

Frequency Converters

INGEDRIVE LV 200



Air Cooled Low Voltage
300 to 1400 kW
380 to 690 V

Ingeteam

Frequency Converters

Air cooled, low voltage

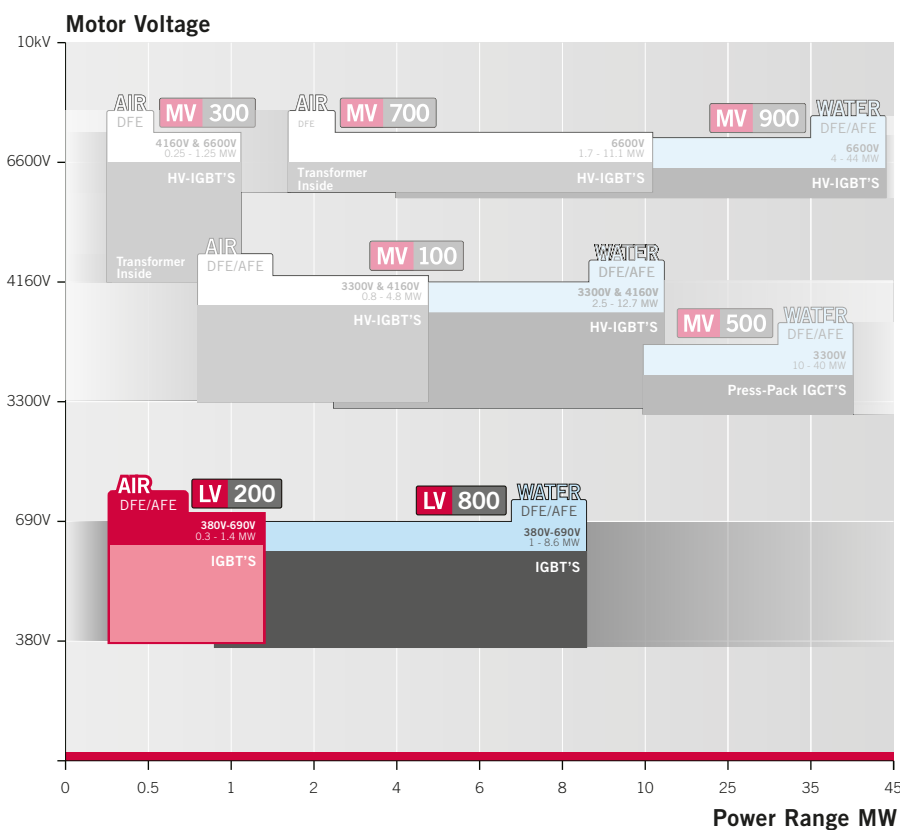
INGEDRIVE™ LV200

The most flexible, modular low-voltage equipment range on the market.

The INGEDRIVE™ LV200 frequency converter range has been designed to efficiently control energy consumption in any sector requiring high levels of exchange with minimal space and maintenance. 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, compact and efficient family of frequency converters.

Based on the concept of modular design and thanks to the built-in transformer, INGEDRIVE™ LV200 medium-voltage converters cover a wide range of power supply voltages for the most demanding applications in sectors including mining, steelmaking and water pumping 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™ LV200 frequency converter range extends up to 8.6MW and is available from 380V to 690V.



Sectors
Energy Generation
Mining, Cement, Materials Transport
Steelmaking
Water Treatment and Distribution.
Test Benches and Wind Tunnels.





Main Benefits

Versatility

Its great modularity and huge range of possible combinations make the LV200 a versatile device suitable for many applications.

Robustness and Integrity

The LV200 range offers different rectification configurations and a two level inverter based on IGBT power semiconductors, making this range highly robust.

Reliable and User Friendly

Since it is designed with a minimum number of components, the two level topology with IGBTs makes it highly reliable and user friendly.

Easy Maintenance

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

Highly Compatible

Designed for both new and existing motors thanks to its built-in sinusoidal filter at the converter outlet.

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Control cabinet

Input cabinet

High-quality packaging

- Front access for all user and maintenance actions.
- Protection level from IP23 to IP54.

Touch screen for local control [HMI]

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

Emergency stop button

Power cabinets

Input cabinet

Easily-accessible cabinets

- Control and power cabling.
- Available with upper or lower inlet.

Safety

- Open door detector.
- Inaccessible active elements.

Inverter with 2L topology based on IGBT semiconductors Basic power modules [BPM]

- Based on IGBTs.
- Easy access, maintenance and exchange.
- Control via fibre optic.
- Optional dV/dt filter, optional sinusoidal filter.

6P, 12P or AFE rectifier

Power management module

- Built into the power cabinet and communication with the CPU via fibre optic.

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.
- Modular and scalable control topology.
- Robust, certified control design.



Fans

- Built-in fans .



“Low-maintenance, reliable design with maximum robustness for applications in the most demanding environments.”

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Control Features

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



HMI and Operator Panel

The whole INGEDRIVE™ family has powerful, user-friendly interface tools developed for parametrisation, 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, parametrisation, with user level definition.
- Operating panel: user-friendly tool with a touch screen containing important information such as the general status, measurement, 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 package of tools for developing and customizing the HMI: both the web application and the operating panel are easily customizable so that they can be adapted to client requirements, permitting customized development according to the client's own requirements.

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 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).

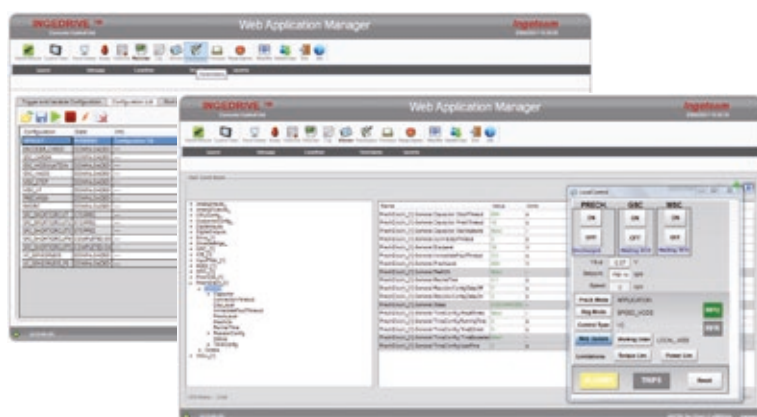
PLC and Control Software

Standard INGEDRIVE™ devices contain a PLC whose programming is based on the IEC61131-3 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 managing not only single-drive but also multi-drive configurations, adapting itself to the requirements of different applications with the following functional features:

- Multidrive topology adapted to the application's requirements.
- DC bus voltage regulation using DFE or AFE technology.
- Posibilidad de Bus DC redundante usando dos rectificadores AFE conectados a redes diferentes.
- 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 (brush / brushless).
 - Permanent magnet motors.
 - Vector control.
 - Control vectorial sin encoder (sensorless).
- Battery control for hybrid topologies.
- Redundant topologies using doubly-fed motors: Synchronous and Asynchronous.



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Certification

The LV200 series complies with the IEC low-voltage equipment as well as having certifications such as the following:

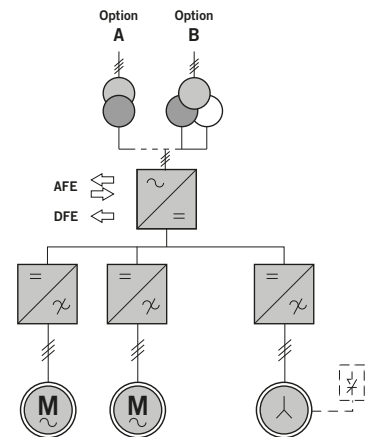
- CE marked certificates
- Marine application certification: BV, DNV-GL, LR, etc.
- Asbestos Free
- Green Passport



Topologies

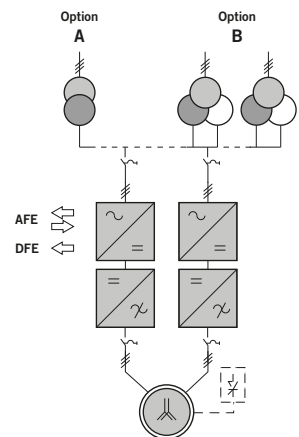
Multi-Drive Solutions:

Multi-drive applications in which several inverter stages are connected to a common DC bus. When some motors brake, others can accelerate, transferring the energy between both via their DC bus connection. (Example: Mill stands with coils and decoilers for the metal industry).



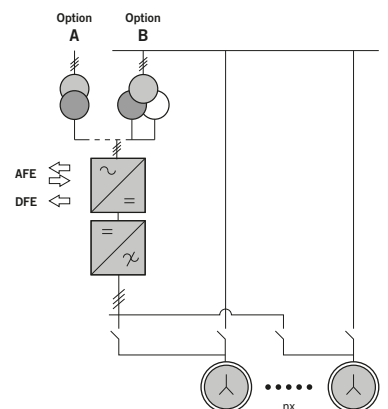
Redundant single-drive solutions:

Applications which consists of motors doubly fed by two converters whose rectifier phase can be DFE or AFE.



Single-Drive Solutions:

Standard applications based on a single motor fed by an AFE or DFE converter. Sequential startup option of several motors.



Why Ingeteam?

flexible + customized

One of Ingeteam's cornerstones and hallmarks by which our clients recognise us is our flexibility and ability to customize 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 core of any INGEDRIVE device, namely the power stack, Ingeteam's design and engineering department adapts the final product to comply with the client's requirements, without compromising reliability or robustness and increasing usability and optimisation for each application. 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 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.

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



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.

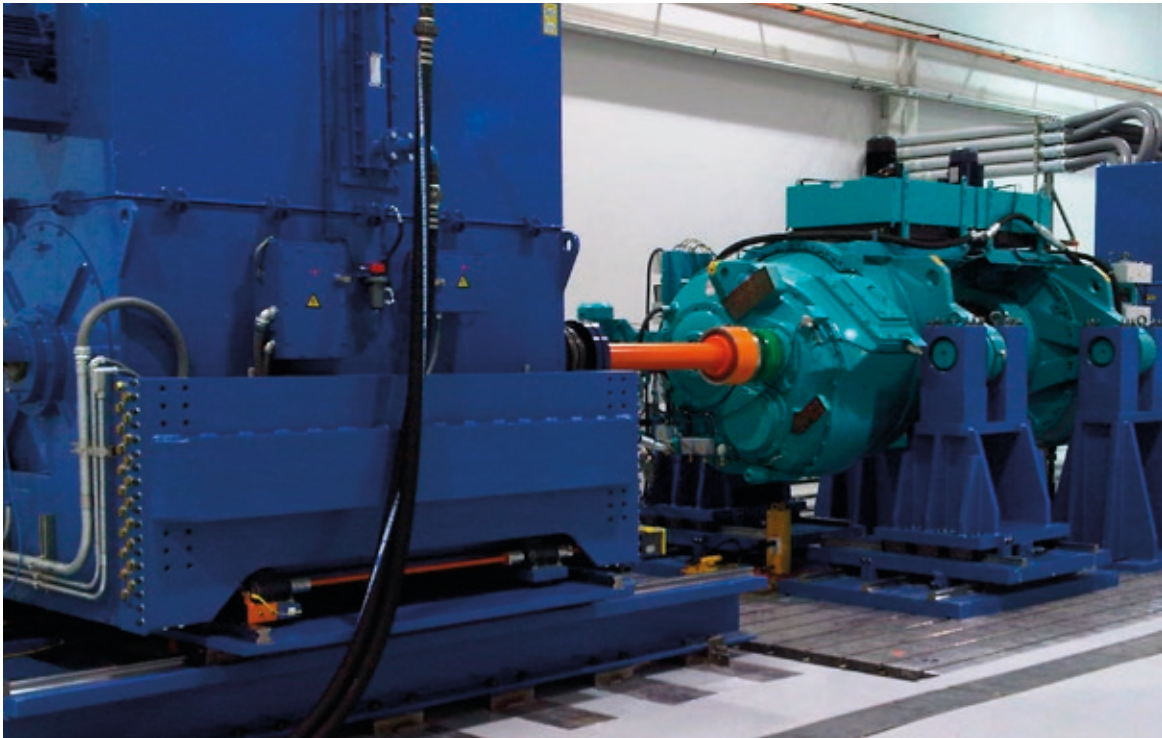
Hence, the flexibility, development capacity, customization and quality of our products are key points which make our clients consider us as technological partners.

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380 - 480 V _{AC}			w/o filter		With dV/dt output filter		With sinusoidal filter	
Rectifier Type	Power kW	Current A	Width mm	Weight kg	Width mm	Weight kg	Width mm	Weight kg
<div>➡</div> <div>DFE</div>	6 Pulse		1210	700	1210	740	1610	1000
	450	700	1610	900	1610	980	2410	1500
	605	945						
	670**	1050**						
	12 Pulse		810	550	810	590	1210	850
	500	700	1210	750	1210	830	2010	1300
	670	945						
	750**	1050**						
<div>⚡</div> <div>AFE</div>	375	525	1210	900	1210	940	1610	1200
	500	700	2410	1700	2410	1780	3210	2250
	670	945						
	750**	1050**						
	1010	1418	3610	2850	3610	2970	4810	3300

** Double winding motor required (not applicable when using sinusoidal output filter) Depth: 605 mm Height: 1955 mm





Test bench

690 V _{AC}			w/o filter		With sinusoidal filter	
Rectifier Type	Power kW	Current A	Width mm	Weight kg	Width mm	Weight kg
 DFE 6 Pulse	460	500	1210	700	1610	1000
	620	675	1610	900	2410	1500
	830	900				
	920**	1000				
	490	500	810	550	1210	850
	660	675	1210	750	2010	1300
	880	900				
	980**	1000				
 AFE	510	500	1210	900	1610	1200
	690	675	2410	1700	3210	2250
	920	900				
	1020**	1000				
	1380	1350	3610	2850	4810	3300

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

Depth: 605 mm Height: 1955 mm

690 V _{AC}			With dV/dt output filter	
Rectifier Type	Power kW	Current A	Width mm	Weight kg
 DFE 6 Pulse	415	450	1210	740
	555	605	1610	980
	745	810		
	830**	900		
	440	500	810	590
	590	675	1210	830
	790	900		
	880**	1000		
 AFE	460	450	1210	940
	620	605	2410	1780
	830	810		
	920**	900		
	1240	1215	3610	2970

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

Depth: 605 mm Height: 1955 mm

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Considerations

Motor type: Squirrel Cage induction

Performance: 95%

Power factor: 0,9

Ambient temperature: 0 °C to 40 °C (max.). Up to 50 °C with reduction factor

Dv/dt filter required for distances between converter/motor > 40m

Load type: Variable torque

Altitude: < 1000 m.a.s.l. (metres above sea level)

Standard Characteristics

Hardware Interface

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]

Miscellaneous

Lighting and socket in control cabinet
Color operation touch screen (HMI) - 7"
Space heaters (to avoid condensation in enclosures)
Varnished boards
Fixing rods and door retainers (only marine applications)
Lifting lugs
RAL7035 cabinet color
IP23 [Air] / IP44. IP54 with suitable MCT sealing modules [Water]
CE Marking and green passport certification
Halogen free and flame retardant materials
Road truck packing (basic wooden box)

Electronic Components

Input filter (AFE and 6P DFE only)
Input contactor (only for AFE and 6P DFE)
Internal Precharge and Discharge System
Long life Polypropylene Capacitors

Functionalities

Black Out Prevention
Fault Ride Through Capability
Encoder / encoderless vector control
Flying Start Functionality

Software

Programming plus Ingewebapp Remote Access. No license required

Documentation

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

Extended control panel: BCP + drive connection and NFU control

Expansion IO modules for additional connectivity

External heaters control and feeding (up to 300W)

External fans control and feeding

External Pt100 measurement (up to 8 channels)

Communications

F.O.Adaptor

Profibus-DP, Modbus TCP, CAN Open, Modbus RTU, DeviceNet

Other Fieldbus Communication Protocol

Miscellaneous

MCT sealing modules

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

Electrical Components

Internal UPS

Input circuit breaker instead of contactor for 6P and AFE rectifiers

Output breaker*

Output manual switch

EMI filter

Insulation Monitoring System (Only for transformerless connection)

Excitation module for synchronous motors

Special auxiliary supply voltage

Grid side top power cable access

Motor side top power cable access

Control top cable access

Sinusoidal filter

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



24/7 support.

Direct access to design engineers and I+D

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

Once the warranty period has expired, 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.

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