

Control process for the power supply device of an electrostatic filter.

The invention relates to a control process for the power supply device of an electrostatic filter.

Power supply devices which consist of an indirect converter equipped with a measuring and control unit and having a downstream high-voltage transformer are known, for example, from DE-OS 35 22 569. A serious disadvantage of the control process known hitherto is the necessity to measure the filter current and the filter voltage on the secondary side, i.e. on the high-voltage side of the transformer, in order to determine secondary states. Measuring devices for measuring under high voltage are expensive and susceptible to faults. In addition, extensive screening and insulating measures must be taken in order to guarantee the safety of the operating staff. On the other hand, the determination of secondary states is indispensable, since the electrostatic filter should be controlled as optimally as possible and, moreover, a constant adaptation of the desired values, for example for the intermediate-circuit current, is necessary.

Because of the high-voltage problems described above, the desired-value specification for values such as, for example, intermediate-circuit current, pulse repetition frequency or pulse duration has hitherto taken place in that the filter characteristic was measured and with the aid of this measurement, on the basis of the experience of the operating staff, new desired values were specified manually.

This type of desired-value specification has disadvantages. Its reliability and accuracy is dependent on the experience and attentiveness of the operating staff and it leads to high staff costs. In particular because of stricter environmental laws (for

example operating-temperature air) it is necessary to operate the electrostatic filter optimally. Because the puncture voltage of the filter changes during operation, for an optimal operation the desired values
5 must be determined and adapted anew again and again. Because of the rapidity of the change of the puncture voltage a constant desired-value adaptation is not possible even for trained staff.

From DE-A-15 57 061 it is known to measure the
10 primary current in order to control the operating voltage, supplied to the electrostatic filter, by way of a magnetic amplifier arranged on the primary side.

The object of the present invention is to avoid the secondary measurement with high voltage. A further
15 object of the invention consists in accelerating and automating the desired-value specification in such a way that the electrostatic filter is controlled optimally and environmental protection conditions are thereby fulfilled. In particular, for reasons of
20 economy the upgrading of existing installations should be possible with the control process in accordance with the invention. Moreover, staff costs should be saved through the automation.

The object is achieved with the features of claim
25 1.

As a rule in this respect actual values, for example the primary voltage, are measured on the primary side, but it is possibly also sensible to measure desired values, actual values and desired
30 values, associations of actual and desired values or combinations thereof.

In an advantageous development of the control process the secondary actual values are calculated from the primary actual values of voltage and current and in
35 this way the electrostatic filter is examined for filter puncture and filter short-circuit.

In this respect the electrostatic filter can be operated with direct current, with current pulses or with a combination of both. With electrostatic filters operated with current pulses, several small measuring
5 pulses are applied in the pauses between two pulses to be able to measure also in the pulse pauses values which are meaningful on the primary side.

In a further advantageous development of the invention a filter characteristic is taken up, this
10 filter characteristic is evaluated and on the basis of the evaluation of the filter characteristic new desired values, for example for the intermediate-circuit current, are determined. The calculation of the new desired values takes place in an automation unit which
15 is of a higher level than the measuring and control unit.

Further advantages and details emerge from the following description of an exemplary embodiment and in connection with the further individual claims.

20 The Figure shows diagrammatically an arrangement for carrying out the control process and the guide process for the desired-value specification.

An indirect converter 2 equipped with a measuring and control unit 1 supplies a high-voltage transformer
25 3, the output voltage of which is applied by way of a rectifier 4 to an electrostatic filter 5. The measuring and control unit 1 is connected to an automation unit 6 of a higher level. The automation unit 6 of a higher level can be, for example, a memory-
30 programmable control (Siemens S5) or a personal computer. The measuring and control unit 1 measures or determines continuously - for example every millisecond - on the primary side intermediate-circuit current and primary voltage and determines filter current and
35 filter voltage from these variables.

If the filter voltage decreases from one

measurement or calculation to the next from a value above a specified variable minimum value, for example 5 kV, to less than a specified variable percentage, for example 25%, filter puncture is detected. If the
5 filter voltage in a specified variable puncture waiting time between 0 and 200 ms, for example 100 ms, increases again above this percentage, in the measuring and control unit 1 the counter for self-extinguishing punctures is increased by one. Otherwise, the counter
10 for punctures which are not self-extinguishing is increased by one and a deionizing reaction is introduced. The filter 5 is subsequently recharged.

If the primary voltage of the high-voltage transformer 3 decreases below a specified variable
15 minimum value in the region of 60 to 100 V, typically about 80 V, during a specified variable short-circuit waiting time of, for example, 250 ms does not increase again above this value and at the same time a filter current flows which is greater than a specified
20 variable minimum current, for example 10% of the maximum current, filter short circuit is detected and the current supply into the intermediate circuit of the indirect converter 2 is blocked for a specified variable waiting time of, for example, 500 ms.
25 Moreover, the instant of the filter short circuit is stored. The filter 5 is subsequently recharged. If the number of filter short circuits during a specified variable period, for example one minute, exceeds a specified variable maximum number, for example 10,
30 sustained short circuit is detected and the electrostatic filter 5 is disconnected.

At intervals the automation unit 6 of higher level transmits commands and possibly necessary parameters to the measuring and control unit 1. These commands can
35 be:

- the command to change the operational type (d.c.

- operation, pulse operation, mixed operation),
- the command to change the operating parameters and the new operating parameters,
- the command to take up a filter characteristic.

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- When the measuring and control unit 1 receives the command to take up a characteristic, the measuring and control unit 1 interrupts the normal operation of the electrostatic filter 5, takes up the filter
- 10 characteristic and transmits the data to the automation unit 6 of higher level. The automation unit 6 indicates the filter characteristic on a monitor (not shown), evaluates the transferred data and transmits new desired values to the measuring and control unit 1.
- 15 New desired values can be specified for all variable values. The following are examples:
- manipulated variables, for example intermediate-circuit current and with pulse operation the pulse duration,
 - 20 - comparison variables, for example the critical voltage for the detection of a filter short circuit,
 - times, for example the puncture waiting time.

- 25 If the electrostatic filter 5 is operated with direct current the filter characteristic is shown as function of the filter voltage in dependence upon the filter current. If the electrostatic filter is operated with current pulses the filter voltage is
- 30 shown as filter characteristic as function of the time. To be able to measure the filter values on the primary side during the pause between two pulses, during the pulse pause small measuring pulses are periodically applied to the electrostatic filter 5, for example at a
- 35 frequency between 100 and 1000 Hz. In pulse operation this is not only necessary during the characteristic

take-up, but always, since otherwise during the pulse pauses the electrostatic filter 5 is decoupled from the high-voltage transformer 3 by the rectifier 4.

In the above, in addition to a control process for
5 the power supply device of an electrostatic filter 5 by way of a measuring and control unit 1, the guiding of the measuring and control unit 1 of a power supply device for an electrostatic filter 5 by way of an automation unit 6 of a higher level was described. Of
10 course it is likewise possible to guide several electrostatic filters 5 with such an automation unit 6. The operational types of the electrostatic filters are in this respect completely independent of one another.



Claims

1. Control process for the power supply device of an electrostatic filter, the device consisting of an indirect converter equipped with a measuring and control unit and with downstream high-voltage transformer, whereby the measuring and control unit (1) measures current and voltage of the high-voltage transformer (3) on the primary side and, from this, secondary filter current and secondary filter voltage are automatically calculated and upon detection of a filter short circuit from the calculated values for a specified variable waiting time of the external current supply no more current is removed, the instant of the occurrence of the filter short circuit is stored and the indirect converter (2) is disconnected if the number of filter short circuits within a specified variable period exceeds a specified variable limit.

2. Process according to claim 1, characterized in that the electrostatic filter (5) is operated with direct current.

3. Process according to claim 1, characterized in that the electrostatic filter (5) is operated with current pulses.

4. Process according to claim 1, 2 or 3, characterized in that the electrostatic filter (5) is operated with direct current on which current pulses are imposed.

5. Process according to one or more of claims 1 to 4, characterized in that with an electrostatic filter (5) operated with current pulses, during the pause between two current pulses at short intervals measuring pulses are applied to the electrostatic filter (5).

6. Process according to one or more of claims 1 to 5, characterized in that a filter puncture is detected in that the filter voltage decreases in a



short time, for example 1-10 ms, from a high value, for example greater than 5 kV, to a low value, for example less than 25% of the previous voltage.

7. Process according to claim 6, characterized in that upon detection of a filter puncture a counter in the measuring and control unit (1) is increased, after a specified variable puncture waiting time it is examined anew as to whether a filter puncture is taking place, and with the presence of a filter puncture a deionizing reaction is introduced.

8. Process according to one or more of claims 1 to 7, characterized in that a filter short circuit is detected in that with small primary voltage, for example 60 to 100 V, of the high-voltage transformer (3) a high filter current flows, for example more than 10% of the maximum current.

9. Process according to one or more of the above claims, characterized in that at intervals a filter characteristic is taken up, from which new desired values are calculated for the control of the indirect converter (2).

10. Process according to claim 9, characterized in that manipulated variables, for example the intermediate-circuit current, comparison variables, for example the minimum value for detection of a filter short circuit, and times, for example the puncture waiting time, can be specified as new desired values.

11. Process according to claim 9 or 10, characterized in that the characteristics are transmitted by the measuring and control unit (1) to an automation unit (6) of a higher level, are evaluated by the automation unit and the new desired values are transmitted to the measuring and control unit (1).