Save costs through longer service life and elimination of shielded cables

One of the advantages of the modern frequency inverter is that the short switching times that are now achievable help to reduce losses. However, every time the frequency inverter output turns on or off, the speed of this transition causes a resultant voltage spike to be transmitted down the shielded cable to the motor. A further disadvantage of a high switching frequency are EMC problems.

A simple method of reducing dv/dt only on short cable runs between the frequency inverter and motor is to use a dv/dt choke or filter which limits the rise rate to less than 500V/μs which is acceptable for most modern motors and standards. The EMC interferences will be reduced in the radiation range from 1MHz to 30MHz.

In addition to du / dt increases, there is a considerable amount of symmetrical and asymmetrical current distortion generated at the connecting line between the inverter and motor by the fast switching of power semiconductors. These distortions are getting worse with increasing cable length and may increase the performance of the engine by loud noises and in extreme cases they can cause an overheating. A conventional motor choke can be a solution to this problem - the motor choke meets higher requirements than the dv/ dt choke due to its design.

The voltage increase will be limited to less than 500 V/μs. The spikes of the conductor to conductor to voltage at the motor are less than 1000 V. The choke dampens interferences caused by conductors in the lower frequency range very well, too. The losses and the typical noise in the motor plate are reduced.

With particularly long cable runs of >100m between the frequency inverter, the screened wire used for EMI suppression can cause capacitive coupling between the cable and ground. A conventional motor reactor may not provide sufficient attenuation in such cases.

The sinusoidal filter converts the distorted voltage waveform from the frequency inverter into a smooth sinusoidal curve. In particular the ripple caused by the fast switching of the power semiconductors is smoothed, typically down to 3 - 5%. When used in conjunction with a screened cable this type of filter will remove most symmetric and asymmetric noise, except in extreme cases.

Benefits of REO Sinusoidal filters:
- Output voltage is sinusoidal
- Switching edges are completely flattened
- High attenuation of noise emissions
- Effective against symmetrical interference
- Suitable for very long motor cables
- Shielded motor cable is not required
- The efficiency of the system is increased
- Reduction of motor noise and eddy current losses

<table>
<thead>
<tr>
<th>Cables</th>
<th>Additional costs for shielded cables</th>
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<tbody>
<tr>
<td>4x1,5 m</td>
<td>ca. 43%</td>
</tr>
<tr>
<td>4x6 m</td>
<td>ca. 32%</td>
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<tr>
<td>4x25 m</td>
<td>ca. 37%</td>
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<tr>
<td>4x50 m</td>
<td>ca. 27%</td>
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<tr>
<td>4x120 m</td>
<td>ca. 17%</td>
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*The cost savings of using standard cable can be considerable. In a typical drive installation using a 4kW drive at a distance of 200m from the motor, cable savings alone can be around 125,- EUR. This means that almost three times as many installations could be cabled using standard cable, as opposed to shielded. These savings quickly mount up when larger drives are utilised. The saving for a typical 160kW installation is approximately 1800,- EUR. Considering REOs sinusoidal filters can be used for cable lengths up to 1000 m, savings for this configuration would reach nearly 9000,- EUR.*