



## MV7000

Entering a new dimension  
for reliability and performance  
in medium-voltage AC drives


## A world leading company in electrical solutions

Converteam is an engineering company providing customized solutions and systems converting electrical energy into productive performance. These solutions are built around 3 core components: rotating machines, variable speed drives, automation and process controls. Our scope covers consulting, design, manufacturing, system integration, installation, commissioning and a broad range of services. Our worldwide workforce remains fully committed to one overriding goal: to bring you the best in technology, backing this up with truly effective service on all markets. Our expertise covers marine applications, industry, oil & gas and offshore, renewable sources of energy, and more.

# A broad range of solutions that harness the latest technology

With over a century of recognized excellence in electrical systems and power electronics, Convertteam group is a world leading engineering company in power conversion.

The new Convertteam range of high performance medium voltage drives, the MV7000, brings innovation to the field of large drives technology. It gives an effective answer to the increasing demand for outstanding performance, excellent reliability and improved compactness.

Using proven technology from Convertteam's extensive range of drives, the MV7000 converters offer compact and efficient design and they perfectly match the more dynamic and high performance demands:

- general industrial applications: fans, compressors, pumps, mixers, extruders, wind turbines, wind tunnels, mine winders, conveyors, test benches
- high speed drives for oil and gas: high speed compressors
- drives for metals industry: hot rolling and cold rolling mills
- drives for marine, naval and offshore applications.

The MV7000 drives are designed to meet your expectations in terms of:

- performance with high efficiency up to 99%
- reliability with press-pack IGBT technology, fuseless protection and low component count
- compactness, modularity and front access
- low operating costs.

In addition, the MV7000 offers you additional benefits such as:

- quality of supply to the driven motor (high-grade torque, no machine derating, low noise and vibration level)
- minimum network interference (low harmonics, high power factor)
- ease of use (advanced control features, function block diagram, operating panel, remote PC)
- ease of maintenance (self monitoring system, all front access, modular construction).

## A complete range of high performance drives

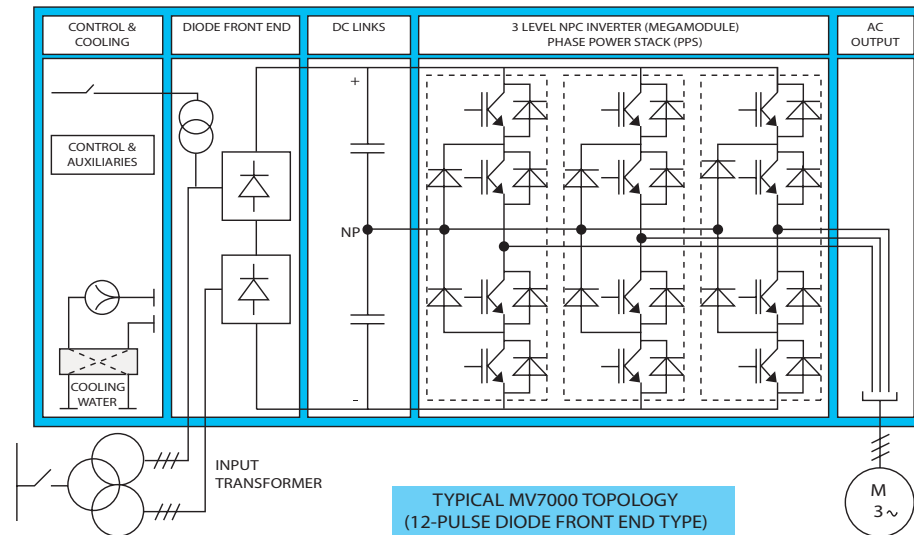
MV7000 drives cover the medium and high power range up to 33MW with motor voltages from 3.3 to 6.6kV. The drives are water cooled PWM (Pulse Width Modulation) voltage source inverters. They can feed both induction and synchronous machines with high performance vector control, across all speed ranges from low speed marine propulsion drives to high speed compressor drives without a gearbox. The MV7000 drive is modular and features different options, such as regenerative front ends, dynamic braking choppers, connection to a common DC bus, so that the drive can be configured to suit virtually all applications.

Output voltage	Reference	Output power	Output power	Output current	Width	Depth	Weight
kV		MW	MVA	A	(mm)	(mm)	(kg)
	(*)MV7303	3	3.75	660	2800	800	2800
	MV7306	6	7.5	1350	4200	1000	5000
3.3	MV7308	8.4	10.5	1800	4200	1000	5400
	MV7312	12	15	2700	5000	2000	10000
	MV7316	16.8	21	3600	5000	2000	10800
6.6	MV7612	12	15	1350	9400	1200	12500
	MV7616	16.8	21	1800	9600	1200	13300
	MV7624	24	30	2700	9400	2400	17000
	MV7632	33.6	42	3600	9600	2400	26600

Technical data, dimensions and weights given for basic standalone drives are subject to change without notice. Please contact Convertteam for details.

(\*)MV7303 uses Flat Pack IGBT Technology

# Advanced technology to support advanced requirements



## Low harmonics without costly additional equipment

The MV7000 features as standard a 12-pulse (or 24-pulse) diode front end, fed by a 2 (or 4) phase-shifted secondary winding transformer. The harmonics injected into the network are very low. The drive complies with international standards for voltage and current harmonic distortion, without any harmonic filters or var-compensation equipment. The drive continues to operate in the event of voltage dips without tripping (ride-through). When required, electrical braking is available with an optional dynamic braking chopper connected to a resistor.

## Energy optimization

For reversing applications with frequent braking, a PWM active front end enables regeneration of the energy to the network. Additionally, the active front end gives unity power factor and a sinusoidal input with negligible harmonics.

For multiple drive applications with both motoring and regenerating drives (typically tension reels in the metals industry), a common DC link fed by a single active front end is perfectly suited for reducing overall equipment cost and footprint.

## Soft start-up without grid disturbance (Patent in progress)

The MV7000 provides low inrush current when energizing the drive. Pre-magnetizing of the input transformer is achieved by means of auxiliary transformer. Closing of main circuit breaker is completed without incoming bus disturbance.

## Higher efficiency and compatibility with all motors

The inverter features the "Press-Pack" IGBT power semiconductors, which enhance the power capabilities of the MV7000 in the larger sizes. For the higher power range these devices give considerably increased power, less losses and improved reliability due to lower component count and rugged design. As a result, the MV7000 is at the top level for reliability, efficiency and power density.

The PWM 3-level NPC (Neutral Point Clamped) inverter provides excellent output waveform, and subsequently very low current THD (Total Harmonic Distortion).

This results in negligible derating of the driven machine and negligible amplitude of torque pulsations at the shaft, a huge benefit for critical process applications.

The drive can supply either new machines with standard insulation or machines in retrofit applications.

The PWM control strategy used by the MV7000 means high quality performance, with adjustable PWM patterns and frequency at every operating point, providing a wide range of flexibility for:

- low switching losses
- low motor THD
- operating at very low frequency, with full torque
- operation at high frequency, up to 300Hz.

# Technical expertise for the benefits of customers

Power density up to 1.1MVA/m<sup>3</sup> for the complete drive is achieved.

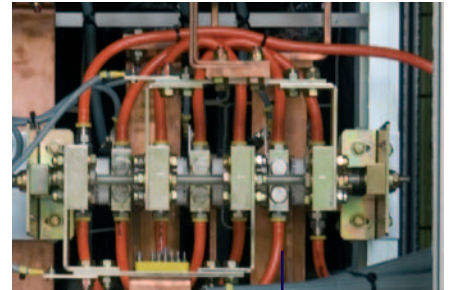


All photos show the product with marine options.

# A look inside the MV7000

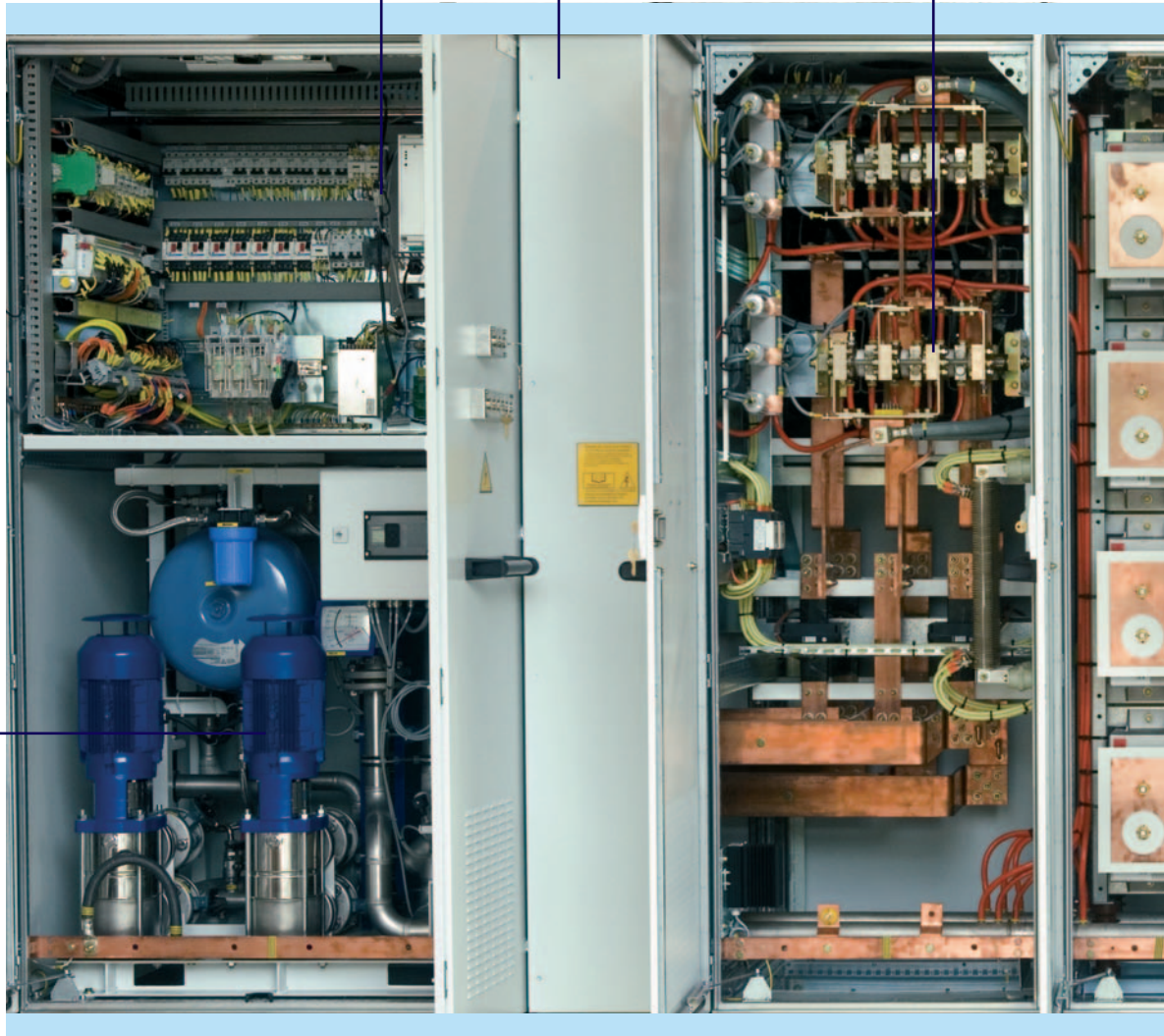


Power Electronics  
Controller PEC



Diode Front End  
Diode Stack

« Optional »  
Top cable entry

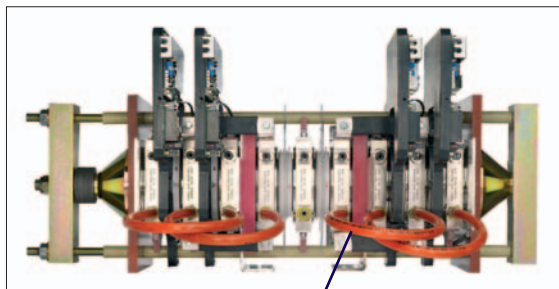


Cooling unit  
« Optional » standby  
pump shown

# medium voltage drive



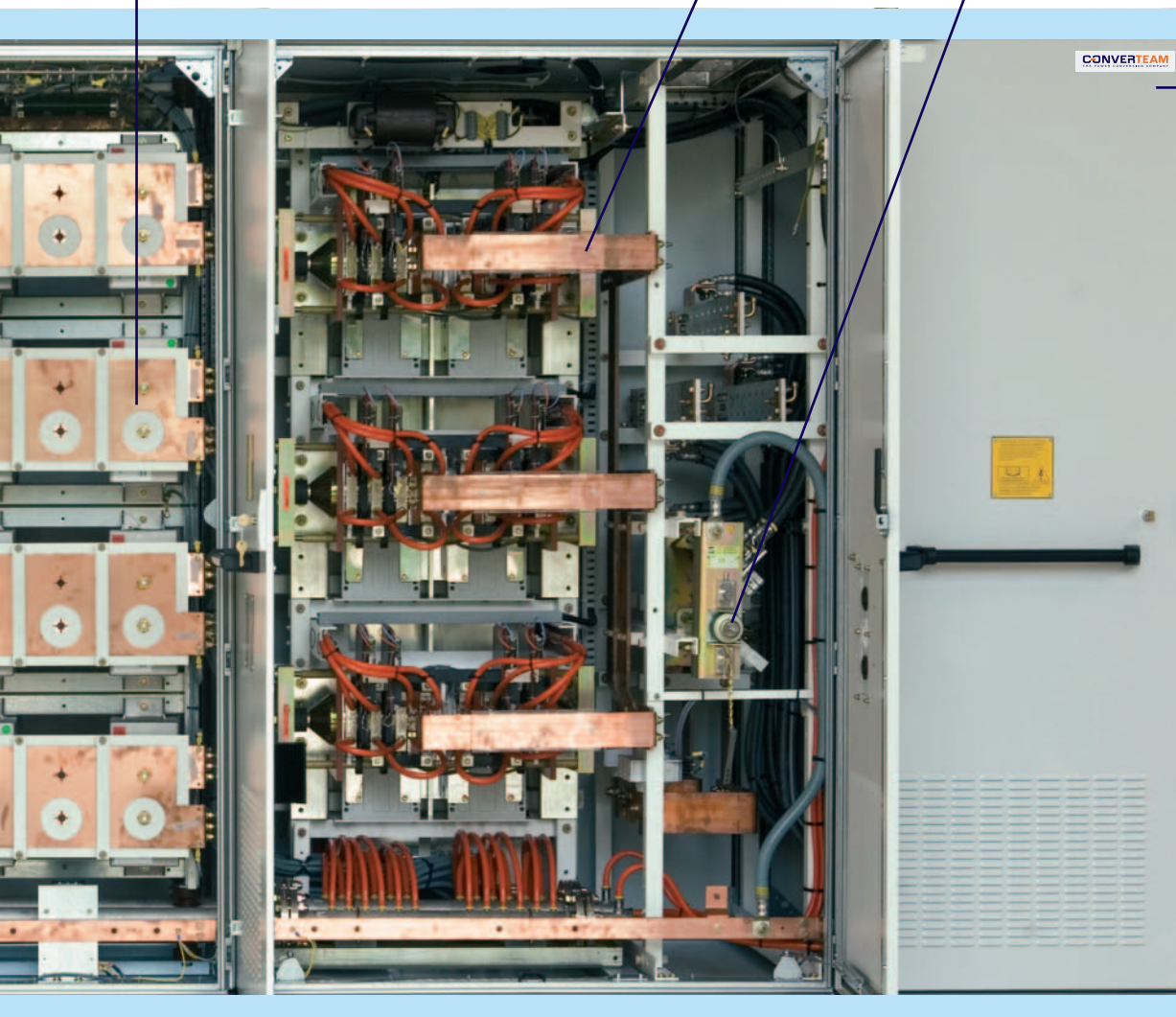
DC link capacitors



Inverter Unit  
Phase Power Stack (PPS)



Grounding Switch



« Optional »  
dV/dt filter

# Designed to better serve your needs

## Low parts count

The MV7000 requires only twelve PPIs (Press-Pack IGBT) per drive up to 8.4MW (@ 3300V), compared to other drives that require 18 to 36 power switches.

Low component count with high quality devices provides the MV7000 with an inherently more reliable design.

## Press-Pack IGBT (PPI)

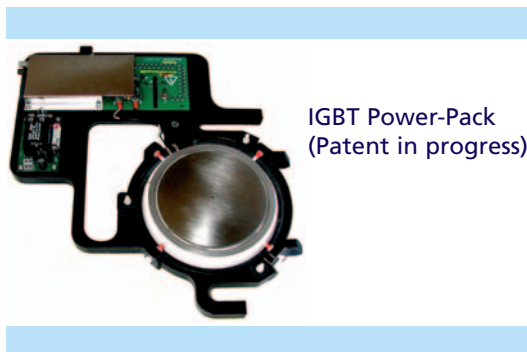
In 2003, Convertteam introduced the PPI in medium voltage drives for their higher power ranges. In addition to improved compactness and robustness, such devices offer:

- capability to limit any over-currents with safe turn-off under all operating and failure conditions
- case rupture free and arc ignition free due to pressed contacts and no wire bondings
- N+1 series redundancy: operation with redundant level off is allowed thanks to secured continuous conduction of the PPI in failure mode
- long life expectancy even under load cycling
- high capability at low motor frequency operation.

## Phase Power Stack (PPS)

The PPS is the main modular block that allows us to build the 3-level NPC inverter. Each PPS includes 4 PPIs and 2 NPC diodes. Each PPI is mounted in a withdrawable power pack.

The PPS integrated technology allows fuseless and snubberless design.



## Megamodule

The assembly of 3 PPSs composes the Megamodule that provides all the functions of the inverter. This standard building block with integrated technology allows modular arrangements of the MV7000 range such as:

- parallel connection for high power ratings
- connection to a common DC link for multiple motors
- active front end configuration
- single phase inverters for dedicated applications.

Based on the success of the PPI and PPS, Convertteam developed Megamodules with higher voltage ratings.

6.6kV is achieved simply by connecting 2 PPIs in series (Patent in progress). Higher voltages can be reached by connecting more PPIs in series (on request).



Megamodule

## Cooling unit

Converteam has been continuously improving water cooling technology since deionized water cooling was introduced in 1975:

- all metal pipes & valves in contact with deionized water are stainless steel
- deionized water to fresh water heat exchanger is a high pressure stainless steel plate design
- close monitoring of the water conductivity, pressure, flow and leakage is provided
- deionized water is distributed to PPS with high pressure, non conductive hoses.



High pressure  
non conductive hoses

## High grade control

The drive controller is a state-of-the-art Power Electronics Controller (PEC) featuring an Encoderless Vector Control (EVC). For dedicated drives, like drives for process industries, a vector control with an encoder is also available.

### Outstanding benefits

- high level performance dynamic control
- high reliability
- dedicated software for parameter setting, editing, archiving (using a remote PC)
- fieldbus for connection to automation systems
- Functional Block Diagram (FBD) for motor control and application software
- drive protection settings and monitoring
- full control of drive input transformer and motor auxiliaries.

### Adaptability

The PEC is a VME bus controller using the most advanced processor technologies and is adaptable, enabling it to cover a wide range of drive applications and configuration options.

### Ease of operation

Local set-up and monitoring can be achieved with the Drive Data Manager (DDM). This redefines the keypad concept with menu navigation, on-line help and diagnosis, upload/download of parameter settings, quick start and instrumentation facilities all wrapped up in an ergonomic design with a large display.

The DDM is mounted on the control cubicle door.

# Reducing cost of ownership

## Maintenance

### Reliable components

The MV7000 technology, built on robust PPIs and fuseless design, provides a low parts count, which is the key of reliability enhancement, MTBF increase and availability improvement.

### Easy access

The MV7000 design allows easy access to the drive components from the front. Rear access is not necessary. The IGBT power pack board can be withdrawn easily without need to disconnect the water circuit.

### Personnel safety

MV7000 converters are test proven against arc ignition effect for high short-circuit current level. Kirk key interlock system and grounding switch are provided as standard.

## Service and support

### Testing

A comprehensive factory testing schedule is carried out on all MV7000s to give further enhanced drive reliability. Full load current and voltage testing is included.

### Training

Complete training can be provided on Convertteam's medium voltage drives at our factory or on your site. A full range of training is available including customized and advanced training.

### Commissioning

The MV7000 allows efficient commissioning with reduced start-up time.



Factory test facilities

# MV7000 Data Sheet

## OUTPUT CHARACTERISTICS

Output voltage	0 - 3.3kV, 0 – 6.6kV		
Output power factor	-1 to 1		
Output frequency	0 to 90Hz (Higher output frequencies up to 300Hz on request)		
Motor inverter type	Pulse Width Modulated (PWM) 3-level Neutral Point Clamped (NPC)		
Motor Type	Induction or synchronous (option)		

## INPUT CHARACTERISTICS

Input voltage	Medium voltage input transformer for 12 or 24 pulses		
Supply frequency	50/60Hz ± 5%		
Supply converter	12 pulse DFE	24 pulse DFE	AFE
Input power factor	> 0.96		1

## GENERAL CHARACTERISTICS

Cooling	Raw water to deionized water heat exchanger. Raw water inlet temp. 15°C to 38°C [ $>38^{\circ}\text{C}$ or $<0^{\circ}\text{C}$ with derating <sup>(1)</sup> ]		
Auxiliary voltage	3 phase 400V ± 10%, 1 phase 230V ± 10%, 50Hz		
Efficiency <sup>(2)</sup> (typical)	99%	98.8%	98.6%
Storage temperature	-20°C to 60°C (without water in cooling circuit)		
Audio noise	< 75 dB(A) 1 m from cubicle line-up		
Operating ambient temperature	5°C to 45°C		
Humidity	5 to 95% non-condensing		
Altitude	< 1000m above mean sea level		
Installation	Indoors		
Color	RAL7035		
Enclosure protection class	IP 31 – Kirk key interlock system		
Standards	IEC		

## CONTROL CHARACTERISTICS

Motor control type	Flux vector control without encoder for induction, synchronous or permanent magnet machines
Electronic protections	Over-current, current limit, DC link over and under-voltage, motor stall, ground fault, supply loss ride-through
Speed accuracy	< 0.5% without encoder and <0.1% with encoder
Control sources	Drive Data Manager™ Keypad. Remote control. Ethernet link

## OPTIONS

Common mode filter (for AFE transformer-less)	Top cable entry
AFE input filter	Input and/or output isolating switch
Output sinusoidal filter (long cable or high speed motor)	Encoder board
Output dV/dt filter @ 3.3kV (cable length range 50-200m; other on request)	Kinetic support
Dynamic braking chopper	Marine options (including IP33 and anti-condensation heater)
Anti-condensation heater	ANSI flange (for Cooling Interface)
Standby pump for Cooling Unit	3-phase auxiliary voltage 460V-690V 50/60Hz
Three-way valve on raw water	Ethernet link: one additional port
Direct link to external air-to-water exchanger with three-way valve	Serial communication (2 serial ports RS232 with Modbus protocol)
IP54	External power cable connection (below cubicle)

<sup>(1)</sup> Water regulation system required (e.g. three-way valve) for water input temperature  $<15^{\circ}\text{C}$

<sup>(2)</sup> At rated output power and power factor 0.9, without option and not including auxiliary consumption

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