積極節能有限公司
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歐姆定律
OHM'S LAW

$$P = VI \qquad V = IR \qquad P = \frac{V^2}{R} \qquad P = I^2R$$

P = 電功率
V = 電壓
I = 電流
R = 電阻

P = Power
V = Voltage
I = Current
R = Electric Resistance

Source: EMSD

變壓器的效率（功率損耗）
EFFICIENCY OF A TRANSFORMER (POWER LOSS)

$$P_{loss} = P_{in} - P_{out} \qquad P_{loss} = \frac{P_{out}}{\eta} - P_{out} \qquad \eta = \frac{P_{out}}{P_{in}} \times 100\%$$

P_{loss} = 功率損耗
P_{in} = 輸入有效功率
P_{out} = 輸出功率
η = 電效率

P_{loss} = Power Loss
P_{in} = Input Effective Power
P_{out} = Output Power
η = Electrical Efficiency

Source: EMSD

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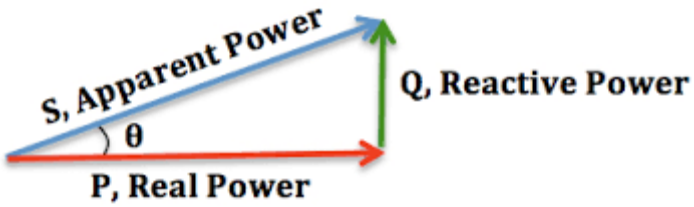
交流電功
AC POWER



$$P^2 + Q^2 = S^2$$

$$cos\theta = \frac{P}{S}$$

θ = 功率因數
P = 有功功率
Q = 無功功率
S = 表觀功率

θ = Power Factor (PF)
P = Active Power
Q = Reactive Power
S = Apparent Power

Source: EMSD

電阻和溫度的關係
DEPENDENCE OF RESISTANCE ON TEMPERATURE

$$\mathbf{Rt = R0\ [1 + \alpha(T - T0)]}$$

Rt = 溫度的電阻值
R0 = 當時溫度的電阻值
α = 電阻溫度系數
T = 上升的溫度
T0 = 當時的溫度

Rt = Resistivity at a Temperature
R0 = Resistivity at a Reference Temperature
α = Temperature Coefficient
T = Rising Temperature
T0 = Reference Temperature

Source: EMSD

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電流需求量
CURRENT DEMAND

$$I = \frac{P}{V} \times N \times A$$

P = 電功率
V = 電壓
I = 電流
N = 燈具的數量
A = 容許參差額

P = Power
V = Voltage
I = Current
N = Number of Luminaires
A = Allowance for Diversity

表 7(1) **容許參差額** **此表只適用於每相電流需求量不超逾 400 安培的裝置。**			
須應用參差額計算的導體或開關設備的用途	房產類別		
	個別家庭裝置，包括一幢大廈內的個別居住單位	小型商店、倉庫、辦公室及商業樓宇	小型酒店、宿舍、賓館等
照明	總電流需求量的 66%	總電流需求量的 90%	總電流需求量的 75%

資料來源：電力(線路)規例工作守則- 2015 年版 - 機電工程署

Table 7(1) **Allowance for Diversity** **This table is applicable to installations having a current demand not exceeding 400 A in each phase.**			
Purpose of Conductors or Switchgear to which Diversity Applies	Type of Premises		
	Individual Household Installations, Individual Dwellings of a Block	Small shops, Stores, Offices and Business Premises	Small Hotels, Boarding Houses, Guest Houses, etc.
Lighting	66% of Total Current Demand	90% of Total Current Demand	75% of Total Current Demand

Source: Code of Practice for the Electricity (Wiring) Regulations - EMSD

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決定電纜大小（傳統方法）
CABLE SIZING (CONVENTIONAL METHOD)

$$Ib \leq In \leq Iz$$

Ib = 電路設計電流
In = 保護裝置額定電流值
Iz = 導體的有效載流量

Ib = Circuit Design Current
In = Nominal Rating of Protective Device
Iz = Effective Current-Carrying Capacity of Conductor

Source: EMSD

電纜導體的選擇和大小
SELECTION AND SIZING OF CABLE CONDUCTORS

$$It \geq Iz = \frac{In}{Ca \times Cg \times Ci \times Cp}$$

It = 電流值
Iz = 導體的有效載流量
In = 保護裝置額定電流值
Ca = 環境溫度校正因數
Cg = 電纜組合校正因數
Ci = 隔熱物質校正因數
Cp = 保護器件因數

It = the value of current tabulated
Iz = Effective Current-Carrying Capacity of Conductor
In = Nominal Rating of Protective Device
Ca = Correction Factor for Ambient Temperature
Cg = Correction Factor for Grouping
Ci = Correction Factor for Thermal Insulation
Cp = Correction Factor for Protective Device

Source: EMSD

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電壓降
VOLTAGE DROP

$$\mathbf{VD = V_{AM} \times Ib \times L}$$

VD = 總電壓降
V_{AM} = 檢查電壓降
Ib = 電路設計電流
L = 導體的長度

VD = Grand Voltage Drop
V_{AM} = Voltage Drop Testing
Ib = Circuit Design Current
L = Length of Conductor

Source: EMSD

總諧波失真率
TOTAL HARMONIC DISTORTION (THD)

$$\%THD = \frac{\sqrt{\sum_{h=2}^{\infty}(I_h)^2}}{I_1} \times 100$$

I_1 = 基波電流的均方根值
I_h = 第 h 諧波級次的電流均方根值

I_1 = r.m.s. value of fundamental current
I_h = r.m.s. value of current of the *h*th harmonic order

Source: EMSD

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電路保護導體
CIRCUIT PROTECTIVE CONDUCTOR

$$S = \frac{\sqrt{I^2 t}}{k}$$

S = 導體
I = 故障電流
t = 接地故障時電流切斷時間
k = 整體因數

S = Conductor
I = Fault Current
t = Earth-Fault Disconnection Times
k = Overall Factor

Source: EMSD

計算電費
CALCULATING THE ELECTRICITY TARIFF

B = W × kWH

B = 電費
W = 耗電量
kWH = 每度電費

B = Bill
W = Energy Consumption
kWH = Price per Unit of Electricity

Source: EMSD / CLP / HK Electric

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照明功率密度
LIGHTING POWER DENSITY

$$LPD = \frac{N1 \times W1 + N2 \times W2 + \ldots\ldots + Nn \times Wn}{A}$$

LPD = 照明功率密度
$N_1, N_2, \ldots Nn$ = 室內每種照明裝置的數量
$W_1, W_2, \ldots Wn$ = 室內每種照明裝置的瓦數
A = 空間面積

LPD = Lighting Power Density
$N_1, N_2, \ldots Nn$ = Number of Each Lighting Fitting in the Space
$W_1, W_2, \ldots Wn$ = Wattage of Each Lighting Fitting in the Space
A = Area of Space

Source: EMSD

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流明方法
LUMEN METHOD

$$E = \frac{I}{h^2}$$

E = 照度，lux
I = 發光強度，cd
h = 室空間高，即燈具至工作面的高度，m

E = Illuminance, lux
I = Luminous Intensity, cd
h = Mounting Height, m

$$E = \frac{\Phi \times N \times U \times K}{A}$$

E = 平均照度，lux
Φ = 光源的光通量，數據從製造商獲得。
N = 燈具的數量
U = 利用系數，與燈具的設計有關，數據由製造商提供，但選擇時須首先計算室空間比。
K = 維護系數，與光源老化，燈具和室內表面逐漸被灰塵污染等有關，有設計者估計。
A = 工作面的面積，m^2

E = Average Illuminance, lux
Φ = Luminous Flux, Obtainable from Manufacturer.
N = Number of Luminaires
U = Utilization Factor, related to the design of luminaire, data is obtainable from manufacturer, but need to calculate the room index
K = maintenance factor, related to aging of light source, dirt accumulated in luminaire and room. Data is to be accessed by designer.
A = area of working surface, m^2

Source: EMSD

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室空間比
ROOM INDEX CALCULATION

$$RI = \frac{L \times W}{(L+W)h}$$

RI = 室空間比
L = 室長，m
W = 室闊，m
h = 室空間高，即燈具至工作面的高度，m

RI = Room Index
L = Length of Room, m
W = Width of Room, m
h = Mounting Height, i.e. Distance from luminaire to working surface, m

為照度均勻，燈具需適當排列。燈具之間的距離 S 與空間間高 h 的比例（SHR）亦與燈具的設計有關，可從製造商的光度數據查得，通常 S = 1.0h to 1.5h。

To achieve uniform illuminance, the luminaires should be suitably arranged. The space to mounting height ratio (SHR) is related to the luminaire design and recommended value can be obtained from manufacturer.
In general, S = 1.0h to 1.5h.

Source: EMSD

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逐點演算法
Point-by-point method

$$E = \frac{I_\theta}{h^2} cos^3\theta$$

OR

$$E = (I_1 \times K_{\rho 1} \times K \times \cos \alpha_1 / d_1^2) + (I_2 \times K_{\rho 2} \times K \times \cos \alpha_2 / d_2^2)$$

E = 工作面某點的照度
I = 從照射面某點面向燈具方向的光源光強度
α = 入射角
θ = 反射角
d = 光源與工作面的距離
K_ρ = 照明系數，與反射光對計算點上照度的貢獻有關。
K = 維護系數，與光源老化，燈具和室內表面逐漸被灰塵污染等有關。

E = illuminance of a point in the working surface
I = intensity of light source to the point at a certain direction
α = Angle of Strike
θ = Angle of Reflection
d = Distance from light source to working surface
K_ρ = Coefficient of illuminance, contributed by reflectance
K = maintenance factor, related to aging of light source, dirt accumulated in luminaire and room.

Source: EMSD