



**INGEDRIVE MV 100**

Frequency Converters

MEDIUM VOLTAGE — WATER COOLED

2500 to 12700 kW  
3.3 to 4.16 kV

***Ingeteam***

# Frequency Converters

water cooled, medium voltage

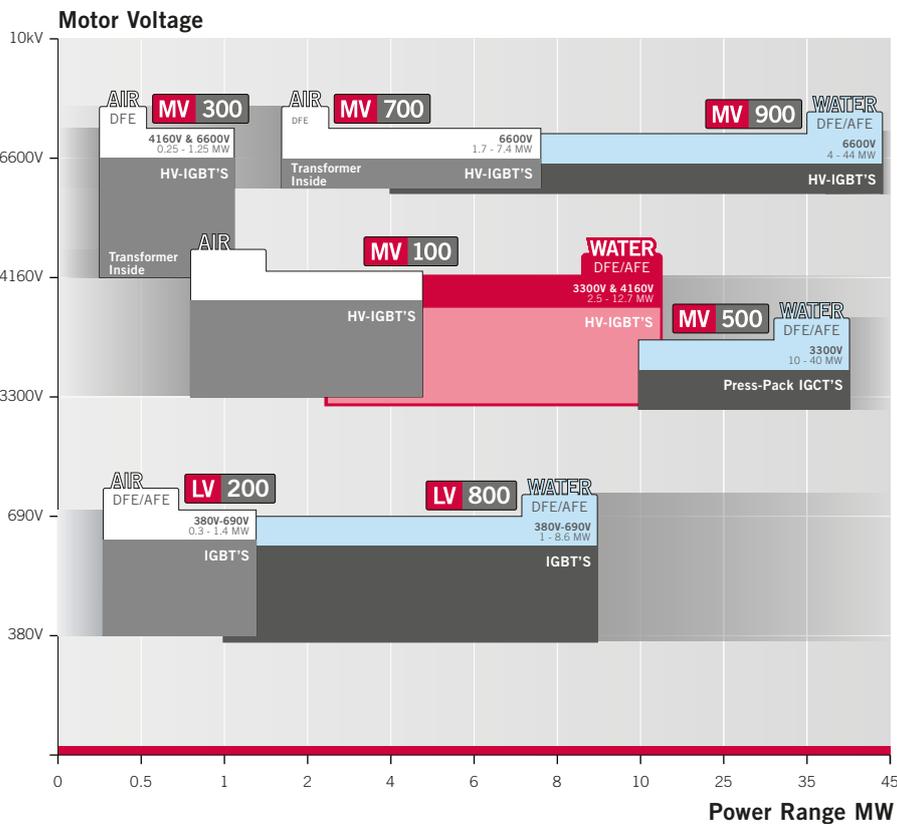
## INGEDRIVE™ MV100 Water

The most reliable, versatile medium voltage family for applications with high power demands.

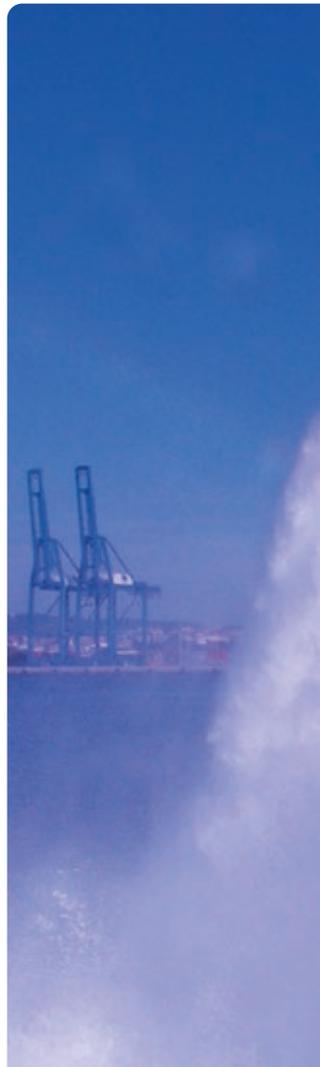
The INGEDRIVE™ MV100 frequency converter range has been designed for applications requiring high energy exchange in very demanding environmental conditions. Ingeteam has invested more than four decades of experience in designing and manufacturing power converters, applying all of its know-how and including the latest advances in control electronics, with the most reliable semiconductors and passive elements on the market. The result is a robust, and reliable family of frequency converters with a high-power density per m<sup>3</sup>, making it one of the most compact designs available on today's market.

Based on the concept of modular design, INGEDRIVE™ MV100 medium-voltage converters cover a wide range of powers for the most demanding applications in sectors including mining, marine, steelmaking, and oil & gas amongst others. Likewise, its versatile control architecture together with its powerful CPU (Converter Processing Unit) makes it possible to control any type of electrical rotary machine (be it induction, synchronous or permanent magnet) with the best possible performance in terms of speed and torque precision.

The INGEDRIVE™ MV100 frequency converter range extends up to 12.7MW and is available for an output voltage of 3300V and 4160V.



- Sectors**
- Marine & Offshore
  - Oil & Gas
  - Power Generation
  - Mining, Cement, Materials Handling
  - Steelmaking
  - Water Treatment
  - Test Benches and Wind Tunnels





## Main Benefits

### **Robustness and Integrity**

The MV100 range offers different rectification configurations and a 3L-NPC inverter based on HV-IGBT power semiconductors, making this range highly robust. Available for single-drive and multi-drive topologies.

### **Easy Maintenance**

It has been designed to minimise and facilitate maintenance and user tasks.

### **Highly Compatible**

The INGEDRIVE™ MV100 converter is designed for installation with both new motors and for existing motors thanks to the possibility of including a sinusoidal filter.

### **Designed for very demanding environmental conditions**

The INGEDRIVE™ MV100 family has been especially designed to work in highly-demanding environmental conditions in terms of temperature and salinity.

### **Fresh water cooled**

No deionizers needed, saving space and maintenance.

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## High-performance, robust and reliable design

### Control cabinets

#### Touch screen for local control [HMI]

- Powerful, user-friendly interface.
- Remote and local accessible control.

#### Control Unit

- Powerful CPU for regulation and control, with a built-in PLC for basic control logic.
- Remote diagnostics, monitoring and control via a web application without the need to install any additional software.
- Easily accessible cabinet and main components.
- Modular and scalable control topology.
- Robust and certified control design.



### Cooling cabinet

#### Cooling outlet

- Highly-efficient design.
- Redundant cooling pumps.
- Internal air / water exchanges. Minimal air loss.

#### Safety

- Grounding switch, key interlocks, and door locks included for maximum safety.
- Emergency stop button.

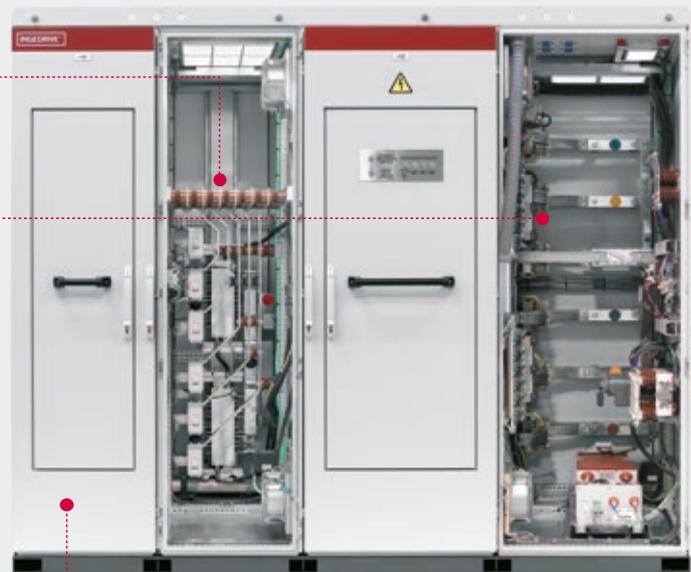
## Input and output cabinet

### Input cabinet

- Easily-accessible cabinets for control and power cabling.
- Available with upper or lower inlet.

### Output cabinet

- Standard dv/dt filter for minimizing overvoltages in motor terminal blocks for high compatibility with the motor.
- Optional sinusoidal filter.
- Lower and upper output access available.



### High-quality packaging

- Front access for all user and maintenance actions.
- Protection level from IP44 to IP54.

## Power cabinet

### AFE inverter with 3L-NPC topology based on HV-IGBT semiconductors Basic power modules [BPM]

- Based on HV-IGBTs.
- Easy access, maintenance and exchange.
- Arc flash detection.

### Power control module

- Integration in the Power Cabinet, isolated from basic control electronics via Fiber Optic.

### Air/Water Exchangers

- It mimizes the need for Air Conditioner in the electric rooms due to the reduced heat loss.



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## Control features

In order to analyse the potential, architecture and adaptability of the control system by INGEDRIVE equipment, three areas need to be considered:

## HMI and Operator Panel

The whole INGEDRIVE family has powerful, user-friendly interface tools developed for parameterisation, commissioning, use and maintenance and for users of all levels, using the following:

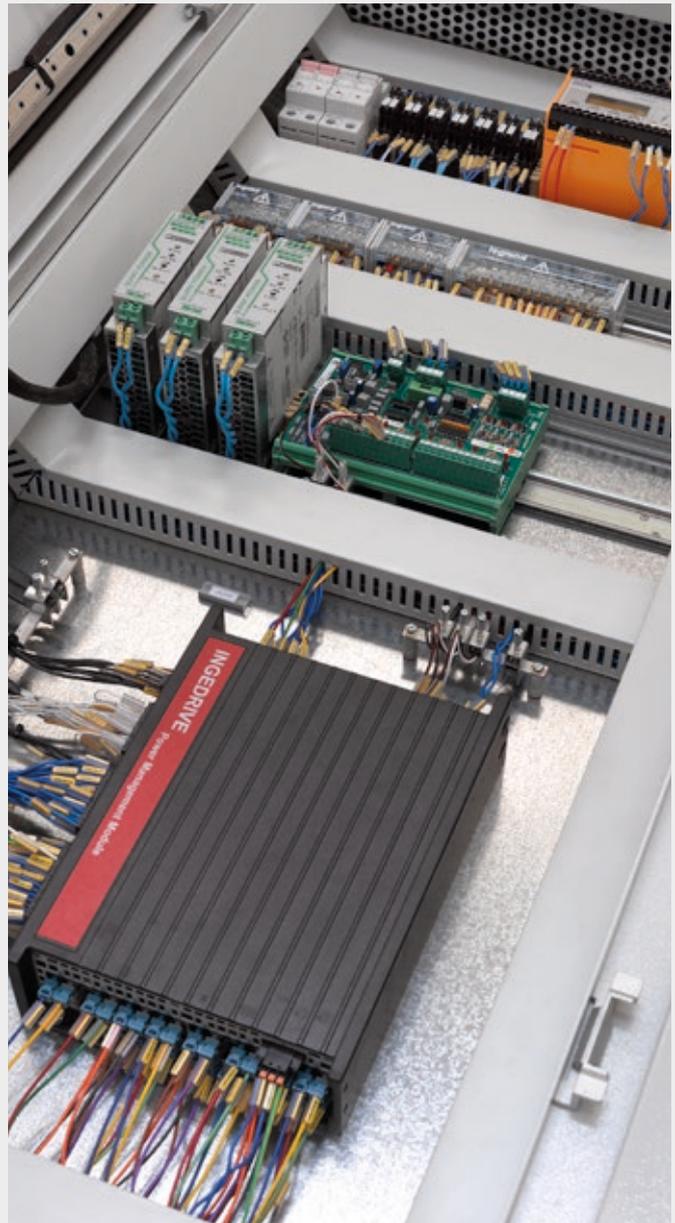
- Web Application: Embedded in the CPU with functional features such as software updating, alarms log, parameterisation, with user level definition.
- Operator Panel: User-friendly tool with a touchscreen containing important information such as the general status, measurements, alarms and basic local control functional features.
- Remote Diagnosis, Control and Log: The whole INGEDRIVE™ family offers clients powerful tools for commissioning and support based on web technology. This server technology only requires a web browser, allowing remote access via Ethernet to all enabled functional features.
- Customized Panels: Ingeteam offers a tool package for developing and customizing HMIs: Both the Web Application and the Operator Panel are easily customizable so that they can be adapted to client requirements, including the client's own development.

## Hardware Architecture

The control hardware is based on standard shared modules for the whole INGEDRIVE™ family, both in low and medium voltage. The control system consists of the following main modules: PMM [Power Management Module] and CPU [Converter Processing Unit] which permit a single-drive or multi-drive configuration and can be used for different topologies.

### The main characteristics are as follows:

- Reliable hardware based on standard modules.
  - Versatile modular design.
  - Validated in different application sectors.
- Advanced processing capacity.
  - DSP processor for regulation and control functions and PLC microprocessor for control logic functions.
- Powerful interface for inputs and outputs.
  - High-resolution measurements.
  - Option for digital/analog input/output expansion.
  - Permits communication with multiple field buses.
- High electromechanical resistance.
  - Robust design with metal casing.
  - EMC-certified (IEC 60092 / IEC 61800).



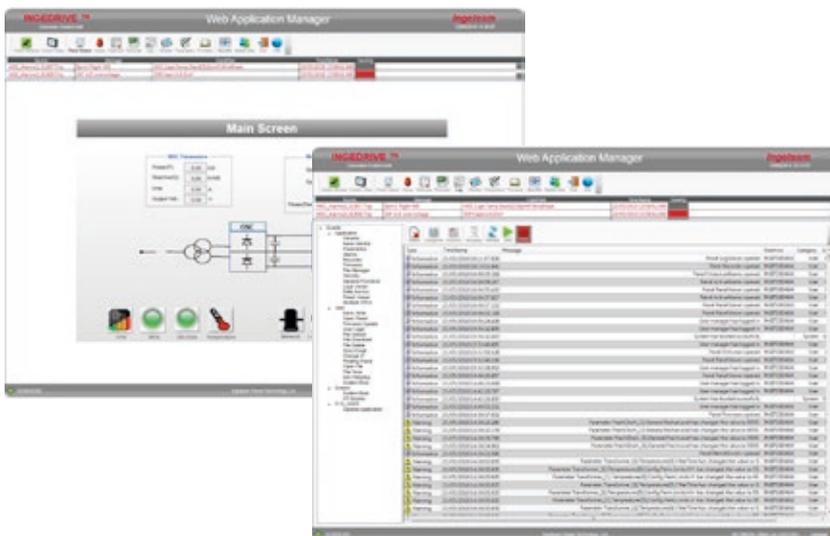
## PLC and Control Software

Standard INGEDRIVE devices contain a PLC whose programming is based on the 61131-3 standard, allowing the client to use their own logic and program their own signals and communication according to their needs. The INGEDRIVE family's control system is so powerful and versatile that it can be adapted to the different converter topologies of the whole range, such as the following:

- Two-level inverter.
- Three-level NPC inverter with vector modulation or selective harmonic elimination.
- 5-level inverters with H-Bridge topology.

Furthermore, the control system is capable of not only managing single-drive but also multi-drive configurations, adapting itself to the requirements of different applications with the following functional features:

- Multi-drive topology adapted to the application's requirements.
- DC bus voltage regulation using DFE or AFE technology.
- Redundant DC bus option using two AFE rectifiers connected to different power networks.
- Frequency converter for hybrid topologies. Static Frequency Converter.
- Option to control multiple types of machine with auto.tuning control algorithms developed for each type of motor.
  - Asynchronous motor.
  - Synchronous motor (brushed and brushless control).
  - Permanent magnet motors.
  - Vector control.
  - Encoderless vector control.
- Battery control for hybrid topologies.
- Redundant topologies using doubly-fed motors. Synchronous and asynchronous..



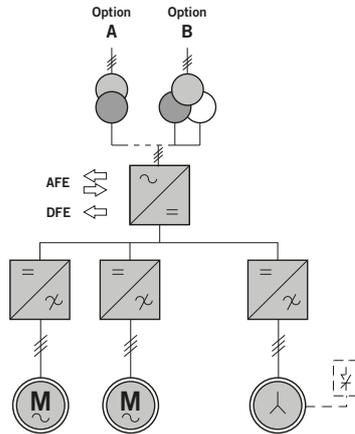
# Frequency Converters

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## Topologies

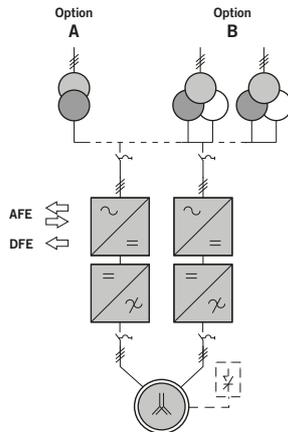
### Multi-drive solution:

Multi-drive application in which several inverters are connected to one single DC bus. While some motors can be braking, others can be motoring, thus transferring energy between themselves through the DC bus (i.e. tension reels on reversing cold mills in the metal industry and test bench applications).



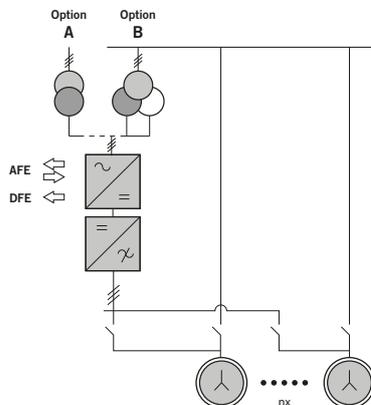
### Redundant single-drive solution:

an application consisting of a motor with two windings fed by two inverters. The rectifier side can be DFE or AFE.



### Single-drive solution:

a standard application consisting of one motor with a winding fed through a DFE or AFE converter. Sequential synchronous start as an option.



## Why Ingeteam?

*flexible + customized*

One of Ingeteam's cornerstones and hallmarks by which our clients recognise us is our flexibility and ability to adapt our products, services and solutions which, together with the high standards of quality in our products, make INGEDRIVE™ a leading reference in the major sectors where we are present.

**Flexibility:** Adapting ourselves to design requirements, adapting our products to specific applications, offering flexible service and support whenever and wherever our clients need it.

**Customization,** taking the main element of any INGEDRIVE™ equipment which is the BPM (Basic Power Module) or power module. Ingeteam's design and engineering department adapts the final product to comply with each client's specific requirements, without compromising reliability or robustness and increasing usability and optimisation for each application.



## Certification

The MV100 series complies with the IEC medium-voltage equipment as well as having certifications such as the following:

- CE marked certificates
- Marine application certification: BV, DNV-GL, LR, etc.
- Asbestos Free
- Green Passport



We not only manufacture devices but also personalise them to offer the best solution in a wide range of sectors including the marine sector, industry, mining, and oil & gas. Perhaps this is why over 90% of our clients rate us as being flexible and as providing highly-customizable solutions. These two cornerstones are complemented with demanding quality standards which all of our products are subjected to, allowing Ingeteam to offer.



### More than 45 years' experience in power converters

Over 45 years' experience in power electronics for applications in a wide range of sectors including energy generation, industry, mining and the marine sector have created an extensive, solid knowledge base. This enables our design and engineering department to advise our clients on the best option and adapt equipment and software to each particular application, thus offering custom-made solutions.



### Load tests of all equipment at rated current

With the aim of including the latest advances in power electronics in INGEDRIVE™ equipment, Ingeteam boasts the largest power electronics laboratory in southern Europe and one of the biggest in the world. The testing and validating facilities cover a surface area of 13.000 m2 with a capacity for testing equipment over 40MVA and with voltages up to 6.6 kV and a team of international engineers and researchers.



### Manufactured 100% in Europe

Ingeteam designs and manufactures the entire INGEDRIVE™ range in its logistics and manufacturing centres in Europe. Ingeteam always works with mainly european leading brands and directly controls the entire manufacturing process to thus ensure the final quality of its products.

Hence, Ingeteam offers combined or specific tests, besides the routine tests carried out on all INGEDRIVE™ equipment.

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3300 V <sub>AC</sub>				With dV/dt output filter		With sinusoidal output filter		
Rectifier Type	Power kW	Current A	Width mm	Weight kg	Width mm	Weight kg		
 <b>DFE</b> <b>12 Pulse</b> <small>V<sub>IN</sub> = 2x 1850 V<sub>AC</sub></small>	2500	496	2010	2500	2600	3500		
	3530	700						
	5000	991	2610	3150	3800	5150		
	6360	1261						
	7060**	1400						
	<b>24 Pulse</b> <small>V<sub>IN</sub> = 4x 1850 V<sub>AC</sub></small>	2500	496	2810	2900	3400	3900	
		3530	700					
		5000	991	2810	4300	4000	6300	
		6360	1261					
7060**		1400						
9530		1889	4210	4500	6000	7800		
11450		2270	4610	5500	7000	9500		
12720**		2522						
 <b>AFE</b> <small>With ext. transformer (Xsc 15%) V<sub>IN</sub> = 3300 V<sub>AC</sub></small>	2500	496	2010	2600	2600	3600		
	3530	700						
	5000	991	3410	4800	4600	6800		
	6360	1261						
	7060**	1400						
	<small>With ext. transformer (Xsc 7%) V<sub>IN</sub> = 3300 V<sub>AC</sub></small>	2500	496	2610	3600	3200	4600	
		3530	700					
		5000	991	4610	6400	5800	8400	
		6360	1261					
7060**		1400						
<small>Transformerless V<sub>IN</sub> = 3300 V<sub>AC</sub></small>	2500	496	3410	3900	4000	4900		
	3530	700						
	5000	991	6210	7000	7400	9000		
	6360	1261						
	7060**	1400						

\*\* Double winding motor required (not applicable when using sinusoidal output filter)

Depth: 1260 mm Height: 2320 mm

4160 V <sub>AC</sub>		With dV/dt output filter			With sinusoidal output filter		
Rectifier Type	Power kW	Current A	Width mm	Weight kg	Width mm	Weight kg	
 <b>12 Pulse</b> <small>V<sub>IN</sub> = 2x 2350 V<sub>AC</sub></small> <b>DFE</b>	2500	393	2010	2500	2600	3500	
	3530	555					
	5000	786					
	6360	1000					
	7060**	1110					
	<b>24 Pulse</b> <small>V<sub>IN</sub> = 4x 2350 V<sub>AC</sub></small>	2500	393	2810	2900	3400	3900
		3530	555	2810	4300	4000	6300
		5000	786				
		6360	100	4210	4500	6000	7800
		7060**	1110				
9530		1499					
11450		1800	4610	5500	7000	9500	
12720**		2000					
 <b>With ext. transformer (Xsc 15%)</b> <small>V<sub>IN</sub> = 4160 V<sub>AC</sub></small> <b>AFE</b>	2500	393	2010	2600	2600	3600	
	3530	555	3410	4800	4600	6800	
	5000	786					
	6360	1000					
	7060**	1110					
<b>With ext. transformer (Xsc 7%)</b> <small>V<sub>IN</sub> = 4160 V<sub>AC</sub></small>	2500	393	2610	3600	3200	4600	
	3530	555	4610	6400	5800	8400	
	5000	786					
	6360	100					
	7060**	1110					
<b>Transformerless</b> <small>V<sub>IN</sub> = 4160 V<sub>AC</sub></small>	2500	393	3410	3900	4000	4900	
	3530	555	6210	7000	7400	9000	
	5000	786					
	6360	1000					
	7060**	1110					

\*\* Double winding motor required (not applicable when using sinusoidal output filter)

Depth: 1260 mm Height: 2320 mm

**Considerations**

**Motor type:** Squirrel Cage induction

**Performance:** 97,1%

**Power factor:** 0,91

**Ambient temperature:** 0 °C to 45 °C (max.). Up to 55 °C with reduction factor

**Inlet water temperature:** 0 °C to +38 °C (max.). Up to 45 °C with reduction factor

Chopper braking resistor excluded & to be placed external to cabinet

**Load type:** Variable torque

Overloads N/A

**Altitude:** < 1000 m.a.s.l. (metres above sea level) / Up to 5000 m.a.s.l. with reduction factor

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Standard Characteristics	
<b>Hardware Interface</b>	Analog inputs: 2
	Analog outputs: 2
	Digital inputs: 9
	Digital outputs: 10
	Emergency control with wire break detection: 4
	Basic control panel: E-Stop, CPU access and local-remote switch
	Redundant Encoder (Except for sensorless control) [Encoder not supplied with the drive]
<b>Miscellaneous</b>	Lighting and socket in control cabinet
	Color operation touch screen (HMI) - 7"
	Three way valve (for Internal water temperature control)
	Redundant cooling pump set
	Space heaters (to avoid condensation in enclosures)
	Varnished boards
	Fixing rods and door retainers (only marine applications)
	Lifting lugs
	RAL7035 cabinet color
	IP44. IP54 with suitable MCT sealing modules
	CE Marking and green passport certification
	Halogen free and flame retardant materials
	Special tool (power stack handling fork lift)
	Road truck packing (basic wooden box)
	Redundant Deionization Tank
<b>Electronic Components</b>	Insulation Monitoring System (Except for transformerless connection)
	Internal Precharge and Discharge System
	Long life Polypropylene Capacitors
	Internal UPS
<b>Functionalities</b>	Black Out Prevention
	Fault Ride Through Capability
	Sensorless vector control
	Flying Start Functionality
<b>Software</b>	Programming plus Ingewebapp Remote Access. No license required
<b>Documentation</b>	Documentation set (2 printed + 2 digital) in English or Spanish

Optional Features	
Hardware interface	Extended hardware interface/package
	Analog inputs: +2
	Analog outputs: +2
	Digital inputs: +10
	Digital outputs: +10
	Extended emergency control circuit with wire break detection: +5
	Emergency control with wire break + short-circuit detection
	Synchronous transfer (IC3 I/O modules+ Voltage measurement) (Bypass contactors are excluded) (These modules will be placed external to the VFD in a cabinet supplied by others)
	Expansion IO modules for additional connectivity
	External heaters control and feeding (up to 300W)
Communications	External fans control and feeding
	External Pt100 measurement (up to 8 channels)
	F.O.Adaptor
Miscellaneous	Profibus-DP, Modbus TCP, CAN Open, Modbus RTU, DeviceNet
	Other Fieldbus Communication Protocol
	Filter for primary coolant
	Primary sea water cooling
	Special RAL painting
	Reactive power compensation only for converters with AFE rectifiers
	Special degree of protection
	Customized cabinet indications (placed on door)
	Vibration Dampers
	Packing for maritime transportation
	MCT sealing modules
	Cooling pipes - side access
	ARC FLASH compliant (+400mm width)
Electrical Components	Output breaker
	Output manual switch
	EMI filter
	Insulation Monitoring System (Only for transformerless connection)
	Excitation module for synchronous motors (Ref.: MC9101-A)
	Special auxiliary supply voltage
	Grid side top power cable access
	Motor side top power cable access
	Control top cable access
	Over Voltage Limiter Unit (OVLU)
	Dynamic Braking Chopper
Documentation	Additional documentation set and language
Certification	DNV-GL, LR, BV, CCS, RINA, RRR, TL, Others
Witness FAT	Per day. Only standard tests included
Overloads	Derating at low frequencies & overloads

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**CRS  
360°**

**CUSTOMER  
RELATIONSHIP  
SERVICE**

## INGEDRIVE™ Support

In our commitment to offering our clients complete and personalised solutions, Ingeteam offers a 360° CRS (Customer Relationship Service) with all of our product range, providing you with comprehensive consultancy, direct technical support, training and maintenance services throughout the lifetime of our products.

360° CRS is a dynamic, personalised service that covers all of stages and contact points between Ingeteam and our clients. The 360° CRS programme is supported by a professional technical team whose goal is client satisfaction and continuous improvement of products and services, always hand in hand with the latest advances and technologies in each application sector.



## The following services are part of the 360° CRS programme



### Support with technicians and engineers. Direct access to design engineers and R+D

During the warranty period, in the event of an incident, Ingeteam guarantees assistance with key technicians and engineers providing advice and high-quality support to our clients.

Additionally, Ingeteam offers its clients the option to extend out-of hours customer support services provided by the Ingedrive technical support team by means of customized contracts to suit the needs of our clients.



### 25-year life cycle incl. service + spares

Ingeteam guarantees the repair service of the entire INGEDRIVE™ family for a period of 25 years as of the date of purchase of our equipment.



### Remote Access

INGEDRIVE™ products are ready to be monitored remotely which enables Ingeteam's technical team to offer our clients the option to track and analyse any incident in a device remotely.



### Commissioning

The commissioning of INGEDRIVE™ equipment is carried out by highly-qualified, multidisciplinary staff with experience in a wide range of sectors, to ensure your installation has best adaptation and best performance. This, together with the fact that devices leave the factory having been completely tested and verified, makes the commissioning time considerably shorter.



### Spare Parts Stock

Ingeteam has designed the INGEDRIVE™ range based on the concept of power stacks. This enables us to have a permanent stock of main converter components in our logistical and manufacturing centres, reducing the supply times for immediately attending to potential emergencies to a minimum.



### Repairs [Field Service]

Anytime, anywhere. The aim of INGEDRIVE™ Support is to minimise the impact of a potential stoppage or incident in our devices.



### Technical Support and Engineering

Ingeteam offers its clients pre-sales technical and engineering support in order to provide assistance and advice during the initial stages and from the project definition to the commissioning of our equipment and delivery of our installations.



### Training [Training Centre]

Ingeteam's team of course leaders offers comprehensive, customized theory and practical programmes to meet the training requirements of its clients.

Ingeteam has a specific area for providing theory and practical classes where we have specific material and converters with different topologies from the entire INGEDRIVE™ range. The different options can be summarised in two levels in which the subject content and depth of learning is adapted to the student and to the aim of the course.

- User Level Course:  
Explains maintenance and troubleshooting Aimed at users and end users.
- Expertise Level Course:  
Aimed at equipment commissioning engineers. Suitable for integrators.

**Ingeteam Power Technology S.A.**  
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***Ingeteam***

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