

# YASKAWA

## Efficiënt Aandrijven met Yaskawa Matrix Technologie

Live vanuit De Kwakel, vrijdag 5 juni 2020.

**YASKAWA**

Erik van Driel

Business Unit Manager  
Drives, Motion & Controls Division

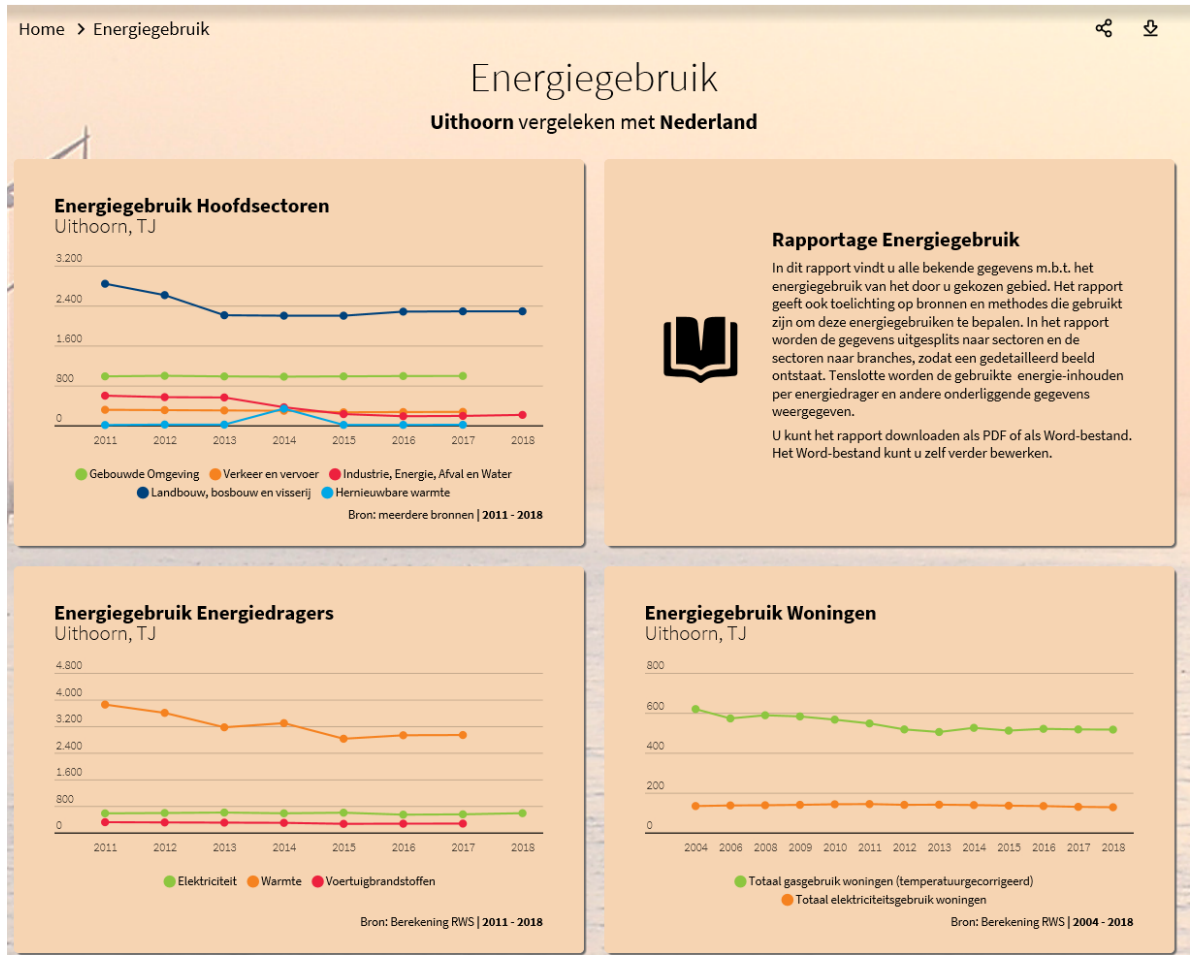
**YASKAWA Benelux B.V.**

Brainport Industries Campus  
BIC 1  
5657 BX Eindhoven (NL)  
Phone +31 (0) 40 289 55 00  
Mobile +31 (0)6 23 83 44 54  
erik.vandriel@yaskawa.eu.com  
www.yaskawa.eu.com

- Introductie Yaskawa organisatie
- Ontwikkeling Matrix Technologie / U1000
- De innovatie van Matrix Technologie
- Vergelijk met andere aandrijfconcepten
- Quick Scan voor toepassingen
- Toepassingsvoorbeelden
- Advies voor opstellen business case
- Ondersteuning
- Aanvullende informatie via [www.yaskawa.eu.com](http://www.yaskawa.eu.com)

Adrian Lischka  
Yaskawa Europe GmbH  
Product Manager

# EFFICIENT AANDRIJVEN: ACTUEEL EN STEEDS CONCRETER



Klimaatkoord Retweeted

**Martien Visser** @BM\_Visser · Oct 9

De Australische duurzame sector wil naar 700% hernieuwbaar en het overschot als waterstof exporteren. Ik heb voor NL alvast stukje land met zonpy geserveerd. Voldoende voor alle energieverbruik in NL, inclusief conversieverliezen en inclusief energie voor vliegen en varen.

Translate Tweet

# GLOBAL PRODUCT PORTFOLIO

In industrial automation, YASKAWA is one of the  
global **leading technology providers**



**Industrial  
robots**

48,000

430,000



**AC drives**

2.2 Million

Production in 2018

27 Million



**Servos  
and motors**

2.1 Million (each)

18 Million

Installed base (status as of 2018)

# INNOVATIVE SOLUTION PHILOSOPHY

Inventor of

# Mechatronics

Introduction of a  
holistic engineering philosophy  
(1969).

# YASKAWA BENELUX



Start Sales Yaskawa Electric GmbH  
1990

Relocation to Brainport Industries Campus  
in Eindhoven



1979  
Yaskawa Electric GmbH

2004  
Robotics business in Breda

2008  
Relocation to Science Park Eindhoven in Son

2013  
Start-up Drives & Motion business

2016  
Integration of VIPA Controls

2019

# MATRIX TECHNOLOGIE SINDS 2005

1ste Generatie



2005

1ste MV Matrix Inverter



2007

Huidige Generatie



2014

# UW TOEPASSING, ONS UITGANGSPUNT



Innovatieve Matrix technologie



Lager dan 5%



Regeneratief



Tijdbesparing bij installatie



Machine veiligheid ingebouwd

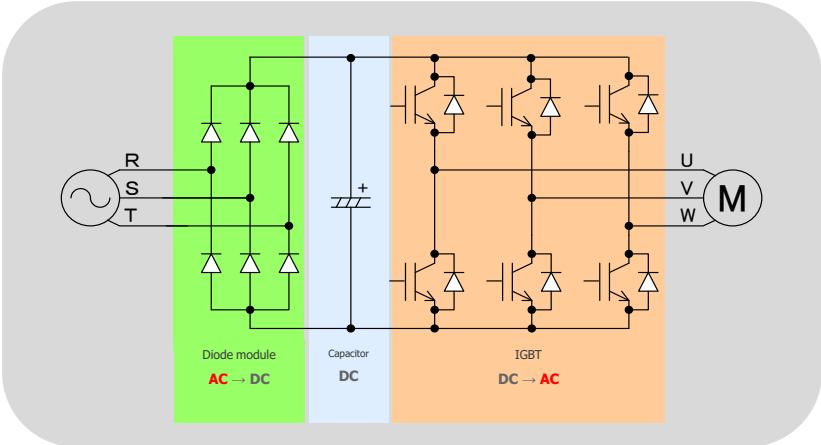


Efficiënte aandrijving en eenvoudige installatie

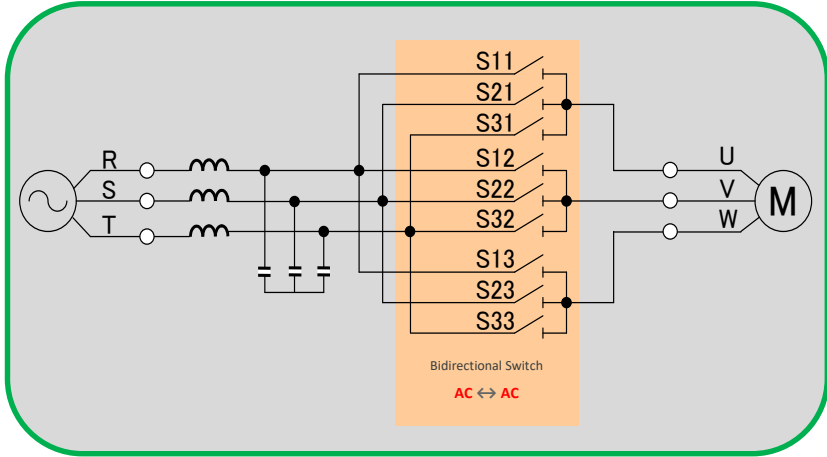


Clean Power: minimale verliezen.

# DE INNOVATIE VAN U1000 MATRIX INVERTER



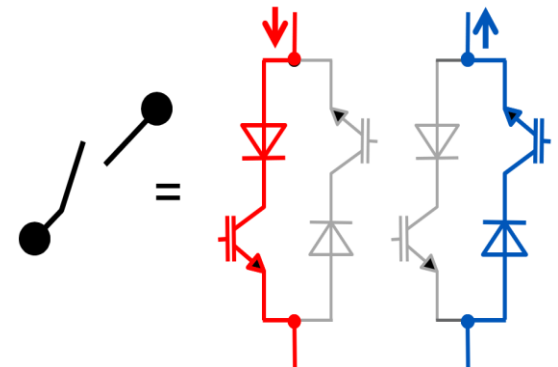
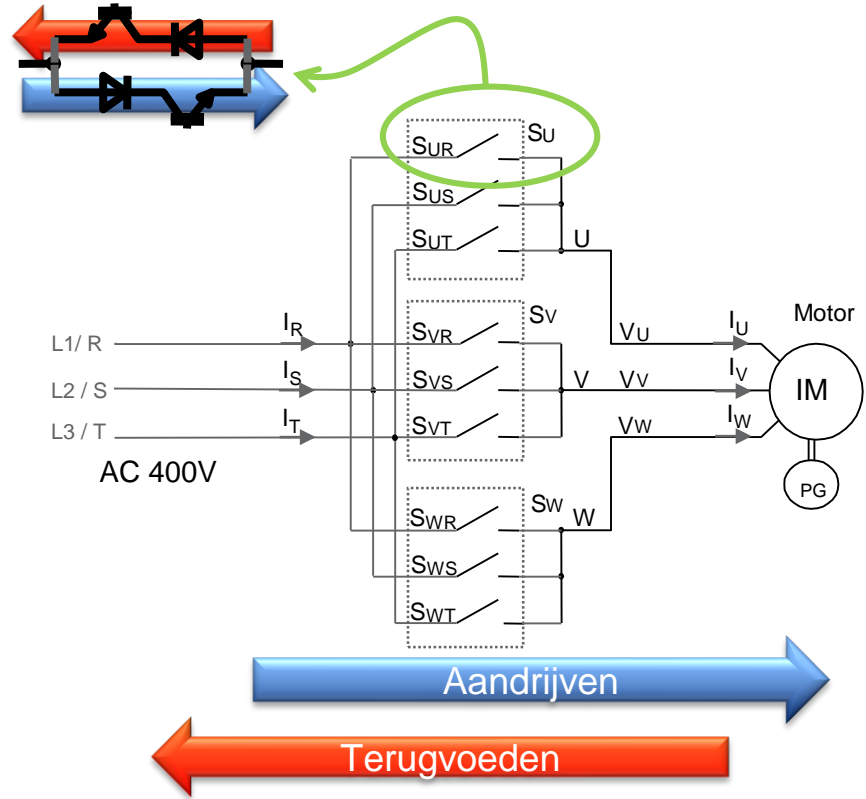
Conventional Drive Topology



Matrix-Converter

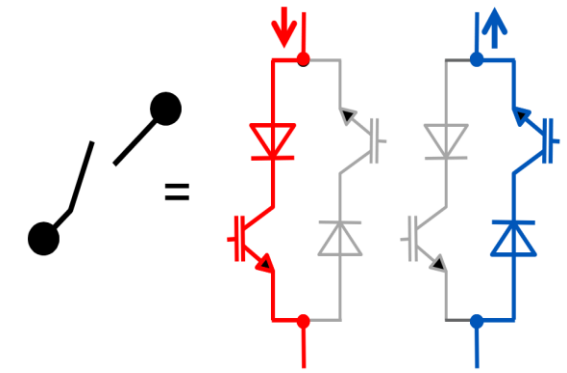
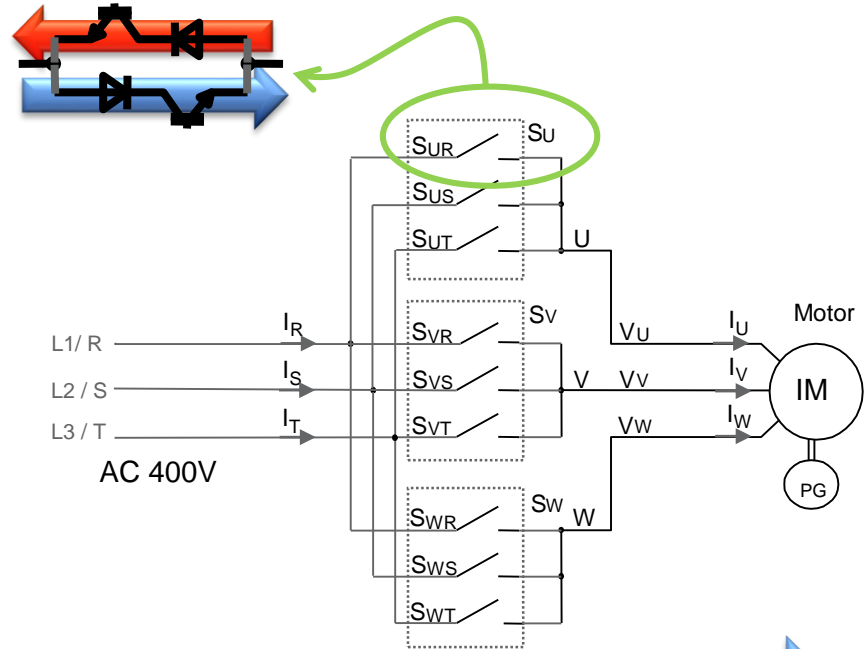


# ONTWERP EN ENERGIESTROMEN



9x vermogenshalfgeleider modules  
Insulated Gate Bi-Polar Transistors (IGBT) en Diodes

# ONTWERP EN ENERGIESTROMEN



9x vermogenshalfgeleider modules  
Insulated Gate Bi-Polar Transistors (IGBT) en Diodes

Aandrijven


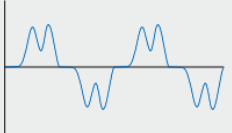

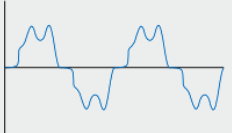

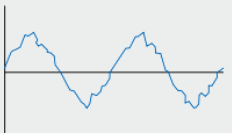

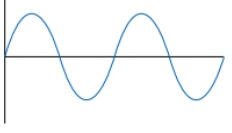
Terugvoeden

Efficiënt Aandrijven:  
Direct Terugvoeden Regeneratieve Energie

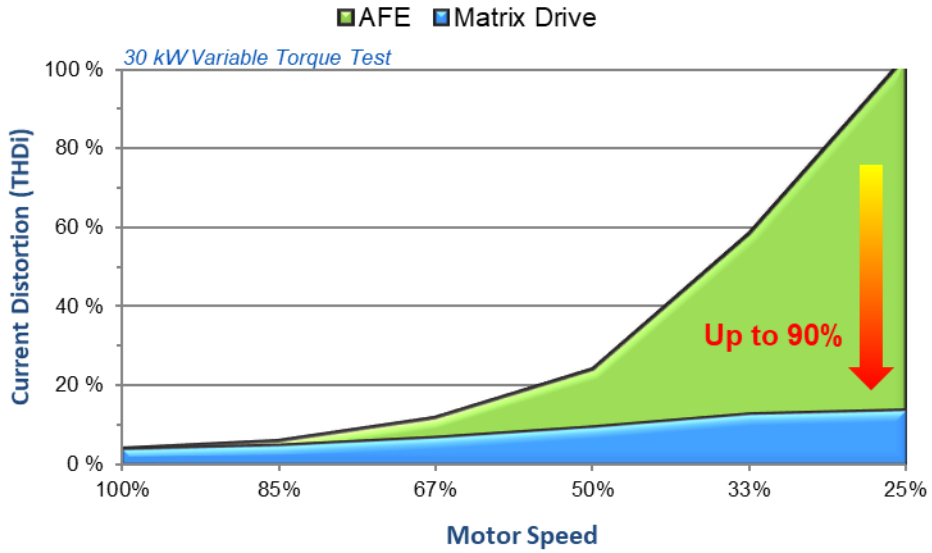
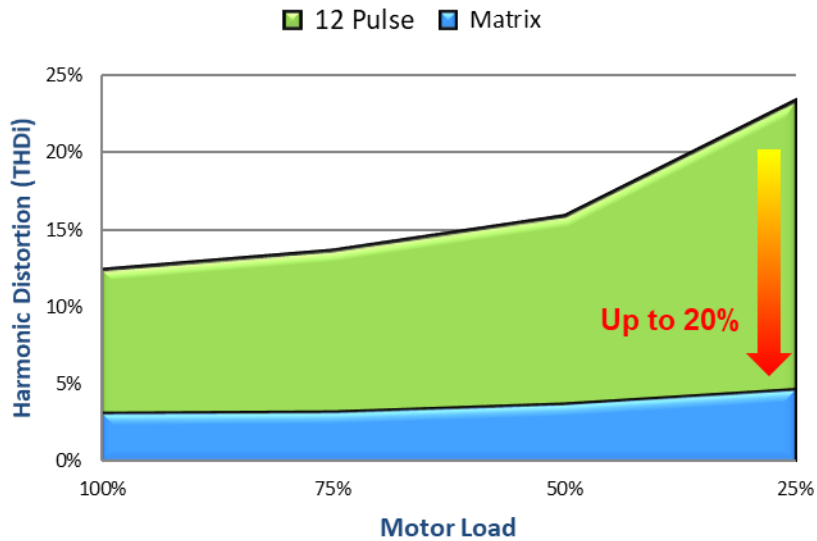
Efficiënt Aandrijven: AC-AC

# VERGELIJK HARMONICS EN POWER FACTOR



	Standard AC drive		88% <i>Current distortion</i>	0.75 <i>Power factor</i>
	Standard AC drive with DC reactor		33% <i>Current distortion</i>	0.9 <i>Power factor</i>
	12 pulse system with Standard AC drive		7 – 12% <i>Current distortion</i>	0.95 <i>Power factor</i>
	Matrix converter U1000		3 – 5% <i>Current distortion</i>	0.98 <i>Power factor</i>

# POWER QUALITY - VERGELIJK



## Voordelen:

- Exacte dimensionering van transformatoren, kabels en generatoren.
- Nagenoeg zuivere sinus inputstroom.
- Arbeidsfactor van 0.98
- Compacte, eenvoudige installatie: voedingskabel IN en motorkabel UIT

# AFMETINGEN: VERGELIJK 12/18 PULSE / U1000 MATRIX

U1000 VS 12/18 PULSE SYSTEMS

12/18 PULSE SYSTEM

3 Contactor  
Bypass Cabinet



Excellent for  
new and  
retrofit  
installations



U1000 Matrix  
Bypass Cabinet

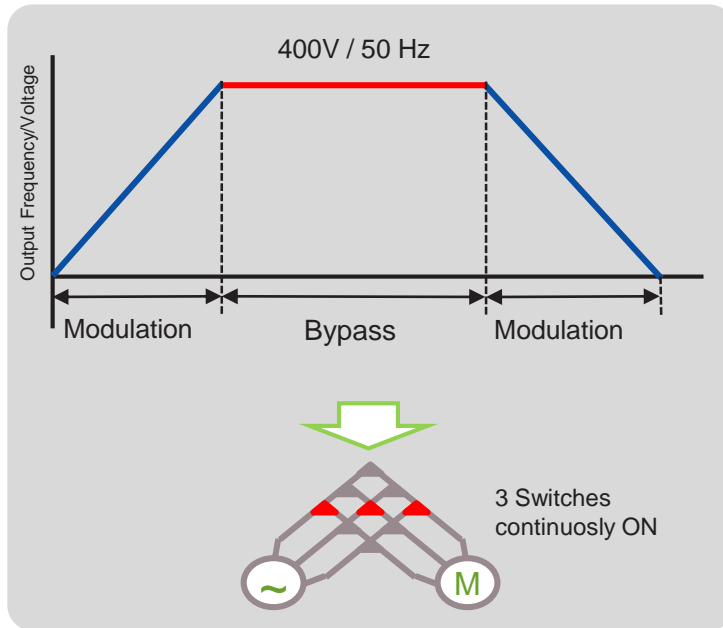
Up to 65%  
smaller



Example: 55 kW, 480V

# INGEBOUWDE BY-PASS FUNCTIE

MAXIMUM EFFICIENCY AT STEADY POWER SUPPLY FREQUENCY



- ✓ No switching/heat losses
- ✓ No harmonics
- ✓ Higher efficiency
- ✓ Quiet motor operation
- ✓ No external components required
- ✓ Automatic, soft switching

Simple to setup: Turn the feature ON and set your speed, so easy!!!

# QUICK SCAN VOOR TOEPASSINGEN



*Low Harmonics*



*Regeneratie  
Wisselende belasting*

*Beperkte Inbouwruiimte*

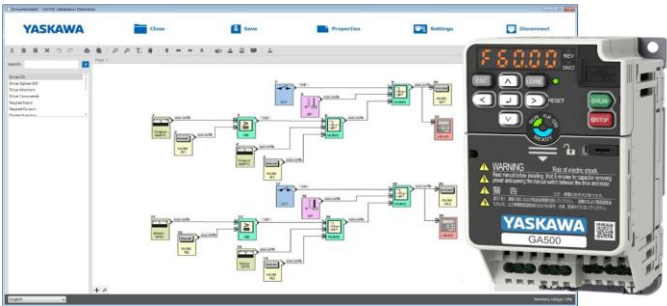
*Power Quality*

*Integrale Systeemkosten ( Initieel) en Gebruikskosten ( TCO)*

# KRANEN / HIJSEN



- Funderingen voor o.m. windmolens,
- DEMAG overheadkranen met schuifanker motoren.
- 1.000 ton hijsvermogen ( 4 kranen 250 ton synchroon).
- Hoge nauwkeurigheid is key.
- Execution Class 3 ( onderzeeboten, kerncentrales)
- Vochtige lucht met hoog zoutgehalte.
  
- Inbouwmaten.
- Power Factor (IEEE519)
- Low Harmonics
- Geen remweerstand nodig.
- DWEZ applicatiesoftware



DriveWorks EZ standaard in alle Yaskawa frequentieregelaars



# CENTRIFUGE

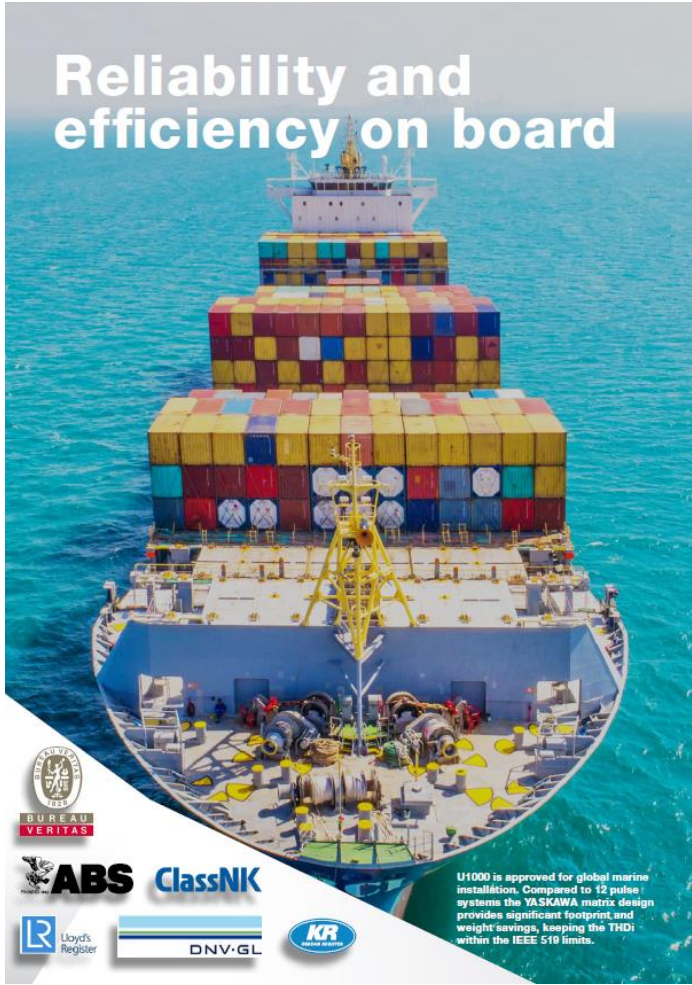


## Feed en Biofuel (130 kW)

- Compacte installatie
- Geen remweerstand, geen hitte/ warmte in het proces. Hogere brandveiligheid.
- Tijdbesparing: Reductie deceleratie van 480 s naar 7 s  
→ netto 1 uur extra productiecapaciteit per shift.

# MARINE

- Alle gangbare Marine certificaten.
- Zeer beperkte inbouwruimte
- Eenvoudige installatie.
- Lage THDi
- Omgevingstemperatuur +50 °C
- Auxillary Drive Applications/ Single Drive Applications  
Pompen, (Koel) Compressoren, Winches  
Bowtrusters



**Reliability and efficiency on board**

**BUREAU VERITAS**

**ABS ClassNK**

**Lloyd's Register** **DNV-GL** **KR**

U1000 is approved for global marine installation. Compared to 12 pulse systems the YASKAWA matrix design provides significant footprint and weight savings, keeping the THDi within the IEEE 510 limits.

# ROLTRAPPEN



## Munich municipal utility (GER)

- Escalator modernization in the subway
- Easy retrofit
- Compact design
  - ➔ All in one unit
- Keep the public grid in clean condition
  - ➔ No harmonic impact
- No need for braking resistors, cooling and ventilation

# BRANDSTOF POMPINSTALLATIE



## Fuel Transfer Pump

- State-owned company engaged in energy sector including oil, gas and renewable energy
- Clean grid
  - ❖ THDi <5%
- Easy installation
  - ❖ 3 wires in, 3 wires out
- Reliability



# U1000 MATRIX DRIVE ADVANTAGES

## 4Q OPERATION



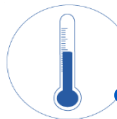
- ❖ Reuse of kinetic energy
- ❖ Built-in AFE performance
- ❖ Easy setup and Compact design

## MAINTENANCE FREE



- ❖ 10 years maintenance free design
- ❖ No maintenance = No cost
- ❖ No caps, no pre-charge contactor

## COOL OPERATION



- ❖ Less operation heat by eliminating braking resistors
- ❖ Low cabinet cooling, reduced risk of fire

## EASY OPERATION



- ❖ Easy installation (3 wires in 3 wires out)
- ❖ Reduced installation space
- ❖ Compact all in one unit

## CLEAN GRIDS



- ❖ Exceeds IEEE519 standard (THDi <5%)  
→ Ultra-low harmonic current
- ❖ Reuse of kinetic braking energy
- ❖ Monitoring of saved energy / costs by the U1000

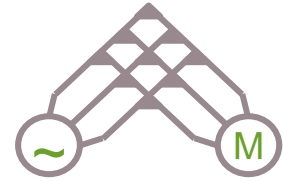
## REDUCED COST



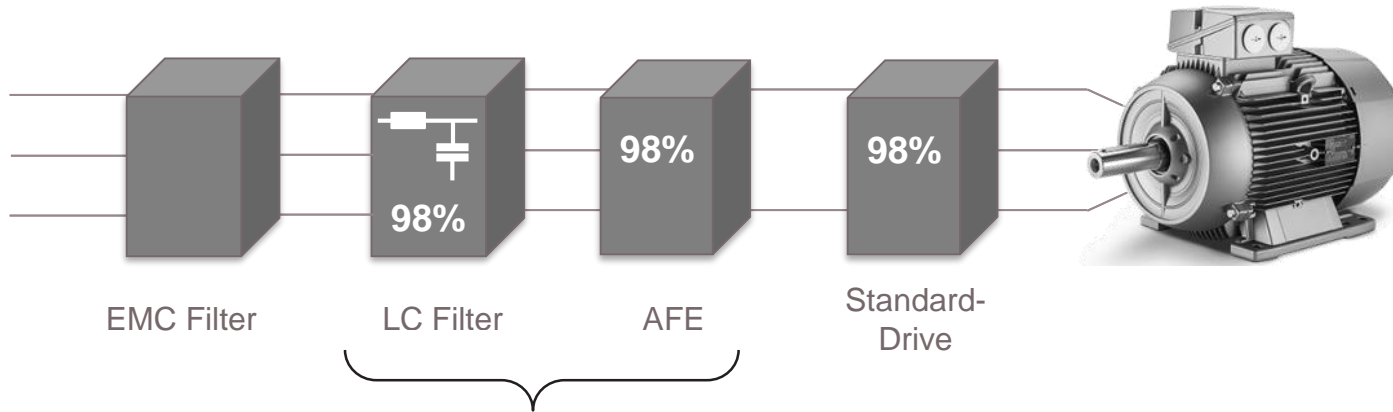
- ❖ Low energy costs
- ❖ Minimal maintenance
- ❖ EN ISO 13849-1 Cat. 3 PLe, IEC / EN 61508 SIL3
- ❖ IEC 60721-3-3, Class 3CS (Chemical gases), Class 3S2 (solid particles)



# U1000 MATRIX DRIVE 4Q SYSTEM COMPARISON



## Conventional Low Harmonic 4Q System

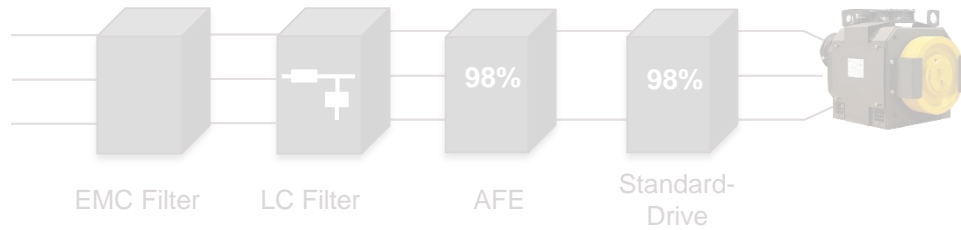


**All these cost money  
and reduce efficiency!**

$$\eta_{\text{total}} \approx 93\sim 95\%$$

# U1000 MATRIX DRIVE 4Q SYSTEM COMPARISON

Conventional Low Harmonic 4Q System



≈ 93~95%



Reduce WIRING by <b>70%</b>	Reduce SIZE by <b>65%</b>
Reduce WEIGHT by <b>81%</b>	Reduce POWER by <b>19%</b>



**MATRIX-CONVERTER  
U1000**

≈ 97%

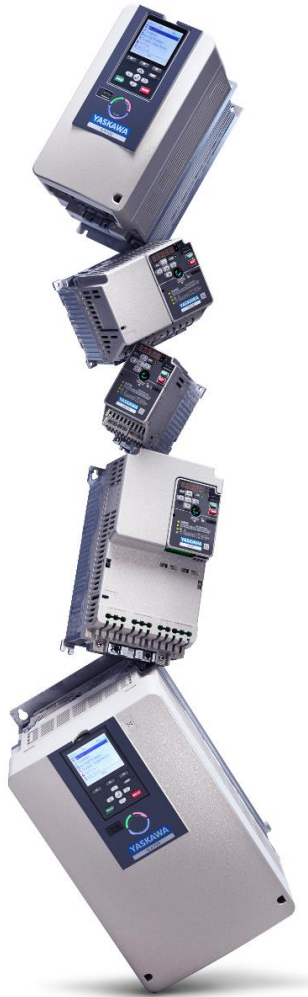


# ONDERSTEUNING MAAKT HET VERSCHIL



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- Onderzoek naar potentiële toepassingen, Retrofit of Greenfield.
- Assisteren bij opstellen business case(s)
- Gericht technisch advies
- Veldtesten
- Ondersteuning bij engineering
- Installatie en inbedrijfstellen
- Trainingen, standaard of maatwerk



### Related Use Cases



Compact frequency drives for four 250 tonne cranes



Electricity from gravel: the quarry power plant



Migros pioneering logistics processes

The screenshot shows the Yaskawa website's application page. At the top, the Yaskawa logo is on the left, and navigation links for 'PRODUCTS', 'SYSTEMS', 'SERVICE & TRAINING', 'APPLICATIONS', and 'ABOUT YASKAWA' are in the center. On the right, there are links for 'NEWS & EVENTS', 'CONTACT', and 'CLOUD'. Below the navigation is a large banner image of a quarry power plant with the title 'Electricity from gravel: the quarry power plant'. Underneath the banner, there is a breadcrumb trail: 'Yaskawa Europe > Applications > Electricity from gravel: the quarry power plant'. The main content area includes 'INDUSTRIES' (Crane - Hoist, Renewable Energy) and 'CLIENT' (Hans Zöchling GmbH). A paragraph describes the technology's role in energy recovery in the extraction of raw materials. Below this, it identifies 'Hans Zöchling GmbH' as a family business in Hainfeld, Austria, and lists its various operations. The bottom of the page features a large image of three industrial frequency converter units in a rack, with navigation arrows on either side and a progress indicator at the bottom.

**YASKAWA** YASKAWA EUROPE | EN NEWS & EVENTS CONTACT CLOUD

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Enter name, description, product or keywords:  Product:  Document Type:  Language:

Name	Product	Document Type	Language
<a href="#">↓</a> <b>Convertisseur Matriciel U1000</b> Convertisseur matriciel régénérateur à faible distorsion harmonique, Brochure No. YEU_INV_U1000_FR_v3_0120	All	Brochures	French
<a href="#">↓</a> <b>Convertitore Matrix U1000</b> Convertitore matrix rigenerativo a basse armoniche U1000, Brossura YEU INV U1000 IT v1 04	All	Brochures	Italian
<a href="#">↓</a> <b>U1000 Falownik</b> Falownik z odzyskiem energii o bardzo niskim poziomie harmonicznym, Brossura YEU INV UT PL v1 0715	All	Brochures	Polish
<a href="#">↓</a> <b>U1000 for Marine</b> U1000 for installations on ships and offshore, V1	All	U1000 Series	English
<a href="#">↓</a> <b>U1000 Matrix Converter</b> Low harmonics regenerative matrix converter, Brochure No. YEU_INV_U1000_EN_v3_02/2019	All	U1000 Series	English
<a href="#">↓</a> <b>U1000 Matrix-Konverter</b> Rückspeisefähiger Matrix-Konverter U1000, Broschüre YEU_INV_U1000_DE_v3	All	U1000 Series	German



At home.

In any application.

We have extensive knowledge and many years of experience in automation with more than 27 million AC drives installed worldwide. Thanks to the high manufacturing quality and the design for long, maintenance-free operation, they perform their work discretely for many years.

**YASKAWA**

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PRODUCTS SYSTEMS SERVICE & TRAINING APPLICATIONS ABOUT YASKAWA

Pick your AC Drive  
Your perfect AC Drive just a few clicks away

GA5000 REV DWEZ  
F6000  
ESC ▲ LORE  
< J > RESET  
V  
RUN ALM CLR  
READY  
Φ RUN  
STOP  
WARNING Risk of electric shock

Yaskawa Europe > Products > AC Drives

**GA500 | GA700**  
General Purpose Industrial Drives

**D1000 | R1000 | U1000**  
Regenerative Solutions

**A1000 | J1000 | V1000**  
Legacy Drives

Input Power Supply (V) 400

Input Power Phases 3-phase

BMC Filter 1

Max. Applicable Motor Power (H) (kW) 22.00 132.00

**GA500 SERIES**  
GA50C4060EBA

RATED OUTPUT CURRENT (NORMAL DUTY)	60 A	MAX. APPLICABLE MOTOR POWER (ND)	30 kW
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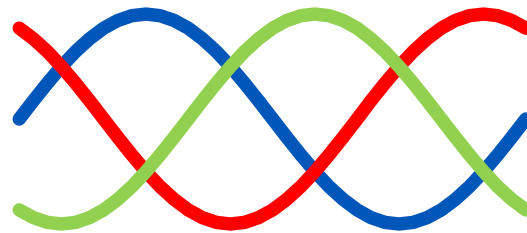
**GA700 SERIES**  
GA70C4075BBA

RATED OUTPUT CURRENT (NORMAL DUTY)	74.9 A	MAX. APPLICABLE MOTOR POWER (ND)	37 kW
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**GA700 SERIES**  
GA70C4060BBA

RATED OUTPUT CURRENT (NORMAL DUTY)	59.6 A	MAX. APPLICABLE MOTOR POWER (ND)	30 kW
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# Get OFF the Bus, Ride the Wave!



**U1000 Industrial Matrix Drive**

**YASKAWA**