ENGINEERING TOMORROW

Danfoss

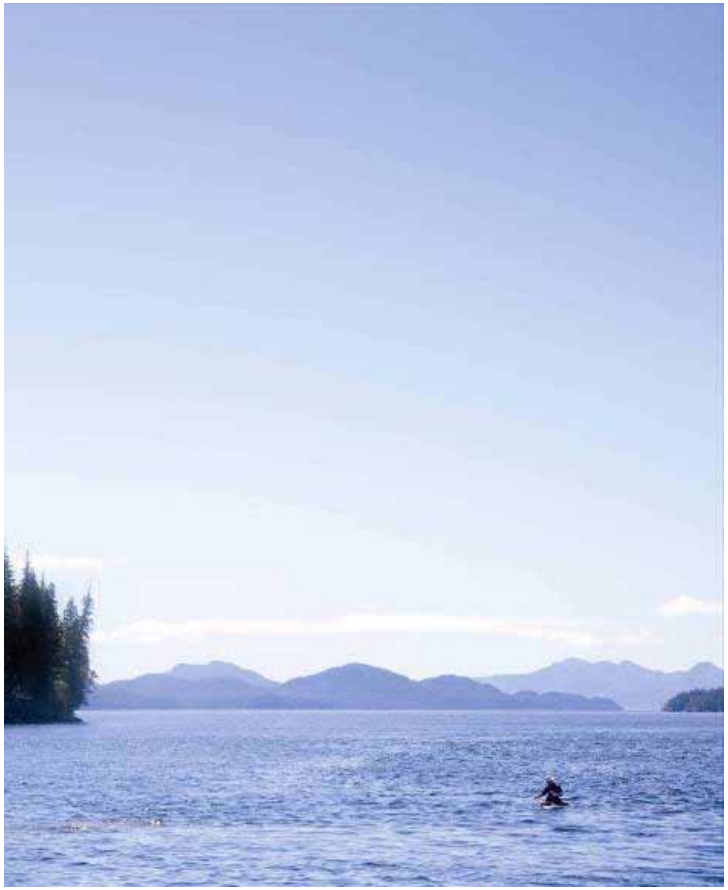
Svein R. Haldar

Drives businesses

Kort om Danfoss

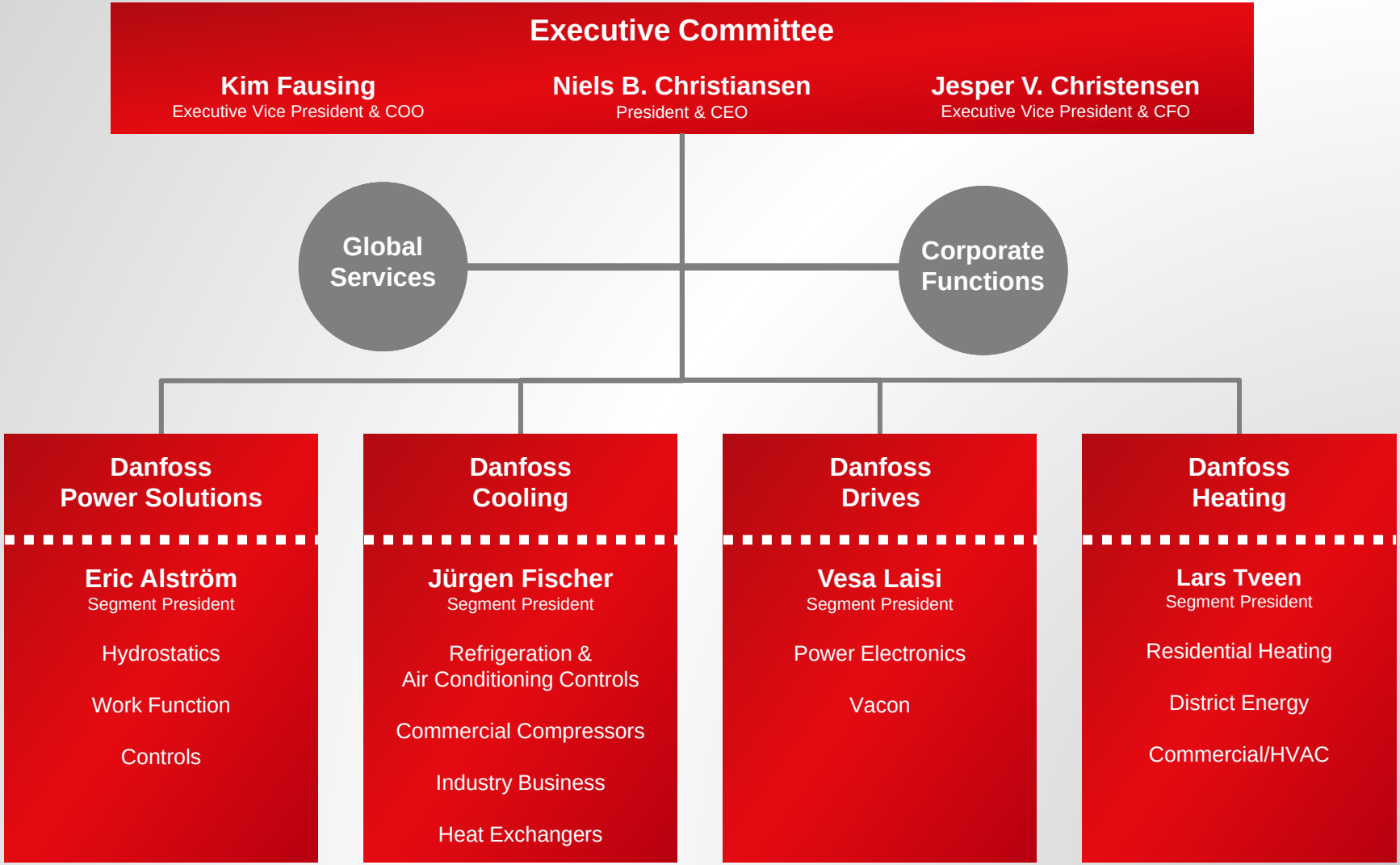
- Over 80 års erfaring med energibesparende teknologier (Startet 1933)
- Løsninger på klimautfordringer
- Globalt kompetansesenter for energieffektivitet – plassert på Sønderjylland
- Bitten og Mads Clausens Fond har aktiemajoriteten i Danfoss

Kort om tall



Omsætning	33.904 mio. DKK
Medarbejdere, globalt	23.430
EBIT	12.5 %
Frit cash flow	3.150 mio. DKK
Egenkapital	12.597 mio. DKK
Fabrikker, globalt	58 in 18 countries
Salgsselskaber, globalt	>100 i 47 lande
Top 3 markeder	USA, Tyskland og Kina

Danfoss organisation



Danfoss Drives Norway

Internal Sales & Markedsføring :


Unni


Sigbjørn

Teknisk support & Service:


Henning


Simen


Pål


Robert

Salg:


Bjørn


Svein


Gorm


Mohammed


Skui

Solution:


Per Halvor


Reidar


Arve


Ørjan


Håvard

Marketing


Tone

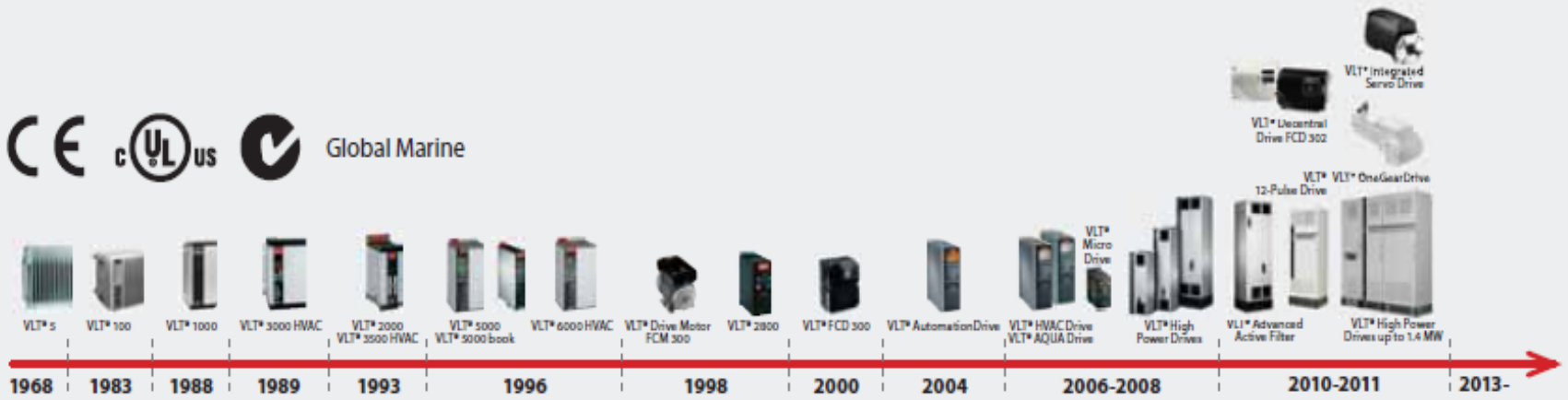

Holmestrand

Danfoss: Først i verden med serieproduksjon av Frekvensomformere

Proven reliability

The first VLT® HVAC Drive – the VLT® 100 from 1983 – has proven the reliability of VLT® drives. Original VLT® HVAC Drives installed in1983 are still functioning reliably over 20 years later.

Global Marine



3

Breadth and depth in expert products

VLT®

- **AC drives** (0.18 – 1,400 kW)
- **Decentral drives**
- **Integrated servo drives**
- **Soft starters**
- **Power options** (filters)
- **Software tools**

- **Solar inverters** (supplier to SMA)
- **Power stacks** for wind industry
- **Customized power modules**

Breadth and depth in expert products

Low voltage drives up to 1.4 MW

VLT® AutomationDrive FC 301/FC302

VLT® AQUA Drive FC 202

VLT® HVAC Drive FC 102

VLT® Refrigeration FC 103

VLT® Lift Drive LD 302

VLT® Low Harmonic Drive

VLT® 12-pulse Drive

VLT® Advanced Active Filter AAF

VLT® Midi Drive FC 280

VLT® Micro Drive FC 51

Decentral drives, motion drives and gear motors up to 7.5 kW

Soft starters

VLT® DriveMotor FCM 106 and FCP 106

VLT® Integrated Servo Drive ISD 510

VLT® OneGearDrive®

VLT® DecentralDrive FCD 302

VLT® Soft Starters

Software

VLT® Software

Services

DrivePro® Services and Support

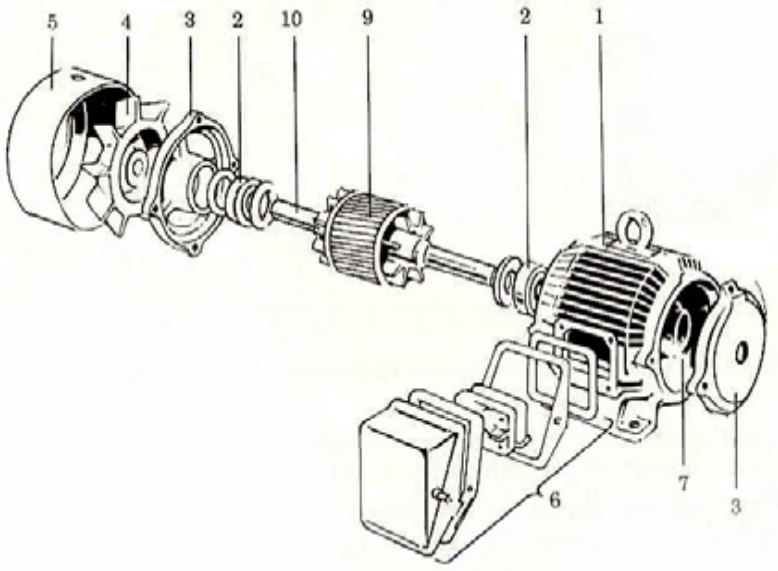
Breadth and depth in expert products

VACON®

- **Air and liquid cooled drives** (0.25 – 6,000 kW)
- **Decentral drives**
- **Active Front-End drives**
- **Industrial system drives**
- **Grid converters**
- **Customer-specific solutions**
- **Solar inverters**
- **Wind power converters**
- **Software tools**

Vekselstrømsmotoren

Viftedeksel Rotor Stator



Koblingshus

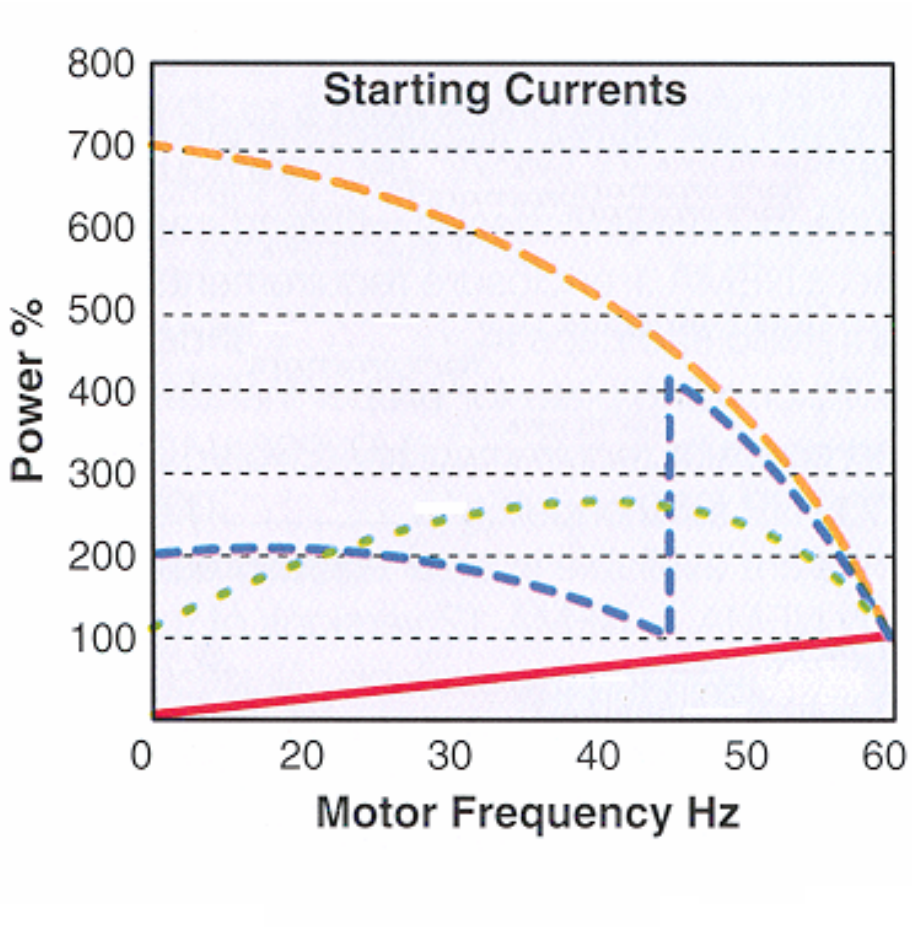
Motorhastighet og poltall

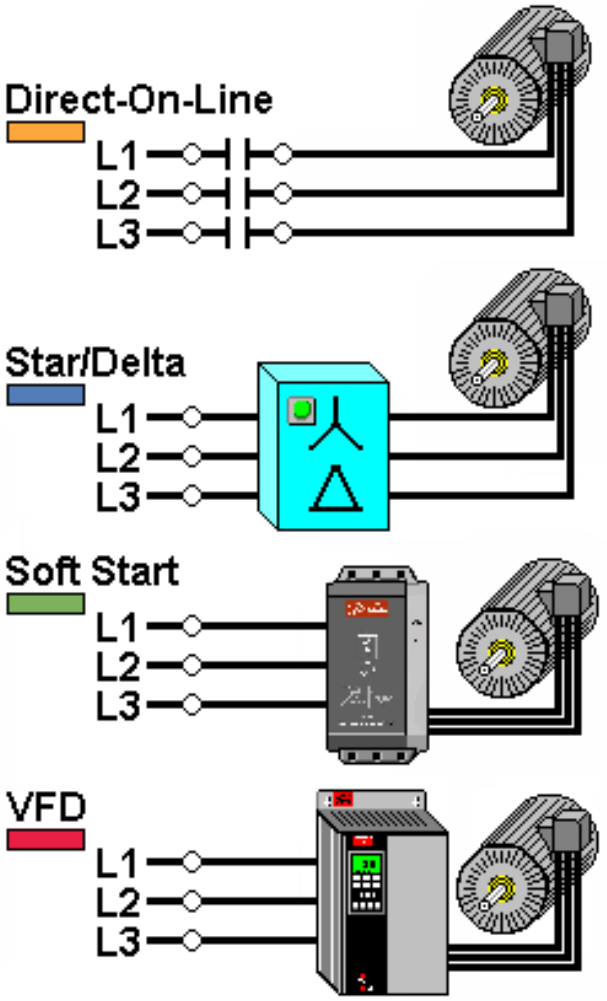
- Det er hovedsakelig tre forhold som avgjør motorhastigheten :
  - Motorens poltall
  - Dreiefeltets frekvens
  - Slippet i motoren (sakkingen)
- Standard motorer har ”synkront” turtall på : 3000, 1500, 1000 og 750 omdreininger pr. minutt.

Nominell motorhastighet:

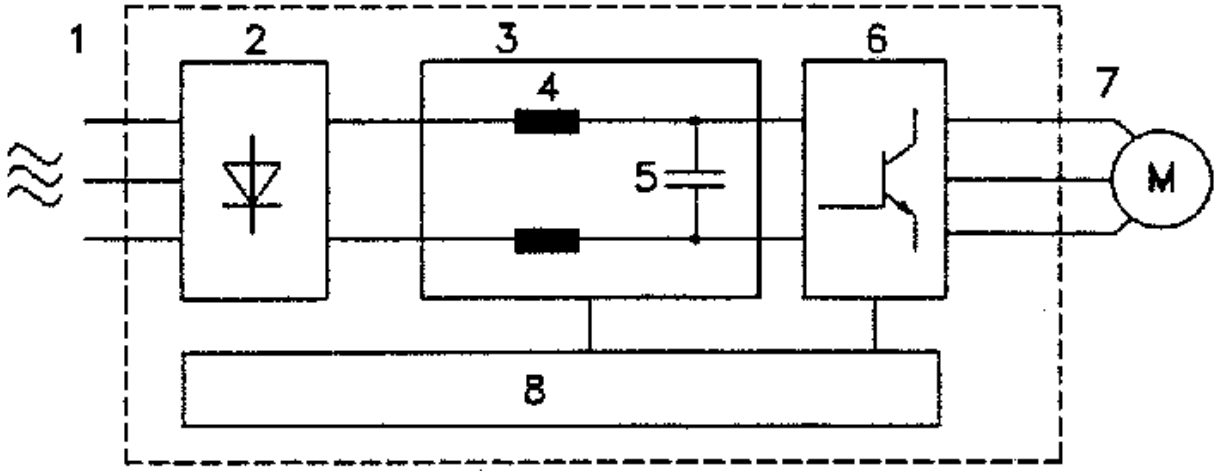
$$\frac{\mathbf{f\ (frekvens)} \times 60\ (\text{sek.})}{P\ (\text{polpar})} - n_{slip}$$

Redusering av startstrøm



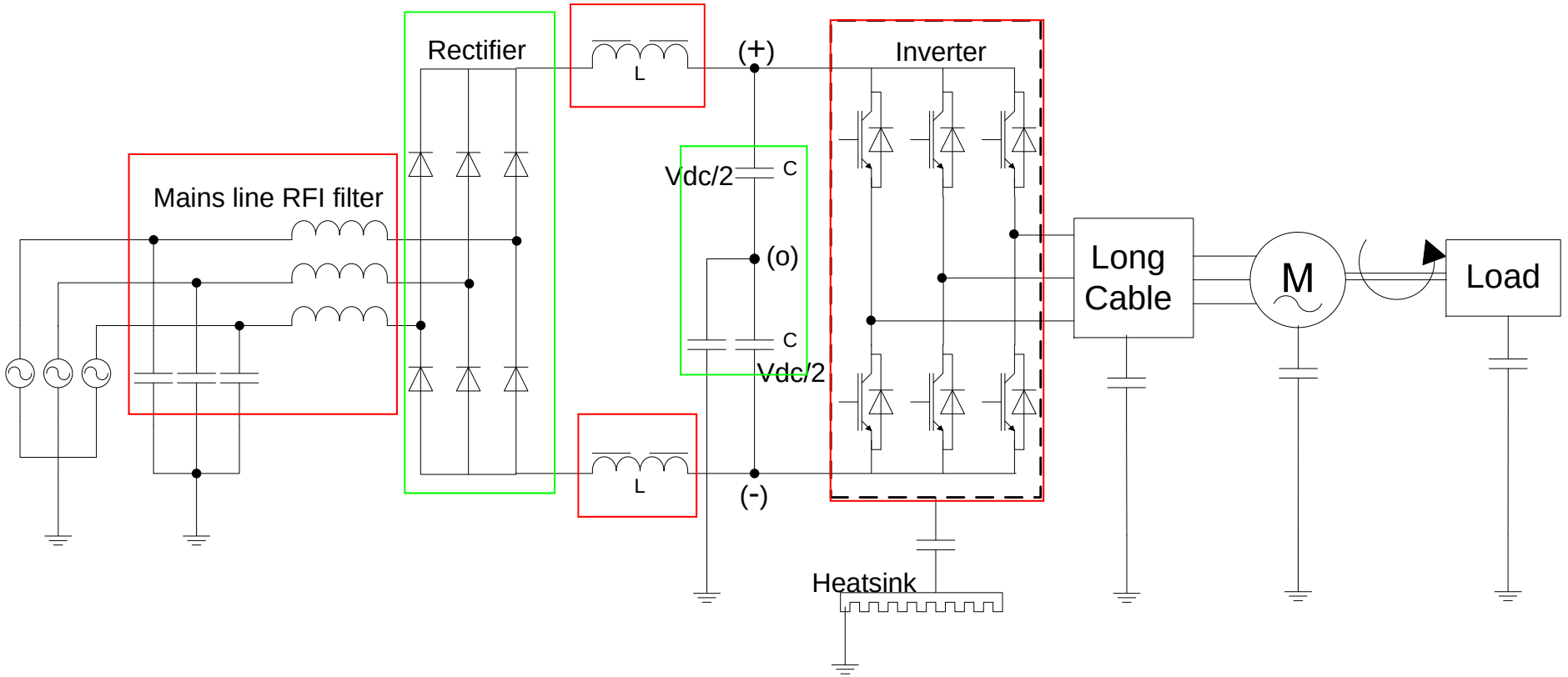


Blokkdiagram for PWM frekvensomformer



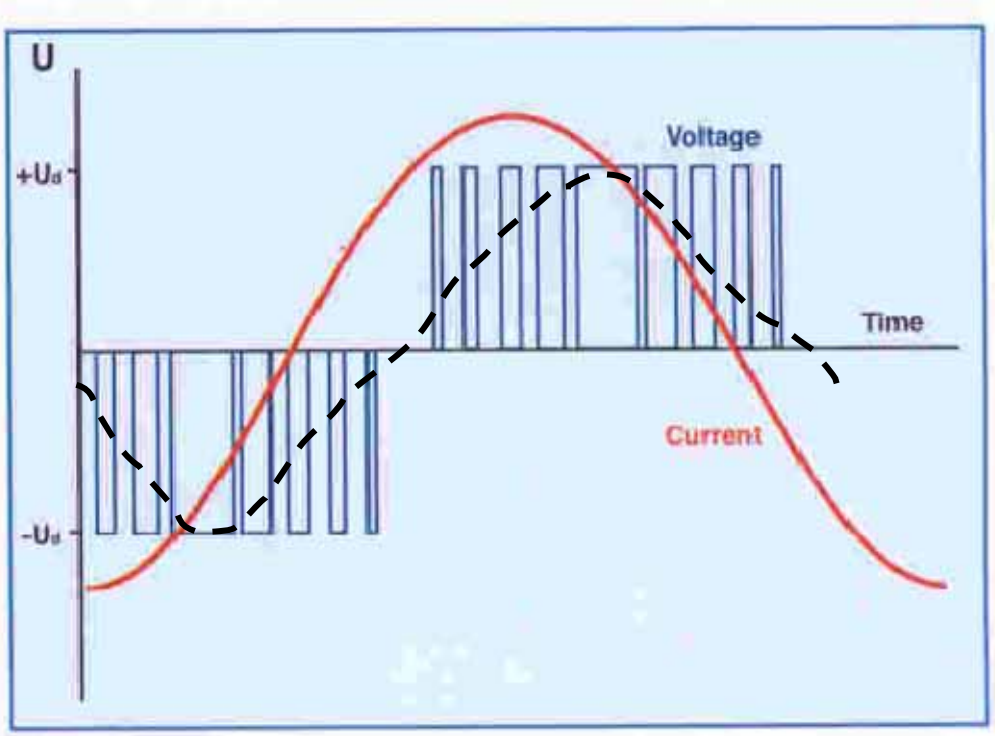
1. Nettspenning inn
2. Likeretteren
3. Mellomkretsen
4. DC-drosler (mellomkretsspoler)
5. Mellomkretskondensatorer
6. Vekselretteren
7. Motoren
8. Styrekortet (CPU)

Elektrisk oppbygning av frekvensomformeren

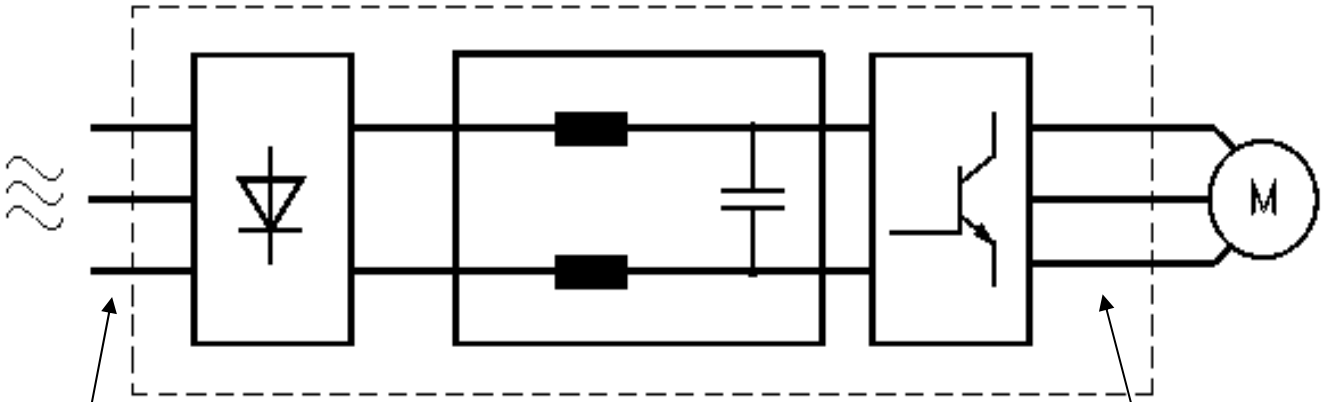


Utgangsspending og strøm.

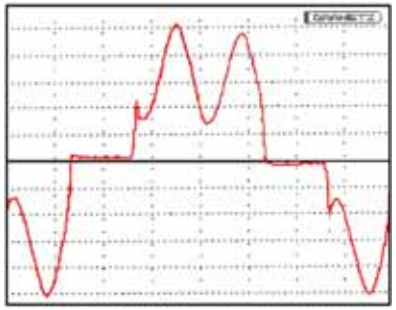
Switch metoden i inverteren (IGBT) produserer en variabel bredde av pulser



Possible sources of disturbances

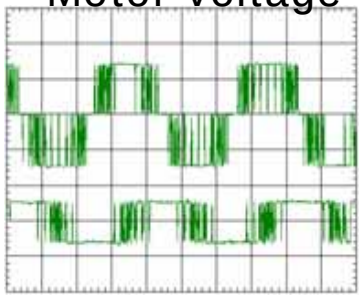


Input current



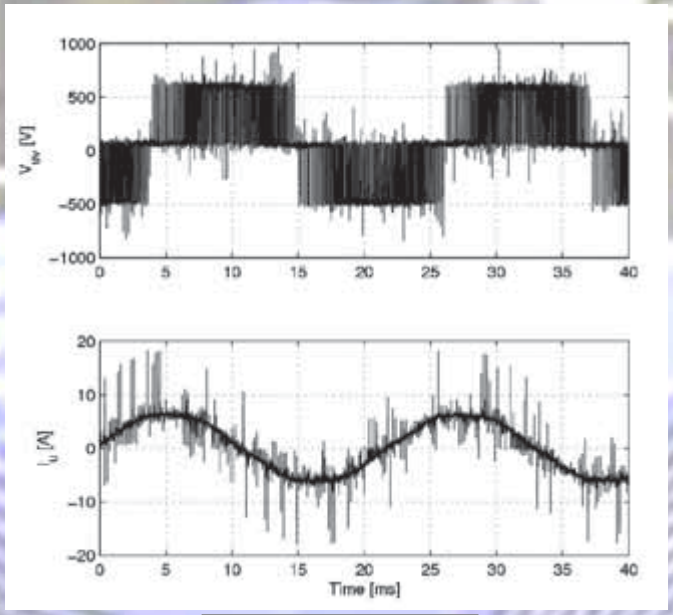
Harmonics <10 kHz

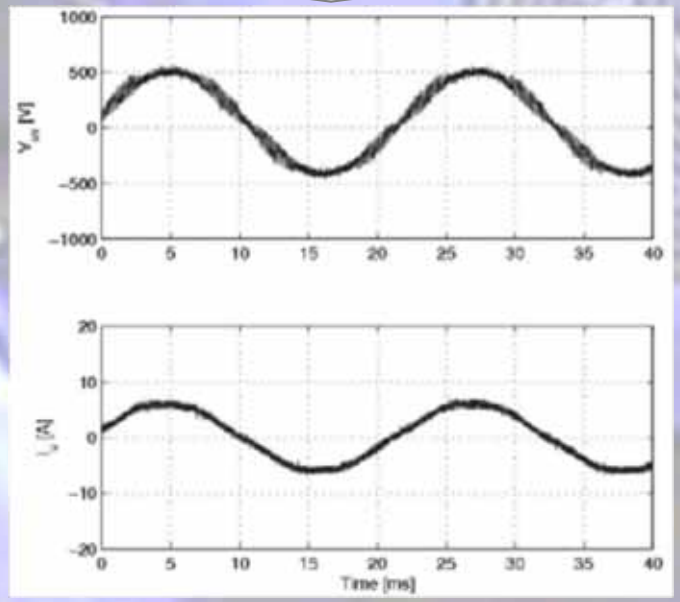
Motor voltage



Conducted emissions
150 kHz – 30 MHz

Radiated emissions
30 MHz – 1GHz



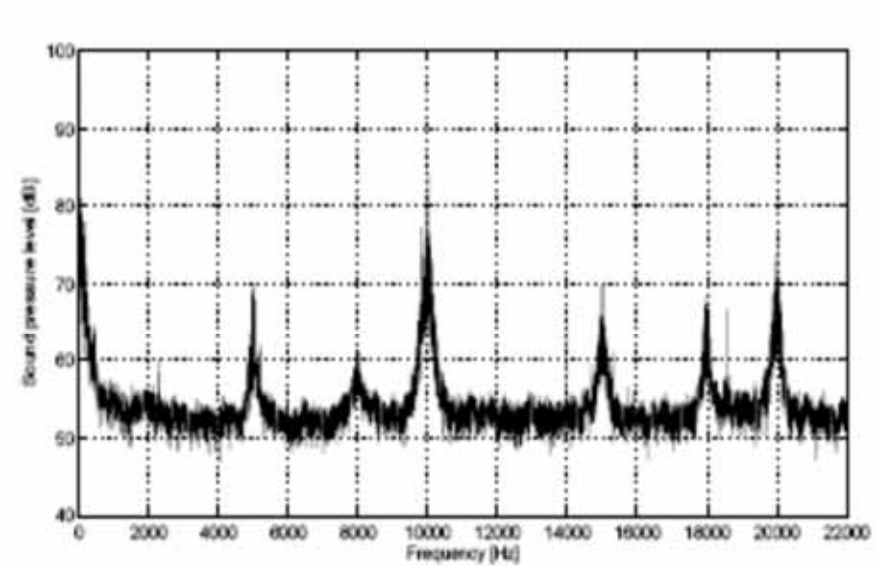


Smooth motor operation, Protection of bearings and insulation

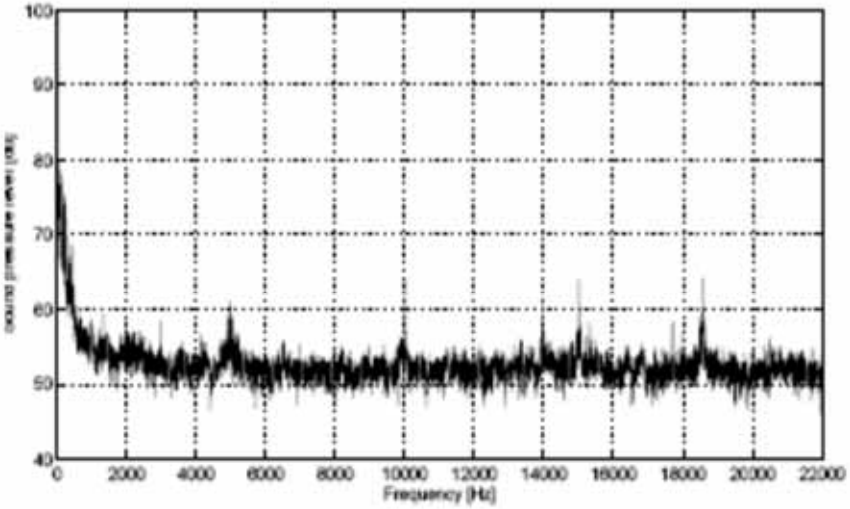
- VLT® Sine-Wave Filter
  - Provides a sinusoidal phase-to-phase motor terminal voltage
  - Reduction of thermal losses and bearing currents
  - Extend motor lifetime and increase service intervals
  - Product range:
    3 x 200 – 500 V, 2.5 – 800 A
    3 x 525 – 690 V, 13 – 660 A
  - Enclosures
  - IP 00 and IP 20 wall-mounted enclosure up to
    75 A (500 V)/13 A (690 V)
  - IP 23 floor-standing enclosure from
    115 A (500 V) / 28 A (690 V)

Akustisk støyreduksjon

- Lydmåling med og uten sinusfilter



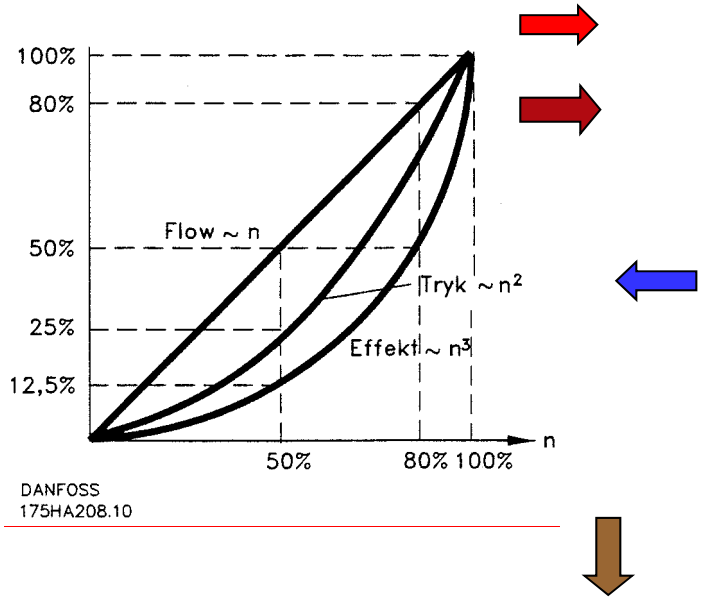
(a) No filter



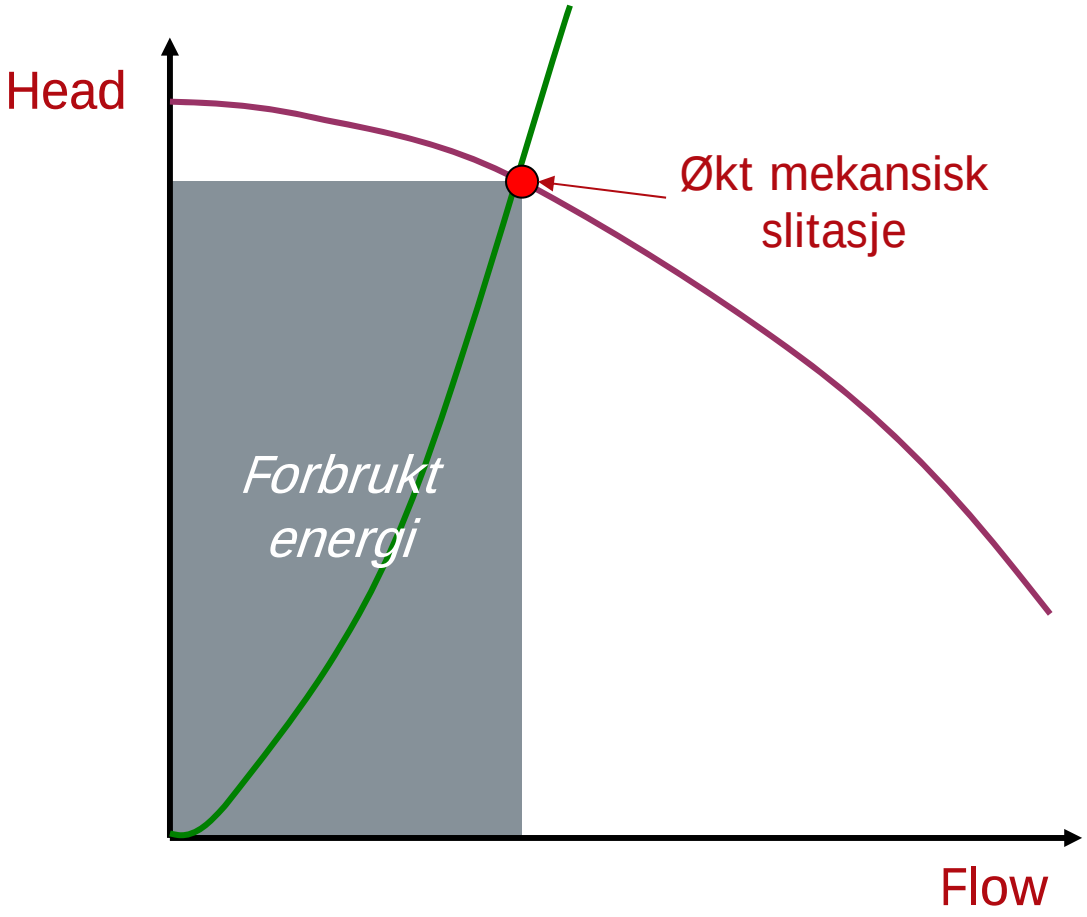
(c) Sine-wave filter

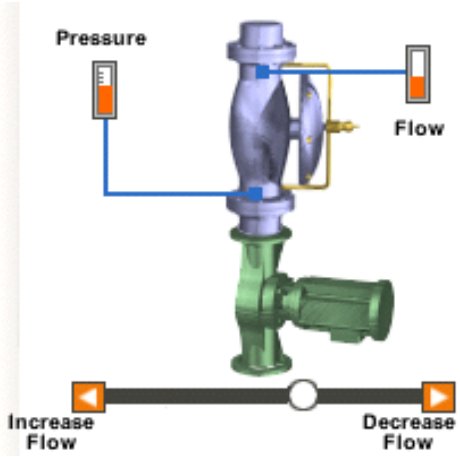
Forholdet mellom hastighet og effektforbruk i sentrifugaldrifter

- **Hvis hastigheten reduseres med 20 % vil effektforbruket falle med 50 %.**
- **Mengden reduseres linjert med turtallet.**
  - **Altså med 20 %**
- **Trykket faller i annen potens.**

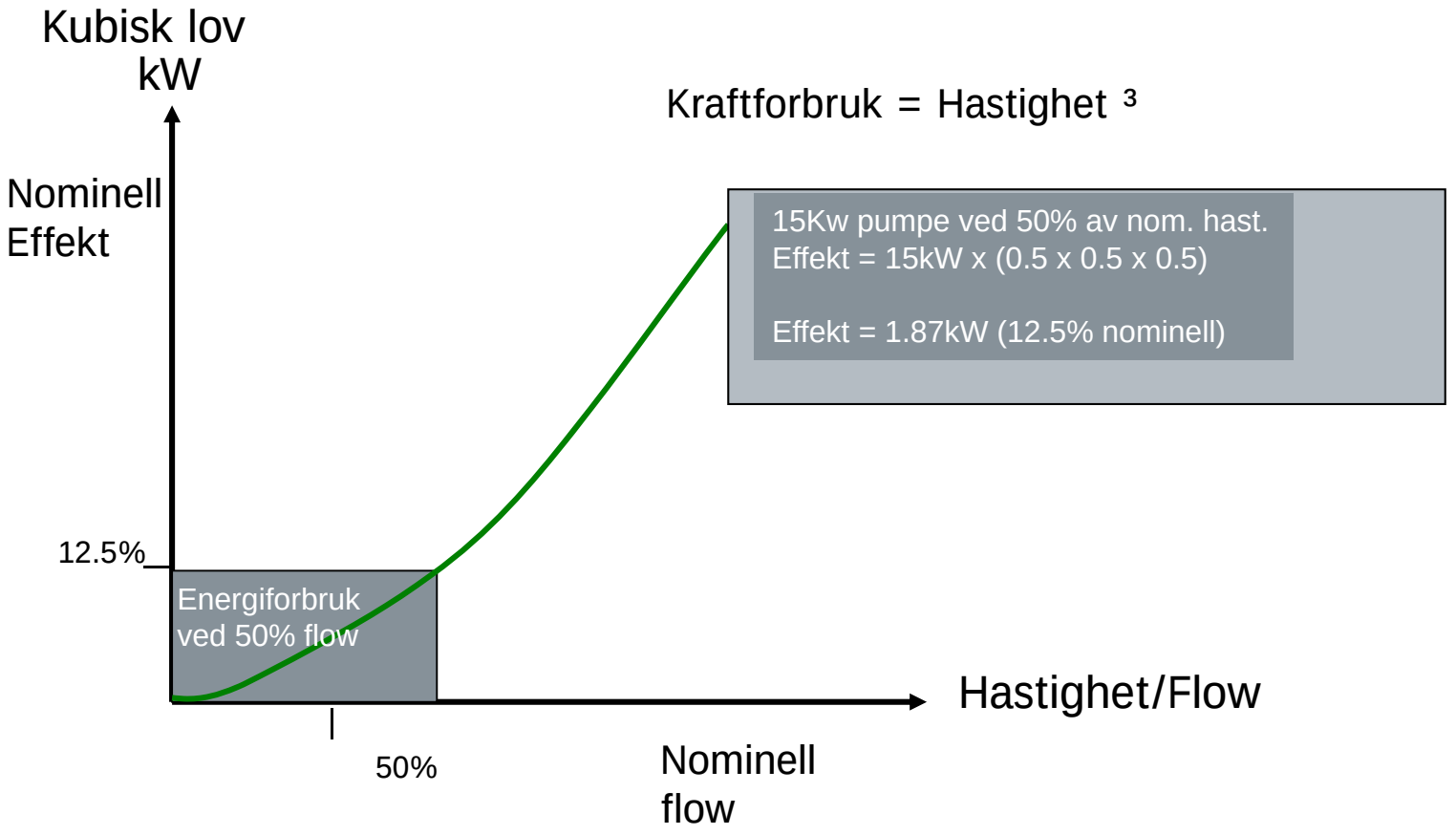


Regulering Flowregulering - Ventil





Regulering - VLT



Sleep Mode

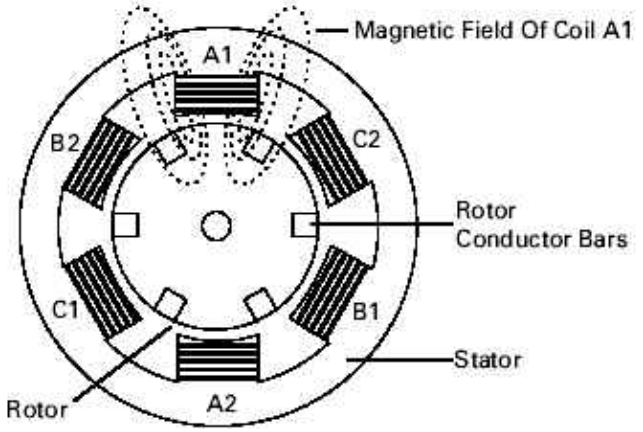
- Based on low flow or speed
- Boost function
- Internal or external signal to enter sleep mode
- For single-pump and cascade applications

✓ Maximizes energy savings

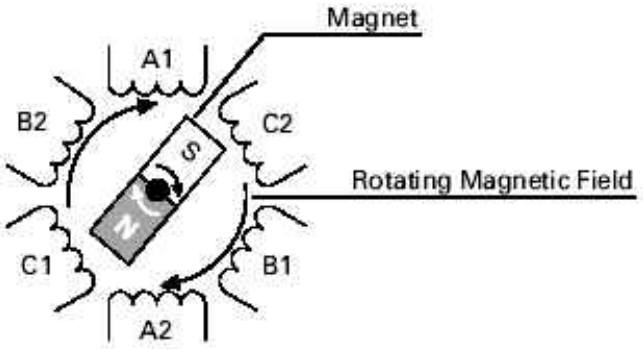
✓ Reduces wear on equipment

Motorprinsipper

Induksjonsmotor
Magnetfeltet i rotoren dannes av indusert elektrisk strøm i de kortsluttede delene av rotor



PM Motor
Magnetfeltet i rotoren dannes av den permanente magneten



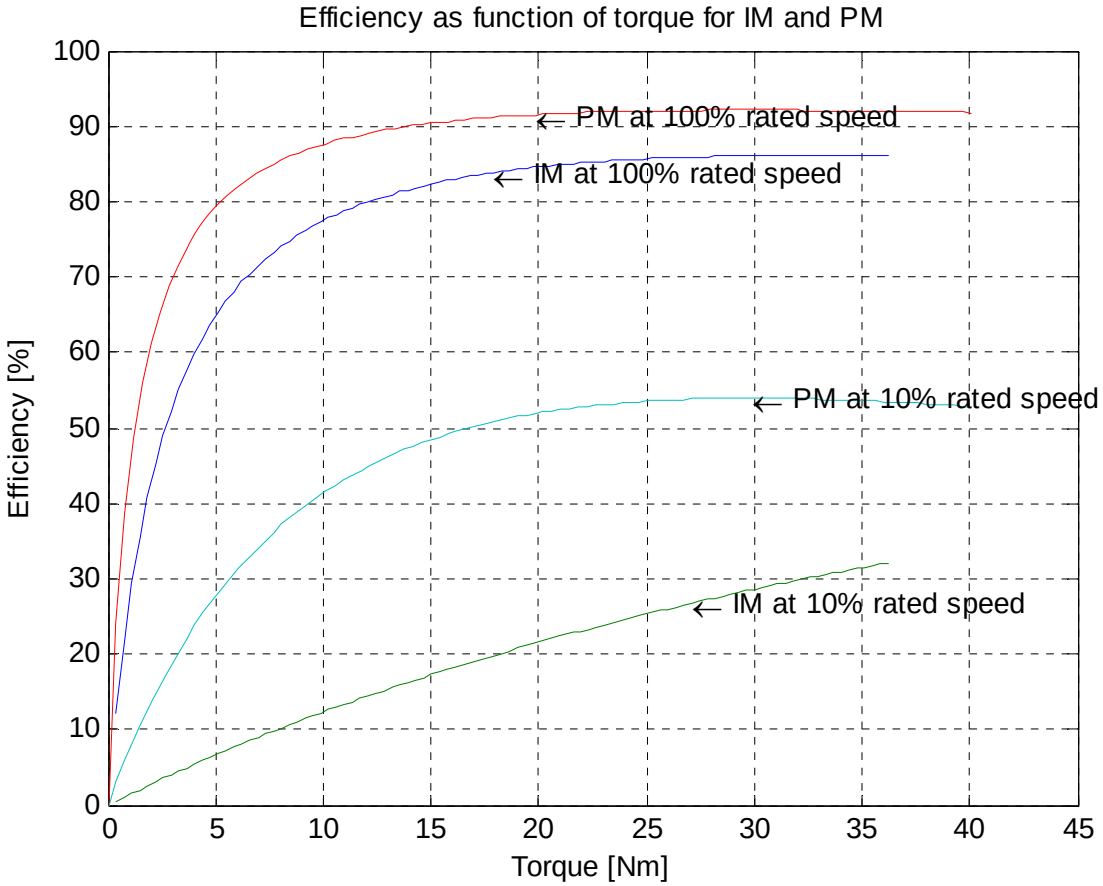
Virkningsgrad: Induksjonsmotor vs. PM

Induction Motor (IM)
5,5 kW EFF2
Effekttap

- Magnetisering trengs for å generere moment, gir særlig høyt tap ved lav last.
- Statortap
- Rotortap

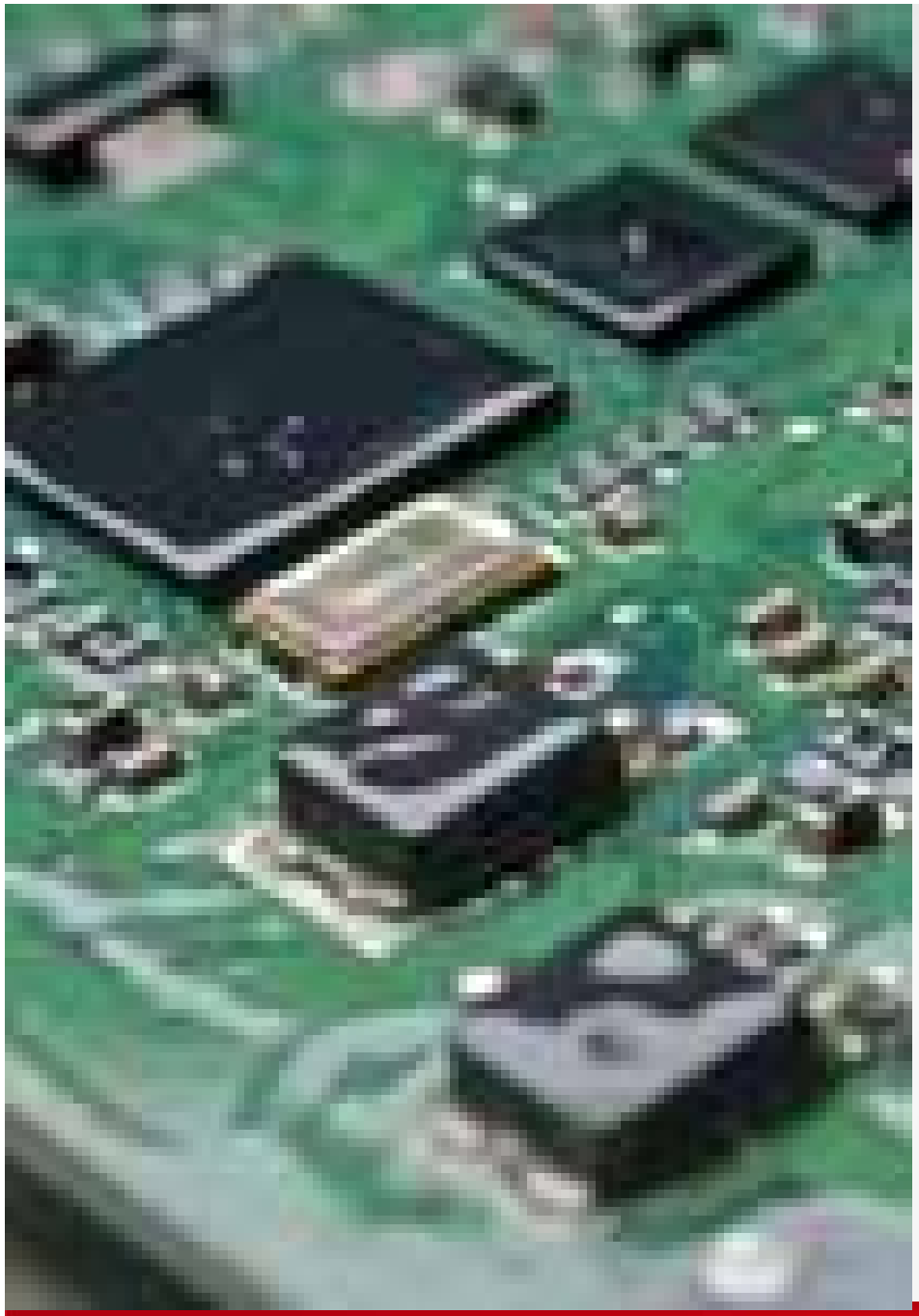
PM Motor Effekttap
5,5 kW

- Statortap



Enclosure and protection class meeting the application needs

- IP 00 – IP 66/NEMA 4X enclosures (depending on power size)
- All power sizes available in IP 54/55 enclosures
- Convenience of having the VSD close to the pump
- Optional mains disconnect switch saves cost for external switch
- Reduction of cable costs
- No need for air condition capacity
- Reduction of control room costs



PCB Coating

- As standard conforming to class 3C2 (IEC 60721-3-3). If used in especially harsh conditions it is possible to order a special coating that complies with class 3C3.
- 3C3 PCB from 90 kW comes as standard coating to ensure long lifetime even in harsh wastewater environments.
- Ruggedized for extra protection ‘Ruggedized’ version, that ensures that components remain firmly in place in environments characterized by high degrees of vibration such as Marine and mobile equipment.

Extended Temperature Range

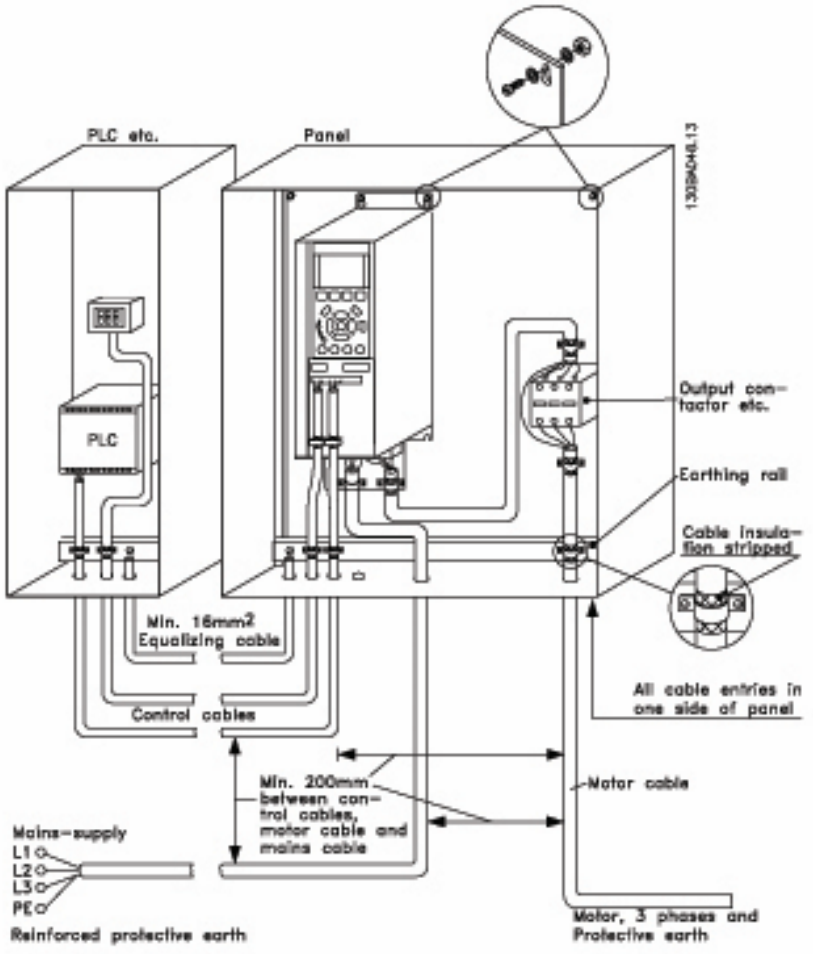
- Temperature specifications have been expanded to -25° C
- This is the lowest rating for any HVAC drive on the market

Value proposition:

- No need for additional cabinets
- Installation close to application for reduced cable length

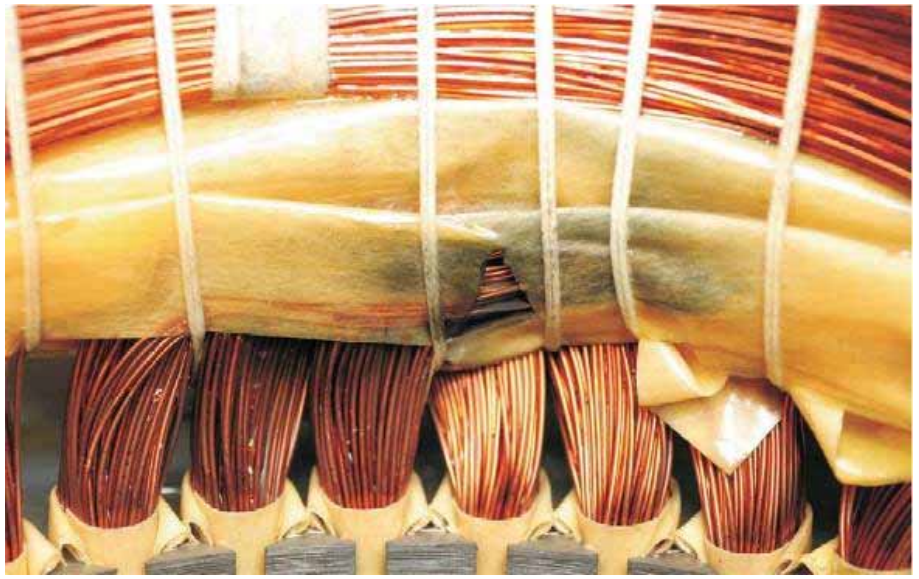
EMC-riktig installasjon

- Dette bildet viser en
  EMC-riktig installasjon
- Alt integrert :
  DC-drosler/nettfilter
  RFI/EMC-filter
  EMC-riktige tilkoblinger
- Gir optimale EMC egenskaper!



Motorisolasjon

- Ved kritiske overspenning kan motorisolasjonen ryke.
- Ved følgende faktorer bør det iverksettes tiltak:
- Gamle motorer med dårlig isolasjon
- Applikasjoner med intensiv bremsing (høy Vdc)
- Aggressive omgivelser (klor, gass, støv)
- 690 V applikasjoner

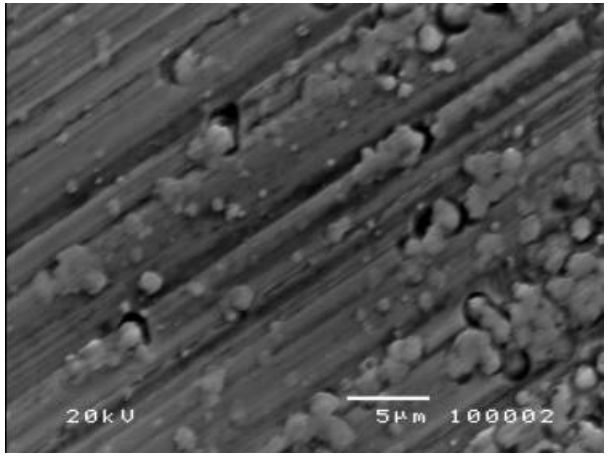


Skader på motorlager

Akselspenningen gir elektriske utladninger I lager. Gir mulighet for svikt I lager.

Risikofaktorer:

- Eksentrisk last. For eksempel reimdrift
- Dårlig installasjon (manglende jording)
- Tørre omgivelser, og områder med høy statisk elektrisitet (tekstilindustri)



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THD og Kompenseringsteknikk

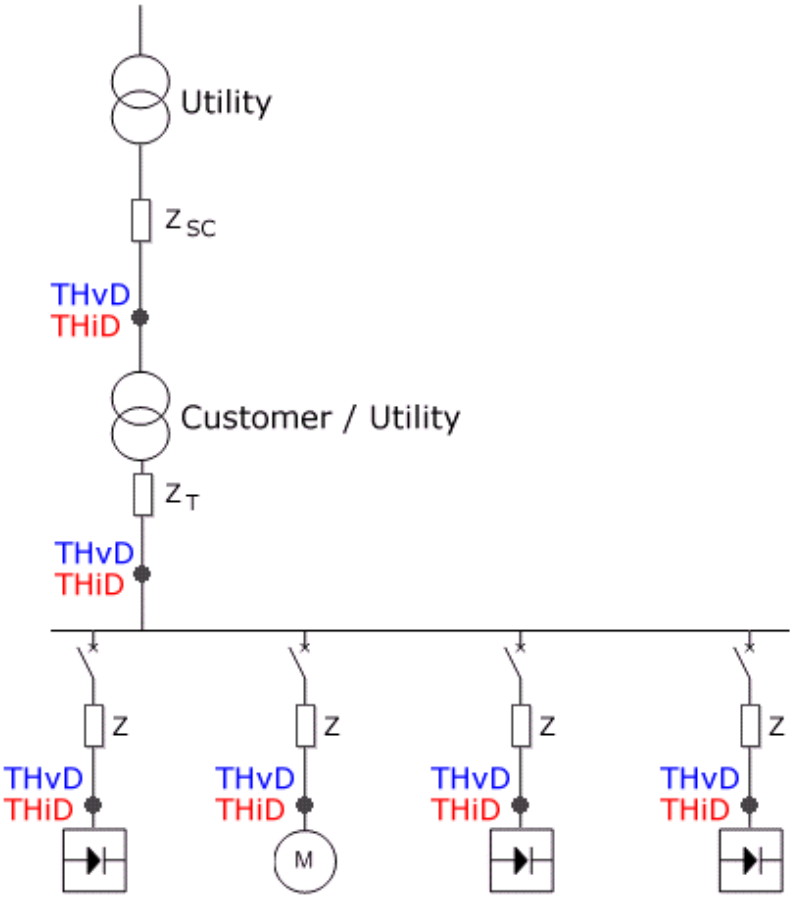
Anbefalinger

- Redusere harmonisk støy, uten å påføre prosjekter unødvendige tiltak og kostnader
- Husk: THvD = THiD x Z (impedans)

THvD (system) bør holdes under 8%

Sentral kompensering demper THiD I hele anlegget.

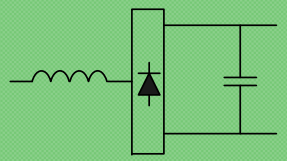
Passiv kompensering demper THiD pr. Forbruker.



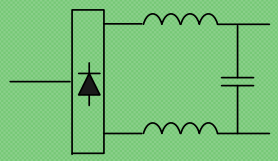
Kompenseringsteknikk for frekvensomformere

Passive løsninger:

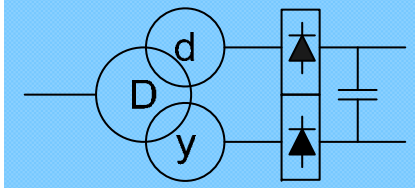
DC-spoler



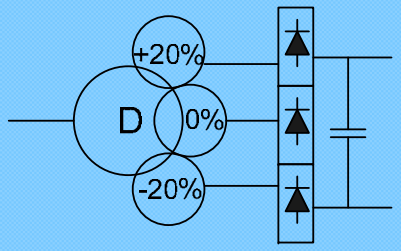
AC-spoler



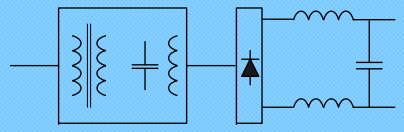
12-pulse



18-pulse

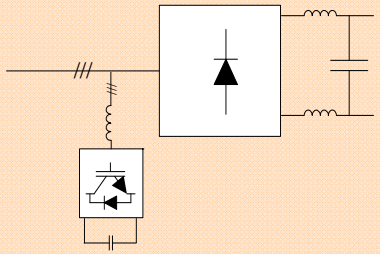


Advanced Harmonic Filter

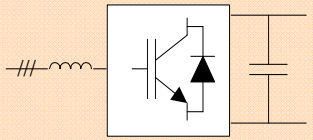


Aktive løsninger:

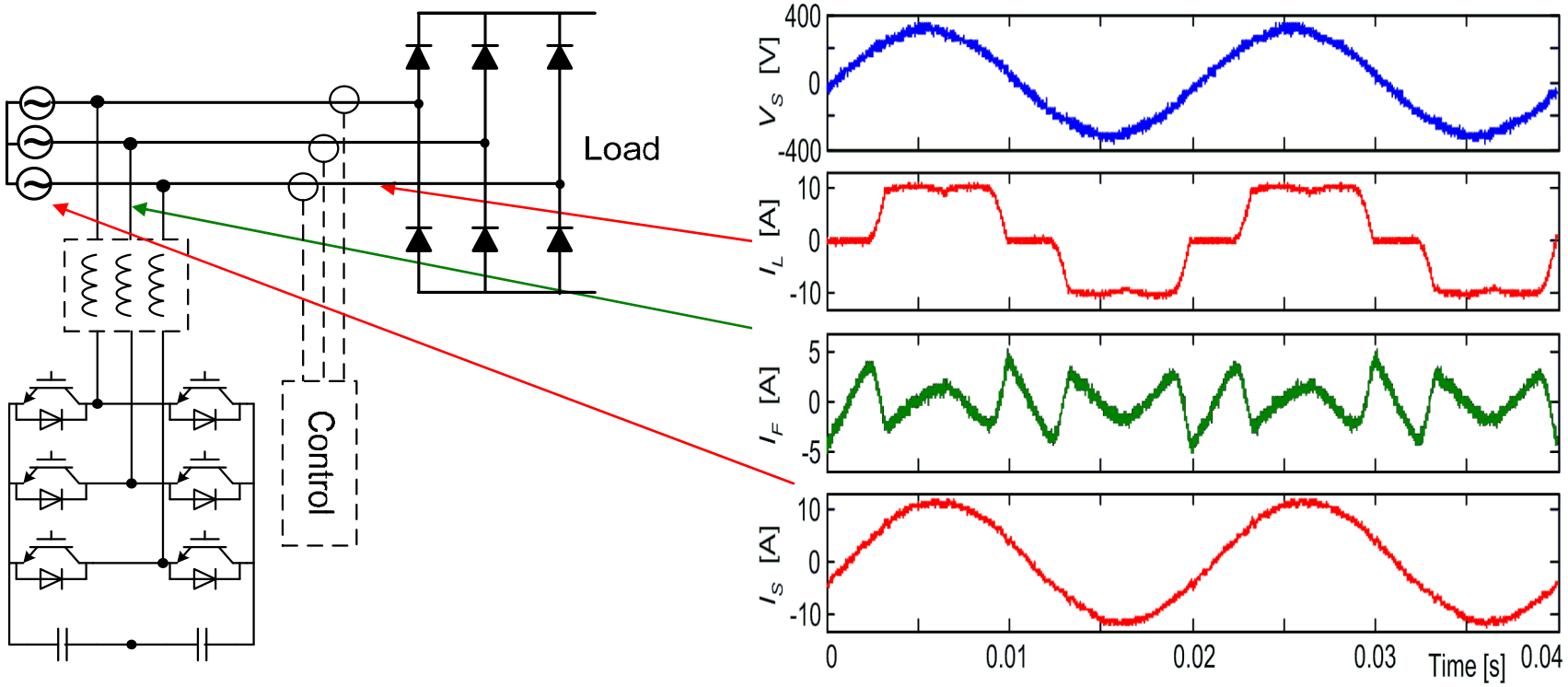
AAF & Low Harmonic Drive



Active Front End



Active Filters



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TOMORROW

VLT | VACON

ENGINEERING TOMORROW

Danfoss

Danfoss Drives solutions

Marine kompetansesenter Holmestrand

- **Diesel Elektrisk fremdrift**
- **Hybridløsninger**
- **Energiconvertere DC/DC, AC/DC, DC/AC**
- **Komponenter for DC energidistrbusjon**
- **Kran og winchløsninger**
- **Drilling**

Bruksområder for energiconverter

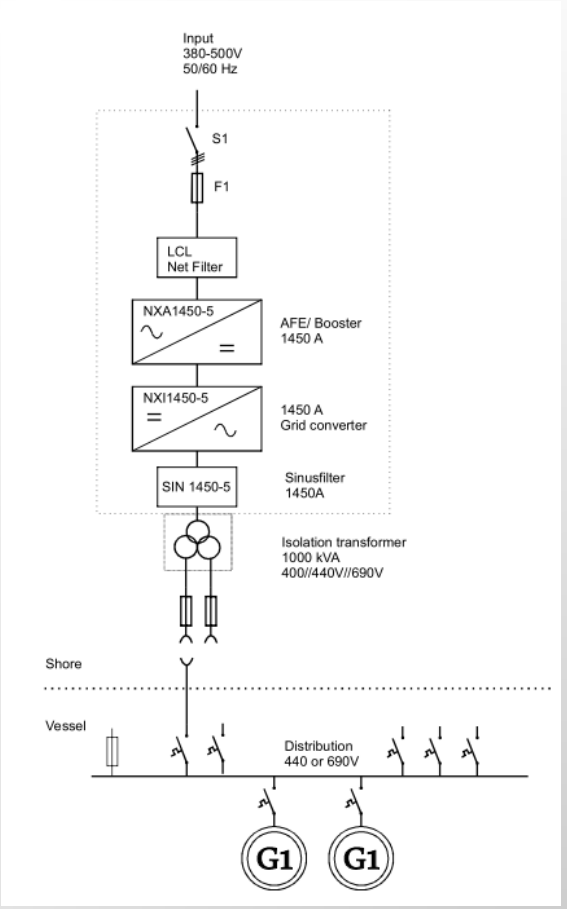
Shore to ship Landstrøm

Variabel speed Akselgenerator

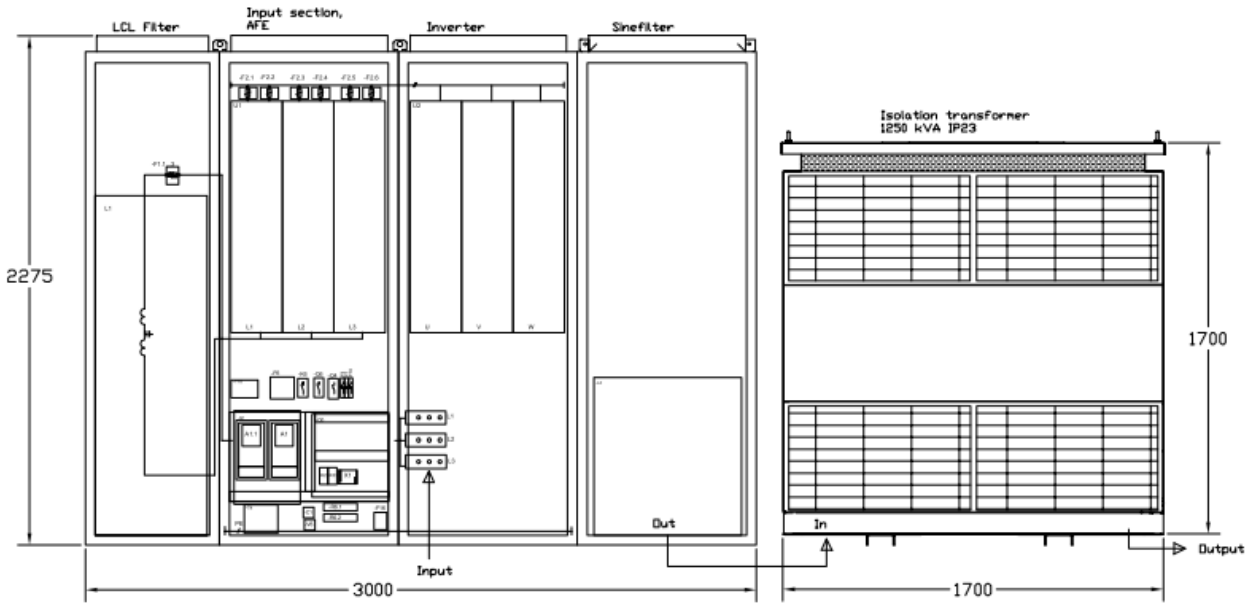
Power shaving/ spinning reserve batterier
Brenselscelle

Vacon ® Grid converter

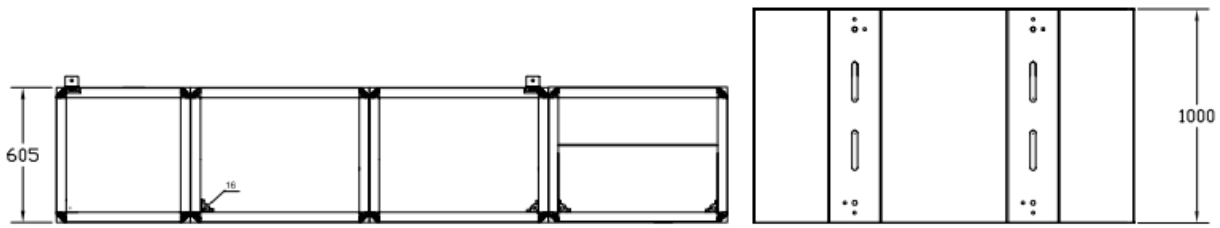
1. Fast og ren sinus spenningstilførsel
2. Ingen utkobling ved overlast
3. Mater maks-strøm ved kortslutning, slik at selektivitet opprettholdes
4. Kompenserer automatisk for spenningfall frem til hovedtavle
5. Synkronisrerer selv mot skipets hovedtavle
6. Kan levere effekt i parallel med skipets generatorer
7. Håndterer transformator startstrømmer opp til 10-20 x I nom
8. Kan oppfylle nettselskapenes krav til spenningskvalitet, f.eks: VDE 0216-1-1



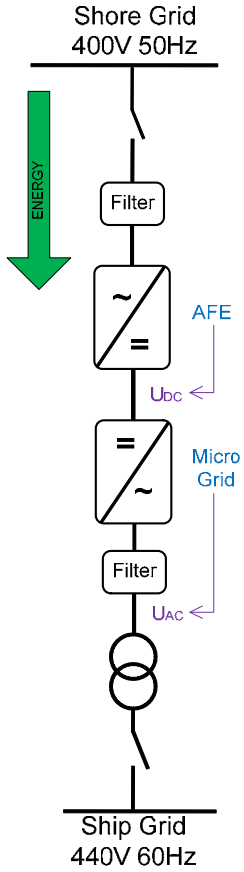
VACON® Grid Converter 1 MW



Front view



Bottom view



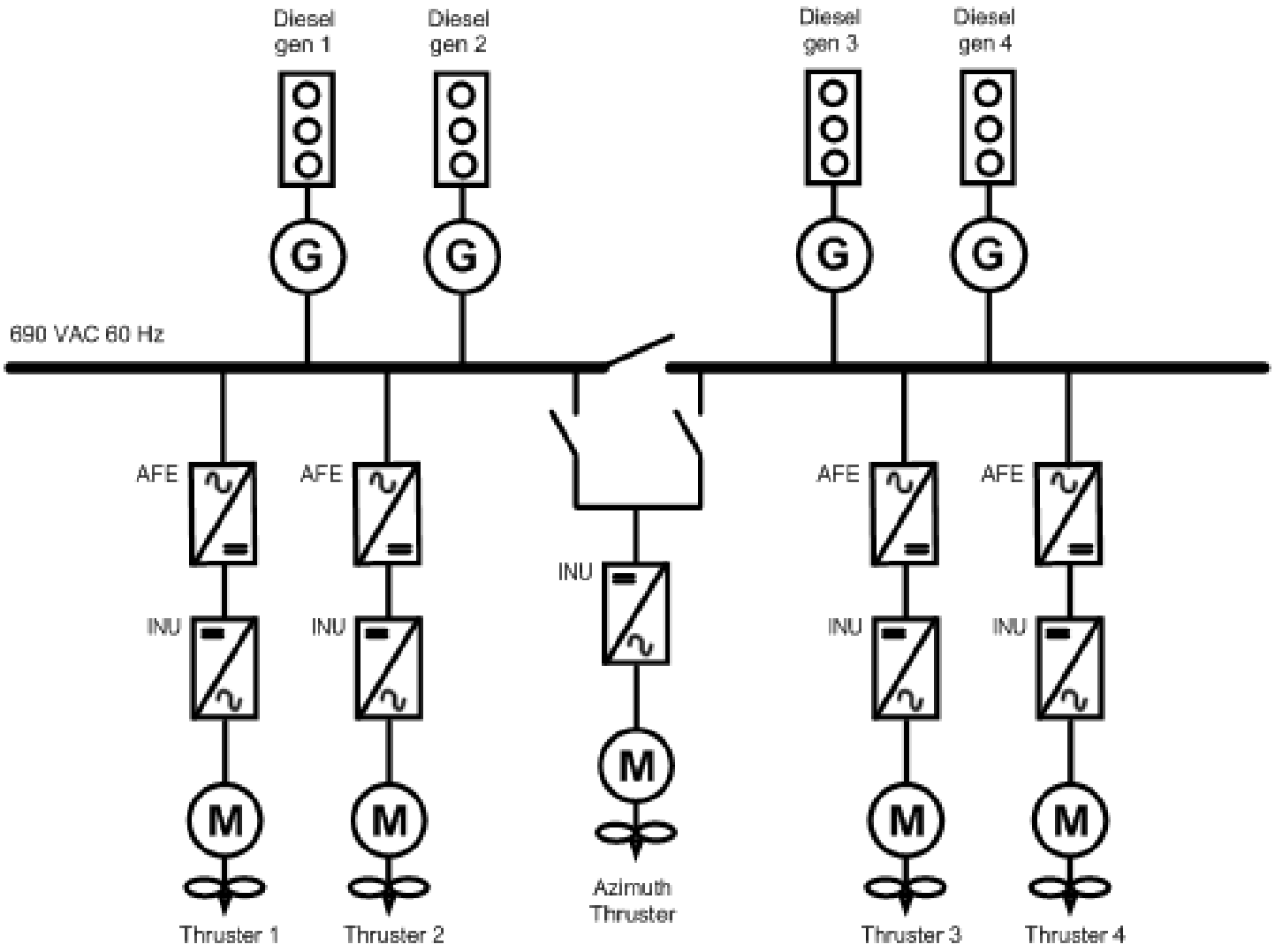
Verdens første EL-ferje

20 min kryssing
1000 kWh batterier, 2x 450 kW propulsion
50 ruter forventes elektrifisert i nærmeste fremtid

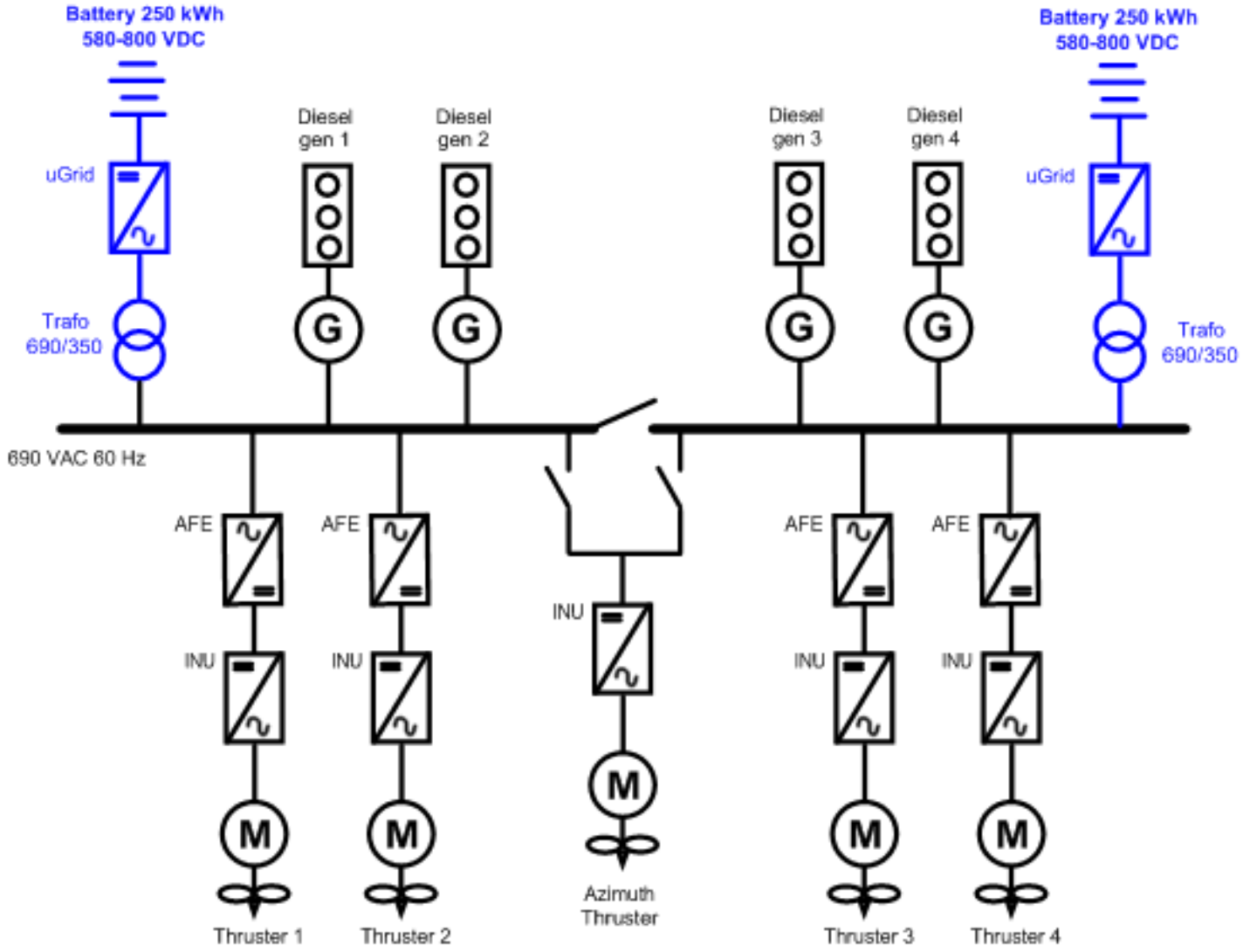
Omformere for mellomspenning, 3,3 – 4,2 kV

Danfoss Drives
Case: Olympic Energy – Energy Storage

Før...



...Etter

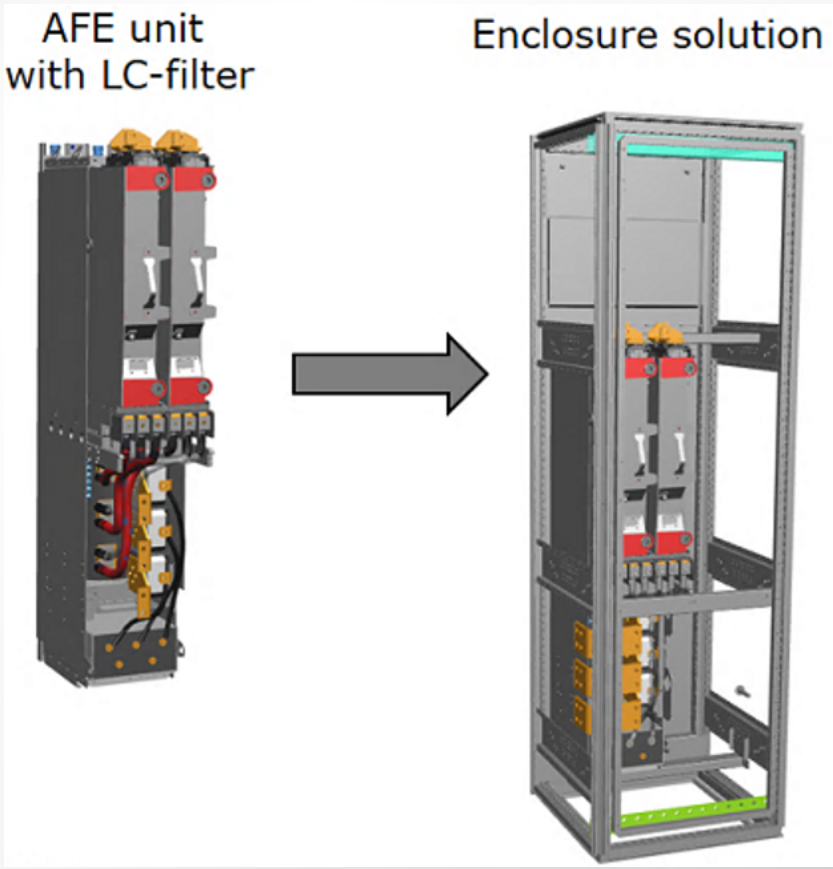


Ettermontering av container med drives og batterier på eksisterende fartøy

Batterier fra LG

Hvordan ser fremtiden ut?

Nye vannkjølte omformere



Energiomvandling er nøkkelen til effektive løsninger

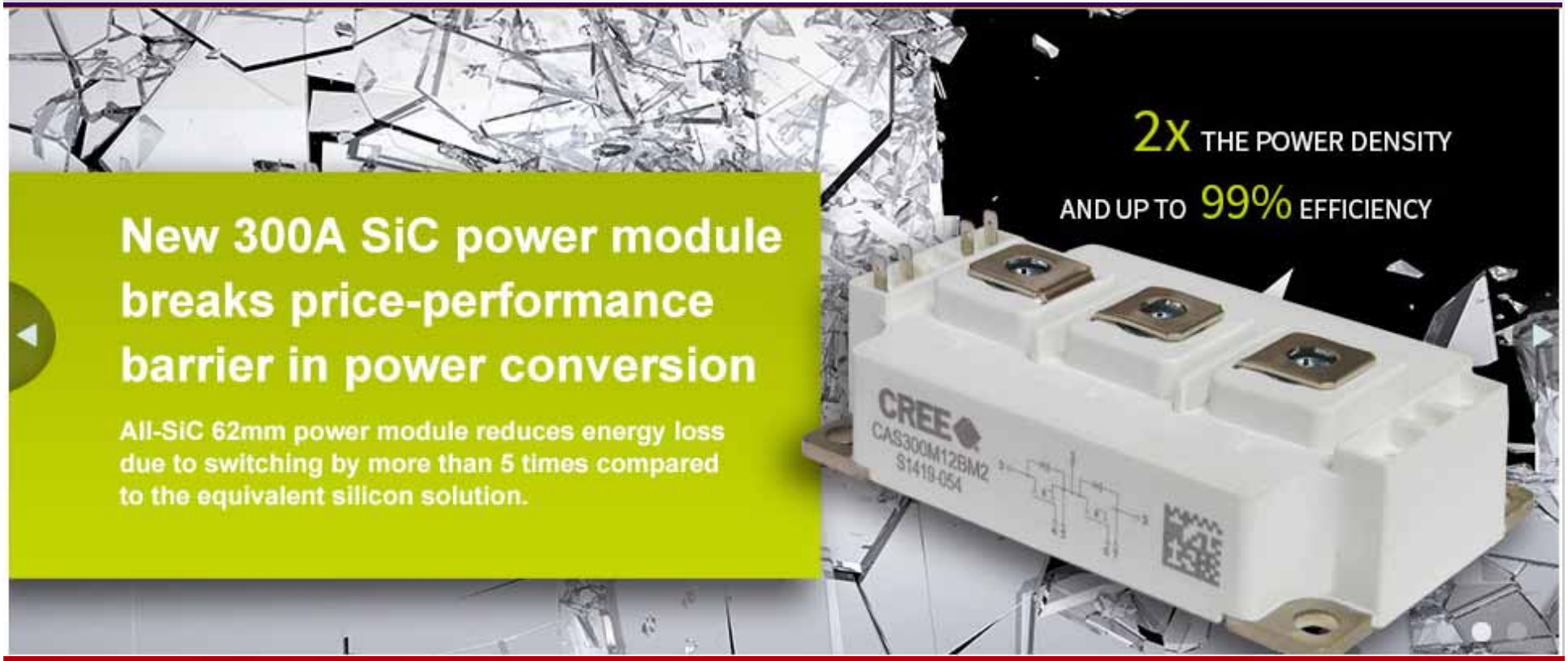
Elektriske kjøretøy

Fornybar energi

Ladestasjoner

Passivhus

Silicone Carbide komponenter er tilgjengelig nå



Power density reduseres betraktelig

1500 kW DC/AC converter
BxHxD=746x882x375mm

1500 kW AC/DC/AC converter
BxHxD=746x1175x375mm


SUPERB wallpapers
That's all Folks!