

XMV660 **OUTDOOR**

MV VARIABLE SPEED DRIVE



IP55 / NEMA3R



XMV660 OUTDOOR

The XMV660 NEMA3R is the most innovative, rugged and reliable outdoor medium voltage drive ready for 24/7 operation under the most demanding environments.

The XMV660 MV drive goes one step further in achieving high performance by implementing proven low voltage technology within a rugged, modular, multi-level configuration. The multi-step quasi-sinusoidal output voltage produced by the cascaded H-bridge power modules is low in dV/dt and supplies sinusoidal current to the motor. The multi-pulse phase shift transformer at the input minimises harmonic current drawn from the grid ensuring compliance to international THD standards.

Designed under the strictest safety regulations, the XMV660 OUTDOOR complies with the most demanding industrial requirements. The XMV660 is available in a wide voltage and power range and offers the best power quality, uncompromising safety and proven reliability across the full range.

EXTREME INNOVATION FOR
EXTREME ENVIRONMENTS

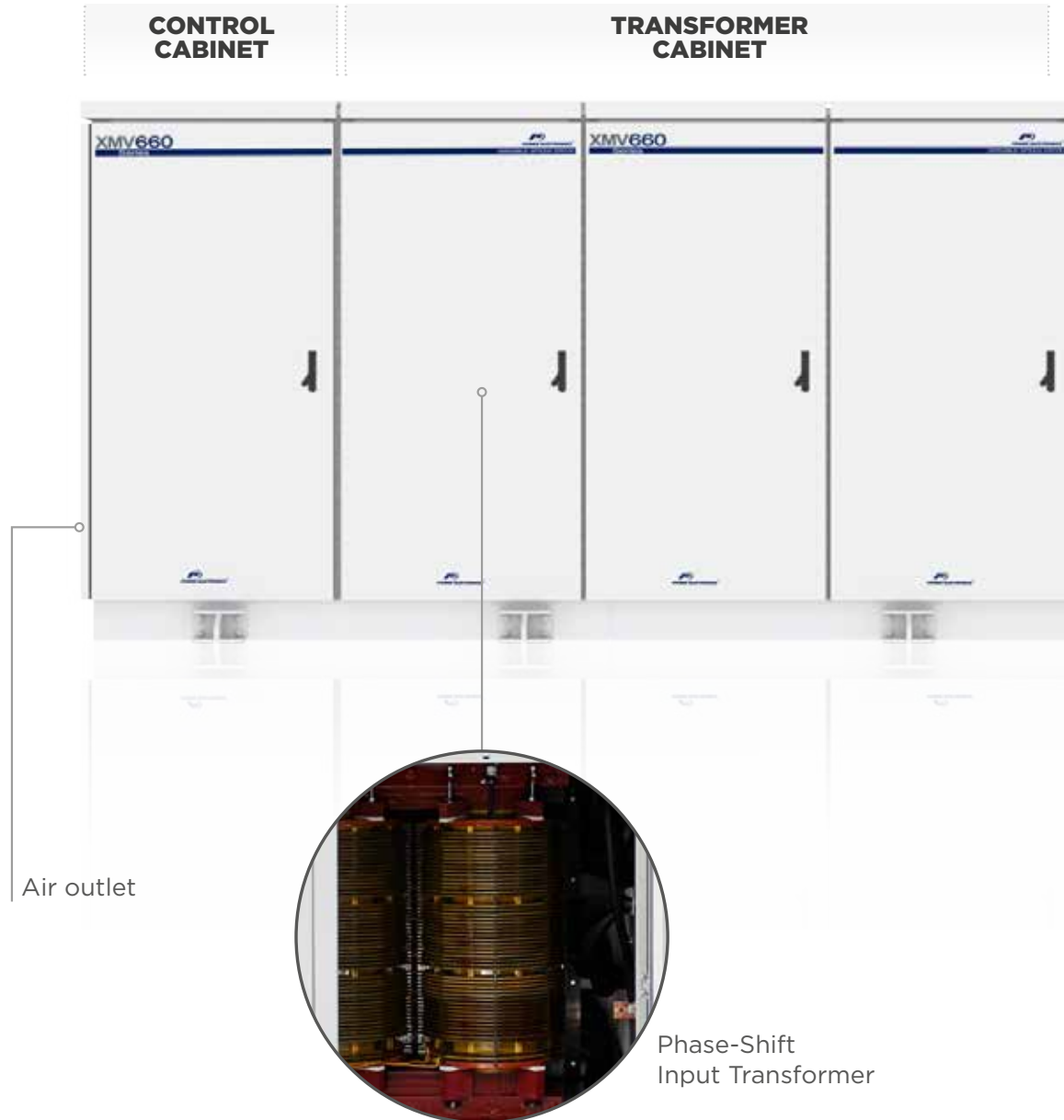
- RUGGED DESIGN: NEMA3R | IP55-OUTDOOR RATED STAINLESS STEEL ENCLOSURE WITH MINERAL ISOLATION AND C5M EXTERIOR COATING
- MULTI-LEVEL, PULSE-WIDTH MODULATION WITH PHASE SHIFT TRANSFORMER
- HIGH EFFICIENCY AND POWER FACTOR AT PARTIAL LOADS
- LOW HARMONICS - IEEE 519 COMPLIANCE
- 50°C OPERATION
- NON-STOP INNOVATIVE COOLING - SMART AND RELIABLE CYCLONE AIR FILTERING THAT WITHSTANDS EXTREME DESERT CONDITIONS
- LOW dV/dt - NO MOTOR DERATING OR MOTOR CABLE LENGTH RESTRICTION
- OUTPUT VOLTAGE BOOST TRANSFORMER TAP ADJUSTMENT
- REDUNDANCY



XMV660 OUTDOOR TOPOLOGY

The XMV660 OUTDOOR uses multi-step pulse width modulation (PWM) to control the series connected LV power modules, producing a quasi-sinusoidal output voltage waveform with low dV/dt and sinusoidal current low in THDi, without the need for bulky external filters. This topology eliminates problematic peak voltages at the motor terminals, and other side effects such as excessive motor heating and stray currents through to motor bearings.

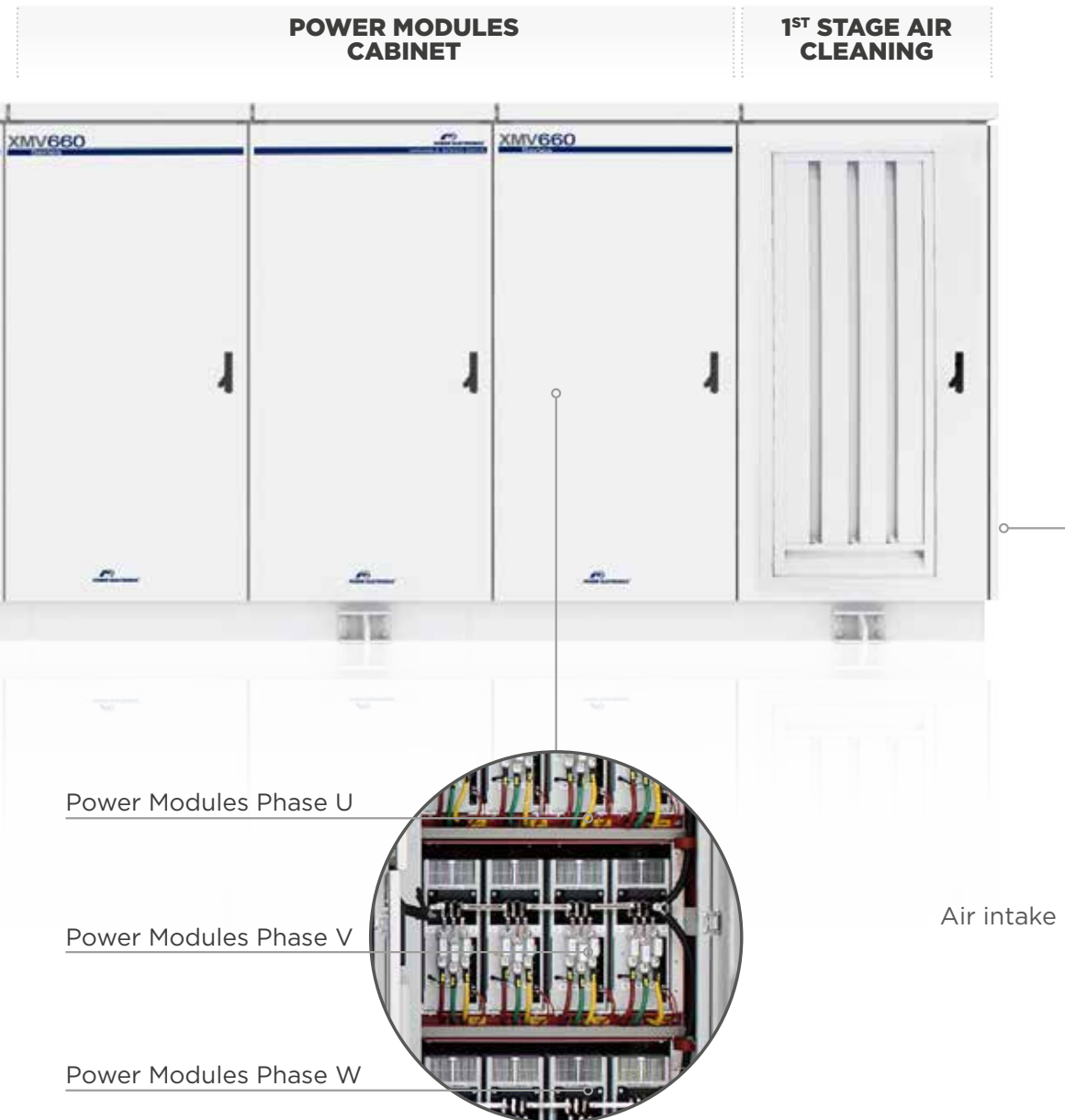
The input of each power module is connected to individual secondary windings of the multi-pulse phase shift transformer, minimising harmonic current drawn from the grid, and provides high electric protection and improved power factor and efficiency, even at light loads.

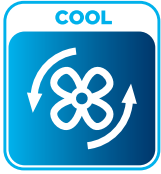


WHY THE XMV660 OUTDOOR IS UNIQUE?

BECAUSE OUR OUTDOOR SOLUTION GIVES YOU GREAT SAVINGS:

- **NO NEED FOR AN ELECTRICAL ROOM**
- **NO CIVIL WORKS ASSOCIATED**
- **NO NEED FOR A COOLING SYSTEM**
- **NO COOLING SYSTEM CONSUMING ENERGY**
- **REDUCED O&M - FILTERLESS SYSTEM**
- **NO AMBIENT NOISE INSIDE FACILITY**





XMV660 OUTDOOR COOLING SYSTEM

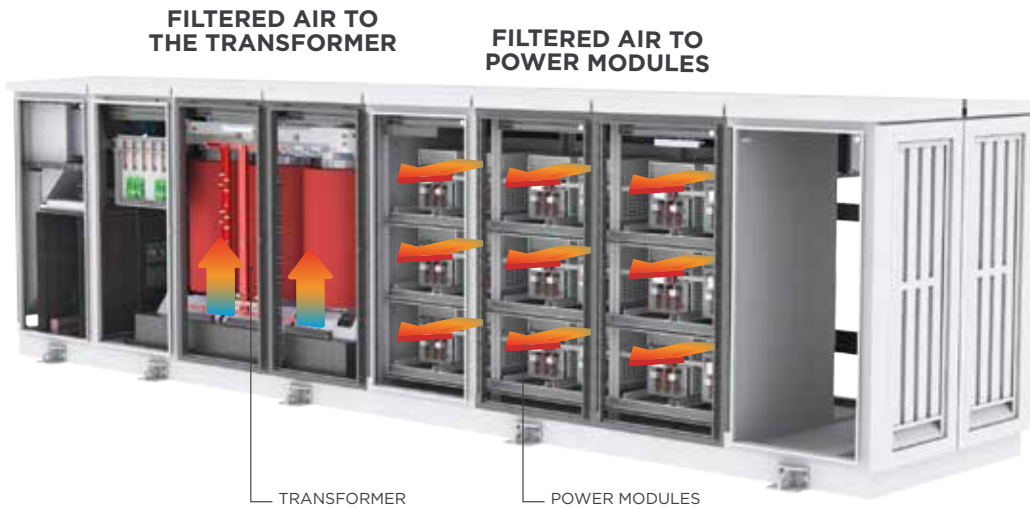
The innovative filter-less “cyclone drive” cooling system delivers a constant stream of clean air to the XMV660. At the air intake, the labyrinth sifts the larger dust particles from the air stream, enabling the cyclone drive to eject the remaining contaminants, ensuring a constant flow of clean air into the electronics chamber and transformer cubicle without the need to maintain cumbersome dust filters.

AIR CLEANING 1st stage





IP55 / NEMA3R



3



4



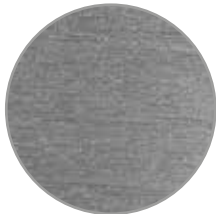
RUGGED DESIGN FOR OUTDOOR CONDITIONS

The XMV660 OUTDOOR delivers high performance under extreme conditions owing to its rugged sandstorm resistant design.

The leading medium voltage technology has been integrated in a truly outdoor enclosure. A system born to run under the most extreme conditions that are commonplace in Oil & Gas, Power Generation and Water applications.



MINERAL PANEL



STAINLESS STEEL



POLYMERIC PAINTING



Outdoor equipment is a challenge that has been overcome by Power Electronics' Solar Division, and the best engineering practices have been migrated to the XMV660 OUTDOOR by featuring the unit with:

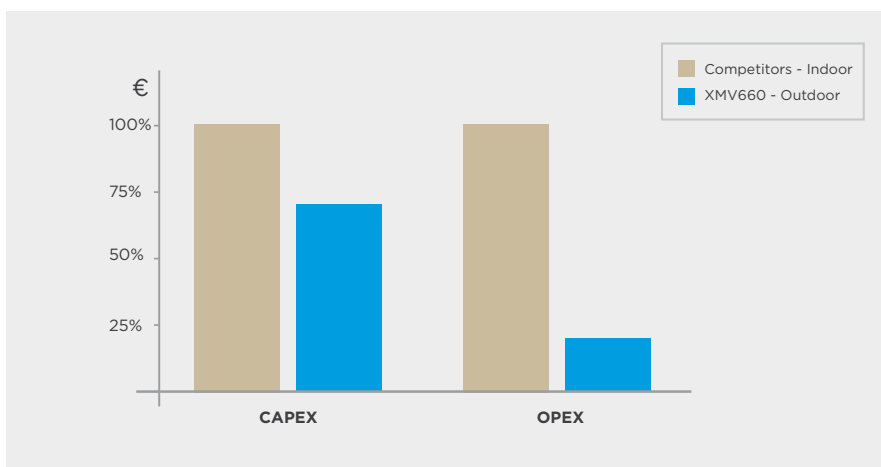
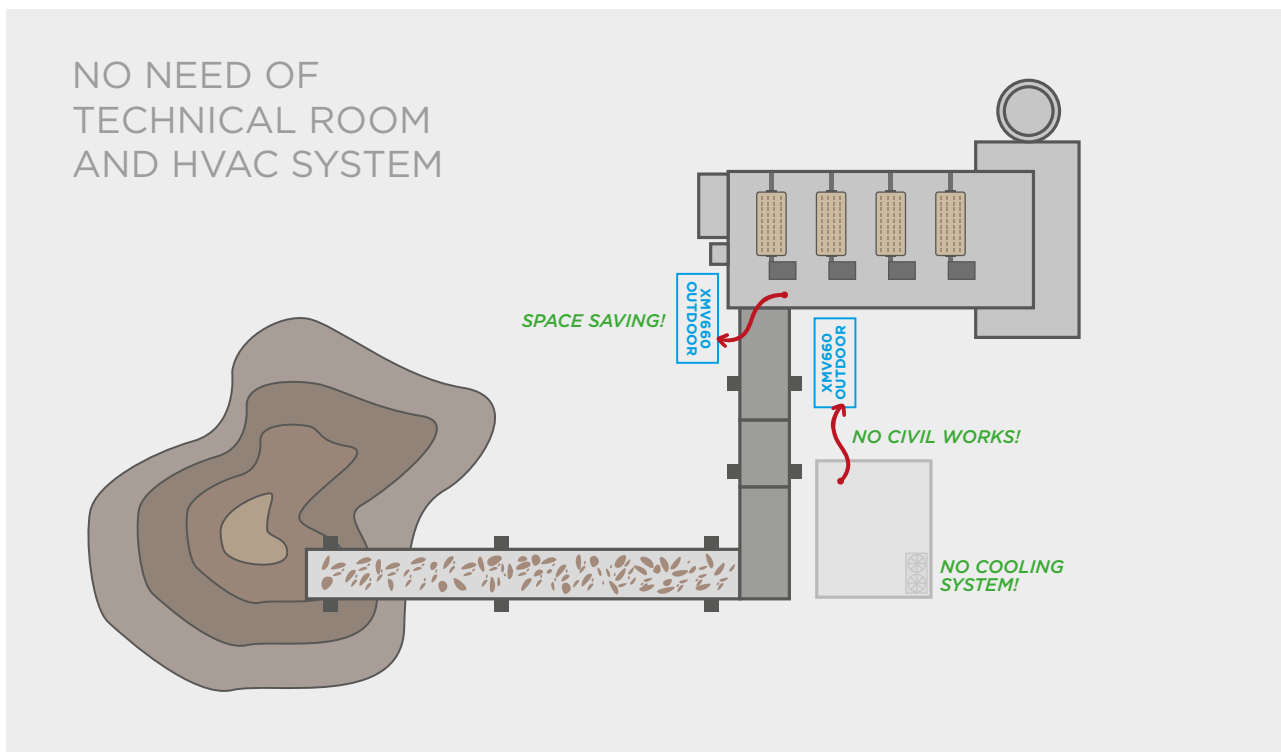
- **Totally Sealed electronics protected from dust and moisture.**
- **Conformal coating on electronic board shields PCBs from aggressive atmospheres.**
- **Rugged outdoor enclosure with double gasketed doors.**
- **50mm mineral isolation panel that dissipates heat from direct sunlight.**
- **Corrosion impervious polymeric coating (C5-M).**
- **Temperature and humidity control prevents harmful internal water condensation.**

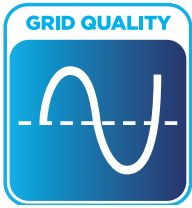


CAPEX AND OPEX

A highly globalized market demands reliable, safe and efficient solutions to reduce the OPEX and CAPEX in new projects, and XMV660 OUTDOOR MV drive links these concepts by providing substantial savings on:

- **CAPEX (Construction and Civil Works):** Multi-MW AC drives have a large foot print that force designers and constructors to build impressive technical rooms. The civil works in remote locations represent an important investment that the outdoor XMV660 helps to minimize.
- **OPEX (HVAC):** The AC drives dissipates in heat between 2% to 4% of the power converted, this means that the HVAC systems for e-houses represents a high percentage of the electrical operating cost of the facility. The XMV660 OUTDOOR is ready to directly exchange heat into the surrounding environment at up to 50°C, being the smarter and the most cost-effective solution.





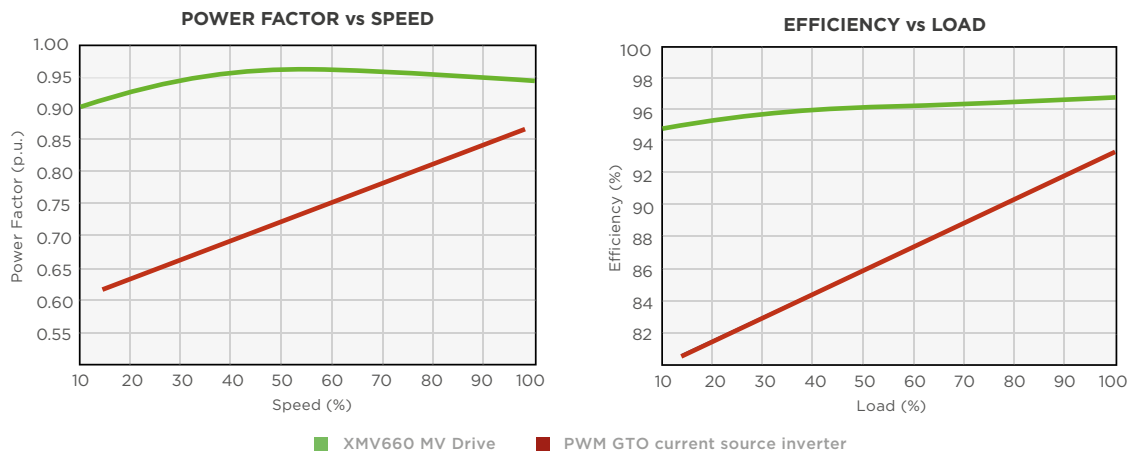
POWER QUALITY AND EFFICIENCY

XMV660 topology meets the most stringent regulations regarding power quality (IEEE519) and electromagnetic compatibility (EMC 2004/108/EC).

An input phase shift transformer of 18 to 54 pulses minimises the THDi level, eliminating the need for harmonics filters.

Outstanding Power Factor $PF > 0.95$ above 20% load, therefore no capacitor banks or active filters are needed.

High efficiency $\eta > 96\%$ above 40% load (Including transformer).





MAXIMUM MOTOR CARE

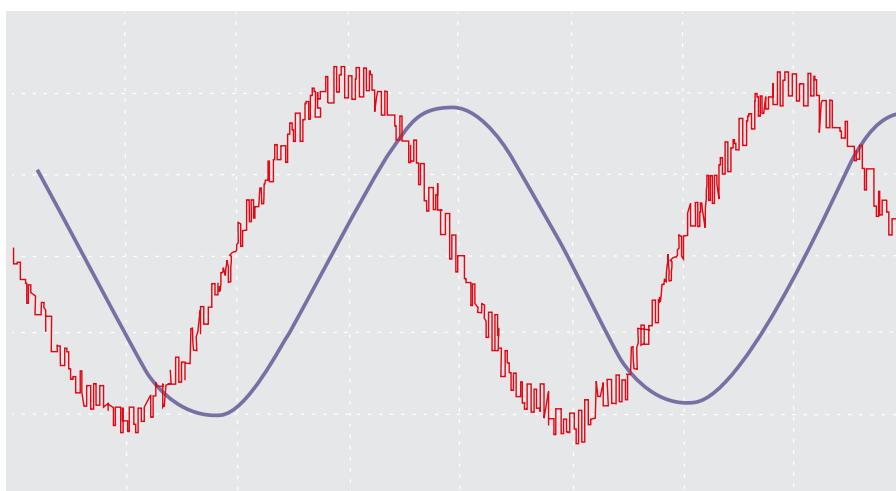
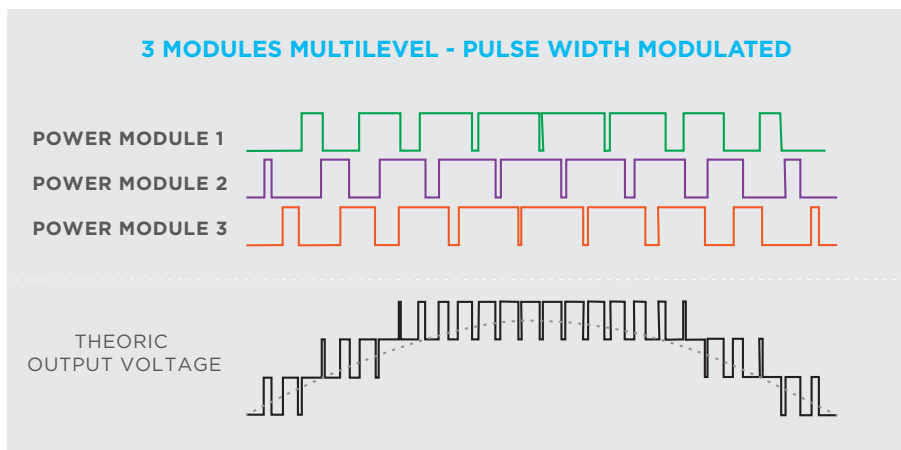
Power modules of 700V are connected in series to generate a quasi sinusoidal voltage low in dV/dt , supplying sinusoidal current to the motor with negligible THDi. Additional output filters are not needed.

Series connected H-bridge power modules generate a quasi-sinusoidal output voltage waveform low in dV/dt , harmonic voltage factor and negligible THDi, providing sinusoidal current to the motor.

The multi-step topology offers low common mode voltage (CMV), coupled with the low dV/dt , eliminates voltage peaks at the motor terminals. Therefore the XMV660 can be installed with new and existing motors employing standard insulation, without the need for additional motor derating or further motor protection, or to compensate for long motor cables.

Eliminating potential common mode currents (CMC) from circulating through the motor bearings allows the use of standard bearings and lubrication techniques.

Noise induced vibrations and torque pulses on the motor shaft are non-existent owing to the multi-step pulse width modulation (PWM) with H-bridge cascaded power modules topology.



■ Motor Voltage Wave Form ■ Motor Current Wave Form



SAFETY AND PROTECTION

The XMV660 integrates built-in hardware and software protections that reduce the associated risk of medium voltage installations.

An input phase-shift transformer offers a wide variety of benefits to your installation:

- Protects power rectifier bridge semiconductors and withstands grid transient fluctuations.
- Reduces the short circuit power and therefore the fault current in case of an unlikely internal isolation defect.
- Boosts output voltage by compensating for grid and drive voltage drops by using an on-site tap adjustment of the transformer. The motor will work at the rated voltage avoiding undesired motor oversizing and overheating.
- A custom made input transformer allows the user to order a different input and output voltage. Thus, there is no need to install further transformers or switchgear, and allows the user to work with different rated voltage equipment within the same facilities.

The drive monitors the input, the output and each individual power module offering multiple software and hardware protections that will protect your costly rotating assets (pump, fan, conveyor, compressors...).

Each power module is protected by fuses that provide overcurrent protection to the rectifier bridge.

The XMV660 can be delivered with a pre-charge system that magnetises the transformer and charges each power module DC bus. This system limits the inrush current at the drive's connection.

The XMV660 can be delivered with input protection modules that avoid the need for medium voltage protection switchgear.

Safety system, mechanical interlocks, restricted settings access with password and a warning buzzer will warn you of undesirable settings.





MAXIMUM RELIABILITY AND AVAILABILITY

The XMV660 is delivered fully factory tested to ensure the best performance under any load condition.

Transformer's and power module's temperature are permanently monitored to detect fan clogging or failure. Additionally the drive is available with a redundant cooling system that maximises the availability rate.

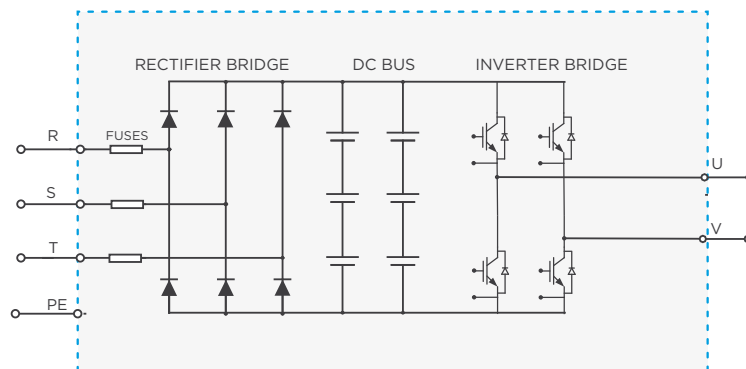
The Redundant Power System (RPS) permits the drive to keep running at reduced capacity in the unlikely event of a power module failure.

Multi-step topology using proven low voltage power modules ensures long service life and maximum availability.

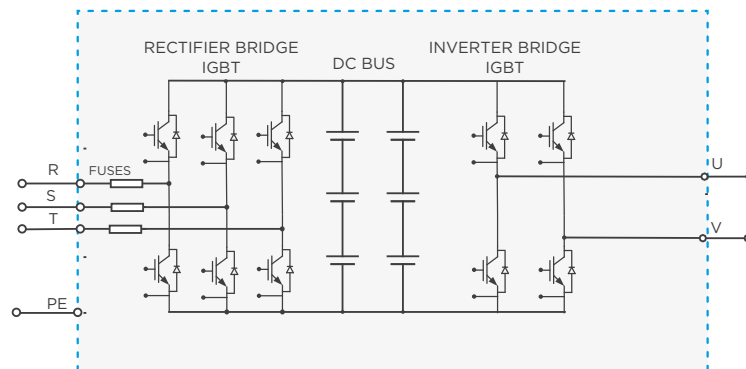
POWER MODULE TOPOLOGIES

The XMV660 is available with different module topologies that improve built-in standard features (regenerative, reduced size...), for further information consult Power Electronics.

STANDARD MODULE



REGENERATIVE MODULE





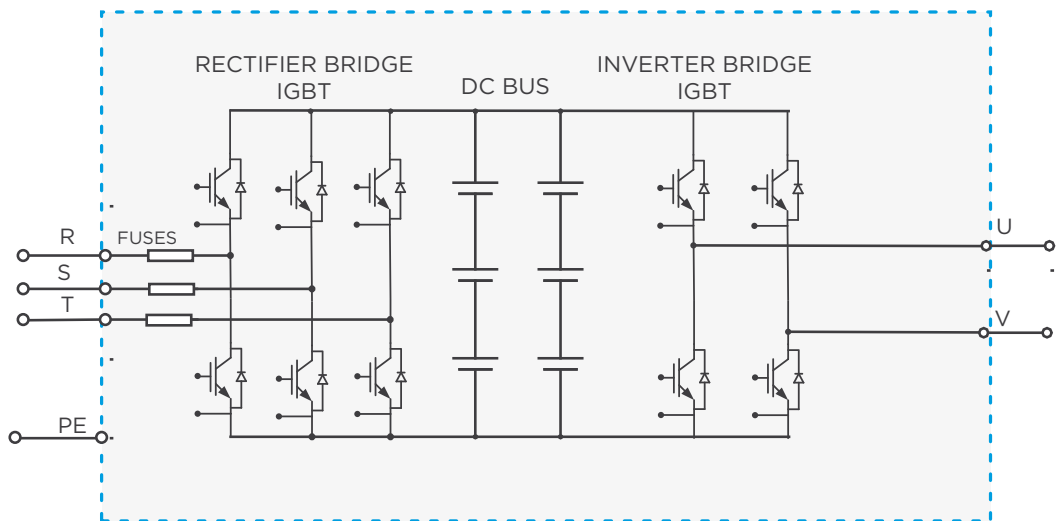
REGENERATIVE CAPACITY

The Power Electronics XMV660 regenerative drive is a high-performance device. It is applicable for “downhill” conveyor belts, lifting systems, winches and it is especially used to reverse the direction on high power fans or stopping large loads in highly reduced times such as in the case of centrifugal machines.

The XMV660 Active Front End is built to operate indefinitely at full capacity as an electric power generator, for example, connected to mini-hydraulic turbine generators (<10MW), or even be capable of connecting to two medium voltage networks of different frequencies and voltages, transferring energy in a bidirectional and controlled way between the two non-synchronized networks.

The regenerative XMV660 can be used to raise water and store electrical energy as potential energy, the same equipment is able to return power to the electricity grid when necessary. Thanks to the versatility of the motor control, low maintenance asynchronous induction motors can be used. Furthermore, the turbines are not required to rotate at a fixed speed, the XMV660 is able to optimize the system’s efficiency, both elevation and generation.

REGENERATIVE MODULE



The regenerative cell topology allows the XMV660 to maintain fault tolerance in both power and ventilation elements, as well as all the benefits of our systems and control algorithms such as Master-Slaves using fiber optics, tolerance for voltage gaps, unnecessary auto tuning, start on the fly

In the unlikely event of a power module failure, the equipment can continue to operate until the process allows the replacement of the damaged module.



Mini-hydraulic (<10MW) generation and elevation



Downhill conveyor for high altitude mining



MAINTENANCE FRIENDLY

The XMV660 is delivered with full frontal access to all compartments: power modules cabinet and power transformer cabinet with the control cabinet integrated.

All of the cabinets are designed to provide an easy front access that simplifies maintenance and supervision. The transformer cabinet can be installed out of the plant room in order to reduce indoor heat loads.

Low voltage tests allow for a safe fully functional performance before commissioning.

An accessible front connection together with a guide frame permits power modules to be manually changed by an operator with the aid of a trolley.

A redundant design of the power conversion stage and cooling system increases availability rates with a reduced stock of spare parts.

Filters and gratings are easily removable from the front without opening the cabinet or disturbing the normal operation of the application. Hence providing maximum safety to routine maintenance tasks.



ACCURATE, POWERFUL AND FLEXIBLE MOTOR CONTROL

Power Electronics' success is measured by our customer's satisfaction so the motor control systems developed by Power Electronics have been designed to meet the most demanding requirements. Integrating V/f control and two vector controls: the Power Motor Control (PMC) and the Advanced Vector Control (AVC) as standard.

SECOND GENERATION PLATFORM

In order to take advantage of the latest in control technology microprocessors, the XMV660 incorporates new control hardware. This technology includes Backward Compatibility and retrofit features for easy transition and coexistence of both the latest models and also the previous versions, where a long life cycle is mandatory.

New hardware lets us increase the motor control precision, there are additional control algorithms, also new and improved functions such as ventilation speed control, integrated control for external bypass, more capacity for several PowerPLC customised programs, the combinations are virtually unlimited.



QUICK AND POWERFUL RESPONSE

PMC and AVC allow its application in high starting torque, dynamic or precise applications. The XMV8 is suitable for all existing applications.

NO AUTO TUNING NEED

PMC factory settings and motor nameplate parameters ensure perfect performance without enabling the auto tuning function during commissioning. We have invested in new control methods to simplify settings. A fast and reliable commissioning saves time and money.

START AND STOP MAXIMUM CONTROL

Owing to the MBC (Mechanical Brake Control), the Pre-Magnetisation and Delay off IGBT, pre-loaded processes can be started and stopped smoothly.

MULTIPLE DRIVE'S SYNCHRONIZATION

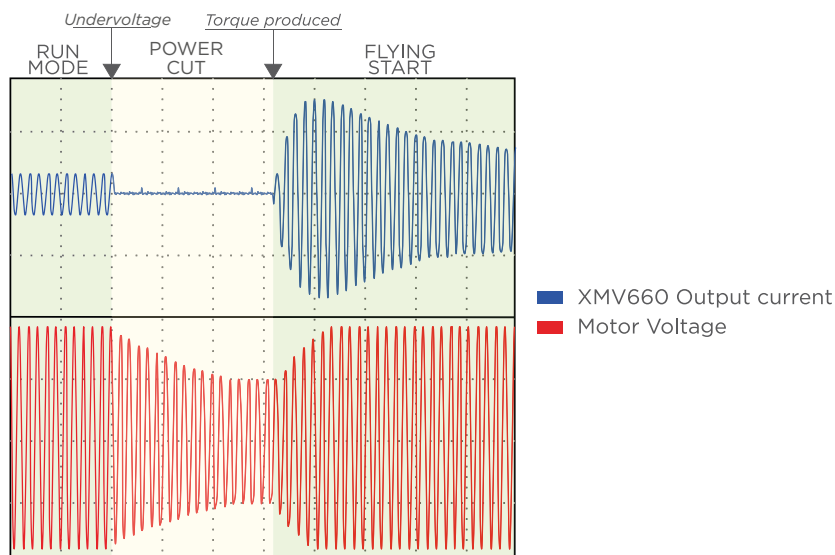
PMC-OLTC is the unique master-slave motor control that allows the synchronisation of multiple drives and motors without encoder. The result is a smooth, powerful and fast response with the least maintenance and supervision. Every motor will provide the same torque under any circumstance, therefore ageing all the motors homogeneously. Moreover, its reduced starting in-rush current peaks allow the reduction of the drive and motor oversizing in demanding conveyors and mills.

REDUNDANT POWER SYSTEM (RPS)

In the unlikely case of a power module failure the RPS permits the drive to keep running by overriding the failed module and the corresponding modules in the other two phases, ensuring the output voltage remains balanced at reduced power.

POWER LOSS RIDE THROUGH

The on board UPS enables continued motor control during grid transient undervoltage conditions, until the drive is able to reconnect the motor when the grid voltage returns to normal.



ADDITIONAL FUNCTIONALITIES

Thermal motor protection, motor overload prediction, motor stall, fly start, automatic restart, etc... complete the wide control features.



EASY TO DRIVE

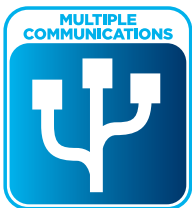
The user interface of the XMV660 is intuitive and user friendly. Coupled with the wide range of Fieldbus protocols available, the XMV660 can meet any connection requirement.



GRAPHIC DISPLAY

The graphic display provides a much more intuitive data presentation, an easy navigation through the control parameters and allows saving thousands of customised configurations defined by the user.

- TFT-LCD screen of 2.8".
- Customised visualization by the user.
- Fault Register (Logs).
- Language selection.
- Removable display unit for remote installation.



COMMUNICATIONS

The XMV660 integrates as standard Modbus RTU protocol over RS232, RS485 and USB hardware. Optionally fibre optic and the communication protocols Profibus -DP, DeviceNet, CAN Open, Ethernet Modbus TCP and Ethernet IP are available.

I/O SIGNALS

DI: There are 9 programmable and 5 preassigned digital inputs optically isolated and 1 motor PTC input built-in. 3 digital inputs can be programmed to select up to 7 different speed or torque references or they can be programmed individually to set remote commands such as start, stop, reverse, set acceleration and deceleration ramps, speed limit, alternative control, pulse flow meter, ...

DO: 2 programmable and 3 pre-assigned changeover relays and 3 programmable contacts built-in as standard. The XMV660 is capable of configuring the output relays by using the 3 built-in comparators to set remote alarms (current, speed, torque, power, flow, low and high input voltage, reference, acceleration and deceleration ramps, etc), control external mechanical brakes, control external cooling, action pipe filling pump,...

AI/AO: There are 3 inputs and 3 programmable analogue outputs. They are optically and galvanically isolated. External sensors or potentiometers are easily programmable as a voltage or current analogue signal in engineering units (% , l/s, m³/s ,l/m, m³/m, l/h, m³/h, m/s, m/m, m/h, Bar, kPa, Psi, m, °C, °F, °K, Hz, rpm). Additionally if the sensor is damaged or with noise coupling problems, the drive is able to filter, detect the failure and stop the application.

Many more options available. Consult Power Electronics with your requirements.



POWERCOMMS

The PowerCOMMS tool offers real performance information about motor and drive status. The XMV660 integrates an accurate power grid analyser and drive's diagnosis function. This tool operates from a PC, and communicates with the drives through Ethernet or RS485/RS232, registers, plots and exports all the drive visualisation parameters: energy consumption, regenerated energy, motor voltage, PTC signal, IGBT temperature, motor overload, Power Modules status, etc.

Not only can you monitor both drive and motor, you can also remotely control and commission multiple drives. Use the tool to copy and save the XMV660 parameters remotely to speed up the commissioning or configuration, saving time and money.



POWERPLC

PowerPLC is the tool that allows our Applications Engineers to customise and enhance the XMV660 performance for the customer's application, implementing multiple functions without additional hardware.

Multiple motor control, automatic pump and crusher unclogging, compressor regulation, cranes control, petrol pump softstart, paper and cable rolling control, biogas digesters & mixers, accumulators, calendar functions, and much more... The user establishes the limits for the XMV660.

XMV660_{outdoor}

TECHNICAL CHARACTERISTICS

INPUT	Input voltage (kV) ^[1]	2.3kV to 13.8kV (±10%)
	Frequency	50/60Hz (±10%)
	Power factor	> 0.95 (over 20% load)
	THDi (%) current ^[2]	< 5%
	Power transformer	Phase-shift transformer, dry type (Copper or aluminum)
	Voltage dip	Exceeds IEC/EN 61000-4-34
	Overvoltage protection	Surge Arresters
OUTPUT	Technology	Multi-level, pulse-width modulation, low voltage power modules connected in series
	Pulses / power modules in series	18p/3, 24p/4, 30p/5, 36p/6, 54p/9
	Power modules (A) / (V)	120A, 200A, 300A - (400A, 630A Optional) / 600V-700V
	Current harmonic distortion (THDi)	< 5%
	Harmonic voltage factor (HVF)	< 0.019 (No motor derating required)
	Efficiency	≥96% (including transformer) @Pn
	Tripless operation	Redundant Power System (RPS)
ENVIRONMENTAL RATINGS	Output voltage boosting	Transformer Tap Adjustment
	Degree of protection	(IEC60529) IP55, NEMA3R
	Operation temperature ^[3]	-20°C to +50°C
	Storage temperature	-25°C to +55°C
	Humidity	< 95%, non condensing
	Altitude	<1000m; >1000m power derating 1%/100m. Max. 3000m Optional reinforced isolation for up to 4500m.
	Cooling	Forced air cooling, Self cleaning filters
CONTROL	Control mode	Local control (Display and push-buttons) Remote control (I/O and communications), Web display (wifi)
	Control method	V/Hz VECTOR CONTROL Open Loop: PWM speed / torque control, AVC: speed / torque control Close Loop (Encoder): PWM speed / torque control, AVC: speed / torque control
	Carrier frequency	1kHz
	Control power supply	Redundant 2x230Vac II P+N (1kVA), UPS integrated
	Other characteristics	Voltage/Power ride through, quick setting and commissioning, master-slave synchronization, skip critical frequencies, delay-off IGBT, motor pre-magnetization, flux reduction at low load (energy saver), electric DC brake, multi-reference and speed ramp, Power PLC programming, Other consult Power Electronics.
USER INTERCONNECTION ^[1]	Digital inputs	5 programmable, Active high (24Vdc), Isolated power supply 5 pre-configured (Start/Stop ; Reset, control mode, reference) 1 PTC input
	Analogue inputs	3 programmable differential inputs. 0-20mA, 4-20mA, 0-10Vdc and ±10Vdc. (Optically isolated)
	Digital outputs	2 programmable changeover relays (250Vac, 8A or 30Vdc, 8A) 3 programmables NO contacts (250Vac, 8A or 30Vdc, 8A) 3 pre-configured contacts (Start/Stop, Warning, Failure)
	Analogue outputs	3 isolated programmable outputs: 0-20mA, 4-20mA, 0-10Vdc and ±10Vdc
	Encoder (optional)	2 differential encoders input (process y vector control). Input signal from 5 to 24Vdc
COMMUNICATIONS	Standard Hardware	USB, RS232, RS485, Ethernet
	Optional Hardware	Fiber optics, 9 Pin D-SUB, CAN
	Standard Protocol	Modbus-RTU, Modbus TCP, Ethernet IP
	Optional Protocol	Profibus-DP, Devicenet, CAN Open
PROTECTIONS	Motor protections	Rotor locked, torque limit, Motor overload (thermal model), Output current limit, Phase current imbalance, Ground fault current, Phase voltage imbalance, Motor over-temperature (PTC), Speed limit, excessive starting and stopping time.
	Drive protections	Input phase loss, Low input voltage, High input voltage, maximum number of faulty modules, High input frequency, Low input frequency, drive overload, drive over-temperature, Analogue input signal loss (speed reference loss), communication loss (time-out), Power supply fault, Emergency stop
	Power modules protections	Overcurrent (fuses), high DC bus voltage, Low DC bus voltage, DC bus voltage instability, low input voltage, fiber optics communication lost, communication time overpassed (time-out), control voltage lost, gate drive fault, power module overtemperature.
REGULATION	Electromagnetic compatibility	Directive EMC 2004/108/EC, IEC/EN 61800-3, IEEE 519-1992
	VSD design and construction	IEC/EN 61800-4 General requirements, IEC/EN 61800-5-1 Safety, IEC/EN 60146-1-1 Semiconductor converters
	MV transformer	IEC/EN 60076 -1, -11, IEC/EN 60146-1-3, IEC/EN 61378-1

NOTES [1] Other configurations, consult Power Electronics.

[2] Harmonics are below the limits defined in IEEE519 for all I_{sc}/I_L .

XMV660 OUTDOOR - CONFIGURATION TABLE

X66 XMV660 Series	1000		A		66		5		3		H	
	Active Power		Cells Max. Amps		Output voltage		Overload		Degree of protection		Grid voltage	
X66	0150	150kW	A	120	23	2.3kV	2	120%	1	UL NEMA1	X	Low voltage
	B	200	30	3kV	5	150%	3	UL NEMA3R	A	2.3kV
	1000	1000kW	C	300	33	3.3kV	B	Starting Model	4	IEC IP41	B	3kV
	1100	1100kW	D	450	38	3.8kV	...	Under request	5	IEC IP54	C	3.3kV
	1200	1200kW	E	630	41	4.1kV			...	Under request	D	3.8kV
	F	900	60	6kV					E	4.1kV
	9000	9000kW	G	1250	63	6.3kV					F	6kV
	10M0	10000kW	H	1500	66	6.6kV					G	6.3kV
	12M5	12500kW	Regenerative		69	6.9kV					H	6.6kV
	24M5	24500kW	R	120	10	10kV					I	6.9kV
	...	Under request	S	200	11	11kV					J	10kV
			T	300	13	13.8kV					K	11kV
			U	450	...	Under request					L	13.8kV
			V	630							M	15kV
			W	900							...	Under request
		X	1250									
		Y	1500									
		...	Under request									

NOTES Check the rated current of the motor nameplate and indicate the short circuit current to guarantee the compatibility with the selected drive.
Consult configuration availabilities with Power Electronics.

XMV660 OUTDOOR - STANDARD RATINGS

XMV660 4.16kV			
CODE	NOMINAL CURRENT (A)	MOTOR POWER	
		(kW)	(HP) ^[1]
X660298A 41	50	298	400
X660336A 41	60	336	450
X660373A 41	70	373	500
X660447A 41	80	447	600
X660522A 41	90	522	700
X660597A 41	100	597	800
X660671A 41	120	671	900
X660746B 41	130	746	1000
X660932B 41	160	932	1250
X66119B 41	200	1119	1500
X661305C 41	230	1305	1750
X661491C 41	260	1491	2000
X661752C 41	300	1752	2350
X661864D 41	320	1864	2500
X662051D 41	360	2051	2750
X662237D 41	390	2237	3000
X662610D 41	450	2610	3500
X662983E 41	520	2983	4000
X663356E 41	580	3356	4500
Under request			

XMV660 6.6kV			
CODE	NOMINAL CURRENT (A)	MOTOR POWER	
		(kW) ^[2]	(HP)
X660400A 66	45	400	536
X660450A 66	50	450	603
X660500A 66	55	500	671
X660560A 66	60	560	751
X660630A 66	70	630	845
X660710A 66	80	710	952
X660800A 66	90	800	1073
X660900A 66	100	900	1207
X661000A 66	110	1000	1341
X661250B 66	140	1250	1676
X661400B 66	150	1400	1877
X661600B 66	180	1600	2146
X661800B 66	200	1800	2414
X662000C 66	220	2000	2682
X662500C 66	270	2500	3353
X662800C 66	300	2800	3755
X663150D 66	350	3150	4224
X663550D 66	390	3550	4761
X664000D 66	440	4000	5364
X664500E 66	500	4500	6035
X665000E 66	550	5000	6705
Under request			

NOTES [1] HP standard motor rated power (cos φ • Eff = 0.8, 4.16kV)
[2] kW standard motor rated power (cos φ • Eff = 0.8, 6.6kV)

2.3kV, 3kV, 3.3kV, 6kV, 10kV, 11kV, and 13.8kV Standard Ratings available under request.