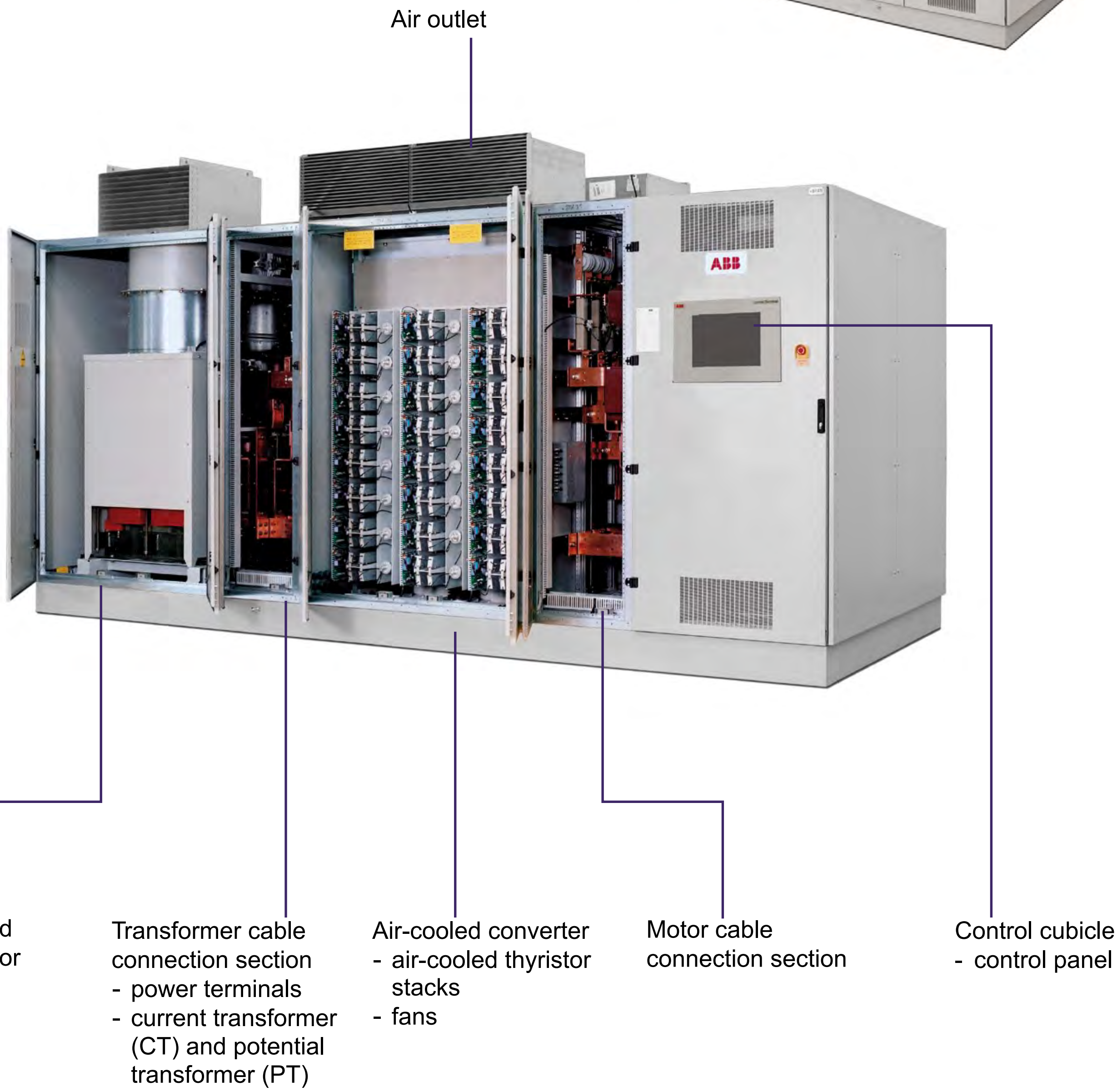
ПРИВОДЫ ПЕРЕМЕННОГО ТОКА ВЫСОКОВОЛЬТНЫЕ
Техническое описание на преобразователи частоты MEGADRIVE-LCI

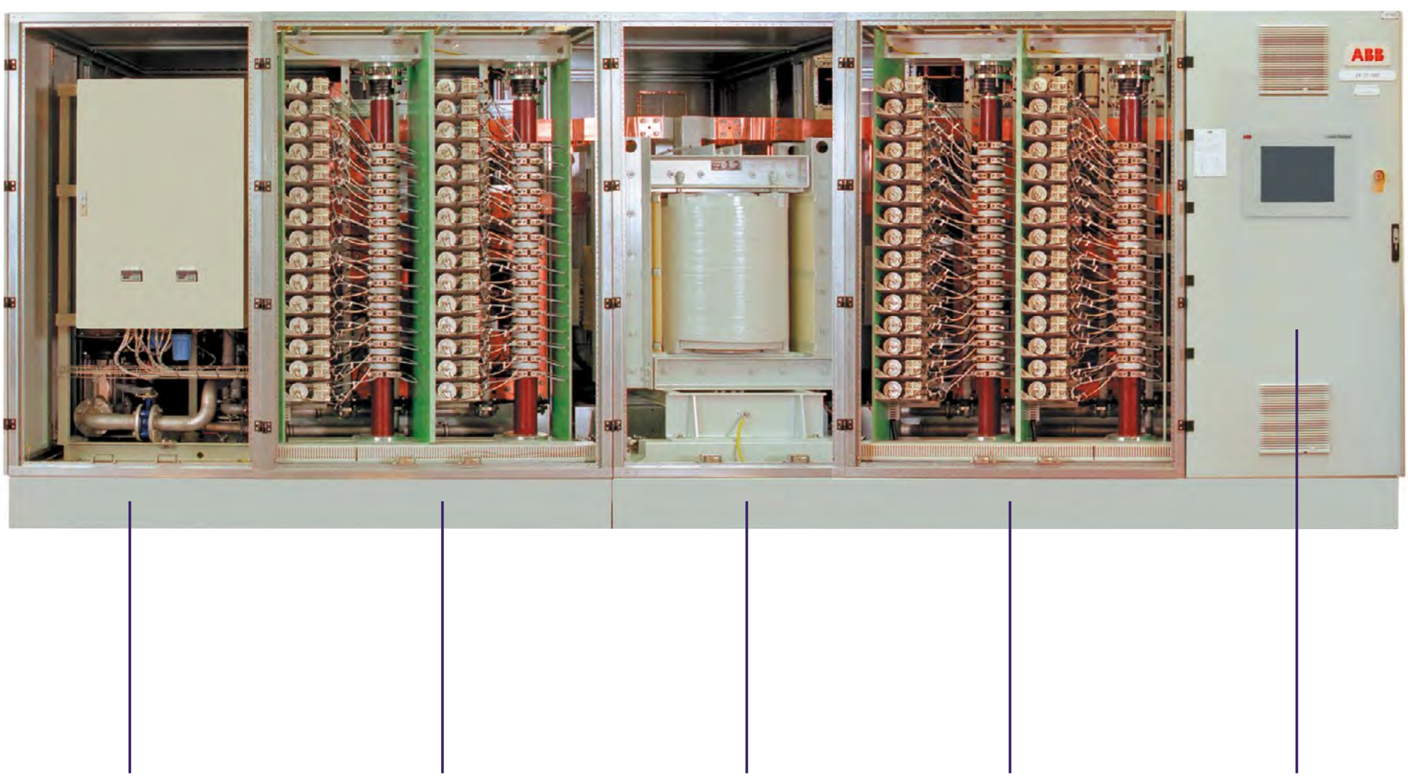
MEGADRIVE-LCI air cooled

Air cooling is mainly used for soft starters and applications in the lower power range. It provides short-time overload capability, but requires clean air and dissipates the losses to the converter room.



MEGADRIVE-LCI water cooled

Water cooling is the preferred solution for high-powered drives. It is very efficient as almost all converter losses are dissipated via the heat exchanger to the raw water. It results in a compact layout and is less sensitive to dusty and aggressive atmospheres.



Variable speed control

Many industrial processes can be improved by using variable speed control. The larger the process and the higher the performance demands, the greater the benefits gained from the MEGADRIVE-LCI.

Energy savings

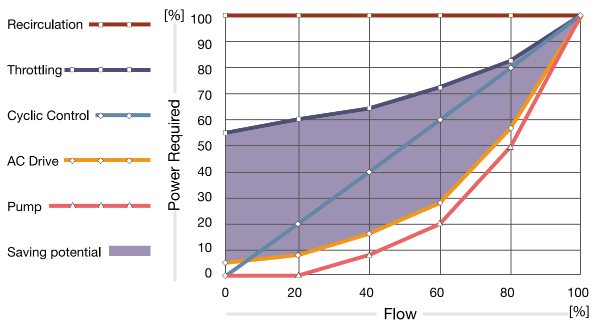
By employing variable speed drives instead of mechanical control methods, energy savings of up to 60% can be realized. The power required to run a pump or a compressor is roughly proportional to the cube of speed. In other words, a pump or compressor running at half speed can consume as little as one eighth of the energy compared to one running at full speed. A small reduction in speed can make a big difference in energy consumption. As many pump and compressor systems often run at partial load, the use of a variable speed drive can produce huge savings.

Benefits

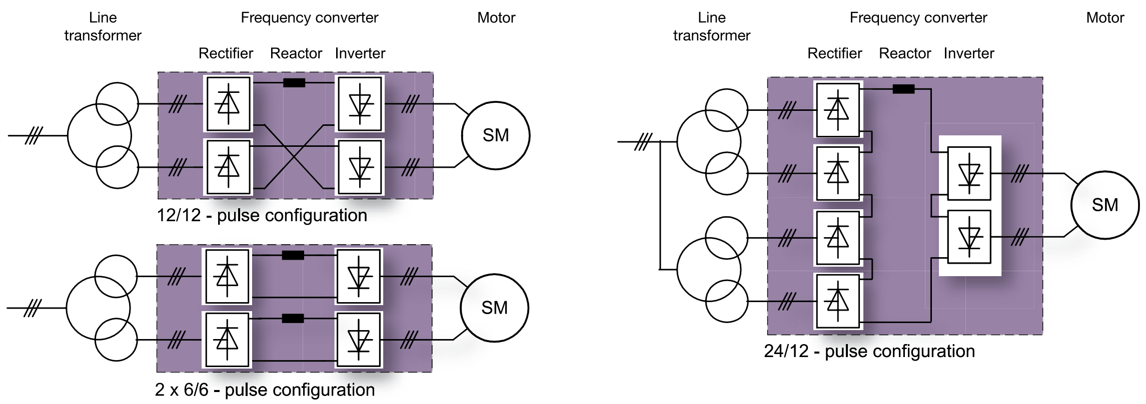
- Substantial energy savings as applications run at their optimum operating point
- Smooth and accurate process control at low flow rates
- Less stress and wear reduces maintenance requirements
- Increased reliability because mechanical flow control devices as potential source of failures are eliminated

Productivity increase

Productivity can be considerably increased by employing variable speed drives. Case studies indicate 348 operating days per year using an electric drive, due to less maintenance, compared to 329 days using mechanical speed control.



Power consumption



Examples of MEGADRIVE-LCI variable s

Soft starting of large synchronous machines

Starting a large synchronous machine on-line can have a negative impact on the network and the machine itself. These problems can be overcome with the MEGADRIVE-LCI soft starter.

Starting of motors and generators

Direct on-line starting of large synchronous machines causes starting currents of up to six times the nominal current and imposes large electrical stress on the supply network, thermal stress on the motor and mechanical stress on the shaft string.

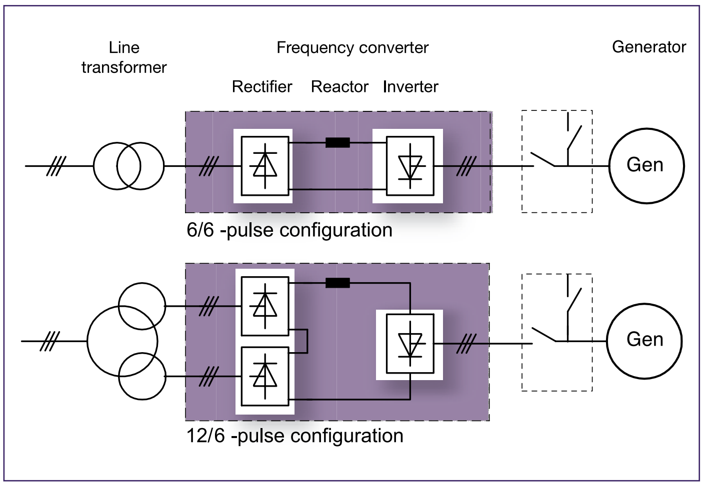
These problems can be overcome with the use of a MEGADRIVE-LCI soft starter. It smoothly accelerates the motor and the load from zero to nominal speed, when the motor is automatically synchronized to the power system and the circuit breaker for fixed-speed operation is closed.

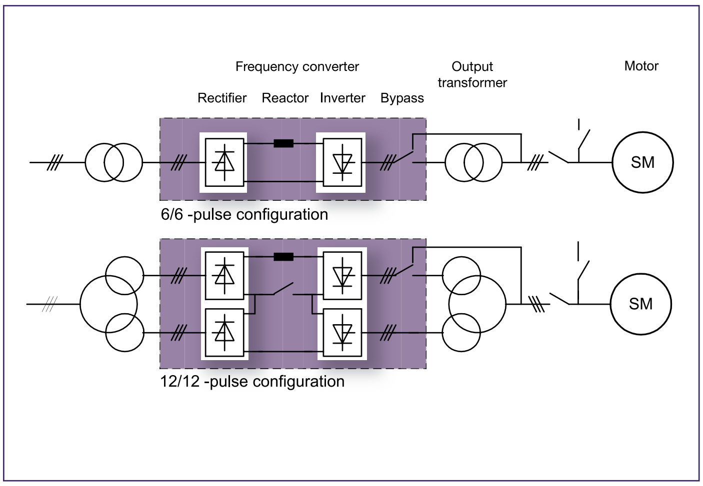
Gas turbine starters

Gas turbines often have to be started and run up quickly at short notice. MEGADRIVE-LCI gas turbine starters use the generator as motor and run it up to a speed which is above the ignition speed of the gas turbine. The gas turbine can then accelerate the generator independently to rated speed and synchronize it to the power system.

Benefits

- Reduced starting impact on network and machinery
- Longer lifetime of equipment
- Starting current limited to rated current or less
- Sequential starting of several machines, even of different power ratings, with a single MEGADRIVE-LCI soft starter
- Flying start allows acceleration or deceleration at any speed
- Generating operation allows decelerating of machine to speed zero
- No speed and no rotor position sensor required
- Various starter configurations available





Examples of MEGADRIVE-LCI gas turbine starter

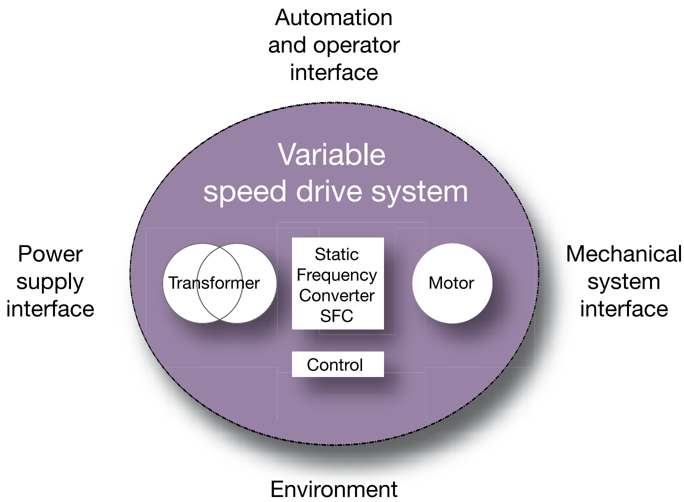
Examples of MEGADRIVE-LCI so

configurations

System integration

To design a drive system, it is important to consider the total solution.

The MEGADRIVE-LCI is designed as a system. It is important to consider not only the process, but the total solution - including the supply network, site conditions, national standards, higher-level control, switchgear, overall efficiency and other plant-specific characteristics.



Mechanical system interface

Variable speed drive systems are usually operated over a wide speed control range. They are generally subjected to torque pulsations, which occur in a broad band of frequencies. Aspects which concern the transfer of the torque between motor and driven machine have to be carefully considered when designing the mechanical system interface. A torsional study can clarify whether the shaft design is acceptable.

Power supply interface

The power system interface has to be designed to ensure that the converter withstands dis-turbances from the power system and that the current harmonics from the converter do not cause voltage drops in the network.

Network-friendly converter configurations minimize harmonics. A design with a 12-pulse or even 24-pulse rectifier is usually sufficient to reduce the harmonic content to an acceptable level. In weak networks, additional filtering might be needed. As the filters are capacitive at line frequency, they also provide a power factor correction according to customer's specifications.

Automation and operator interface

The automation and operator interface is the integration of the drive system controls at the plant control level. The communication with the control room can be designed with conventional wiring using analog and binary input/output modules or with communication interfaces for serial data exchange.

Environment

Country and plant-specific characteristics have to be taken into account when designing a drive system. Equipment dimensions and weight, installation restrictions, conveyance of the cooling medium and of electric power have to be clarified. In addition, demands on environmental compliance, protection classes, electromagnetic compatibility (EMC) and noise emission have to be considered.

Synchronous motors

Designing a drive system involves selecting and matching the motor and the drive to satisfy requirements determined by the load, the supply system, the ambient conditions and the process.

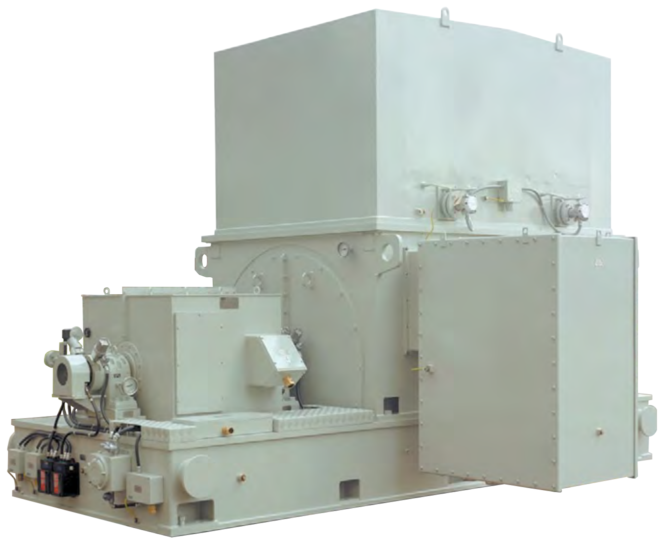
Synchronous motors

Synchronous motors are typically considered for high power ratings (above 8 MW to more than 100 MW). In addition to their high power capabilities, synchronous motors offer the benefits of high efficiency and high performance through the utilization of different rotor designs. They are available air or water cooled, self or forced ventilated, for harsh environmental conditions or hazardous areas and – with different pole pair numbers – for different maximal speeds. Specially designed high-speed 2-pole motors can be operated up to 6400 rpm with a MEGADRIVE-LCI output frequency of 107 Hz. Depending on the rotor and exciter design, the maximum speed of these motors varies with the power rating.

In order to guarantee the specified output and reliable operation of a large variable-speed synchronous motor designed to operate with a MEGADRIVE-LCI, ABB's design engineers pay special attention to ensure that

- motor cooling system remains fully effective throughout the specified speed range at the specified load,
- full account is taken of the additional losses resulting from the harmonic content in voltage and current,
- motor insulation withstands the voltage waveforms that may occur,
- motor and converter voltages ensure highest drive efficiency and lowest cable cost,
- motor reactances match converter operation,
- clarification if torsional analysis of the shaft train is necessary,
- excitation system excites the machine at any speed including standstill.

ABB's AMS 4 and 6-pole motors up to 20 MW



ABB's WMT 2-pole motors up to 12 MW / 6400 rpm or 20MW / 5000 rpm

MEGADRIVE-LCI data sheet

Motors
Synchronous motors

Standards
IEC, EN, CE

Input (line side)
6, 12 or 24-pulse thyristor rectifier
Variation: ±5% of nominal voltage: rated power
down to –15%: safe operation with derated output power
below –15%: voltage dip ride through ≥4sec
Frequency: 50 or 60Hz
Power factor: approx. 0.85 ind. at rated speed/load

Output (motor side)
6 or 12-pulse thyristor inverter
Voltage range: 0 … rated output voltage
Frequency: 0 … 60Hz (higher optional with derating)
Power factor: approx. 0.90

Auxillary voltages
For fans, pumps, excitation:
3~400 … 500Vac, ±15%
For converter control: (approx. 1.5 kVA)
from UPS: 1~120 … 240Vac, ±10% or
from battery: 110 … 220Vdc, ±10%

Excitation
AC controller for motors with brushless excitation or 6-pulse rectifier for motors with slip rings

Efficiency
Typical converter efficiency > 99% at rated speed/load

Temperature
Ambient air: +5° C to 40° C (higher with derating)
Raw water: +2° C to 32° C (higher with derating)

Noise level at 1m distance
Air cooled: ≤80 dB (A)
Water cooled: ≤75 dB (A)

Enclosure classes
Air cooled: standard IP30, optional IP31, IP41
Water cooled: standard IP30, optional IP31, IP41, IP54

Control interface
Standard: Parallel galvanically isolated analog and digital I/O
Optional: Bus interface including Modbus, Profibus (others on request)

Protective functions
Overcurrent, line over- and undervoltage, earth fault, output overfrequency, overvoltage and overflux, air or water cooling monitoring, motor stall and many others

Examples of power parts for MEGADRIVE-LCI drives and starters
* data for specified conditions regarding
- input voltage variations
- motor frequency and commutation reactance
- cooling conditions
* other configurations and ratings on request

Type codes MEGADRIVE-LCI air cooled

MEGADRIVE-LCI types No redundancy	Thyristor cooling	Converter line side	Converter motor side	Input voltage (kV)	No. of thyristors/branch (No redundancy)	Output voltage (kV)	Output current (kA)	Shaft power (MW)
A0606-211N	Air	6-pulse	6-pulse	2.1	1	2.0	1.6	4.5
A0606-302N				3.0	2	2.7	2.0	8.0
A0606-453N				4.5	3	4.1	2.0	12.0
A0606-604N				6.0	4	5.5	2.0	16.0
A1206-101/1N		12-pulse	6-pulse	2* 1.0	1/1	2.0	1.6	4.5
A1206-151/2N				2* 1.5	1/2	2.7	2.0	8.0
A1206-232/3N				2* 2.3	2/3	4.1	2.0	12.0
A1212-211N		12-pulse	12-pulse	2* 2.1	1	2* 2.0	1.6	9.0
A1212-302N				2* 3.0	2	2* 2.7	2.0	16.0
A1212-453N				2* 4.5	3	2* 4.1	2.0	24.0
A1212-604N				2* 6.0	4	2* 5.5	2.0	32.0

Type codes MEGADRIVE-LCI water cooled

MEGADRIVE-LCI types No redundancy	Thyristor cooling	Converter line side	Converter motor side	Input voltage (kV)	No. of thyristors/branch (No redundancy)	Output voltage (kV)	Output current (kA)	Shaft power (MW)
W0606-211N	Water	6-pulse	6-pulse	2.1	1	2.0	2.3	7.0
W0606-372N				3.7	2	3.4	2.3	12.0
W0606-563N				5.6	3	5.0	2.3	18.0
W0606-714N				7.1	4	6.6	2.3	23.0
W0606-855N				8.5	5	7.8	2.3	27.5
W0606-986N				9.8	6	9.0	2.3	32.0
W0606-1107N				11.0	7	10.2	2.3	36.0
W1212-211N		12-pulse	12-pulse	2* 2.1	1	2*2.0	2.3	14.0
W1212-372N				2* 3.7	2	2*3.4	2.3	24.0
W1212-563N				2* 5.6	3	2* 5.0	2.3	36.0
W1212-714N				2* 7.1	4	2* 6.6	2.3	46.0
W1212-855N				2* 8.5	5	2* 7.8	2.3	55.0
W1212-986N				2* 9.8	6	2* 9.0	2.3	64.0
W1212-1107N				2*11.0	7	2* 10.2	2.3	72.0
W2412-101/1N		24-pulse	12-pulse	4* 1.0	1/1	2* 2.0	2.3	14.0
W2412-181/2N				4* 1.8	1/2	2* 3.4	2.3	24.0
W2412-272/3N				4* 2.7	2/3	2* 5.0	2.3	36.0

ACS6000
Water-cooled, 5 - 36 MW

Cost and energy savings are possible with a water-cooled drive system that is configured to fully meet your needs.

EMC compliant cabinet for problem-free operation in electromagnetic environment

User-friendly drive control panel for local operation
- Keypad with multi-language display
- Main supply on/off pushbuttons
- Emergency off pushbutton

DC bus grounding switch and electromechanically interlocked doors of power sections for personal safety

Terminal Unit (TEU) and Control Unit (COU) Contains the power terminals and the control swing frame

Capacitor Bank Unit (CBU) DC capacitors for smoothing the intermediate DC voltage

Water Cooling Unit (WCU) Supplies deionized water for cooling the main power components

Active Rectifier Unit (ARU) Self-commutated, 6-pulse, 3-level voltage source inverter with IGCT technology

Inverter unit (INU) Self-commutated, 6-pulse, 3-level voltage source inverter with IGCT technology

Voltage Limiter Unit (VLU) Optional dynamic DC voltage limiter

Power Electronic Building Block (PEBB), One phase leg of a 3-level Voltage Source Inverter (VSI) topology, which can be used both as an AC to DC or DC to AC converter

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