

MB Drive Services

<https://mb-drive-services.com/>

“On-Demand” webinars – Final sale

2026-01-12



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

| Webinar Title | Type | Duration | Original price | Discounted price |
|--|-------------|-----------------|-----------------------|-------------------------|
| Know Your Drive System (KYDS) - Part 1: Transformer | On-demand | ~ 80 min | CHF 25 | CHF 12 |
| Know Your Drive System (KYDS) - Part 2: VFD | On-demand | ~ 80 min | CHF 25 | CHF 12 |
| Know Your Drive System (KYDS) - Part 3: Motor | On-demand | ~ 80 min | CHF 25 | CHF 12 |
| Know Your Drive System (KYDS) - Part 4: Cooling and recooling | On-demand | ~ 60 min | CHF 20 | CHF 10 |
| Know Your Drive System (KYDS) - Part 5: Harmonic filter | On-demand | ~ 60 min | CHF 20 | CHF 10 |
| Know Your Drive System (KYDS) - All parts | On-demand | ~ 360 min | CHF 100 | CHF 45 |
| VFD topologies in comparison | On-demand | ~ 90 min | CHF 30 | CHF 15 |
| Harmonics and harmonic mitigation | On-demand | ~ 60 min | CHF 20 | CHF 11 |
| Fault ride through functionality | On-demand | ~ 60 min | CHF 25 | CHF 12 |
| Difference between power transformer and converter transformer | On-demand | ~ 30 min | CHF 12 | CHF 7 |
| Selection of switching frequency | On-demand | ~ 45 min | CHF 15 | CHF 7 |
| Power cables in drive systems | On-demand | ~ 50 min | CHF 15 | CHF 7 |
| When is transformer tap changer required | On-demand | ~ 50 min | CHF 12 | CHF 6 |
| Why is the inrush current of converter transformers so high? | On-demand | ~ 50 min | CHF 12 | CHF 6 |
| Low ratio of grid short-circuit power and VFD installed power | On-demand | ~ 50 min | CHF 12 | CHF 6 |
| Transformer winding connection and vector group | On-demand | ~ 50 min | CHF 15 | CHF 7 |
| Drive system efficiency | On-demand | ~ 70 min | CHF 25 | CHF 12 |
| Speed and position encoders in drive systems | On request | ~ 50 min | CHF 15 | CHF 10 |
| VFD versus hydrodynamic (fluid) coupling | On request | ~ 60 min | CHF 20 | CHF 12 |

On-demand = recorded webinar (replay)

Prices in CHF (Swiss Franc)

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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

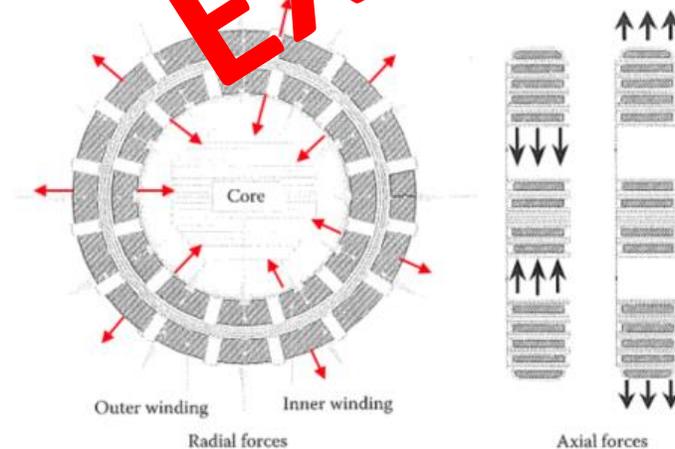
Short circuit modes

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 present (for any transformer)
 - Axial forces critical for multi-winding transformers with stacked secondary windings



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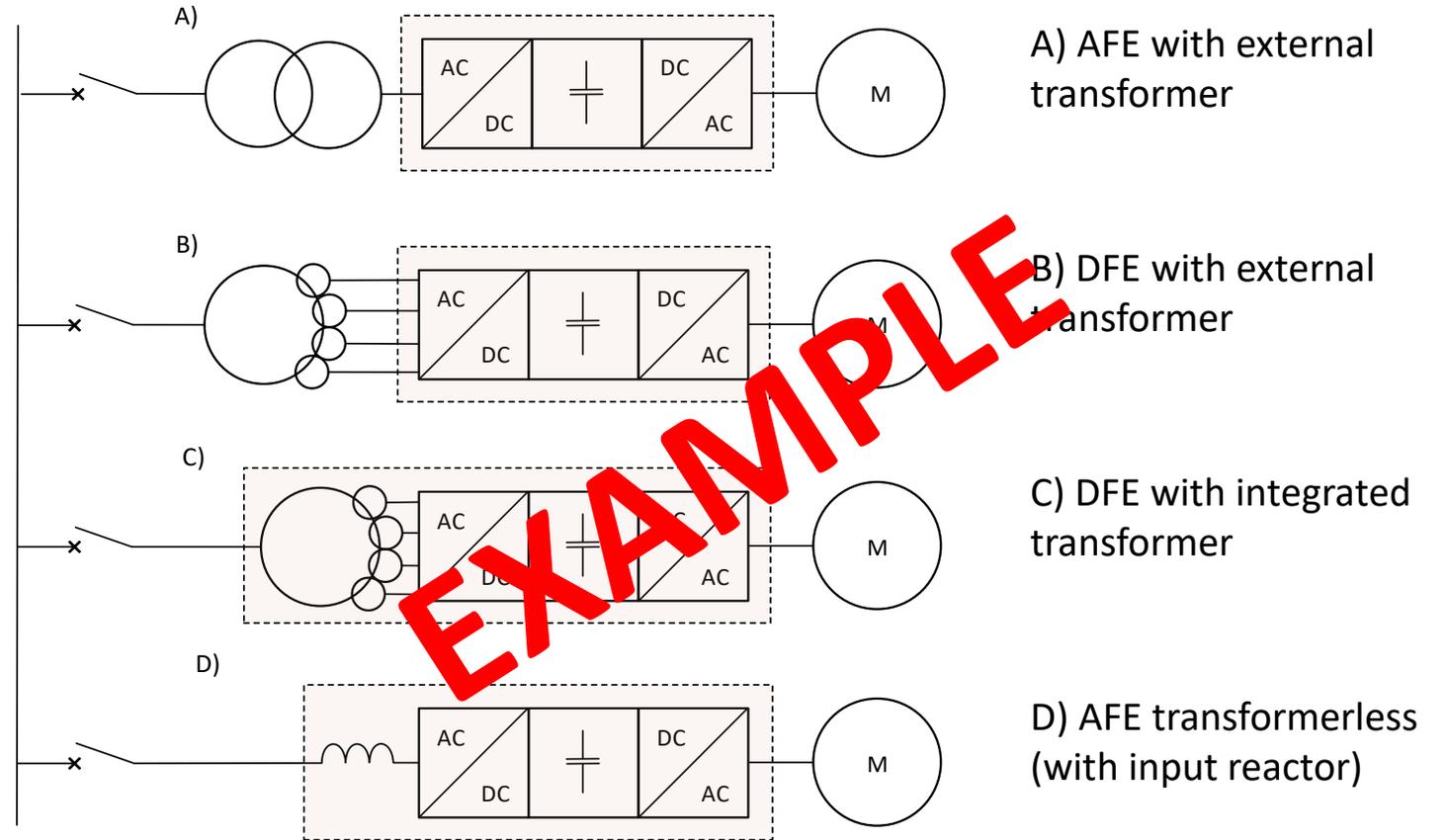
KYDS – Part 2: Variable Frequency Drives



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

Rectifier

Types of grid connection



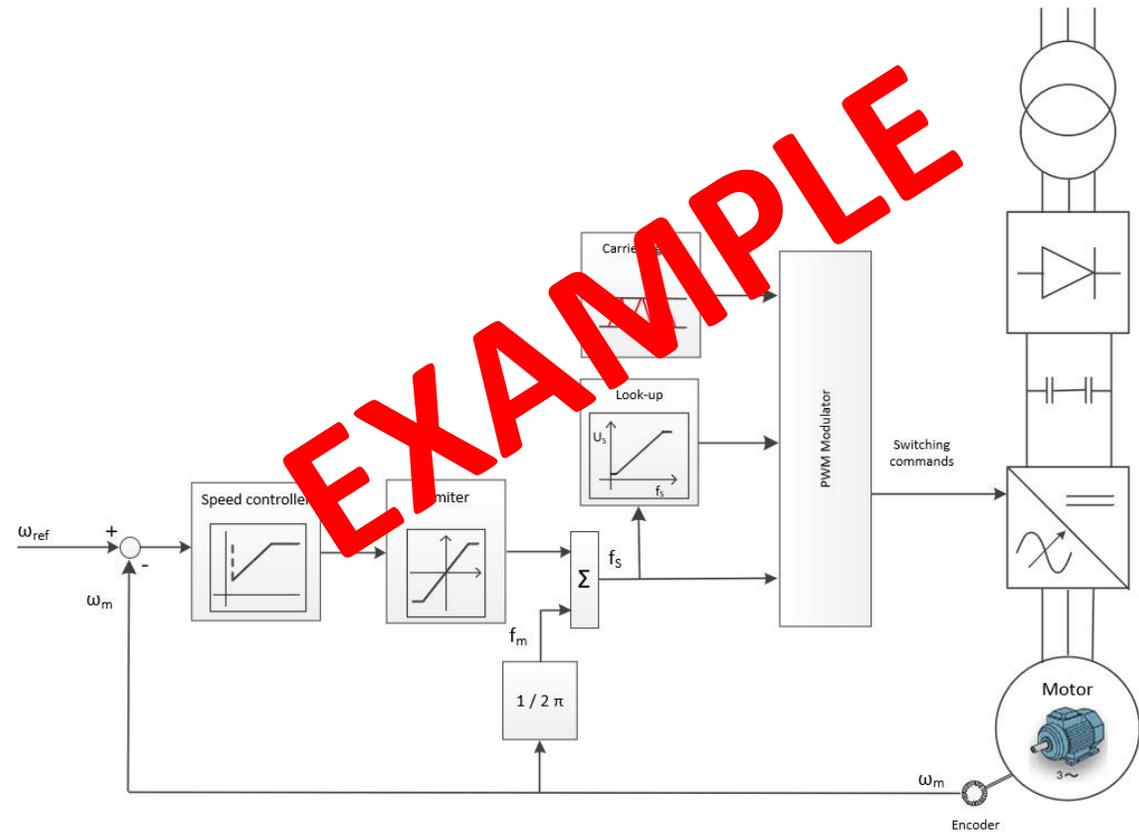
AFE = Active Front End

DFE = Diode Front End

Performance: Dynamics

Scalar control (“V/f”)

- Closed loop scalar



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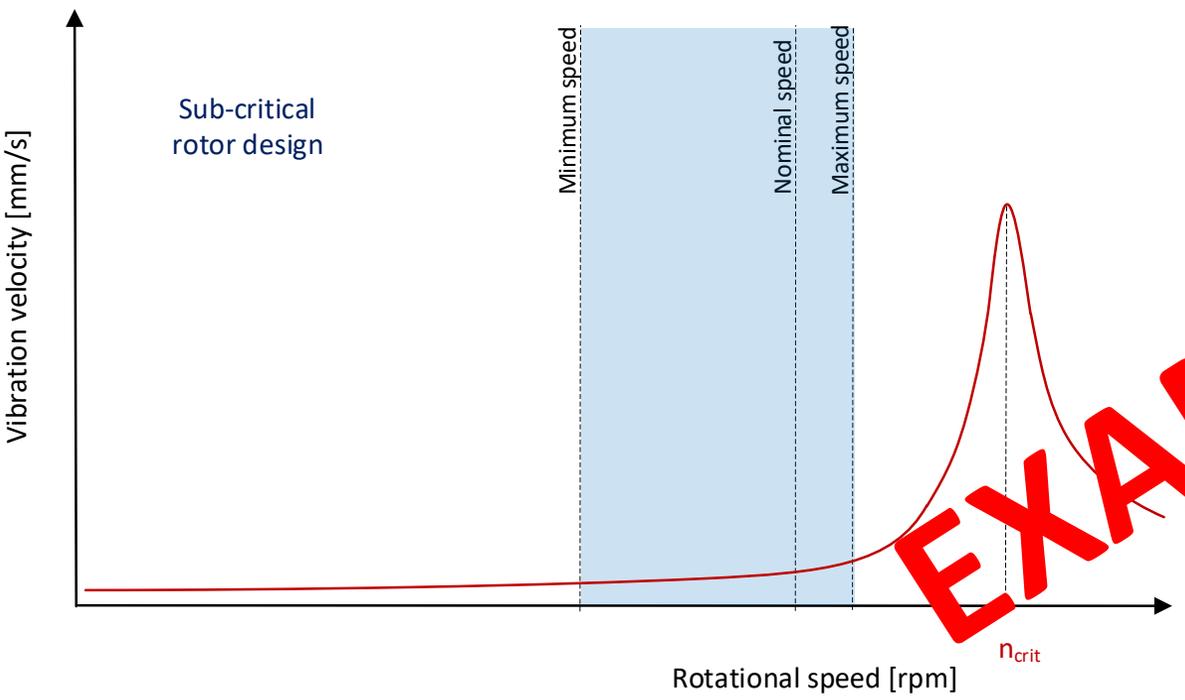
KYDS – Part 3: Motors

- 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

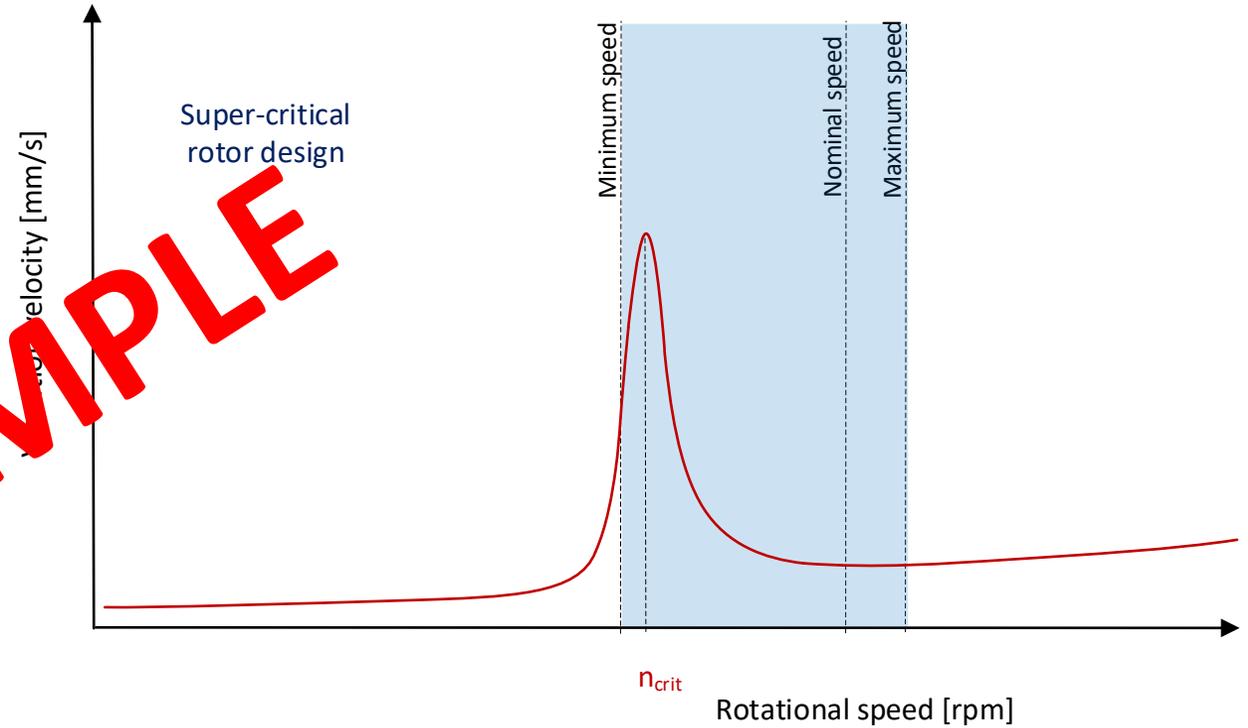
Advantages of VFD operation

- 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 Line | VFD-fed |
|-----------------------------------|--|--|
| Starting current | $(4 - 6) \times I_n$ (typ.) | Less than $1 \times I_n$ |
| Starting torque | $(0.4 - 0.7) \times T_n$ | Up to $1 \times T_n$ |
| Start-up time | Given | Adjustable |
| Torque pulsations during start-up | Large | Given by VFD control (~ 5...10% of T_n) |
| Number of starts | Limited (e.g. 3 x from cold, 2 x from hot) | Virtually unlimited |



EXAMPLE



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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

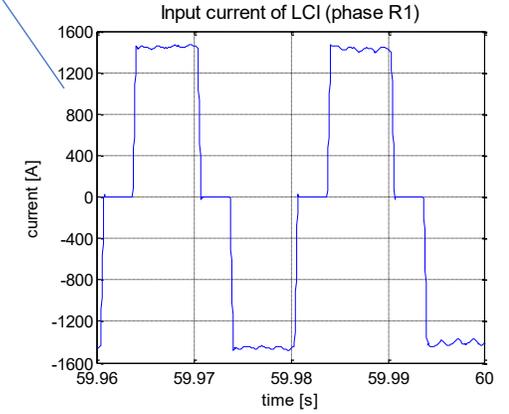
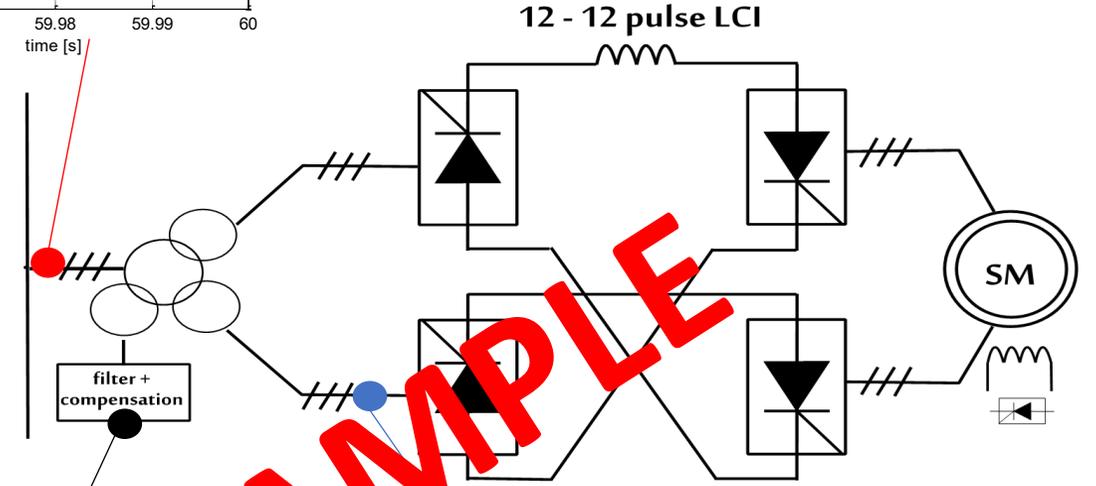
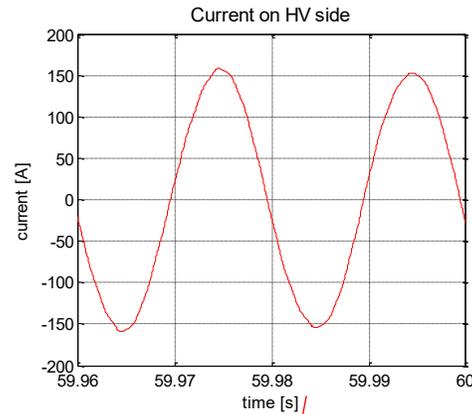
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KYDS – Part 5: Filter system

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

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

Measurement methods

Efficiency expressions:

$$\textcircled{1} \quad \eta = \frac{P_{out}}{P_{in}}$$

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

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

EXAMPLE

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!



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

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

| 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) |

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:

MB Drive Services GmbH

Baslerstrasse 3

5200 Brugg, AG

Switzerland