RELAY PROTECTION AND AUTOMATION OF COMPENSATION DEVICES

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Abstract: *In this article, you will learn about the reactive power balance, which is one of the pressing problems in the electrical power system today, and the devices that ensure this reactive power balance, that is, reactive power compensation devices, study their operating modes and protect them. devices from abnormal operating modes. You will become familiar with the methods.*

Keywords: *Reactive power and reactive power balance, capacitor bank and its operating modes, compensating structures, relay protection devices and circuits.*

Introduction: Electricity produced at power plants is transmitted to consumers from power grids simultaneously in the form of active and reactive energy. If some consumers consume useful active power from the network (spiral lamps, heating devices, stoves). Other elements that have an inductive load in the consumer circuit are not only active during operation, but also consume reactive power to create electric magnetic fields (electric motors, welding and coil transformers). When an active-inductive load is connected to the electrical network, the current I lags behind the voltage U by an angle φ. The cosine of this angle (cos φ) is called the power factor. Electricity receivers with such a load consume active power P and reactive power Q.

Reactive power compensation involves the generation or consumption of reactive power using compensating devices. Reactive power compensation is carried out to ensure reactive power balance, reduce energy losses in networks, and regulate voltage.

Main part: Reactive power compensation in the power system is one of the main issues. A lack of reactive power in the network leads to a voltage drop in the power system. Voltage is one of the main indicators of quality in the power system; its value

below the nominal level leads to the fact that products become unusable (break down) in industrial enterprises, the work process stops, and the operation of the power system is disrupted. To prevent such situations, it is necessary to compensate for reactive power, and reactive power compensation ensures the operation of the power system in nominal mode.

Reactive power compensation (production) in industrial plants is slightly better than production in power plants. A clear confirmation of this is that in our republic, by resolution of the Cabinet of Ministers on March 1, 2004, the law "On the procedure for planning work on reactive power compensation" was adopted.

A capacitor bank, synchronous compensators and static elements of compensating devices are used as a reactive power compensation device. Synchronous compensators are mainly used in power transmission and distribution substations because they consume reactive power when there is excess reactive power in the network and, conversely, produce reactive power when there is a shortage of reactive power.

As mentioned above, asynchronous motors are consumers of reactive power. Asynchronous motors of industrial enterprises account for 60-65% of reactive power consumption. Considering the above, reactive power compensation at industrial enterprises is one of the main issues. They are widely used as reactive power compensation devices for capacitor banks in industrial plants, pumping stations, and electric motors used for the power plant's own needs.

Like other devices in the electrical power system, the capacitor bank also has abnormal conditions, and protecting the capacitor bank from abnormal conditions is one of the main issues.

In this article we will discuss abnormal operating conditions of capacitor banks, the operating process that occurs in a capacitor bank in abnormal conditions, the reasons for the occurrence of abnormal operating conditions, methods of protection against abnormal operating conditions, and the choice of relay protection. devices and get acquainted with their connection diagrams.

Types of protection and circuits of capacitor banks.

The entire type of relay protection used in capacitor protection can be divided into three:

- General battery protection;
- Group protection;
- Individual protection (capacitor sections).

The general protection of all capacitor devices includes: multi-phase short circuit protection, single-phase earth fault protection, overload and overvoltage protection.

In general, protection of capacitive devices from multiphase short circuits is carried out for any capacitor connection schemes. This protection should work to increase the performance of capacitor devices without downtime. In capacitor devices operating at low voltage, such protection is carried out using protectors and circuit breakers. In high-voltage networks this is done using fuses and relay protection (Figure 1).

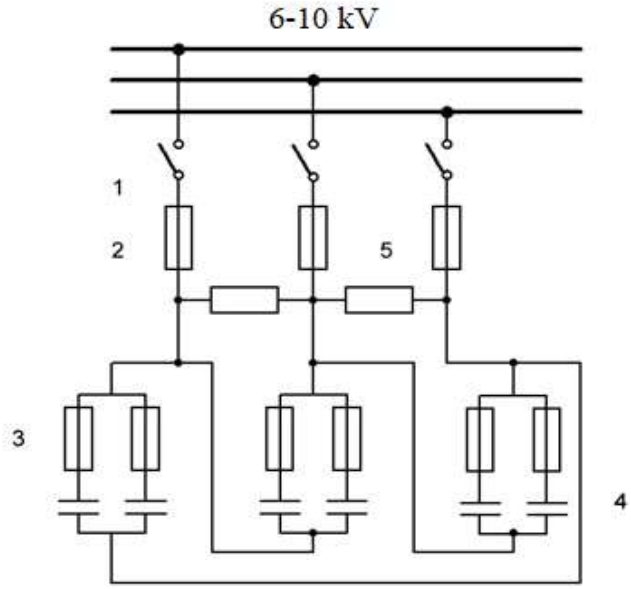

Figure 1. Diagram illustrating the implementation of capacitive device protection using capacitors. 1-disconnector; Storage of the 2nd protection device; 3rd group of protection of executive storage; 4-capacitors; 5-phase resistors.

Summary: The reactive power balance has a direct impact on the operating state of the power system, especially industrial enterprises, so it is important to install reactive power compensation devices or reactive power sources. In conclusion, we can say that it is necessary to protect reactive power sources or their compensating devices from abnormal operating conditions, and it is important to do this correctly and reliably.

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