



MEDIUM VOLTAGE DRIVE

MD1000

REGAL[®]

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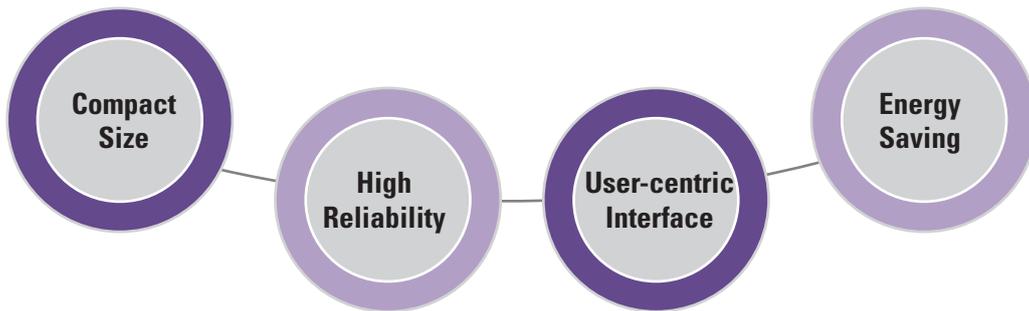
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LEADER IN ADVANCED TECHNOLOGY

OPTIMUM MV VSD SOLUTION FOR INDUSTRIAL PLANTS AND SoC SYSTEMS

Marathon medium voltage drives consist of compact integrated systems built on cutting-edge technologies, delivering optimum energy-saving solutions featuring high efficiency and power factor. The system supports a user-friendly HMI (Human Machine Interface) that allows easy operation and displays desired information for customers maximum convenience.

Marathon medium voltage drive offers leading industrial drive solutions with proven reliability and economic viability. It also contributes to energy saving and environment protection in various industries including gas, water treatment, marine, power generation and cement.



ENERGY SAVING DRIVE SOLUTION MEDIUM VOLTAGE DRIVES

3.3kV	200kVA - 3,700kVA
4.16kV	250kVA - 4,700kVA
6.6kV	400kVA - 7,500kVA
10kV	600kVA - 11,000kVA
11kV	660kVA - 12,500kVA



CUSTOMIZED SOLUTIONS FOR VARIOUS INDUSTRIAL SECTORS

Our Marathon medium voltage drives can offer you a customized solution, whilst incorporating our customers specific requirements and drawings, with proven reliability in the following various industrial sectors.

SERIES OVERVIEW

MV VSD Series	MDMV-MD1000
Voltage	3.3kV / 4.16kV / 6.6kV / 10kV / 11kV
Capacity	200kVA - 12,500kVA
Control Mode	V/F, Sensorless Vector
IP Class	Standard IP21 (IP42 optional)
Standards	CE, UL
Frequency	50 / 60Hz
Topology	Multi-level PWM

MAJOR APPLICATIONS



Oil & Gas

- Electric submersible pumps
- Reciprocating/Centrifugal compressors
- Conveyors
- Unloading & booster pumps



Water Treatment

- Inlet/outlet pumps
- Auxiliary pumps
- Defoaming pumps
- Booster pumps

Power Generation

- Boiler feed/water pumps
- Condensation pumps
- Cooling water pumps
- District heating water circulation pumps
- Primary and secondary air fans
- Coal mill and conveyors



Metal

- Furnace fans
- Fluid transfer pumps
- Conveyors
- Sludge pumps
- Quenching pumps



Marine

- Thrusters
- Conveyors
- Vessel propulsion
- Pumps



Mining

- Mill Drives
- Conveyors
- Slurry Pumps
- Crushers
- Fans

Cement

- Kilns
- Cement mills
- Raw mills
- Crushers
- Exhaust fans
- Main & auxiliary fans



Pulp & Paper

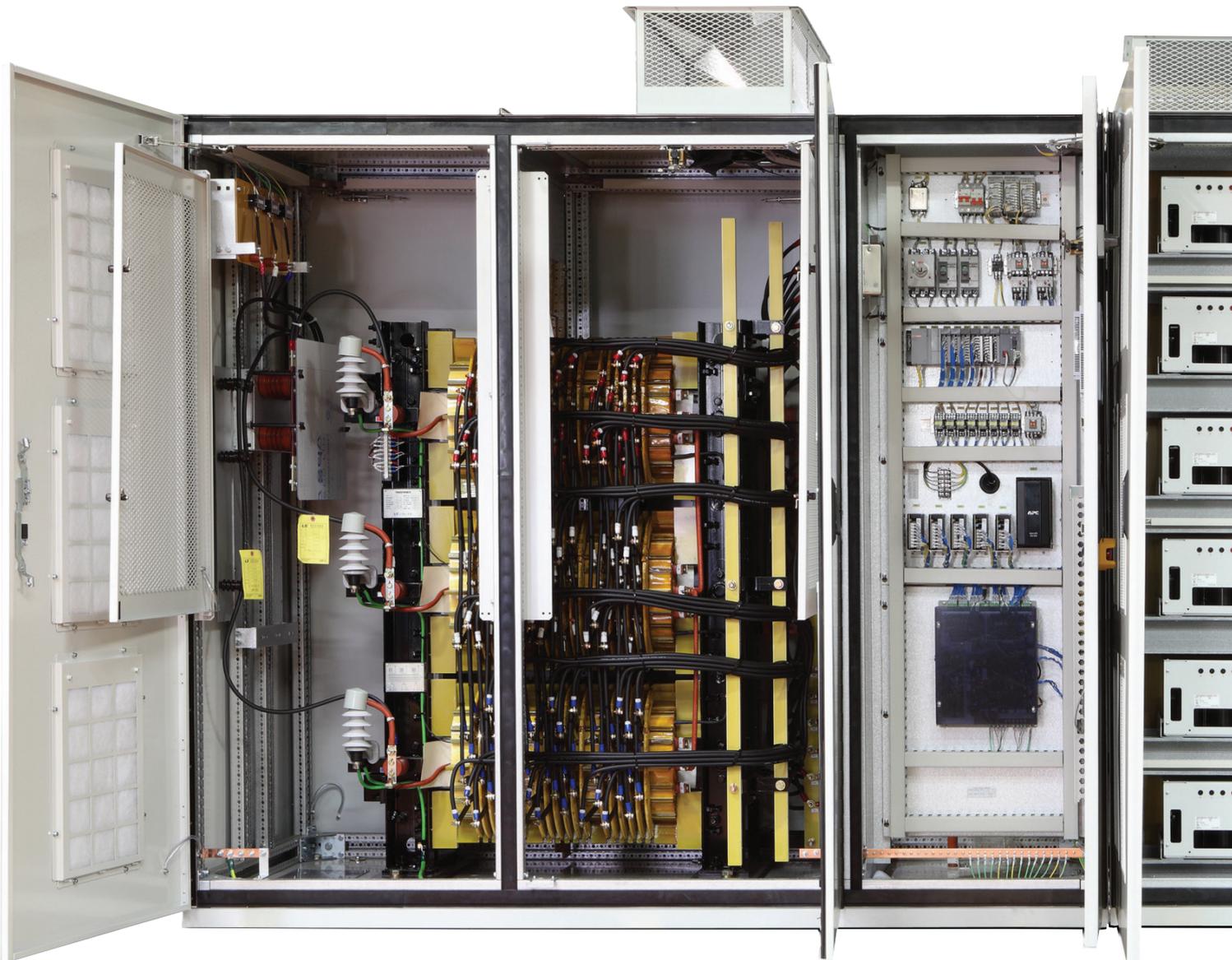
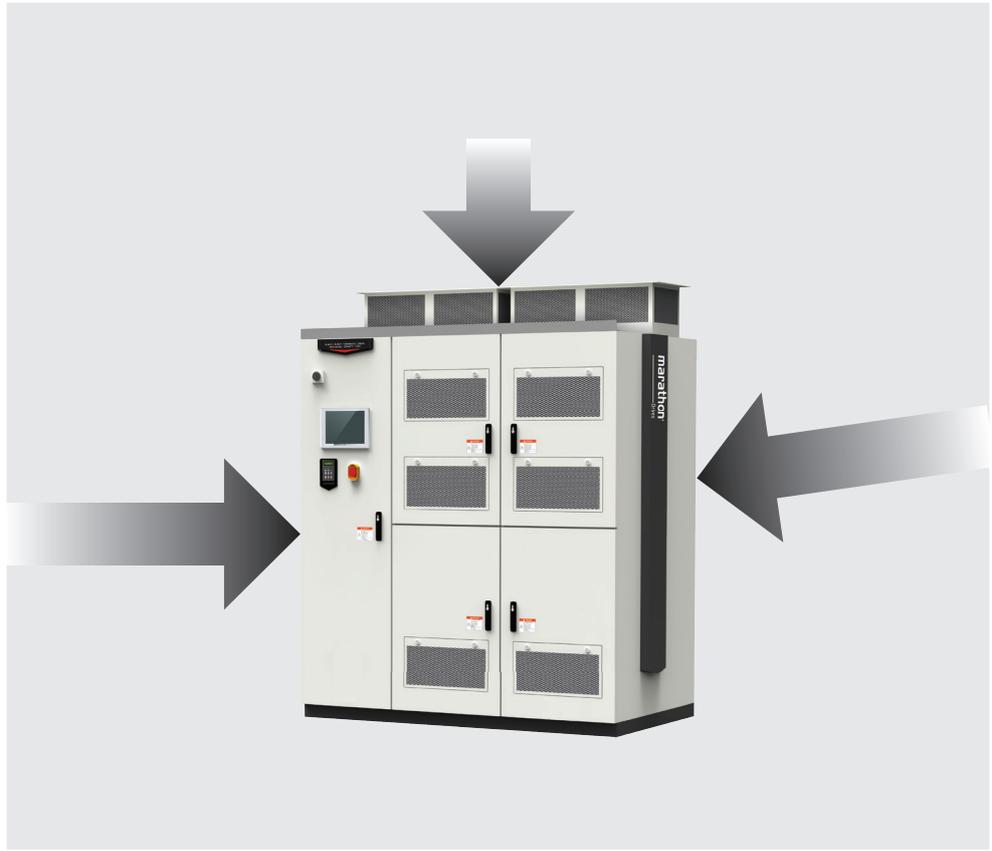
- Boiler fans
- Chippers
- Auxiliary pumps
- Chip refiners
- Vacuum pumps



INTRODUCTION

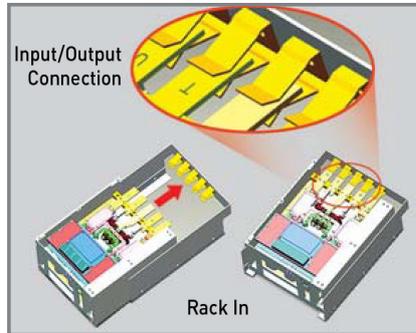
COMPACT DESIGN

Thanks to Marathon's optimized drive design we can minimise installation footprint and investment costs.



FRONT-ACCESS MAINTENANCE

The rack-in type is constructed with a simplified cell, allowing users to access the drive from the front for maintenance. This eliminates need for additional space in the rear reducing the product installation footprint.



LOW-NOISE FAN

The M1000 model uses a fan that features a considerably reduced noise level, supporting 0-10V speed control through its built-in PID control.



BENEFIT

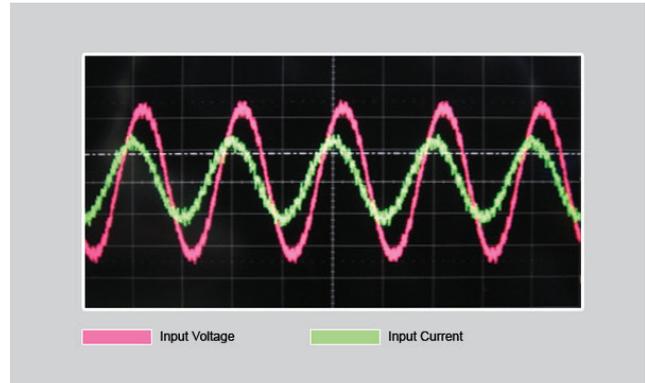
ENERGY SAVING THROUGH EFFICIENT ENERGY MANAGEMENT

Marathon medium voltage drives demonstrate a unique compact system built on optimal design. Designed for easy installation the drive can be installed without requiring input / output filters, therefore providing higher efficiencies and energy saving benefits.

IMPROVED INPUT POWER QUALITY AND THD (TOTAL HARMONIC DISTORTION)

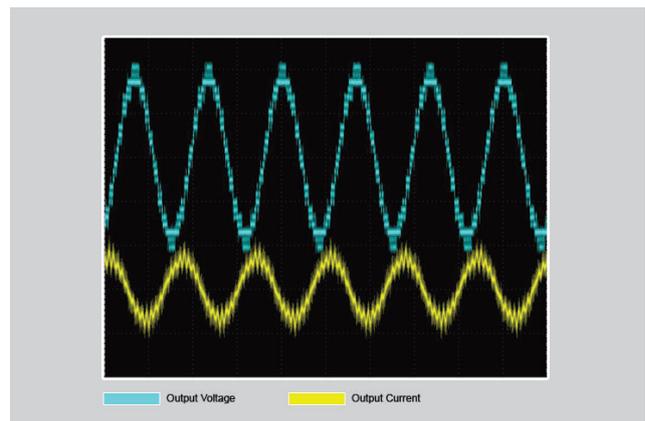
By adopting multi-winding phase-shift transformer we can provide

- Application of extended delta-type transformer and separated-type multi-pulse rectifier drastically reducing input power THD, hence complying with IEEE-519 standard.
- Input currents almost identical to sine waves eliminating the need for additional harmonic filters or active filters on the input side.



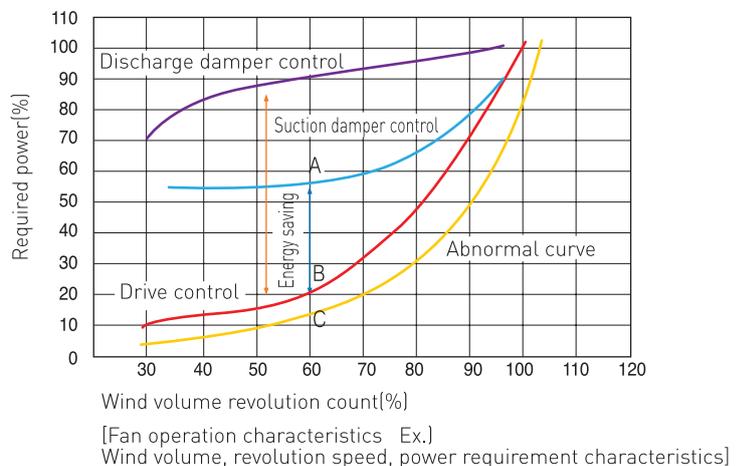
PRODUCING MULTILEVEL PWM - TYPE SINUSOIDAL OUTPUT

- Compatible with conventional motors and cables to ensure it fits in with existing system design
- Minimal impact of voltage reflection, allowing longer cable length between drive and motor
- Medium voltage drives minimize mechanical stress on motor, eliminating need for additional sine wave filters.



ACHIEVING ENERGY SAVING AND MINIMUM ENERGY LOSS THROUGH OPTIMIZED SPEED CONTROL

The optimum way to save energy with fan pump and blower applications is to control the motor speed with the MDMV Drive. This is more effective than conventional mechanical systems.



EXAMPLE OF OPERATING CONDITIONS

1. Motor in use: 3300V, 600KW, 6P (motor efficiency: 95%)
2. Operating at 60% of air flow volume (motor efficiency of 90% at 100% of flow volume)

1. INLET-SIDE DAMPER CONTROL POWER (A)

$$600 \times 0.55 \times \frac{1}{0.95 \text{ Motor Efficiency}} = 347.4kW \dots (1)$$

Note) 0.55: Power rate required for damper's suction control when operating at 60% of air flow volume

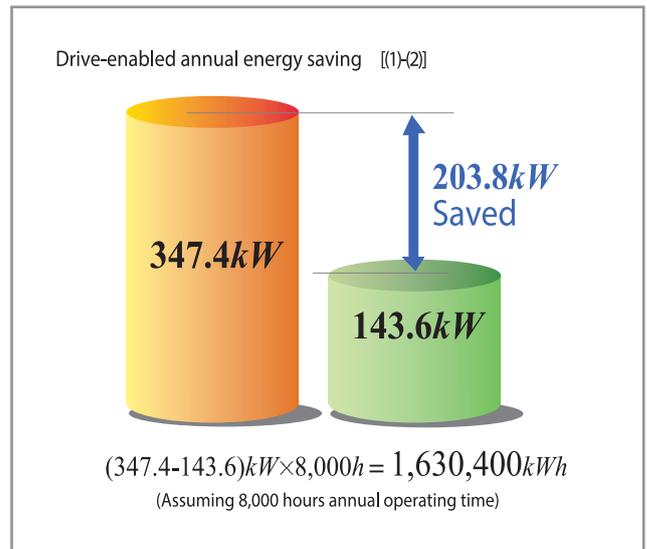
2. DRIVE CONTROL POWER

$$\text{Rated Motor Output (C)} \quad 600 \times (0.6)^3 = 129.6kW \dots (1)$$

$$\text{Motor Input Power} \quad 129.6 \times \frac{1}{0.95 \text{ Motor Efficiency}} = 136.4kW$$

$$\text{Drive Input Power(B)} \quad 136.4 \times \frac{1}{0.95 \text{ Drive Efficiency}} = 143.6kW \dots (2)$$

3. ENERGY SAVING



The electricity bill that can be saved per year assuming an electric power tariff of 0.06kW.h

$$1,630,400 \times 0.06 = \$97,824$$

INCREASING FACILITY EFFICIENCY

IMPROVING THE PRODUCTIVITY WITH OPTIMIZED FACILITY OPERATION RATIO

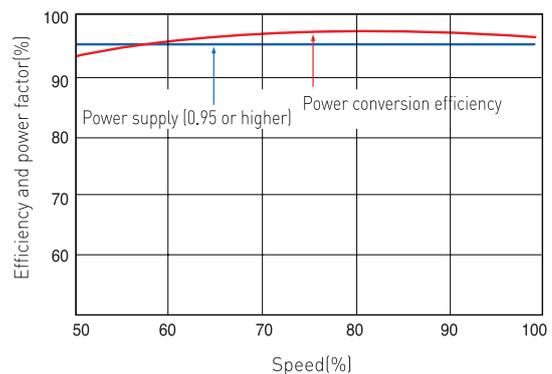
- Effective process control through prompt and flexible speed control in response to change in operating environment and demand.
- Improving productivity and product quality with optimized facility operation ratio.

GUARANTEEING HIGH OPERATING EFFICIENCY AND POWER FACTOR

- Delivering a high power factor at 95% or above with an independent built-in system without additional power factor correction equipment required
- Improving system efficiency with a drive-only system configuration without the need for input / output filters

REDUCING OPERATION AND MAINTENANCE COSTS

- Soft starting eliminates network instability and process risks from starting current and voltage drop.
- Reducing maintenance frequency and costs with decreased motor stress and extended equipment service life.



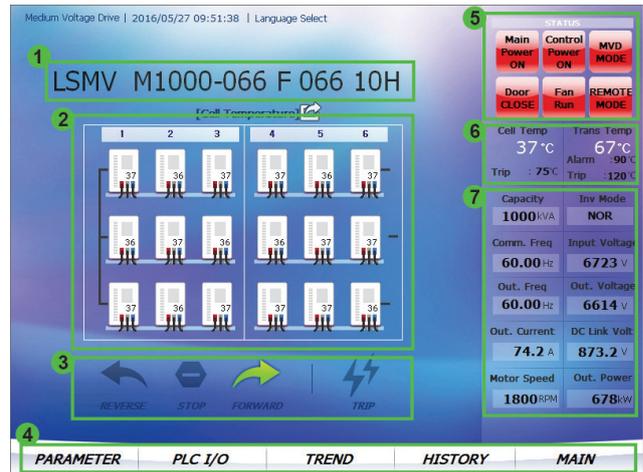
BENEFIT

ENERGY SAVING THROUGH EFFICIENT ENERGY MANAGEMENT

Marathon medium voltage drives demonstrate a unique compact system built on optimal design. It is easy to install and is designed not to require input / output filters, therefore providing higher efficiencies and energy saving benefits.

MONITORING (HMI) STANDARD HD HMI MONITORING MAXIMISES USER CONVENIENCE

- 12.1 inch touch screen
- Supporting multi languages (English, Chinese, Korean, Russian, Spanish, Thai and Portuguese)
- Control and system state monitoring
- Powerful data control (data logging, diagnostics and information)
- User-centric convenience (HD display, high data throughput, user-friendly interface)
- Supporting dedicated editor for changing display items (optional).



- 1 MD VSD Model Name
- 2 Cell Mode
- 3 MV VSD Operation
- 4 Menu Selection
- 5 Power / Fan
- 6 Temperature Display
- 7 MV VSD Mode

EXTERNAL INTERFACE



Ethernet I/F



Serial I/F (RS-232C)



Serial I/F (RS422/485)



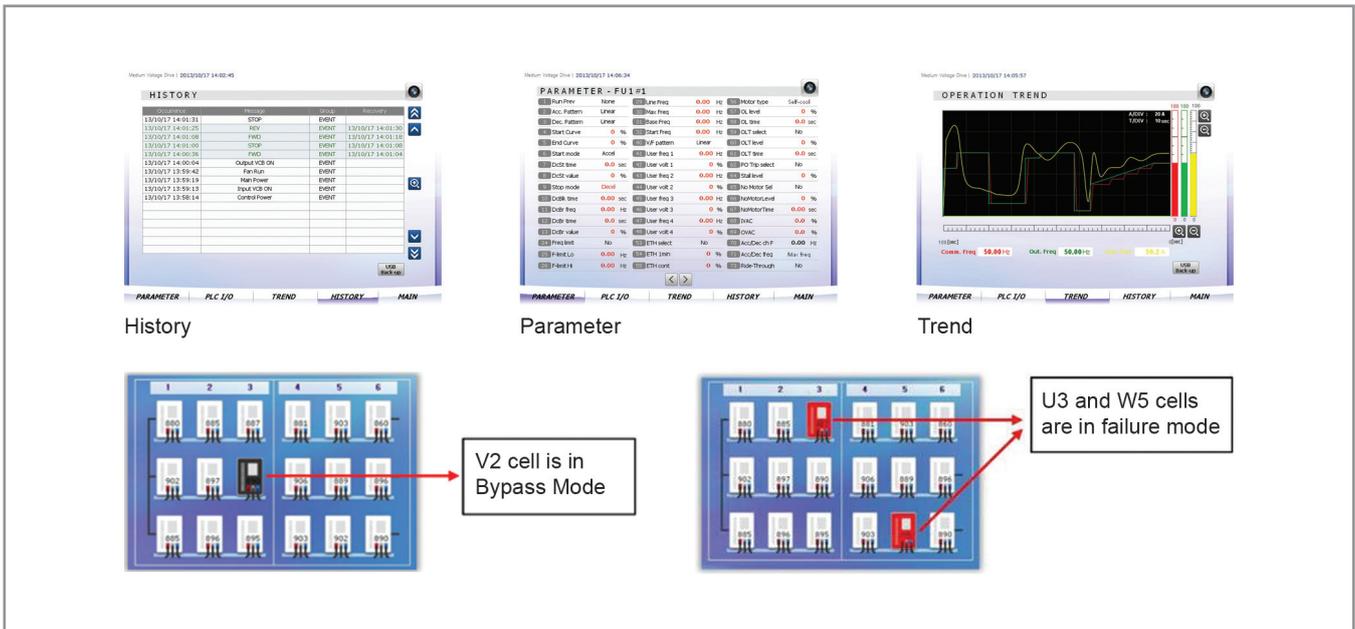
USB I/F



CF card I/F



Expansion port



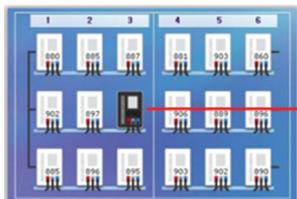
History



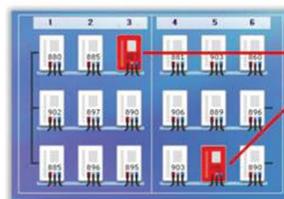
Parameter



Trend



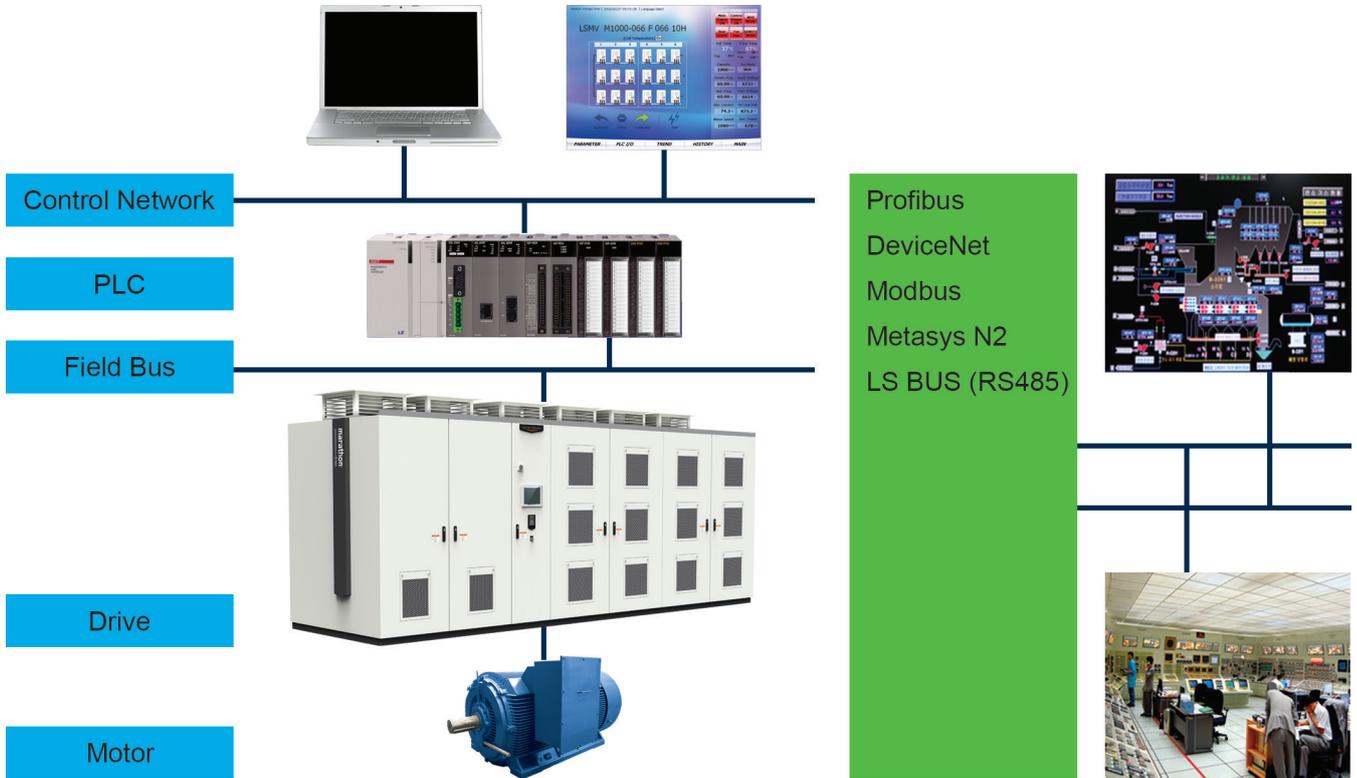
V2 cell is in Bypass Mode



U3 and W5 cells are in failure mode

COMMUNICATION

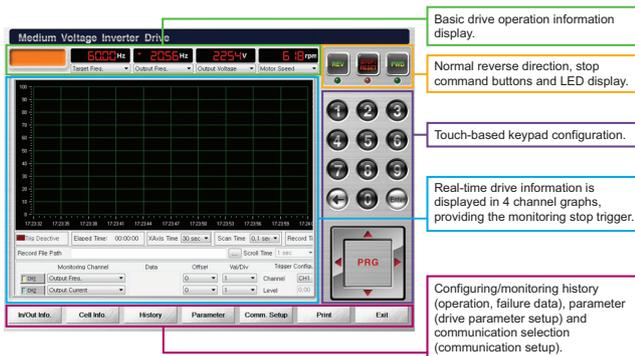
- Standard built-in PLC supports customization (I/O extendability, etc.)
- Providing the improved system compatibility with field-bus communication options



MONITORING

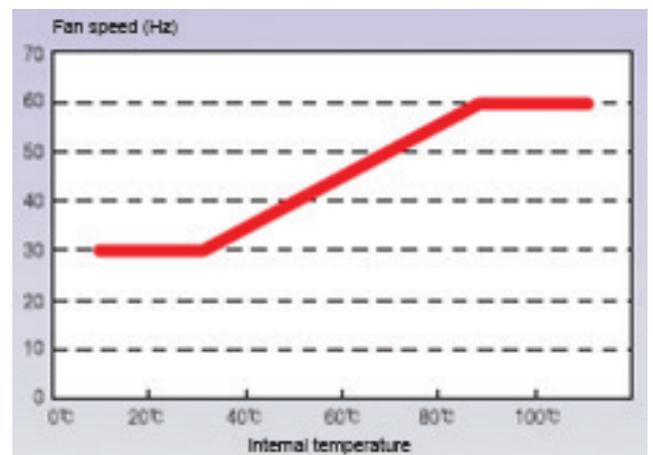
MV System View (option)

- MV System View is a PC (Windows XP and Window 7 compatible) based software that uses RS485/232 communication links between MVD and PC to control / monitor MVD.
- Communication standards and a built-in system view enables flexible application in various systems. It facilitates remote operation and operating state monitoring by higher-level systems.



OPTIMIZED PID CONTROL OF COOLING FAN ACCORDING TO HEAT RELEASE

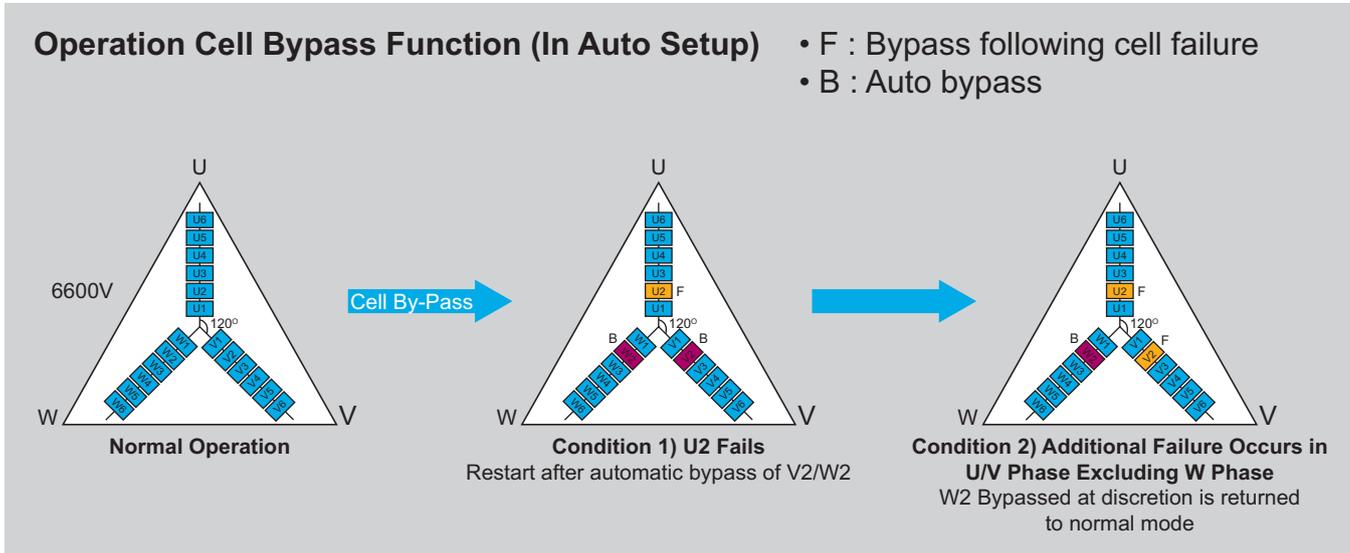
Reducing fan noise, power consumption and extending fan service life by optimizing cooling fan speed control in proportion to the drive internal temperature systems.



FUNCTION

CELL BYPASS FUNCTION

Cells are connected series allowing continuous operation automatically bypassing failed cells, thus allowing continuous operation without delay in production.



FLYING START

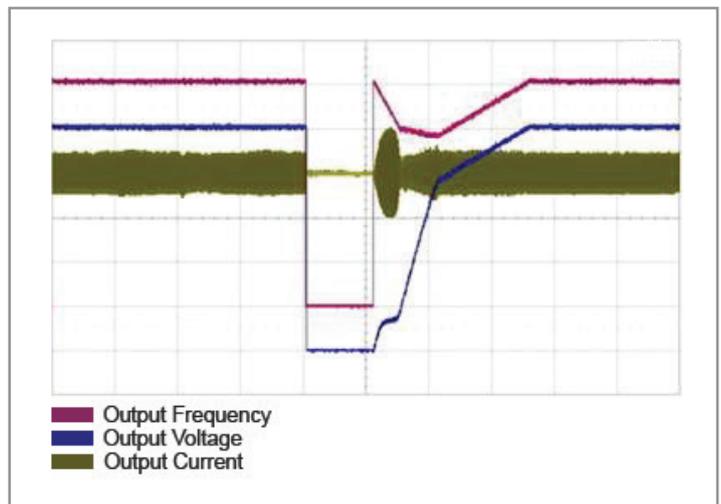
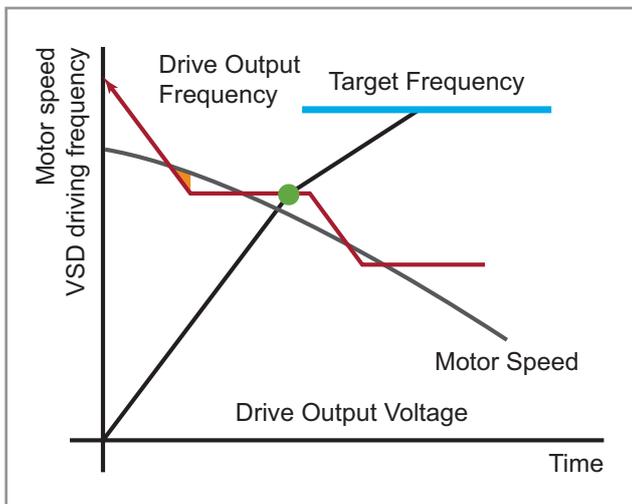
Automatically estimates speed of the rotating motor to reach the frequency without any system failure (trip).

EXAMPLE OF FLYING START

- Select flying as part of the application
- Reset after trip
- Automatic restart
- Restart after ride-through

EXAMPLE OF FLYING START

- Reduce speed estimation time by controlling the drive output frequency speed reduction
- Reduce estimation time by reducing output frequency
- Reducing estimation time by controlling voltage response

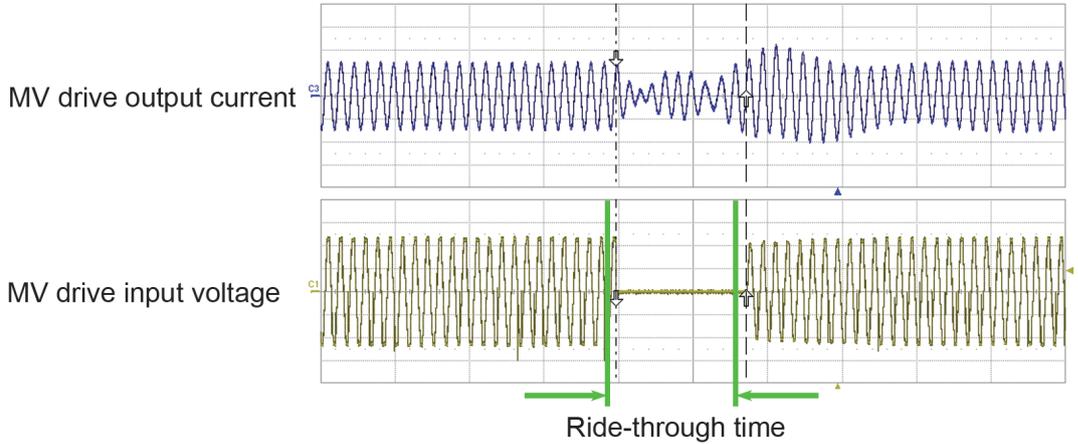


RIDE-THROUGH CAPABILITY

Mechanical energy created by the load is regenerated to continue operation for up to 5 cycles when power outage occurs. It allows continuous operation without stopping the drive or system.

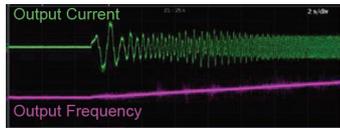
Improving Power Quality and Reducing Industrial Damage

- Unpredictability
- Irregularity
- Response to force majeure events.

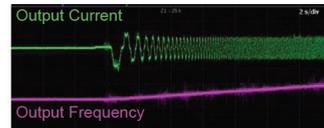


ANTI-CURRENT HUNT ALGORITHM IN RESONANCE AREA

Continuous drive operation possible in the resonant area followed by application of the drive.



Residual current hunting makes continuous operation impossible



Continuous operation possible in spite of residual current hunting

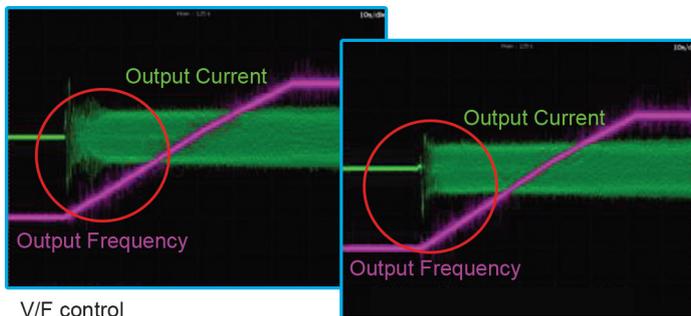
Residual area avoidance function not applied

Resonant area avoidance function applied

SENSORLESS VECTOR FUNCTION

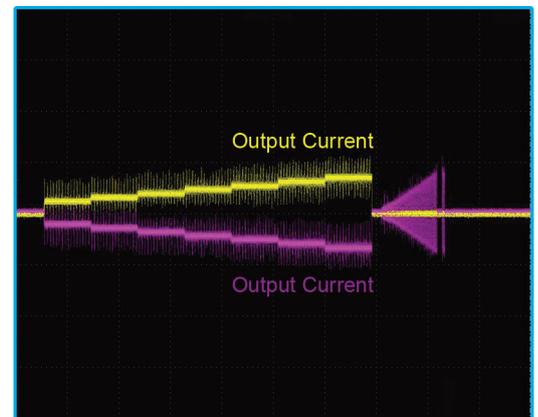
IMPROVED STARTING TORQUE AND ACCURATE TORQUE CONTROL

Powerful sensorless algorithm improves speed and torque control precision in low-speed area.



V/F control

Sensorless vector control

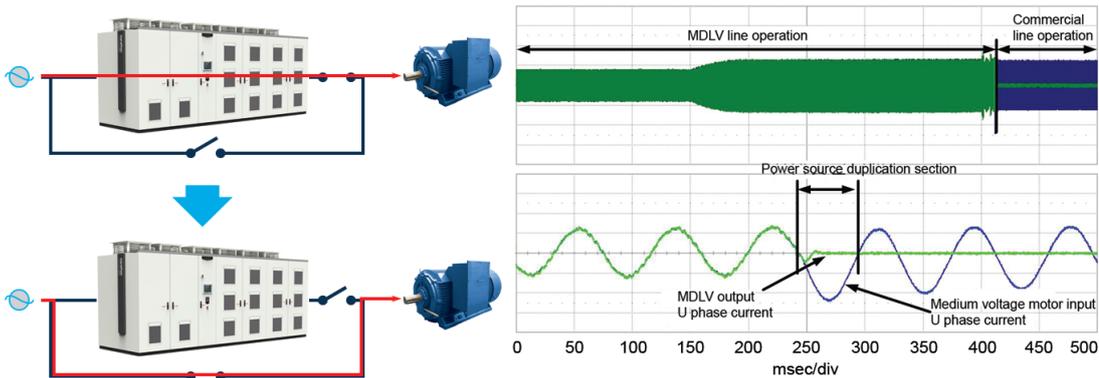


Auto-tuning

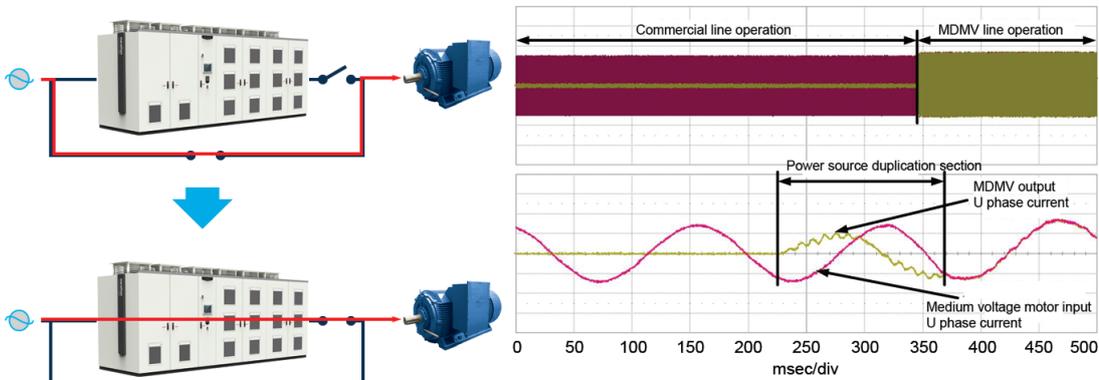
FUNCTION

SYNCHRONOUS TRANSFER FUNCTION

- Switching motor power from medium voltage drive to commercial power (bypass mode) or vice versa (drive mode).
- Synchronous transfer function performs synchronization of the phases of two power sources while motor is running, enabling power transfer and prevention of ensuing over-current.
- Short up / down transfer time
- Ensuring reliability with over-current



Inv mode --> Grid mode (Up)

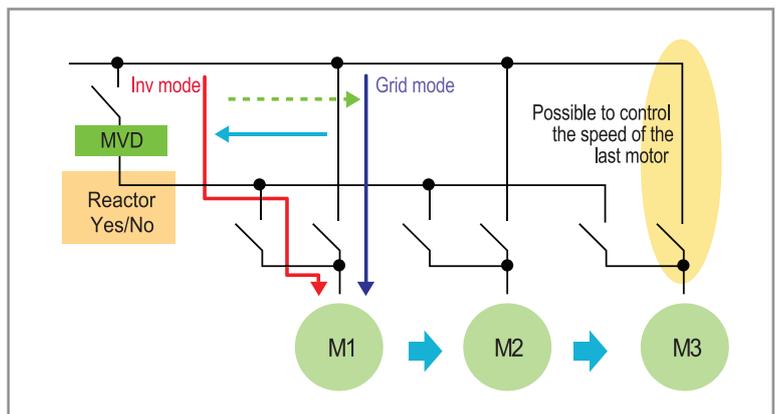


Grid mode --> Inv mode (Down)

MULTI MOTOR TRANSFER

Multi-motor synchronous transfer function allows users to start multiple (up to 3) MV motors sequentially in drive mode and control the last motor speed

1. Start M1 motor in Inv Mode and transfer it to Grid Mode
2. Start M2 motor in Inv Mode and transfer it to Grid Mode
3. Start M3 motor in Inv Mode to control speed



DESIGN

NEXT GENERATION MOTOR DRIVE SOLUTIONS ENABLING ENERGY SAVINGS IN VARIOUS INDUSTRIES

MULTI-WINDING PHASE-SHIFT TRANSFORMER

- Multi-winding phase-shift transformer (18 pulse for 3.3kV, 24 pulse for 4.16kV, 36 pulse for 6.6kV or 60 pulse for 10kV/11kV) is in place with taps for change in input voltage.
- Reducing power harmonics with multi-pulse filtering in compliance with IEEE standards.
- Eliminating need for harmonic filter and power factor improving condenser.

MASTER CONTROL MODULE

- Master control module to control multi-level PWM output voltage and fiber optic communication link (9 cells for 3.3kV, 12 cells for 4.16kV, 18 cells for 6.6kV, 60 cells for 10kV/11kV).
- User-centric HMI to support system diagnostics and monitoring.

CELL DRIVE MODULE

- Six low voltage single phase drives in series connection per phase, generating 25 level 3 phase output voltage (6.6kV model); designed to ensure easy cell maintenance.
- Each cell performs PWM switching in distributed control mode and has default built-in cell protection and bypass functions.

Multi-winding Phase-shift Transformer Module

Master Control Module

Cell Drive Module

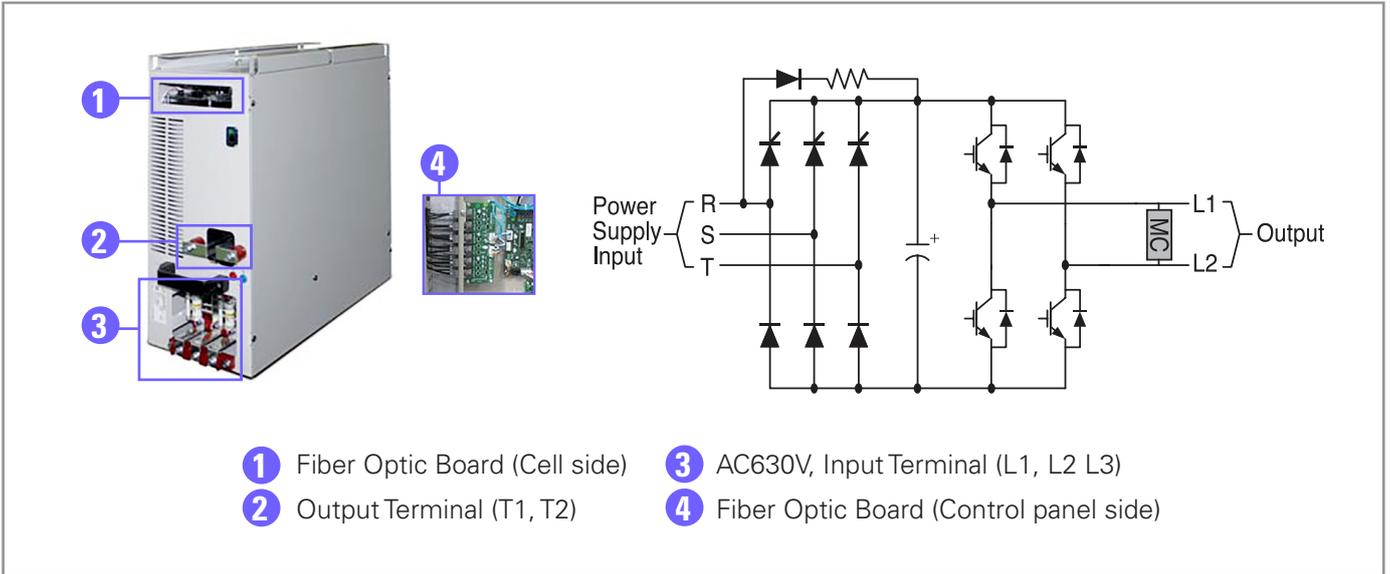
At 6.6kV



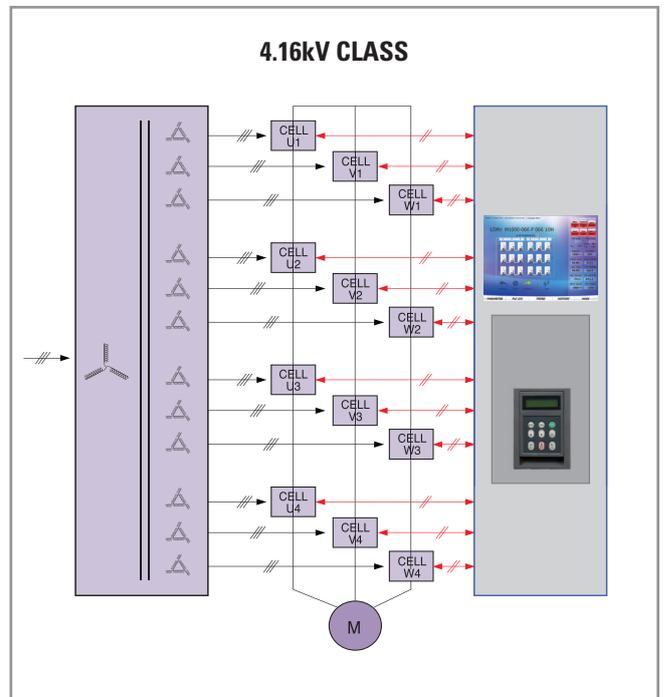
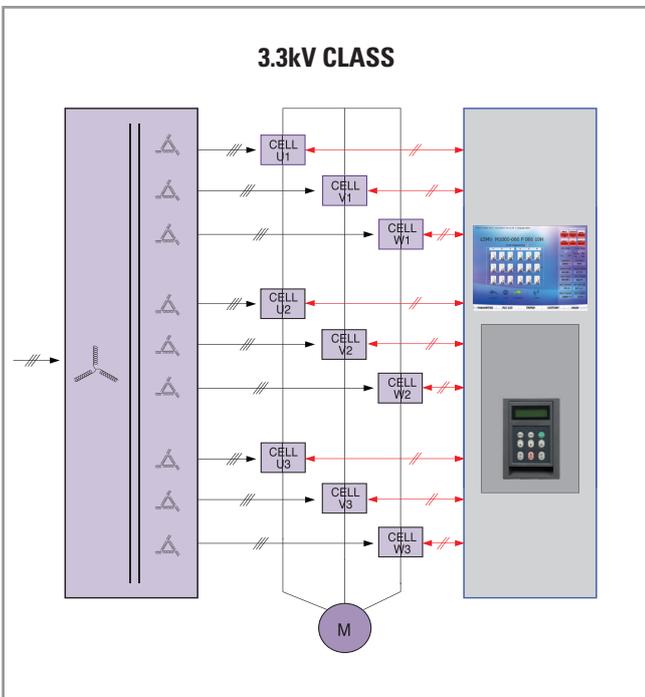
DESIGN

POWER CELL

- Cell specific keypad allows users to check individual cell details.
- Additional R/S/T and P/N check PIN allows for safe cell state monitoring.

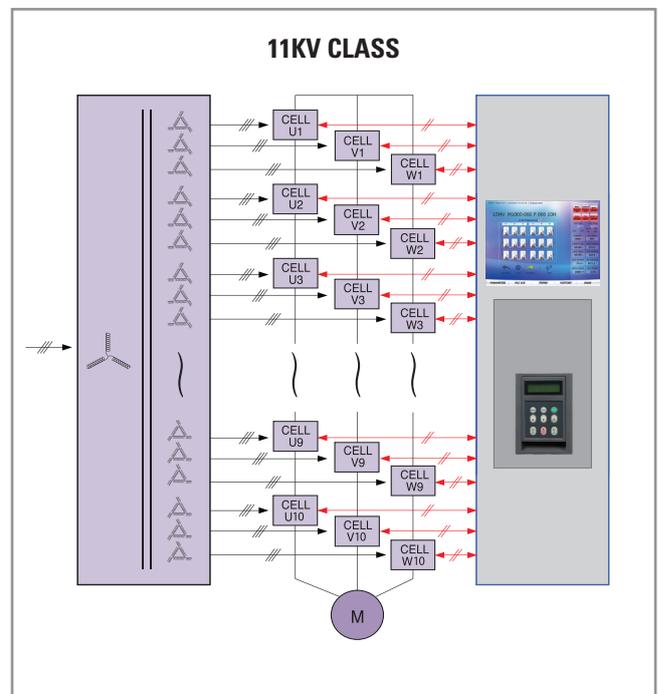
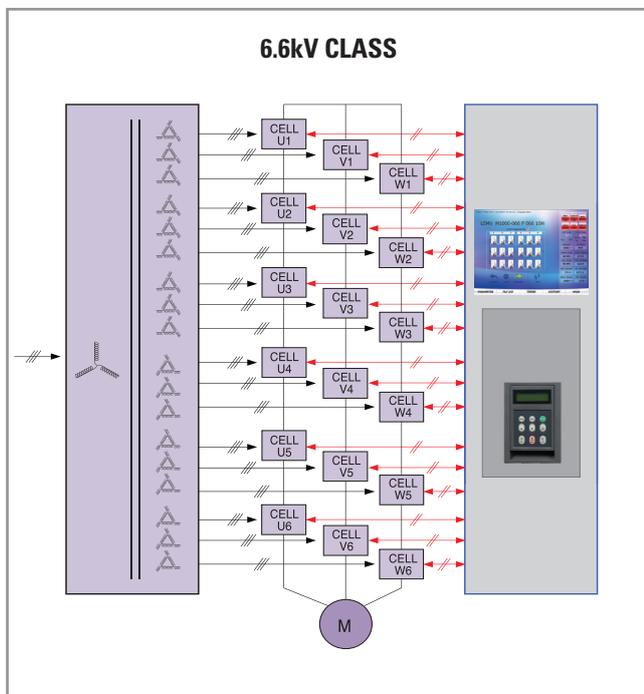
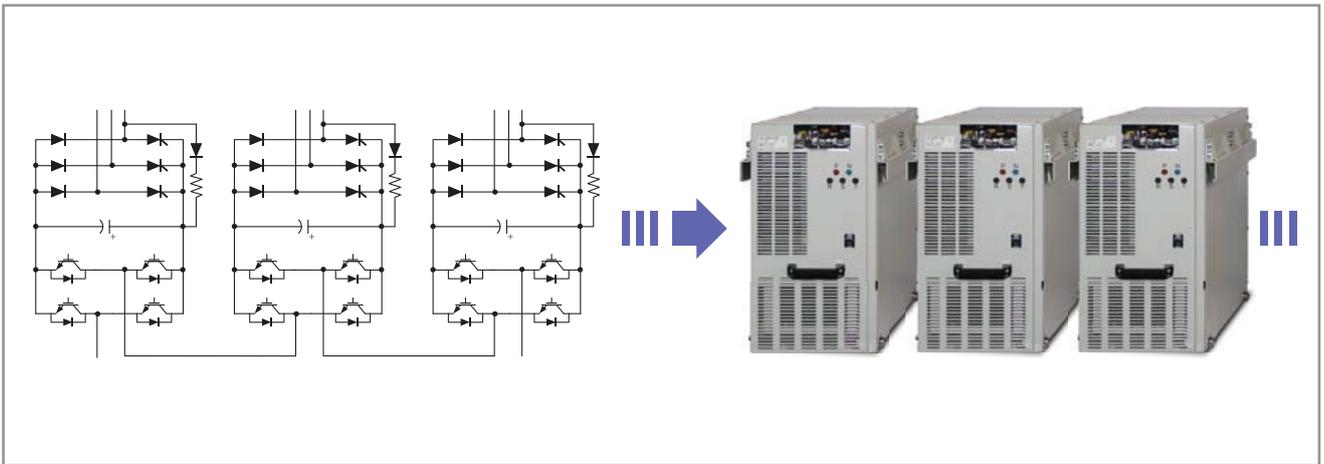


SYSTEM CIRCUIT DIAGRAM



CASCADED H-BRIDGE MULTI LEVEL DRIVE

- Adopting multi winding phase shift transformer lowers input THD (Eliminating the need for input filters).
- Multiple voltage steps allow lower output THD (Eliminating the need for output filters).
- Reducing common mode voltage and leakage current (Effective to extend motor service life).
- Enabling complete modularization of power module circuits.
- Modular design makes easy voltage increase.
- Continuous operation possible through individual power cell failure.
- Minimal impact of voltage reflection allows for longer cable distance between drive and motor.



SELECTION AND ORDERING DATA

USER CENTRIC CUSTOMIZED SOLUTIONS

With its proven reliability and perfect green energy solution, Marathon MV VSD fully satisfies the needs of each and every customer.



SELECTION AND ORDERING DATA

Item		Standard Rating													
3.3kV Class	MDMVMD□□□□-03□□_ _ _ _	200	300	400	500	600	750	10H	12H	15H	20H	25H	30H	37H	
	50/60Hz														
	Output Capacity (kVA)	200	300	400	500	600	750	1000	1200	1500	2000	2500	3000	3700	
	Rated Current (A)	35	53	70	88	105	131	175	218	260	350	438	525	657	
	Maximum Applicable Motor Capacity (kW) ¹⁾	160	240	320	400	480	600	800	960	1200	1600	2000	2400	2960	
4.16kV Class	MDMVMD□□□□-041□□_ _ _ _	250	380	500	630	750	950	12H	15H	19H	25H	31H	37H	47H	
	50/60Hz														
	Output Capacity (kVA)	250	380	500	630	750	950	1200	1500	1900	2500	3100	3700	4700	
	Rated Current (A)	35	53	70	88	105	131	175	218	260	350	438	525	657	
	Maximum Applicable Motor Capacity (kW) ¹⁾	200	304	400	504	600	760	960	1200	1520	2000	2480	2960	3760	
6.6kV Class	MDMVMD□□□□-06□□_ _ _ _	400	600	800	10H	12H	15H	20H	25H	30H	40H	50H	60H	75H	
	50/60Hz														
	Output Capacity (kVA)	400	600	800	1000	1200	1500	2000	2500	3000	4000	5000	6000	7500	
	Rated Current (A)	35	53	70	88	105	131	175	218	260	350	438	525	657	
	Maximum Applicable Motor Capacity (kW) ¹⁾	320	480	640	800	960	1200	1600	2000	2400	3200	4000	4800	6000	
10kV Class	MDMVMD□□□□-100□□_ _ _ _	600	900	12H	15H	18H	22H	30H	37H	45H	60H	75H	90H	11M	
	50/60Hz														
	Output Capacity (kVA)	600	900	1200	1500	1800	2200	3000	3700	4500	6000	7500	9000	11000	
	Rated Current (A)	35	53	70	88	105	131	175	218	260	350	438	525	657	
	Maximum Applicable Motor Capacity (kW) ¹⁾	480	720	960	1200	1440	1760	2400	2960	3600	4800	6000	7200	8800	
11kV Class	MDMVMD□□□□-110□□_ _ _ _	660	10H	13H	16H	20H	24H	33H	41H	49H	66H	83H	10M	13M	
	50/60Hz														
	Output Capacity (kVA)	660	1000	1300	1600	2000	2400	3300	4100	4900	6600	8300	10000	12500	
	Rated Current (A)	35	53	70	88	105	131	175	218	260	350	438	525	657	
	Maximum Applicable Motor Capacity (kW) ¹⁾	528	800	1040	1280	1600	1920	2640	3280	3920	5280	6640	8000	10000	
Power Factor		About 95% (at rated speed and load conditions)													
Efficiency		About 97% (at rated speed and load conditions)													
Input Current THD		Satisfies IEEE standard 519-1992													
Input	Main Circuit	3 phase 3 kV/3.3 kV/4.16 kV/6 kV/6.6 kV/10 kV/11 kV ±10%, 50/60 Hz ²⁾													
	Control Circuit	3 phase 220 V/380 V/440 V ±10%, 50/60 Hz ±5%													
Output	Rated Voltage	3 phase 3 kV/3.3 kV/4.16 kV/6 kV/6.6 kV/10 kV/11 kV Max. 37 level													
	Output Frequency	0 - 120 Hz													
Overload Capacity		60 seconds at 120% (at normal duty)													
Operation System Monitoring		12.1 inches HMI : XP80 (Standard)													
Signal in/ Output PLC		XGK input: 32 channels, output: 32 channels													
Protection Features		Over-current, Drive overload, Output cable earth fault, Electronic thermal, Output cable opening output cable open phase, Input overvoltage, Input under-voltage, Input cable open phase, Cell DC over-voltage, Cell overheating, Transformer overheating and etc.													
Communication Function		RS-485 built in Option : DeviceNet, Profibus, Modbus-RTU, Metasys N2													
Architecture	Protection	IP21(Standard)~IP42(option)													
	Cell Bypass	Built-in default (manual/auto bypass)													
Installation Environment	Cooling Mode	Air cooling													
	Ambient Temperature	0 - 40°C													
	Humidity	Max. 85% (No Condensation)													
	Altitude	1,000m or below													
	Installation	Installation: indoor ³⁾													
Input Transformer		Class H, air cooling, N/+5%/10% or -5%/N/+5%													

Notes: ¹⁾ Motor power factor 0.8.

²⁾ Please contact Regal for other voltage specifications.

³⁾ Install the HVAC system as well when installing the product herein.

OPTIONS

Type		Function
Local Drive	Additional Local Drive Box	RUN/STOP
		Input : Current / Voltage speed reference
		Monitoring(Meter) : Current, RPM
		Switch : Emergency stop
Communication Card	RS-485	
	Modbus RTU	
	Profibus	
	Device NET	
	Metasys N2	
PLC Function	Analogue Input	No. of input channels (max. 16 channels per slot)
		Voltage input (DC 1-5V, DC 0-5V, DC 0-10V, DC -10-10V)
		Current input (DC 4-20mA, DC 0-20mA)
		Select range (select in PLC program)
		Resolution (1/16,000)
	Analogue Output	No. of output channels (max. 8 channels per slot)
		Voltage output (DC 1-5V, DC 0-5V, DC 0-10V, DC -10-10V)
		Current output (DC 4-20mA, DC 0-20mA)
		Select range (select in PLC program)
		Resolution (1/16,000)
	Digital Input	No. of input channels (max. 16 channels per slot)
		Rated input voltage (DC 24V)
Rated input current (4mA)		
Common (Com) mode (16 points/1COM)		
	Insulation mode (photocoupler)	
Digital Output	No. of output channels (max. 16 channels per slot)	
	Rated input voltage (DC12/24, AC110/220V)	
	Rated input current (1 point: 2A, Common: 5A)	
	Common (Com) mode (16 points/1COM)	
	Insulation mode (relay)	
Thermoresistor Input	No. of input channels (max. 4 channels per slot)	
	Input sensor type (PT100, JPT100)	
	Input temperature range(PT100 : -200 - 850°C, JPT100 : -200 - 640°C)	
	Precision (room temperature [25°C] : ±0.2% within, full range [0-55°C] : ±0.3% within)	

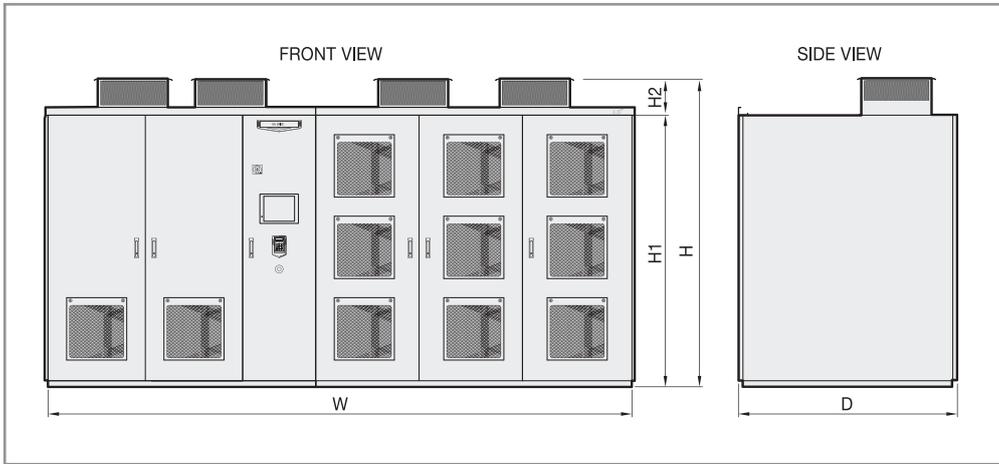
Notes: 1) Can select up to 4 options in among the following PLC options

Ex) 2 additional analogue inputs, 1 additional digital input, 1 additional thermoresistor input

2) As synchronous transfer function uses 2 PLC slots, reducing available options to 2, be sure to contact Regal if you need PLC extension base.

TECHNICAL DATA

SCHEMATIC DRAWING OF MDMV-MD1000



DIMENSIONS AND WEIGHT

Voltage [V]	Power Frequency [Hz]	Output Capacity [kVA]	Rated Current [A]	Product Model No.	Max. Applicable Motor Capacity [kW] ¹⁾	Panel Size [mm] ²⁾					Approximate Weight [kg]
						Width		Depth		Height	
						W	D	H	H1	H2	
3000	50/60	680	131	MDMVM1000-030□030750	544	3600	1800	2550	2250	300	4806
		900	175	MDMVM1000-030□03010H	720	3600	1800	2550	2250	300	5285
		1100	218	MDMVM1000-030□03012H	880	3600	1800	2550	2250	300	5670
		1360	260	MDMVM1000-030□03015H	1088	3600	1800	2550	2250	300	5933
		1810	350	MDMVM1000-030□03020H	1448	4400	1900	2650	2350	300	8073
		2270	438	MDMVM1000-030□03025H	1816	4400	1900	2650	2350	300	8747
		2720	525	MDMVM1000-030□03030H	2176	4700	2200	2950	2650	300	10644
		3360	657	MDMVM1000-030□03037H	2688	4700	2200	2950	2650	300	11568
3300	50/60	750	131	MDMVM1000-033□033750	600	3600	1800	2550	2250	300	4806
		1000	175	MDMVM1000-033□03310H	800	3600	1800	2550	2250	300	5285
		1200	218	MDMVM1000-033□03312H	960	3600	1800	2550	2250	300	5670
		1500	260	MDMVM1000-033□03315H	1200	3600	1800	2550	2250	300	5933
		2000	350	MDMVM1000-033□03320H	1600	4400	1900	2650	2350	300	8073
		2500	438	MDMVM1000-033□03325H	2000	4400	1900	2650	2350	300	8747
		3000	525	MDMVM1000-033□03330H	2400	4700	2200	2950	2650	300	10644
		3700	657	MDMVM1000-033□03337H	2960	4700	2200	2950	2650	300	11568

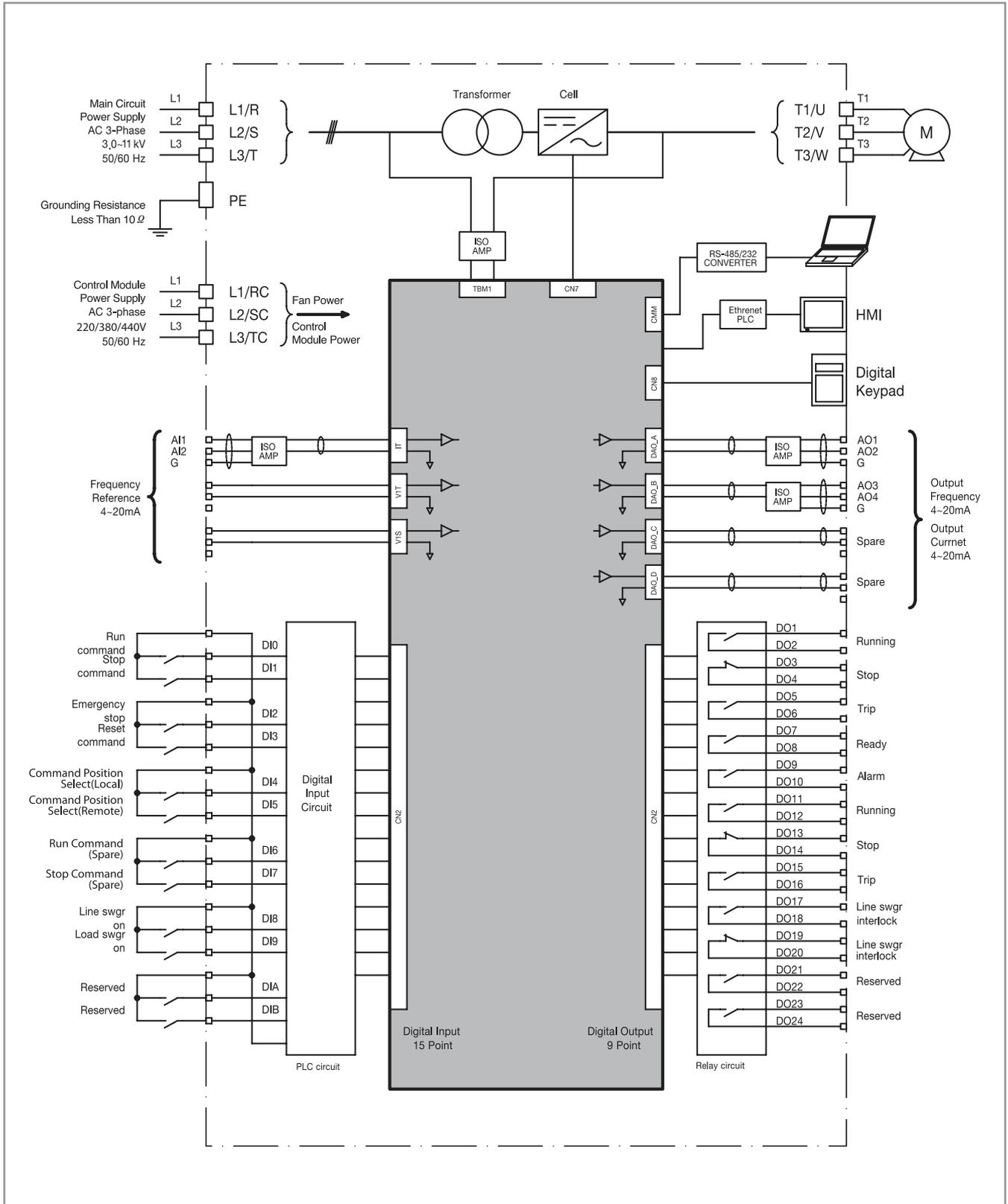
Voltage [V]	Power Frequency [Hz]	Output Capacity [kVA]	Rated Current [A]	Product Model No.	Max. Applicable Motor Capacity [kW] ¹⁾	Panel Size [mm] ²⁾					Approximate Weight [kg]
						Width		Depth		Height	
						W	D	H	H1	H2	
4160	50/60	950	131	MDMVM1000-041□041950	760	4000	1800	2550	2250	300	6051
		1200	175	MDMVM1000-041□04112H	960	4000	1800	2550	2250	300	6401
		1500	218	MDMVM1000-041□04115H	1200	4000	1800	2550	2250	300	6909
		1900	260	MDMVM1000-041□04119H	1520	4000	1800	2550	2250	300	7430
		2500	350	MDMVM1000-041□04125H	2000	5000	1900	2650	2350	300	9870
		3100	438	MDMVM1000-041□04131H	2480	5000	1900	2650	2350	300	10622
		3700	525	MDMVM1000-041□04137H	2960	5500	2200	2950	2650	300	12861
		4700	657	MDMVM1000-041□04147H	3760	5500	2200	2950	2650	300	14681
6000	50/60	1360	131	MDMVM1000-060□06015H	1088	4800	1900	2550	2250	300	7959
		1800	175	MDMVM1000-060□06020H	1440	4800	1900	2550	2250	300	8652
		2200	218	MDMVM1000-060□06025H	1760	4800	1900	2550	2250	300	9317
		2720	260	MDMVM1000-060□06030H	2176	4800	1900	2550	2250	300	10091
		3630	350	MDMVM1000-060□06040H	2904	6400	1900	2650	2350	300	13718
		4540	438	MDMVM1000-060□06050H	3632	6400	1900	2650	2350	300	15057
		5450	525	MDMVM1000-060□06060H	4360	6900	2200	3550	3250	300	18766
		6810	657	MDMVM1000-060□06075H	5448	6900	2200	3550	3250	300	21456
6600	50/60	1500	131	MDMVM1000-066□06615H	1200	4800	1900	2550	2250	300	7959
		2000	175	MDMVM1000-066□06620H	1600	4800	1900	2550	2250	300	8652
		2500	218	MDMVM1000-066□06625H	2000	4800	1900	2550	2250	300	9317
		3000	260	MDMVM1000-066□06630H	2400	4800	1900	2550	2250	300	10091
		4000	350	MDMVM1000-066□06640H	3200	6400	1900	2650	2350	300	13718
		5000	438	MDMVM1000-066□06650H	4000	6400	1900	2650	2350	300	15057
		6000	525	MDMVM1000-066□06660H	4800	6900	2200	3550	3250	300	18766
		7500	657	MDMVM1000-066□06675H	6000	6900	2200	3550	3250	300	21456
10000 / 11000	50/60	600	35	MDMVM1000-100□100600	480						
		900	53	MDMVM1000-100□100900	720						
		1200	70	MDMVM1000-100□10012H	960						
		1500	88	MDMVM1000-100□10015H	1200						
		1800	105	MDMVM1000-100□10018H	1440						
		2200	131	MDMVM1000-100□10022H	1760						
		3000	175	MDMVM1000-100□10030H	2400						Note ²⁾
		3700	218	MDMVM1000-100□10037H	2960						
		4500	260	MDMVM1000-100□10045H	3600						
		6000	350	MDMVM1000-100□10060H	4800						
		7500	438	MDMVM1000-100□10075H	6000						
9000	525	MDMVM1000-100□10090H	7200								
11000	657	MDMVM1000-100□10011M	8800								

Notes: ¹⁾ Motor power factor 0.8.

²⁾ Contact Regal for the dimension of 10kV/11kV class products.

TECHNICAL DATA

STANDARD CONNECTION DIAGRAM



CIRCUIT TERMINALS

Number	Application
L1(R)	Main circuit input voltage rating 3kV/3.3kV/4.16kV/6kV/6.6kV/10kV/11kV,±10%(TAP "0" in the),50/60Hz
L2(S)	
L3(T)	
U	Main circuit output voltage 3kV/3.3kV/4.16kV/6kV/6.6kV/10kV/11kV,0-120Hz
V	
W	
Ground	Grounding resistance:< Less than 10 Ω
L1(RC)	2 Phase, 220V Control power 3 Phase, 220V, 380V, 440V 50Hz or 60Hz (Voltage : ±10%, Frequency : ±5%,)
L2(SC)	
L3(TC)	

CONTROL CIRCUIT

Type	Terminal No.	Signal Name	Functional Description	Function
Analogue Input	A11	Freq Reference	Operating command input	User Selection (DC 0-10V or 4-20mA
	A12			
Analogue Output	A01	Output Speed	Feedback operating speed feedback	User Selection (DC 0-10V or 4-20mA) Spare 2 Signal
	A02			
	A03	Output Current	Feedback output current feedback	
	A04			
	A05	Output Speed	Reserve	
	A06	Output Current	Reserve	
	A07			
	A08			
Digital Input	DI0	Rst	Reset	FX/RX/RST/JOG/BX/Speed-L/ Speed-M/Speed-H/Speed-X/Xcel-L/ Xcel-M/Xcel-H/Up/Down/3-Wire/ Analog hold/Ana. Change/Xcel stop/Loc Rem / Door Open/Trans.OHW/Trans.OHT/ Motor OHT/Fan Trip/Ext Trip1/Ext Trip2/ Medium Voltage/Run Enable/ Control LV/PLC_Error/None
	DI1	Ext Trip	External failure	
	DI2	Fx	Normal direction operation	
	DI3	Rx	Reverse direction operation	
	DI4	Trans. OHT	Transformer overheating	
	DI5	Fan Trip	Fan failure	
	DI6	Medium Voltage	Apply input power	
	DI7	Run Enable	Operation possible	
	DI8	Control LV	Control power loss	
	DI9	Reserve	-	
	DI10	Reserve	-	
	DI11	Reserve	-	
	DI12	Reserve	-	
	DI13	Reserve	-	
DI14	BX	Emergency stop		
Digital Output	AXA1	Ready	Control power read	None/FDT-1/FDT-2/FDT-3/FDT-4/FDT-5/OL/IOL/Stall/OV/LV/OH/Lost Command/Run/Stop/Steady/Speed Search/Ready/Warning/FAN RUN/NORMAL/OCT/Cell_ByPass/RUN_MV
	AXA2	FAN RUN	Fan operation command	
	AXA3	RUN	MVD in operation	
	AXA4	Warning	MVD warning	
	AXA5	Reserve	-	
	AXA6	Reserve	-	
	AXA7	Reserve	-	
	AXA8	Reserve	-	
30ACB	TRIP	MVD failure		

TECHNICAL DATA

PROTECTIVE FUNCTION - INDIVIDUAL CELL PRODUCTION FUNCTION

Protection Function	Description
Over Current	It occurs when cell output current is at or over a standard level.
Over Voltage	If the main circuit DC voltage rises over a standard level due to regenerative energy from motor braking or generation load or power system voltage surges and over voltage trip occurs, it cuts off power to drive and stop free run.
Arm Short	It occurs when the IGBT arm or output short circuits. Drive output is cut off and free run stopped in case of arm short circuit.
Communication Error	It occurs if there is a communication problem between the cell and master.
Cell Overheat	It occurs if the internal heatsink's cell temperature rises over a standard level.
NTC Open	It occurs when cell's internal temperature sensor fails and there is a problem in temperature measurement.
Low Voltage	It occurs when the main circuit DC voltage falls below a standard level.

SYSTEM PROTECTION FUNCTION

Protection Function	Description
Over Current	If the output current of MV drive reaches 140% or more of rated current, output is cut off and free run stopped.
Over Load	If the output current of the MV drive reaches 120% or more of the rated current and stays at that level for 1 minute or longer, output is cut off and free run stopped.
Ground Fault	If phase imbalance of output current occurs at or above a standard level following a grounding fault of the output cable of MV drive, output is cut off and free run stopped.
Motor Over Load	If the MV drive output current exceeds OL level and the OL time set for the rated motor current, output is cut off and free run stopped.
E-thermal	If the motor is deemed to be overheated at or above a standard level based on the theoretical calculation of motor temperature rise (based on MV drive output frequency and output current), output is cut off and free run stopped.
Low Current (No Motor Trip)	It occurs when it is deemed that the motor connection is broken due to switch gear failure on the output side while the MV drive is operating or starting, output is cut off and free run stopped.
Output Phase Open	It is a function to protect the MV drive from open phase of the output cable during operation.
Input Phase Open	It is a function to protect the MV drive from open phase of the input cable during operation.
Input Over Voltage	It occurs when the main transformer input voltage reaches 120% or more of the MV drive rated voltage and cuts off output.
Input Low Voltage	It occurs when the main transformer input voltage reaches 70% or less of the MV drive rated voltage and cuts off output.
DC Over Voltage	If DC voltage of any of the cells used in the MV drive exceeds 1050V, output is cut off.
Cell Overheat	If any of the cells reaches 75°C or more, it is regarded as failure and output is cut off.
Trans Overheat	If the main transformer temperature reaches 120°C or more, failure is detected through the multi-function digital input.
BX	It is a fault used for the MV drive emergency stop. Power is cut off at user's decision when an emergency occurs and signal is received through switch or external signal link.
Motor Overheat	If trip signal of motor temperature sensor is received through digital input, output is cut off.
Fan Error	If a fan installed on the top to cool the MV drive fails and signal is received through the digital input, output is cutoff.
Ext Trip 1, Ext Trip 2	Contacts can be configured as faults in accordance with fault stop and sequence setup configured by users to handle specific events other than tripping.
Control Low Voltage	It occurs when power is not supplied following a problem in the MV drive control power and output is cutoff.
PLC Error	If a problem occurs in the PLC installed within the MV drive and PLC failure contact is received from the digital input, output is cutoff.
Can Error	It is a protection function that activates if there is a communication problem between the MV drive controller and cell. It is interlinked with the cell bypass operation as configured.
Cell Trip	It is a protection function that allows the master to trip cells where faults have occurred.

INSTALLATION

INSTALLATION ENVIRONMENT

M-series products should be installed in an environment where the following conditions are met:

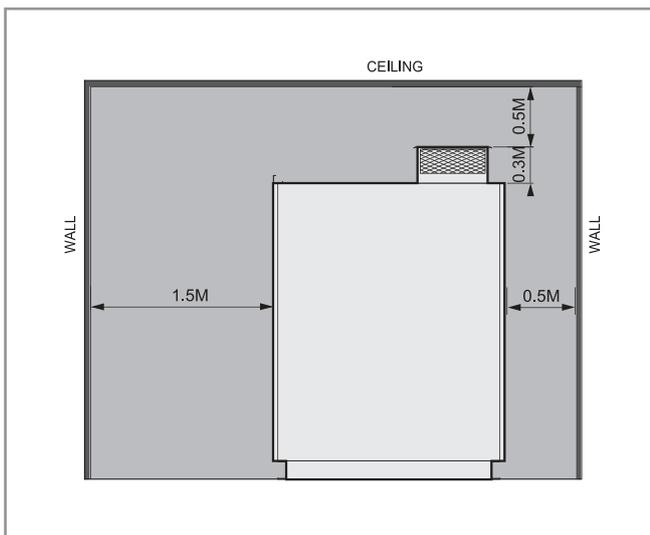
- Ambient temperature : 0 - 40°C
- Ambient humidity : 85% or less (no dew formation)
- No water dropping from above
- No direct exposure to dust
- No existence of corrosive liquid or gas
- Absence of excessive vibration

Space equal to the product footprint should be secured in advance in reference to applicable drawing when product is to be installed.

SPECIFICATIONS

Sufficient space should be secured to cool down the product during the operation and facilitate maintenance.

MDMV-MD1000



AMBIENT TEMPERATURE

This product should be installed at a location not exposed to severe environment changes in order to maintain product reliability. Temperature around the product and air allowed into the MDMV should be maintained at 40°... or below. When the product is installed in a confined place, an additional cooling fan or air conditioner should be installed to keep the room temperature at or below 40°.

BLOCKING OF FOREIGN MATERIALS

Particular care should be taken to keep foreign materials such as dust or metal debris from finding their way into product while it is being installed. Extra care should be taken to keep foreign materials from contaminating the transformer enclosure. Do not leave installation tools or unused parts inside the panel after installation.

MAINTENANCE

ROUTINE MONITORING & CHECKS

To prevent advance failure of the MV drive and ensure operational reliability over an extended period of time, check the product as described in the following table. Routine checks include a daily check that can be performed during operation (Table 1) and regular checks that are performed when power is isolated and operation has stopped (Table 2).

When performing a regular check, make sure that the keypad at the front of a cell is completely turned off to prevent damage from electric shocks.

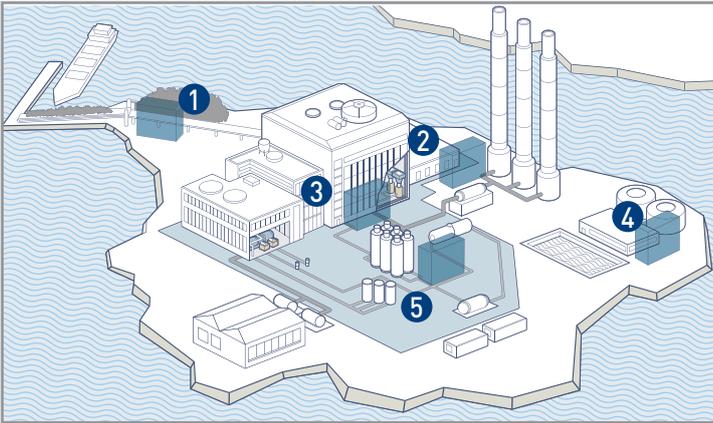
ROUTINE CHECK LIST - TABLE 1

Check Location	Check Items	Check Description
System	Ambient Temperature	Check ambient temperature, humidity, dust, hazardous gas, oil leak, and the like.
	System in General	Check abnormal vibration and noise
	Power Voltage	Check if the main circuit voltage and control voltage are normal
Main circuit	Transformer	Check for abnormal odor, sound, and noise
Cooling System	Cooling Fan	Check for abnormal vibration and noise
		Check and clean air filter
Display	Instrument	Check measurement accuracy and indicator reading

ROUTINE ANNUAL CHECKS - TABLE 2

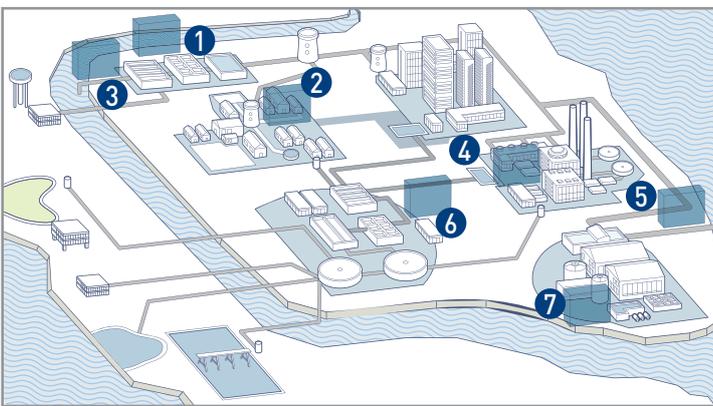
Check Location	Check Items	Check Description
Main Circuit	Transformer, Power Supply, Cell Panel	Check the insulation between the main circuit terminal and ground and between terminals with the insulation resistance meter
		Check if any screw, bolt, or connector is loose
		Check if any part is overheating
		Clean the inside of the panel
	Cable	Check for cable shield damage, deterioration
	Transformer	Check if the primary side voltage and secondary side voltage are normal
	Cell	Check for smoothing capacitor leaks
		Check if the smoothing capacitor is swollen
		Measure and check smoothing capacitor capacitance
		Check if any screw or bolt is loose
Check if normal circuit and control circuit fuses are normal		
Control Circuit	Operation	Clean dust built up inside product and heat sink
		Check if the protection circuit and indicator circuit operate as intended
	Relay	Check if the product operates as intended
		Check if the timer operates as intended
		Check if there is any damage to the contact.
	Board	Check for abnormal odor and discoloring
		Check power supply voltage
Cooling System	Cooling Fan	Check for abnormal vibration and noise
		Check operating direction

APPLICATION SECTORS



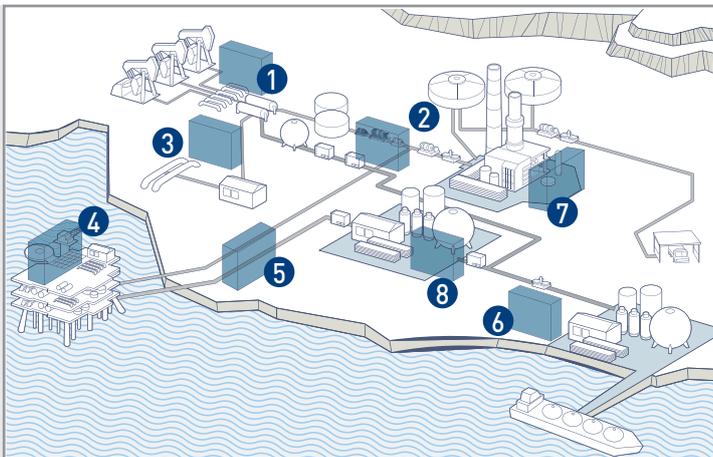
POWER GENERATION

- 1** • Coal Conveyors
• Coal Mill
- 2** • Induced Draft Fan
• Forced Draft Fan
- 3** • Primary Air Fan
• Secondary Air Fan
• Gas Recirculation Fan
- 4** • Sea Water Lifting Pump
- 5** • Circulating Water Pump
• Boiler Feed Pump
• Condensate Extraction Pump
• Cooling Water Pump



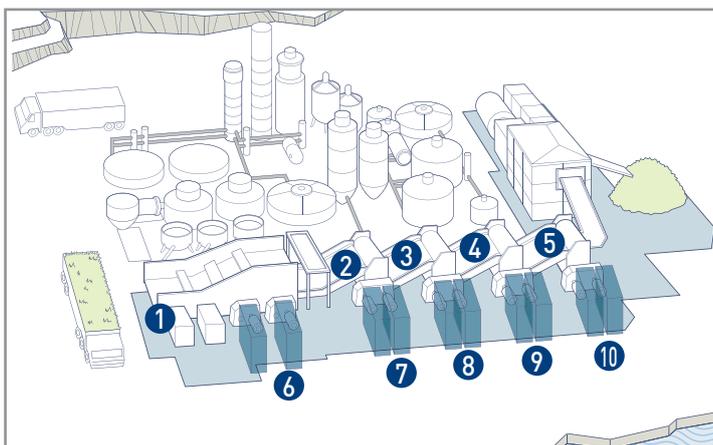
WATER TREATMENT

- 1** • Transfer Pump
• Distribution Pump
• Booster Pump
- 2** • Distribution Pump
• Booster Pump
- 3** • Raw Water Intake Pump
- 4** • Process Feed-Water Pump
• District Heating Pump
• Cooling Water Pump
• Slurry Pump
- 5** • Feed-Water Pump
- 6** • Influent and Effluent Pump
• Treatment Pump/Fan
- 7** • Intake Pump
• Brine Pump
• Booster Pump
• High Pressure Pump



OIL-GAS & CHEMICAL

- 1** • Loading Pump
• Injection Pump
- 2** • Compressor
- 3** • Injection Pump
- 4** • Loading Pump
- 5** • Delivery Pump
- 6** • Loading Pump
- 7** • Compressor
• Injection Pump
• Boosting Pump
• Loading Pump
- 8** • Compressor
• Injection Pump
• IDF
• FDF



SUGAR MILL

- 1** • Cane Knife
- 2** • Pressure Feed
- 3** • Pressure Feed
- 4** • Pressure Feed
- 5** • Pressure Feed
- 6** • Cane Shredder
- 7** • Mill
- 8** • Mill
- 9** • Mill
- 10** • Mill

QUOTATION SPECIFICATIONS

Form for quotation

1 Name of Application

2 Type of Load Pump Fan Blower Compressor Others

3 Torque Characteristics Variable Torque Proportional Torque Constant Torque Constant Output J(GD²/4) kg.m²

4 Operation Conditions Motor Current _____ A, Annual Operation Time _____ hours

5 Motor Specifications Squirrel Cage Induction Motor Wound Rotor Type Motor
 Existing New
 Output _____ kW, Voltage _____ V, Frequency _____ Hz, Number of Poles _____
 Speed _____ min, Rated Current _____ A, Efficiency _____ %, Power Factor _____ %

6 Speed Control Range Minimum _____ /min to Maximum _____ /min or Minimum _____ /Hz to Maximum _____ /Hz

7 Acceleration / Deceleration Time Setting
 Acceleration Time _____ Second(s)/ _____ min
 Deceleration Time _____ Second(s)/ _____ min

8 Overload Capacity _____ % / _____ Second(s)

9 By Pass Operation Circuit Required < Automatic Manual >

10 Power Supply Specifications
 Main Circuit Voltage _____ V, _____ Hz
 Control Circuit Voltage 220V 3P 380V 3P 440V 3P Others _____ V 3P

11 Ambient Conditions
 Indoors
 Ambient Temperature _____ °C, Humidity _____ % or less
 Air Conditioned Facility (Provided Not Provided)
 Install Space (Width _____ mm Height _____ mm Depth _____ mm)
 Cable Entry (Bottom Top)

12 Options

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APPLICATION CONSIDERATIONS

The proper selection and application of motors, motor control and components, including the related area of product safety, is the responsibility of the customer. Operating and performance requirements and potential associated issues will vary appreciably depending upon the use and application of such products and components. The scope of the technical and application information included in this publication is necessarily limited. Unusual operating environments and conditions, lubrication requirements, loading supports, and other factors can materially affect the application and operating results of the products and components and the customer should carefully review its requirements. Any technical advice or review furnished by Regal Beloit Australia Pty Ltd and its affiliates with respect to the use of products and components is given in good faith and without charge, and Regal assumes no obligation or liability for the advice given, or results obtained, all such advice and review being given and accepted at customer's risk.

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