TECO ELECTRIC & MACHINERY CO., LTD.

10F, No. 3-1, Yuan Cyu St., Nan-Kang District, Taipei 115, Taiwan

TEL : 886-2-6615-9111Ext. 1763 FAX : 886-2-6616-2518

http://www.teco.com.tw/fa/product.htm

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TECO

MV510

Medium Voltage Drive

TECO Electric and Machinery Co., Ltd, founded in 1956, has successfully diversified into a conglomerate with worldwide business operations covering five continents and become the world's third largest manufacturer of industrial motor. In 1995, as a role from investor supplier to owner/ supplier with the acquisition of all Westinghouse Electric Corporation shares in the joint venture, TECO established TECO-Westinghouse Motor Company (TWMC) to strengthen the core business competitiveness and global brand leadership.

Not satisfied with producing motors, TECO is also committed to motor drives manufacturing for more than 20 years on applications of industrial automation, industrial machinery, air-conditioning system of buildings, energy-saving projects, and wastewater treatment, etc.

Today, TECO is launching the new product of medium & high voltage motor drives, MV510, in compliance with the world's main specifications to promote energy-saving and environment-protecting ideas.

CONTENTS

Product Features

High Quality Power Input

By phase shifting of the secondary winding and multi-pulse diode rectifier, isolated powers can be acquired and supplied for power cells. (30(36) pulses for 6.6kV, 48(54) pulses for 11kV) By using the technique of multi-pulse rectifier, the harmonic current could be eliminated greatly.

10kV 1250kW test data (input current)

Order	5	7	11	13	17	19	23	25	29	31	THD
IEEE519	4.0	4.0	2.0	2.0	1.5	1.5	0.6	0.6	0.6	0.6	5
Harmonics(%)	0.34	0.72	0.32	0.12	0.13	0.09	0.04	0.02	0.02	0.01	1.59

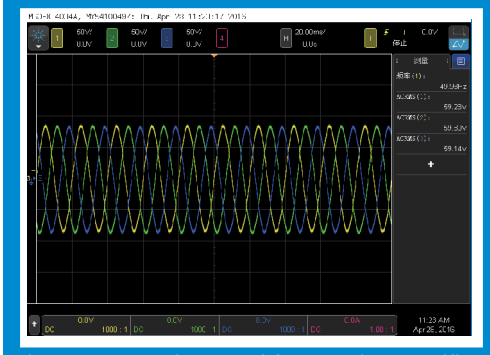


Fig.1. Input voltage with 48-pulse rectifier

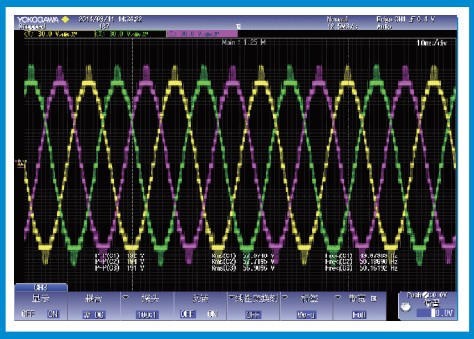


Fig.2. 33-level output line-voltage

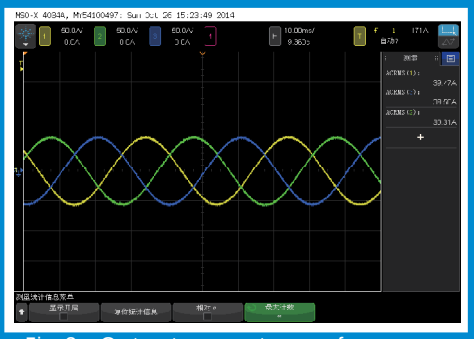


Fig.3. Output current waveform

The Features of Nearly Perfect Power Output

The technique of multi level & cascade applied in MV510 general medium voltage drive greatly eliminates the output harmonic content. The output waveform is almost a perfect sine waveform(see Figure 2 and Figure 3). Compared with other high voltage and high power MVDs, it has the following advantages:

- No need of extra output filtering device
- Directly driving the general high voltage synchronous or asynchronous motor, and the temperature of the motor will not be increased
- No need of motor derating operation
- No dv/dt damage to insulation of motor and cable
- No torque ripple induced by harmonics, and the service life of motors and mechanism devices can be extended
- No cable length limited when voltage drop is in the allowable range

The simple configuration for driving standard high voltage motors directly realizes highly efficient operation with minimal loss due to no input voltage transformers.

In Compliance with stringent international standards

The power supply input and output of MV510 general medium voltage drive meet the most stringent IEEE 519-1992 and GB/T14549-1993, no need of independent input filter; the cost for harmonic elimination is saved for customers. Because of the high power factor of the system, the compensation device for power factor is not needed, thus the reactive input and the input capacity are reduced, and the cost for capacity increasing of power network is minimized.

HMI with Powerful Function :

- Systematic Control on Touch Panel (Fig.4)
- Monitor & Control for Temperature & Status of Power Cell Unit(Fig.5)
- Monitor & Control for Operational Status (Fig.4)
- Operation Function Test by Using Low Voltage(Fig.6)
- Recordable 10 trips
- Password setting
- Remote Control
- Emergency Stop

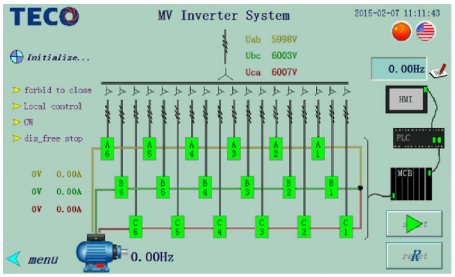


Fig.4

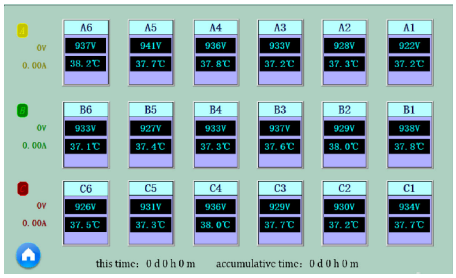


Fig.5

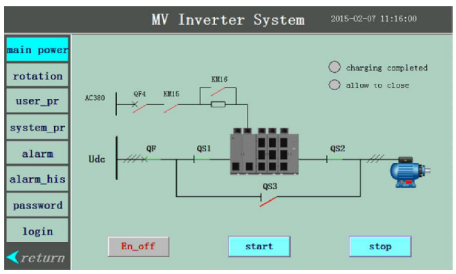


Fig.6

Flexible and easy installation :

To meet customers' request, MV510 can provide any possible entries and exits on top, bottom or both for installation.

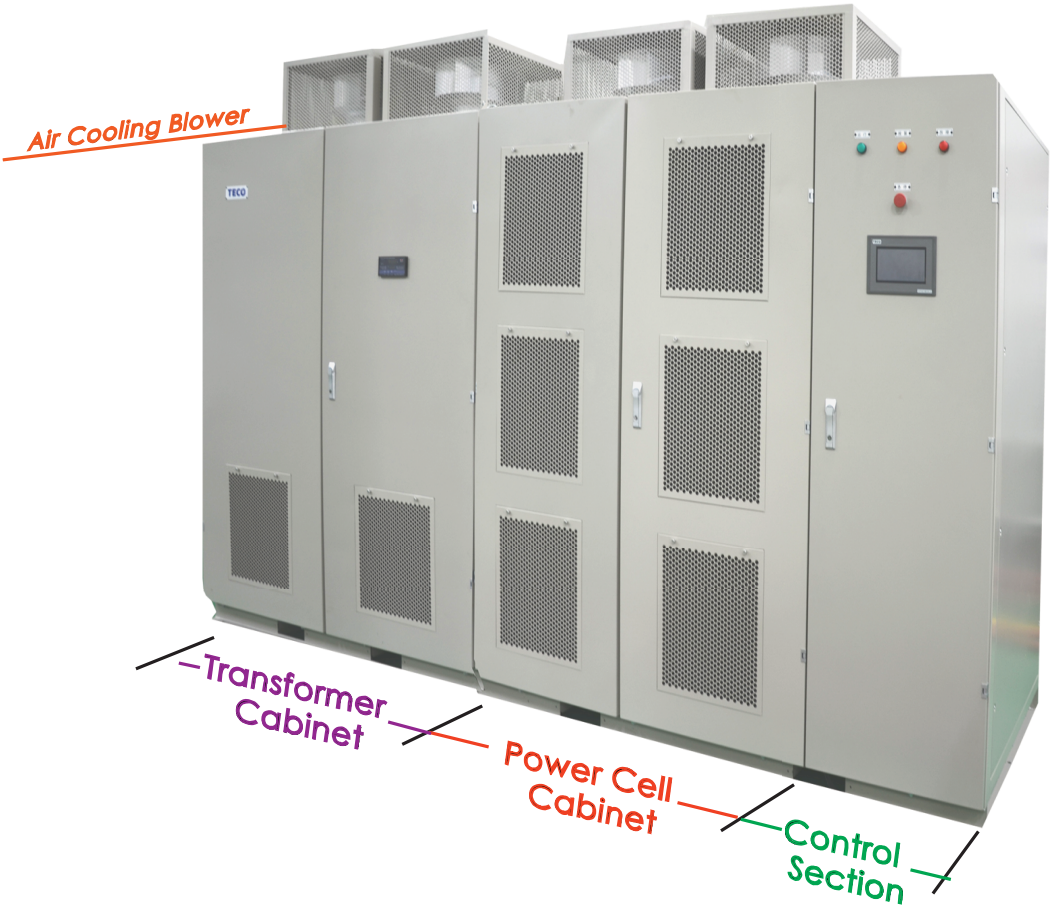
Excellent serviceability :

Due to modular design of power cell, it's quite convinent to replac power cell for repairing. Moreover, only few spare parts are necessary. The power cells are universal to be used in MV510 with same current rating regardless of voltage classes.

Besides the above advantages, the MV510 general medium voltage drive has the following functions and features :

- Protection of overload and over-current
- Protection of open-phase and grounding
- Protection of over-voltage
- Overheat protection
- Current limited function
- Interlock protection of control power supply
- Two sets of control power for redundancy
- Power cell by-pass function (optional)
- Cabinet door opening alarm function
- Lock-phase function
- Synchronizing switch function between variable frequency and work frequency
- Soft start of motors, no impact to mechanical equipment and network
- High effiency: greater than 98% MVD efficiency under rated work condition
- Power cell communicate with controller through optic fiber, completely electric isolated
- Built-in PID regulator to realize the closed-loop control.
- Multiple communication methods with host computer, isolated RS485 interface, standard MODBUS
- RTU communication protocol, PROFIBUS DP (optional), industrial Ethernet communication protocol (optional)
- Accurately fault records to inquire information and locate fault
- Compact construction, reasonable layout (can do customer-design)
- AVR(automatic voltage regulation)
- Flying start funtion

Product Structure



Transformer Cabinet

Isolated Transformer: Suppling indepent phase-shift power for power cells from secondary multi-winding greatly improve the current waveform of side network, and reduce the harmonic pollution of the grid network.

Cooling Blower of Transformer : Depending on different power to configure corresponding dry-type transformer cooling blower on the top of the cabinet.

Power Cell Cabinet

Control Section

Controller : Space vector PWM control, collecting and dealing with signals by fiber optic cable to communicate with power cells, completely electric isolated.

Power Cell : Modular design which allows easy interchange and maintenance.

I/O Board : dealing with system digitals and analog signals, meets requirements from different application fields.

Monitor : Chinese/English LCD display, which can be used for parameter setting, running record, fault storage communication, and by using DSP as control chip etc. No hard disk, easy for operation.

By-pass Cabinet or Switching Cabinet (optional)

Isolated knife-switch, vacuum contactor, vacuum breaker or other assembled modes can be chosen according to users' working conditions. The function of by-pass cabinet is to put the motor into grid network running to ensure the continuity of production after the MV VFD finishes start-up; the function of switch cabinet is to switch the MV VFD output to different motors.

System Cooling Blower

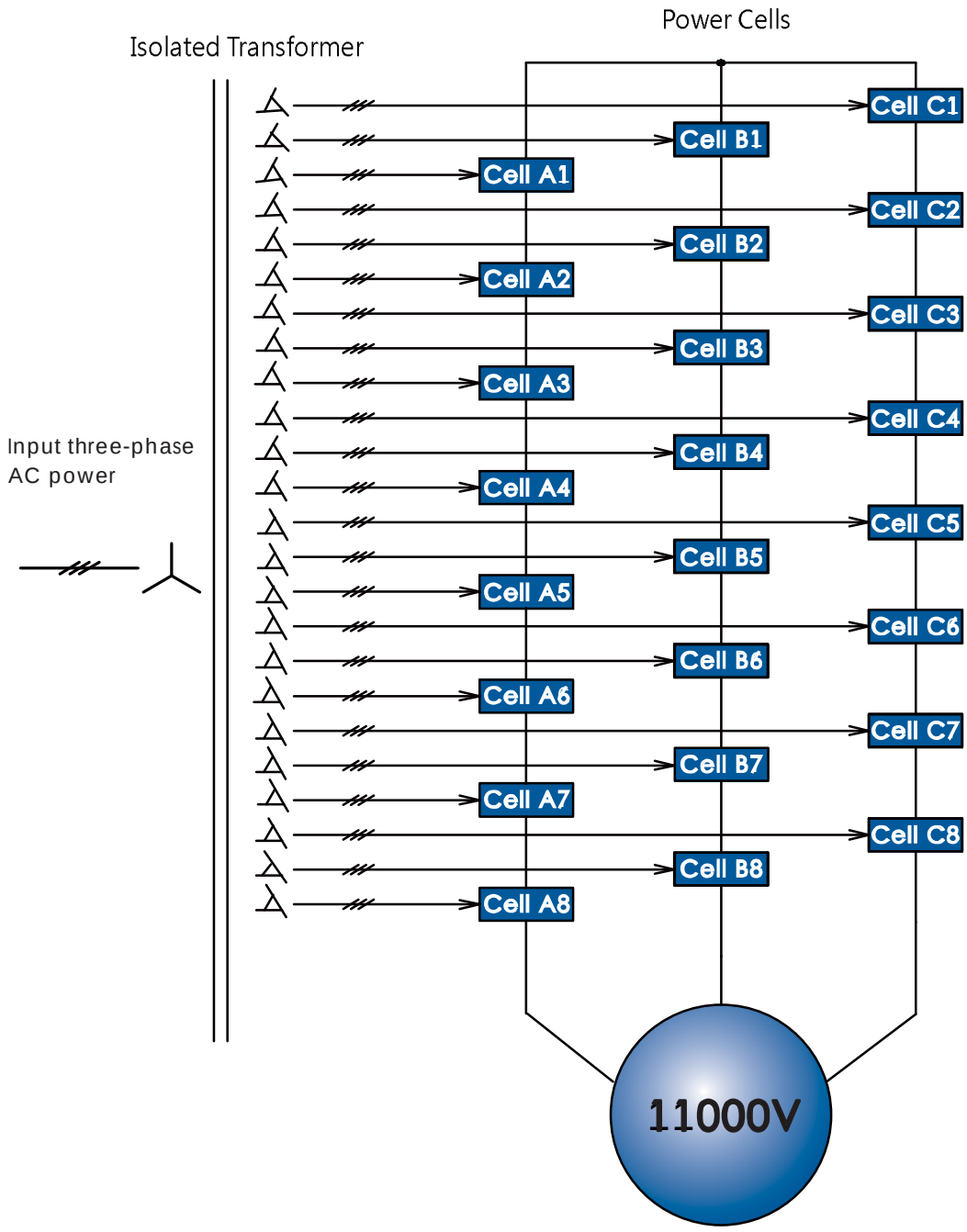
Using German EBM blower or same level product, big air volume and long lifetime.

Theory

MV510 MVD adopts AC-DC-AC mode, the main circuit switch component is IGBT. MV510 MVD adopts power cells in series and overlapping method, takes full advantages of the mature technology, thus has high reliability.

Main Circuit Topology Diagram

3.3kV series: 9 power cells, 3 cells each phase, Y connected.
4.16kV series:12 power cells, 4 cells each phase, Y connected.
6.6kV series:15（18）power cells, 5（6）cells each phase, Y connected.
11kV series: 24 power cells, 8（9） cells each phase, Y connected.



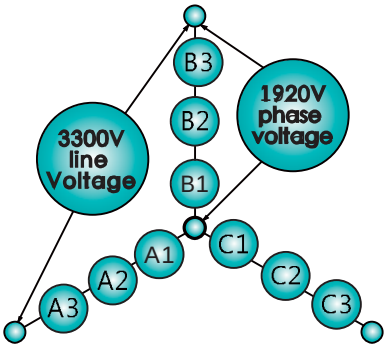
Voltage Overlapping Diagram

MV510 MVD has several power cells connected in series in each phase. The transformer secondary windings provide isolated phase-shifted power to power cell. For example, 3.3kV MVD has 3 power connected in series cells. Changing the power cells number in each phase can get different phase voltage, the phase voltage can output 1920V (the line-voltage is 3.3kV); 6.6kV MVD has 5 (6) power cells in each phase, the phase voltage can output 3810V (the line-voltage is 6.6kV); 11kV MVD has 8 (9) power cells in each phase,the phase can output 6350V(the line-voltage is 11kV).

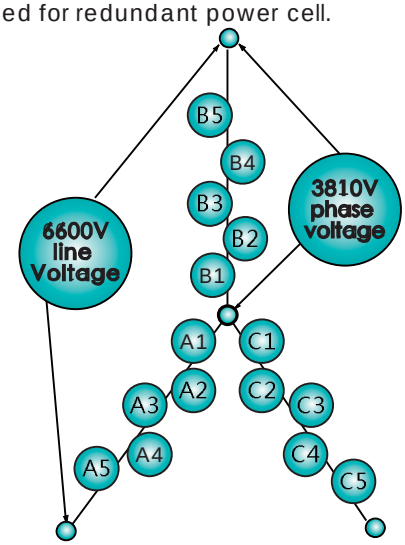
MV VFD Series	Power Cells	Pulse Number	Output Phase Voltage (V)	Output Line Voltage (kV)	Voltage Level In Each Phase(No)
3.3kV	9	18	1920	3.3	7
4.16kV	12	24	2400	4.16	9
6.6kV	15(18)	30(36)	3810	6.6	11(13)
11kV	24(27)	48(54)	6350	11	17(19)

Remark:

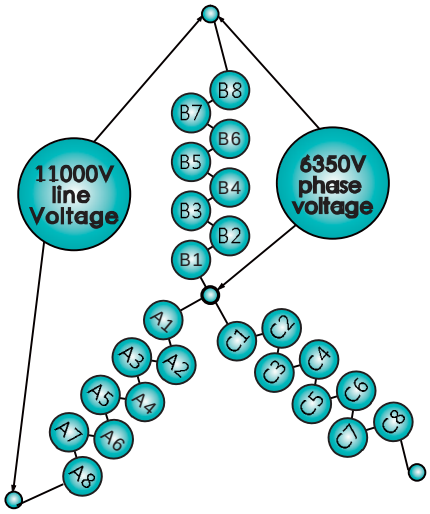
( ),which is optional,is designed for redundant power cell.



take 3 cells for example



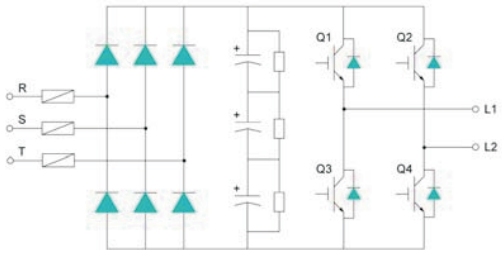
take 5 cells for example



take 8 cells for example

Power Cell Structure Diagram

The power cell has AC-DC-AC stucture, equivalent to a three-phase input, single phase output LV voltage source MVD. All the cells have the same electrical and mechanical parameters, easy for maintenance and replacement.



The power cell receives the signals through the fiber optic cable, and adopts the space vector PWM control method to turn on or turn off IGBT Q1~Q4 to generate single phase PWM waveform. Each cell only has three possible output voltage statuses. When Q1 conducts together with Q4, the output voltage status of L1 and L2 is 1; when Q2 conducts together with Q3, the output voltage status of L1 and L2 is -1;when Q1 conducts together with Q2 or Q3 conducts together with Q4, the status of L1 and L2 is 0.

Application

Achievement of ideal operation patterns

- Because the airflow (flow rate) is controlled directly by the drive output frequency, with none of the pressure loss by dampers (valves), the ideal operation pattern can be achieved easily.
- The machine can be started and stopped frequently.
- With speed search function, operation can be smoothly restarted even when fans are coasting.
- Minimum frequency setting function prevents pumps from failing to supply, meaning that stable supply can be maintained.

Energy-saving operation

- Switching operation from conventional damper (valve) control using a commercial power supply to frequency control with MV510 MVD saves a large amount of energy.
- Even bigger energy savings are possible with machines with standby operation (under normal duty conditions).

Energy Saving by Speed Control

The shaft power of wind and hydraulic machines such as fans, blowers, and pumps is proportional to the cube of the rotational speed.
Since drives maintain high efficiency even at low speed, a significant energy saving can be expected by using drives for wind and hydraulic machines while operating them at lower speeds.

Example: Calculation Formula for Energy Saving Effects with Fans and Blowers

Power Consumption with Damper Control

$$P_d\,(kW) = \frac{P_0}{\eta_{f0}\,\eta_{m0}}$$

P_0 : Motor rated power
η_{f0} : Fan rated efficiency
η_{m0} : Motor rated efficiency

Power Consumption with Drive Control

$$P_i\,(kW) = \frac{\left(\frac{Q}{Q_0}\right)^3}{\eta_f\,\eta_m\,\eta_i}\,P_0$$

Q/Q_0 : Ratio of air flow to fan rating
P_0 : Motor rated power
η_f : Fan efficiency
η_m : Motor efficiency
: Drive efficiency

Extended machine life

- The machine runs at low speed during no-load operation, helping to prolong its life.
- Machine life can be further extended by operation methods that minimized impact on the machine by using MV510 to attain soft starting and soft stopping.

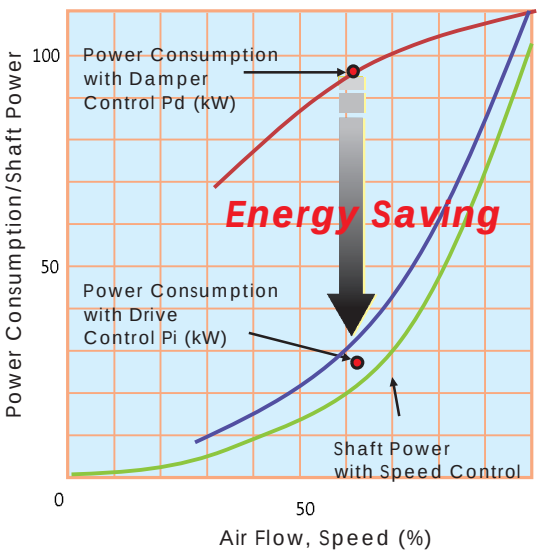
Stable operation

- Because the airflow (flow rate) is controlled directly by the drive output frequency, with none of the pressure loss by dampers (valves), the ideal operation pattern can be achieved easily.

Reduced power supply capacity

- With MV510 the accel/decel time can be set as required, and the starting current can be cut substantially. This means that power supply capacity can be reduced.

Power Consumption Characteristic Curve



MV510 general MVD has runned successfully at different industries in worldwide. It can provide perfect control solutions for users' high voltage AC (synchronous/induction) motors to realize soft start, speed regulation, energy saving and intelligent control.

Application Industries and Fields :

Thermal Power, Hydropower, Garbage Power

•Force Draft Fan •Slurry Pump •Primary Fan •Compressor •Coal Mill •Secondary Fan
•Water Pumping Energy Storage Pump •Induced Draft Fan •Condensation 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 And Nonferrous Metallurgy

•Blast Furnace Blower •Primary Dust Removal Blower •Induced Draft Fan •Compressor
•Kneader •Compressing Blower •Force Draft Fan •Secondary Dust Removal Blower
•Water-delivery Pump •Descaling Pump •Feed Water Pump

Cement And Building Materials

•Kiln Draft Fan •Kiln Fan •Rotating Kiln Transmission
•Coal Mill •Dust Removal Fan •Cooling Fan

Municipal (Heat Supply, Water Supply, Sewage etc.)

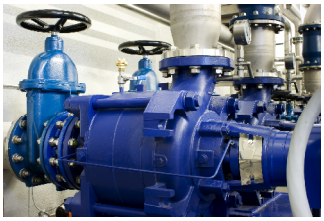
•Pressure Blower •Induced Draft Fan •Force Draft Fan •Pressure Pump
•Sewage Pump •Cleaning Water Pump •Lifting Pump •reclaimed Water Pump

Light Industry, Chemical Industry

•Gas Blower •Pressure Pump •Compressor •Axial Ow Pump
•Soft Water Pump •Water-delivery Pump

Military Industry And Others

•Test Stand •Wind Tunnel

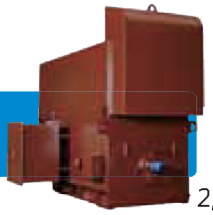


Motors for Medium-Voltage Drives

AC motors for medium & high Voltage

Inverter Duty Motor 200~30,000 HP

Synchronous Motor



2,000~60,000 HP

Slip Ring Induction Motor 25~25,000 HP

Squirrel Cage Induction Motor 125~30,000 HP

HP	1	100	1,000	10,000	60,000
kW	0.75	75	750	7,500	45,000

Product Parameters

Model Identification

MV ① 510 ② - H ③ A0 ④ / 100 ⑤ - S ⑥ 00 ⑦

① MV : TECO Medium-Voltage AC Drive

② Series Number, 510 : asynchronous, 512 : synchronous

③ Input Voltage : A-2.4kV, B-3kV, C-3.3kV, D-4.16kV, E-6kV, F-6.6kV, G-7.2kV, H-10kV, J-11kV, K-13.8kV, X-others

④ Output Voltage Class : "33"-3.3kV, "42"-4.16kV, "66"-6.6kV, "A0"-10kV, "B0"-11kV, etc

⑤ Rated Current(A), for example : 077,120

⑥ S : power cell without bypass ; B : power cell with bypass

⑦ Customized Code

The motor rated voltage, load current and overload conditions should be select the right type of MV510 drive.

For example , the type code MV510-F66/077-S00 represents a MVD which has 6.6kV rated voltage and 77A rated output current (the 880kVA power), it can be used to drive the medium voltage asynchronous motor satisfying 6.6kV rated voltage and less than 77A rated load current.

Technical Parameters

MVD rated power	250-10000kW/315-12500kVA※
rated voltage	2.4kV~13.8kV (-20%~+15%)※
rated frequency	50Hz/60Hz ※
modulation technique	CPS-SPWM
control mode	V/f,VC,SLVC
control power	380VAC, 1~5kVA depend on power level
input power factor	>0.96
efficiency	>97%
output frequency range	0Hz~120Hz ※
frequency resolution	0.01Hz
instantaneous over-current protection	200% protect immediately (can be customerized)
overload capability	120% 60seconds
current limited protection	10% -150% setting
analog inputs	Two loops 4 ~ 20mA
analog outputs	Four loops 4 ~ 20mA
host communications	Isolated RS485 interface, ModBus RTU, Profibus DP(optional)
	Industry Ethernet Protocol (optional)
accelerating and decelerating time	0.1s ~ 6000s(has relationship to load)
inputs and outputs switch signals	12 inputs / 9 outputs (extensible)
ambient temperature	-5 ~ + 45℃ ※
storage/transportation temperature	-40 ~ + 70℃ ※
cooling methods	forced air cooling
environment humidity	<95%, no condensation ※
installing altitude	<1000m, when altitude is higher than 1000m, each 100 meter
	increasing needs 1% derating of MVD
dust	Non-conductive, no causticity, <6.5mg/dm³ ※
Enclosure	IP30 ; IP31 (can be customerized)※
cabinet colors	PANTONE Warm Gray 2C (can be customerized)

※ Please consult with TECO Co. Ltd. for the information beyond the above table.

Dimensions

FIG3.2

3.0KV/3.3KV STANDARD MVD MODEL SELECTION-ASYNCHRONOUS MOTOR/SYNCHRONOUS MOTOR

ITEM	MVD MODEL	CURRENT (A)	MVD POWER (kV/kVA)	ADAPTABLE MOTOR (kW)	CABINETCODE	DIMENSION (mm×mm×mm)
1	MV510-C33/037-S□□	37	3.3/200	150	FIG3.1	3260×1600×2200
2	MV510-C33/050-S□□	50	3.3/250	200	FIG3.1	3260×1600×2200
3	MV510-C33/060-S□□	60	3.3/315	250	FIG3.1	3260×1600×2200
4	MV510-C33/075-S□□	75	3.3/400	315	FIG3.2	3360×1400×2200
5	MV510-C33/100-S□□	100	3.3/530	420	FIG3.2	3360×1400×2200
6	MV510-C33/120-S□□	120	3.3/630	500	FIG3.2	3360×1400×2200
7	MV510-C33/150-S□□	150	3.3/800	630	FIG3.3	3560×1400×2400
8	MV510-C33/180-S□□	180	3.3/1020	830	FIG3.3	3560×1400×2400
9	MV510-C33/200-S□□	200	3.3/1140	900	FIG3.3	3560×1400×2400
10	MV510-C33/240-S□□	240	3.3/1250	1050	FIG3.3	3560×1400×2400
11	MV510-C33/300-S□□	300	3.3/1560	1250	FIG3.4	3660×1400×2400
12	MV510-C33/340-S□□	340	3.3/1900	1500	FIG3.4	3660×1400×2400
13	MV510-C33/400-S□□	400	3.3/2250	1800	FIG3.5	4600×1400×2400
14	MV510-C33/480-S□□	480	3.3/2750	2250	FIG3.6	4800×1400×2400
15	MV510-C33/600-S□□	600	3.3/3400	2750	FIG3.7	5000×1400×2640
16	MV510-C33/680-S□□	680	3.3/3850	3100	FIG3.7	5000×1400×2640
17	MV510-C33/800-S□□	800	3.3/4500	3750	FIG3.7	5000×1400×2640

※ Refer to instruction manual for details of more cabinets and specifications.

FIG4.3

4.16KV STANDARD MVD MODEL SELECTION-ASYNCHRONOUS MOTOR/SYNCHRONOUS MOTOR

ITEM	MVD MODEL	CURRENT (A)	MVD POWER (kV/kVA)	ADAPTABLE MOTOR (kW)	CABINET CODE	DIMENSION (mm × mm × mm)
1	MV510-D42/037-S□□	37	4.2/266	215	FIG4.1	3360×1400×2200
2	MV510-D42/050-S□□	50	4.2/360	300	FIG4.1	3360×1400×2200
3	MV510-D42/060-S□□	60	4.2/430	350	FIG4.1	3360×1400×2200
4	MV510-D42/075-S□□	75	4.2/540	450	FIG4.2	3560×1400×2200
5	MV510-D42/100-S□□	100	4.2/720	575	FIG4.2	3560×1400×2200
6	MV510-D42/120-S□□	120	4.2/860	700	FIG4.2	3560×1400×2200
7	MV510-D42/150-S□□	150	4.2/1080	900	FIG4.3	3760×1400×2400
8	MV510-D42/180-S□□	180	4.2/1250	1000	FIG4.3	3760×1400×2400
9	MV510-D42/200-S□□	200	4.2/1440	1120	FIG4.3	3760×1400×2400
10	MV510-D42/240-S□□	240	4.2/1720	1400	FIG4.3	3760×1400×2400
11	MV510-D42/300-S□□	300	4.2/2160	1750	FIG4.4	3860×1400×2400
12	MV510-D42/340-S□□	340	4.2/2450	2000	FIG4.4	3860×1400×2400
13	MV510-D42/400-S□□	400	4.2/2880	2300	FIG4.5	4560×1400×2640
14	MV510-D42/480-S□□	480	4.2/3450	2800	FIG4.6	4600×1400×2640
15	MV510-D42/600-S□□	600	4.2/4320	3500	FIG4.7	5000×1400×2640
16	MV510-D42/680-S□□	680	4.2/4900	4000	FIG4.7	5000×1400×2640
17	MV510-D42/800-S□□	800	4.2/5600	4500	FIG4.7	5000×1400×2640

※ Refer to instruction manual for details of more cabinets and specifications.

FIG6.1

6.0KV/6.6KV STANDARD MVD MODEL SELECTION-ASYNCHRONOUS MOTOR/SYNCHRONOUS MOTOR

ITEM	MVD MODEL	CURRENT (A)	MVD POWER (kV/kVA)	ADAPTABLE MOTOR (kW)	CABINET CODE	DIMENSION (mm×mm×mm)
1	MV510-F66/037-S□□	37	6.6/400	315	FIG6.1	3960×1400×2200
2	MV510-F66/050-S□□	50	6.6/500	400	FIG6.1	3960×1400×2200
3	MV510-F66/060-S□□	60	6.6/630	500	FIG6.1	3960×1400×2200
4	MV510-F66/075-S□□	75	6.6/800	630	FIG6.2	4160×1400×2200
5	MV510-F66/100-S□□	100	6.6/1000	850	FIG6.2	4160×1400×2200
6	MV510-F66/120-S□□	120	6.6/1250	1000	FIG6.2	4160×1400×2200
7	MV510-F66/150-S□□	150	6.6/1560	1250	FIG6.3	4660×1400×2400
8	MV510-F66/180-S□□	180	6.6/1850	1500	FIG6.3	4660×1400×2400
9	MV510-F66/200-S□□	200	6.6/2250	1800	FIG6.3	4660×1400×2400
10	MV510-F66/240-S□□	240	6.6/2650	2150	FIG6.3	4660×1400×2400
11	MV510-F66/300-S□□	300	6.6/3400	2650	FIG6.4	4860×1400×2640
12	MV510-F66/340-S□□	340	6.6/3750	3000	FIG6.4	4860×1400×2640
13	MV510-F66/400-S□□	400	6.6/4500	3600	FIG6.4	4860×1400×2640
14	MV510-F66/480-S□□	480	6.6/5300	4300	FIG6.5	5560×1400×2800
15	MV510-F66/600-S□□	600	6.6/6850	5600	FIG6.6	5660×1400×2800
16	MV510-F66/680-S□□	680	6.6/7700	6300	FIG6.6	5660×1400×2800
17	MV510-F66/800-S□□	800	6.6/9140	7500	FIG6.6	5660×1400×2800

※ Refer to instruction manual for details of more cabinets and specifications.

FIG11.2

10KV/11KV STANDARD MVD MODEL SELECTION-ASYNCHRONOUS MOTOR/SYNCHRONOUS MOTOR

ITEM	MVD MODEL	CURRENT (A)	MVD POWER (kV/kVA)	ADAPTABLEMOTOR (kW)	CABINET CODE	DIMENSION (mm×mm×mm)
1	MV510-JB0/037-S□□	37	11/700	560	FIG11.1	4260×1400×2400
2	MV510-JB0/050-S□□	50	11/950	760	FIG11.1	4260×1400×2400
3	MV510-JB0/060-S□□	60	11/1140	900	FIG11.1	4260×1400×2400
4	MV510-JB0/075-S□□	75	11/1400	1100	FIG11.2	4860×1400×2400
5	MV510-JB0/100-S□□	100	11/1900	1500	FIG11.2	4860×1400×2400
6	MV510-JB0/120-S□□	120	11/2280	1800	FIG11.2	4860×1400×2400
7	MV510-JB0/150-S□□	150	11/2850	2250	FIG11.3	6260×1400×2400
8	MV510-JB0/180-S□□	180	11/3400	2800	FIG11.3	6260×1400×2400
9	MV510-JB0/200-S□□	200	11/3800	3000	FIG11.3	6260×1400×2400
10	MV510-JB0/240-S□□	240	11/4500	3600	FIG11.3	6260×1400×2400
11	MV510-JB0/300-S□□	300	11/5700	4500	FIG11.4	6260×1400×2640
12	MV510-JB0/340-S□□	340	11/6450	5300	FIG11.4	6260×1400×2640
13	MV510-JB0/400-S□□	400	11/7600	6450	FIG11.5	7050×1600×2800
14	MV510-JB0/480-S□□	480	11/9100	7600	FIG11.6	7660×1600×2800
15	MV510-JB0/600-S□□	600	11/11400	9100	FIG11.7	8000×1600×2800
16	MV510-JB0/680-S□□	680	11/12500	10000	FIG11.7	8000×1600×2800

※ Refer to instruction manual for details of more cabinets and specifications.

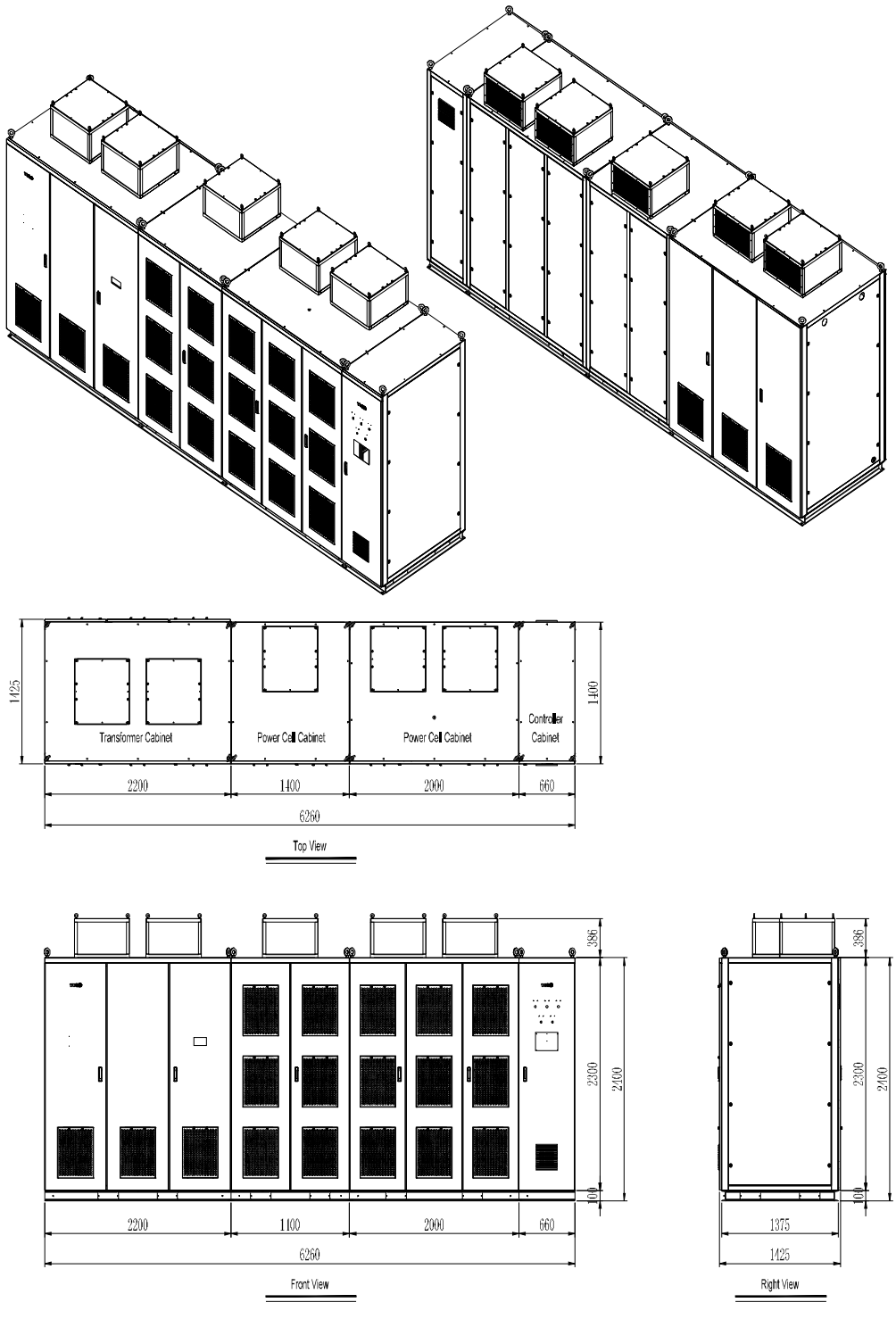
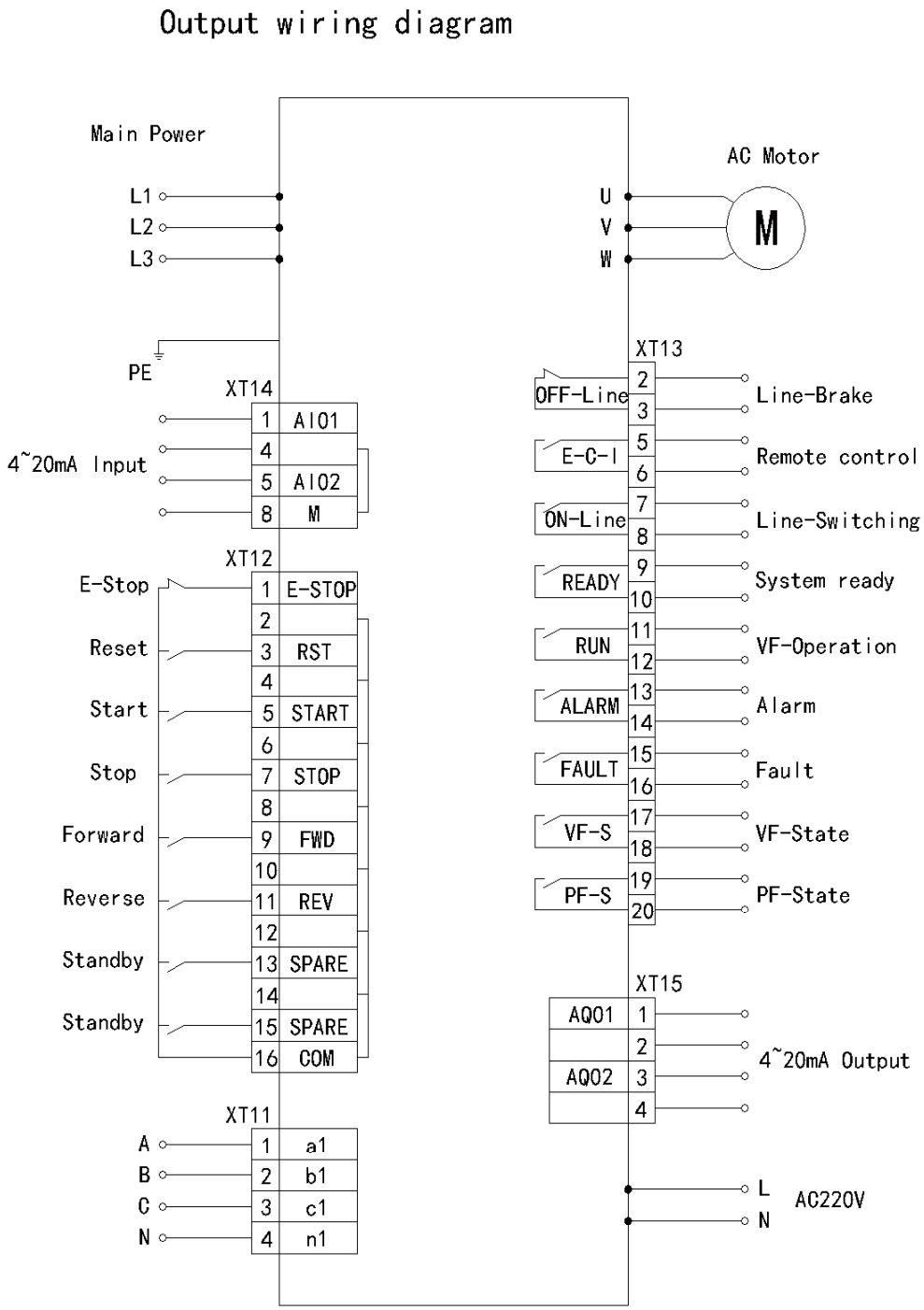

1425
Transformer Cabinet
Power Cell Cabinet
Power Cell Cabinet
Controller Cabinet
1400
2200
1400
2000
660
6260
Top View
386
2300
2400
100
2200
1100
2000
660
6260
Front View
386
2300
2400
100
1375
1425
Right View

FIG11.3

General Wiring Diagram

System diagram

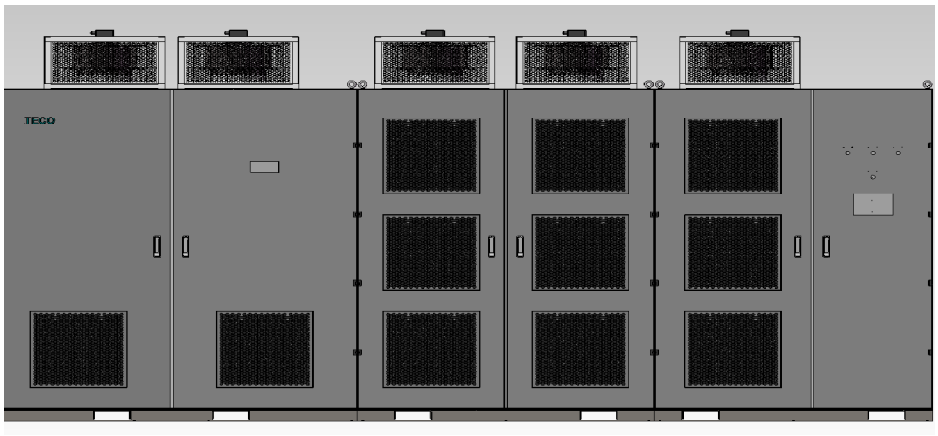


Executing Standards

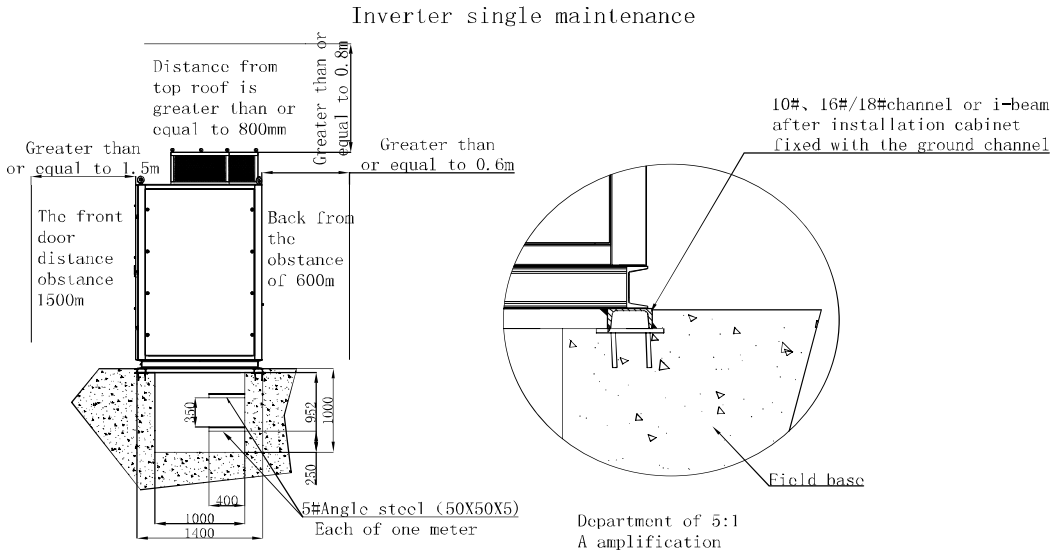
Standards Number	Standards Description
IEC 60038:2002	Standard voltages
IEC 60196:1965	Standard frequencies
IEC 60068-2-1:1990	Electric and electronic products--Basic environmental tes regulations for electricians--Guidelines for vibration(sine)
IEC 61131/111	PLC Correlative norms
IEC 801	Electro-magnetic radiation and anti-surge-interference
IEC/PQC 89:1990	Specification for single and double sided printed boards with plain holes
IEC/PQC 90:1990	Sectional specification: Single and double sided printed boards with plated-through holes
IEC 60146-2:1999	Semiconductor self-commutated converters
IEC 61175	Design of signals and connections
IEC 61800:1997	General specification for speed control assembly with semiconductor adjustable frequency for A.C. motor
IEC 60068	Correlative tests
IEC 60068-2-6	Anti vibration standard
IEC 60068-2-27	Anti shock standard
IEC 61800-4:2002	drive systems above 1000V A.C. and not exceeding 35kV Adjustable speed electrical power drive systems. Part 4: General requirements. Rating specifications for A.C. power
IEEE 519-1992	Practices and requirements for harmonic control in electrical power systems
IEC 60870	Communication protocol
IEC 61800-3	EMC Radiated interference standard
IEC 60146-1-1:1991	Semiconductor converters. Specifi cation of basic requirements (eqv IEC60146-1-1:1991)
IEC 60146-1-2:1991	Semiconductor converters. Application guide (eqv IEC60146-1-2:1991)
IEC 60146-1-3:1991	Semiconductor converters. Transformers and reactors (eqv IEC 60146-1-3,1991)
IEC 60529:2001	Degrees of protection provided by enclosures (IP Code) (eqv IEC 60529:1989)
IEC 60664-1: 2007	Insulation coordination for equipment within low-voltage systems - Part 1: Principles, requirements and tests (idt IEC 60664-1:1992)
IEC 60038:1983	IEC Standard voltages
IEC 60050-151:2001	International electrotechnical vocabulary, chapter 151: electrical and magnetic devices.
IEC 60050-551:1999	International Electrotechnical Vocabulary. Chapter 551: Power electronics.
IEC 60076	Electric power transformer
IEC 60721-3-1:1997	Classification of environmental conditions Part 3:classification of groups of environmental parameters and their severities, storage.
IEC 60721-3-2:1997	Classification of environmental conditions Part 3.Classification of groups of environmental parameters and their severities.
IEC 60721-3-3:2008	Classification of environmental conditions Part 3.Classification of groups of environmental parameters and their severities. Stationary use at weather protected locations.
IEC 61000-2-4:2002	Electromagnetic compatibility (EMC) Part 2- Environment chapter 4- Compatibility levels in industrial equipments for low-frequency conducted disturbances.
IEC 61000-4-7:2002	Electromagnetic compatibility (EMC) Part 4: Testing and measurement techniques chapter 7. General guide on harmonics and inter-harmonics measurements and instrumentation, for power supply systems and equipment connected.
IEC 61800-3:2004	Adjustable speed electrical power dive systems Part 3: product standard including specific test methods.
IEC 60757-1983	Identification of insulated and bare conductors by colors.
IEC 106:1989	Environment condition guides for specifying performance rating of equipments.

Installation & Transportation

Take 1800kW/10kV MVD for example



Cabinets Layout (Front)



*Section Diagram Cable Cuct & Trench

Installation requirements

1. The minimum length of the cable tube is the length of MVD cabinets and the bypass cabinet.
2. For the safety and convenience of the cable routing, it is recommended that the cabinets are equipped upon the cable tube as shown above. The bottom of the MVD is made of 10# channel steel, (For rated power is larger than or equal to 1600kW, it is made of 16# channel steel. For rated power is larger than 4000kW, it is made of 18# joist steel.) Thus, it is required to select the right one according to the MVD weight.
3. A certain space should be kept around the cabinets. The distance between the back of cabinet to the wall should be no less than 1000mm for 6kV MVD, and no less than 1200mm for 10kV MVD. The distance between the top of cabinet to the ceiling should be no less than 800mm, the distance between the front of cabinet to the wall should be no less than 1500mm.

MV510 MVD is composed of transformer cabinet, power cell cabinet/control cabinet . High power MVD has to be equipped with starting cabinet. See dimension details of MV510 General MVD in Outline Dimensions , which includes the basic shape, location, installation dimensions, as well as hoisting location, size and location of up air blower and input wiring hole.

Requirements of Transportation

- MV510 series medium voltage drive may be transported by truck, train, ship etc.
- During the transportation of MV510 series medium voltage drive, please be careful to lay down gently and keep away from rain exposed to sunlight, strenuous vibration and impact, and inversion of cabinet.
- Please consider the possibility of height limitation, while selecting the conveyance and route.
- The load capacity of conveyance should be larger than the weight of MV510 series MVD.

Requirements of Storage

The operation ambient temperature range of MV510 series medium voltage drive is -5℃~40℃ and the storage ambient temperature range is -40℃~70℃. The ambient temperature can affect the life time and reliability of the MVD in high degree. Please don't install the MVD in a high temperature situation. If the ambient temperature is higher than the permitted value, it is strongly suggested to equip with forced ventilation or air-condition. Following situations should be avoided for MVD storage:

- Exposed to sunlight
- Corrosion gas
- Inflammable and explosive gas
- Conductive dust
- Humidity
- Salt, oil fume and dust

Three possible methods of handling MV510 cabinets :

- Overhead Crane Lifting
- Hand Chain Hoist Lifting
- Roller Lifting

Requirements of Civil Construction

- The MVD has to be installed upright to the ground
- There is no obvious vibration of the foundation
- The ground must be fi re-proof material, smooth and wear-resistant, level and can bear the weight of MVD (minimum 1000kg/m²)

Attention !

- The transformer cabinet and power cell cabinet are whole assembled, strictly tested, and carefully packed in the factory before the delivery. When lifting, please do best to make the lifting center coincident with the barycenter of transformer cabinet and power cell cabinets.
- According to the package mark and drawing position to lift the transformer cabinet, don't lift the transformer cabinet only by hook of the cabinet.
- If the installation ground is not flat, the metal cabinets of the MVD may be buckle, causing the cabinet doors to be misaligned and/or not open and closed properly.
- The devices inside the cabinet are not weatherproof. If it is necessary to temporarily store the drive in an outdoor area, heaters should be placed inside the equipment to prevent moisture from being accumulated, and a plastic cover or a tarp should be placed over the drive.
- Standing under the crane is forbidden while lifting the cabinets.
- Forbidden to correct the cabinet position by person while the cabinet is tilted during lifting, otherwise death may be caused because of the heavy cabinets.

Power Cable Selection

Selection of Power Cable should strictly observe related norms and meet the following requirements :

- Current carrying capacity
- Installation and laying modes
- Power industry standard
- Manufacturer standard
- Voltage drop caused by cable length

Attention !

- Armored cable with shielding effect is recommended for high voltage cable used between the MVD and motor
- If the whole section area is less than 50% section area of single-phase conductor, a grounding cable is needed to prevent the shield over-current from being produced by potential difference of grounding grid.
- Section area of grounding cables should be bigger than 16mm²
- After cabinets are installed, the cabinets and channel steel base should be fixed by spot wielding, and the channel steel base should be grounded reliably. The value of grounding resistance should be no more than 4Ω.

Selection of Control, Signal and Communication Cables

- High quality single shielded twisted pair line or multiple shielded twisted pair line should be selected for control, signal and communication cable.
- Analog input and output cable : whole shielded twisted pair line, section area 0.5~1.5mm²
- Digital input and output cable : whole shielded twisted pair line, section area 0.5~1.5mm²
- Rotary encoder cable : whole shielded twisted pair line, section area 0.5~1.5mm²
- Communication wire : Special communication wires or whole shielded twisted pair line, section area 0.5~1.5mm²

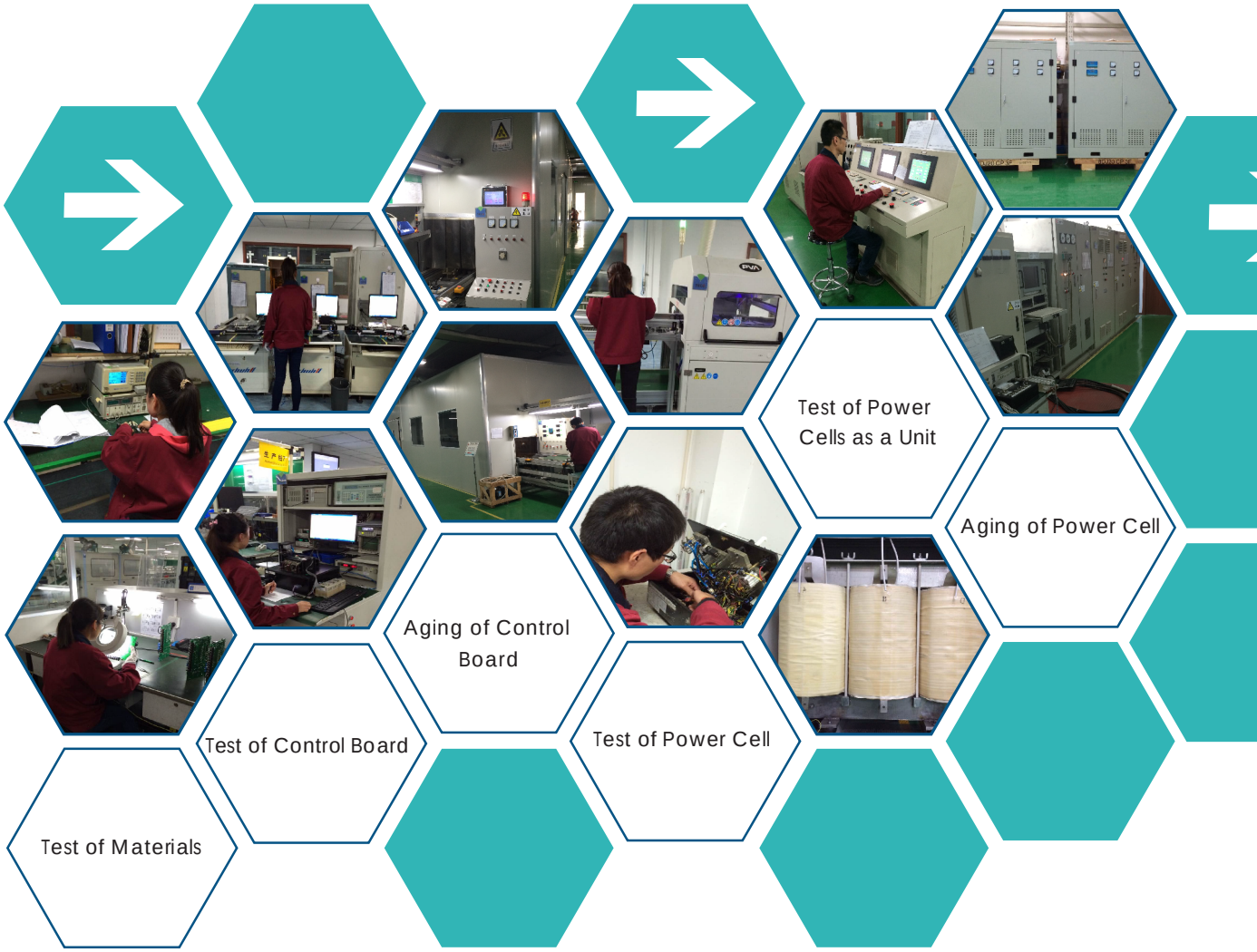
Attention !

- Control, signal, communication, power wires and power cables should be routed separately in cable channel and bridge duct. In case of mix routing, the distance between the secondary wires and power cables should be kept larger than 30cm, and net to lay wires in parallel. If parallel routing is inevitable, the longer the parallel wires is, the larger the distance between the secondary wires and power cables should be kept.
- It is not permitted that power wires or ground wires share a common shielded wire with signal wires.
- If the length of signal or control cable is longer than 50m, active isolated converter and auxiliary relay should be set in the input and output circuit.
- Shielding layer of cables should be single-end grounding at the side of MVD.
- For diminishing the electric potentials interference between different components, a electric potential balance cable should be laid parallel to control wires, and the section area of wires should be bigger than 16mm².
- If there are relays or contactors in the circuit, or the load is inductive or capacitive, anti-interference components should be mounted in the loop of relays and contactors.
- Control, signal and communication cables should be laid by the corner and the zero electric potential to improve the capability of anti-interference.
- Cables for different kinds of signals should be cross routing.
- Shielding layer to terminal should be as short as possible. Avoid wiring the shield to grounding spot by a single long cable.

※ Please consult with TECO Co., Ltd. for more information.

Reliability & Service

Every MV510 MVD has to pass complete and strict test to ensure the reliability.



pre-sales
Selection of MVD

Customized
solutions

Installation Manual

pre-sales
Application
Evaluation

Remote Diagnosis

Aging of overall unit

Customer
confirmation

Spare parts manual

pre-sales
Application
Program

Installation

Technology
Support

Training manual

pre-sales
spot diagnosis

Trial run

Commission

※ Please consult with TECO Co., Ltd. for more information.

MEMO

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