



AXPERT-HIVERT

Medium Voltage Drive





Introduction

Amtech is one of the leading manufacturers of low voltage AC Drive with world class manufacturing facility and strong in-house R&D. Now Amtech has come up with the state-of-art technology innovated Axpert-Hivert Series Medium Voltage VFD. With the strong technical support system and global network, Amtech is in position to provide highest up time in the industry.

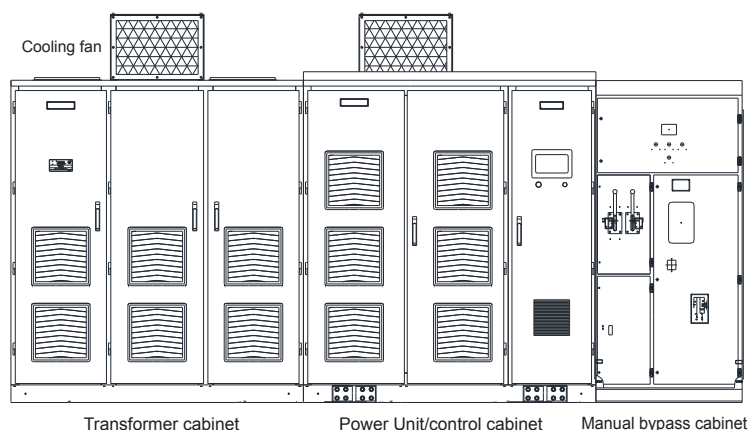


Product Structure

Transformer Cabinet

Isolating Transformer: Secondary multi-winding output provides phase-shifted power supply to the power cell unit. This greatly improves the current waveform on grid side and reduces the harmonic interference of the equipment to power grid.

Transformer Cooling Fan: Cooling fan specifically for dry transformer is configured according to different capacity.



11 kV cabinet outline drawing (including manual bypass cabinet)

Power Unit Cabinet

Controller: For space vector PWM control, signal acquisition and processing, communication between units via fiber optics for completely electrical isolation.

Power Unit: Modular design of power cell units, interchangeable and easy to manufacture, install and repair.

Interface board: The core of the new I/O interface board is S7-200 SMART CPU, the module comes standard with Ethernet interface, supports Siemens S7 protocol, TCP/IP protocol and effectively supporting a variety of terminal connections. In addition, the CPU module is integrated with one RS485 interface, able to communicate with the third-party equipment such as the MV drive and touch screen. At the same time, it is equipped with expansion CM01 signal board to realize RS232 / RS485 free communication and support Profibus and Ethernet TCP/IP communication protocol.

Monitoring HMI: 10 inch touch screen, control system status and monitoring, powerful data control (data logging, diagnostics, and information), user-centric convenience (HD display, high data throughput, user-friendly interface).

By-pass Cabinet or Switching Cabinet (Optional)

The by-pass cabinet or switching cabinet may employ isolating breaker, vacuum contactor or the combination, depending on the user's working conditions. The function of by-pass cabinet is to put the motor into operation on mains power supply after the inverter exits, so as to ensure the continuity of user's process. The switching cabinet is designed to divert the inverter output to different motors.

System Cooling Fan

High efficiency fan from world renowned manufacturer. The benefits are large air flow and long service life.

Working Principle of Inverter

Axpert-Hivert Series Medium Voltage Drive adopts AC-DC-AC direct medium voltage input and output and employs IGBT based power cells in series. The medium voltage output is the result of the overlapping waveforms from each power cell. The Axpert-Hivert Series has very high reliability, thanks to the proven technology of normal voltage inverter.

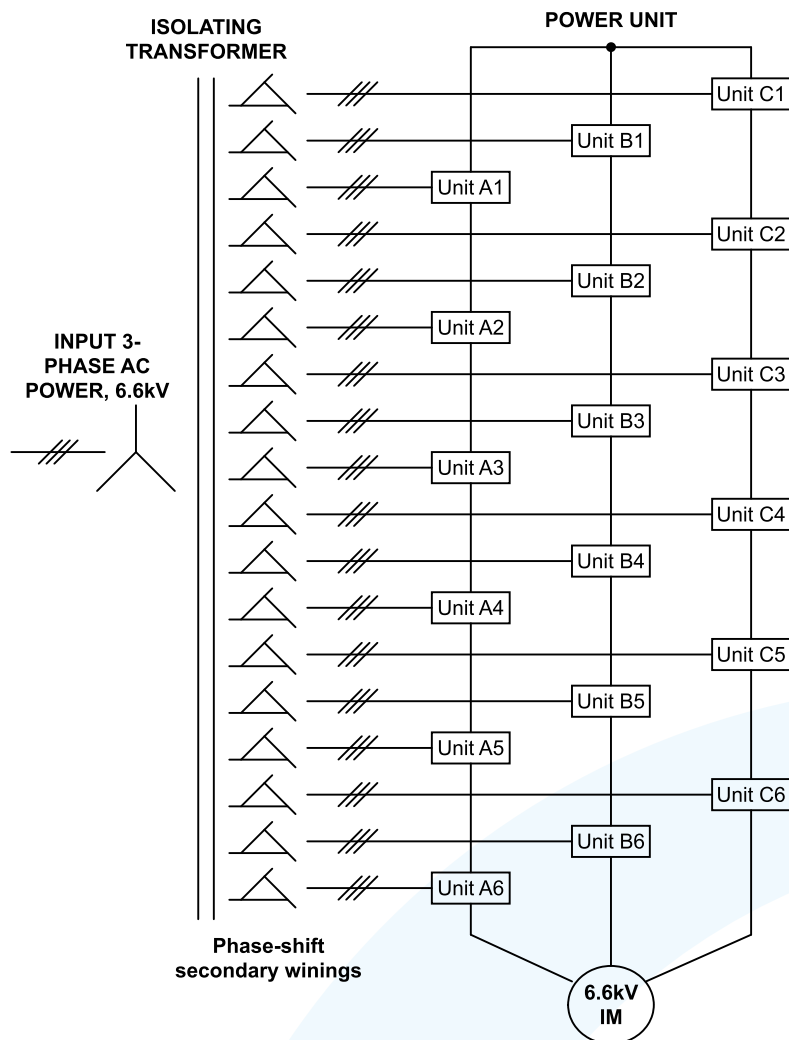
1. Topology Structure of Main Circuit

3.3 kV Series: Consisting of 9 power cells; 3 power cells are connected in series to form one phase, 3-phase Y-type connection.

4.16 kV Series: Consisting of 12 power cells; 4 power cells are connected in series to form one phase, 3-phase Y-type connection.

6.6 kV Series: Consisting of 18 power cells; 6 power cells are connected in series to form one phase, 3-phase Y-type connection.

11 kV Series: Consisting of 27 power cells; 9 power cells are connected in series to form one phase, 3-phase Y-type connection.



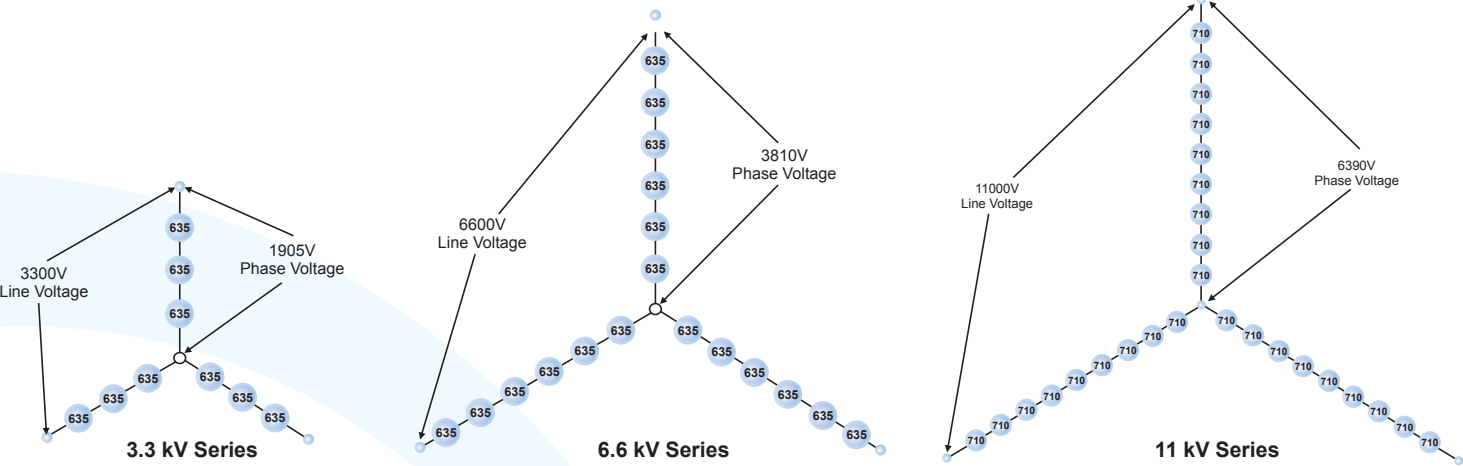
Main Circuit Diagram of Axpert-Hivert Series 6.6 kV Medium Voltage Drive



2. Voltage Overlap Diagram

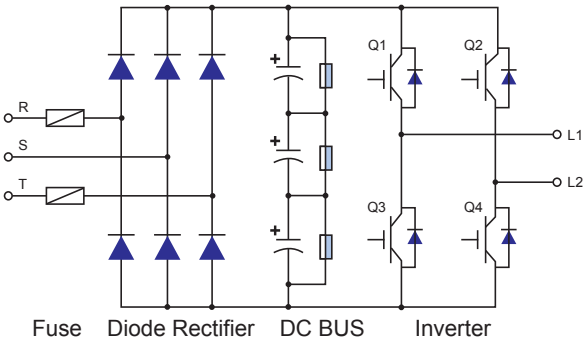
Each phase of Axpert-Hivert Series Medium Voltage Drive consists of multiple power cells connected in series, and each power unit is isolated by the secondary winding of isolating transformer. By changing the quantity of units in series, the phase-shifted power supply can easily obtain the output of different voltage level, without being subjected to the restriction of the power devices for their voltage level performance. Assuming that each phase of an inverter rated 6.6 kV consists of 6 power cells and the rated voltage of power cell is 690V, the phase voltage will be 3810 V after connection in series (the corresponding line voltage is 6.6 kV). Each phase of 11 kV Inverter consists of 9 power units, the rated voltage of power unit is 710V, and the working voltage is 710V.

Inverter Series	Quantity of Series Unto for Each Phase	Unit Rated Voltage (V)	Unit Working Voltage (V)	Output Phase Voltage (V)	Output Line Voltage (KV)	Number of Voltage Level for Each Phase
3.3 kV	3	690	635	1905	3.3	7
4.16 kV	4	690	600	2402	4.16	9
6.6 kV	6	690	635	3810	6.6	13
11 kV	9	710	710	6390	11	19



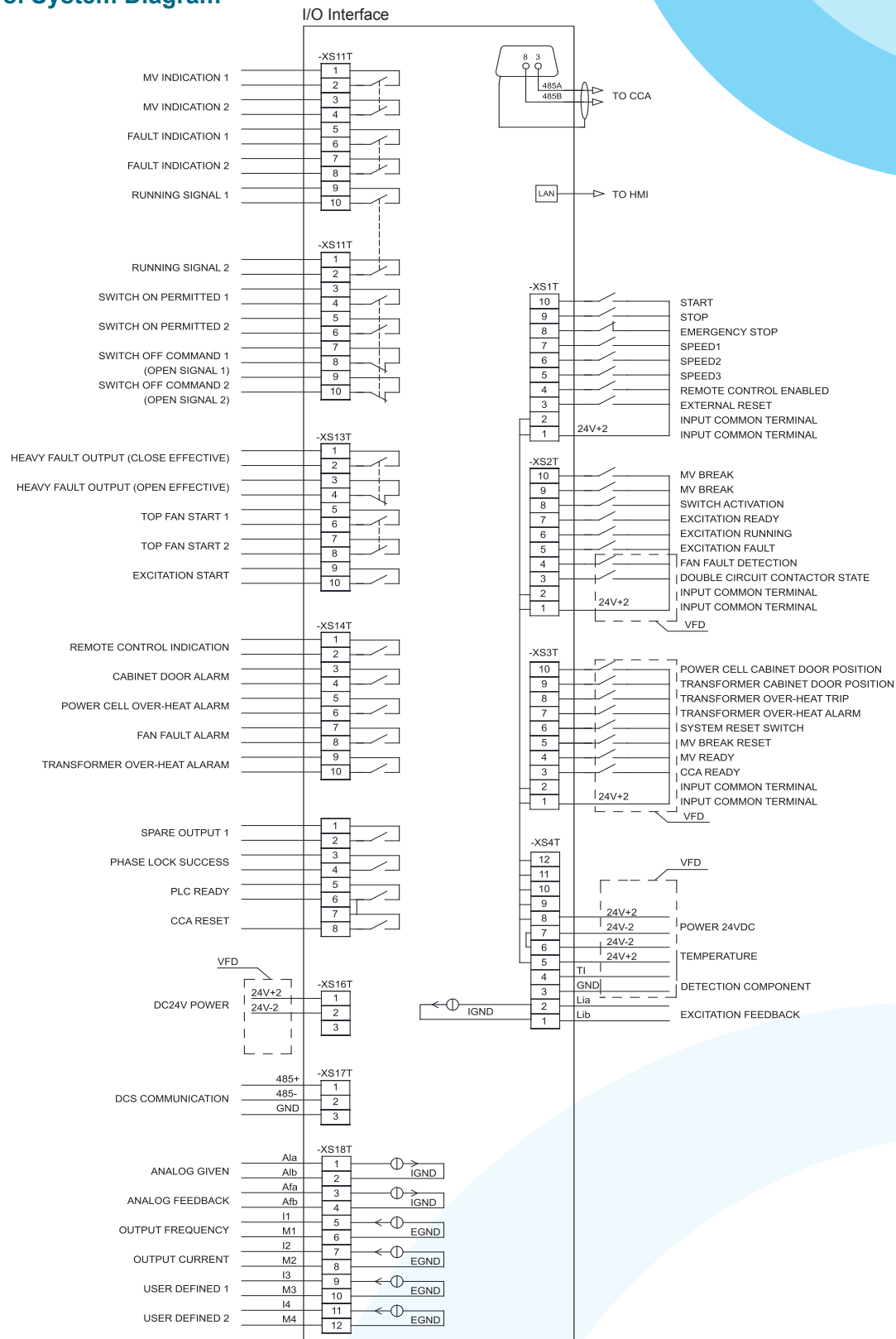
3. Structural Diagram of Power Unit

Axpert-Hivert Series Medium Voltage Drive consists of multiple power cells connected in series, and each power unit is powered by the secondary isolating winding of the input isolating transformer. The power unit is of AC-DC-AC structure, equivalent to a low-voltage power source inverter of 3-phase input single-phase output. As power units are fully identical in structure and electrical performance, very easy for maintenance and replacement.



The power unit receives the signal via optical fiber and adopts space vector sine wave pulse (PWM) to control the conductivity and disconnection of Q1~Q4 IGBT, outputting single-phase pulse width modulation waveform. Each unit is only possible to have three states of output voltage. When Q1 and Q4 are connected, the output voltage state of L1 and L2 will be 1; when Q2 and Q3 are connected, the output voltage state of L1 and L2 will be -1; and when Q1 and Q2, or Q3 and Q4 are connected, the output voltage state of L1 and L2 will be 0.

4. External Control System Diagram



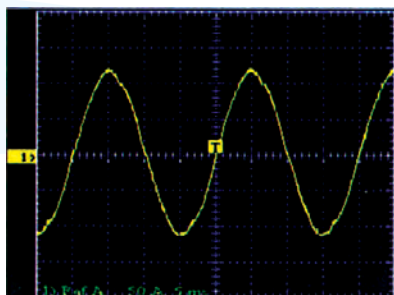


Product Characteristics

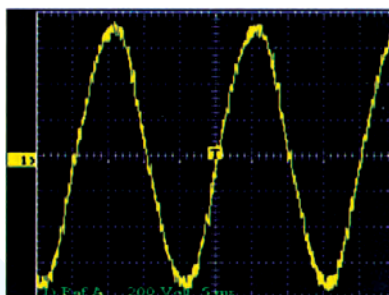
Expert-Hivert Series Medium Voltage large-capacity drive is a type of medium voltage AC motor speed regulation drive. Our drive adopts the advanced technology of series connection and wave overlap of the power cell, space vector sine wave PWM control. It also incorporates full English operating interface and high-performance IGBT based modules, featuring high reliability, superior performance and easy operation. It can be used for a wide range of applications such as regulation, energy saving, soft startup and intelligent control of the fan, water pump, compressors and other similar loads driven by medium voltage AC motor.

High-quality Current Input

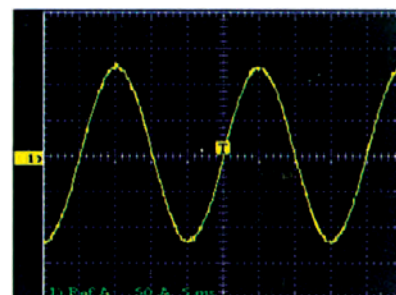
- Through phase-shift step down voltage, the secondary winding of isolating transformer on input side provides isolated power source to each power cell. For 3.3 kV, it is equivalent to 18-pulse, (24-pulse for 4.16 kV, 36-pulse for 6.6 kV, 54-pulse for 11 kV) un-controlled rectifying input. This eliminates most of the harmonic current caused by each power cell and greatly reduces the generation of harmonics on grid side.
- The harmonic voltage and THD caused to electric grid by the inverter meets the most stringent requirements for THD as specified in IEEE Std 519-1992 and GB/T14549-93 (Quality of Electric Energy Supply Harmonics in Public Supply Networks). The inverter does not require installation of any filter, but it can protect the surrounding equipment from harmonic interference. The power factor within normal range of speed regulation is over 0.95, so the power-factor compensation capacitors are not required.
- Reduces the reactive input and decreases the supply capacity.



Input Current Waveform



Output Voltage Waveform



Output Current Waveform

Perfect Output Performance

The units are connected in series and of PWM overlap output. Each phase consists of 6 units for 6.6 kV series inverter, and 9 units for 11 kV series. This results in greatly reduced output of harmonic content, so that the output waveform is nearly perfect sine wave. In comparison with other types of high voltage large-capacity drives, Expert-Hivert Series MVD has following advantages:

- No output filter required.
- Able to drive common high-voltage motor without increasing the motor temperature or decreasing the motor capacity.
- Motor cable is free of any length restriction.
- Protective insulation of motor is free from the damage of dv/dt stress.
- Service life of the equipment will not be shortened due to harmonic torque.



User-Friendly Touch Screen Interface

Touch screen manages all functions of VFD, and provides user friendly VFD information screen. It is used to set and display VFD parameters, display the working state of VFD, assist VFD fault diagnosis, control VFD operation and other functions.

HMI by TPC1061Ti touch screen, uses the advanced Cortex-A8 CPU as core. It is a high brightness TFT LCD display with resolution 1024 x 600 and 10.2 inch screen. Graphical display makes the interface more rich, fast and intuitive, user-friendly operation.

Touch screen LCD display has eight windows including:

- Monitoring interface
- Trend curve
- Function parameters
- System parameters
- Fault record
- Other settings
- Power cell status
- Excitation adjust

Advantage: No mechanical rotating component, long operating reliability, and easy upgrading of software.

Flexible Control Options

- **Local Control:** Direct control from the button on cabinet door or the HMI. This is the main control method.
- **Remote I/O Control:** Realize remote control by connecting to the remote switch signal via the I/O board.
- **Host Control:** Isolated RS-485 port and adoption of standard Modbus-RTU communication protocol. Able to connect with host system like DCS for optimized coordination control.

Five Options of Frequency Set

- Direct command from main interface.
- Set by analog signal (4...20 mA signal).
- Set by host computer via RS-485 port.
- Multi-speed set, suitable for the working conditions in cyclic change.
- In event of closed-loop operation, it will be automatic set by built-in PID via computation.

AVR (Automatic Voltage Adjustment) Function

According to output voltage feedback, the inverter automatically adjusts the output voltage to make it free from the influence caused by the change of grid voltages and loads, and protect the motor from insulation damage due to long over voltage or core overheating due to high magnetic flux density.

PID Function

Built-in full digital PID is provided for closed-loop control upon the users' requirements and for realization of operation under constant pressure or constant fluid flux. PID parameters can be adjusted online.

Current Limiting Function

In event the output current of the inverter exceeds the preset value, the inverter will automatically limit the current output to avoid overcurrent protection incurred during acceleration or deceleration or due to sudden change of the loads, thus to minimize the stop times of the machine.

Self-diagnosis Function

Expert-Hivert MVD is provided with complete self-diagnosis capability to monitor the system status online. In event of any fault, the inverter will be automatically activated to take protective actions and save the time, cause and location of the fault. This will help the maintenance personnel find the cause and eliminate the fault quickly.

Instantaneous Power Loss Tracing Function

In event of instantaneous electric grid power loss, the inverter controls the motor to be under power-generating status and keep decelerated operation. If the electric grid resumes to normal, the inverter will immediately return to original operating status. The keeping time is 1000 msec and typical value of the fan load is 3 sec.

Other Characteristics

- Highly efficient, with the system total efficiency up to 95% or over.
- Redundant control power is simultaneously supplied by 415 VAC.
- Wide range of input voltage.
- Fast braking function.
- Resonance frequency avoidance.
- Customized design available upon the user's request.

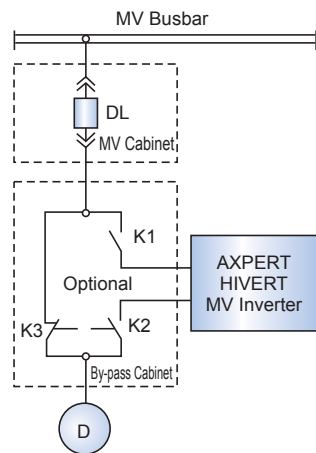




Application Program

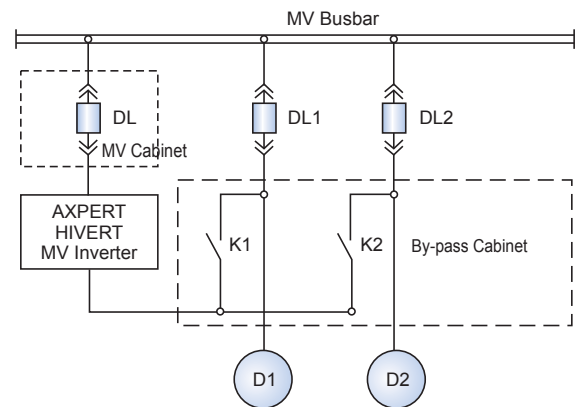
1. One inverter drives one motor

When the inverter exits the operation, it may switch the motor into the grid via the by-pass circuit, thus to ensure the continuity of the production activity. If vacuum contactor is selected for the switch K1, K2 and K3, the switching operation may be completed automatically.



2. One inverter switches between two motors

To cut your investment, you may select this method where one inverter needs to switch between two motors, i.e. one in service and one on standby.



Product Parameters

1. Technical Parameters

	3.3 kV Series	4.16 kV Series	6.6 kV Series	11 kV Series
Rated input voltage	3.3 kV (-20%...+15%)	4.16 kV (-20%...+15%)	6.6 kV (-20%...+15%)	11 kV (-20%...+15%)
Input frequency	50 Hz / 60 Hz (±10%)			
Modulation technology	Space vector PWM control			
Control power	415 VAC, ≤30 kVA depending upon the power rating			
Input power factor	>0.96			
Efficiency (including transformer)	>96%, under rated load, for VFD >98%			
Output frequency range	0...80 Hz			
Output frequency resolution	0.01 Hz / 0.002 Hz			
Overload capacity	120% for 2 minute			
Analog input	3-channel, 4...20 mA / 2...10 V			
Analog output	4-channel, 4...20 mA			
Communication with host	Isolating RS-485 port, MODBUS RTU protocol, other protocol optional			
Accel and Decel time	5...1600 s			
Digital Input and output	Input : 14 / Output : 22 (All potential free contacts)			
Operating environmental temperature	-5...45 °C, derate above 45 °C, consult Amtech for derating			
Storage/transportation temperature	-40...70 °C			
Cooling mode	Forced air cooling			
Environmental humidity	95% or below, no condensation			
Installation elevation	1000 m, derate above 1000 m, consult Amtech for derating			
Protection level	IP30, consult Amtech for higher protection			
Cabinet colors	RAL 7032, consult Amtech for customization			

2. Model and Identification

Axpert-Hivert – 

Rated output current (A), e.g. 077, 130

Rated output voltage (kV), e.g. 3.3, 4.16, 6.6, 11

Applicable motor type, Y: Asynchronous, T: Synchronous

Name of Amtech Axpert-Hivert Series Medium Voltage Drive

For example, Axpert-Hivert-T6.6 / 130 represents an inverter with 6.6 kV voltage and rated output current up to 130 A (Capacity: 1490 kVA), used for driving the synchronous motor with rated power up to 1200 kW. Axpert-Hivert-Y11 / 040 represents an inverter with 11 kV voltage and rated output current up to 40 A (Capacity: 775 kVA), used for driving the asynchronous motor with rated power up to 640 kW.

3. Product Series

3.3 kV Series

Axpert-Hivert-Y(T)3.3/	31	40	48	61	77	96	130	154	173	192	220	243	275	304	340	400	425	500	550	600	660	750	800
Rated O/P Current (A)	31	40	48	61	77	96	130	154	173	192	220	243	275	304	340	400	425	500	550	600	660	750	800
Inverter Capacity (kVA)	180	230	275	350	440	550	750	880	990	1100	1260	1390	1575	1740	1950	2300	2430	2860	3150	3430	3775	4300	4575
Applicable Motor (kW)	150	180	220	275	350	440	590	700	790	880	1000	1100	1250	1400	1600	1825	2000	2280	2500	2750	3000	3500	3600
Weight (kg)	3100	3500	3700	3950	3800	4000	4100	3660	3780	3950	4120	4340	5530	5740	6040	6390	7000	7400	7600	7800	10500	12500	14500
Type of Cabinet	LD1			LD2S			LD3S			LD4			LD5			LD6							

4.16 kV Series

Axpert-Hivert-Y(T)4.16/	31	40	48	61	77	96	130	154	173	192	220	243	275	304	340	400	425	500	550	600	660	750	800
Rated O/P Current (A)	31	40	48	61	77	96	130	154	173	192	220	243	275	304	340	400	425	500	550	600	660	750	800
Inverter Capacity (kVA)	225	290	350	440	555	700	940	1110	1250	1390	1590	1750	1990	2200	2450	2890	3075	3600	3975	4330	4755	5400	5775
Applicable Motor (kW)	180	240	280	350	450	550	750	900	1000	1100	1250	1400	1600	1800	2000	2300	2500	2900	3200	3500	3800	4300	4600
Weight (kg)	3200	3600	3800	4000	3900	4100	4300	4070	4230	4450	4660	4865	6400	6660	6920	7280	8800	9000	9300	9800	11000	12500	15000
Type of Cabinet	LJ1			LJ2			LJ3S			LJ4			LJ5			LJ6							

6.6 kV Series

Axpert-Hivert-Y(T)6.6/	40	48	61	77	96	130	154	173	192	220	243	275	304	340	400	425	500	550	600	660	750	800
Rated O/P Current (A)	40	48	61	77	96	130	154	173	192	220	243	275	304	340	400	425	500	550	600	660	750	800
Inverter Capacity (kVA)	460	550	700	880	1100	1490	1760	1975	2200	2500	2775	3150	3475	3890	4575	4860	5720	6290	6860	7550	8575	9150
Applicable Motor (kW)	365	440	550	700	880	1200	1400	1600	1800	2000	2250	2500	2800	3100	3600	3900	4550	5000	5500	6000	6900	7400
Weight (kg)	4800	5100	5400	4300	4800	5300	5920	6230	6530	6880	7270	9220	9570	10070	10670	14700	15200	15800	16000	20500	22500	24500
Type of Cabinet	LC1S			LC2S			LC3S					LC4				LC5				LC6		

11 kV Series

Axpert-Hivert-Y(T)11/	31	40	48	61	77	96	104	115	130	154	165	192	205	243	275	304	325	364	400	462	500	600	800
Rated O/P Current (A)	31	40	48	61	77	96	104	115	130	154	165	192	205	243	275	304	325	364	400	462	500	600	800
Inverter Capacity (kVA)	600	775	920	1175	1475	1830	1975	2200	2475	2940	3150	3660	3900	4630	5240	5800	6200	6950	7630	8800	9530	11450	15250
Applicable Motor (kW)	470	640	730	930	1200	1450	1550	1750	2000	2400	2500	2950	3150	3700	4000	4650	5000	5550	6100	7050	7600	9200	11000
Weight (kg)	3930	4160	4475	4830	4900	5300	5530	5830	6120	8510	8640	9050	9560	10160	13020	13620	14320	15620	15720	25400	27400	29400	45400
	4000	4200	4550	4700	4970	5410	5710	5880	6170	7580	7525	7965	8280	8795									
Type of Cabinet	LB1S			LB2S			LB3S			LB4			LB5			LB6							
	LB1			LB2			LB3																

- Cabinet type that ends with "S" means this cabinet is "front-side service zone only" cabinet; all other cabinets are "double-side service zone" cabinets.
- # Contact Amtech for details.

MVD Dimension Details

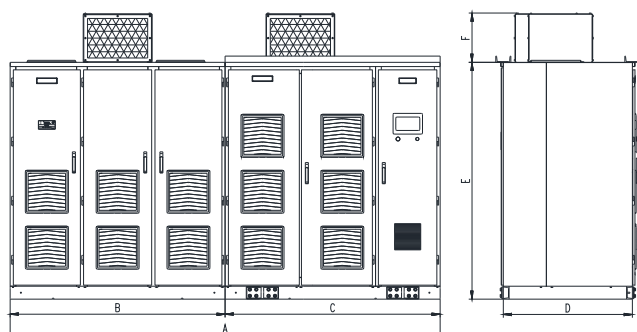


Fig.1 Cabinet Outline with Seperate Transformer Cabinet

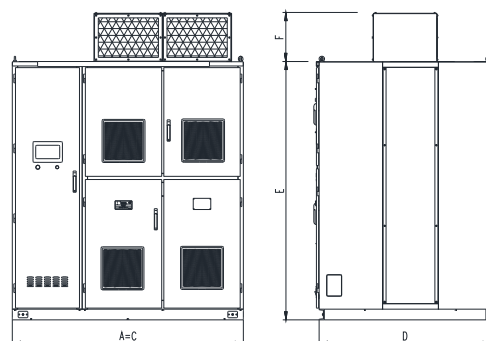


Fig.2 Cabinet Outline with Integrated Transformer Cabinet

CABINET CODE	A (Total Width)	B (Transformer Cabinet Width)	C (Power Cell Cabinet Width)	D (Depth)	E (Cabinet Height)	F (Fan Height)
3.3 kV Series						
LD1	2150	*	2150	1400	2400	450
LD2S	4000	2000	2000	1200	2200	450
LD3S	4050	2000	2050	1200	2300	450
LD4	4350	2150	2200	1400	2400	450
LD5	5350	2400	2950	1400	2400	450
LD6	8050	#	#	1600	2400	450
4.16 kV Series						
LJ1	2150	*	2150	1400	2400	450
LJ2	2150	*	2150	1600	2400	450
LJ3S	4050	2000	2050	1200	2300	450
LJ4	5050	2400	2650	1400	2400	450
LJ5	6200	2400	3800	1400	2400	450
LJ6	6900	2400	4500	1600	2400	450

All dimensions are in mm.

- * Transformer is included in power cell cabinet (Refer Fig.2) and total width of cabinet is equal to width of power cell cabinet.
- # Contact Amtech for details.

Note :

- The by-pass cabinet and switching cabinet are optional.
- Size of manual by-pass cabinet, manual switching cabinet and automatic switching cabinet: 1000 wide, 2100 high in minimum, or as high as the inverter if the inverter is over 2100 high; the depth is the same as the inverter cabinet.
- Size of the automatic by-pass cabinet: 2x1000 wide, 2100 high in minimum, or as high as the inverter if the inverter is 2100 high or higher the depth is the same as the inverter cabinet.
- Dimensions & specifications are subject to change without notice.

CABINET CODE	A (Total Width)	B (Transformer Cabinet Width)	C (Power Cell Cabinet Width)	D (Depth)	E (Cabinet Height)	F (Fan Height)
6.6 kV Series						
LC1S	3500	1500	2000	1200	1900	450
LC2S	4200	2000	2200	1200	2200	450
LC3S	4550	2000	2550	1200	2300	450
LC4	6000	2400	3600	1400	2400	450
LC5	7800	2700	5100	1400	2400	450
LC6	8900	2800	6100	1600	2400	450
11 kV Series						
LB1S	4300	1700	2600	1200	1900	450
LB1	4000	2000	2000	1400	2050	450
LB2S	4800	2100	2700	1200	2200	450
LB2	4300	2150	2150	1600	2250	450
LB3S	5000	#	#	1200	2200	450
LB3	4750	2150	2600	1600	2250	450
LB4	7550	2700	4850	1600	2400	450
LB5	10050	2800	7250	1600	2800	450
LB6	13950	#	#	1600	2600	450



Application Industries and Fields

Axpert-Hivert Series Medium Voltage Drive is a perfect solution for soft start, speed adjusting, energy saving and intelligent control of high voltage AC motors (including synchronous and asynchronous motors).

Typical application industries include :

Thermal power, Hydro power, Garbage biomass

- Forced draft fan
- Slurry pump
- Primary fan
- Compressor
- Water pumping energy storage pump
- Induced draft fan
- Coal mill
- Secondary fan
- Condensate pump
- Powder exhaust fan



Petroleum, Petrochemical, Natural gas

- Pipeline transportation pump
- Water injection pump
- Feed water pump
- Submerged pump
- Brine pump
- Compressor
- Pressure blower
- Feed water pump for offshore oil platform



Coal mines & minerals

- Descaling pump
- Mud pump
- Slurry pump
- Clean water pump
- Feeding pump
- Stirring pump
- Kiln transmission
- Ventilation fan
- Drainage pump
- Medium pump



Steel & nonferrous metallurgy

- Blast furnace blower
- Primary dust removal blower
- Induced draft fan
- Compressor
- Kneader
- Compressing blower
- Forced draft fan
- Secondary dust removal blower
- Water-delivery pump
- Descaling pump
- Feed water pump



Cement & building materials

- Kiln draft fan
- Kiln fan
- Rotary kiln transmission
- Coal mill
- Dust removal fan
- Cooling fan



Municipal (heat supply, water supply, sewage etc.)

- Pressure blower
- Induced draft fan
- Forced draft fan
- Pressure pump
- Sewage pump
- Cleaning water pump
- Lifting pump
- Reclaimed water pump

Light industry, chemical industry

- Gas blower
- Pressure pump
- Compressor
- Axial flow pump
- Soft water pump
- Water-delivery pump



Military industry & others

- Test stand
- Wind tunnel

OUR OTHER OFFERINGS

MOTOR CONTROL



"DRIVE FOR SUCCESS"

We provide complete motor control system solutions or individual system components to address industry specific requirements and optimize your process.

Our solutions are simple, compatible and environment friendly, resulting in efficient production, cost optimization and minimizing human intervention. It even leads to energy conservation especially in typical Fan, Blower applications.

Flagship Solutions

- Apert-Eazy+ Series VFD
- Apert-VT240S Series VFD
- Apert-Hivert Series Medium Voltage Drive
- Apert-Opti torque Series Soft Starter
- Apert-Eazy HF Series High Frequency Drive

Applications

- Fans, Blowers, Pumps
- Compressors, Centrifuges
- Agitators & Conveyors
- Oil & Gas
- Mining

AUTOMATION



"AUTOMATION. MADE EASY"

"Automation Made Easy" is our philosophy to simplify the increasing complexity of modern production systems through our Amtech-Jetter PROCESS PLC technology platform.

Our 30 years experience in Machine, Line, Plant and Networking Automation has helped us to find the best solution in terms of functionality, sustainability and efficiency.

Flagship Solutions

Jet Control series PLC Controllers, Expansion Modules, Jet view Soft SCADA, HMIs, Jet Move series Servo and Axes Control System.

Applications

- Paper Machine Automation
- Textiles Manufacturing
- Packaging
- Winder Machine
- Crane & Material Handling Equipment
- CNC Machines
- Semiconductor Assembly Line
- Retrofit solutions

POWER QUALITY



"ONE STOP SOLUTION TO QUALITY POWER"

Amtech's Power Quality Solution offers you the synergy of multiple benefits - energy conservation, enhanced operational efficiency and reliability through a range of products and services.

Products

- Apert-i-Sine Series Active Front end Converter
- Apert-i-Sine Series Active Harmonic Filter (AHF)
- Apert-i-Sine Series Active Static VAR Compensator (STATCON)
- Static Harmonic Converter
- Harmonic Reactor
- Sinus Filter
- EMI/RFI Filter

Services

- Harmonic Audit and Solutions to comply with IEEE-519 standard
- System design, optimization & pay-back analysis
- Consultancy for Power Quality Improvement
- Training on Power Quality Management
- Energy Audit and solutions by experienced BEE certified professionals

INDUSTRIAL ELECTRONICS



"YOUR TECHNOLOGY PARTNER"

Amtech's Power Electronics Engineering Services offer technology solutions to independent R&D labs, industrial segments like Traction, Oil & Gas, Automotive and Renewable Energy for wind to reduce your time to market.

Products

- Traction Drive
- High Voltage Power Supply
- Battery back-up drive & systems for critical loads
- Wind Power Converter
- Digital Heater controller
- Batter charger
- Drive Train

Services

- Power Electronics Engineering Services
- Customized solutions for industry specific applications
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