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# Medium Voltage Drives

## Design Considerations in Demanding and Special Applications

# Table of Contents

1. Introduction
2. Typical system requirements
3. Designing a special purpose drive
4. Interesting examples

# Medium Voltage AC Drives

## Markets served



Mining and minerals



Chemical, oil and gas



Marine



Metals



Cement



Power



Water



Special applications,  
e.g. test stands

# Industrial and General Purpose Drives Introduction

- All sectors have relatively simple applications:
  - Fans, pumps etc.
- Main argument for using a MV drive is process efficiency and removing mechanical regulation devices
- The improvements in process quality is also a big driver

However:

- Reliability, availability, etc. are important
  - But maybe less so: often the drive can be bypassed in case of emergency
- This portion of the market is very cost driven



# Industrial and General Purpose Drives Introduction

- Drives in this segment are mostly:
  - IGBT based
  - 2 Quadrant
  - Square torque loads
  - Driving DOL machines or machines with nominal frequencies in the range 50 or 60 Hz



# Special Purpose Medium Voltage AC Drives

## Markets served



Mining and minerals



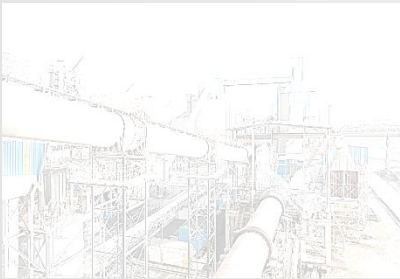
Chemical, oil and gas



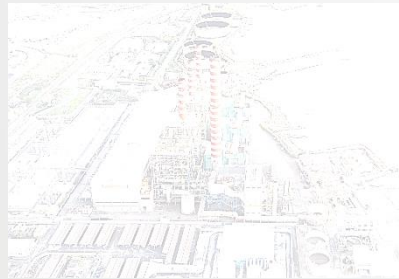
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# Special Purpose Drives

## Introduction

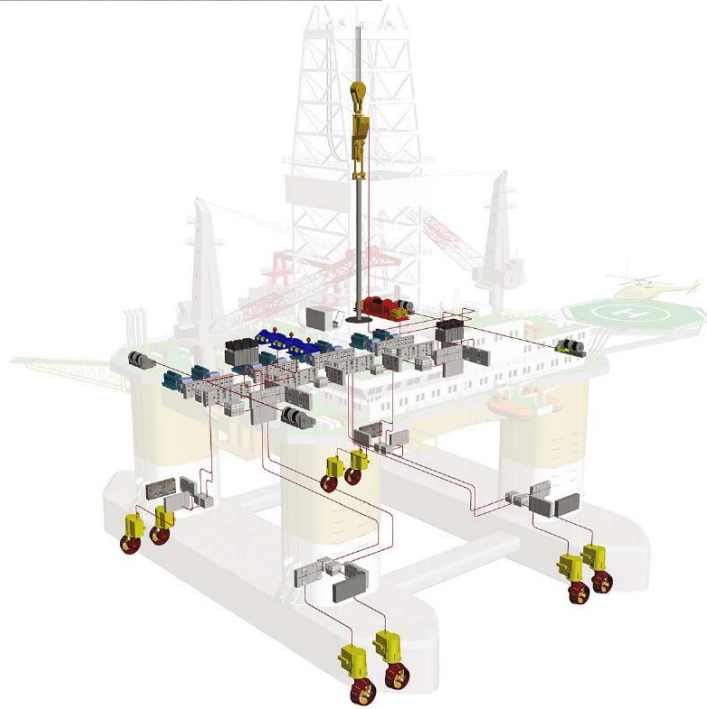
- Special purpose drives can not be replaced by DOL machines
- The drives are critical to the system operation and availability and reliability are often critical. When the drive stops operation the process often stands
- Quite often the machines are specially designed and optimised for the process
- Drives and systems are engineered to order according to customer specifications
- Constant torque, four quadrant operation and wide field weakening range requirements are common

# Special Purpose Drives Markets: Marine

Propulsion



Dynamic Positioning

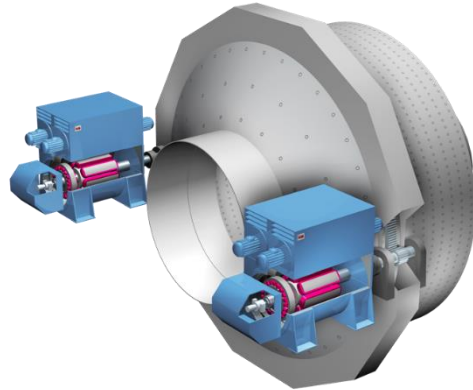




# Special Purpose Drives

## Markets: Minerals and Mining

Grinding mills



Mine hoists



And more...



# Special Purpose Drives Markets: Metals

Hot rolling mills



Profile mills



Cold rolling mills



# Drive System Requirements

# Special Purpose Drives Requirements

## Availability

- **Network event ridethrough**
  - Drive must remain connected even if there is a temporary short circuit on the supply network
  - Severe power quality events (+20% and -25% voltage fluctuation requirements are common). In special cases even more is possible
  - Unbalanced grid conditions
  - Very weak grids
- **Redundancy**
  - Operation must be guaranteed even with a hardware failure
- **Fuseless design**
  - Fuses are prone to ageing and nuisance trips





# Special Purpose Drives Requirements

## Safety

- **Arc proof design**
  - No danger to operating personnel irrespective of fault condition
- **4 Quadrant braking capability**
  - Crash stop: Marine
  - Mine hoists
  - Conveyors, especially down hill
- **Safety functions**
  - Safe torque-off
  - Emergency off / stop
  - etc.



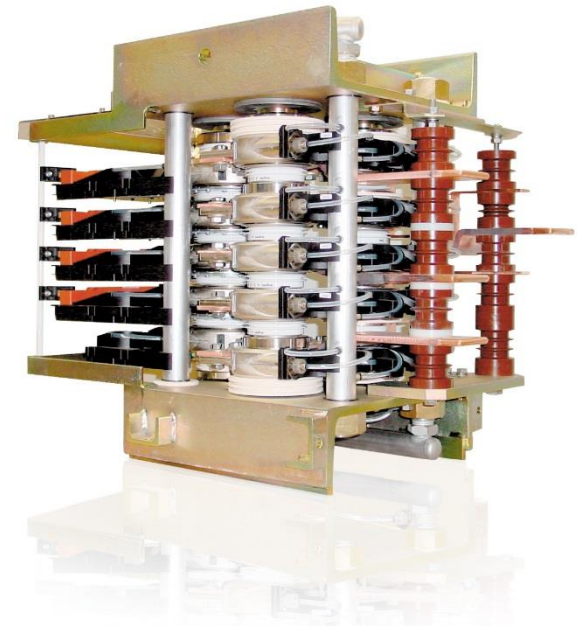
# Special Purpose Drives Requirements

## High dynamic performance

- **Ridethrough**
  - Very fast reversal of torque to keep dc link charged using process kinetic energy
- **Process Requirements**
  - Metals rolling plants
  - Marine propulsion: ice breakers

## Maintenance

- **Quick repair times**
- **Containment of the fault energy**



# Special Purpose Drives Requirements

## Operating conditions

- **Overload**
  - Requirements of up to 300% are common
- **Output frequency**
  - Low frequency operation, 1.75 Hz field weakening point.
  - Rated torque at less than 1 Hz
  - High starting torque
  - Operation up to 5x nominal speed



# Form Follows Function



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