

MAKING MODERN LIVING POSSIBLE

Danfoss



VLT[®] Low Harmonic Drive

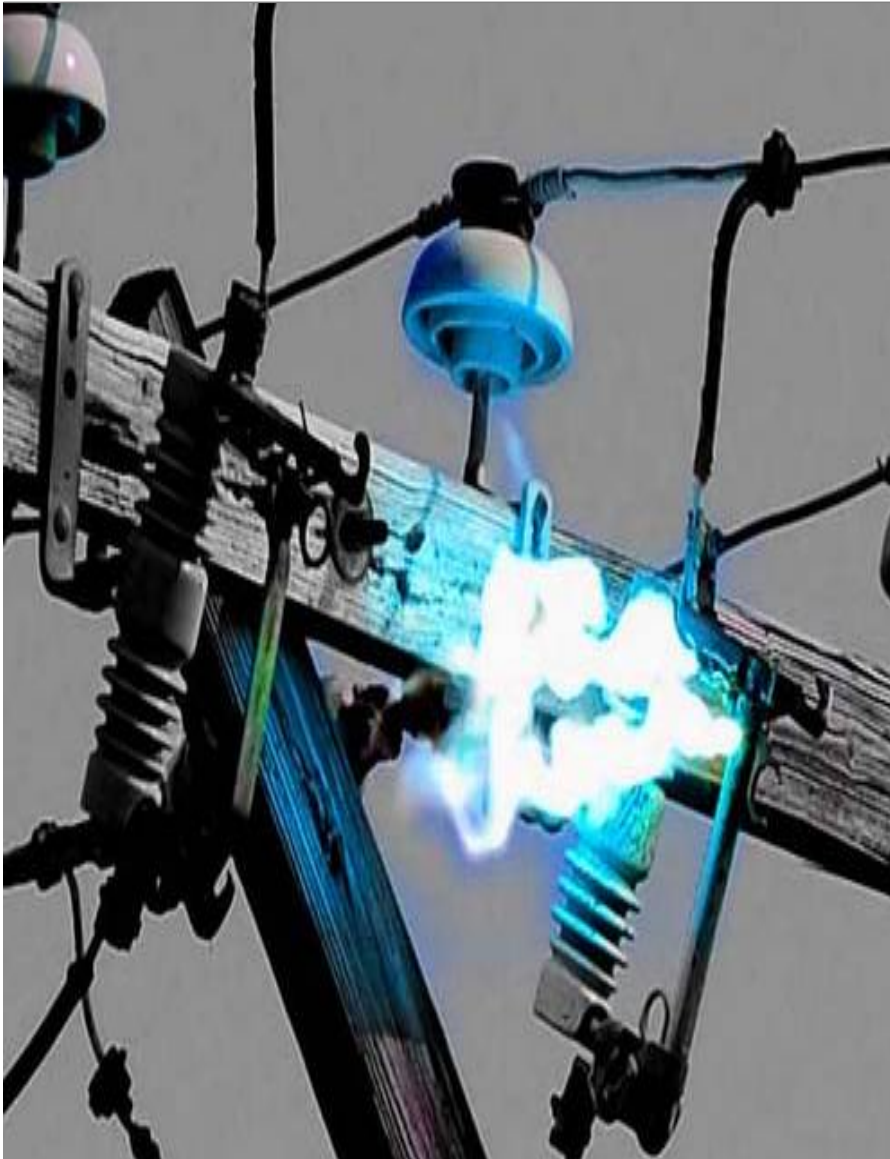
VLT[®]
THE REAL DRIVE



Harmonic disturbance

- Acoustic noise
 - Planes, trains, automobiles, busses, construction machinery generate noise
 - Noise is damaging to people resulting in Stress, Tension and Fatigue

- Electrical noise
 - Power supplies, computers, drives and other non-linear loads generate electrical noise
 - Electrical noise in the form of current harmonics is damaging to electrical systems resulting in:
 - Stress – overload of electrical system
 - Conflict – tripping of protective devices
 - Fatigue – premature failure of system components



Harmonic disturbance

Phenomena caused by current distortion:

Transformer or cable effects:

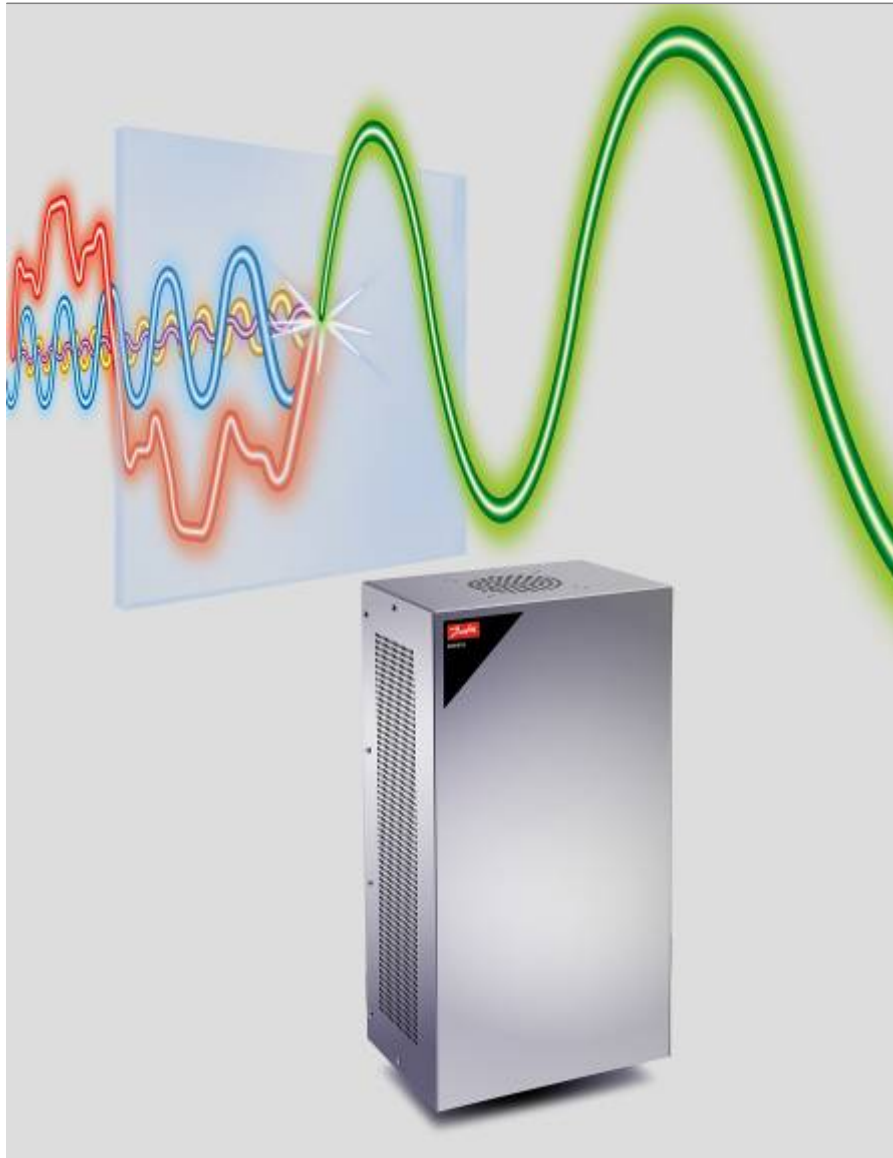
- Increased copper losses in both
- Increased iron losses in transformers
 - hysteresis
 - stray flux
- Skin and proximity effects of cables
- Audible noise from transformer

Capacitor effects

- Resonances
- Stress/overload

Voltage distortion

- Malfunction, Erratic operation and/or breakdown of electronic equipment
- Increased losses in environmental equipment
- Torque ripple in motors
- Overheating in motors
- Resonances



Harmonic disturbance

Harmonic mitigation techniques have continuously been developed to reduce current distortion:

- AC-coils
- 12-pulse drive
- DC-coils
 - VLT® 3000 the first drive with built-in DC-coil
- Trap and low pass filters
- 18- and 24-pulse drive
- New passive filters
 - Danfoss AHF sets new product standard
- Active Front End Drives
- Active Filters

Now it is time for a new trendsetter:

The new Low Harmonic Drive

The window of opportunity

Processor power:

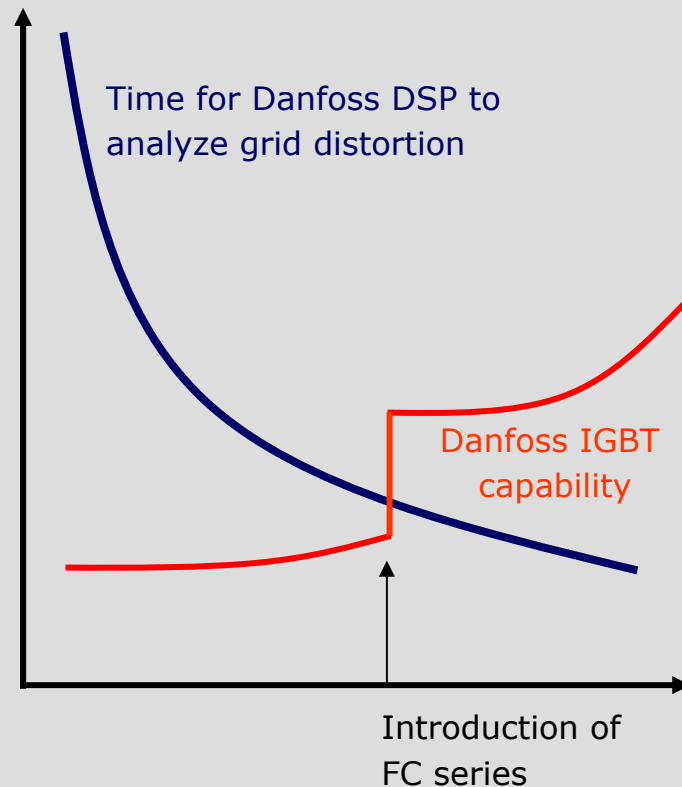
- The new VLT AutomationDrive hardware is able to perform real time analysis

Power components:

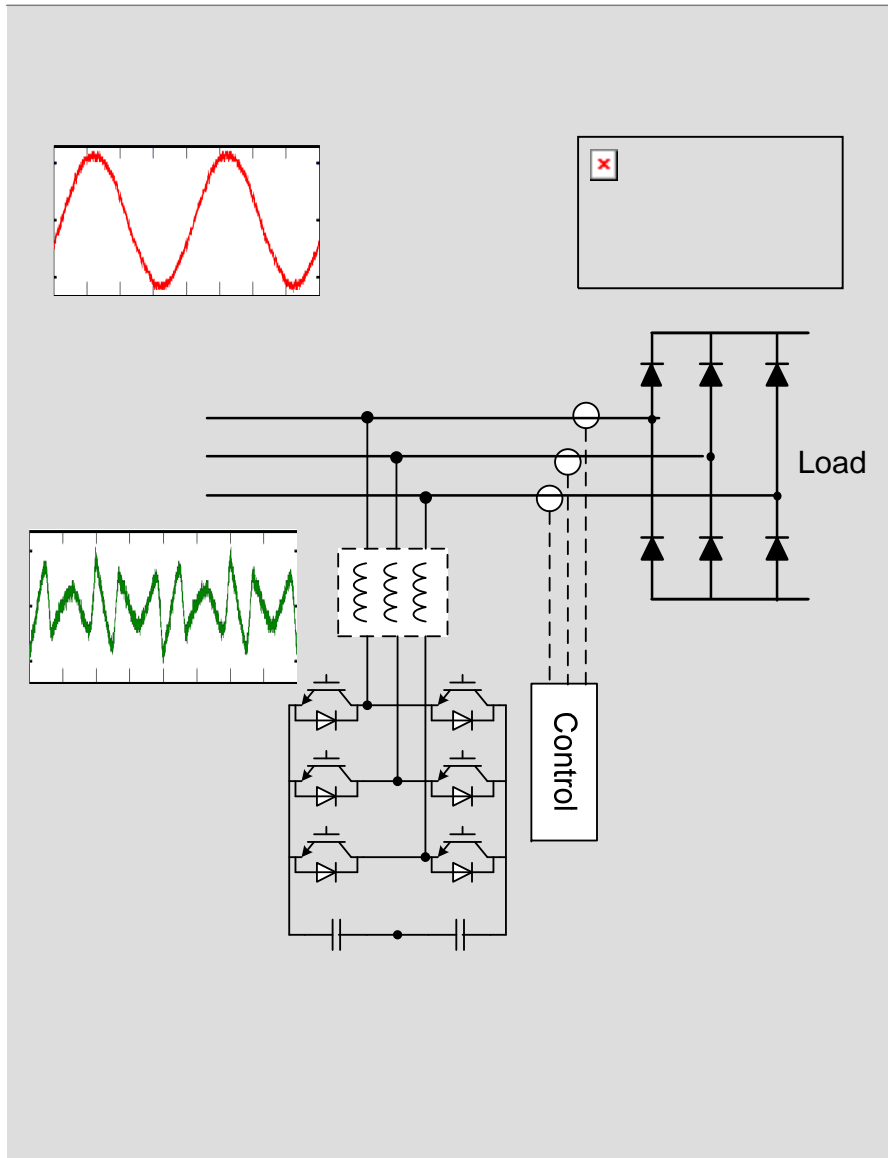
- Danfoss' second generation of IGBT modules have lower losses

The development of our new FC-drive series allows us to use standard components to make an Active Filter. The drive component re-use is 80-90% resulting in:

- Mass production
- High product reliability
- Same service
- Re-uses innovative drive hardware



The new Low Harmonic Drive



- The filter portion of the VLT® Low Harmonic Drive has same working principles as a set of noise cancellation headphones
- Noise/distortion is measured and a counter phase signal is imposed to compensation for the noise
- Noise cancellation earphones can inject 100 mW at 50-1000 Hz
- The VLT® Low Harmonic Drive is injecting several hundred watts at 250-2000 Hz

The new Low Harmonic Drive

The new LHD combines the best of three worlds

The standard drive:

- VLT® Drive series HVAC, AQUA and AutomationDrive

The Active Front End:

- High mitigation
- Dynamic adapting to load
- All in one package
 - Three wires in – three wires out
 - No configuration needed
 - Easy to install

The Active Filter:

- Fewest possible components in main current pathway ⇒ high efficiency
- Controlled motor is unaffected
- Grid/product conditions view in LCP
- Sleep mode



The new Low Harmonic Drive

- Power range: 160-710 kW NO
132-630 kW HO
- Voltage: 380-480 V +5/-10%
- Frequency: 50-60 Hz
- Enclosure: IP 21/NEMA 1
IP 54 (hybrid)
- Standards: CE, UL, cUL, Ctick

Product is now released!



Danfoss Motion Controls

- Net sales 2008: EUR 638 mio
- Employees: 3,976 worldwide

Motion Controls consist of:

- Danfoss Drives
- Danfoss Gearmotors
- Danfoss Silicon Power
- Danfoss Solar Inverters





Danfoss Group

- Danfoss is a family-owned, global company (no public shares, but approx. 3% employee shares)
- Net sales 2008: EUR 3,641 mio
- Employees: 31,717 worldwide
- Production of 250,000 items per day

- 70 manufacturing sites
- 113 sales companies
- 115 agents and distributors

