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“On-Demand” webinars

Status 2025-08-28

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Introduction

- Webinars on selected topics from the field of medium voltage variable frequency drive systems
- Based on 15 years of industrial experience (system design, technical tendering, project engineering)
- Right mix of theory combined with industrial practice
- Not just stating information but explaining things
- Proven by many satisfied customers
- On-demand: Recorded webinars available for replay at your convenience

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List of webinars

Webinar Title	Type	Duration	Cost
Know Your Drive System (KYDS) - Part 1: Transformer	On-demand	~ 80 min	CHF 25
Know Your Drive System (KYDS) - Part 2: VFD	On-demand	~ 80 min	CHF 25
Know Your Drive System (KYDS) - Part 3: Motor	On-demand	~ 80 min	CHF 25
Know Your Drive System (KYDS) - Part 4: Cooling and recooling	On-demand	~ 60 min	CHF 20
Know Your Drive System (KYDS) - Part 5: Harmonic filter	On-demand	~ 60 min	CHF 20
Know Your Drive System (KYDS) - All parts	On-demand	~ 360 min	CHF 100
VFD topologies in comparison	On-demand	~ 90 min	CHF 30
Harmonics and harmonic mitigation	On-demand	~ 60 min	CHF 20
Fault ride through functionality	On-demand	~ 60 min	CHF 25
Difference between power transformer and converter transformer	On-demand	~ 30 min	CHF 12

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List of webinars

Webinar Title	Type	Duration	Cost
Selection of switching frequency	On-demand	~ 45 min	CHF 15
Power cables in drive systems	On-demand	~ 50 min	CHF 15
When is transformer tap changer required	On-demand	~ 50 min	CHF 12
Why is the inrush current of converter transformers so high?	On-demand	~ 50 min	CHF 12
Low ratio of grid short-circuit power and VFD installed power	On-demand	~ 50 min	CHF 12
Transformer winding connection and vector group	On-demand	~ 50 min	CHF 15
All about drive system efficiency	On-demand	~ 70 min	CHF 25
Speed and position encoders in drive systems	Coming soon	~ 50 min	CHF 15
VFD versus hydrodynamic (fluid) coupling	Coming soon	~ 60 min	CHF 20

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KYDS – Part 1: Transformers

- Naming convention
- Purpose of VFD Transformers
- Configurations and Topologies
- Requirements from VFD side
- Design Aspects (detailed)
- Transformer Protection
- Reliability and Availability
- Q & A

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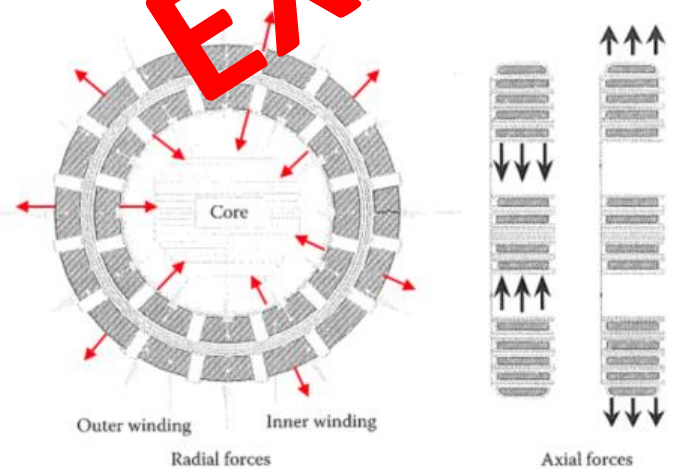
Short circuit modes

Multi-winding transformer

- 2/3-phase short circuit of one secondary winding
- 3-phase short circuit of all secondary windings
- Diode fault → Arc back

Short circuit current causes mechanical and thermal stress

- Thermal aspect not critical
- Mechanical integrity critical
- Axial and radial forces
  - Radial forces always [illegible] (for any transformer)
  - Axial forces critical for multi-winding transformers with stacked secondary windings



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KYDS – Part 2: Variable Frequency Drives

- Purpose of VFD
- Acronyms
- VFD Topologies
- Rectifier Types
- Cooling Types
- High Power Drives
- Performance
- Special Features
- Q & A

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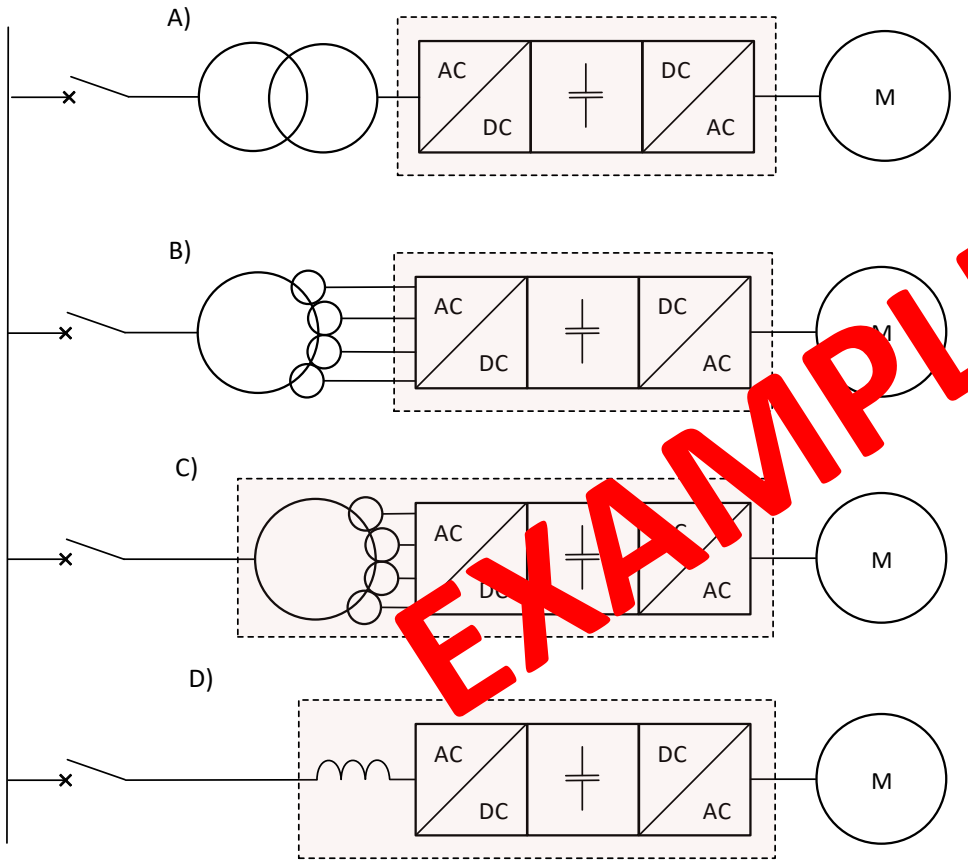
Rectifier

Types of grid connection



A) AFE with external transformer

B) DFE with external transformer

C) DFE with integrated transformer

D) AFE transformerless (with input reactor)

AFE = Active Front End

DFE = Diode Front End

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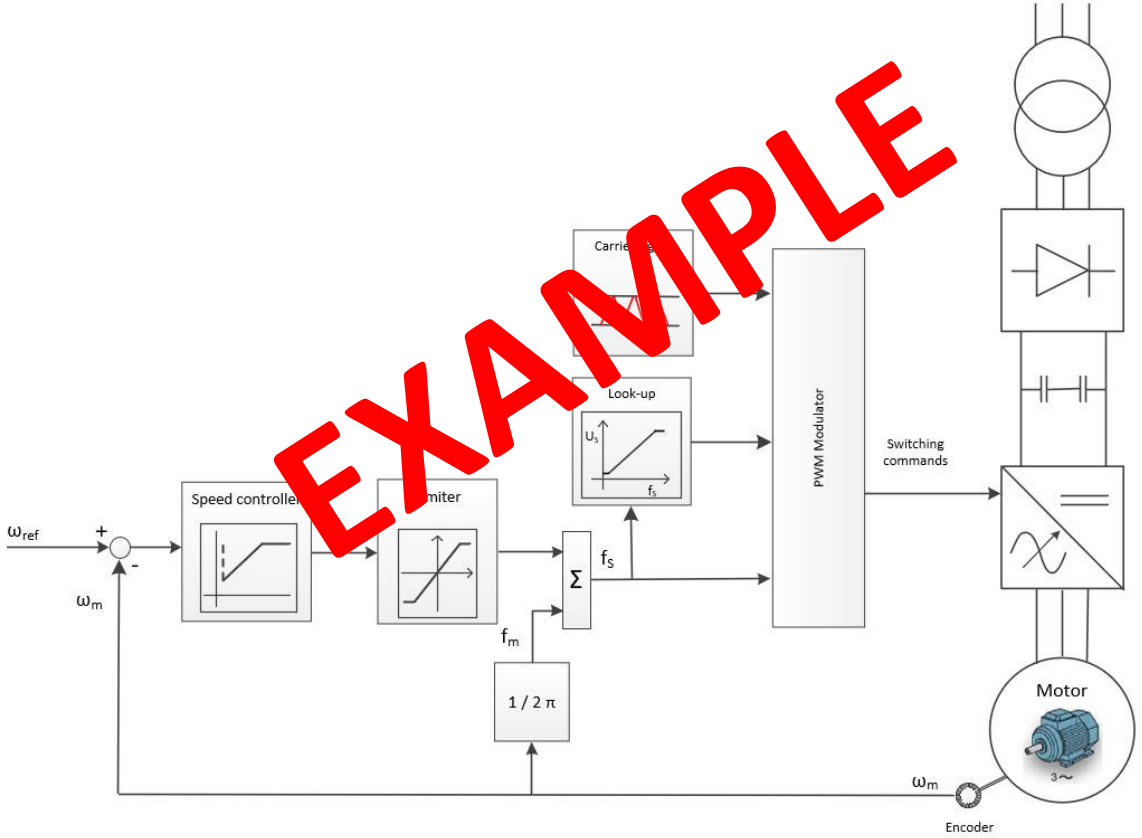
Performance: Dynamics

Scalar control (“V/f”)

- Closed loop scalar



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KYDS – Part 3: Motors

- Classification & Basic types of motors
- Comparison of asynchronous and synchronous machines
- Advantages of VFD operation
- Motor design for variable speed operation
- Motor critical speed
- Motor power factor and efficiency
- Motor protection

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Advantages of VFD operation

- Low starting current (below nominal)
- Unrestricted number of consecutive starts
- High starting torque
- Minimization of torque pulsations
- Controlled start-up (adjustable ramps)
- More freedom for motor design
- Selection of field weakening point

	Direct On [illegible]	VFD-fed
Starting current	(4 – 6 x In (typ.)	Less than 1 x In
Starting torque	(0.[illegible] – 0.7) x Tn	Up to 1 x Tn
Start-up time	Given	Adjustable
Torque pulsations during start-up	Large	Given by VFD control (~ 5…10% of Tn)
Number of starts	Limited (e.g. 3 x from cold, 2 x from hot)	Virtually unlimited

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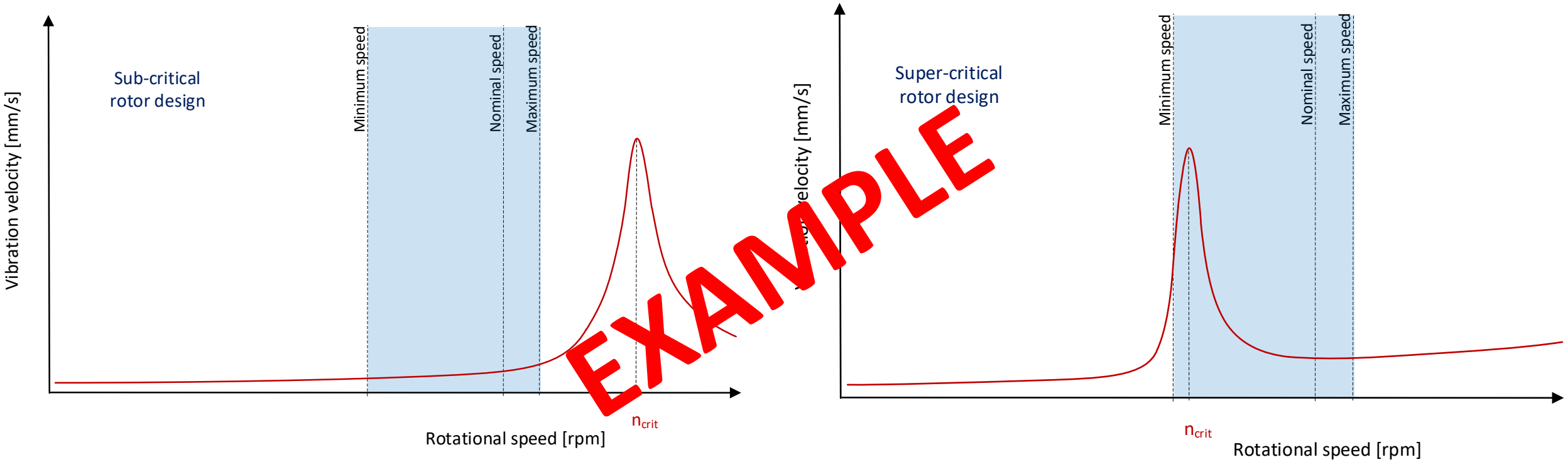

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KYDS – Part 4: Cooling system

- VFD losses
- VFD cooling types
- Engineered solutions
- Selection of suitable cooling
- Re-cooling of the ambient
- Cooling in extreme conditions

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KYDS – Part 5: Filter system

- Harmonics in drive systems
- Purpose of a filter
- When is a filter system needed
- Types of filters
- Filter design
- Filter protection

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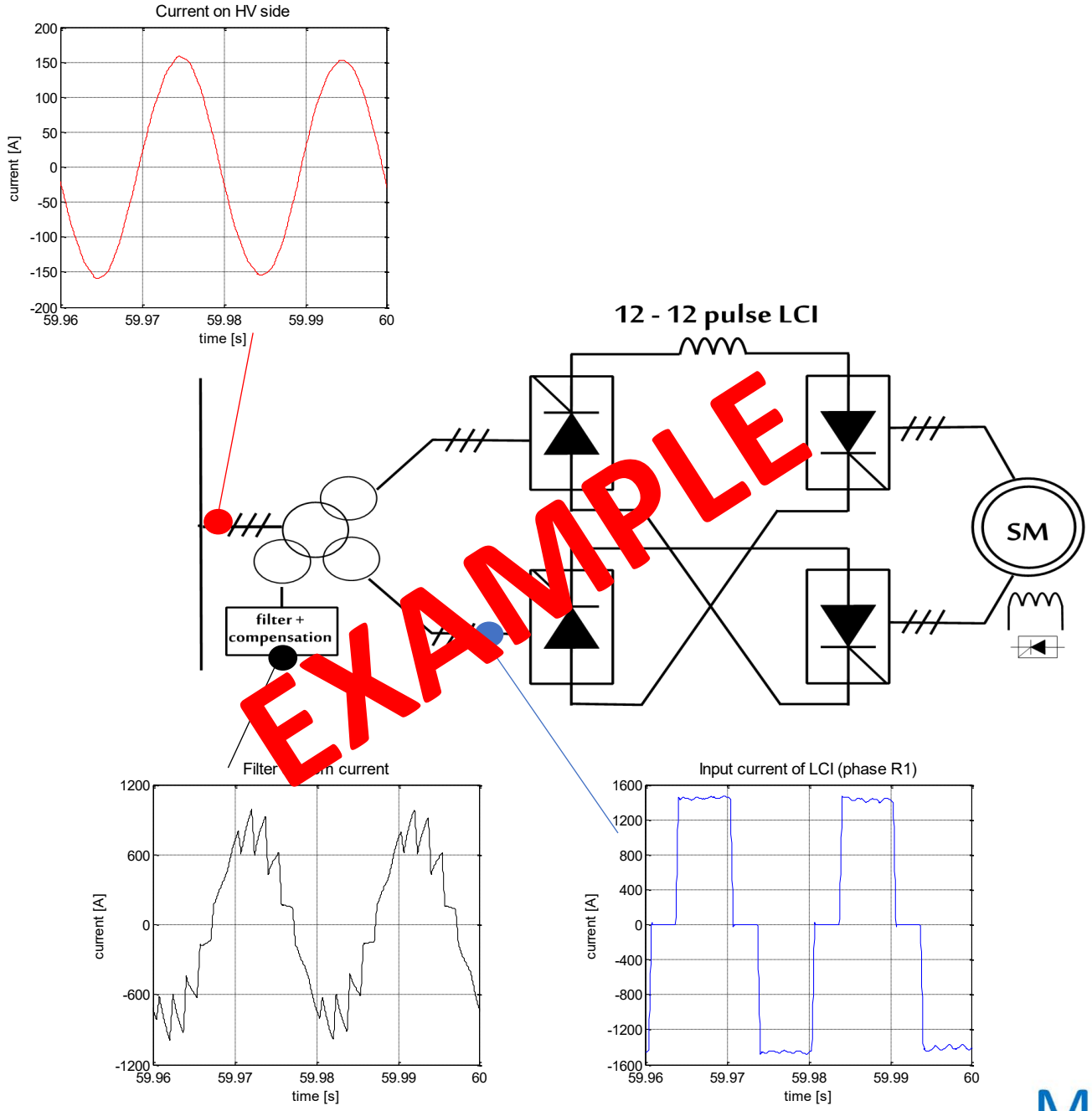
How does a passive filter work?



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All about drive system efficiency

- Definition of efficiency
- Typical efficiency values of MV drive system incl. component breakdown
- Efficiency as a function of load
- Calculated versus measured values
- Catalog versus guaranteed values
- System parameters affecting efficiency
- Geared versus gearless systems
- How to specify efficiency performance
- Measurement methods and their accuracy
- Standards and regulations

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Measurement methods

Efficiency expressions:

1. $$\eta = \frac{P_{out}}{P_{in}}$$

2. $$\eta = \frac{P_{out}}{P_{out} + P_{loss}}$$

3. $$\eta = \frac{P_{in} - P_{loss}}{P_{in}}$$

EXAMPLE

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System parameters affecting efficiency

Motor parameters

Motor type	Induction	Induction	Synchronous
Motor shaft power	10000 kW	10000 kW	10000 kW
Motor voltage	6.6 kV	6.6 kV	6.6 kV
Motor current	1084 A	1000 A	889 A
Motor frequency	50 or 60 Hz	51 or 60 Hz	52 or 60 Hz
Motor speed	1492 or 1792 rpm	1492 or 1792 rpm	1500 or 1800 rpm
Power factor	0.83	0.90	1.00
Motor efficiency	97.20%	97.20%	98.40%
Motor input active power	10288 kW	10288 kW	10163 kW
Motor input apparent power	12395 kVA	11431 kVA	10163 kVA
switching frequency	standard	standard	standard
Converter (VFD) heat losses[1)]	119 kW	110 kW	100 kW
Converter output rating	11951 kVA	11951 kVA	11951 kVA
Converter efficiency			
- based on active power	98.85%	98.94%	99.03%
- based on apparent power	99.05%	99.05%	99.03%
- based on converter rating	99.01%	99.09%	99.17%

[1)] Losses including auxiliaries (such as cooling water pumps, cooling fans, control boards etc.)

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VFD topologies in comparison: One size does not fit all!

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VSI topologies

Cascaded H-bridge (CHB)

- Popular VFD topology
- Available since late 1980s
- Introduced by US company Robicon (later acquired by Siemens)
- Cell-based topology
- High parts count
- One power cell contains 6 rectifier diodes, 4 active switches and 4 anti-parallel diodes
- Rectifier: DFE: integrated transformer (multi-winding)
- No braking capability
- Nominal output voltage: typically from 2.3 kV up to 13.8 kV
- Output power scaled with voltage
- Motor friendly output waveform

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Transformer winding connection and vector group

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Clock number / clock notation

- Reference: Phase A pointing at 12 o'clock
- Counter-clockwise rotation
- 1 hour difference = 30° phase displacement (1 = 30° lag, 2 = 60° lag etc.)
- 30 minutes difference = ½ hour = 15° phase displacement

EXAMPLE

Rectifier	Phase displacement	Angle (clock notation)
12-pulse	30 degree	1 hour (60 minutes)
18-pulse	20 degree	0.667 hour (40 minutes)
24-pulse	15 degree	0.5 hour (30 minutes)
36-pulse	10 degree	0.333 hour (20 minutes)

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How to pay

a) Using PayPal: send the money to info@mb-drive-services.com

b) Transfer to our bank account:

Bank: PostFinance	
IBAN: CH52 0900 0000 8980 8108 2	
BIC: POFICHBEXXX	
Company:	
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Baslerstrasse 3	
5200 Brugg, AG	
Switzerland	

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