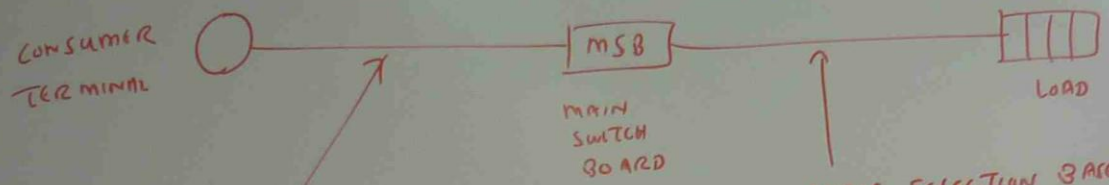
Proof — CABLE SELECTION BASED ON VOLTAGE DROP



Pb CALCULATE THE VOLTAGE DROP IN EACH SEGMENT OF A 3 PHASE 400 VOLT NON DOMESTIC INSTALLATION CONSISTING OF THE FOLLOWINGS

CONSUMER MAIN

3 PHASE, MAXIMUM DEMAND = 45 A, ROUTE LENGTH = 25m

CABLE SIZE 16 mm^2

CABLE CONFIGURATION – VG0 SINGLE CORE THERMOPLASTIC AND SHEATHED COPPER CONDUCTOR

CABLE INSTALLATION

THE CIRCUIT IS ENCLOSED IN HEAVY DUTY RIGID THERMOPLASTIC CONDUIT WITH NO OTHER CIRCUITS. CONDUIT IS BURIED IN THE GROUND HAVING AN AMBIENT SOIL TEMPERATURE 25°C AND TOP COVER of 0.65m

SUB MAIN

3 PHASE MAXIMUM DEMAND = 35 A ROUTE LENGTH = 35m

CABLE SIZE = 10 mm^2

CABLE CONFIGURATION

V90 SINGLE CORE THERMOPLASTIC AND SHEATHED COPPER CONDUCTORS STRUCTURE IN TREFOIL FORMATION AND INSTALLED IN SINGLE CIRCUIT CONFIGURATION. UNENCLOSED IN AIR.

FINAL SUB CIRCUIT

1 PHASE, MAXIMUM DEMAND= 20 AMP, ROUTE LENGTH=35m

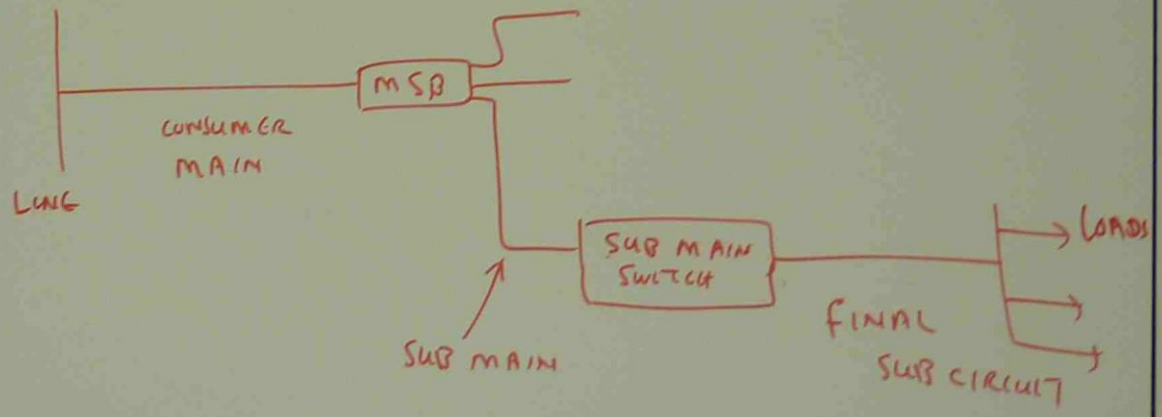
CABLE SIZE= 4 mm^2

CABLE CONFIGURATION – V90 TWO CORES AND EARTHED THERMOPLASTIC AND SHEATHED COPPER CONDUCTORS

CABLE INSTALLATION – THE CABLES ARE CLIPPED TO THE BUILDING STRUCTURE AND INSTALLED IN SINGLE CIRCUIT CONFIGURATION.

UNENCLOSED IN AIR

DOES THIS PORTION OF THE INSTALLATION COMPLY WITH THE VOLTAGE DROP REQUIREMENT OF AS/NZS 3000?



CONSUMER MAIN

$$L = \frac{1000\ Vd}{I\ Vc}$$

L = LENGTH (m)

I = MAXIMUM DEMAND CURRENT (A)

Vd = 3ϕ VOLTAGE DROP

Vc = ← SEE IN CABLE SELECTION TABLE

CABLE INSTALLATION CONFIGURATION

TABLE 41 ←

PAGE 81

AS 3008.

90°C

CABLE SIZE mm²	Vc
16	2.55

$$25 = \frac{1000 \times Vd}{45 \times 2.55}$$

$$Vd = \frac{25 \times 45 \times 2.55}{1000} = 2.868\ V\ (3\phi)$$

$$1\phi = \frac{3\phi\ Vd}{\sqrt{3}}$$

$$Vd = \frac{2.868}{1.7321} = 1.655\ V$$

SUBMAIN

BASE ON SUB MAIN CABLE INSTALLATION CONFIGURATION, SELECT TABLE 40, PAGE 80 OF AS 3008

TABLE 40

C.SA	Vc
$10mm^2$	4.05

$$L = \frac{1000\ Vd}{I\ Vc}$$

3ϕ
$$Vd = \frac{L \times I \times Vc}{1000}$$

$$= \frac{35 \times 35 \times 4.05}{1000}$$

$$= 4.96\ V$$

$$1\phi\ Vd = \frac{3\phi\ Vd}{\sqrt{3}} = \frac{4.96}{1.7321}$$

$$= 2.86\ V$$

FINAL SUB CIRCUIT

TABLE 42, PAGE 82

$4mm^2 = 10.2\ (3\phi\ Vc)$

$$1\phi\ Vc = \frac{3\phi\ Vc}{0.866}$$

$$= \frac{10.2}{0.866}$$

$$= 11.77$$

$$L = \frac{1000\ Vd}{I\ Vc}$$

$$Vd = \frac{L\ I\ Vc}{1000}$$

$$= \frac{35 \times 20 \times 11.77}{1000}$$

$$1\phi\ Vd = 8.23\ V$$

TOTAL Vd = CONSUMER MAIN Vd + SUB MAIN Vd + FINAL SUB CIRCUIT Vd

= 1.655 + 2.86 + 8.23

= 12.7V

AS 3000

5% of 240V = $\frac{5}{100} \times 240 = 12V$

THE ACTUAL VOLTAGE DROP 12.7V IS HIGHER THAN THE LIMITATION 12V

IT DOES NOT COMPLY WITH AS 3000:2007

G007

CABLE SELECTION USING AS/NZS 3008.1.1

THE AUSTRALIAN STANDARD AS/NZS 3008.1.1:1998 ELECTRICAL INSTALLATIONS – SELECTION OF CABLES SETS OUT A METHOD FOR SELECTING COMMONLY USED CABLES IN COMMON INSTALLATION AND ENVIRONMENT.

THE STANDARD IS MAINLY CONCERNED WITH SELECTING CABLE, CONDUCTOR SIZE BASED ON CURRENT CARRYING CAPACITY, VOLTAGE DROP CONSIDERATION AND SHORT CIRCUIT TEMPERATURE CONSIDERATION.

TABLE 40 → 50

VOLTAGE DROP OF CABLE, CROSS SECTIONAL AREA AND TEMPERATURE

READ V_c IN THE FOLLOWING TABLES

COPPER

INSULATED SHEATHED

SINGLE CORE | TREFOIL (CONDUIT) → TABLE (40)

SINGLE CORE | TOUCHING FLAT, TRAY ENCLOSURE → TABLE (41)

MULTI CORE → TABLE (42)

SIZE C.SA	V_c	
1		
2		
3		

ALUMINIUM

SINGLE CORE (TREFOIL (CONDUIT)) → TABLE (43)

SINGLE CORE FLAT | TOUCHING TRAY → TABLE (44)

MULTI CORE → TABLE (45)

FLEXIBLE

SINGLE CORE - TREFOIL (CONDUIT) → TABLE (46)

MULTI CORE → TABLE (47)

MIMS

SINGLE CORE + MULTI CORE → TREFOIL (CONDUIT) → TABLE (48)

AERIAL

COPPER - INSULATED — TABLE (49)

ALUMINIUM — TABLE (50)

V_c => UNIT VOLTAGE DROP (mV/A-m)

MILLI VOLT PER AMPERE METRE

V_d => VOLTAGE DROP (VOLT)

$$V_d = \frac{V_c \times L \times I}{1000}$$

L = LENGTH OF CABLE (m)

I = CURRENT (MAXIMUM DEMAND) (A)

Q4 DETERMINE THE VOLTAGE DROP FOR EACH 3 ϕ SEPARATE FINAL SUB CIRCUIT SHOWN AND INDICATE IF EACH RESULT IS WITHIN S.AA LIMITATION. PERMISSIBLE VOLTAGE DROP IS 14.2 V. ASSUME ALL CABLES ARE OPERATING AT THEIR NORMAL TEMPERATURE

V_d PERMISSIBLE 14.2V

SEPARATE FINAL SUB CIRCUIT

(1) 25 mm^2 COPPER, V(75), TPI CABLE IN CONDUIT, 30 m, 75 A

75C ↑ TREFOIL

TABLE 40 75C $V_c = 1.54$ $V_d = \frac{V_c L I}{1000} = \frac{1.54 \times 30 \times 75}{1000} = 3.49V$ PERMISSIBLE

(2) 2.5 mm^2 COPPER V75 SDI CABLE, UNENCLOSED & SPACED APART. 40 m, 27 A

TABLE 41 75C $V_c = 15.6$ $V_d = \frac{15.6 \times 40 \times 27}{1000} = 16.85V$ NOT PERMISSIBLE

110C

(3) 10 mm^2, COPPER, X-HF (110) MULTICORE CABLE ON CABLE TRAY. 10 m, 80 A

TABLE 42 110C $V_c = 4.39$ $V_d = \frac{4.39 \times 10 \times 80}{1000} = 3.43V$ PERMISSIBLE

④ 10 mm² COPPER, MULTICORE, MIMS CABLE 100C

PF = 1, 25m, 55 A

TABLE 4B $V_c = 3.92$ $V_d = \frac{3.92 \times 25 \times 55}{1000} = 5.39$

PERMISSIBLE

⑤ 150 mm², COPPER, SINGLE CORE, MIMS CABLE

3m, 400 A

TABLE 4B $V_c = 0.297$ $V_d = \frac{0.297 \times 3 \times 400}{1000} = 0.36$

PERMISSIBLE

⑥ 70 mm², ALUMINIUM, MULTICORE, X-90 CABLE ↑ 90C

ON CABLE TRAY, 120m, 180A

TABLE (45) $V_c = 0.943$ $V_d = \frac{0.943 \times 120 \times 180}{1000} = 21.45$

NOT PERMISSIBLE

⑦ 2.5 mm² COPPER V(75) TPS MULTICORE CABLE 75C

IN CONDUIT, 15m, 16A

TABLE (42) → 75C $V_c = 15.6$ $V_d = \frac{15.6 \times 15 \times 16}{1000}$

$= 3.74$ PERMISSIBLE

③ 1.0 mm

UNDER

TABLE 42

90C

(2) 1.0 mm^2 V90 TPS MULTI CORE CABLE IN UNDER GROUND CONDUIT. 55m, 3A

TABLE 4.2 → U_c = 46.2

90°C

$$V_d = \frac{46.2 \times 55 \times 3}{1000}$$

$$= 19.67$$

NOT PERMISSIBLE

GOOT T/

1. DETERMINE THE MAXIMUM DEMAND OF A SINGLE DOMESTIC ELECTRICAL INSTALLATION SUPPLIED AT SINGLE PHASE WITH THE FOLLOWING LOADS

24 LIGHTING POINTS

10m LIGHTING TRACK

4 x 10A SOCKET OUTLET

8 x 10A DOUBLE SOCKET OUTLET

1 x 50W EXHAUST FAN

1 x 1000W STRIP HEATER

1 x 15A SOCKET OUTLET

1 x 10KW RANGE

1 x 4.8 KW WATER HEATER

1 x 3 KW TENNIS COURT LIGHTING

(2) DETERMINE THE MAXIMUM DEMAND OF THE HEAVIEST LOADED PHASE IN A DOMESTIC ELECTRICAL INSTALLATION COMPRISING

26 LIGHTING POINTS

24 X 10A SINGLE OUTLET

1 X 15A SOCKET OUTLET

1 X 16.6 KW RANGE

1 X 4 KW AIR CON

1 X 12.46 KW INSTANTANEOUS WATER HEATER

1 X 3.6 KW CLOTH DRYER ACROSS 3Φ

RED	WHITE	BLUE
15A SOCKET OUTLET	15X10A SOCKET OUTLET	26 LIGHTS
5 KW HOT PLATE	5 KW HOT PLATE	4X10A SOCKET OUTLET
4 KW AIRCON	4-3KW WATER HEATER	4-3KW WATER HEATER
4-3KW WATER HEATER	3.6KW DRYER	

(3) DETERMINE THE MAXIMUM DEMAND OF THE HEAVIEST LOAD OF PHASE OF 30 UNITS HOTEL COMPLEX SUPPLIED BY 3Φ

200 x 60 W LIGHTING POINTS

30 x 50 W 1Φ EXHAUST FAN

10 x 10 A SINGLE SOCKET OUTLET

40 x 10 A SINGLE SOCKET OUTLET

4 x 15 A SINGLE PHASE SOCKET OUTLET

1 x 16.6 KW 3Φ ELECTRIC RANGE

1 x 0.75 KW 3Φ SEWERAGE PUMP

1 x 6 KW 1Φ SAUNA HEATER