Ultra Low Harmonic Drives
For clean network
Fred Donabauer
What are harmonics?

In an ideal case the current in an AC grid is a pure sine wave.

In reality the current deviates from this pure sine wave and contains harmonics.

Harmonics distort the sine wave.

With a traditional frequency converter the amount of harmonic distortion is from 35 % up to 100 %.

Sources of harmonic distortion:

- Harmonics are introduced into the grid by non-linear loads, such as motor starters, variable speed drives and transformers.
Ultra Low Harmonic Drives

Harmonics cause disturbances

Harmonics distort the sine wave and pollute the electrical supply
Disturbances caused to the equipment connected to the grid
- motors, transformers, cables and other equipment can overheat
- displays and lighting can flicker
- circuit breakers can trip
- measurement devices can give false readings
- fuses can blow
- sensitive electronic equipment can be damaged
- communications equipment can experience interference
- capacitor can fail due to resonances
ABB Ultra Low Harmonic Drives help to keep the power network clean

With harmonics mitigation built into the drive, the Ultra Low Harmonic Drive produces exceptionally low harmonic content. Total harmonic distortion of the current is < 3 %.*

Compared to a conventional frequency converter, the harmonic content is reduced even by up to 95 %.

* Typical value at nominal load
# Ultra Low Harmonic Drives

Comparison with multi-pulse solutions

<table>
<thead>
<tr>
<th>Multi-pulse solution</th>
<th>ABB Ultra Low Harmonic Drive</th>
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</thead>
<tbody>
<tr>
<td>Requires a special multi-winding transformer</td>
<td>No dedicated transformer required</td>
</tr>
<tr>
<td>Higher cabling and installation cost</td>
<td>Simple cabling and installation</td>
</tr>
<tr>
<td>Requires more space and weights more</td>
<td>Power factor unity</td>
</tr>
<tr>
<td>Lower power factor</td>
<td>Harmonic performance is robust against supply voltage variations</td>
</tr>
<tr>
<td>Effectiveness depends on line imbalance</td>
<td>Compact design</td>
</tr>
<tr>
<td></td>
<td>Lower transformer losses increase overall efficiency</td>
</tr>
</tbody>
</table>

![Multi-pulse solution](image1.png)

![ABB Ultra Low Harmonic Drive](image2.png)
## Ultra Low Harmonic Drives

Comparison with passive harmonic filter

<table>
<thead>
<tr>
<th><strong>Passive harmonic filter</strong></th>
<th><strong>ABB Ultra Low Harmonic Drive</strong></th>
</tr>
</thead>
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<tr>
<td>Requires an additional filter</td>
<td>Does not require any external parts or cabinets</td>
</tr>
<tr>
<td>Current harmonics typically 6 to 10% (depends on the filter type)</td>
<td>Current harmonics below limits set by harmonic standards IEEE519 and G5/4</td>
</tr>
<tr>
<td>Leading power factor at no load</td>
<td>Power factor unity at any load point</td>
</tr>
<tr>
<td>Load dependent voltage drop over the filter</td>
<td>Full motor voltage even when the network voltage is low</td>
</tr>
<tr>
<td></td>
<td>No risk for resonance</td>
</tr>
</tbody>
</table>

Passive filter

![Passive Filter](image)

ABB Ultra Low Harmonic Drive

![ABB Ultra Low Harmonic Drive](image)
Ultraschwere Harmonische Drives

Suitable for all applications

Compared to a conventional frequency converter, the harmonic content is reduced even by up to 95%.

Typical harmonic distortion of the current $<3\%$

Harmonic distortion of the voltage $<1\%$

Reduced losses and energy consumption of external components

Clean and stable power network

Less unwelcome disturbances

Longer lifetime of equipment

Less maintenance and more uptime

Reliable operation
Ultra Low Harmonic Drives

Comprehensive offering from ABB

Wide power and voltage range,
4 kW to 3,2 MW, 380 V to 690 V

All components integrated into the drive
Excellent all-compatible platform –
learn it once, use it everywhere

Intuitive user interface setting a new
benchmark

Premium motor control

For all industries and applications
- Industrial drives
- Industry specific variants for HVAC and
  water*
Ultra Low Harmonic Drives
For all industries and applications

Industries

HVAC
Water and wastewater
Power
Pulp and paper
Metals and mining
Food and beverage
Chemical, oil and gas
Marine
Ultra Low Harmonic Drives

The solution from ABB

Harmonics mitigation built into the drive
- No additional hardware needed
- No multi-winding transformer arrangements
- No hidden costs

Harmonic distortion of the current typically <3%
Meets the strict limits of IEEE519 and G5/4
Power factor unity in all load conditions
Full motor voltage even when the network voltage is low
Ultra Low Harmonic Drives

The solution from ABB

Complete and compact solution
Simple installation
Significant space savings
Less power cabling
No external filter needed
No special tuning to the network required
Factory tested solution for high reliability
Ultra Low Harmonic Drives

Prevention is better than cure

ABB Ultra Low Harmonic Drives