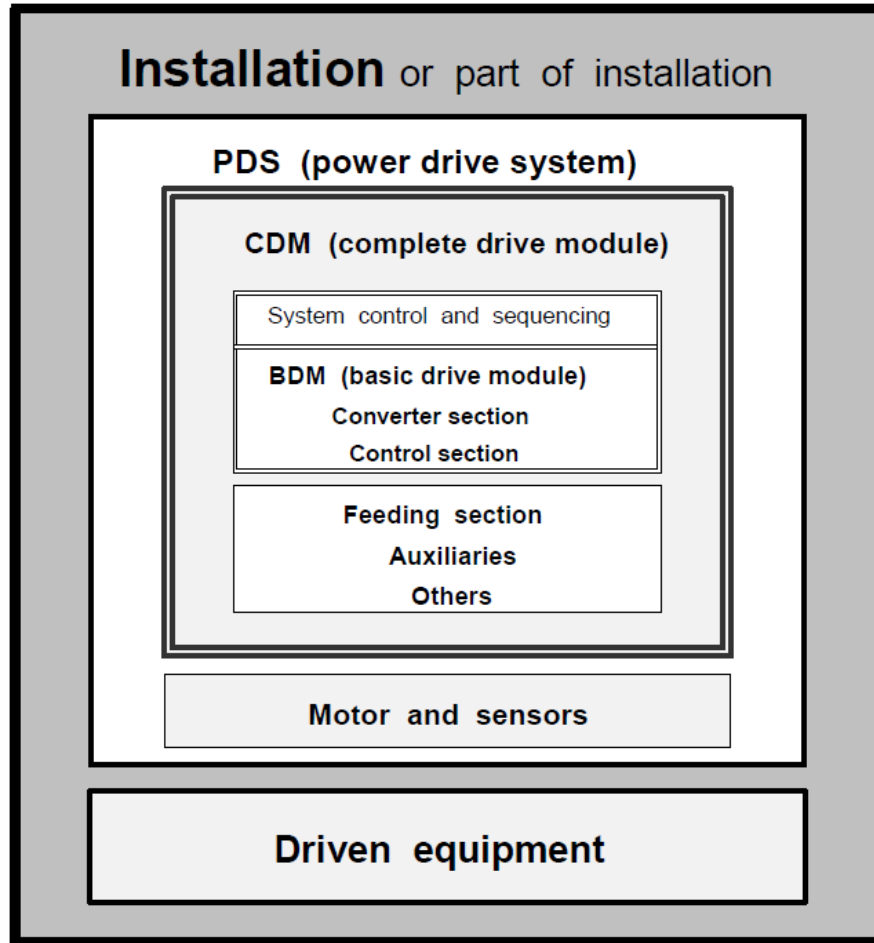


VFD (變頻驅動器) 分類定義

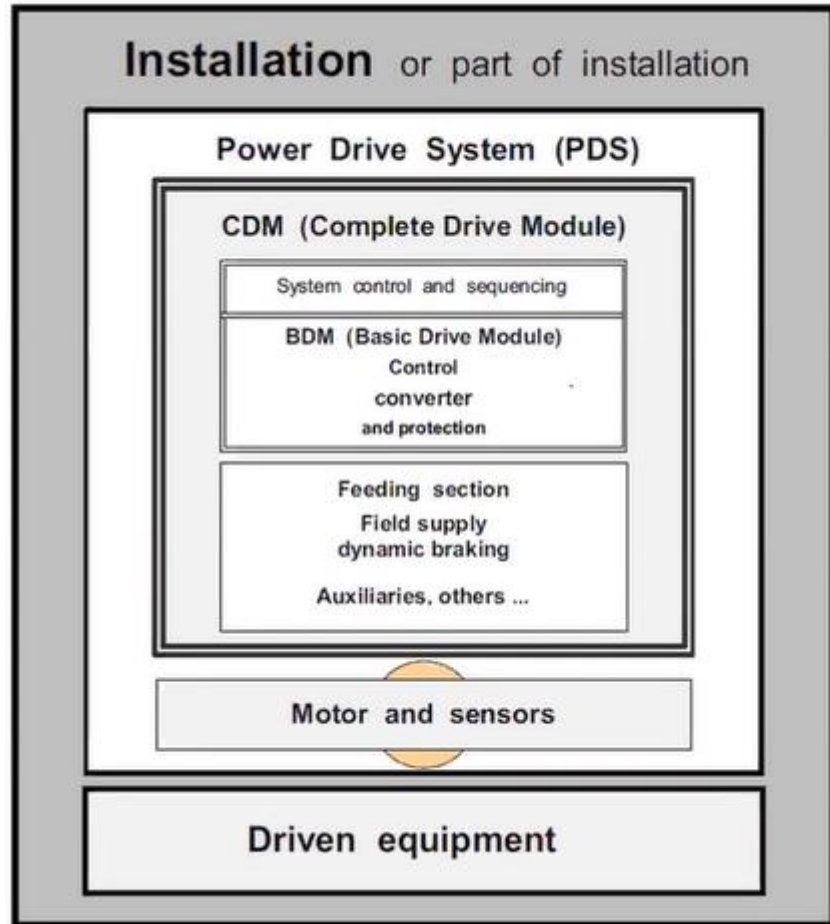


IEC 1197/07

- **Basic Drive Module (BDM)**
基本驅動模組, 一般指包含速度, 扭矩, 電流和電壓等控制的驅動模組
- **Complete Drive Module (CDM)**
完整驅動模組, 不包含馬達或傳感器; 但可以包括但不僅限於基本驅動模組, 饋線和其他擴充應用介面
- **Power Drive System (PDS)**
動力驅動系統, 可用於電機速度控制的系統, 包含完整驅動模組和電機, 但並非驅動設備

VFD (變頻驅動器) 定義

■ 範例介紹_(BDM) 基本驅動模組

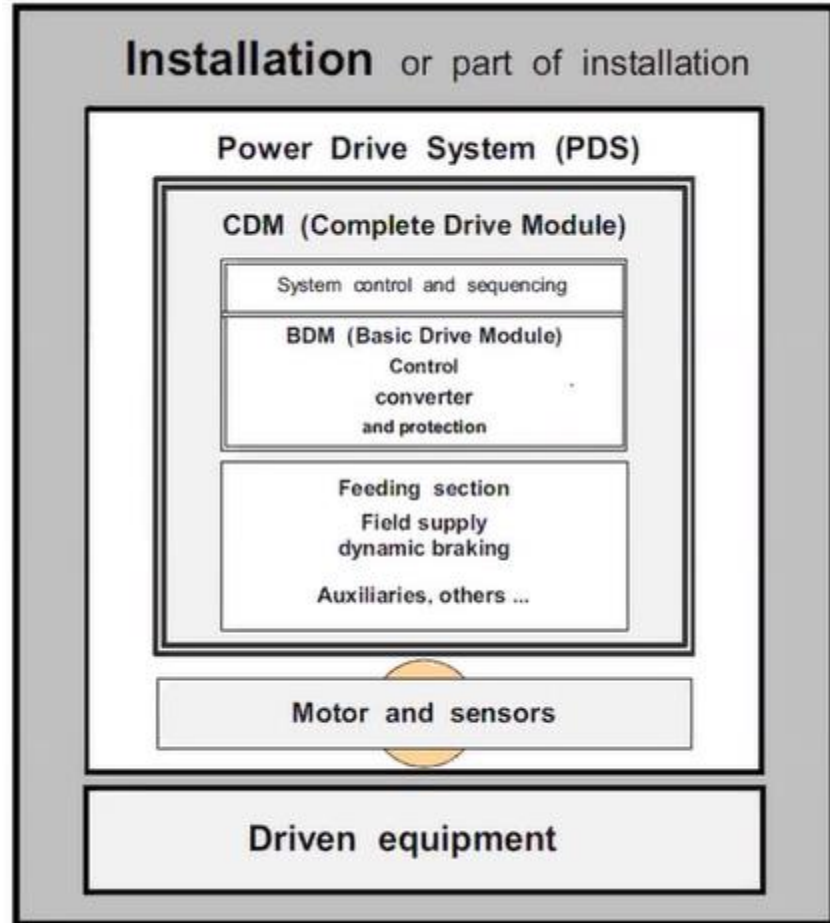


Basic Driver Module (BDM): 基本驅動模組
(Include Control, converter, protection)



VFD (變頻驅動器) 定義

■ 範例介紹_(CDM) 完整驅動模組

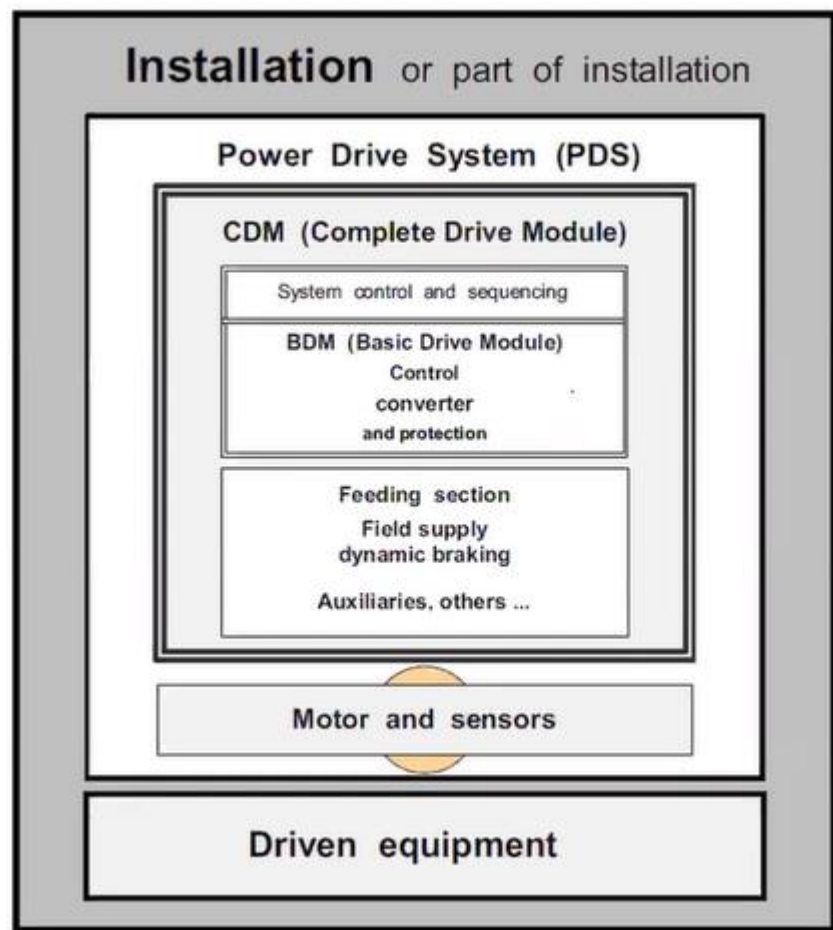


Complete Driver Module (CDM): 完整驅動模組
(the motor and the sensors which are mechanically coupled to the motor shaft are not included)



VFD (變頻驅動器) 定義

■ 範例介紹_(PDS) 電力驅動系統

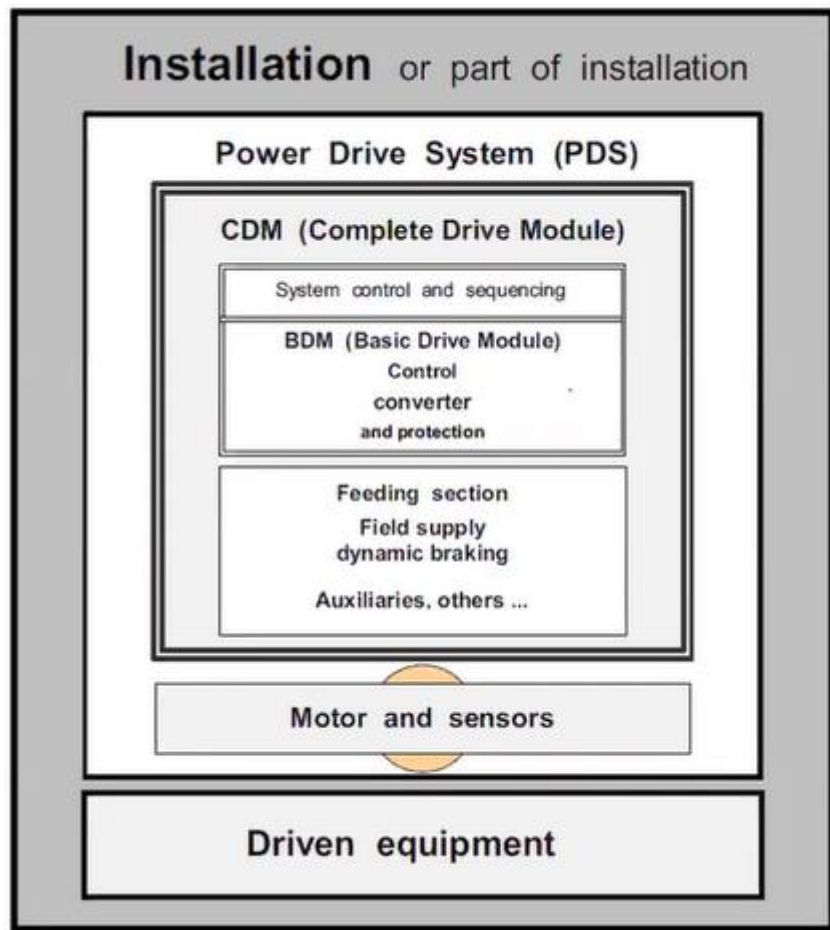


Power Drive System (PDS): 電力驅動系統
(Include CDM, motor, sensor)



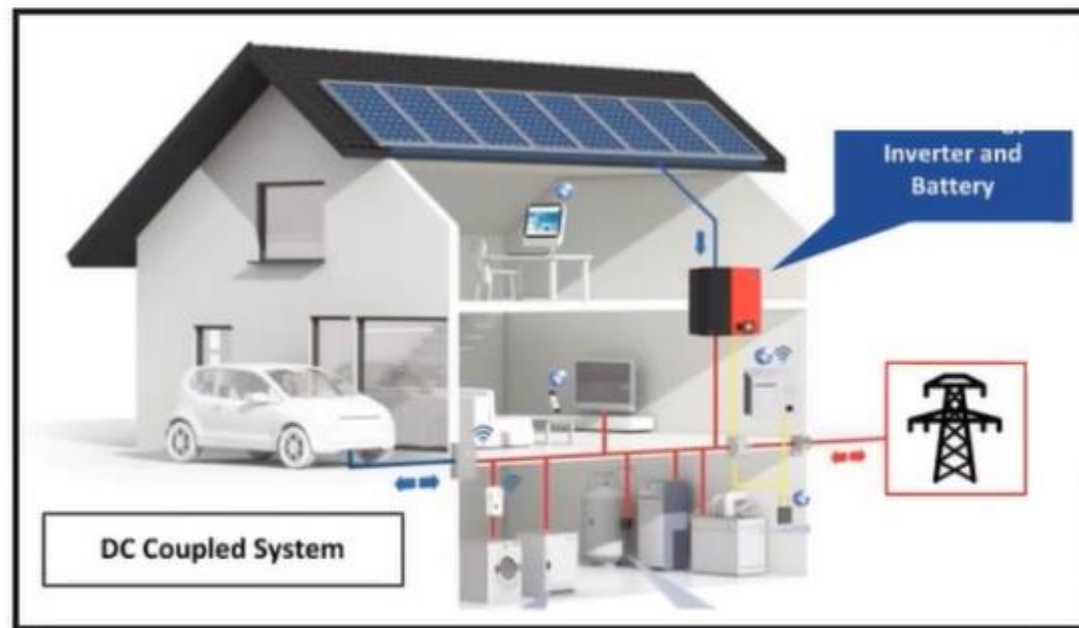
VFD (變頻驅動器) 定義

■ 範例介紹_(Installation) 安裝



Installation: 安裝

(Include PDS, CDM, motor, sensor, driven equipment)



VFD 對應指令與標準說明

• 歐洲指令

LVD 2014/35/EU – EN61800-5-1:2007+A1:2017+A11:2021

EMI 2014/30 EU – EN IEC 61800-3:2018

能效 COMMISSION REGULATION (EU) 2019/1781 – EN 61800-9-2:2017 (with Indicative motor)

• 標準

Standard	IEC	EN	DOP(發佈日) DOW(強制日)
安規	IEC 61800-5-1:2007/A1:2016 IEC 61800-5-1:2022 (2022.08.31 公布)	EN 61800-5-1:2007+A1/2017+A11/2021	2021.8.5 2023.06.21
EMC	IEC 61800-3:2017	EN IEC 61800-3:2018	2019.4.9 2021.7.9
能效	IEC 61800-9-2:2017	EN 61800-9-2:2017	2018.1.7 2020.4.7

VFD 安規標準 – IEC 61800-5-1

• IEC 61800-5-1 CBTL發證單位調查

IEC 61800-5-1:2022	IEC 61800-5-1:2007/AMD1:2016	
No information declared	Bureau Veritas Consumer Product Services Germany GmbH	TÜV SÜD Certification and Testing (China) Co., Ltd. Guangzhou Branch
	DEKRA Testing and Certification (Suzhou) Co.,Ltd.	TÜV SÜD Product Service GmbH Munich
	Intertek Semko AB	UL International Demko A/S
	SGS Fimko Ltd.	UL International Germany GmbH
	SGS-CSTC Standards Technical Services Co., Ltd. Guangzhou Branch	UL Solutions Melville
	TÜV Rheinland (Shenzhen) Co., Ltd.	VDE Prüf- und Zertifizierungsinstitut GmbH
	TÜV Rheinland Shanghai Co. Ltd	

目前沒有可發行IEC 61800-5-1:2022 的CB 測試實驗室

• 法規比較 EN 61800-5-1 and EN 62368 OVC III

Item	61800-5-1	62368	與 62368 比較
以輸入電壓 300Vac比較			
安全電壓	60Vdc (DVC-A)	60Vdc (ES1)	-
初級對次級-安全電壓 (沿面距離)	5.5 mm	5.5 mm	-
初級對次級-安全電壓 (空間距離)	5.5 mm	5.5 mm	-
初級對地 (沿面距離)	3.0 mm	3.0 mm	-
初級對地 (空間距離)	3.0 mm	3.0 mm	-
耐壓要求 (基本絕緣)	1500 Vac	4000 Vac	↓ (鬆)
耐壓要求 (加強絕緣)	3000 Vac	6000 Vdc	
Impulse test (基本絕緣)	4000 Vac	無	↓ (鬆)
Impulse test (加強絕緣)	6000 Vac		

• 測試要求比較 EN 61800-5-1 與 EN 62368

Item	61800-5-1	62368	與 62368 比較
Tape要求	至少三層 一層滿足基本絕緣 兩層滿足加強絕緣	至少兩層 一層滿足加強絕緣	↑ (嚴)
電容放電要求	60V after 1 秒	查表 (Min. 60V after 2 秒)	↑ (嚴)
漏電流要求	3.5mA	10mA	↑ (嚴)
接地測試要求	10A/2 mins	40A/2 mins	↓ (鬆)
燃燒測試 (塑料)	850°C	無	↑ (嚴)
測試使用電子負載	可	可	-

VFD 能效指令 COMMISSION REGULATION (EU) 2019/1781

- 強制日: 2021/7/1
- 修訂內容及影響
 1. Induction electric motors (1000V ↓)
 2. Variable Speed Drives (VSD) 適用範圍
 - (a). Within 120~1200W
 - (b). Rated Voltage 100-1000Vac
 - (c). 3 Phases input
 - (d). Only one AC voltage output
 - (e). 不適用於核設備
 - (f). 不適用於 With sinusoidal input current
- 要求



From 2021/7/1	Motor	三相0.75KW-1000KW meet IE3 三相0.12KW-0.75KW meet IE2
	VSD	三相0.12KW-1000KW meet IE2
From 2023/7/1	Motor	三相0.75KW-200KW meet IE4 單相0.12KW-1000KW meet IE2

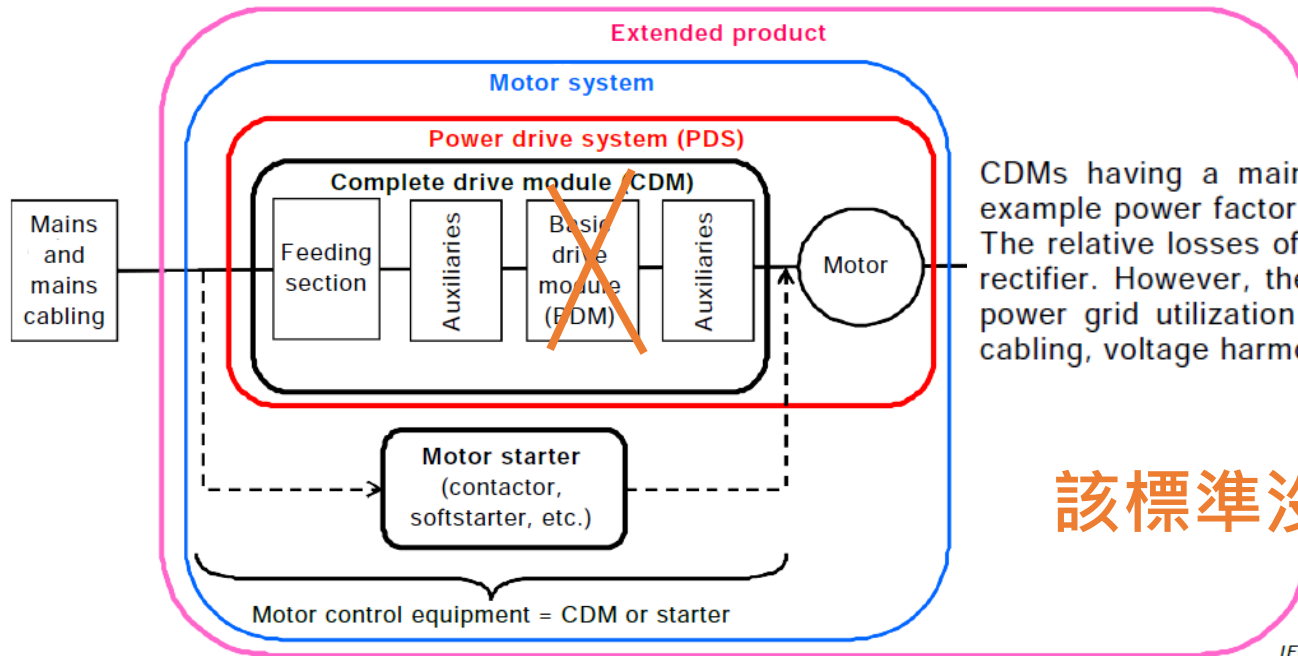
VFD 能效標準 – IEC/EN 61800-9-2

IEC/EN 61800-9-2 適用範圍

- 完整驅動模組(CDM) 和
- 動力驅動系統 (PDS) 和
- 電機啟動器, 包含所有用於電機驅動的設備

針對下列設備不強制

- 100V ↓
- 1000V ↑
- Servo PDS
- Other than single output
- Input current THD < 10%



CDMs having a mains current THD of 10 % or lower (according to IEC 61000-3-12), for example power factor correction (PFC) fed CDMs, can be excluded from the IE classification. The relative losses of an active rectifier are typically twice the losses of a CDM with a diode rectifier. However, the efficiency contribution of an active rectifier can be seen in improved power grid utilization and lower system level losses and disturbances (power transformer, cabling, voltage harmonics, flicker).

該標準沒有包含 BDM

IEC

■ 產品分類-使用環境分為兩種

a) First environment: environment that includes residential premises and establishments directly connected without intermediate transformers to a low-voltage power supply network which supplies buildings used for residential purposes

Note 1 to entry: Houses, apartments, commercial premises or offices in a residential building are examples of first environment locations.

第一類環境

包括居家場所，也包括那些不經過中間變壓器連接到商用建築的低壓供電網路的應用。

注：住宅，公寓，商建都屬於第一類環境

■ 產品分類

b) Second environment environment that includes all establishments other than those directly connected to a low voltage power supply network which supplies buildings used for residential purposes

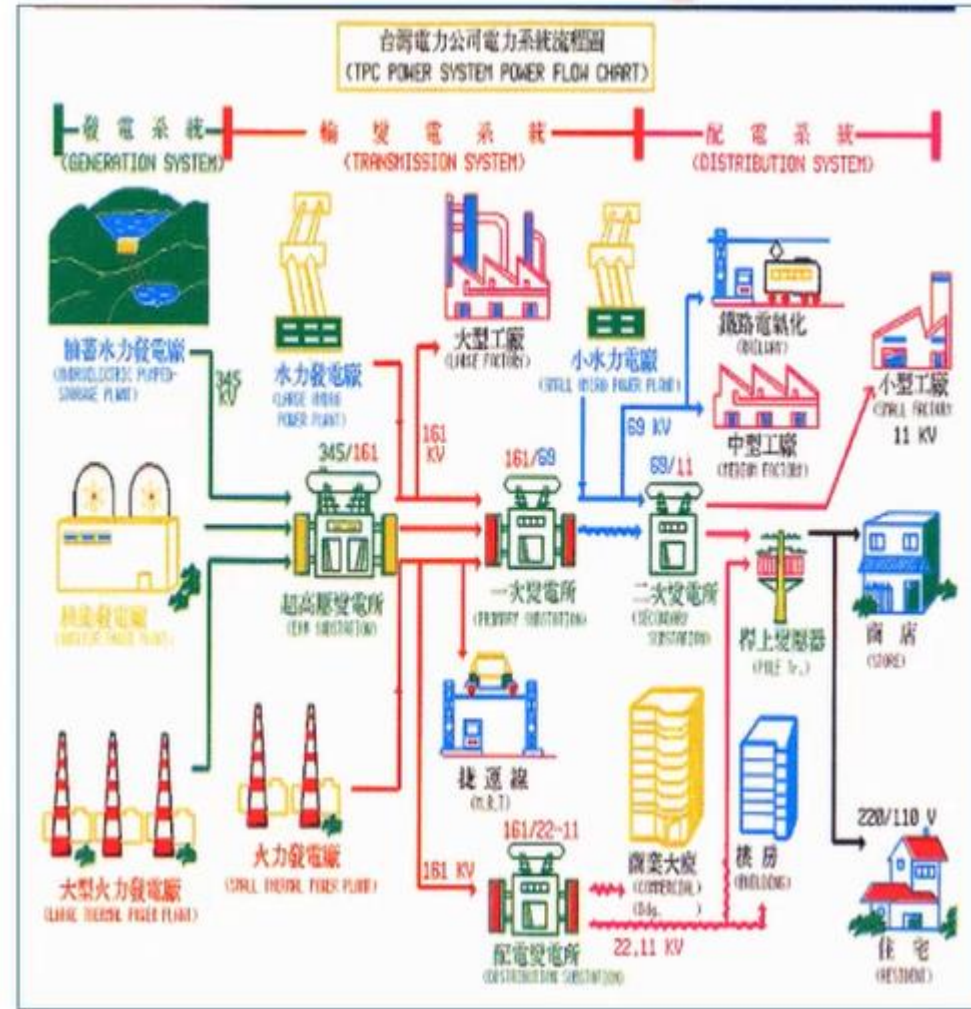
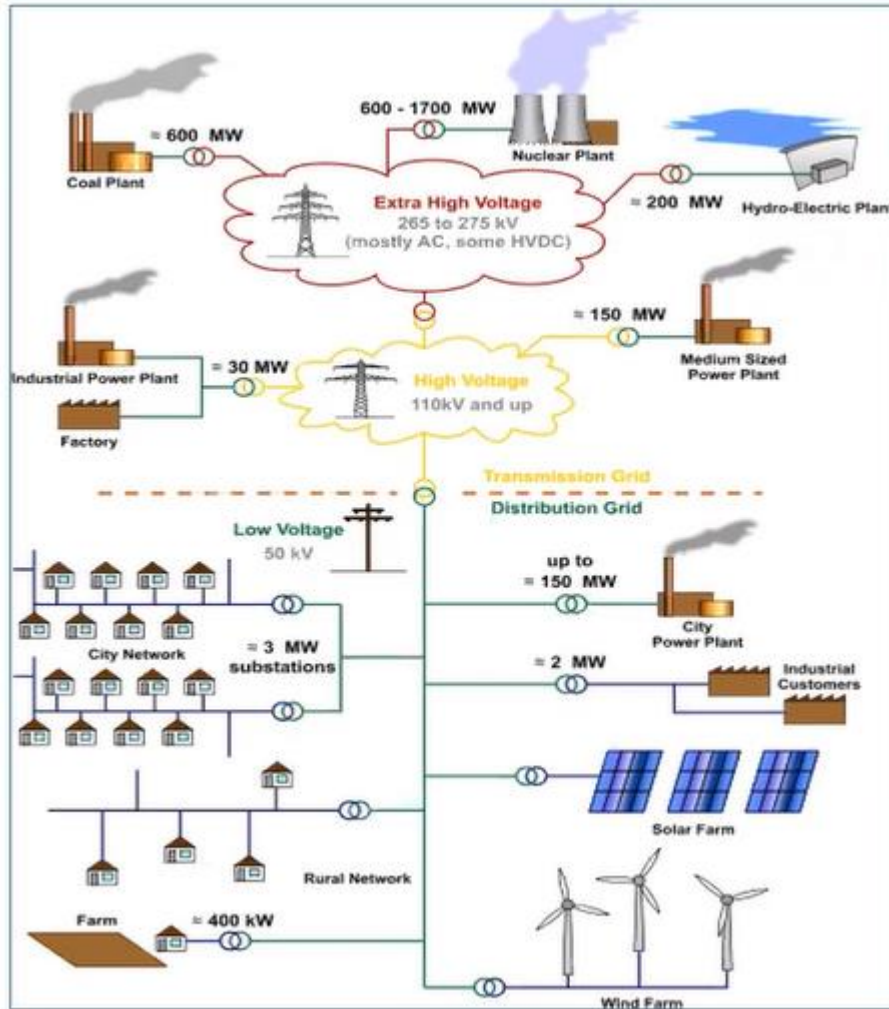
Note 1 to entry: Industrial areas or technical areas of any building fed from a dedicated transformer are examples of second environment locations.

第二類環境

除了那些直接連接到商用建築的低壓供電網路的應用之外，都歸於第二類環境。
例如: 工業區，使用專用變壓器的技術區域

VFD EMI標準 – IEC 61800-3

■ 範例介紹_電源配電系統



VFD EMI標準 – IEC 61800-3

■ 產品分類-使用環境分為四類

C1：額定電壓小於1000V,使用在第一類環境

C2：額定電壓小於1000V，既沒有插頭也沒有可移動部件，而且當應用於第一類環境時候需要專業人員安裝操作的。

注：專業人員指有相關安裝使用PDS技能的人員或機構，技能包括關於EMC的方面。

C3：應用於第二類環境，且額定電壓低於1000V的。

C4：額定電壓大於等於1000V，或者額定電流大於400A，或者應用於第二類環境的複雜系統。

VFD EMI標準 – IEC 61800-3

■ 使用手冊

If special EMC measures are necessary to fulfil the required limits, these shall be clearly stated in the us documentation.

(符合EMC的要求，以下使用的元件，必須敘述在說明書上)

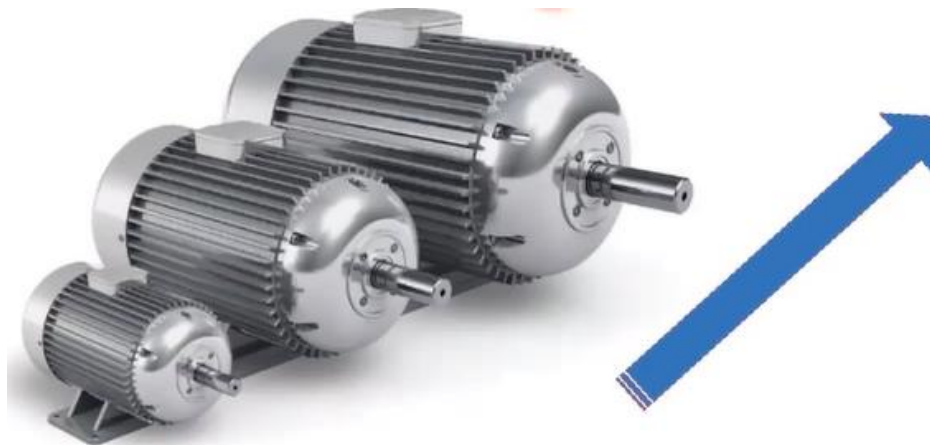
例如：

- maximum and minimum acceptable supply network impedance; 最大及最小可以接受的系統阻抗
- the use of shielded or special cables (power and/or control); 使用隔離或特殊的導線
- cable shield connection requirements; 導線連接的要求
- maximum permissible cable length; 最大允許導線的長度
- cable segregation; 導線的隔離
- the use of external devices such as filters; 使用外部的元件，如濾波器
- the correct bonding to functional earth. 正確的接地

■ 操作模式

A selection of representative operation modes shall be made, taking into account that not all functions, but only the most typical functions of the electronic equipment can be tested. The estimated worst-case dv/dt operating modes for normal application shall be selected. (簡單來說，典型的架構中，評估最差的模式)

On the other hand, it is important to consider the effect of passive capacitive, resistive, or inductive power circuit components, such as snubber components that are used to control the rate of rise of this voltage. The output waveform with these devices present can have dv/dt characteristics that are load dependent. In this case, **it is important that the PDS be tested at the worst case dv/dt point of operation.**



VFD EMI標準 – IEC 61800-3

- 測試項目
- Conducted (in/output) , Radiated Emission
- Harmonics (EN 61000-3-2)
- Flicker (EN 61000-3-3)
- ESD (Electrostatic Discharge) EN 61000-4-2
- RS (Radiated Radio) EN 61000-4-3
- EFT/Burst (Electrical Fast Transient) EN 61000-4-4
- Surge (EN 61000-4-5)
- CS (Conducted Disturbances) EN 61000-4-6
- Voltage dips (EN 61000-4-11)
- Total Harmonic Distortion / Voltage Deviations / Frequency Variations
Frequency rate of change (IEC 61000-2-4)
- Harmonic Order (IEC 61000-4-13)
- Commutation notches test (IEC 60146-1-1)

VFD EMI標準 – IEC 61800-3

■ 其它要求測項

0-10V信號接口 (Signal interface) >3m , 需增加EFT/CS測試

Signal interfaces	Fast transient-burst ^e	IEC 61000-4-4	1 kV/5 kHz Capacitive clamp	B
	Conducted radio-frequency common mode ^e	IEC 61000-4-6 see also 5.3.4	0,15 MHz to 80 MHz 10 V 80 % AM (1 kHz)	A

輔助電源介面 (Auxiliary DC power ports below 60 V) >3m , 需增加EFT/CS測試 ; >30m需增加Surge測試

Ports for process measurement control lines Auxiliary DC power ports below 60 V	Fast transient-burst ^e	IEC 61000-4-4	2 kV/5 kHz Capacitive clamp	B
	Surge ^f 1,2/50 μs, 8/20 μs	IEC 61000-4-5	1 kV ^{d,f}	B
	Conducted radio-frequency common mode ^e	IEC 61000-4-6 see also 5.3.4	0,15 MHz to 80 MHz 10 V 80 % AM (1 kHz)	A

VFD EMI標準 – IEC 61800-3

■ 傳導限值

Frequency band MHz	Category C1		Category C2	
	Quasi peak dB(μ V)	Average dB(μ V)	Quasi peak dB(μ V)	Average dB(μ V)
$0,15 \leq f < 0,50$	66 Decreases with log of frequency down to 56	56 Decreases with log of frequency down to 46	79	66
$0,5 \leq f \leq 5,0$	56	46	73	60
$5,0 < f < 30,0$	60	50	73	60

如果產品測試結果超出C1限值，那麼需要在說明書裡面加上以下警語

Where a PDS does not comply with the limits of category C1, the following warning shall be included in the instructions for use:

Warning

In a residential environment, this product may cause radio interference, in which case supplementary mitigation measures may be required.

VFD EMI標準 – IEC 61800-3

■ 輻射限值

Frequency band MHz	Electric field strength component Quasi-peak dB(μ V/m)			
	Measurement distance 10 m ^a		Measurement distance 3 m ^a	
	Category C1	Category C2	Category C1	Category C2
$30 \leq f \leq 230$	30	40	40	50
$230 < f \leq 1\ 000$	37	47	47	57

^a For selection of measurement distance, see 6.3.1.3.3.

產品測試結果超出C1的限值，同樣需要在說明書裡面加上警告語句：

PS: C1限制值等同於資訊類法規Class B