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RESEARCH OF PROTECTION, OPERATING MODES AND PRINCIPLES OF CONTROL OF CAPACITOR UNITS (CU)

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ABSTRACT

Improving the device is one of the key issues in this regard, which is important in terms of the importance of the KU device in industrial reactive energy coverage and system management The device is basically 380 V, The protection with a capacity of 6,10 kV is selected taking into account the disconnection of capacitors from the on and off currents.

KEYWORDS: *Connection Diagram, To The Stator Terminal, To The Group RP, To The 0.4 Kv Switchgear, Individual, Group, Centralized, By Time, By Current, By Voltage, Low And High Voltage KU, Principles Of Current, Voltage, Time.*

INTRODUCTION

Protection of condensing units. When switching the KU, overvoltage's and current surges occur, especially when switched on for parallel operation with. other batteries or sections. Special high-speed switches are required, which have overestimated wear resistance of contacts.

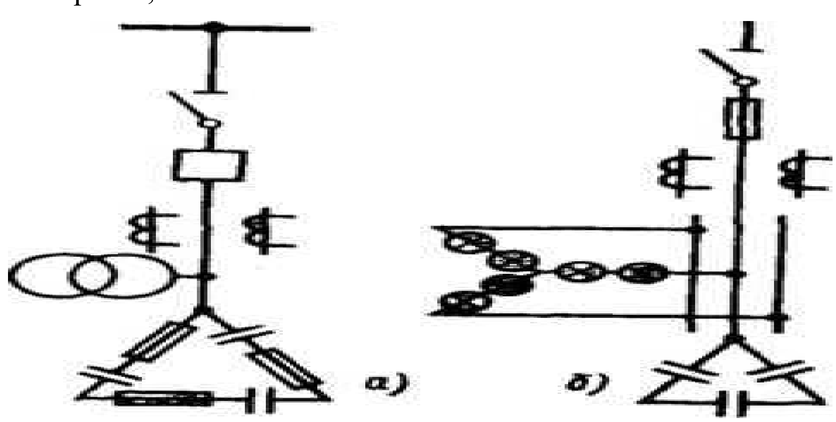

Fig. 1. Schemes for connecting capacitor batteries (KB)

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a - through a 6-10 kV switch; b - through an automatic 380 V.

and mechanical parts designed for such throws and allowing frequent switching. Conventional switches for a voltage of 6-10 kV, as well as circuit breakers and contactors of 380 V, not designed for a purely capacitive load, should be selected with a margin of at least 50% of the rated current,

KB protection is selected taking into account the detuning from the turn-on and discharge currents of capacitors. When protecting the KB with fuses, the current "by the insert bench iB, A, is determined by the formula

$i_B \leq 16.1 * n * Q_K / (\sqrt{3} U_Л)$

where n is the total number of KB capacitors (in all phases), pcs; Qк - rated power of a single-phase capacitor, kvar; Ul - line voltage, kV.

When protected by automatic devices, the latter must have a combined trip unit providing protection with a continuously variable current control. The setting of the current iy, selected on the basis of the overload capacity of the capacitors, should not exceed 130%, it is determined:

$\boldsymbol{i_y < 1,3 * n * Q_K} / (\sqrt{3} U_Л)$

In the presence of higher harmonics in networks, the probability of overloading of capacitors by current in resonant or similar modes is checked and measures are provided to prevent resonance phenomena.

For a quick discharge of capacitors after their disconnection, inductive or active discharge resistances R, Ohm are used, connected in parallel to the capacitor bank:

$R = (15 \cdot U^2_ф \cdot 10^6) / Q_K$

Uf — mains phase voltage, kV; QK is the capacity of the capacitor bank, kVAar.

Operating modes and control principles of compensating devices

In fig. 2 shows an example of a daily graph of reactive power for voltage regulation. The capacitor bank automatically turns on when the voltage drops below the nominal, and turns off when it again rises above the memorial. As a result of such regulation, the voltage does not go beyond the normalized limits 5%.

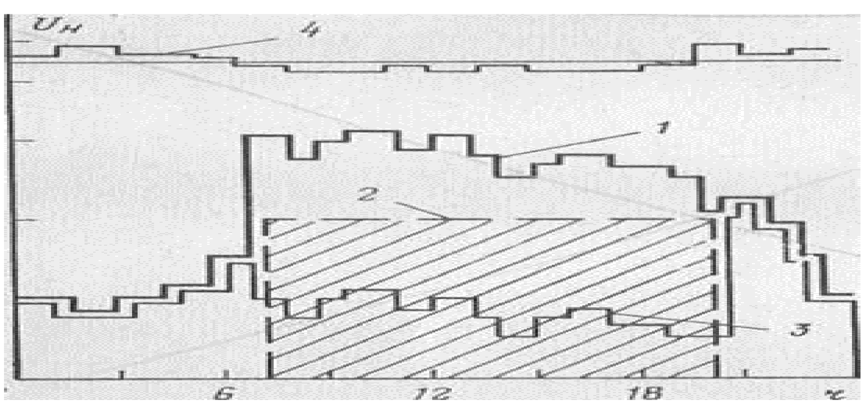

Fig. 2. Daily schedule for voltage regulation of capacitor installations

1 - consumed reactive power; 2 - compensated reactive power; 3 - reactive power after compensation; 4 - voltage change.

First of all, automatic regulation of excitation is used. synchronous electric motors, and then a partial regulation of the power of the design bureau is provided, depending on the nature of the daily load schedule of the enterprise. In three-shift work with even load traffic, as well as in small one-shift enterprises, regulation, as a rule, is not applied, since this is not necessary. The total power of the unregulated parts of the design bureau should not exceed the smallest reactive load of the enterprise. Power control of capacitor units can be automatic, manual or dispatcher using telemechanics or telephone communication. Automatic control of the design bureau can be performed by voltage, by reactive power, by time of day and by combined schemes, depending on several factors. At present, in most cases, it is possible to recommend automatic voltage, time of day and load current control circuits.

Compensating devices reduce electricity losses: and increase the throughput of power supply systems. With an uneven daily schedule of reactive load, the power of the compensating devices must be regulated, since otherwise, during the hours of minimum load, the voltage will increase, which leads to over-burning of lamps and other damage. In fig. 3. An example of the operation of a capacitor bank in four modes is presented - without regulation and with various types of power regulation. It can be seen from the figure that when the capacitor bank is constantly switched on at night and during lunch breaks, a porcompensation and an increase in voltage are obtained. Thus, the mode of operation: compensating devices should be determined not only by the tasks of reducing energy losses for the transfer of reactive power and increasing the throughput of networks and transformers, but also by the task of maintaining the optimal voltage level in the network.

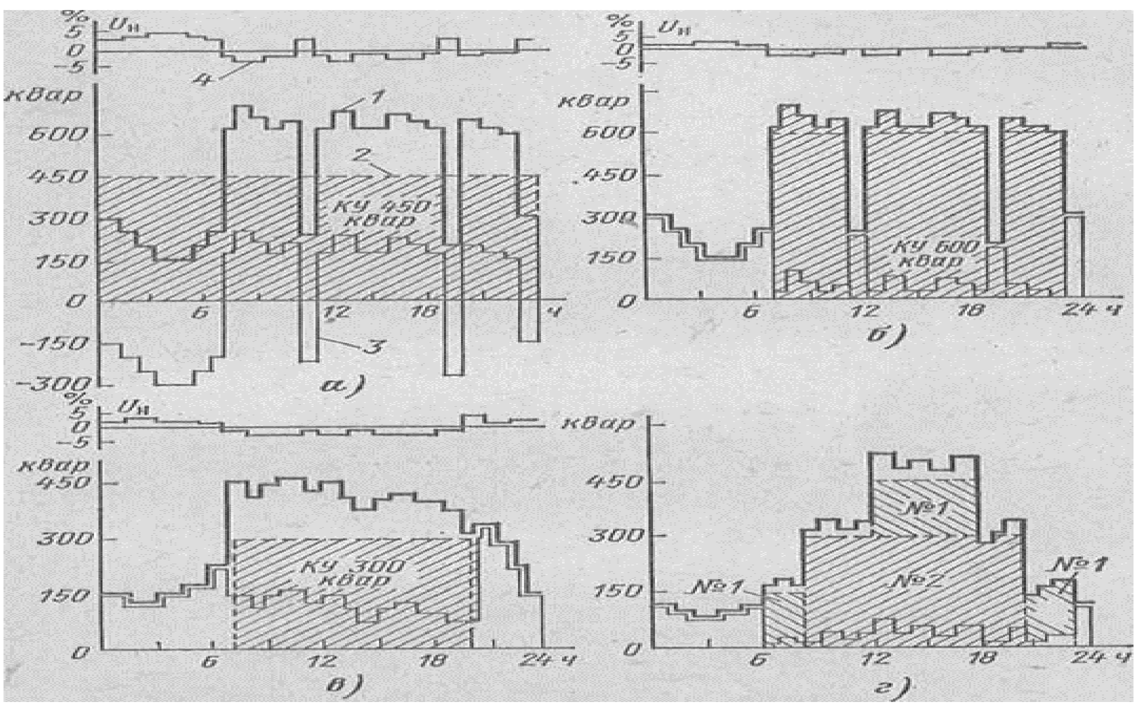

Fig. 3. Graphs of the consumed reactive power 'and its compensation by capacitor units. a - sweat regulation, capacitors are constantly on; .1 —consumed reactive power; 2 - reactive power, which is compensated by installations; .3 - reactive power as a result of overcompensation; 4 - voltage 'as a result of compensation; b - one-stage automatic regulation according to the time of day; c - one-stage automatic voltage control; d - multistage automatic regulation of the load current.

To compensate for reactive power in industrial enterprises are used: a) capacitors; b) synchronous motors and generators; c) synchronous compensators;

d) compensation converters; e) static sources of reactive power (IRM); e) synchronous generators and motors as synchronous compensators.

At a given power of the compensating devices O, - first of all, capacitors should be used (if possible with a voltage of up to 1 000 B, then - with a voltage above 1 000 V) and synchronous motors; at high reactive loads - synchronous compensators. Mercury and silicon conversion substations must be equipped with compensation converters. With the development of semiconductor technology, static IRMs should be widely used.

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