

Operating units with standard motors on frequency inverters

Note

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PROJECT PLANNING NOTES

When operating units with standard 50/60 Hz motors on frequency inverters, some conditions must be observed to ensure reliable operation over the entire life of the unit.

Compliance with these conditions must be ensured and checked by the engineer of the overall system consisting of frequency converter and pump (incl. motor).

Below are more detailed explanations:

Load on the winding insulation of the motor due to inverter operation

Frequency inverters that work according to the principle of pulse width modulation (PWM) generate pulse-shaped voltages at their output.

Depending on the further construction, consisting of the type and length of the cable used, the installation including grounding of the system and other components used, there different characteristics of these voltage pulses at the motor connection terminals with regard to the maximum voltages are occurring and the rise time of the voltage pulses (see also e.g. EN 60034-18-41).

For all standard motors that are not explicitly intended for operation with frequency inverters, the overall system must be designed in such a way that the voltage measured at the motor connection terminals corresponds to impulse voltage insulation class (IVIC) A (low stress) according to EN 60034-18-41.

If the frequency inverter alone does not enable compliance with this condition, the behavior of the system can be positively influenced by these measures:

- a cable length between the frequency inverter and the motor that is as short as possible
- a low-resistance grounding between the frequency inverter and the motor, esp. for higher frequencies
- the use of an output choke at the output of the frequency inverter
- the use of a du/dt filter at the output of the frequency inverter
- the use of a sine filter at the output of the frequency inverter
- the use of a motor interference suppression module designed for pulsed voltage loading at the motor connection terminals.

Basic setting of the parameters for motor control

Depending on the type of frequency inverter, different characteristic values of the motor must be set. These can usually be found on the motor's type plate.

When selecting the input voltage, it is essential to take the max. voltage of the electrical grid into account.

Some frequency inverters offer automatic measurement of additional motor parameters.

Settings for protecting the motor against overload and overtemperature

Usually frequency inverter takes over the short-circuit-, overload- and overtemperature protection of the motor.

These consist of a parameterizable immediate shutdown of the motor if a maximum inverter output current is exceeded, optionally a speed reduction if a parameterizable output current is exceeded, as well as an $I^2 \cdot t$ protection with a tolerance time for short-term overload.

The associated parameters of the limiting functions must be provided with the appropriate values for the motor (rated current, etc.).

If the motor has a PTC or a bimetal switch for temperature monitoring, this must be connected to the frequency inverter at the corresponding inputs and the monitoring must be activated in the parameterization.

Any requirements in the PELV/SELV range must be taken into account when selecting the inputs.

If there is no PTC or bimetal switch, the $I^2 \cdot t$ monitoring must be activated in any case.

Settings for dynamics (acceleration and braking ramps)

The setting of the acceleration ramps must be selected in such a way that the resulting starting current of the motor as well as the current-time area do not exceed a value that would correspond to those during a start-up on the mains. The $I^2 \cdot t$ area of a corresponding motor protection switch can be used as a guide value.

When setting the braking ramp, the mass inertia of the respective rotating parts of the pump must be considered.

If the ramp is too fast, the DC link voltage of the inverter will increase for the duration of the braking process.

If a braking resistor is used, the combination of switch-on voltage and braking ramp must be set in such a way that the voltage load on the motor winding is not higher than that shown at the beginning.

Evaluation of the EMC properties

The evaluation of compliance with any mandatory limit for interference emission as well as the evaluation of the interference immunity of the overall system is the responsibility of the project planner. It depends on the design of the frequency inverter and the type of installation.

The project planning manuals of the frequency inverters usually offer assistance, as do the relevant guidelines and regulations for EMC-compliant installation.

Compliance with the characteristic diagram limits or the permissible limit values of the pump or rather blower

The limit values to be complied with in addition to the above values in relation to the pump or blower include at least the following

- the minimum permissible speed of the pump/blower
- the maximum permissible speed of the pump/blower
- the maximum permissible overpressure or vacuum
- Specific limits of the respective operating principle, such as the lower limits for the side channel compressor at lower speeds than the nominal speed

These can be found in the respective documentation of the Variair variants or requested separately.

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