root causes of abnormal operating conditions, to reduce or prevent damage to the equipment and the impact on adjacent areas power.

3.2. Power System Fault Classification

Power system fault classification is divided into horizontal and vertical fault two categories. Transverse and longitudinal fault was divided many kinds, no matter what kind, will make non-normal operation of the power system, the power system made damage, affecting people's daily lives, and accelerate the consumption of the various components of the power system. Therefore, to maintain the normal operation of the power system is very important, protection devices is an effective measure of power system protection.

Relay protection devices for the role: protection devices extremely strict hardware requirements, not only the four basic requirements, but also the sensitivity and reliability requirements. The sensitivity coefficient and reliability must be moderate, otherwise can not effectively protect the power system. But only maximize the use of protection devices, in order to make the power system running smoothly, without causing socio-economic and people's power loss [5].

Protection devices workflow and performance advantages: the role of protective relays, maintenance personnel can quickly identify the problem with the power system, reduce testing time, timely repair of the electric power system in order to ensure the smooth operation of supply. If there is no protection equipment for power system protection system, the power system is prone to a number of accidents caused by the condition of the whole area of the power outage, and after the protection relay system, the substation will reduce the power system due to hardware failure caused some of the situation does not work happen.

3.3. Protection Devices Operating Mode

Within the electric power system protection and automation equipment of various types such as various types of transformer protection, line protection, bus protection, fault recorder, low-voltage load shedding equipment, small current grounding line selection device, VQC devices, which were adopted by cable current, voltage analog and related equipment status once the required amount, after its own internal changes to digital by analog-digital conversion carried out by means of internal microcontroller and logic operation and exit actions and signals.

We can run from the traditional model of the specific protection devices are summarized below.

(A) Protections devices need to enter include: the protected object by the current, the voltage and related equipment operation amount of time.

(B) Internal protection devices for sampling, computing, logic: through internal procedures, algorithms and logic rules and other protection devices were.

(C) Protection device output: from the content output apparatus includes a signal packet, export action level is equal to the corresponding state.

In the 21st century, with the rapid development of microprocessor-based protection devices are widely used and computer technology, computer network technology based integrated automation substation from scratch and gradually replaced the traditional substation become an important component of the power system section. In the integrated automation substation, the various types of relay protection and automation equipment such as various types of transformer protection, line protection, bus protection, fault recorder, low-voltage load shedding equipment, small current grounding line selection device, VQC devices, due to historical The reason, which are independent of the development of computer hardware entities, various types of protection equipment, measurement and control equipment, utility equipment, stations with AC and DC systems, network communications equipment have become integrated automation substation network architecture nodes, each grade voltage

analog, each interval current analog and a device state volume has passed the station and control unit is converted to digital, network transmission Canon station to monitor background and superior dispatching department (or centralized control station) for the operation, Staff automation system to monitor the situation in real time.

3.3. Relay and Run Category

A. Current Protection

Definition: The reaction was instantaneous action current increases and current protection, called Current Protection. As the name suggests current protection should focus on speed and mobility. Some power system fault current will increase, since the current far exceeding the load current.

The protection system will quickly alert, the failure of the component removal, this action requires only a very short time, the basic characteristics of speed and mobility of current protection provides the basic conditions, and provide a viable basis [6].

Setting principle two ways to solve conflicts.

To resolve this conflict, there are two ways, the first is to ensure that the system of selective and narrow the scope of removal of faulty components, a section of the filter, the removal of a section, excluding all non-defective elements. The second is the current protection, but such protection is no selective advantage is selective as to quickly remove the fault of the component elements, but such protection higher requirements for speed and mobility, not the first highly feasible . So the first approach is the most common, and the second only in the first NA or not fast time will be used.

B. The maximum and minimum operating mode

Run maximum three-phase short circuit current and the device current maximum, and minimum operating mode is just the opposite. Different operation modes with different sub-post and telecommunications, each operating mode needs to find the corresponding devices in order to play its potential to help the power system. Run by the largest current maximum, so that the power system can work faster and better, but the problem is easily prone to cause damage to the device, and minimum operating mode even after a short-circuit current is small, it can ensure the maximum element use, reduce damage to components, to ensure the smooth operation of the power system.

4. Problems Substation Operation of Relay

4.1. Problems Substation Operation

A. Equipment aging

With the continuous development of society, people's daily production and life become increasingly dependent on electricity, the demand for electricity is growing, sometimes even supply shortage phenomenon occurs. At present, demand for electricity power resources and users appear contradictory, since the long-running power equipment, heavy load, leading to some of the equipment affect the efficacy aging occurs. In addition, affected by temperature, the life of electrical equipment parts gradually reduced, mainly due to the equipment generates a high temperature in the long course of the operation, if the temperature exceeds the tolerance limit of the equipment led to equipment aging and shortens life. And poor protection of substation equipment, due to the extensive distribution grid, increasing power equipment and the location of scattered pose a challenge to the management. Under personnel are not sufficient in the case it is difficult to achieve a comprehensive inspection of electrical equipment, electrical equipment on the existence of safety hazards.

B. Security Management

Substation operation problems are mostly caused due to improper network management. First, the scope of the traditional power grid involved is relatively small, and now management personnel are still using the traditional management model, the inspection tasks and management tasks assigned to go, but China's power grid after the upgrade, especially in the substation operation, the traditional management model difficult to meet the needs of modern power system management, leading to a lack of management and safety management difficult to proceed smoothly, secondly, rules and regulations related to substation operation management are not implemented, even as decoration, leading to lax safety management. Again, improper management, primarily managers substation operation itself low educational level, no deep understanding of the importance of management and scientific management difficult to achieve. Finally, there is no incentive to rely on staff management enthusiasm is not high. Substation operation management because there is no set up appropriate incentives, making it difficult to inspire employees involved in the management of enthusiasm, may be due to staff negligence will lead to serious problems [7].

C. Design and manufacture of equipment problems

Through relevant personnel substation accident occurred in operation investigation and study, found that the majority of the causes of accidents and power equipment design, manufacturing failed a great relationship, and even some electrical equipment manufacturers in the interests of the sending substandard electrical equipment to the grid, causing security problems substation operation, so the substation equipment before using it if detailed tests, checks to prevent accidents caused by equipment problems.

D. Problems grid structure

When the grid just building and did not take into account the future expansion of the grid, resulting in the presence of the grid structure constructed unreasonable, especially after the population increased electricity grid extension did not meet the design requirements, resulting in inconsistent power supply and electricity demand in particular peak of easily lead to overloading the power grid problems, when you select power cuts, affecting the normal use of electricity users. Power system due to the grid structure is irrational is difficult to further development.

4.2. The Role of Relay Protection Substation Operation And Troubleshooting

A. The Role of Relay Protection

Relays belongs to electronic control device having a control and the control system, control system, also known as the input circuit, the control system, also known as the output circuit, the relay is often used in automatic control circuit aspect, in fact, it is with a small current controlling high current "automatic switch", having a switching circuit, the security circuit, automatic adjustment action. Complementarily between the relay and the grid, through security role relay substation operation to promote safe and smooth, while the circuit control and protection [8].

B. Measures to remove faults

Understanding the classification of protection in favor of substation equipment for better protection. Depending on the degree of influence can be divided into three categories namely: general, serious, threatening. Depending on the cause may be the fault of three kinds: Component quality, poorly designed anti-measures are not implemented, operations personnel issues. By understanding the different types, we can facilitate the timely analysis of faults and problems, determine the attribution of responsibility as soon as possible, so as to prevent the recurrence of the same fault.

Managers should strictly check the stand-alone device, and statistics. The main circuit running reclosing device, backup power automatic switching device, the switching operation box, voltage switching devices and transformers, circuit, a capacitor, the mother is poor, reactors and other protective devices and other safety automatic devices, strict inspection, statistics, and to keep good records.

In substation operation, the relay itself, while having an important role but there are some drawbacks. By understanding its defects, it is conducive to the normal operation of electrical equipment, also help to improve personnel management and knowledge management standards, protection equipment when problems arise, managers can timely, skilled resolved. While the problems and solutions make a record, easy to improve the protection equipment and promote the efficient operation of the grid [9].

C. Measures to improve the operation of the substation relay protection

First, accelerating improvements in protection operation in intelligence. Intelligence is an important measure to improve the reliability of protection, but also intelligent technology innovation. With artificial intelligence application in more areas, and promote the development of various sectors. And in the power system, also introduced advanced concepts and technology. In power system applications of fuzzy logic, genetic algorithms, evolutionary programming and neural network technology, and applied research is in the field of protection of intelligence to also constantly deepen. Artificial intelligence technology to the development of the power system has a major role, it not only promote protection device performance and stability, and can effectively control the number of unreliable factor itself continuity protection devices, work hidden so on. It has a fast processing capability with the powerful advantage of logical thinking. In the power system, especially for protection work, the popularity of artificial intelligence, application protection operation is conducive to improving reliability.

Secondly, the use of digital control device with excellent performance. Using this digital control device will help improve the quality of protection. In the field of relay protection, FPGA (field programmable their array) and CPLD (complex programmable logic devices) are widely used. The protection of these two devices have a strong advantage, which is characterized by highly integrated functions, and can set multiple computer systems functions on a single chip. Using this digital control devices bring electronic system design greatly change. Such a control device facilitates rapid response protection system, highly integrated, but also beneficial to improve reliability. At the same time shorten the development cycle of the protection device, to some extent; improve the reliability of the protection operation to provide a guarantee [10].

Finally, how to deal with failure protection operation when, from the following aspects: First, the operation of the relay device for tracking purposes. This time understanding its operation, when failure to timely treatment, so as to ensure the smooth operation of equipment and safety equipment; second, so early prevention. That in the absence of failure, the equipment for security management, master the fault data to understand their nature, timely analysis and to develop appropriate measures to facilitate the arrangements for the staff eliminate the fault as soon as possible.

5. Conclusion

With the development of national economy and update of power system, relay protection become the important measures to maintain the normal operation of power system. Relay protection system operation is complex, not only has strict requirements to the current, and at the same time also has a strict control on the performance of the hardware. Managers and executives need to improve their power system and its automation expertise reserves,

professional quality with its own practice for better relay protection system development. Only the sound and rapid development of relay protection system means to make the power system steady and rapid development, to facilitate people's daily lives, and to improve the countries economic and machinery industry, and even high-end industrial countries have a positive impact indelible.

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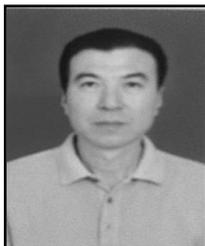
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