

BRAKING OF ELECTRIC DRIVE WITH THE DEVICES OF THE SMOOTH STARTING SERIES SSW

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Currently, the industry is widely used modern electric adjustable based on power electronics, including asynchronous electric devices of smooth start-up, such as a series of SSW. Specifications that are contained in the catalog data to it, give little information about electric transients, especially in braking mode. The article is devoted to advanced study of the mode of operation of the power thyristor block diagrams and corresponding voltage electric braking protyvmykannyam.

The purpose of research - more effective use of smooth start devices in asynchronous electric braking modes.

Materials and methods of research. Analysis of instantaneous values of voltage and operation modes of power semiconductor unit conducted using the theory of electric drive and power electronics and oscillographic investigations.

Results. The device of smooth start - an electronic device used for smooth start and controlled braking electric induction motors with squirrel cage to reduce inrush current or torque motor coordination from the point of load.

The need to limit inrush current due to electrical and mechanical causes of nature.

The causes of electrical nature are:

- Reducing the shocks of the current in the network. In some cases it is necessary to limit the inrush current powerful engines to the limit specified for the power supply.

- Reduction of electrodynamic forces in the windings of the motor.

The reasons of mechanical character limit starting torque engines are: preventing breakdown or quick wear broadcasts; slipping wheels moving cars; large accelerations or delayed, equipment or unacceptable for people in different means of transport (such as escalators, elevators) and others. Sometimes it is necessary to

reduce the starting torque even a small engine to soften blows to the programs and to ensure its smooth acceleration, prevent water hammer in pipes and bolts.

The dependence of the angular velocity of the induction motor voltage nonlinear. Because of the soft start speed control increase the complexity of implementation is now used. In most cases trying to implement control torque or electric shock. To do this, start the process of gradually changing voltage to the motor stator.

In devices such SSW smooth start feature provides a controlled braking electric motor. To this end, to accelerate the drive stops applying braking and dynamic braking permanent or rectified pulsating current. Sometimes it is necessary to brake BEFORE the fan stops rotating in the opposite direction under the effect of traction or other fan.

To ensure braking opposite inclusion function in the scheme of control devices of smooth start-injected two external contactors KM1 and KM2 (Fig. 1). KM1 contactor operates at propulsion mode KM2 - the brake.

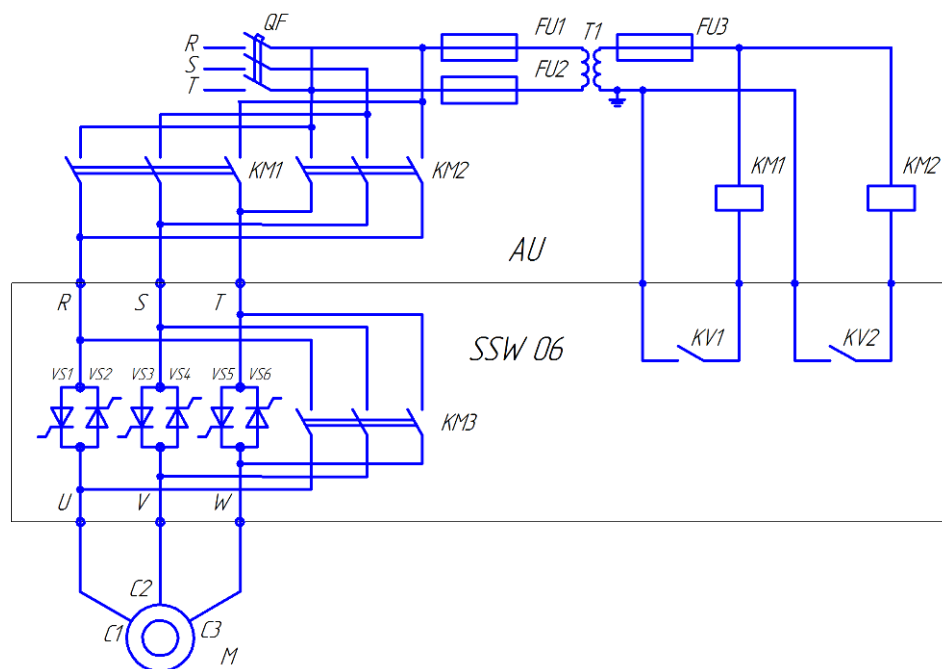


Fig. 1. The scheme switching device SSW06 smooth start inhibition

Manage contactor coils occurs commands microprocessor unit AU smooth start via relay contacts KV1 and KV2. After a smooth start of the engine bypass contactor

km3 blocking thyristor power key, thus increasing lifetime of thyristors and reduced energy losses in the power circle.

Algorithms braking process organized differently. In one case protyvmkannyam braking is to stop the engine, then the brake contactor KM2 off. This engine develops considerable braking moment, which gradually decreases to the value of starting torque.

Otherwise protyvmkannya way hampered engine speed to 20% of the nominal, then turn on dynamic braking pulsating current (Fig. 2). In both cases, bypass contactor km3 off.

Dynamic braking phase thyristor Continuous closed. Direct thyristor VS2 reverse phase A and phase C VS5 thyristor turn on letting the positive half-wave voltage network. Chart voltage at the output device of smooth start during dynamic braking is shown in Fig. 3.

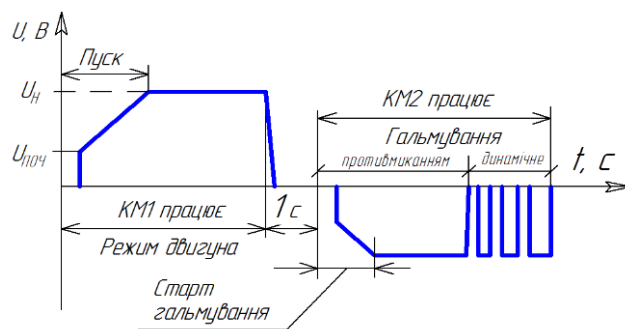


Fig. 2. The supply voltage operation control switches braking opposite inclusion mode

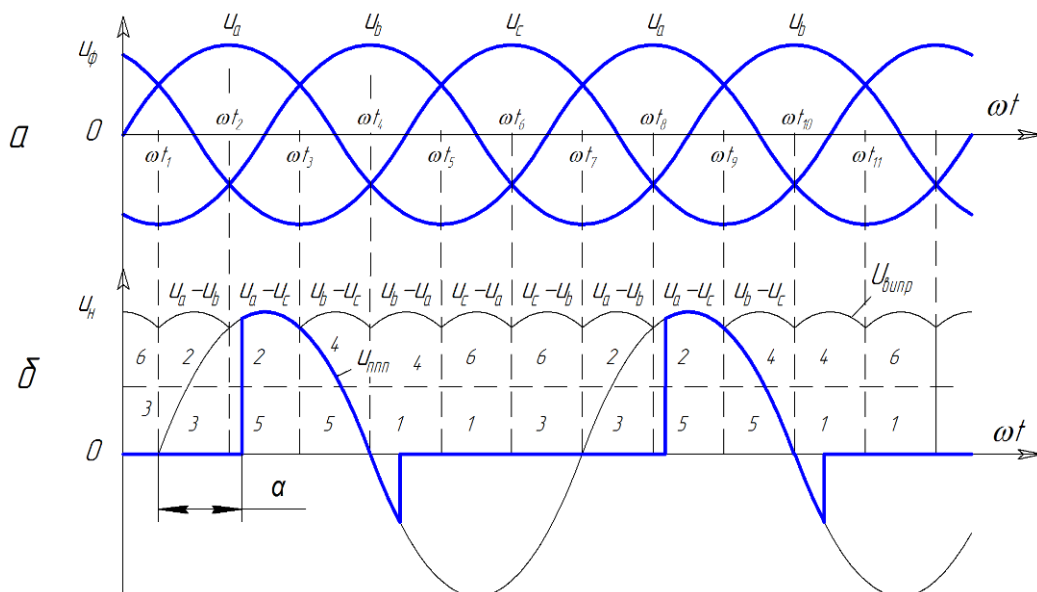


Fig. 3. Charts instantaneous values of voltage supply (a) and the output voltage converters with dynamic braking (b):

u_a, u_b, u_c - instantaneous phase voltage power supply; u_{PPP}, u_{VYPR} - instantaneous voltages respectively output device of smooth start-up and three-phase bridge rectifier; α - angle of triac opening

Oscillogram output voltage charged in the study of the electric device of smooth start and engine series SSW AYR90V4U3 dynamic braking mode, confirms our reasoning (Fig. 4).

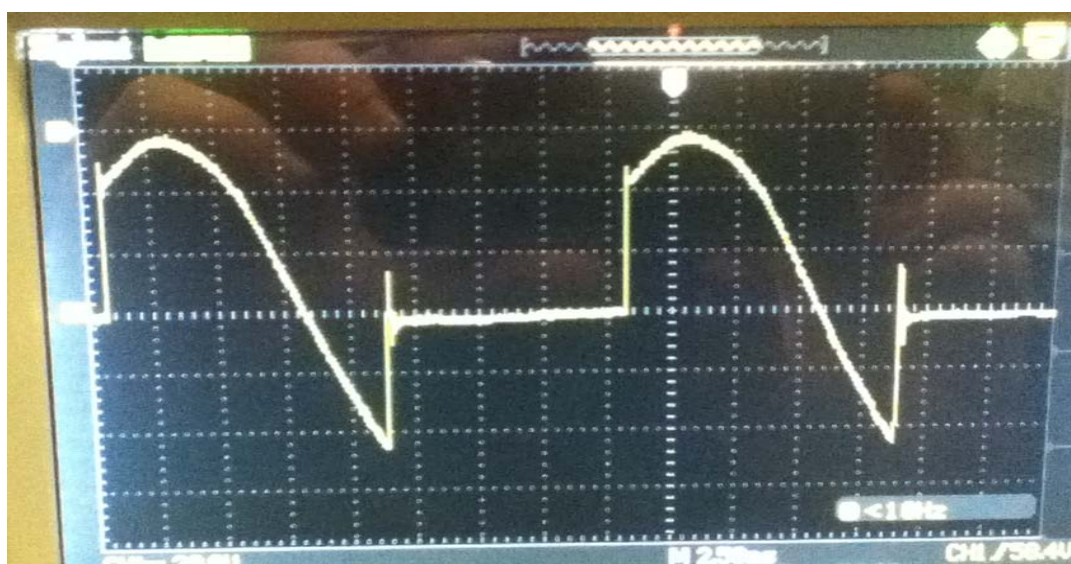


Fig. 4. Oscillogram instantaneous values of voltage pulses output smooth start device SSW-06 mode dynamic braking

After opening the thyristor voltage at the motor windings sinusoidal law gradually increases and then decreases (see. Fig. 3, B). When voltage drop thanks to the energy of EMF induction motor stator current braking is maintained after switching the supply voltage through zero. Duration of triac conduction intervals and VS2 VS5 growing and they remain open for some interval after the polarity of the supply voltage. For this reason, there are rectified voltage curve plots the voltage of negative polarity, which confirms the converter output voltage oscillogram smooth start dynamic braking mode (see. Fig. 4).

According to the oscillogram device generates sinusoidal impulses that the frequency coincides with the frequency of the power supply and create braking time.

Algorithm device control provides smooth start closing thyristor before stopping the engine, because the low frequency pulsating current rotation causes Torque ripple and therefore speed.

By changing the angle of opening of thyristors VS2 and VS5 braking torque provided by regulation. In practice, the opening angle of thyristors regulate power within 40-120 degrees.

The advantages of the method of braking protyvmykannyam are:

high efficiency mechanisms for a quick stop with a large moment of inertia;
can be used to connect the motor windings scheme with an internal switching triangle keys.

The disadvantage is that the implementation braking opposite inclusiona.

Cannes necessary to use two external power contactors.

Conclusion

1. Braking opposite inclusion systems with electric control devices required smooth start two external contactors.

2. Inhibition braking opposite inclusion often combined with dynamic power at the stator windings rectified pulsating current, which is formed by straightening one period mains voltage.

3. The use of dynamic braking provides smooth stop engine.

4. In the curves rectified current emerging areas of negative polarity, which reduces the efficiency of dynamic braking.

5. The magnitude of braking torque regulating thyristor opening angle within 40 - 120 electrical degrees.