Explosion-proof motors

for inverter operation
Type of protection increased safety “e”
Motor selection data
K1.R 112 to 355 ... Ex e II T3

Short catalogue 01-2013
**Explosion-proof motors for inverter operation**

**Motors complying with degree of protection increased safety “e” for inverter operation – the economic alternative to flameproof enclosure “d”**.

Explosion-proof service rooms where potentially explosive gas or vapour/air-mixtures can occur require the use of electric equipment for explosive atmospheres. Explosion-proof motors complying with degree of protection increased safety “e” represent an ideal solution, both from a safety-related and an economic point of view, when used in explosive atmospheres of zones 1 (equipment group II, category 2). These motors must be certified according to the directive 94/9/EC (“ATEX95”).

An increasing use of frequency inverters for energy-efficient speed control of drives can be noticed for zone 1 applications, for example in the chemical industry. Until now the issue of an EC type examination certificate was only done for individual, clearly defined combinations of motor and inverter and only for very limited operating points. That meant for each new case of operation a new certification of the case-specific combination of motor and inverter. As a result mainly expensive motors complying with degree of protection flameproof enclosure “d” or “de” had been used to avoid the cost-extensive and inflexible procedure of individual certification.

For introducing the advantages of frequency inverters also in areas where electric motors complying with degree of protection increased safety “e” are used, the PTB Braunschweig has developed a simplified and cost-effective test and certification process. Thus for type of protection “e” the former approval of motor/inverter pairs is omitted.

For each individual motor type the new EC type examination certificates include the maximum possible torques in relation to the frequency and the motor connection type, the corresponding motor terminal voltages and rated currents, inverter parameters and additional requirements for the inverter. However these requirements should be fulfilled by all new inverters. The motor is protected against unacceptable warming by the definition of inverter parameters and the installation of PTC-thermistors. The monitoring of data from the installed thermal winding protection has to be done by a corresponding circuit breaker, that is marked with II (2) G according to directive 94/9/EC.

The limiting values determined on the name plate and in the EC type examination certificate must be kept under all circumstances. Only frequency inverters shall be used that fulfill the requirements of the EC type examination certificate. The specified maximum torque and frequency must not be exceeded at all. By selection of a suitable inverter and/or the use of filters the maximum permissible pulse voltage for the sizes 132 [K12R112] to 315 has to be limited to 1556 V at the motor terminal. It has to be secured that the operating voltage at the motor terminal is always the same as the value indicated on the name plate (attention to voltage drop caused by filters and cables). This must be taken into account already at process planning and dimensioning and the motors have to be ordered accordingly.

If the terminal voltage of the motor is smaller than specified on the name plate due to voltage drops caused by the frequency inverter, cables and possible chokes or filters, the edge frequency must be adjusted to a smaller value according to the linear voltage-frequency-relation. Consequently the speed control range is smaller.

VEM motors GmbH offers the series K1.R 112 to K1.R 355 with degree of protection increased safety “e” also for inverter operation. The types K11R 132 S4 to K11R 280 M4, K11R 180 M2, K11R 180 L6 and K11R 180 L8 have already been certified by the PTB Braunschweig.

Further types are available on request.
Three-phase motors with squirrel-cage rotor for inverter operation
Type of protection increased safety “e”
Motors for operation in zone 1 acc. to EN 60079-0/EN 60079-7

with surface ventilation, mode of operation S1, continuous duty
Thermal class 155, degree of protection IP 55, temperature class T3
maximum inverter input voltage 500 V

Motor selection data

<table>
<thead>
<tr>
<th>Type</th>
<th>P 50 Hz</th>
<th>l 50 Hz</th>
<th>A 50 Hz</th>
<th>Torque M 50 Hz</th>
<th>Y 87 Hz</th>
<th>∆ 87 Hz</th>
<th>EC-type examination certificate</th>
<th>Data sheet</th>
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<tr>
<td>Frequency f 50 Hz 50 Hz 5 Hz 25 Hz 87 Hz 87 Hz</td>
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<td>A</td>
<td>Nm</td>
<td>Nm</td>
<td>Nm</td>
<td>Nm</td>
<td>kgm²</td>
<td>kg</td>
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Synchronous speed 1000 rpm – 6-pole version

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| Temperature monitoring: NAT 130 °C

1) Motor terminal voltage
An adjustment of the rated voltage of the motor in the range of 220 V up to 500 V is permissible by changing the number of turns of the winding. The rated current changes in a reciprocal ratio to the rated voltage.

Changes are possible for motors that are not yet certified.
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with surface ventilation, mode of operation S1, continuous duty
Thermal class 155, degree of protection IP 55, temperature class T3
maximum inverter input voltage 500 V

Inverter parameters

In connection with the above mentioned monitoring device the following inverter parameters have to be set and kept during operation:

- Minimal pulse frequency: 3 kHz
- Current limit for short time: 1.5*I_n
- Maximum overload period: 60 s
- Minimal frequency f_min: 5 Hz
- Maximum frequency f_max: 87 Hz
- Permissible period for operation below f_min: 60 s

The maximum overload period and the permissible period for operation below f_min comply to a time interval of 10 min.
The torque in relation to the frequency results from the permissible continuous current limit.

Special conditions
Motor operation in groups is not allowed.
Motors of this type shall only be operated with inverters that comply with the above mentioned “inverter parameters”.
The rated current of the frequency inverter shall only amount to max. 2x rated motor current.

The current monitoring of the frequency inverter must be able to detect the effective value of the motor current with a tolerance of ± 5 % related to the rated motor current.
Before start-up it has to be secured that no inverter induced overvoltages with a peak value of more than 1556 V occur at the terminals of the electric motor.

Example of name plate

![Name plate example](image)
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Setting parameters for continuous current limit of the frequency inverter between 5 Hz and 87 Hz
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Setting parameters for continuous current limit of the frequency inverter between 5 Hz and 87 Hz

K11R 200 L4 Ex e II T3, PTB 08 ATEX 3027 X/01
K11R 225 S4 Ex e II T3, PTB 08 ATEX 3028 X/01
K11R 225 M4 Ex e II T3, PTB 08 ATEX 3028 X/02
K11R 250 M4 Ex e II T3, PTB 08 ATEX 3029 X/01
K11R 280 S4 Ex e II T3, PTB 08 ATEX 3030 X/02
K11R 280 M4 Ex e II T3, PTB 08 ATEX 3030 X/01