YASKAWA

DRIVES UPDATE

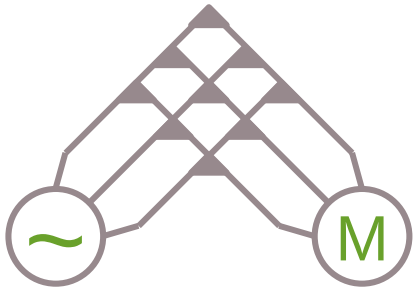
25.06.2019 | Adrian Lischka

YASKAWA

U1000

MATRIX CONVERTER

DIRECT AC TO AC 4Q-LOW HARMONIC DRIVE



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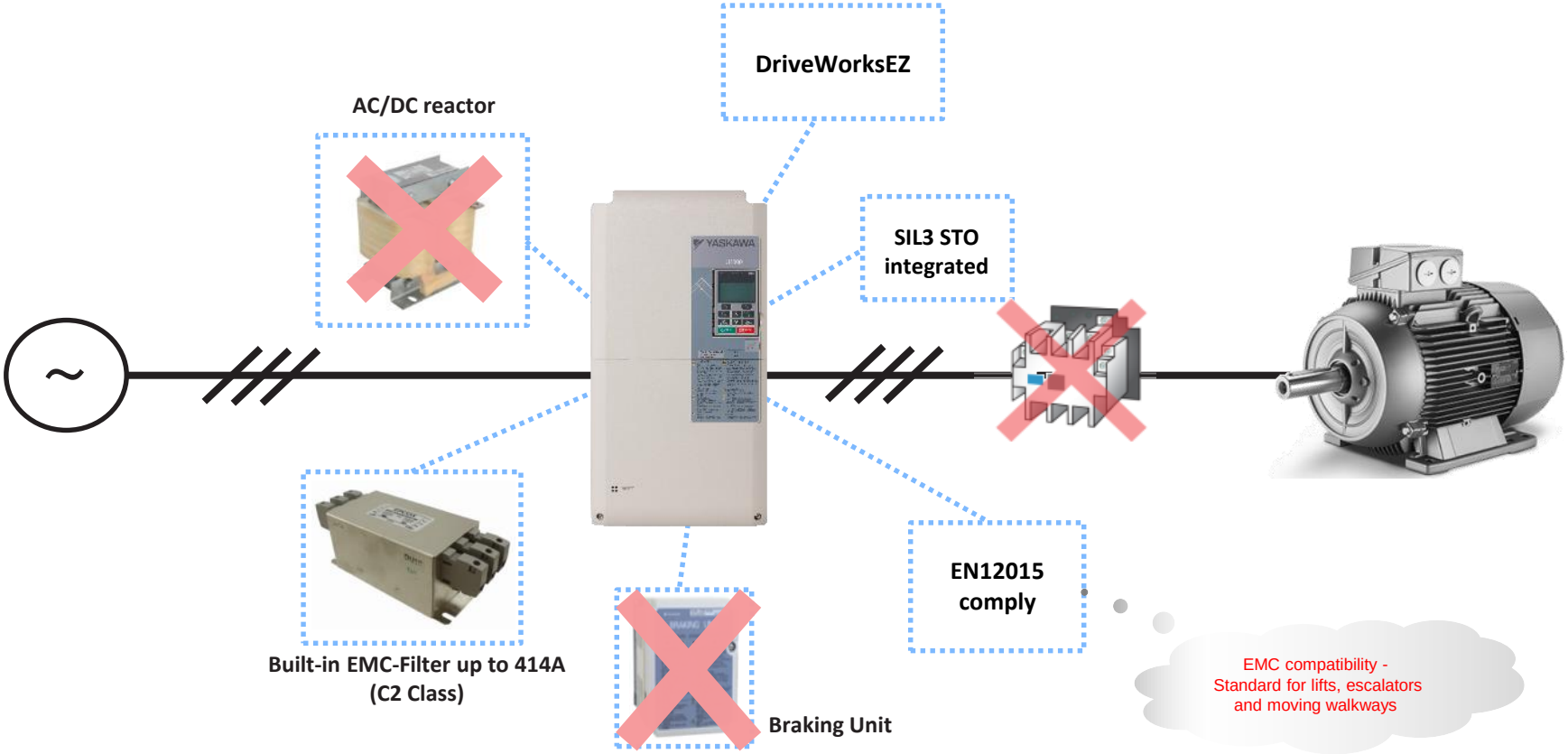
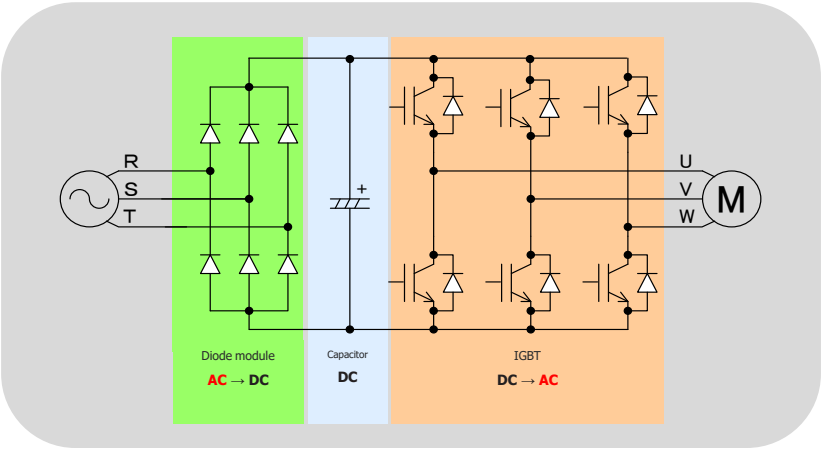
U1000
SPECIFICATION

- 200~240 V AC – 22 to 248 A
- 380~480 V AC – 10 to 930 A
- **Motoring and regenerative operation (4Q)**
- **THDi <5%**
- IP20 housing as standard
- Built-in EMC filter (C2 class) up to 414 A (220kW)
- Dual rating (normal / high overload)
- up to 400 Hz output frequency
- Suitable for IM and PM motors (with and w/o encoder)

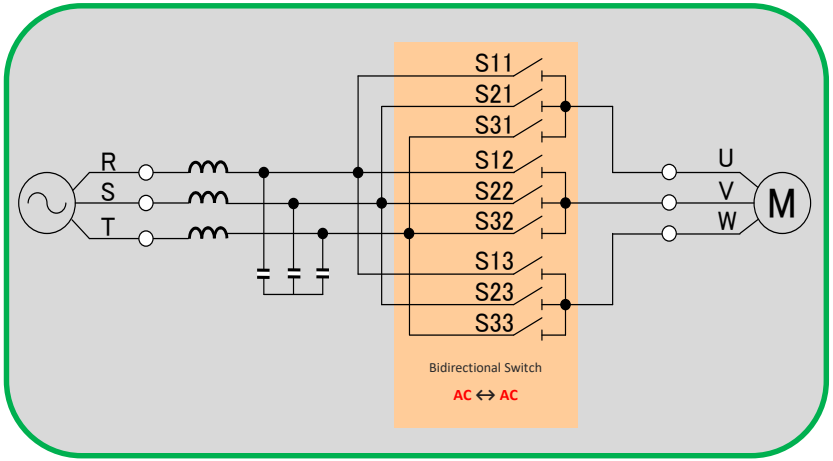
MINIMAL SPACE REQUIREMENT



MATRIX COVERTER

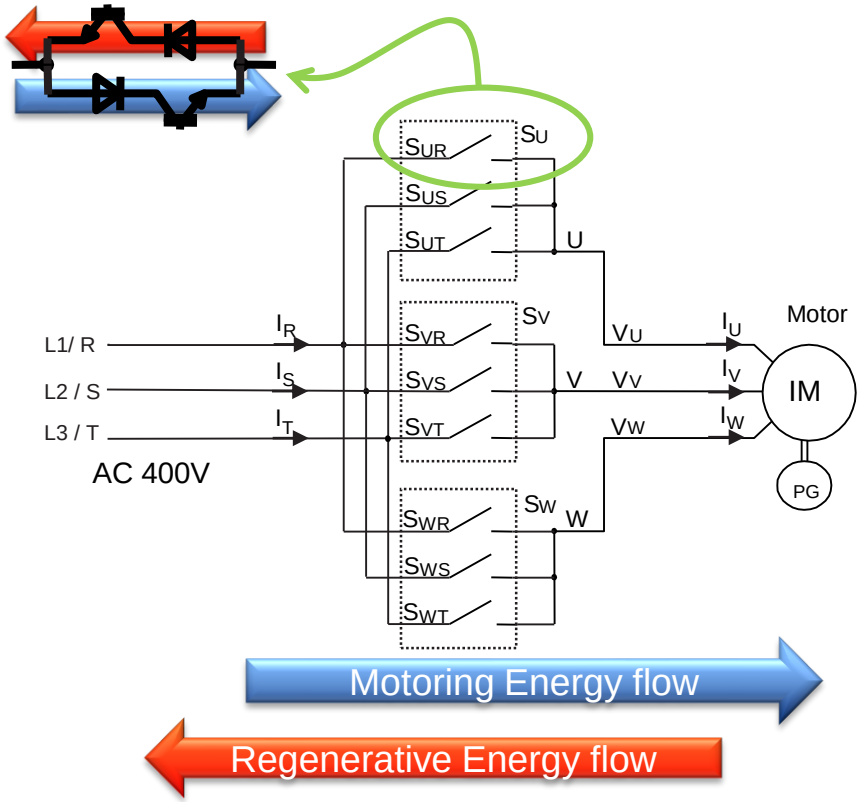


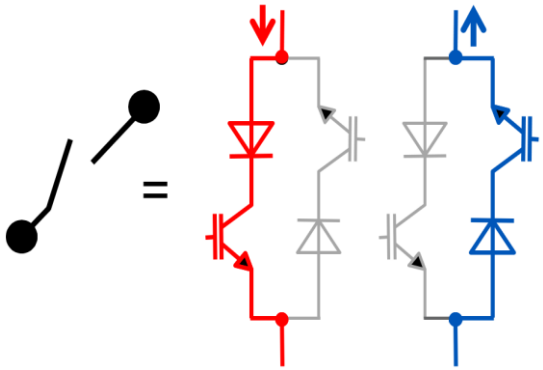
Conventional Drive Topology



Matrix-Converter

MATRIX DESIGN AND ENERGY FLOW





9x Bi-directional Switch

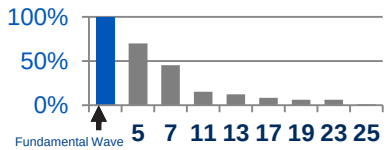
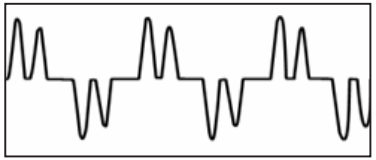
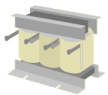
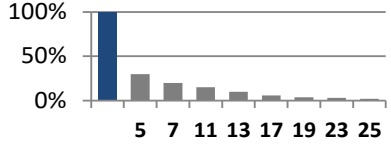
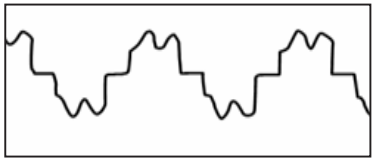
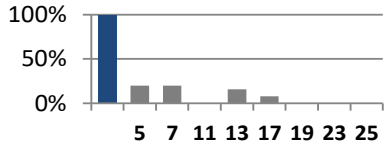
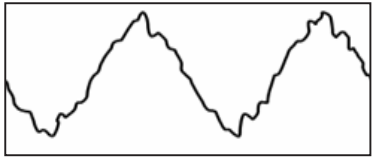
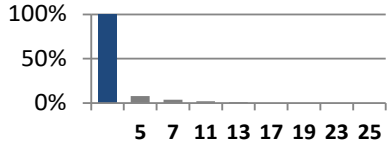
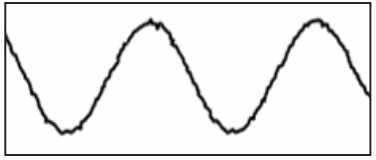
Consisting of:

- Insulated Gate Bi-Polar Transistors (IGBT)
- Diods
- 9x Bi-directional circuits for a total of 18x IGBTs

Makes possible:

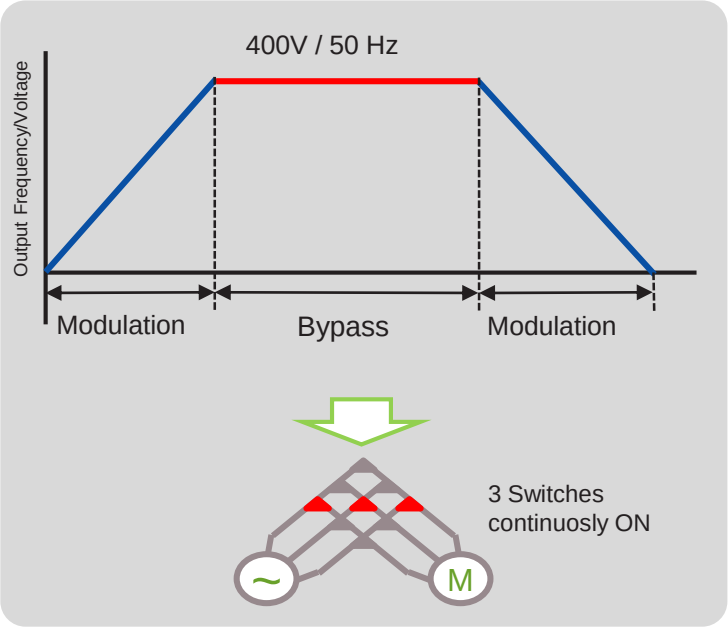
- Motor & regenerative power in one cycle
- Immediate power conversion

CLEAN NETWORKS

		Input Current Harmonics	Input Current Waveform	Current Distortion	Power Factor
Conventional Drive	VFD			88%	0.75
Input Reactor + VFD	 VFD			33%	0.90
12/18 Pulse System	 VFD			6 to 12%	0.95
Matrix Converter	AC-to-AC			3 to 5%	0.98

BUILT-IN BYPASS FUNCTION (Eco Mode)

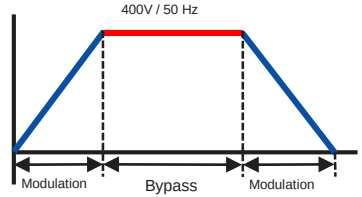
MAXIMUM EFFICIENCY AT STEADY POWER SUPPLY FREQUENCY



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

BUILT-IN BYPASS FUNCTION (Eco Mode)

MAXIMUM EFFICIENCY AT STEADY POWER SUPPLY FREQUENCY

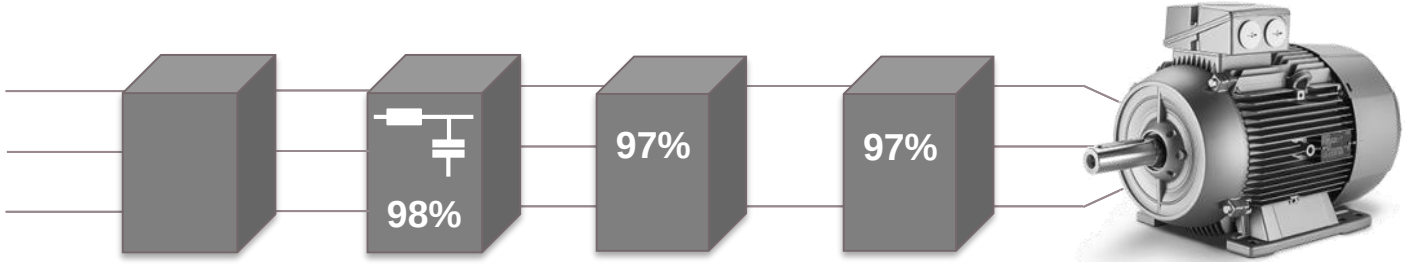


Automatic Integrated Bypass mode

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

4Q SYSTEM COMPARISON

Conventional Low Harmonic 4Q System

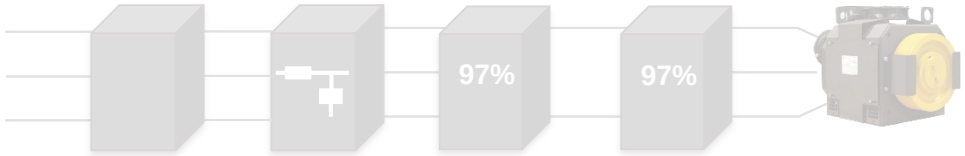


All these cost money and reduce efficiency!

$\eta_{total} \approx 92\text{~}93\%$

4Q SYSTEM COMPARISON

Conventional Low Harmonic 4Q System



≈ 92~93%

≈ 97%

MATRIX-CONVERTER
U1000

- **Reduce WIRING by 70%**
- **Reduce SIZE by 65%**
- **Reduce WEIGHT by 81%**
- **Reduce POWER by 19%**

480V 40HP/30kW

COMPACT DRIVE

U1000 VS 12/18 PULSE SYSTEMS

Excellent for retrofit

12/18 PULSE SYSTEM

3 Contactor
Bypass Cabinet

U1000 Matrix

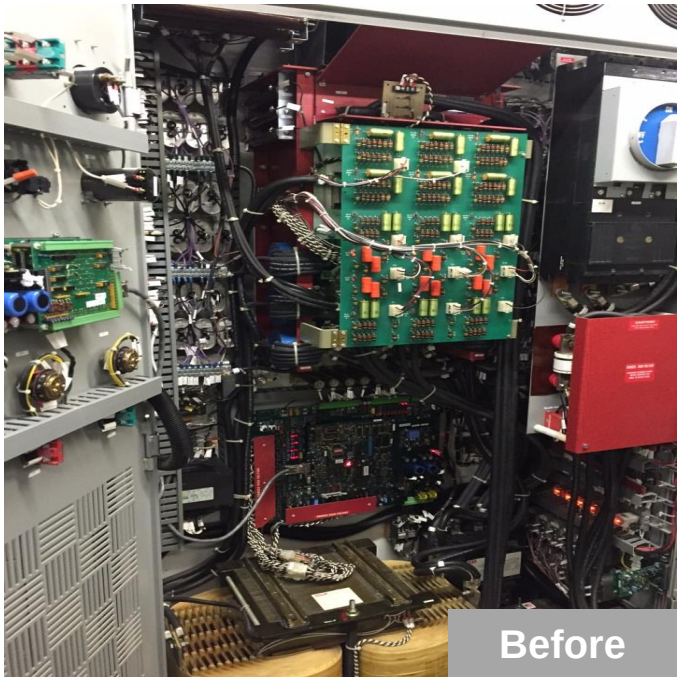
Bypass Cabinet

Up to 65% smaller

Example: 55 kW, 480V

RETROFIT

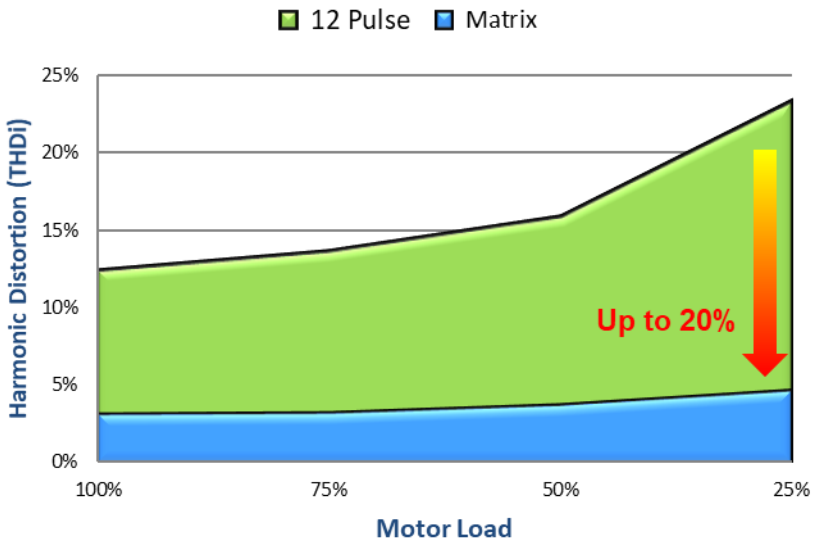
U1000 VS 12/18 PULSE SYSTEMS

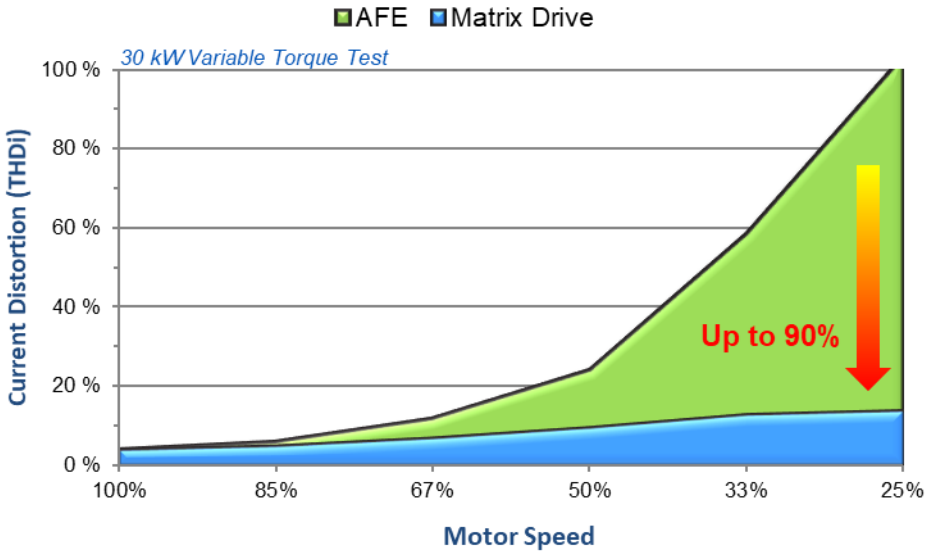


Example: 260 kW, 480V

HARMONIC PERFORMANCE

U1000 MATRIX vs 12 PULSE vs ACTIVE FRONT END (AFE)

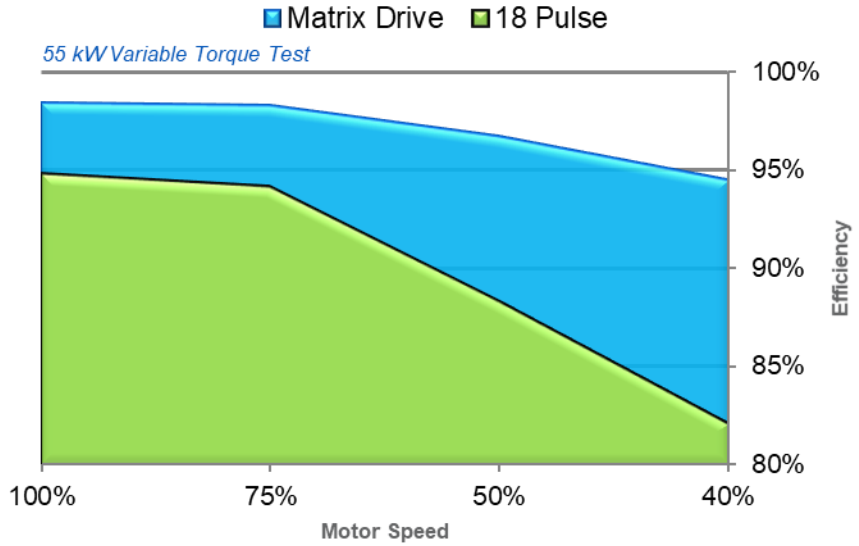


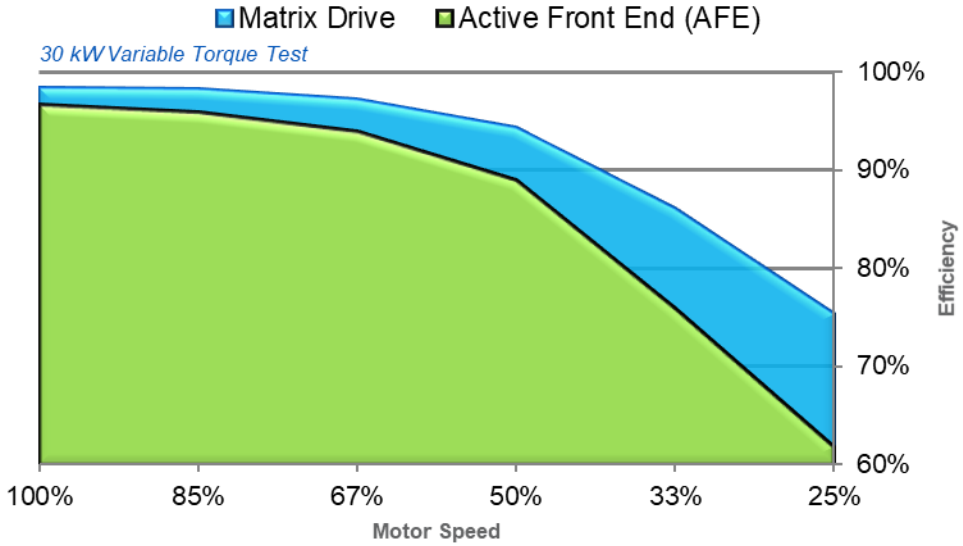


U1000 ensures clean grids running variable torque loads

EFFICIENCY

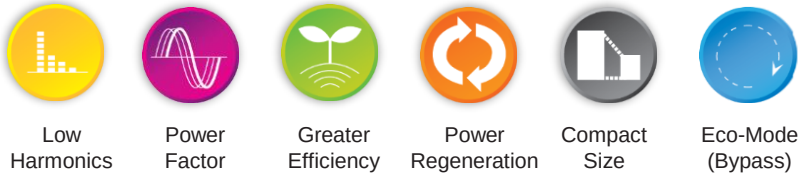
U1000 MATRIX vs 12 PULSE vs ACTIVE FRONT END (AFE)





U1000 ensures higher efficiency running variable torque loads

TECHNOLOGY COMPARISON



U1000 ADVANTAGES

4Q OPERATION

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

EASY OPERATION

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

MAINTENANCE FREE

- 10 years maintenance free design
- No maintenance = No cost

CLEAN GRIDS

- Exceeds IEEE519 standard (THDi <5%)
- Reuse of kinetic braking energy
- Monitoring of saved energy / costs by the U1000

COOL OPERATION

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

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)

TYPICAL APPLICATIONS

Low Harmonic Applications

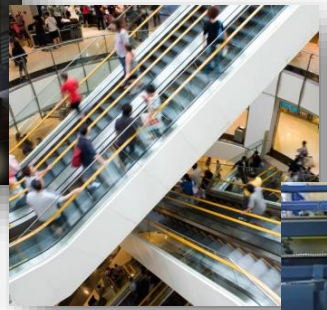
HVAC

Pump

Compressor

Regenerative Applications

Lift



Escallator

Winder

Downhill Conveyor

Test bench

REFERENCES

SBS Shipyard (Switzerland)

- Smooth Start/Stop to avoid yerks of the vessel
- No braking resistors, no waste of reg. energy
  - ➔ Long regenerative time
- Simple control: Just Lift/Lower and speed selection
  - ➔ Speed reference with Up/Down-command

REFERENCES

Munich municipal utility (GER)

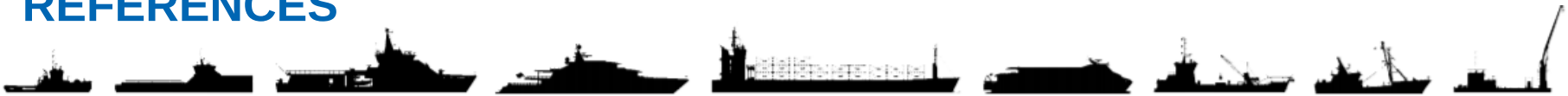
- Escalator modernization in the subway
- Easy retrofit
- Compact design
  ➔ All in one unit
- Keep the public grid in clean condition
  ➔ No harmonic impact
- No need for braking resistors, cooling and ventilation

REFERENCES

BKRS (Netherlands)

- Same performance as A1000 Crane
  - Enhanced Brake Control
  - Ultra Hoist
- Additionally 4Q operation, direct energy feedback to the grid (save energy cost)
- Simple Setup
  - Only one device
  - Reduced installation afford
  - No need for separate R1000 or CDBR + Resistor setup
  - Optimized Energy Efficiency

REFERENCES



Vacon NXP (with input chocke)
THDi ➔ 55 to 60%

U1000 Matrix
THDi ➔ 5%

Damen Shipyard Group (Netherlands)

- Clean grid
  - THDi <5% and THDi=0 at commercial power switching
  - No interference of measurement or radar tools
- Very compact
  - 20% smaller footprint than VACON (w/o filter)
- Application flexibility
  - Fast software modification/implementation with DWEZ
  - Flexible output power (torque) limit in OLV mode
- Fast commissioning with autotune and easy parameter handling
- Very stable motor control with weak grid conditions

Thank You!!!