

УДК 621.314.58

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SURGE PROTECTION IN CENTRIFUGAL COMPRESSORS

Centrifugal compressors are equipment that belongs to the group of dynamic type compressors with a radial design. The main advantage of compressors of this type is their high productivity, which many times exceeds the indicators of compressors of other types. Thereby centrifugal air compressors, the composition of which allows them to be used during intensive operation, are widely used on an industrial scale.

The device and principle of operation of centrifugal compressors are based on the dynamic compression of a gaseous medium. The main element of this equipment is a rotor equipped with a shaft with working wheels, the arrangement of which is symmetrical. During the operation of the equipment, the gas particles are acted upon by the force of inertia, which arises due to the presence of rotational motion carried out by the wheel blades. At the same time, the gas moves from the center of the compressor to the edge of the impeller, and as a result, the gas is compressed and gains speed. One of the main features of installations of this type depends on the power consumed by the equipment, the pressure of the compressed gas and its efficiency, and the level of compressor performance.

The range of adjustment of the compressor at low flows is limited to the limit of the surge zone. At a given injection pressure, it is not possible to reduce the air flow through the compressor below the critical value at which surge occurs. However, the position of the boundary of the surge zone can change significantly depending on the state of the atmospheric air (pressure,

temperature, humidity) and the technical condition of the compressor (compression ratio).

Knowing the current position of the surge zone and the operating point of the compressor, it is possible to adjust the performance of the compressor in such a way that during the movement of the operating point to the low flow zone, the operating point is brought as close as possible to the limit of the surge zone without opening the surge valve. The margin of performance relative to the limit of the surge zone defines a new lower control limit and is selected depending on the speed of movement of the operating point in the direction of decreasing flow.

To ensure the expansion of the operating point, it is necessary to measure the parameters of the atmospheric air, periodically calculate the position of the limit of the surge zone, the speed and direction of movement of the compressor operating point, adjust the performance of the compressor to maintain the specified pressure (or flow) within the extended operating zone by changing the position of the throttle valve, and in if the working point goes beyond the lower limit of the working zone, adjust it by changing the position of the surge valve.

At the same time, reliable surge protection is required, which is triggered, for example, when characteristic fluctuations in the load on the main drive motor appear, as well as fast-acting electric drives of the throttle valve and surge valve. This guarantees that the implementation of the control system will not reduce the safety and trouble-free operation of the units.