

- **CIRCUIT BREAKER CALCULATION FOR SDB**

- **FOR SOCKET**

- 1. **BASEMENT:-**

- $P=17.6 \text{ Kw}$

- $I=P/V=17.6\text{Kw}/\sqrt{3} *380=20\text{A}$

- 2. **GROUND:-**

- $P=12.1\text{Kw}$

- $I=P/V=12.1\text{Kw}/\sqrt{3} *380=20\text{A}$

- 3. **FIRST FLOOR:-**

- $P=9.9\text{Kw}$

- $I=P/V=9.9\text{Kw}/\sqrt{3} *380=16\text{A}$

- 4. **SECOND FLOOR:-**

- $P=24.2\text{Kw}$

- $I=P/V=24.2\text{Kw}/\sqrt{3} *380=20\text{A}$

- **FOR LIGHTING**

- By using the same calculation for all lighting we use 10A for SDB

- **CABLE SIZE FOR MAIN CIRCUIT BREAKER (MCB)**

- ✓ Here we have 4 SDB ,we estimate the length of each SDB from MSB then we calculate the cable size

- 1. **BASEMENT:-**

- $L=1\text{m}$

- $Z_e=0.3$

- $P_{\text{tot}}=P_{\text{socket}}+ P_{\text{light}}=17.96\text{Kw}$

- $I_b=P_{\text{tot}}/V=78\text{A}$

- $I_n \geq I_b , I_n=79\text{A}$

- $I_t \geq I_n, I_t=81\text{A}$ from table , cable size from table 16 mm²

- $V_d=M_v *I_b*L/1000=0.2 \text{ V}$

- $V_d \leq 4\%240 \leq 9.6 \text{ V}$

- $(Z_s)_{\text{ACTUAL}}=Z_e + (R1 + R2)_{\text{ACTUAL}}$

- $R1=1.15 \text{ ohm}$

- $R2=3.08 \text{ ohm}$ from table

$$(R1 + R2)_{ACTUAL} = (R1 + R2) * L * 1.2 / 1000 = 0.005 \text{ ohm}$$

$$(Zs)_{ACTUAL} = Ze + (R1 + R2)_{ACTUAL} = 0.305 \text{ ohm}$$

$$I_F = V / Zs = 787A$$

$$S = \sqrt{I_F * I_F * t} / K = 2.2 \text{ mm}^2$$

- CPC > S , so by considering cable size we choose cpc wire > 2.2 mm² therefore we get 4mm² twin cable

2. GROUND:-

$$L = 2m$$

$$Ze = 0.3$$

$$P_{tot} = P_{socket} + P_{light} = 12.5Kw$$

$$I_b = P_{tot} / V = 54A$$

$$I_n \geq I_b , I_n = 55A$$

$$I_t \geq I_n , I_t = 61A \text{ from table , cable size from table } 10 \text{ mm}^2$$

$$V_d = M_v * I_b * L / 1000 = 0.47 \text{ V}$$

$$V_d \leq 4\% 240 \leq 9.6 \text{ V}$$

$$(Zs)_{ACTUAL} = Ze + (R1 + R2)_{ACTUAL}$$

$$R1 = 1.83 \text{ ohm}$$

$$R2 = 4.61 \text{ ohm from table}$$

$$(R1 + R2)_{ACTUAL} = (R1 + R2) * L * 1.2 / 1000 = 0.015 \text{ ohm}$$

$$(Zs)_{ACTUAL} = Ze + (R1 + R2)_{ACTUAL} = 0.315 \text{ ohm}$$

$$I_F = V / Zs = 762A$$

$$S = \sqrt{I_F * I_F * t} / K = 2.09 \text{ mm}^2$$

- CPC > S , so by considering cable size we choose cpc wire > 2.09 mm² therefore we get 4mm² twin cable

3. FIRST FLOOR:-

$$L = 5m$$

$$Ze = 0.3$$

$$P_{tot} = P_{socket} + P_{light} = 10.2Kw$$

$$I_b = P_{tot} / V = 44A$$

$$I_n \geq I_b , I_n = 45A$$

$$I_t \geq I_n , I_t = 45A \text{ from table , cable size from table } 6 \text{ mm}^2$$

$$V_d = M_v * I_b * L / 1000 = 1.61 \text{ V}$$

$$V_d \leq 4\% 240 \leq 9.6 \text{ V}$$

$$(Z_s)_{\text{ACTUAL}} = Z_e + (R_1 + R_2)_{\text{ACTUAL}}$$

$$R_1 = 3.08 \text{ ohm}$$

$$R_2 = 7.41 \text{ ohm} \dots\dots \text{from table}$$

$$(R_1 + R_2)_{\text{ACTUAL}} = (R_1 + R_2) * L * 1.2 / 1000 = 0.06 \text{ ohm}$$

$$(Z_s)_{\text{ACTUAL}} = Z_e + (R_1 + R_2)_{\text{ACTUAL}} = 0.36 \text{ ohm}$$

$$I_F = V / Z_s = 667 \text{ A}$$

$$S = \sqrt{I_F * I_F * t} / K = 1.8 \text{ mm}^2$$

- CPC > S , so by considering cable size we choose cpc wire > 1.8 mm² therefore we get 2.5mm² twin cable

4. SECOND FLOOR:-

$$L = 8 \text{ m}$$

$$Z_e = 0.3$$

$$P_{\text{tot}} = P_{\text{socket}} + P_{\text{light}} = 24.6 \text{ Kw}$$

$$I_b = P_{\text{tot}} / V = 102 \text{ A}$$

$$I_n \geq I_b , I_n = 103 \text{ A}$$

$$I_t \geq I_n , I_t = 106 \text{ A from table , cable size from table } 25 \text{ mm}^2$$

$$V_d = M_v * I_b * L / 1000 = 1.5 \text{ V}$$

$$V_d \leq 4\% 240 \leq 9.6 \text{ V}$$

$$(Z_s)_{\text{ACTUAL}} = Z_e + (R_1 + R_2)_{\text{ACTUAL}}$$

$$R_1 = 0.727 \text{ ohm}$$

$$R_2 = 1.83 \text{ ohm} \dots\dots \text{from table}$$

$$(R_1 +$$

$$R_2)_{\text{ACTUAL}} = (R_1 + R_2) * L * 1.2 / 1000 = 0.03 \text{ ohm}$$

$$(Z_s)_{\text{ACTUAL}} = Z_e + (R_1 + R_2)_{\text{ACTUAL}} = 0.33 \text{ ohm}$$

$$I_F = V / Z_s = 727 \text{ A}$$

$$S = \sqrt{I_F * I_F * t} / K = 2 \text{ mm}^2$$

- CPC > S , so by considering cable size we choose cpc wire > 2 mm² therefore we get 6mm² twin cable

❖ SUMMARY

CIRCUIT No.	LENGT H(L)	AREA(m m ²)	VOLTA GE DROP(Vd)	CURRE NT It(A)	POWER(W)
BASME NT SOCKET	6 m	4 mm ²	1.3 v	81 A	17.6K w
BASEME NT LIGHTIN	6 m	1.5 mm ²	0.4 2v	14 A	0.364 Kw

G					
GROUN G SOCKET	6 m	4 mm²	1.4 v	61 A	12.1K w
GROUN G LIGHTIN G	6 m	1.5 mm²	0.4 2v	14 A	0.403 Kw
FIRST FLOOR SOCKET	6 m	4 mm²	1.5 v	61 A	9.9Kw
FIRST FLOOR LIGHTIN G	6 m	1.5 mm²	0.4 2v	14 A	0.328 Kw
SECOND FLOOR SOCKET	6 m	6 mm²	1.9 4v	106 A	24.2K w
SECOND FLOOR LIGHTIN G	6 m	1.5 mm²	0.4 2	14 A	0.416 Kw