28 JULAI 2021

Rekabentuk Pemasangan Elektrik Voltan Rendah (Lanjutan)

Papan Agihan dan *Control Board*

Ir. Hamzah Ismail, Jurutera Elektrik Penguasa

Papan Agihan

Definasi:

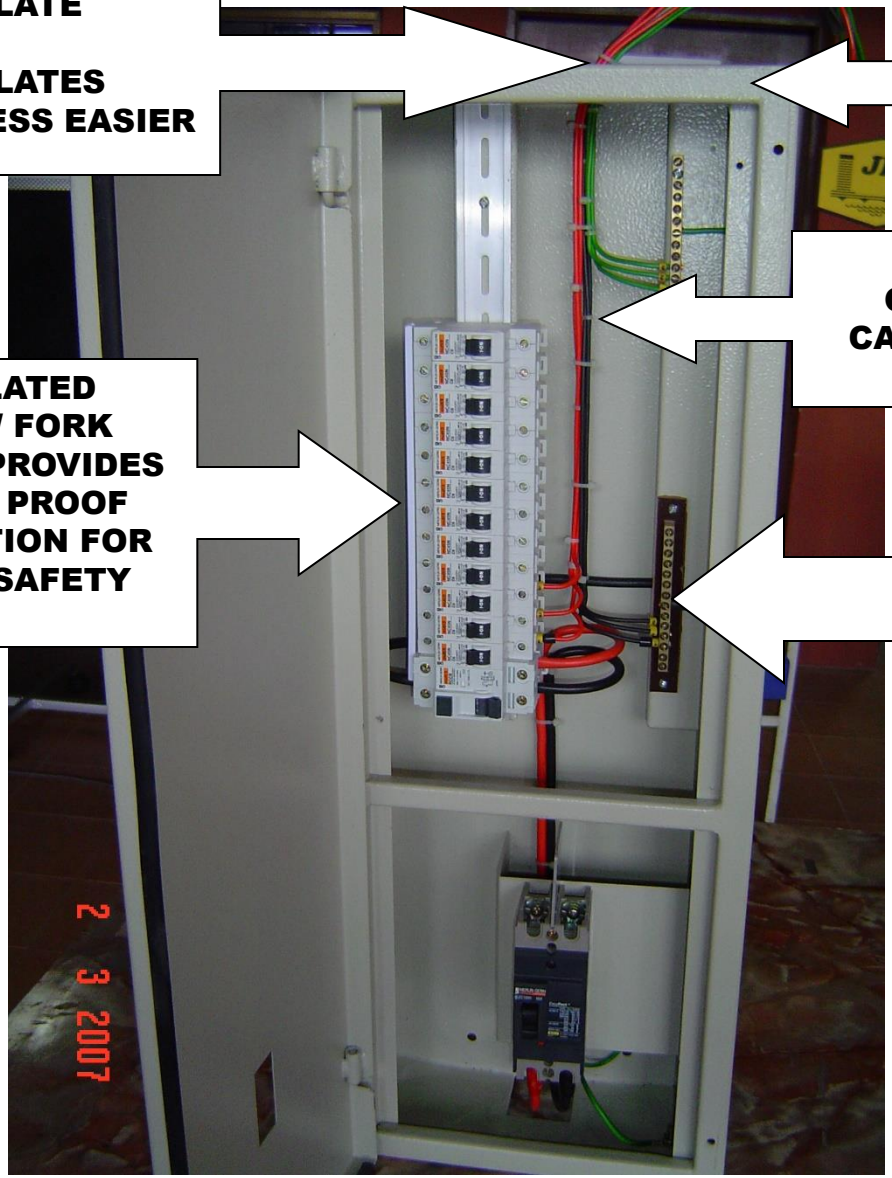
- Papan Agihan *(Distribution Board)*

  'An assembly containing switching or protection devices (e.g. fuses, circuit breaker, RCCBs) associates with one or more outgoing circuits fed from one or more incoming circuits, together with terminals for the neutral and protective circuit conductors'.

Distribution Board

FLAT REMOVABLE GLAND PLATE UNDRILLED.
FLAT REMOVABLE GLAND PLATES MAKES DRILLING AND ACCESS EASIER

ENCLOSURE STEEL THICKNESS 1.2 mm



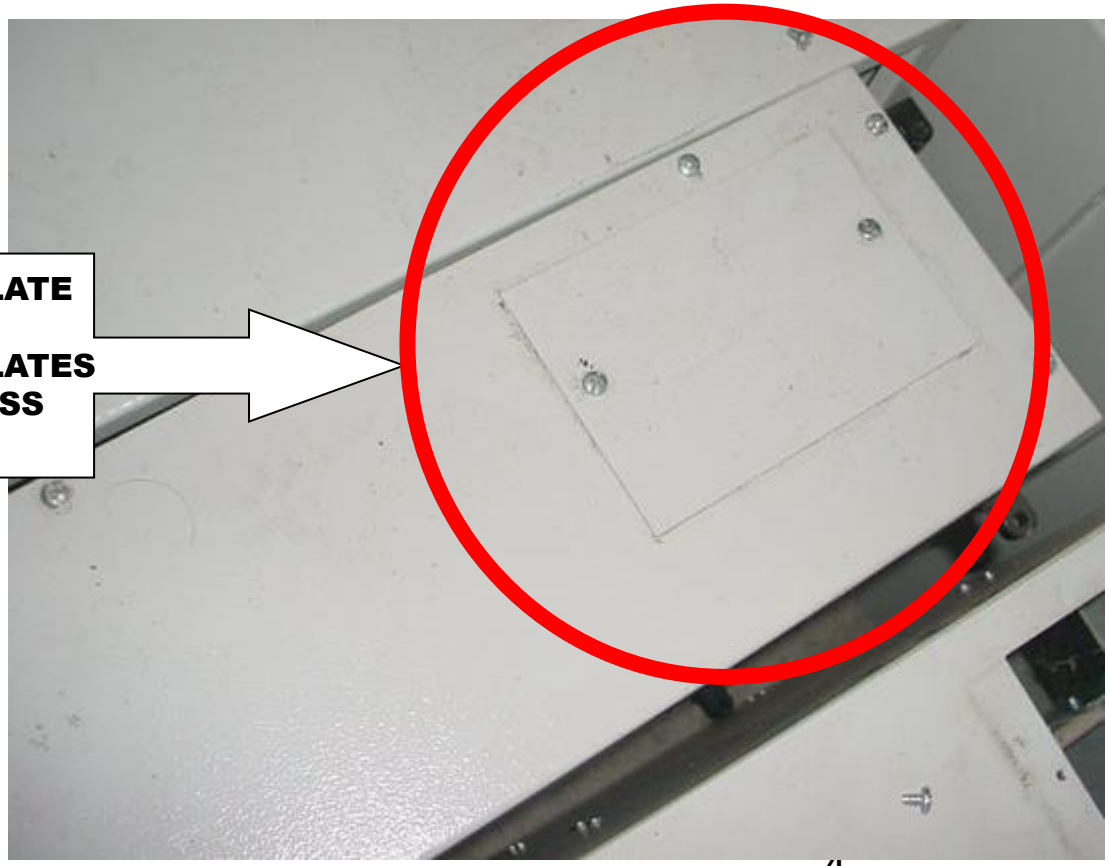
GENEROUS CABLING AREA

INSULATED COMB / FORK BUSBAR PROVIDES FINGER PROOF PROTECTION FOR ADDED SAFETY

THE POSITIONING OF THE NEUTRAL TERMINAL OPPOSITE THE OUTGOING MCBs PROVIDES MUCH SIMPLER CABLE TERMINATION

Distribution Board

FLAT REMOVABLE GLAND PLATE UNDRILLED.
FLAT REMOVABLE GLAND PLATES MAKES DRILLING AND ACCESS EASIER



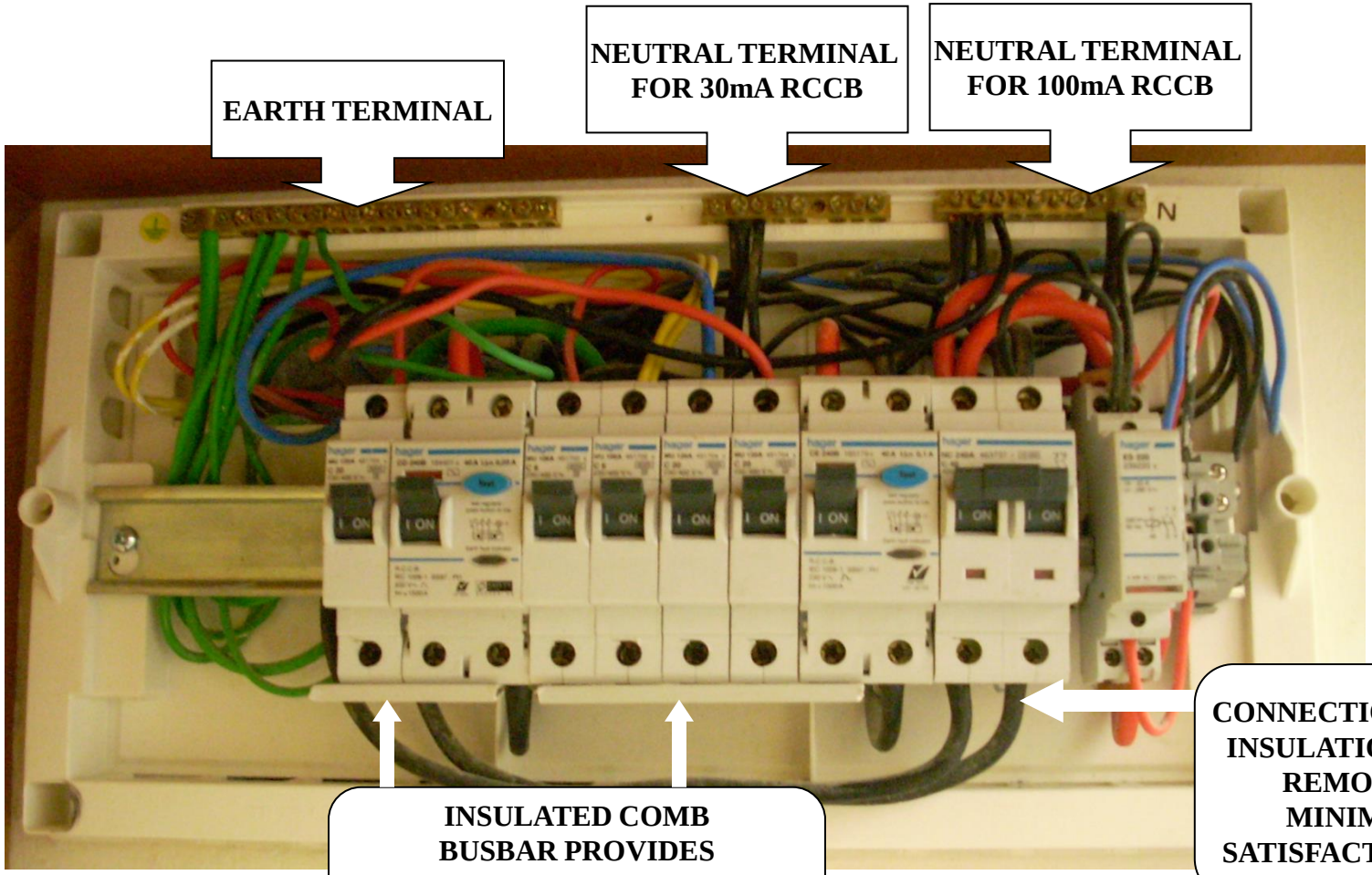
Distribution Board

KNOCKOUTS FOR CABLE ENTRY

Consumer Unit

- Consumer unit shall be called distribution board as specified in IEC 61439-3

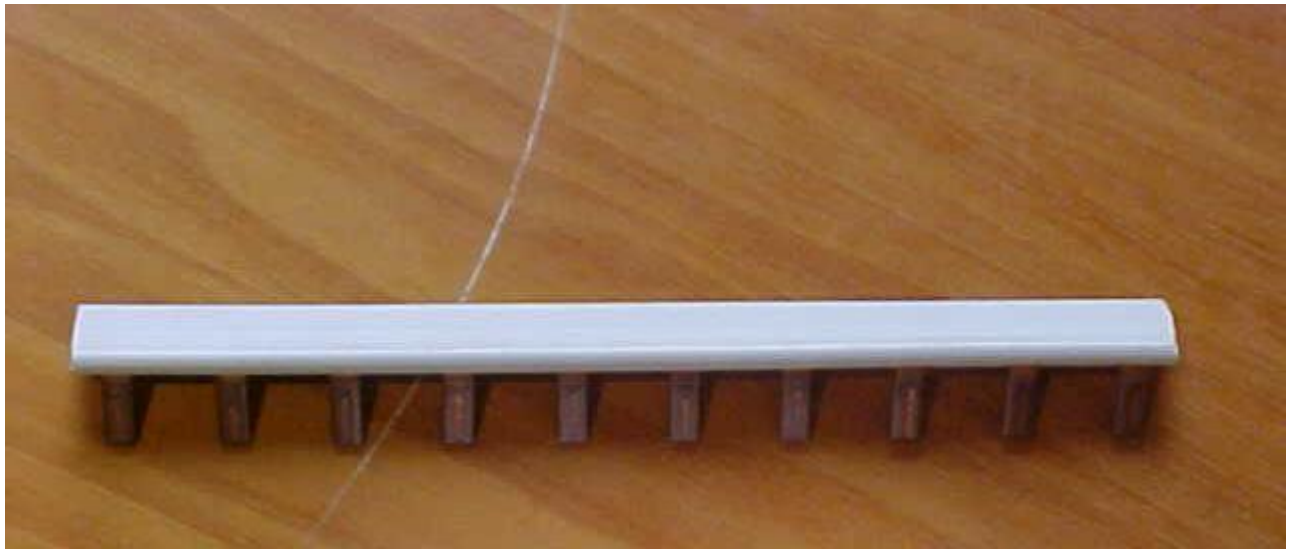
Consumer Unit



MCB dalam all insulated Consumer Unit hendaklah jenis DP dengan breaking capacity 10kA

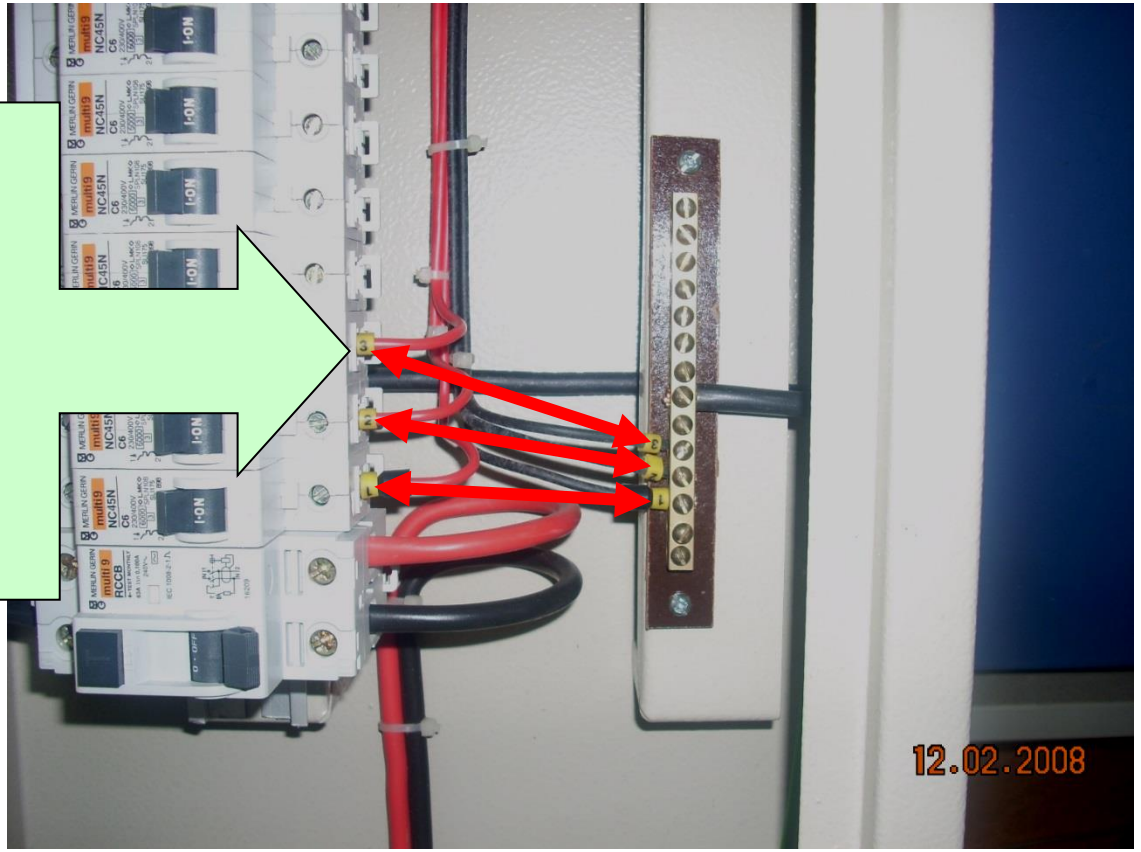
Distribution Boards

- **The comb busbars shall not be less than the sum of the max. current plus 20% spare**



Distribution Boards

- All outgoing cables shall be labeled with circuit number
- The neutral and earth cable shall be labeled and correspond to the phase circuit

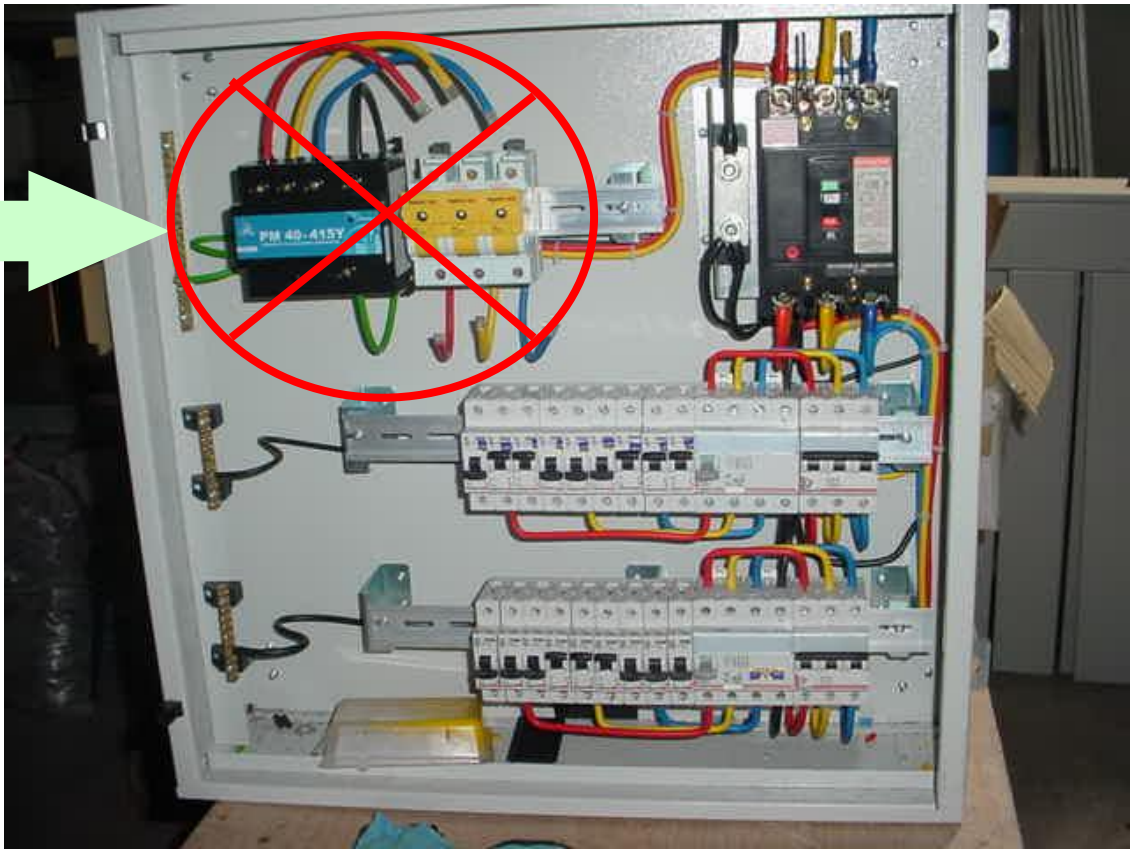


BQ

To provide circuits numbering system and laminating schematic diagram for all DBs (A4 size)

Distribution Boards

SPD shall be housed in separate compartment



Distribution Boards

- Photocopied schematic drawing shall be laminated and displayed on the inside cover of the distribution board

BQ	To provide circuits numbering system and laminating schematic diagram for all DBs (A4 size)

- Beban single phase DB termasuk spare hendaklah ≤ 60A
- DB 1 fasa - penggunaannya - 6 / 10 / 14 way SPN (circuit + 20% spare)
- DB 3 fasa - penggunaannya - 6 / 8 way TPN (circuit + 20% spare)
- Jarak maksimum bagi litar akhir dari DB (last point) adalah 80m (L ≤ 80m)

Distribution Boards

- Kepekaan RCCB 100mA - untuk beban soket komputer di office area/computer lab- maksimum 50 bilangan soket atau 25 bilangan komputer (2 soket untuk 1 komputer)
  - computer leakage current dalam standard ialah 1-2mA
  - anggaran 1.0mA - 1.5mA/computer
- Jika kepekaan RCCB 30mA, untuk beban soket komputer di office area/computer lab - maksimum 14 bilangan soket atau 7 bilangan komputer (2 soket untuk 1 komputer)
- Kepekaan RCCB 10mA - rujuk peraturan elektrik (cth: instant water heater)
- Data Center/ Bilik Server hendaklah diadakan/disediakan DB Khas yang bekalan elektriknya diperolehi dari Essential SSB (bukan diperolehi dari board yang berhampiran)

Komponen Utama di dalam DB

MCB

- Miniature Circuit Breaker
- Rated Current : 6, 10, 16, 20, 25, 32, 40, 50, 60, 63 A
- kA Rating : 6 kA
- Type B, C, D
- Dipasang pada DB untuk litar akhir
- SP/DP/3P

Komponen Utama di dalam DB

RCCB

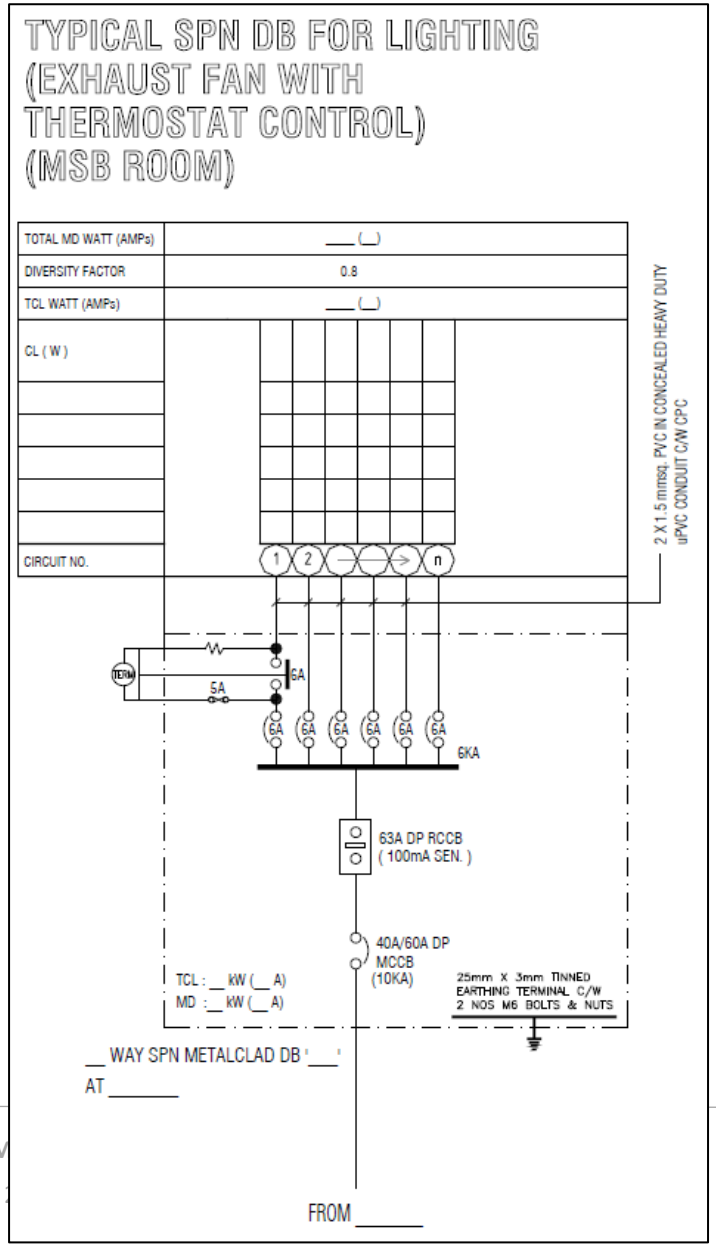
- Residual Current Circuit Breaker
- Rated current : 40 A, 63 A
- Sensitivity : 10mA, 30mA,100mA
- Dipasang pada DB untuk litar akhir
- Type AC, A, B, S
- DP/4P

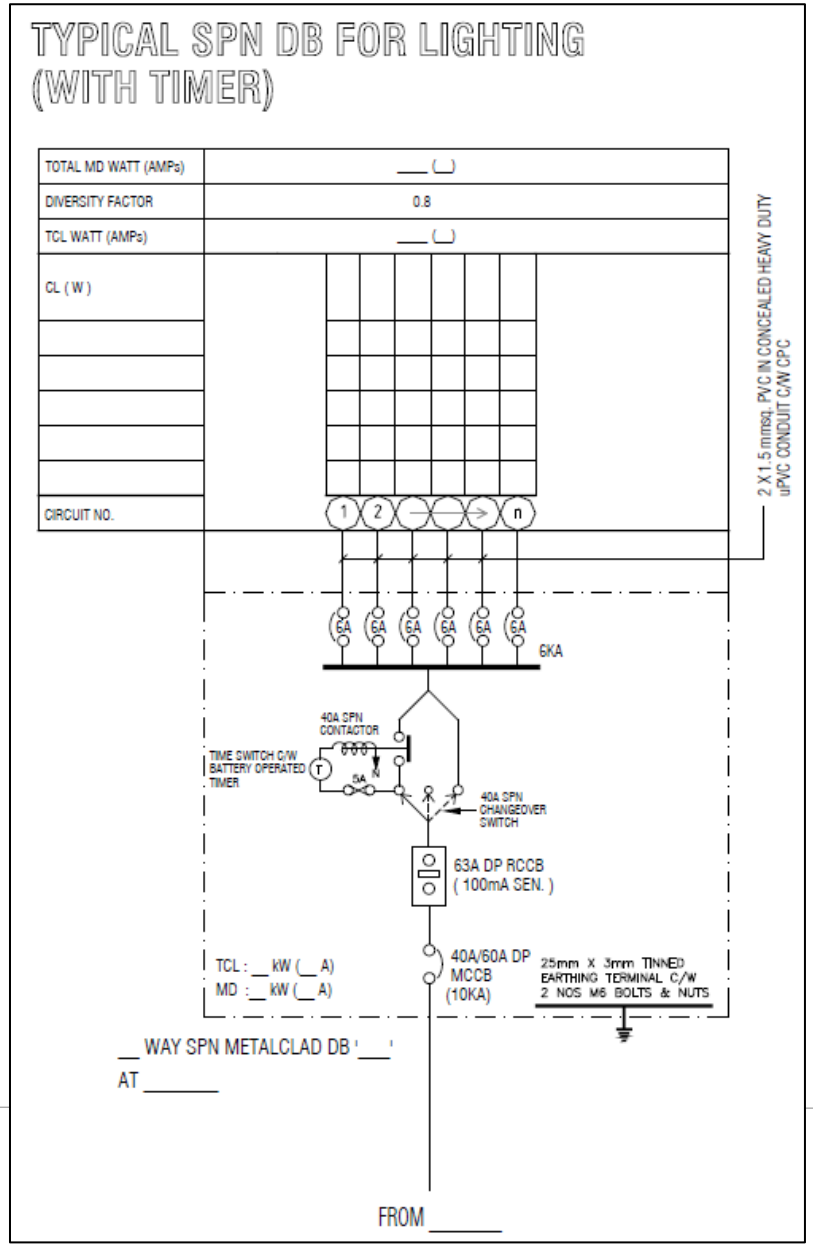
Komponen Utama di dalam DB

MCCB

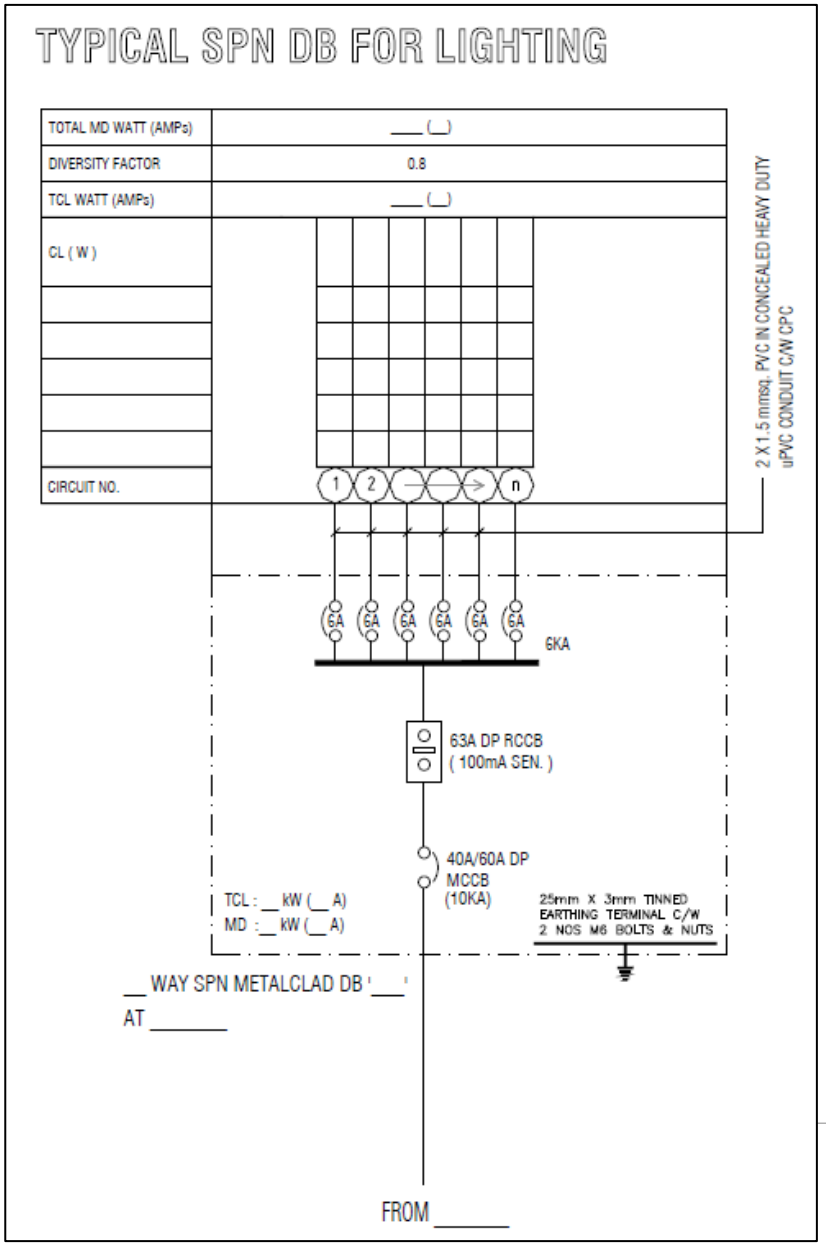
- Moulded Case Circuit Breaker
- Rated Current : 16, 20, 25, 32, 40, 50, 63, 80, 100, 125, 160, 200, 250, 320, 400, 500, 600, 630, 800, 1000, 1250 A
- Untuk DB, kA rating : ≥ 10kA (Icu/Ics)
- DP/TPN/4P
- Rated voltage : 400V/230V
- Higher breaking capacity berbanding MCB

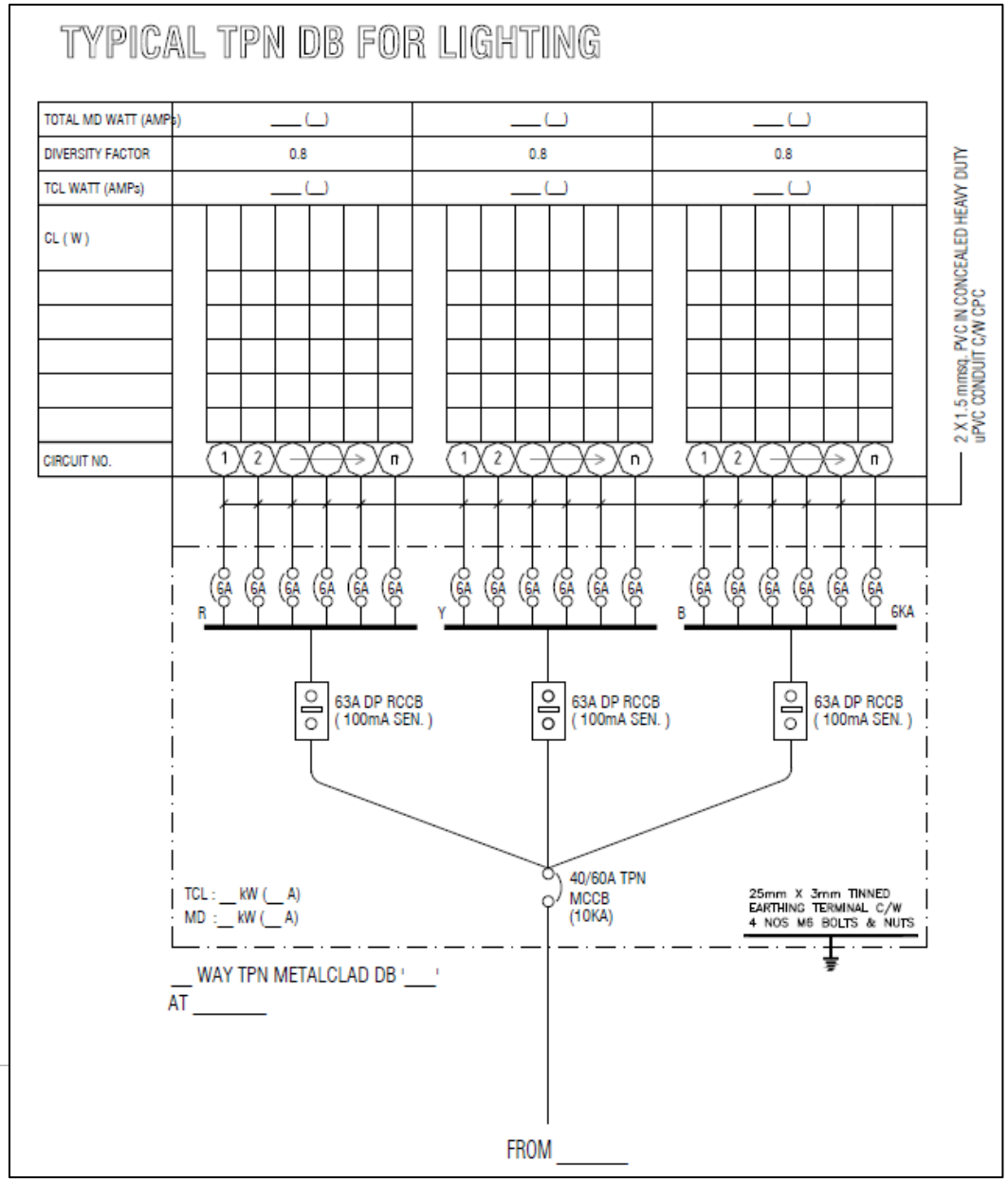
LUKISAN PIAWAI- GAMBARAJAH PENDAWAIAN SKEMATIK DB PIAWAI UNTUK LAMPU





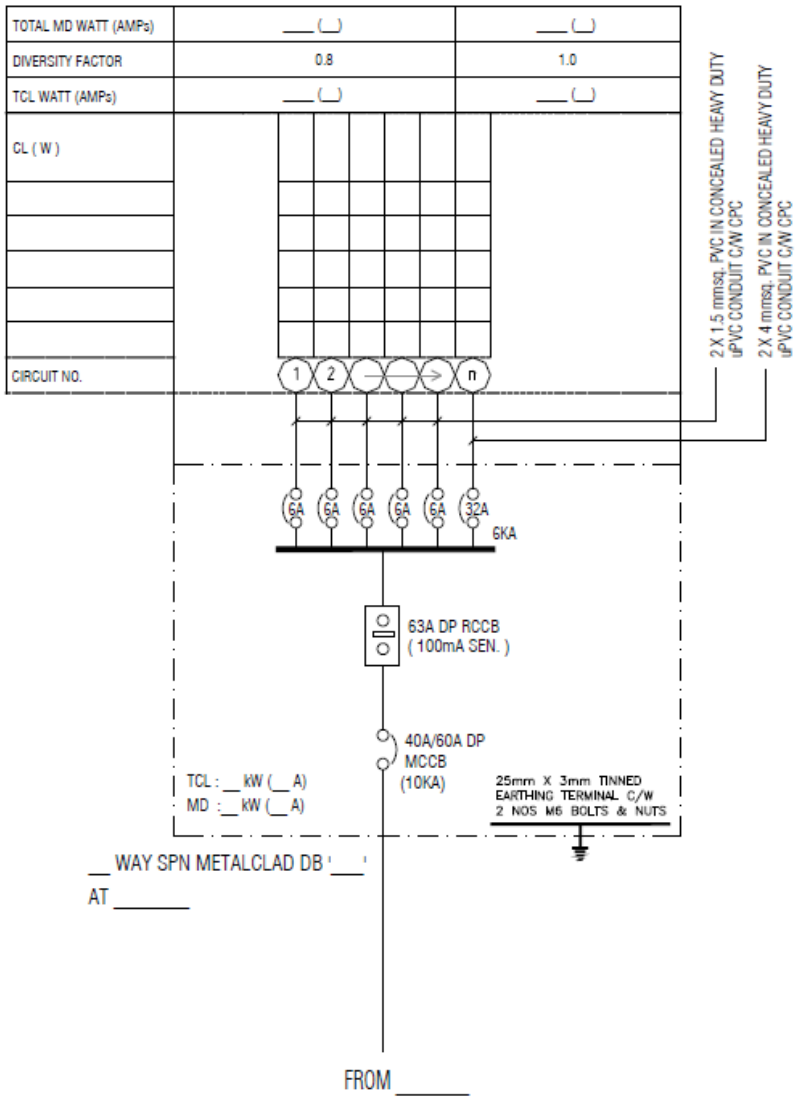
LUKISAN PIAWAI- GAMBARAJAH PENDAWAIAN SKEMATIK DB PIAWAI UNTUK LAMPU



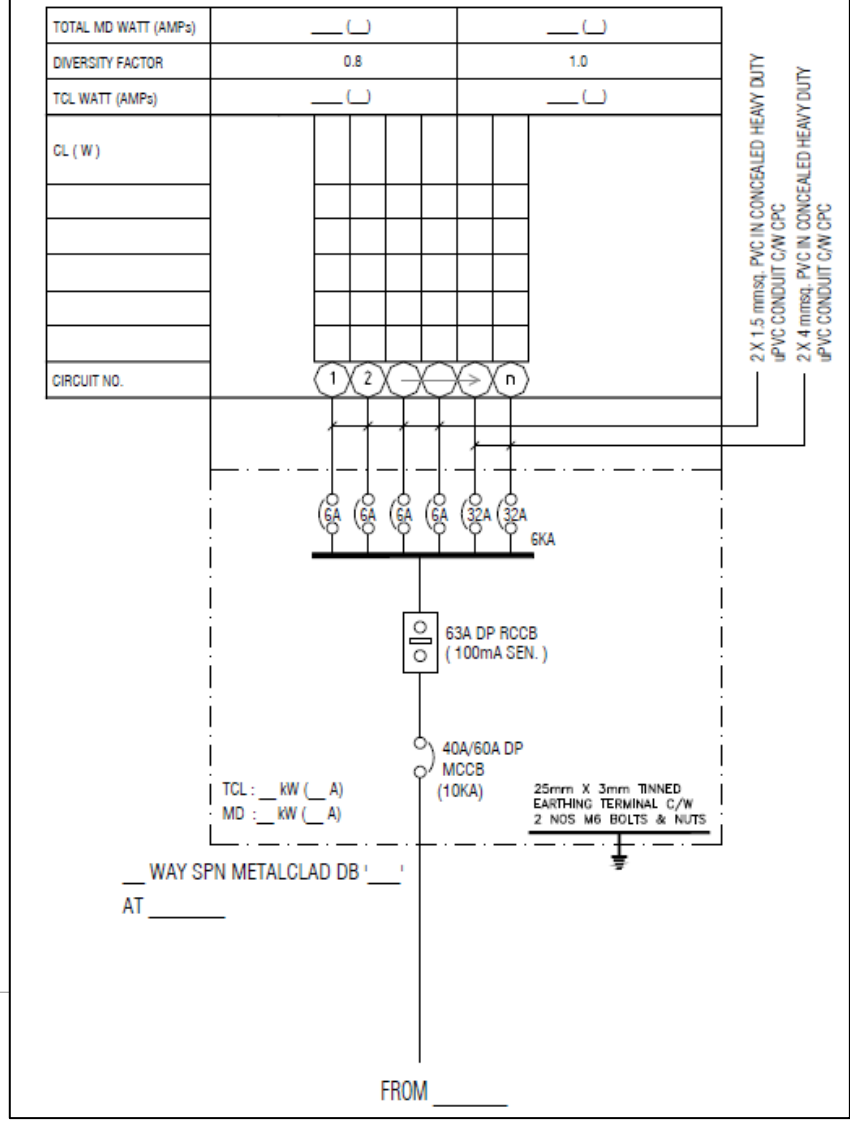


LUKISAN PIAWAI- GAMBARAJAH PENDAWAIAN SKEMATIK DB PIAWAI UNTUK LAMPU DAN KEPERLUAN MEKANIKAL

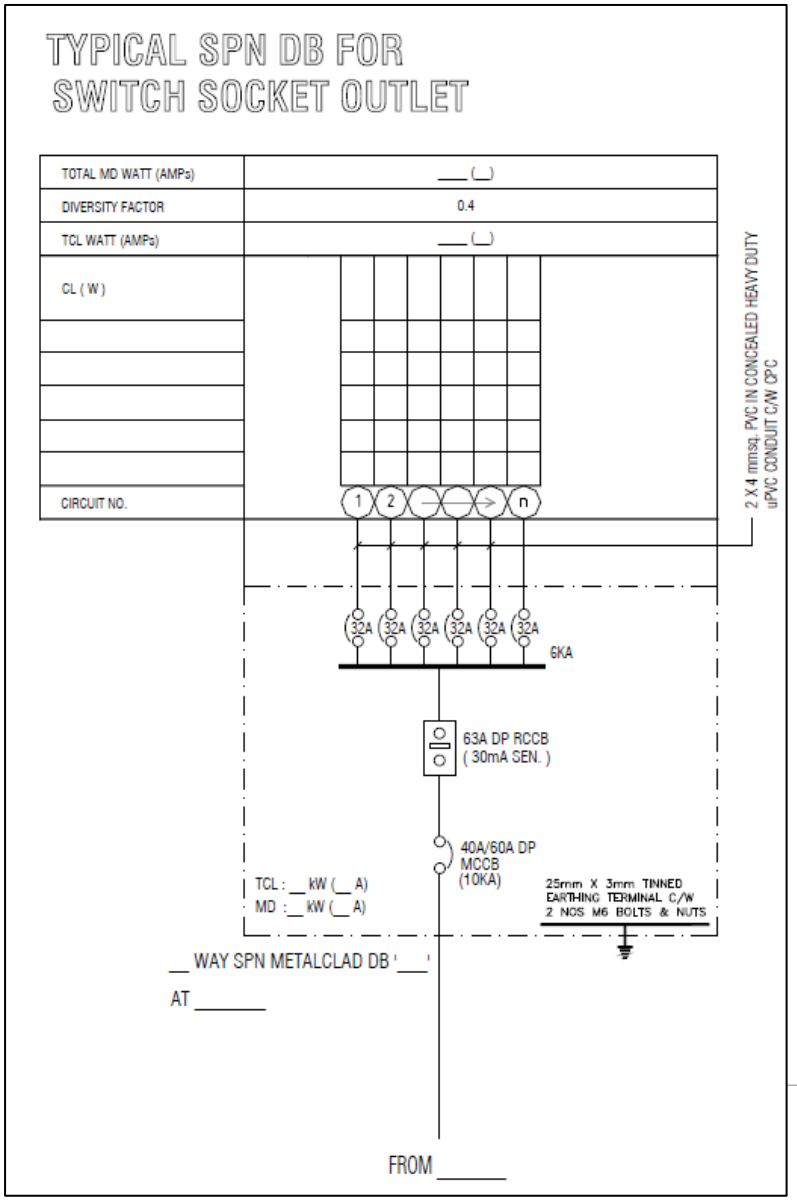
TYPICAL SPN DB FOR LIGHTING & 1 NO. AIR COND

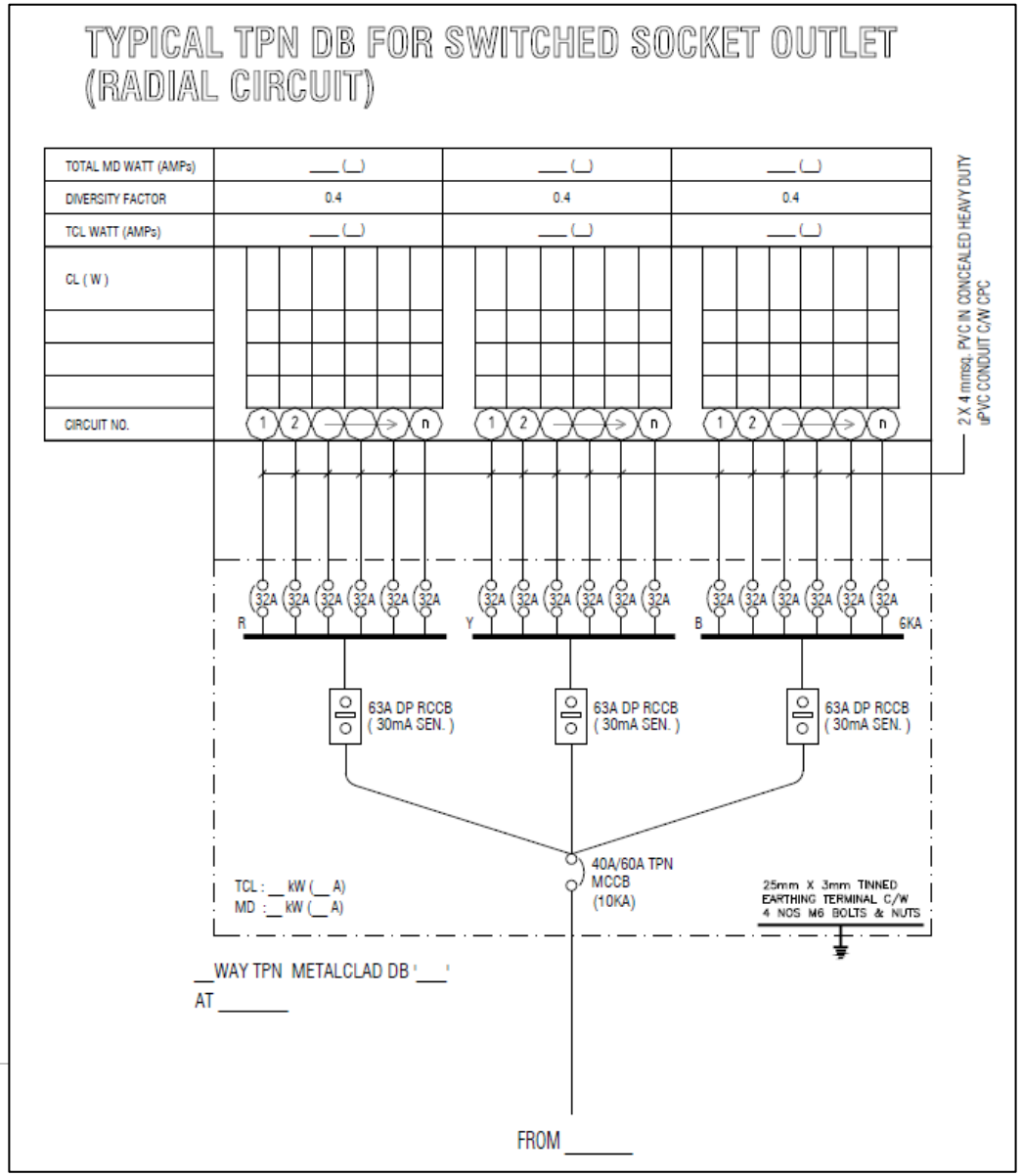


TYPICAL SPN DB FOR LIGHTING & 2 NOS AIR COND

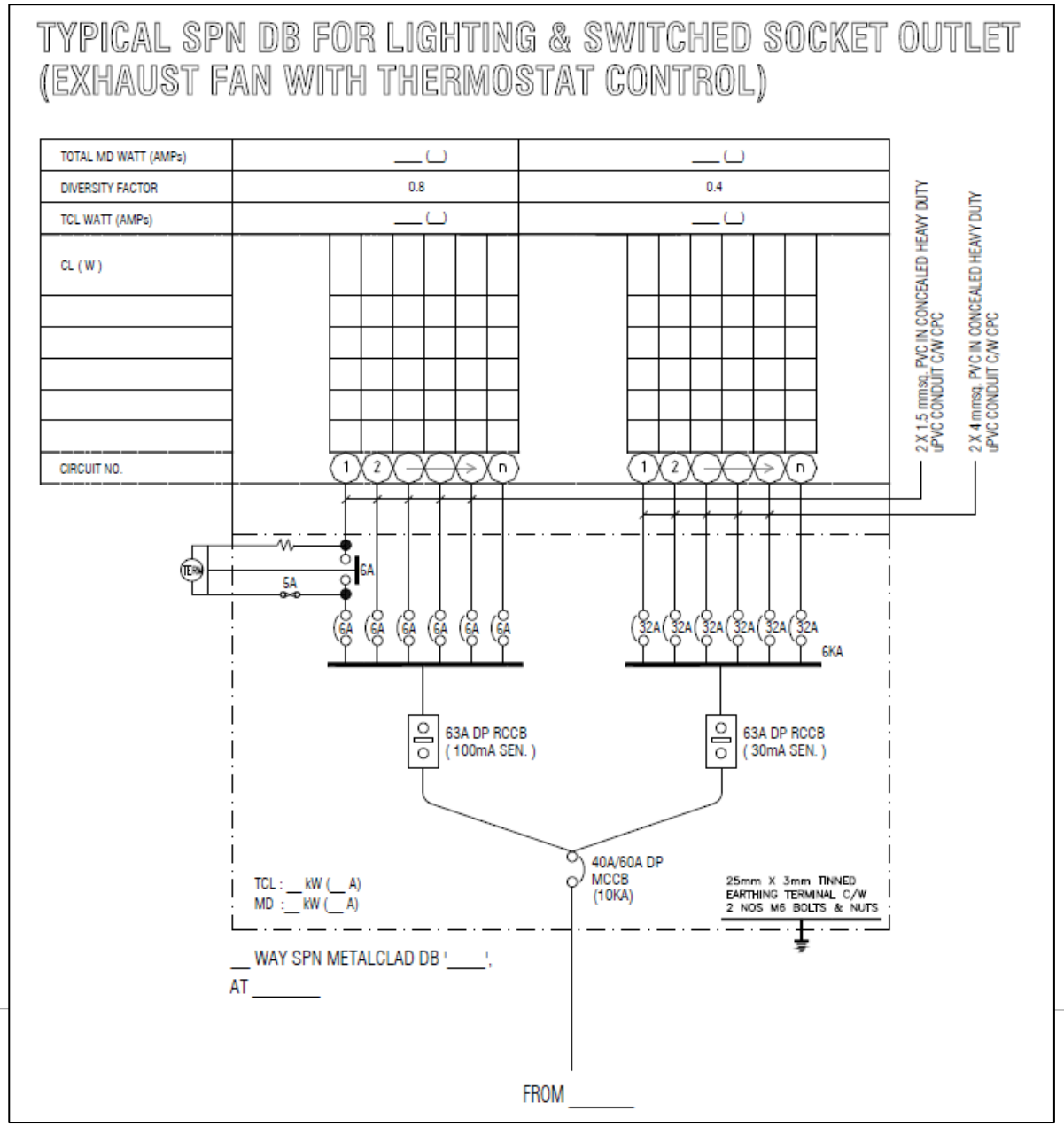


LUKISAN PIAWAI- GAMBARAJAH PENDAWAIAN SKEMATIK DB PIAWAI UNTUK SOKET

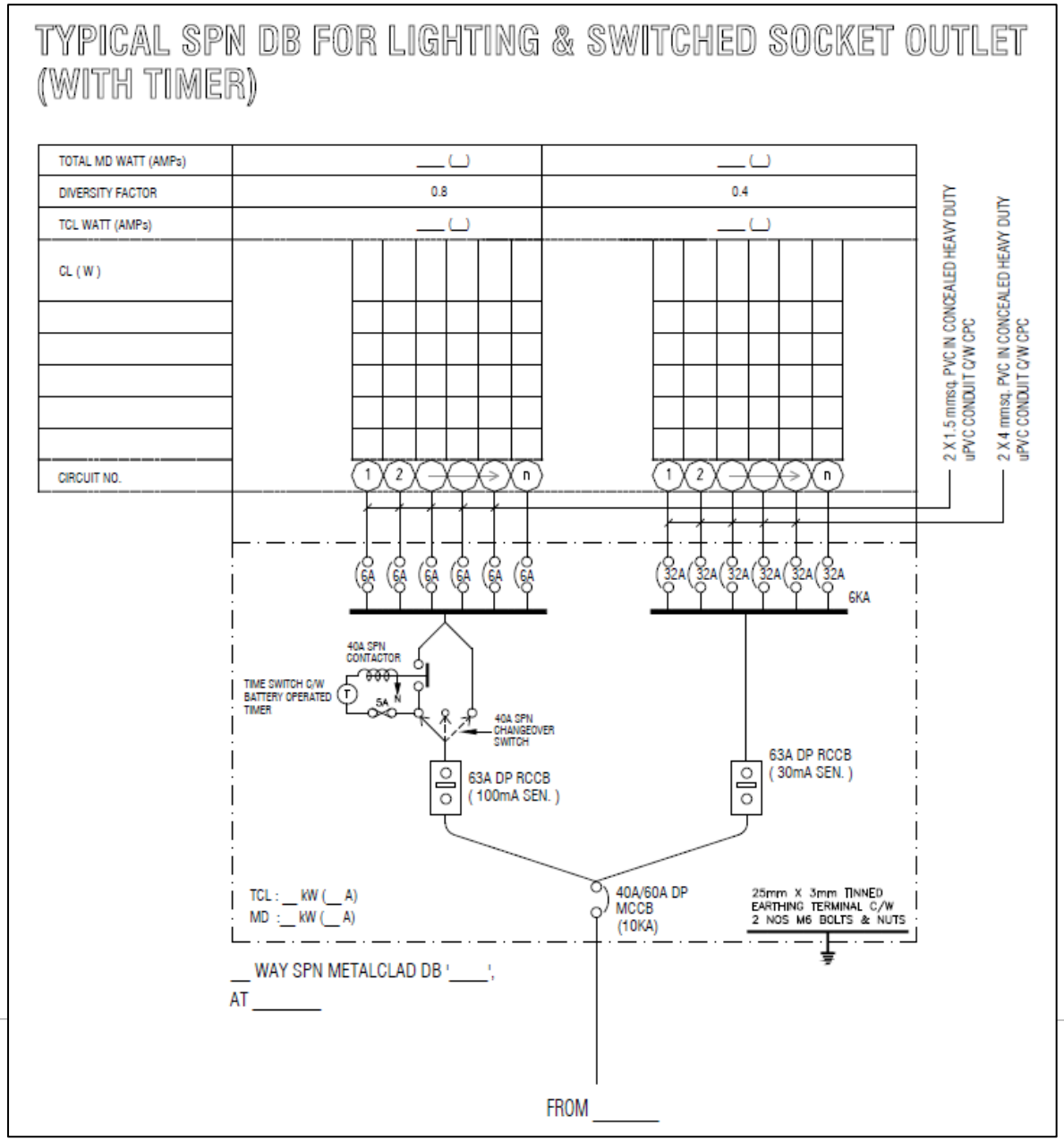




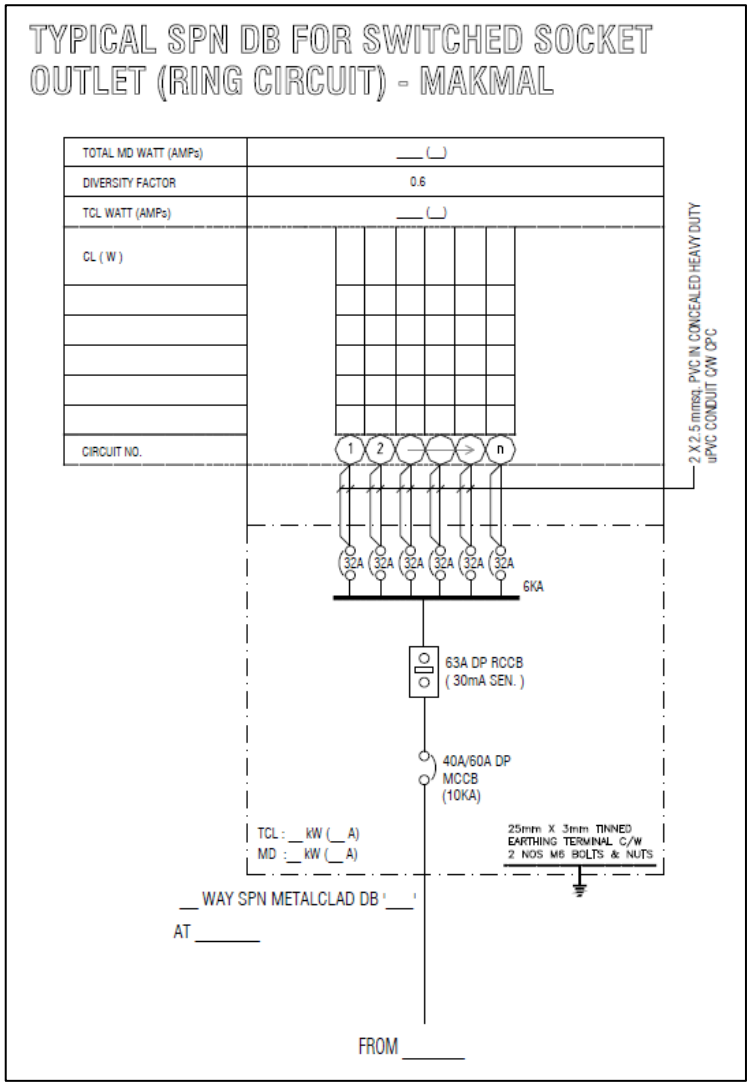
LUKISAN PIAWAI- GAMBARAJAH PENDAWAIAN SKEMATIK DB PIAWAI UNTUK LAMPU DAN SOKET

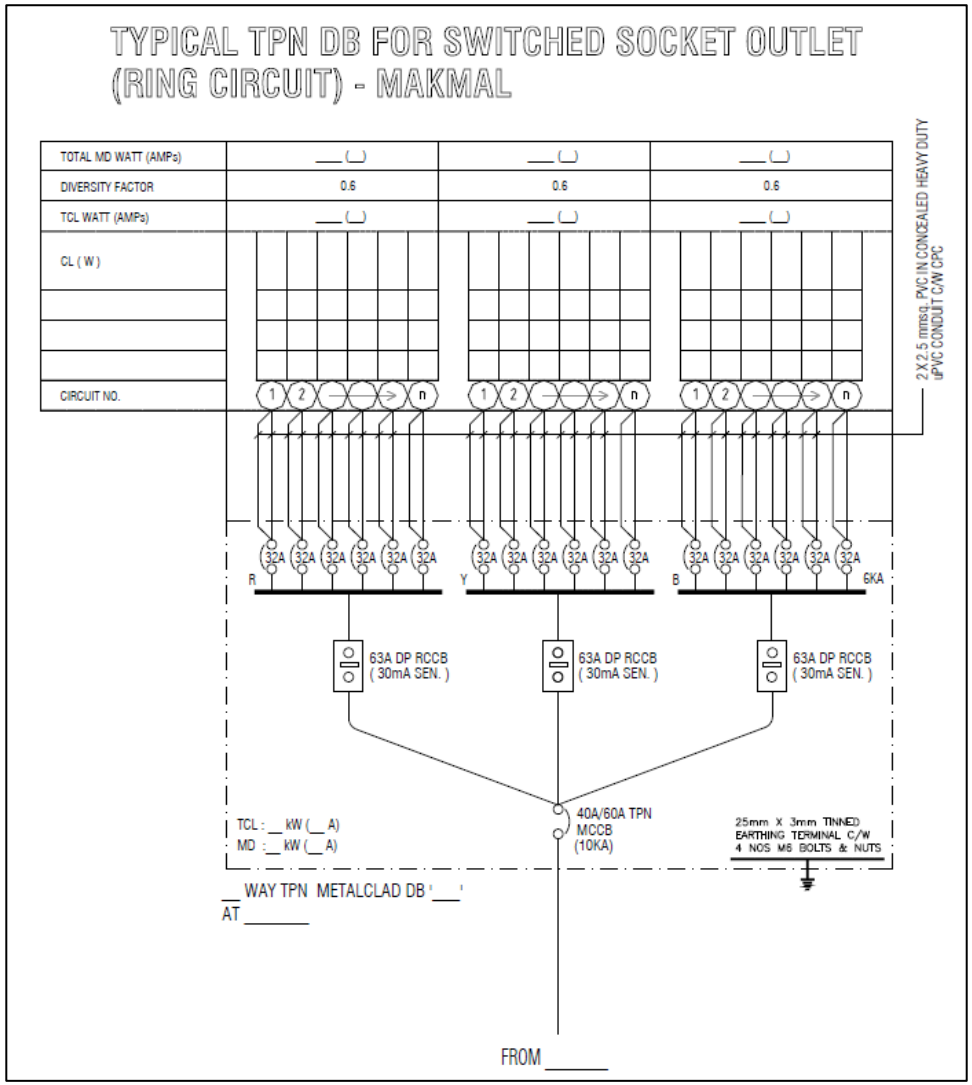


LUKISAN PIAWAI- GAMBARAJAH PENDAWAIAN SKEMATIK DB PIAWAI UNTUK LAMPU DAN SOKET

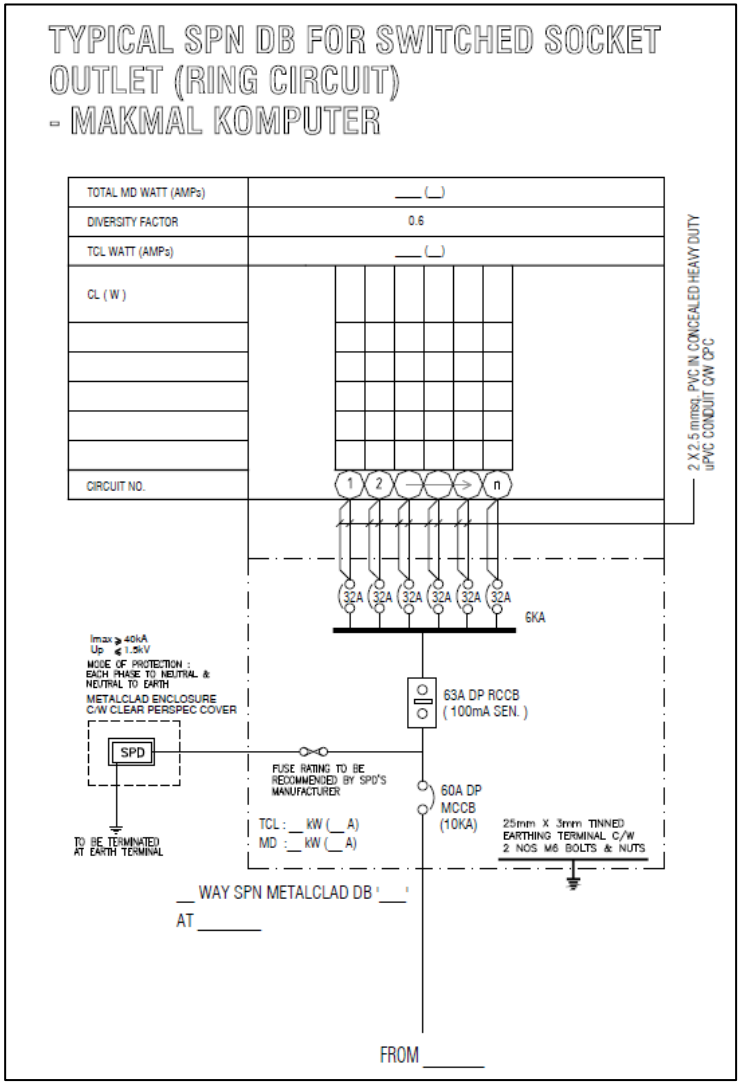


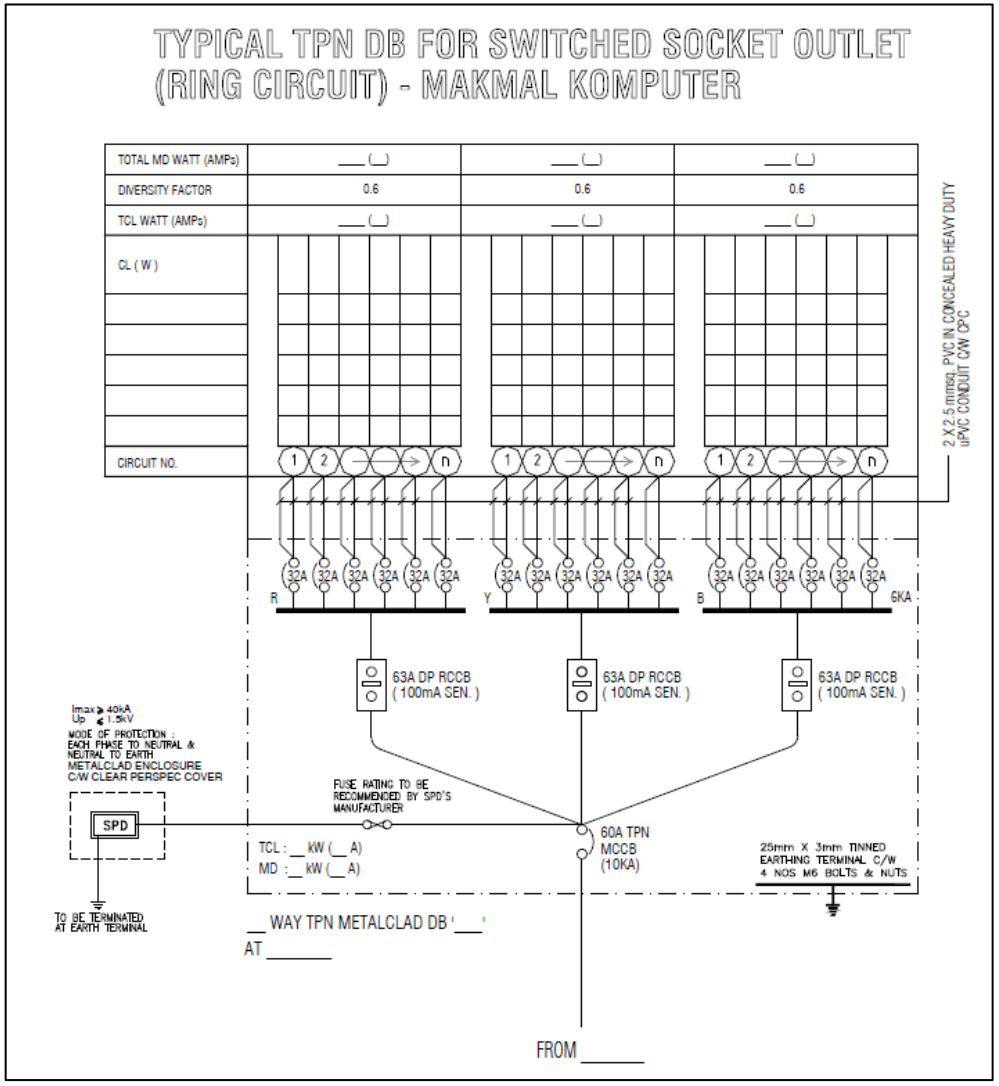
LUKISAN PIAWAI- GAMBARAJAH PENDAWAIAN SKEMATIK DB PIAWAI UNTUK SOKET (RING CIRCUIT)



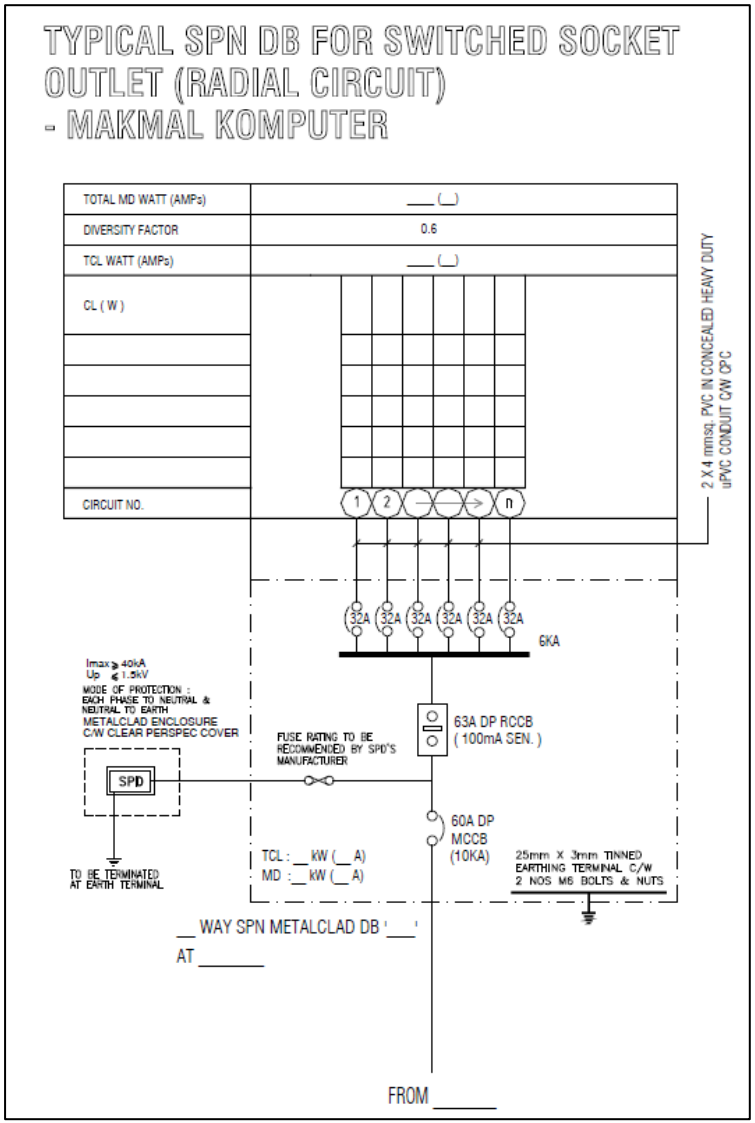


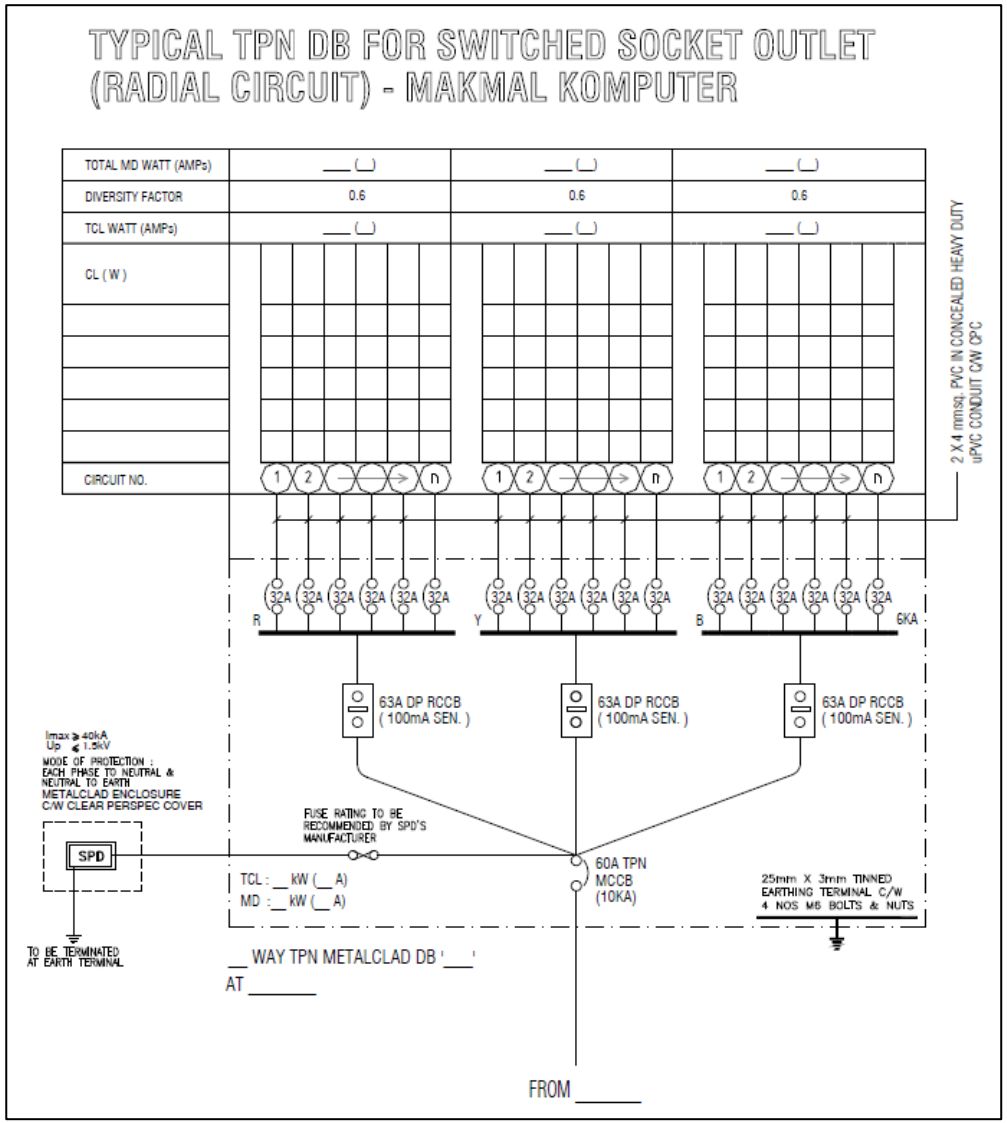
LUKISAN PIAWAI- GAMBARAJAH PENDAWAIAN SKEMATIK DB PIAWAI UNTUK SOKET (RING CIRCUIT)



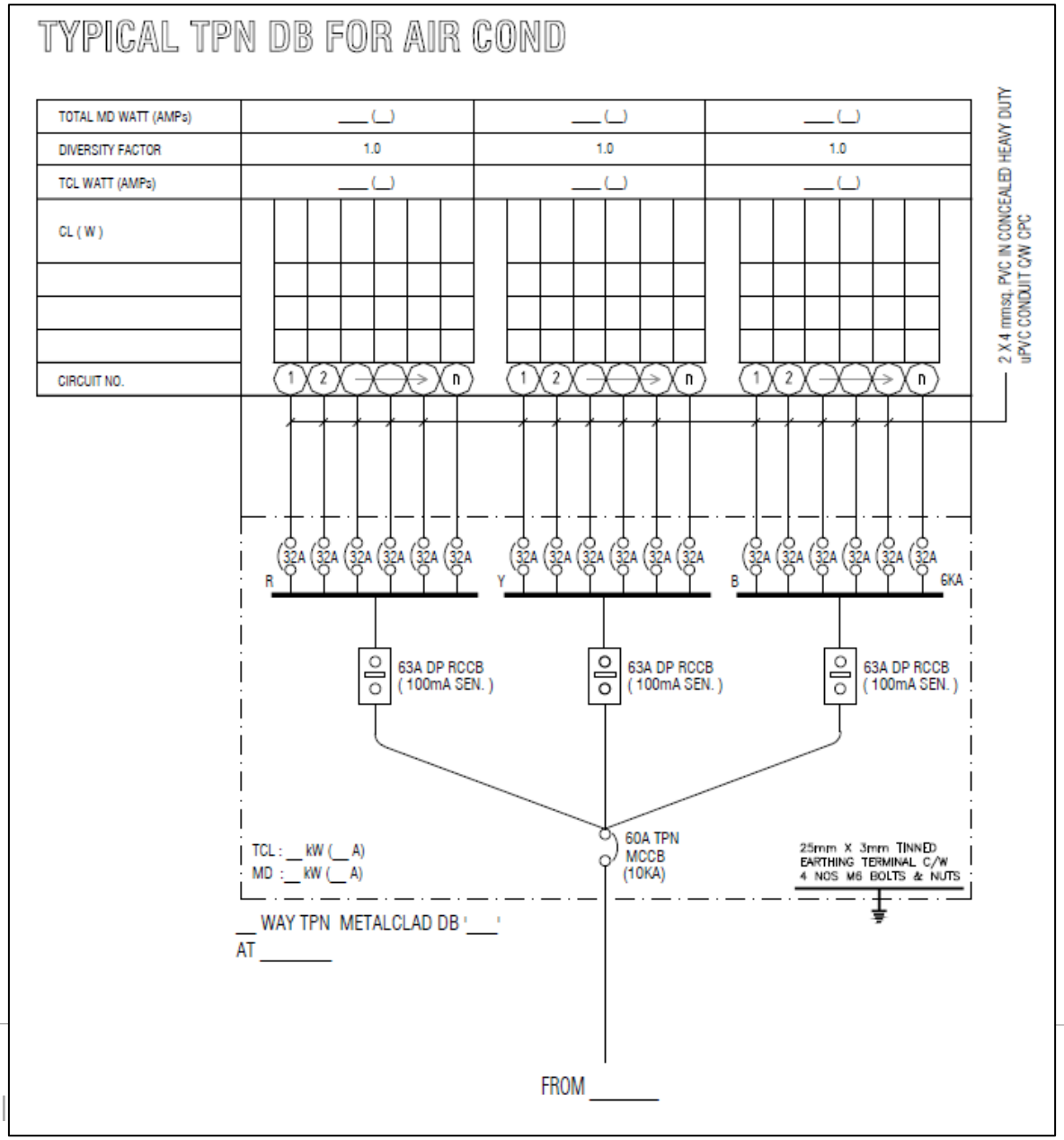


LUKISAN PIAWAI- GAMBARAJAH PENDAWAIAN SKEMATIK DB PIAWAI UNTUK SOKET (RADIAL CIRCUIT)

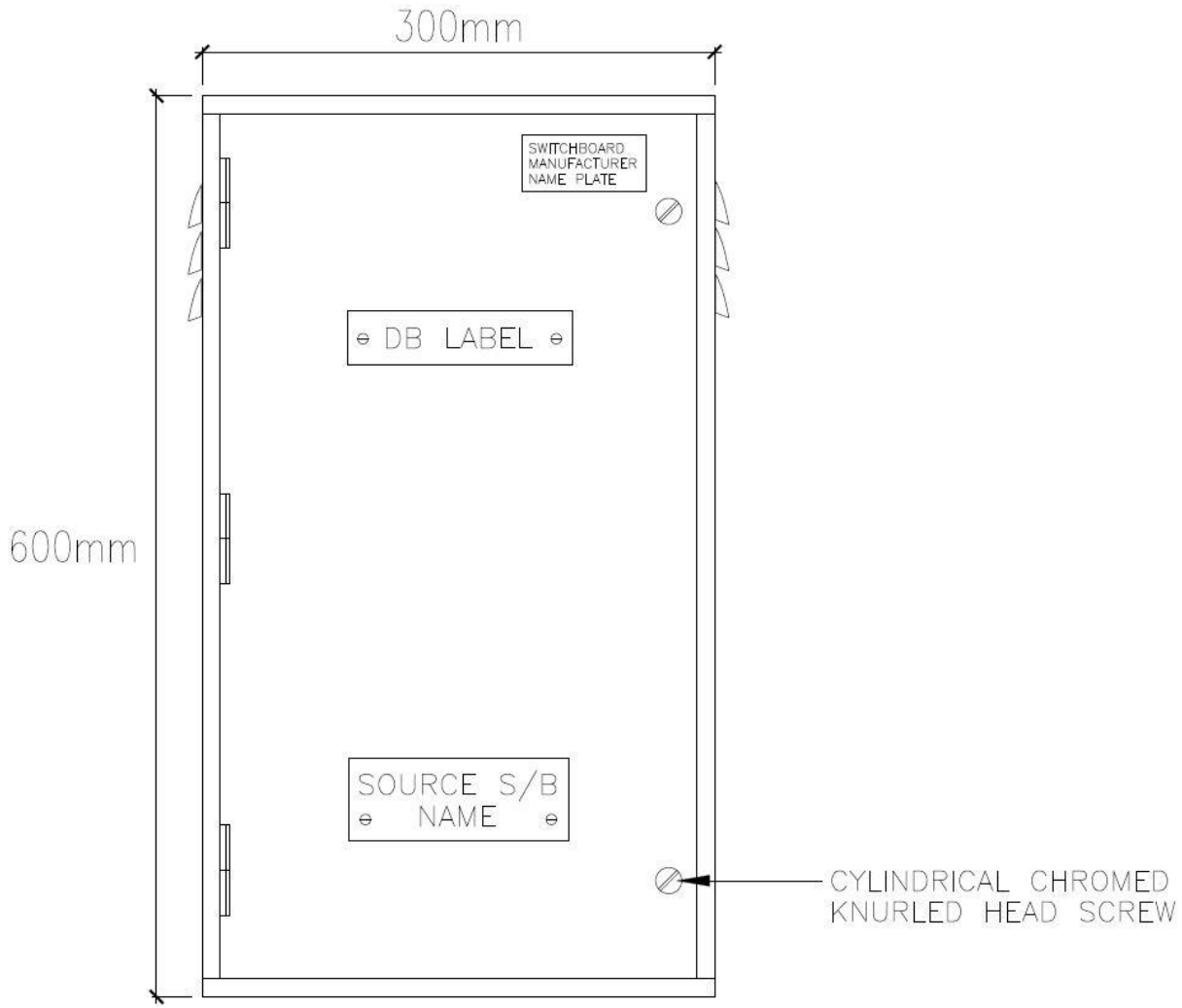




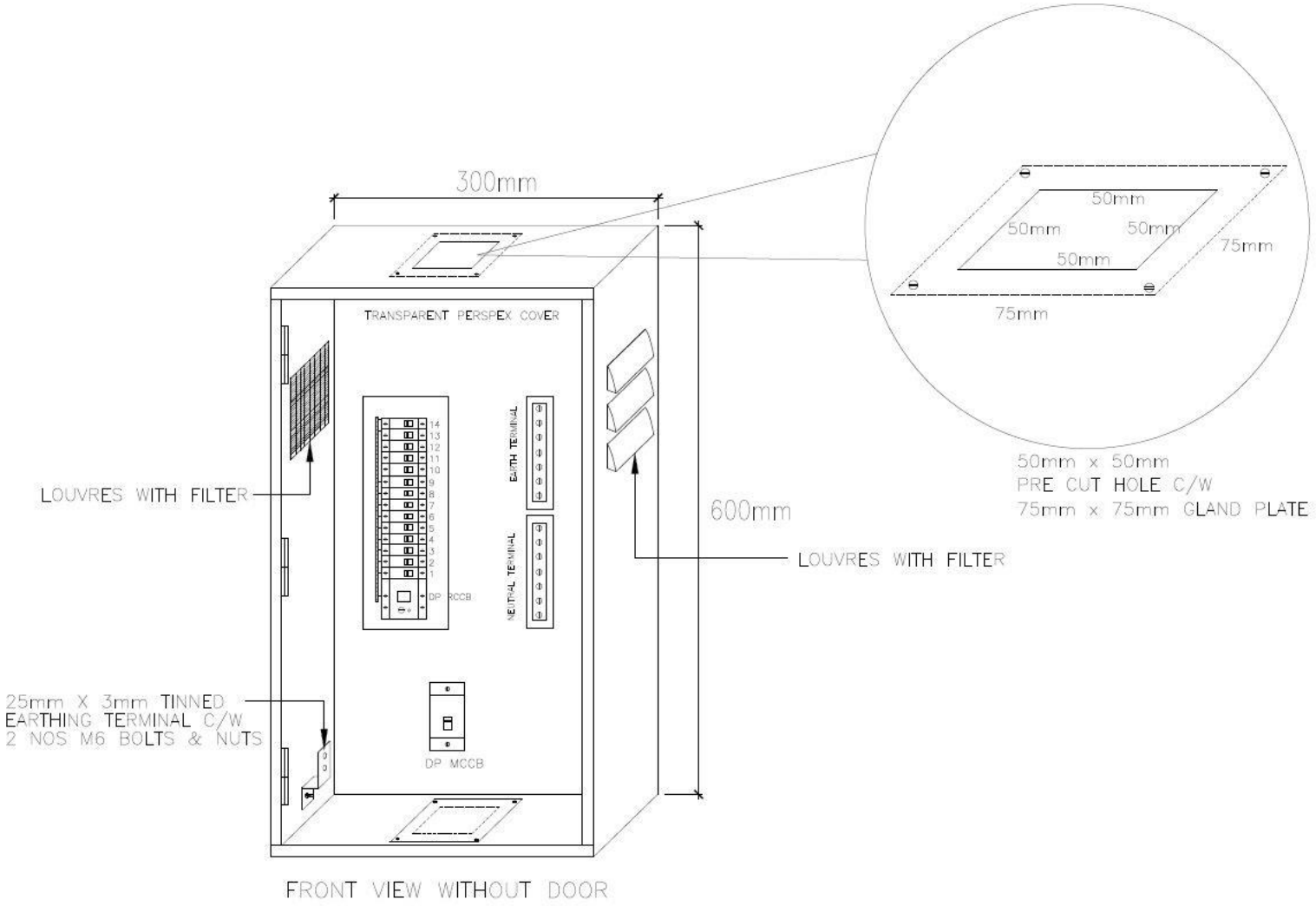
LUKISAN PIAWAI- GAMBARAJAH PENDAWAIAN SKEMATIK DB PIAWAI UNTUK KEPERLUAN MEKANIKAL



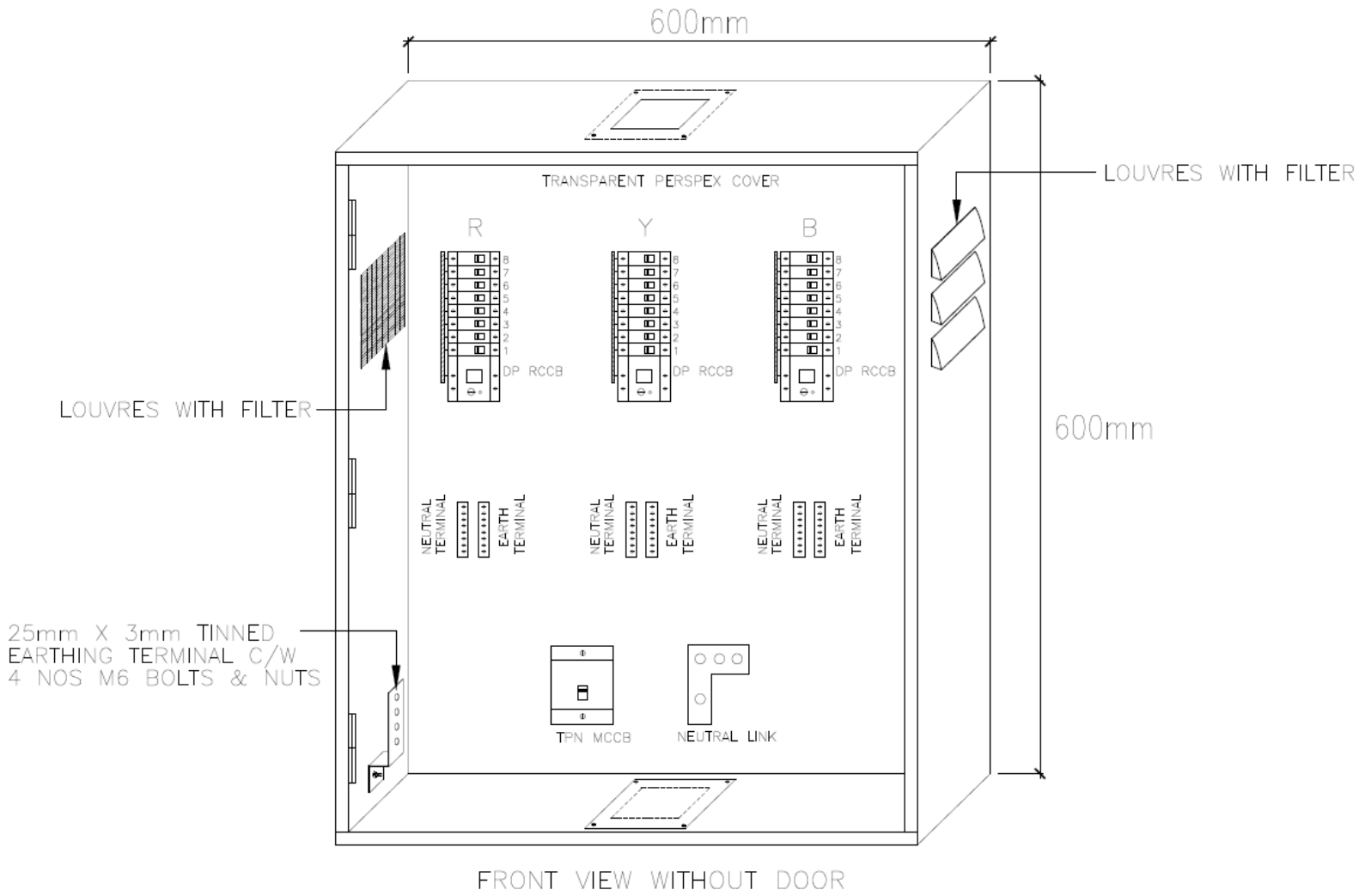
LUKISAN PIAWAI- GAMBARAJAH PIAWAI PAPAN AGIHAN (DB)
SINGLE PHASE DISTRIBUTION BOARD
(6/10/14 WAY SPN)



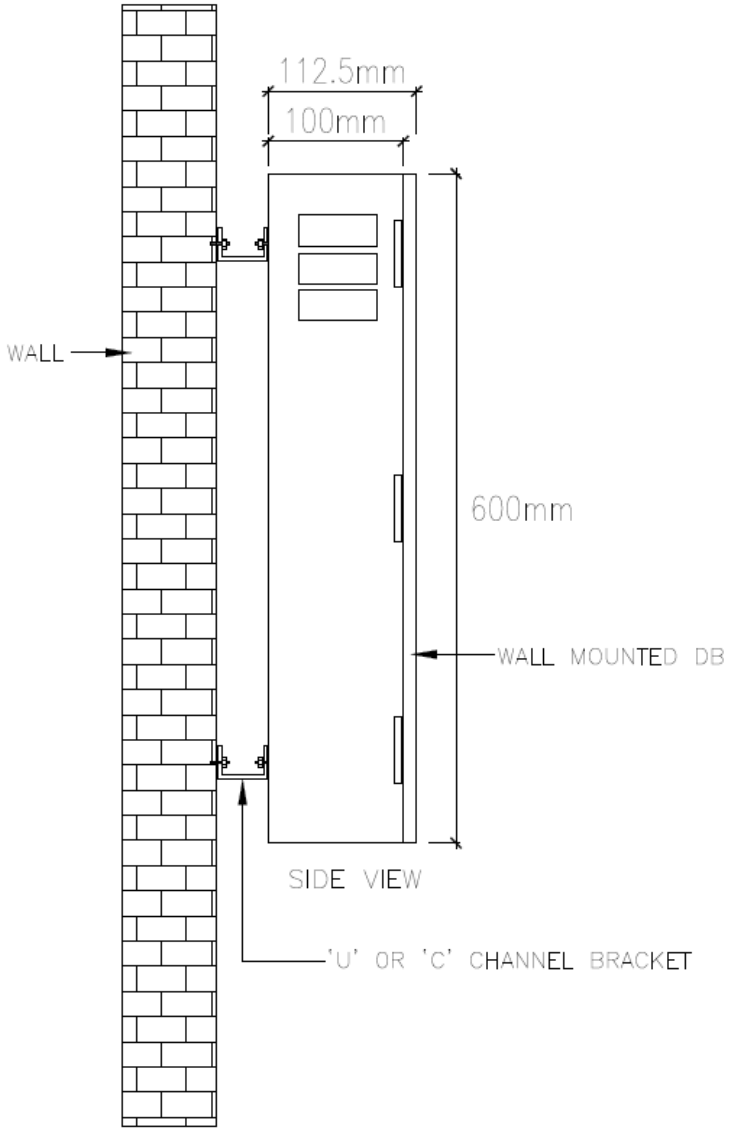
LUKISAN PIAWAI- GAMBARAJAH PIAWAI PAPAN AGIHAN (DB)
SINGLE PHASE DISTRIBUTION BOARD
(6/10/14 WAY SPN)



LUKISAN PIAWAI- GAMBARAJAH PIAWAI PAPAN AGIHAN (DB)
THREE PHASE DISTRIBUTION BOARD
(6/8 WAY TPN)



LUKISAN PIAWAI- GAMBARAJAH PIAWAI PAPAN AGIHAN (DB)



Rekabentuk

MCB RATING	CABLE SIZE
6A	2 x 1.5 mmsq. PVC IN CONCEALED uPVC CONDUIT C/W 1 x 1.5 mmsq. PVC CPC
10A	2 x 2.5 mmsq. PVC IN CONCEALED uPVC CONDUIT C/W 1 x 2.5 mmsq. PVC CPC
10A (FR-MI/MS)	2 x 2.5 mmsq. MI/MS FIRE RATED CABLE IN CONCEALED uPVC CONDUIT C/W 1 x 2.5 mmsq. PVC CPC
20A (WATER HEATER)	2 x 4 mmsq. PVC IN CONCEALED uPVC CONDUIT C/W 1 x 4 mmsq. PVC CPC
32A (A/C SPLIT UNIT)	2 x 4 mmsq. PVC IN CONCEALED uPVC CONDUIT C/W 1 x 4 mmsq. PVC CPC

NOS OF S/S/O	MCB RATING	CABLE SIZE
1	16A	2 x 2.5 mmsq. PVC IN CONCEALED uPVC CONDUIT C/W 1 x 2.5 mmsq. PVC CPC
2	20A	2 x 2.5 mmsq. PVC IN CONCEALED uPVC CONDUIT C/W 1 x 2.5 mmsq. PVC CPC
3 to 10	32A (Ring Circuit)	2 x 2.5 mmsq. PVC IN CONCEALED uPVC CONDUIT C/W 1 x 2.5 mmsq. PVC CPC
3 to 6	32A (Radial Circuit)	2 x 4 mmsq. PVC IN CONCEALED uPVC CONDUIT C/W 1 x 4 mmsq. PVC CPC

ISOLATOR RATING	CABLE SIZE
15A SPN ISOLATOR	2 x 6 mmsq. PVC IN CONCEALED uPVC CONDUIT C/W 1 x 6 mmsq. PVC CPC
20A SPN ISOLATOR	2 x 6 mmsq. PVC IN CONCEALED uPVC CONDUIT C/W 1 x 6 mmsq. PVC CPC
30A SPN ISOLATOR	2 x 10 mmsq. PVC IN CONCEALED uPVC CONDUIT C/W 1 x 10 mmsq. PVC CPC
15A TPN ISOLATOR	4 x 6 mmsq. PVC IN ELECTROGALVANISED TRUNKING C/W 1 x 6 mmsq. PVC CPC
20A TPN ISOLATOR	4 x 6 mmsq. PVC IN ELECTROGALVANISED TRUNKING C/W 1 x 6 mmsq. PVC CPC
30A TPN ISOLATOR	4 x 10 mmsq. PVC IN ELECTROGALVANISED TRUNKING C/W 1 x 10 mmsq. PVC CPC

Rekabentuk

- Kabel Litar Akhir (refer to On-site Guide BS 7671)

Litar	MCB	Kabel (mm^2)	Luas Lantai / Bilangan
Lampu & kipas	6A	1.5	10 nos.
s/s/o (Ring)	32A	2.5	100 m^2 10 nos.
s/s/o (Radial)	32A	4.0	75 m^2 6 nos.
s/s/o (Radial)	20A	2.5	50 m^2 2 nos.
s/s/o	16A	2.5	1 no.
Litar EL / Keluar Sign	6A	1.5	Tidak boleh disekalikan dgn litar lampu 10 nos.

Rekabentuk

- ALL STANDARDS DBs SHALL BE IN FORM:
  - 6 WAY SPN, 10 WAY SPN & 14 WAY SPN
  - 6 WAY TPN & 8 WAY TPN
- ALL WIRINGS FOR EL, K-SIGN & EMERGENCY CIRCUITS SHALL BE IN G.S. CONDUIT.

Phase Balancing

- DB 3 fasa
  - R, Y, B
  - Balance di antara fasa
- SSB
  - Balance untuk semua DB tersambung (DB 3 fasa & DB 1 fasa)
- MSB
  - Balance untuk SSB tersambung
- 15% tolerance antara fasa (JKR practice)

Phase Balancing

- Should not exceed 30% (IEEE 1159)
- Unbalance of load will result in a current flow on neutral. If the unbalance current exceeds the earth fault relay pick up current, this will cause nuisance tripping to the circuit breaker
- Example of current unbalance calculation:

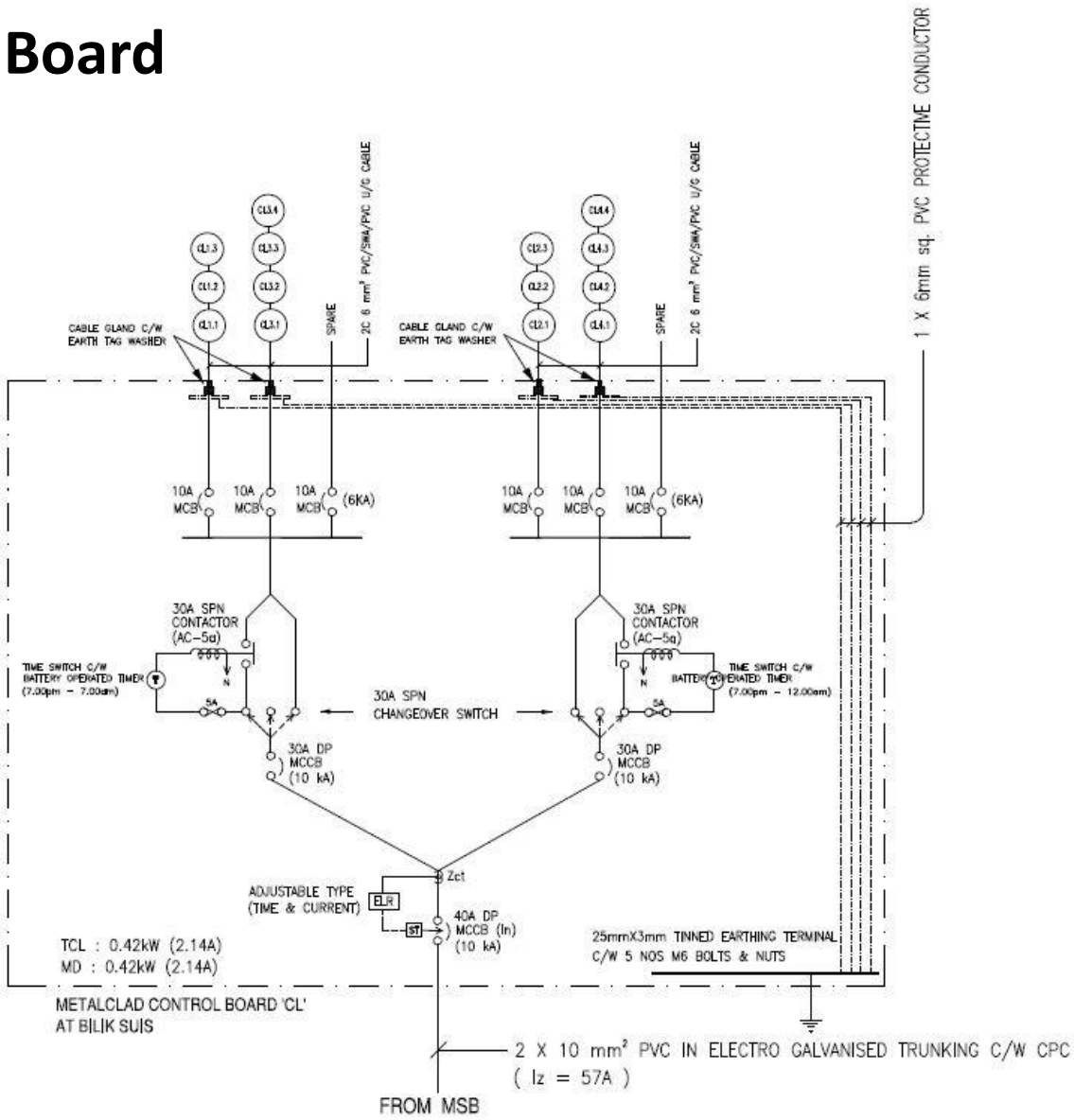
$$\%I_{UNBALANCE} = \frac{Max\ deviation\ from\ average}{Average\ of\ 3\ phases} \times 100\%$$

1. R = 8.33A, Y = 8.82A, B = 7.84A
2. Find the average = (8.33 + 8.82 + 7.84) / 3 = 8.33A
3. Find the max deviation from the average:
   This occurs on the Y phase: 8.82 – 8.33 = 0.49A
4. Divide max deviation by average to find % unbalance: 0.49/8.33= 5.9%

Control Board

- Lampu kawasan / basement parking / common area (corridor)
- Incoming protection menggunakan ELR (lampu kawasan)
- Compound Lighting Control Board
  - Dalam bilik suis/Pondok Pengawal
  - Elak letak di luar bangunan
  - Sebelah MSB
  - 2 set of timer jenis battery operated
  - 7pm to 12 am
  - 7pm to 7am
  - Alternate circuit (Litar selang-seli)
- Kabel Lampu Kawasan
  - 2C 6 mm^2 PVC/SWA/PVC
  - 2C 10 mm^2 PVC/SWA/PVC
  - 2C 16 mm^2 PVC/SWA/PVC

Control Board



Terima Kasih