Motors for Hazardous Areas used with Frequency Converters

ATEX Directives for Explosive Atmospheres
As of July 1, 2003, the ATEX Directives have provided new guidelines and rules for motors operated with variable speed drives in hazardous atmospheres.

For a given motor the precise requirements depend on the applicable zone, category and protection type.

ABB offers certified hazardous area motors (EEx nA, EEx e, EEx d, EEx de, EEx p, EEx pe, DIP) and frequency converters – ABB industrial drives with DTC control (ACS800) and ABB standard drives (ACS550).

In the implementation of the ATEX 95 and ATEX 137 Directives, ABB operates on the basis of the recently updated IEC or EN standards.

What factors should be taken into account when motors for hazardous areas are operated with frequency converters?

The following issues need to be considered when a motor is used with a frequency converter rather than connected Direct On Line:

- **Lower cooling**: For self-cooled (IC 411) motors, the cooling air flow may be inadequate at low speeds, making separate cooling (IC 416) necessary.

- **Temperature rise**: Harmonics created by the converter supply mean the temperature rise is higher than with the network sinusoidal supply.

- **Higher voltage stress**: Due to steep voltage pulses compared to the smooth sinusoidal wave.

- **Cabling**: Must be implemented according to the manufacturer’s instructions and local regulations to limit the harmonics, EMC emissions and bearing currents created by the converter supply.
Main requirements according to EN standards:

- **Non-Sparking Motors EEx nA**: The combination shall be tested as a unit in accordance with EN 50021/EN 60079-15. In cases where it is not practical to carry out testing, calculated results are also accepted.

- **Increased Safety Motors EEx e**: The combination shall be tested as a unit with the associated protective device in accordance with EN 50019/EN 60079-7 for the equipment, and EN 60079-14 for the installation.

Note: Available for motors with form-wound winding.

- **Flameproof Motors EEx d, EEx de**: Options according to EN 50018/EN 60079-1 and EN 60079-14 for the installation, please see table below.

- **Pressurized Motors EEx p, EEx pe**:
  The minimum pressure point within the enclosure must be determined according to the speed range, as described in EN 50016/EN 60079-2.

  Note: Available for motors with form-wound winding.

- **Dust ignition proof motors DIP**:
  The motor shall be dimensioned so that the motor surface temperature remains at a safe level with respect to the temperature class according to EN 50281-1-1.

  ![Example of low voltage hazardous area motor loadability curve. Product specific loadability curves can be found in the product catalogue.](image_url)

### Main requirements according to EN standards for low voltage flameproof motors EEx d, EEx de and dust ignition proof motors DIP operated with VSD*:

<table>
<thead>
<tr>
<th>System configuration</th>
<th>ATEX 95 (Manufacturer) Directive</th>
<th>ATEX 137 (End User) Directive</th>
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<tbody>
<tr>
<td><strong>ABB motor + ABB drive with DTC</strong>&lt;br&gt; (Direct Torque Control)</td>
<td>Loadability curves for low voltage motors are certified by Notified Body based on the type tests carried out.&lt;br&gt;• Motors shall be dimensioned according to respective loadability curves based on type tests carried out by ABB.&lt;br&gt;• Type tests and certification also cover: - risks related to bearing current - winding insulation protection with appropriate thermal sensors.&lt;br&gt;Motors can optionally be equipped with thermistors which can be used as direct thermal protection to limit the motor surface temperature to a safe level.</td>
<td>Equipment shall be selected according to the operating conditions (zone, load).&lt;br&gt;• Requirements of the converter and motor manufacturer regarding dimensioning and installation must be respected (motor cabling, filters, winding and bearing insulation).&lt;br&gt;• Operating conditions and converter data must be shown on the motor’s second rating plate.</td>
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<tr>
<td><strong>ABB motor + frequency converter without DTC</strong>&lt;br&gt; (Direct Torque Control)</td>
<td>• Motors shall be equipped with direct thermal protection (e.g. thermistors) to limit the motor surface temperature to a safe level, or&lt;br&gt;• Motors shall be type tested with the frequency converter concerned for the specific duty.</td>
<td>Equipment shall be selected according to the operating conditions (zone, load).&lt;br&gt;• Requirements of the converter and motor manufacturer regarding dimensioning and installation must be respected (motor cabling, filters, winding and bearing insulation).</td>
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*For requirements for other protection types, please see relevant EN standards.

For any further information, please contact ABB.
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