

MEDIUM VOLTAGE MULTILEVEL CONVERTER

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About Us

FOUNDED IN 1975, SECOM IS A LEADING COMPANY FOR THE DISTRIBUTION AND PRODUCTION OF COMPONENTS AND DEVICES FOR POWER ELECTRONICS

SECOM continuously carries out new research and technical proposal in conjunction with important clients, providing technical support to meet their specific needs.

Production excellence and efficient organization allow SECOM to commit itself to providing to the market with timely and professional service in numerous sectors of static energy conversion. Flexibility and short delivery time have become pillars to SECOM's company policy.

WHO WE ARE



Over the years the company has become an important designer and manufacturer of power electronic devices for industrial automation manufacturing technologies

WHAT WE DO



SECOM studies and manufactures customized solutions on behalf of its customers.

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MULTILEVEL CONVERTER

OVERVIEW

SD-ML (SECOMDRIVE Multilevel converter) are Medium Voltage Multilevel drives based on IGBT cascaded H bridges cells (CHB) Inverter, each in 3L-NPC topology, air and water cooled, with an AC/DC input converter, with output voltage levels from 3.3kV up to 11kV and output power that ranges from 200kVA (at 3.3kV) up to 13000kVA (at 11kV). Configuration and number of cells are according to the output voltage level (3.3kV - 4.16kV - 6.6kV - 11kV).

The AC/DC input converter could be realized in two different versions:

- Non-regenerative type with diode AC/DC converter (Diode Front-End, DFE there in after)
- Regenerative type with three phase IGBT AC/DC converter (Regenerative Front-End, RFE there in after)

Based on the application requirments the suitable AC/DC converter is selected.



MULTILEVEL CONVERTER

OVERVIEW

On supply line side, using multi-level conversion method with multi-windings transformers, the resulting multi-pulses input side current has a very low harmonics content and conforms easily to the IEEE519-1992 and IEC 61000 requirements, without having to use harmonic filters. On output side the motor friendly multi-level voltage waveform allows to convert easily existing fixed speed Direct On-Line Motors to a state of art Variable Speed Drive System, without requiring cumbersome sinusoidal filters to preserve motor insulation integrity.

The CHB converter structure is realised using standardised power modules cells air or water cooled, in a easy to service and maintain modular structure. The cells could be easily extracted from the cabinet structure, on a supporting sliding system.

The basical drive configuration can be supplied also adding various options to fullfill special operational customer needs. The drive could be operated in scalar control (with encoder) to meet application drive system static and dynamic process requirments.

Main applications are machines and plants in metal and in the process industry. Application examples are: pumps, fans, compressors, conveyors, extruders and separators, kilns, grinders and shredders.

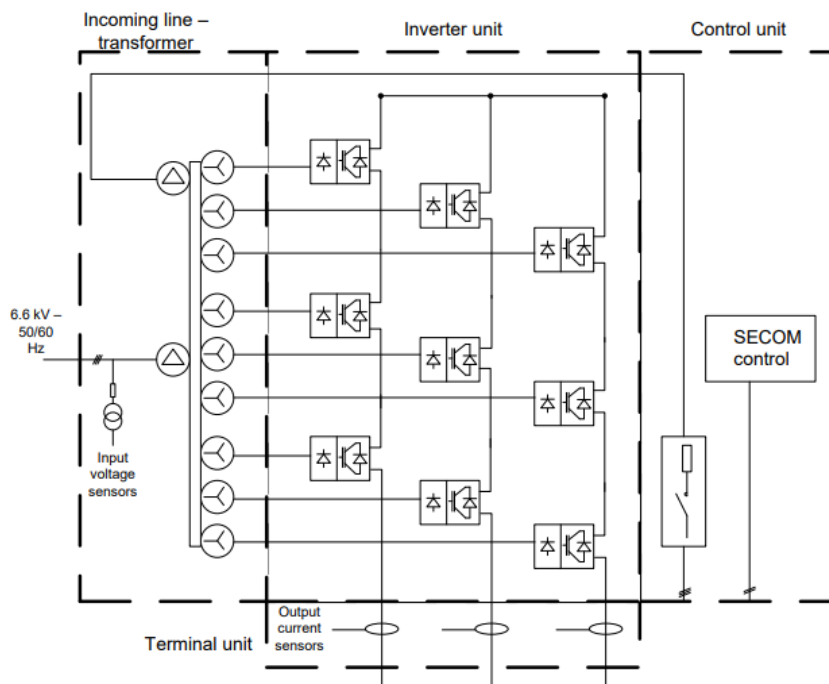


MEDIUM VOLTAGE SYSTEM CONFIGURATION

In a **SD-ML system** the following main components are always present, at least:

- a MV power supply network, there in after just MV supply network;
- a MV switchgear, there in after named MEC (Metal Enclosed Cabinet) that contains the Medium Voltage Main Circuit Breaker, there in after MV MCB;
- MV-ML Converters cabinet with integrated transformer, there in after SD-ML cabinet;
- Auxiliary Motors & Control Starters Section for the auxiliaries of the MV-ML Drive System, there in after AUX. If it's required according to the project and the application, the MV-ML Drive system could include a separated LV switchboard for motor auxiliaries management indicated there in after with AUX or MCS;
- Variable speed MV Main Motor (induction motor);
- LV distribution power center, there in after just PCT where the 3-phase auxiliary feeders are connected.

Power part equipment single line diagram, there in after just SLD:

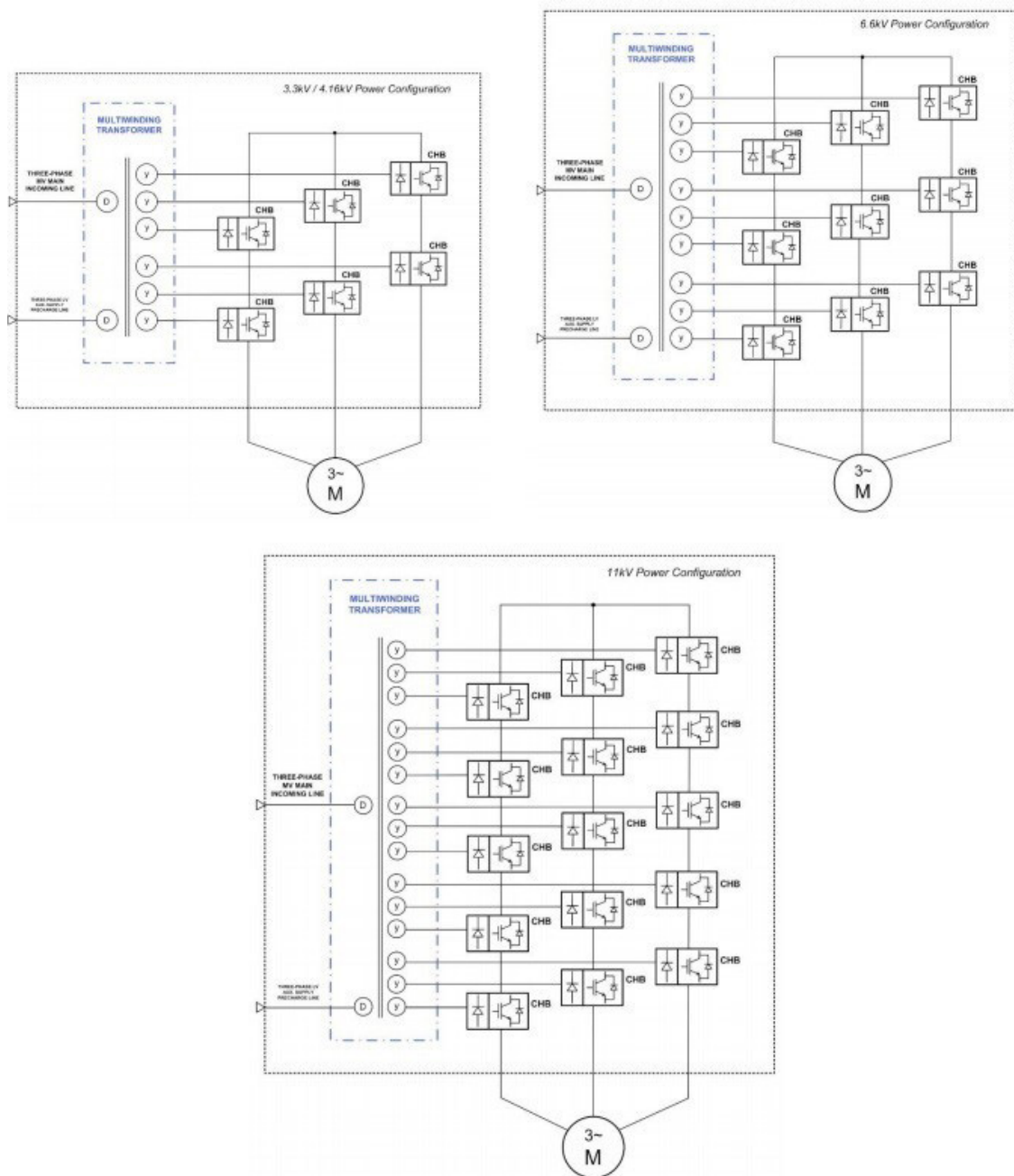


The configuration depicted in the picture above is one of the simplest that could be found and it is used to describe all the components that are always present; any other more involved configuration is always realized with the above components.

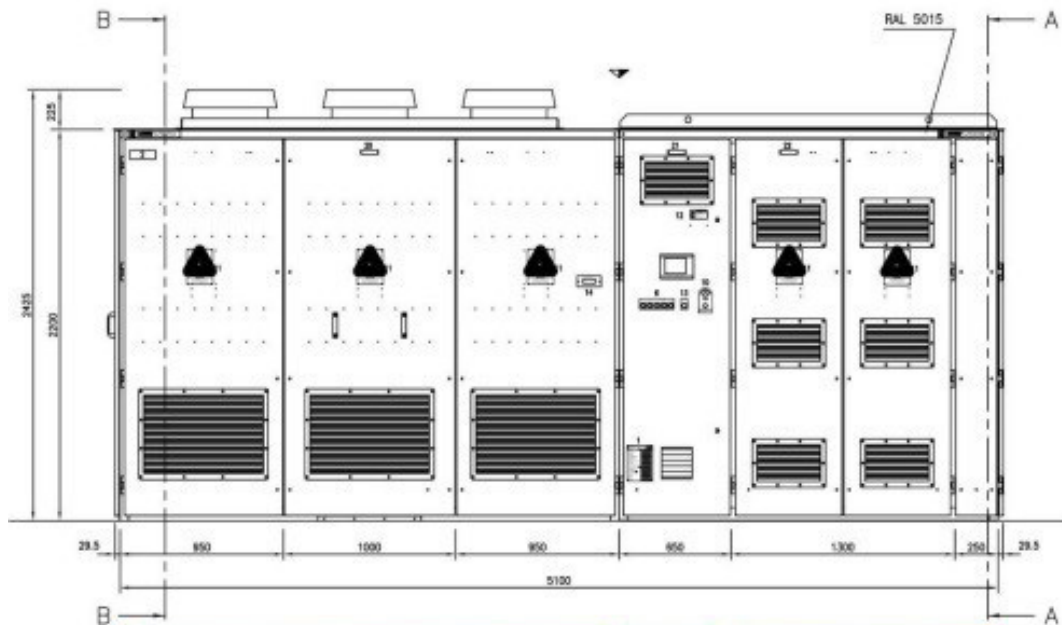
MULTILEVEL POWER PART CONFIGURATION

The Power converter is composed by a suitable number of CHB cells according to the specific application and the voltage level (3.3kV - 4.16kV - 6.6kV - 11kV).

The following figures show the basic SD-ML cabinet power configurations for non-regenerative type (CHB cells with diode bridge 6 pulses version) and the single line diagram of the 6.6kV switchboard configuration with detail of some possible options.



MULTILEVEL CONVERTER CABINET LAYOUT



INCOMING LINE AND MAIN TRANSFORMER SECTION CONTROL SECTION INVERTER AND TERMINAL UNIT

MULTILEVEL CONVERTER CABINET LAYOUT



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TECHNICAL

DATA

General Electric Data	
Power switches elements	IGBTs
Drive arrangement	Single unit in cascaded 3L-NPC H-cell topology no regenerative type with 6 or 12 pulses type diode bridges
Rated output voltage types	3.3 kV - 4.16 kV - 6.6 kV - 11 kV
Efficiency	typ. => 97% (including multi-winding transformer)
Motor type	Induction or Synchronous with separate DC excitation
Main supply voltage (50/60 Hz)	Output voltage \pm 10% typically (different input voltages possible upon request)
Inverter output frequency	Typ. 50/60 Hz - up to 75 Hz
Braking method	Natural deceleration by load torque
Input power factor	Typ. better than 0.95 depending on output load
Output current overload capability	110% for 60 sec every 300 sec with base current of I_n 125% for 60 sec every 600 sec with base current of I_n
Transformer configuration	Multi-windings multi-pulse (see relevant table)
Type of control	Scalar control, FOC sensorless/sensored
Speed accuracy	0.5% @ 100% speed (FOC sensorless)
Torque accuracy	Better than \pm 5% of rated motor torque (FOC sensed and motor rated current \geq 80% of converter rated current)
Auxiliary voltages range	380 ... 480 V _{AC} 50/60 Hz
UPS for control unit	Integrated into converter cabinet auxiliary section as standard
Installation place	Indoor (clean electrical room typically), with site altitude up to 1000 m a.s.l. Atmosphere: general clean environment, free from corrosive gas, dust and explosive/flammable gas
Electrical room operating temperature range	10-35°C without derating - from 36°C to 45°C with derating (standard version)
Humidity	90% relative humidity max (no condensation)
External cooling water operating temperature range	10-32°C (water cooled type only)
Drive switchboard cabinet short circuit withstanding	10 kA for 1 sec, 25 kA peak
Protection degree	IP42 (higher protection degree available upon request, see options)
Power losses to air	For sizing of cooling equipment, max heat losses into air to be considered is about 3.5 kW/100kVA of output power (i.e. for 1000 KVA output type consider approx 35 kW of heat losses, including transformer)

TECHNICAL

DATA

Sound pressure	Less than 80db (A) at 1 m from enclosure
Control unit interface to overriding control system	Profibus as standard or other fieldbuses available
Applicable standards	IEC 60146 - IEC 61800-3/4/5 - IEC 60071-1 IEC 60204-11 - EN 62271

Optional System Components	
EXC - Field exciter converter cabinet	Unidirectional thyristor LV AC/DC converter with crowbar, incoming line circuit breaker (DA standard cabinet type)
AUX MCS - Auxiliary system Motors control starters cabinet + UPS for control unit	Cabinet with starters, feeders for aux, loads & UPS for control unit with drive system supervision panel (OP2) - typically needed for large motors in IC37AW86 cooling method
HIVT - High input voltage transformer version	Special multi-winding transformer version with input voltage higher than 11kV (possible classes up to 36kV) without any additional external MV/MV transformer
IBC - Input bypass cabinet	Input bypass circuitry to bypass inverter unit and providing DOL supply for the driven motor - without synch. bypass
SIBC - Synchronised input bypass cubicle	Input bypass circuitry to bypass inverter unit and providing DOL supply for the driven motor with synch. bypass
OIC - Output isolater cubicle	Output motor isolator & grounding switch
WCV - Water cooling version	Solution with CHB in water cooled version with cabinet Water Cooling Unit (WCU)
HPDV5 - for IP54 protection degree	Cabinet enclosures in IP54
INRL - Converter transformer Inrush current limiter	Converter transformer Inrush current limiter circuitry on primary side

TECHNICAL

DATA

3.3 kV type Medium Voltage Multilevel Drive (SD-ML) - 6 CHB power cells

Code	Converter output rated power S_N (kVA)	Converter output rated current I_N (A)	OVL 125% (60s every 600s) I_{MAX} (A)	Multi-winding transformer rated power (kVA)
SD0K2V03.T31	200	35	43.7	235
SD0K3V03.T31	300	52	65	350
SD0K4V03.T31	420	73	91.3	490
SD0K6V03.T31	612	107	133.8	710
SD0K9V03.T31	840	147	183.8	975
SD1K1V03.T31	1100	192	240	1280
SD1K3V03.T31	1300	227	283.8	1510
SD1K5V03.T31	1500	262	327.5	1750
SD1K7V03.T31	1750	306	382.5	2030
SD2K0V03.T31	2000	350	437.5	2350
SD2K3V03.T31	2300	402	502.5	2670
SD2K7V03.T31	2700	472	590	3135
SD3K0V03.T31	3000	525	656.3	3480
SD3K5V03.T31	3500	612	765	4060

4.16 kV type Medium Voltage Multilevel Drive (SD-ML) - 6 CHB power cells

Code	Converter output rated power S_N (kVA)	Converter output rated current I_N (A)	OVL 125% (60s every 600s) I_{MAX} (A)	Multi-winding transformer rated power (kVA)
SD0K2V04.T31	252	35	43.7	292
SD0K4V04.T31	375	52	65	435
SD0K5V04.T31	526	73	91.3	610
SD0K7V04.T31	770	107	133.8	895
SD1K0V04.T31	1060	147	183.8	1230
SD1K4V04.T31	1385	192	240	1605
SD1K6V04.T31	1636	227	283.8	1898
SD1K9V04.T31	1890	262	327.5	2190
SD2K2V04.T31	2205	306	382.5	2560
SD2K5V04.T31	2520	350	437.5	2925
SD2K9V04.T31	2900	402	502.5	3360
SD3K4V04.T31	3400	472	590	3945
SD3K8V04.T31	3785	525	656.3	4388
SD4K4V04.T31	4410	612	765	5116

TECHNICAL DATA

Expected power losses in air (kW)	Cooling method	CHB frame	Width x height x depth (mm) + 300mm cooling fan on the roof (*) WCU unit included	Weight (kg) (*) WCU included
6.4	Air	A	4100 * 2200 * 1500	4800
9.5	Air	A	4100 * 2200 * 1500	4850
13.4	Air	A	4100 * 2200 * 1500	4940
20	Air	A	4100 * 2200 * 1500	5080
27	Air	A	4100 * 2200 * 1500	5250
35.2	Air	B	4600 * 2350 * 1500	5830
41.5	Air	B	4600 * 2350 * 1500	5980
48	Air	B	4600 * 2350 * 1500	6130
56	Air	B	4600 * 2350 * 1500	6370
64	Air	B	4800 * 2350 * 1500	6750
73.5	Air	C	5100 * 2350 * 1500	7620
86.3	Air	C	5200 * 2350 * 1500	8240
96	Air	C	5300 * 2350 * 1600	8700
112	Air	C	5400 * 2350 * 1600	9500

Expected power losses in air (kW)	Cooling method	CHB frame	Width x height x depth (mm) + 300mm cooling fan on the roof (*) WCU unit included	Weight (kg) (*) WCU included
8	Air	A	4100 * 2200 * 1500	4800
12	Air	A	4100 * 2200 * 1500	4850
16.8	Air	A	4100 * 2200 * 1500	4940
24.6	Air	A	4100 * 2200 * 1500	5080
34	Air	A	4100 * 2200 * 1500	5250
44.5	Air	B	4600 * 2350 * 1500	5830
52.3	Air	B	4600 * 2350 * 1500	5980
60.4	Air	B	4600 * 2350 * 1500	6130
70.5	Air	B	4700 * 2350 * 1500	6370
80.8	Air	B	4800 * 2350 * 1500	6750
92.7	Air	C	5400 * 2350 * 1500	7620
108.5	Air	C	5500 * 2350 * 1500	8240
120.8	Air	C	5500 * 2350 * 1600	8700
141	Air	C	5600 * 2350 * 1600	9500

TECHNICAL DATA

6.6 kV type Medium Voltage Multilevel Drive (SD-ML) - 9 CHB power cells

Code	Converter output rated power S_N (kVA)	Converter output rated current I_N (A)	OVL 125% (60s every 600s) I_{MAX} (A)	Multi-winding transformer rated power (kVA)
SD0K4V06.T31	400	35	43.7	465
SD0K6V06.T31	595	52	65	690
SD0K8V06.T31	835	73	91.3	970
SD1K2V06.T31	1225	107	133.8	1425
SD1K7V06.T31	1680	147	183.8	1950
SD2K2V06.T31	2195	192	240	2500
SD2K6V06.T31	2595	227	283.8	3010
SD3K0V06.T31	2995	262	327.5	3475
SD3K5V06.T31	3500	306	382.5	4060
SD4K0V06.T31	4000	350	437.5	4650
SD4K6V06.T31	4595	402	502.5	5330
SD5K4V06.T31	5395	472	590	6260
SD6K0V06.T31	6000	525	656.3	6960
SD7K0V06.T31	7000	612	765	8120

11 kV type Medium Voltage Multilevel Drive (SD-ML) - 15 CHB power cells

Code	Converter output rated power S_N (kVA)	Converter output rated current I_N (A)	OVL 125% (60s every 600s) I_{MAX} (A)	Multi-winding transformer rated power (kVA)
SD0K6V11.T31	667	35	43.7	773
SD1K0V11.T31	990	52	65	1148
SD1K4V11.T31	1390	73	91.3	1612
SD2K0V11.T31	2038	107	133.8	2364
SD2K8V11.T31	2800	147	183.8	3250
SD3K6V11.T31	3660	192	240	4250
SD4K3V11.T31	4325	227	283.8	5020
SD5K0V11.T31	4992	262	327.5	5791
SD5K8V11.T31	5830	306	382.5	6783
SD6K6V11.T31	6670	350	437.5	7740
SD7K6V11.T31	7660	402	502.5	8886
SD9K0V11.T31	8995	472	590	10435
SD10K0V11.T31	10000	525	656.3	11600
SD11K5V11.T31	11660	612	765	13525

TECHNICAL DATA

Expected power losses in air (kW)	Cooling method	CHB frame	Width x height x depth (mm) + 300mm cooling fan on the roof (*) WCU unit included	Weight (kg) (*) WCU included
12.8	Air	A	4400 * 2200 * 1500	5120
19	Air	A	4400 * 2200 * 1500	5260
26.7	Air	A	4750 * 2200 * 1500	5440
39.2	Air	A	4750 * 2200 * 1500	5730
53.8	Air	A	5250 * 2350 * 1500	6100
70.2	Air	B	5250 * 2350 * 1500	7260
83	Air	B	5250 * 2350 * 1500	7880
95.8	Air	B	5600 * 2350 * 1500	8500
112	Air	B	5600 * 2350 * 1500	9300
128	Air	B	5600 * 2350 * 1500	10100
147	Air	C	6250 * 2350 * 1500	10950
172.6	Air	C	6600 * 2750 * 1700	12100
192	Air	C	6900 * 2750 * 1700	12940
223.8	Air	C	7200 * 2750 * 1700	12350

Expected power losses in air (kW)	Cooling method	CHB frame	Width x height x depth (mm) + 300mm cooling fan on the roof (*) WCU unit included	Weight (kg) (*) WCU included
21.3	Air	A	6200 * 2350 * 1700	6600
31.7	Air	A	6200 * 2350 * 1700	6800
44.5	Air	A	6300 * 2350 * 1700	7080
65.2	Air	A	6300 * 2350 * 1700	7820
89.6	Air	A	6500 * 2350 * 1700	8980
117	Air	B	7300 * 2750 * 1700	10600
138.4	Air	B	7300 * 2750 * 1700	11270
159.7	Air	B	7500 * 2750 * 2000	12200
186.6	Air	B	7800 * 2750 * 2000	13400
213.4	Air	B	7900 * 2750 * 2000	14600
245	Air	C	Contact our team to collect overall dimensions and weights of converter cabinet sizes higher than 402 A	
287.7	Air	C		
320.1	Air	C		
373.2	Air	C		

