pb. THE MAXIMUM DEMAND CURRENT OF A SUBMAIN IN A NON DOMESTIC INSTALLATION IS CALCULATED TO BE 80 AMP. THE SELECTED CABLE IS 4 CORES, NON ARMOURED, V90 INSULATED AND SHEATHED CIRCULAR CABLE WITH COPPER CONDUCTORS. INSTALLATION OF THE CABLE PLACES IT SECURED FLAT ON A SINGLE PERFORATED CABLE TRAY WITH THREE OTHER CIRCUITS ALL TOUCHING. THE CABLE TRAY IS SUSPENDED 300 mm FROM THE CEILING, OPEN TO AIR AND THE CIRCUIT IS PROTECTED BY CIRCUIT BREAKER. CALCULATE CABLE SIZE

CABLE LENGTH = 100m.

TABLE 3(1) ITEM

↳ TABLE

DERATING

TABL

PERFORATED TRAY

ALL TOUCHING

NO. OF TIERS

ROWS OF CABLE SUPPORT

TABLE 3(1) (OR) 3(2)

3(1) ↓ OPEN

3(2) ↓ ENCLOSED

OPEN TO AIR → 3(1)

PERFORATED TRAY ↓

4 CORES → 3 CORES → ITEM 10, 11, 13

A SUBMAIN IN
ATED TO BE
RES, NON
HED CIRCULAR
ATION OF THE
A SINGLE
OTHER
TRAY IS
ING, OPEN
ECTED BY
LE SIZE
LE LENGTH = 100m

D

PERFORATED TRAY → ITEM 10, 11, 13

TABLE 3(1) ITEM (10)

↳ TABLE 13, 14 (COL 2→4) } CURRENT RATING
IS (COL 2, 3)

DERATING

TABLE (24)

PERFORATED TRAY ALL TOUCHING — ITEM 7→9.

3 OTHER CIRCUITS
↓
4 CIRCUITS
↓
DERATING FACTOR 0.78

NO. OF TIERS
ROWS OF CABLE SUPPORT

1000 ← 1 ROW
↳ ITEM 7 → DERATING FACTOR 0.78

V90 TABLE (14) COLUMN (2)

$$\text{CURRENT} = \frac{80A}{0.78} = 102.56 \text{ Amp}$$

C.S.A − $25\,mm^2$

VOLTAGE DROP

3 CORE CABLE →
90C
↓
$25\,mm^2$ → 1.6

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

5% of 415V =

=

Vd <

ACCEPTABLE

BLE 3(1) ITEM (10)

↳ TABLE 13, 14 (COL 2→4)
15 (COL 2, 3)
} CURRENT RATING

DERATING

TABLE (24)

RATED
AY
TOUCHING
— ITEM 7→9

3 OTHER CIRCUITS
↓
4 CIRCUITS
↓

O. OF TIERS
S OF CABLE
SUPPORT

1000 ← 1 ROW
↳ ITEM 7 → DERATING FACTOR
0.78

V90 TABLE (14) COLUMN (2)

$$CURRENT = \frac{80A}{0.78} = 102.56\ Amp$$

$C.S.A - 25\ mm^2$

VOLTAGE DROP

3 CORE CABLE → TABLE 42
90°C
↓
$25\ mm^2 \rightarrow 1.61\ mV/A\text{-}mm$

$$V_d = \frac{V_c L I}{1000} = \frac{1.61 \times 100 \times 102.56}{1000}$$

$= 16.51\ V$

$$5\%\ of\ 415V = \frac{5}{100} \times 415$$

$= 22.5V$

$Vd < 5\%\ of\ 415V$

ACCEPTABLE

pb
3 CIRC

CIRCULAR

ARMOURED

BURIED D

DEPTH O

TEMPERAT

SPACES AT

ONE AND T

175A WHE

CALCU

BURIED D

4 CORES →

1/F | 9

pb/ 3 CIRCUITS of 4 CORES HFI 90 TP

CIRCULAR INSULATED AND SHEATHED NON ARMOURED COPPER CONDUCTOR CABLES ARE BURIED DIRECTLY IN THE GROUND AT A DEPTH OF 0.5m WHERE AMBIENT SOIL TEMPERATURE OF 25°C. THE CABLES ARE SPACED AT A DISTANCE OF 150mm FROM ONE ANOTHER. EACH CIRCUIT IS TO CARRY 175A WHEN PROTECTED BY C.B THE

LENGTH OF CIRCUIT IS 50m.

CALCULATE THE SIZE OF WIRE.

BURIED DIRECTLY IN TO GROUND → TABLE 3(3)

4 CORES → 3 CORES CABLE → ITEM (4) → DERATING 25(2)

↳ TABLE 13/14

COL 23/24

HFI 90 → 90°C

TABLE 15 – COL 13

TABLE 14 COL 23

TABLE 25(2)

NO. OF CABLES IN GROUP	SPACING
	150mm → 0.15 m
3 CIRCUITS	0.78

$$\text{CURRENT} = \frac{175}{0.78} = 224\ A$$

TABLE 14 – COL 23

$70\ mm^2$

$V_c = ?$ TABLE 42

4 CORES – MULTI CORES.

$70\ mm^2 \rightarrow$ 90°C ↓ $0.609\ mV/A\text{-}m$

$$V_d = \frac{V_c L I}{1000} = \frac{0.609 \times 50 \times 224}{1000} = 6.83V$$

5% of 415V =

< 5

ACCEPTA

CABLE SI

70

90 TP
D NON
LES ARE
AT A
NT SOIL
BLES ARE
m FROM
O CARRY
THE

IS 50m.

→ TABLE 3(3)

→ DERATING 25(2)

13/14

COL 23/24

15 – COL 13

3

TABLE 25(2)

NO. OF CABLES IN GROUP	SPACING
	150mm → 0.15 m
3 CIRCUITS	0.78

$$\text{CURRENT} = \frac{175}{0.78} = 224\ A$$

TABLE 14 – COL 23

$70\,mm^2$

$V_c = ?$ TABLE 42

4 CORES – MULTI CORES.

$70\,mm^2 \rightarrow 0.609\ mV/A\text{-}m$ (90°C)

$$V_d = \frac{V_c L I}{1000} = \frac{0.609 \times 50 \times 224}{1000} = 6.83V$$

5% of 415V = 22.5V

< 5% of 415V

ACCEPTABLE

CABLE SIZE IS

$70\,mm^2$

TABLE 42

THREE-PHASE VOLTAGE DROP (V_c) AT 50 Hz

CABLE TYPE: MULTICORE WITH CIRCULAR COPPER CONDUCTORS

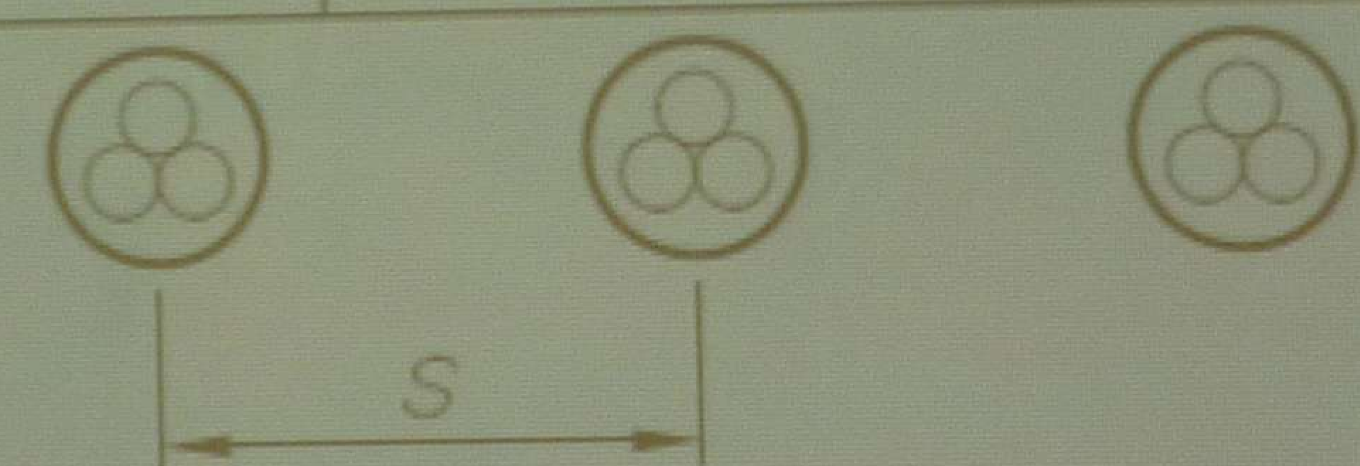
1	2	3	4	5	6	7	8	9	10	11
Conductor size	Three-phase voltage drop (V_c) at 50 Hz, mV/A.m									
	Conductor temperature, °C									
	45		60		75		90		110	
mm²	Max.	0.8 p.f.	Max.	0.8 p.f.	Max.	0.8 p.f.	Max.	0.8 p.f.	Max.	0.8 p.f.
1	40.3	—	42.5	—	44.7	—	46.8	—	49.7	—
1.5	25.9	—	27.3	—	28.6	—	30.0	—	31.9	—
2.5	14.1	—	14.9	—	15.6	—	16.4	—	17.4	—
4	8.77	—	9.24	—	9.71	—	10.2	—	10.8	—
6	5.86	—	6.18	—	6.49	—	6.80	—	7.22	—
10	3.49	—	3.67	—	3.86	—	4.05	—	4.29	—
16	2.19	—	2.31	—	2.43	—	2.55	—	2.70	—
25	1.39	—	1.47	—	1.54	—	1.61	—	1.71	—
35	1.01	—	1.06	—	1.11	—	1.17	—	1.24	—
50	0.751	—	0.790	—	0.829	—	0.868	—	0.920	—
70	0.530	—	0.556	—	0.583	—	0.609	—	0.645	—

TABLE 25(2)

DERATING FACTORS FOR GROUPS OF CIRCUITS

CABLE TYPE: MULTICORE

INSTALLATION CONDITIONS: BURIED DIRECT IN GROUND



1	2	3	4	5	6
Number of cables in group	Derating factors				
	Touching	Distance (*S*), m			
		0.15	0.30	0.45	0.60
2	0.81	0.87	0.91	0.93	0.95
3	0.70	0.78	0.84	0.88	0.90
4	0.63	0.74	0.81	0.86	0.89
5	0.59	0.70	0.78	0.84	0.87
6	0.55	0.68	0.77	0.83	0.87
7	0.52	0.66	0.75	0.82	0.86
8	0.50	0.64	0.75	0.81	0.86
9	0.48	0.63	0.74	0.81	0.85

TABLE 14 (*continued*)

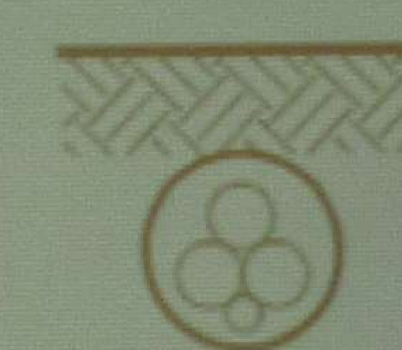
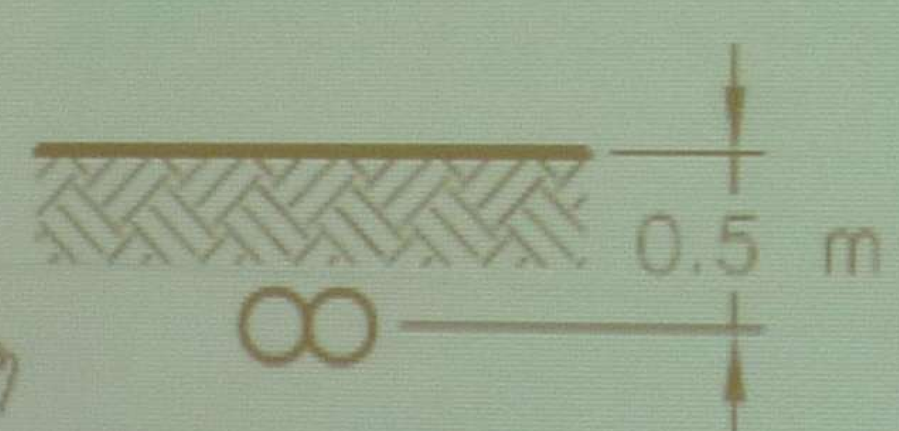
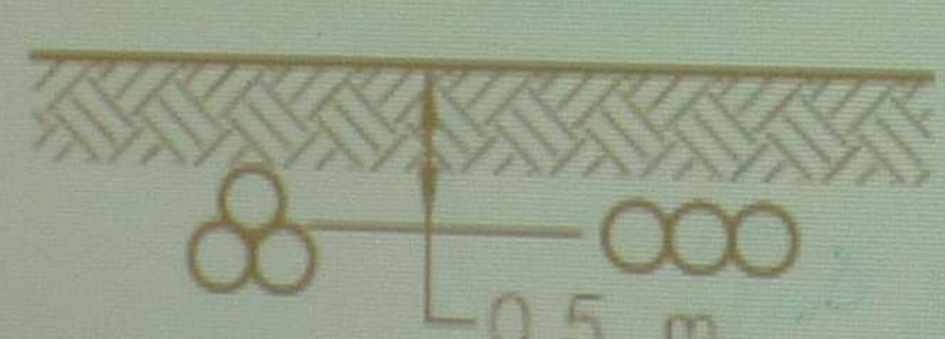
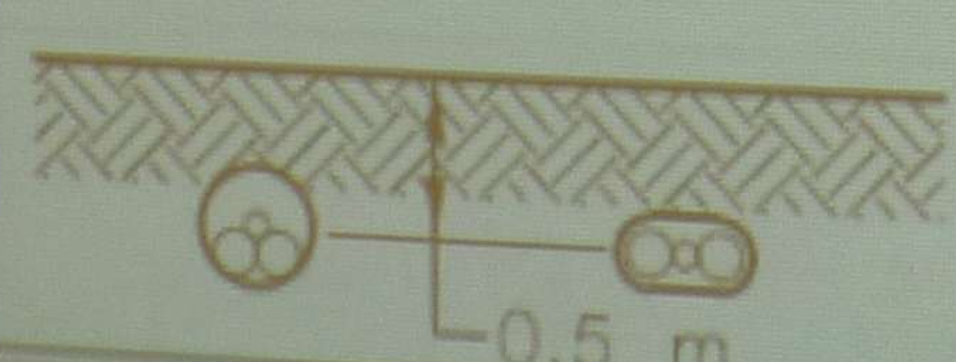
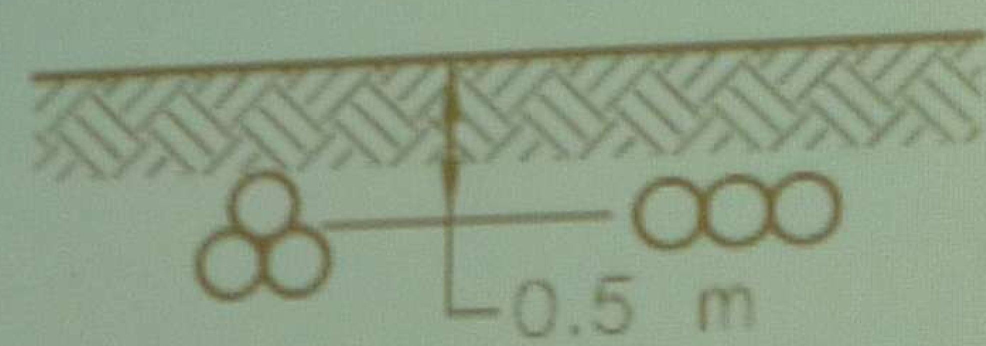
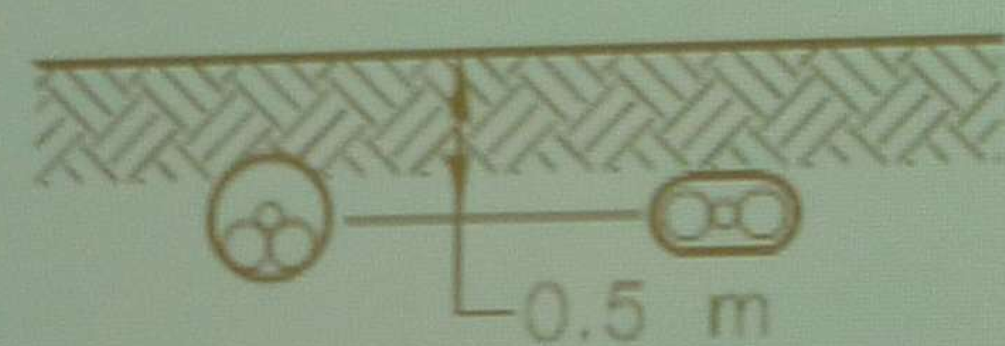
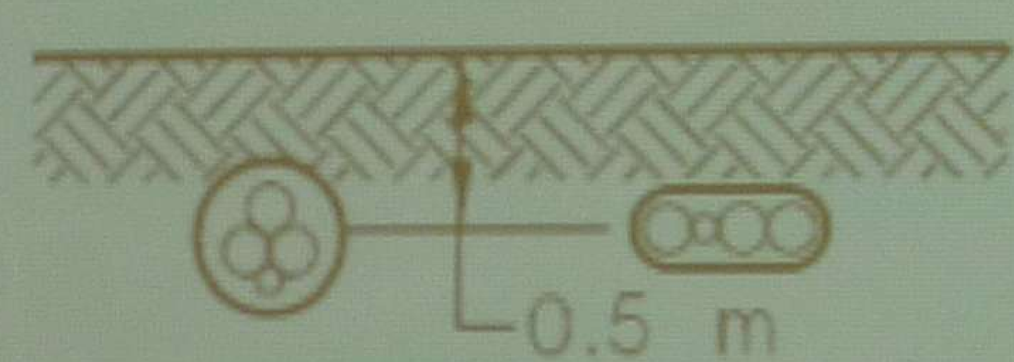
14	15	16	17	18	19	20	21	22	23	24	25	26	27
Conductor size	Current-carrying capacity, A												
	Thermal insulation								Buried direct		Underground wiring enclosure		
	Partially surrounded by thermal insulation, unenclosed		Partially surrounded by thermal insulation, in a wiring enclosure		Completely surrounded by thermal insulation, unenclosed		Completely surrounded by thermal insulation, in a wiring enclosure						
													
											Cu		
mm²	Cu	Al	Cu	Al	Cu	Al	Cu	Al	Cu	Al	Solid/ Stranded	Flexible	Al
1	12	—	10	—	7	—	6	—	16	—	16	17	—
1.5	15	—	13	—	9	—	8	—	20	—	20	21	—
2.5	21	—	19	—	13	—	12	—	29	—	29	28	—
4	28	—	24	—	18	—	15	—	37	—	37	36	—
6	36	—	30	—	22	—	19	—	46	—	46	45	—
10	49	—	42	—	31	—	26	—	63	—	63	62	—
16	66	51	55	42	41	32	34	26	110	85	81	79	63

TABLE 3(3)

SCHEDULE OF INSTALLATION METHODS FOR CABLES DEEMED TO HAVE THE SAME CURRENT-CARRYING CAPACITY AND CROSS-REFERENCES TO APPLICABLE DERATING TABLES—BURIED DIRECT IN THE GROUND

1	2	3	4	5	6
Item No.	Cable details (see Note 1)	Reference drawing (see Note 2)	Current-carrying capacity table reference	Methods of installation for cables deemed to have the same current-carrying capacity (see Note 3)	Derating table for more than one circuit
1	Two single-core cables		Tables 4 and 5 Columns 22 and 23 Table 6 Column 15		
2	Three single-core cables		Tables 7 and 8 Columns 22 and 23 Table 9 Column 15		25(1)
3	Two-core cables		Tables 10 and 11 Columns 23 and 24 Table 12	Cables with a minimum depth of laying of— (a) 0.3 m under continuous concrete paved areas; or (b) 0.5 m in other locations.	

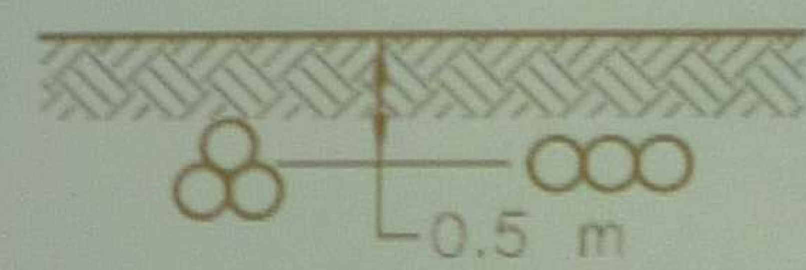
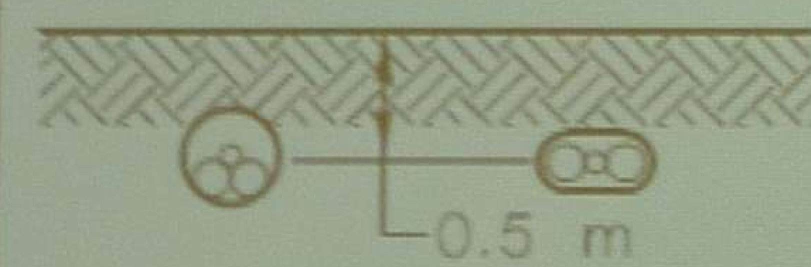
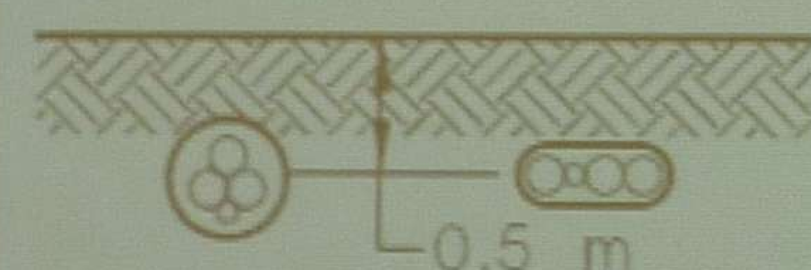
			Column 15		25(1)
2	Three single-core cables		Tables 7 and 8 Columns 22 and 23 Table 9 Column 15	Cables with a minimum depth of laying of— (a) 0.3 m under continuous concrete paved areas; or (b) 0.5 m in other locations.	
3	Two-core cables		Tables 10 and 11 Columns 23 and 24 Table 12 Column 13		25(2)
4	Three-core cables		Tables 13 and 14 Columns 23 and 24 Table 15 Column 13		

NOTES:

1 Earthing conductors, lightly loaded neutral conductors of three-phase circuits and conductors subject only to momentary loading, such as control wiring, shall not be counted in the number of cable cores.

2 See column headings of Tables 4 to 15.

3 See Tables 27 and 28 for rating factors applicable to different ambient soil temperatures and depths of laying.

			Column 15		25(1)
2	Three single-core cables		Tables 7 and 8 Columns 22 and 23 Table 9 Column 15	Cables with a minimum depth of laying of— (a) 0.3 m under continuous concrete paved areas; or (b) 0.5 m in other locations.	
3	Two-core cables		Tables 10 and 11 Columns 23 and 24 Table 12 Column 13		25(2)
4	Three-core cables		Tables 13 and 14 Columns 23 and 24 Table 15 Column 13		

NOTES:

1 Earthing conductors, lightly loaded neutral conductors of three-phase circuits and conductors subject only to momentary loading, such as control wiring, shall not be counted in the number of cable cores.

2 See column headings of Tables 4 to 15.

3 See Tables 27 and 28 for rating factors applicable to different ambient soil temperatures and depths of laying.

DERATED MAXIMUM DEMAND FOR
HRC FUSE PROTECTION

ph/ A FACTORY INSTALLATION HAS A 3φ 400V SUPPLY WHICH HAS A MULTIPLE EARTHED NEUTRAL CONNECTION. THE MAXIMUM DEMAND CURRENT OF THE INSTALLATION IS CALCULATED AT 180 Amp | ph. THE GREATEST PORTION OF THE MAXIMUM DEMAND CURRENT IS BALANCED OVER THREE PHASES. THE ACTIVE CONDUCTORS ARE 3 SINGLE CORE NON ARMOURED V90 INSULATED AND SHEATHED CIRCULAR CABLE WITH COPPER CONDUCTORS. INSTALLATION OF THE CABLE PLACES THEM IN RIGID THERMO PLASTIC CONDUIT. BURIED IN THE GROUND AT THE DEPTH OF 500mm WHERE AMBIENT SOIL TEMPERATURE 25C. THE CABLES ARE PROTECTED BY C.B. DETERMINE THE MAXIMUM

CONDUCTOR S
WIRE .

RIGID THE
BURIED

3

40

SUPPLY
CONNECTION.
STALLATION
EATEST
IS BALANCED
ARE 3
TED AND
NDUCTORS.
IN RIGID
GROUND
MBIENT SOIL
ARE
THE MAXIMUM

CONDUCTOR SIZE AND THE SIZE OF NEUTRAL WIRE. CABLE LENGTH IS 100m.

RIGID THERMOPLASTIC CONDUIT BURIED IN TO GROUND → TABLE 3(4)

√90→90°C

3 SINGLE CORE CABLE → ITEM (2) → TABLE 7/8
COL 24→26
TABLE 9
COL 16/17

→ DERATING TABLE 26(2)

NO MENTION ABOUT SPACING → ASSUME TOUCHING
TABLE 26(2) COL 2

NO MENTION ABOUT NO. OF CIRCUITS → GO/RETURN — 2 CIRCUITS.

CIRCUITS	TABLE 26(2) TOUCHING COL 2
2 →	0.9

CURRENT IN LINE =

=

CABLE SIZE → TA

CSA TABLE C

$70mm^2$ ←

ACTIVE WIRE

NEUTRAL WIRE SIZE

AS3000 :2007 { 3.5.2 (b)(

NEUTRAL
CURRE
200A
70

(2)
ING
2 CIRCUITS.

CURRENT IN LINE = $\frac{180\,A}{0.9}$

= 200A | PHASE WIRE

CABLE SIZE → TABLE 8 COL 24→26

↑ SOLID STRAND

CSA TABLE COL 24

$70mm^2$ ← 203A

ACTIVE WIRE SIZE = $70mm^2$

NEUTRAL WIRE SIZE

AS3000 :2007 {3.5.2 (b)(iv)}

NEUTRAL WIRE CURRENT IS ALSO 200A & SIZE $70mm^2$

VOLTAGE DROP

TABLE 40 | 41 | 42

SINGLE CORE CABLE IN RIGID THERMOPLASTIC CONDUIT 90°C ← V90

TABLE 41

$70mm^2$ → 0.623 mV/A-m

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

$$= \frac{0.623 \times 100 \times 200}{1000}$$

= 12.46V

LESS THAN 5% of 415V

ACCEPTABLE

SIZE IS $70mm^2$

FINAL SUB CIRCU

TABLE 41

THREE-PHASE VOLTAGE DROP (V_c) AT 50 Hz

CABLE TYPES: SINGLE-CORE INSULATED AND SHEATHED COPPER CONDUCTORS, LAID FLAT TOUCHING OR IN A WIRING ENCLOSURE

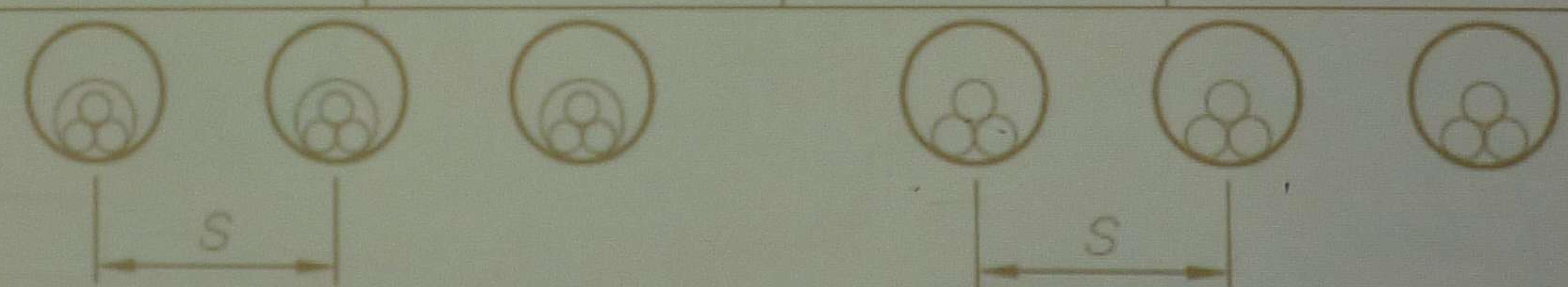
1	2	3	4	5	6	7	8	9	10	11
Conductor size	Three-phase voltage drop (V_c) at 50 Hz, mV/A.m									
	Conductor temperature, °C									
	45		60		75		90		110	
mm²	Max.	0.8 p.f.	Max.	0.8 p.f.	Max.	0.8 p.f.	Max.	0.8 p.f.	Max.	0.8 p.f.
1	40.3	—	42.5	—	44.7	—	46.8	—	49.7	—
1.5	25.9	—	27.3	—	28.6	—	30.0	—	31.9	—
2.5	14.1	—	14.9	—	15.6	—	16.4	—	17.4	—
4	8.77	—	9.24	—	9.71	—	10.2	—	10.8	—
6	5.86	—	6.18	—	6.49	[illegible]	6.81	—	7.23	—
10	3.49	—	3.68	—	3.86	—	4.05	—	4.30	—
16	2.20	—	2.32	—	2.43	—	2.55	—	2.71	—
25	1.40	—	1.47	—	1.55	—	1.62	—	1.72	—
35	1.02	—	1.07	—	1.12	—	1.18	—	1.25	—
50	0.763	—	0.801	—	0.840	—	0.878	—	0.929	—
70	0.545	—	0.571	—	0.597	—	0.623	—	0.657	—
95	0.413	—	0.431	—	0.449	—	0.467	—	0.491	—
[illegible]	[illegible]		[illegible]		[illegible]		[illegible]		[illegible]	

TABLE 26(2)

DERATING FACTORS FOR GROUPS OF CIRCUITS

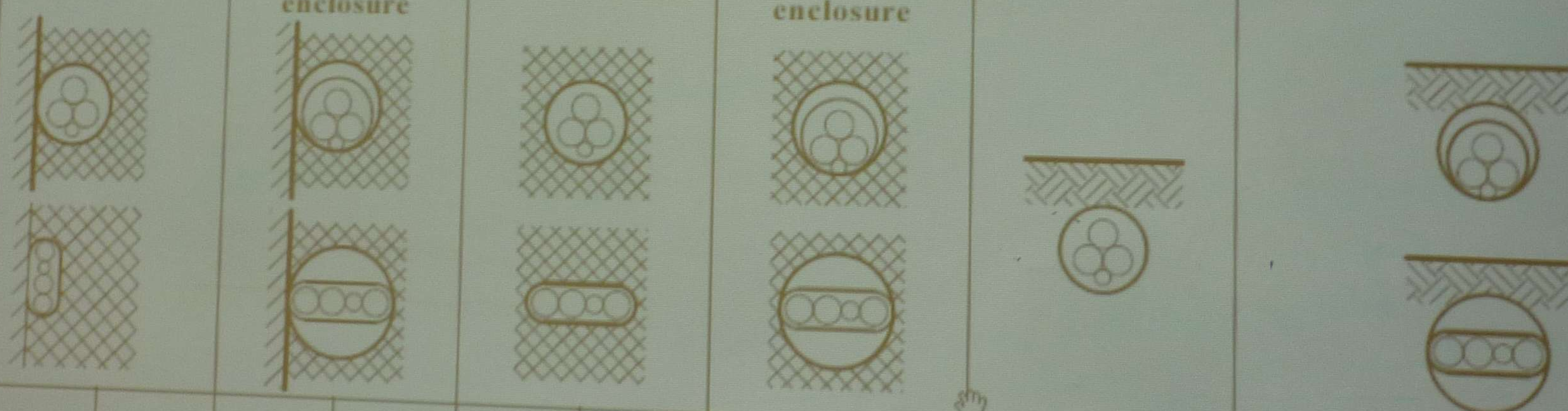
CABLE TYPES: SINGLE-CORE OR MULTICORE

INSTALLATION CONDITIONS: IN UNDERGROUND WIRING ENCLOSURES—MULTICORE CABLES ENCLOSED SEPARATELY OR MORE THAN ONE SINGLE-CORE CABLE PER WIRING ENCLOSURE



1	2	3	4	5
Number of circuits	Derating factor			
	Touching	Distance (*S*), m		
		0.30	0.45	0.60
2	0.90	0.93	0.95	0.96
3	0.83	0.88	0.91	0.93
4	0.79	0.85	0.89	0.92
5	0.75	0.83	0.88	0.91
6	0.73	0.82	0.87	0.90
7	0.71	0.81	0.86	0.89

TABLE 14 (*continued*)



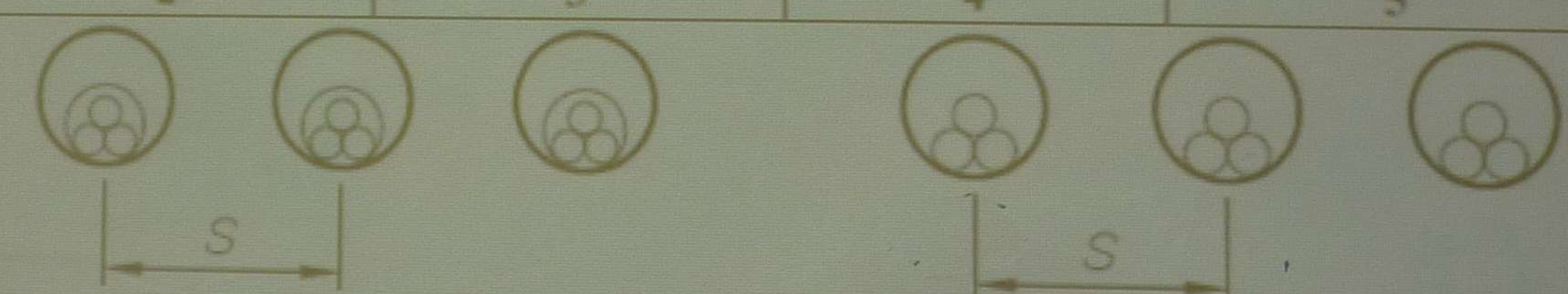
14	15	16	17	18	19	20	21	22	23	24	25	26	27
	Current-carrying capacity, A												
	Thermal insulation								Buried direct		Underground wiring enclosure		
Conductor size	Partially surrounded by thermal insulation, unenclosed		Partially surrounded by thermal insulation, in a wiring enclosure		Completely surrounded by thermal insulation, unenclosed		Completely surrounded by thermal insulation, in a wiring enclosure						
											Cu		
mm²	Cu	Al	Cu	Al	Cu	Al	Cu	Al	Cu	Al	Solid/ Stranded	Flexible	Al
1	12	—	10	—	7	—	6	—	16	—	16	17	—
1.5	15	—	13	—	9	—	8	—	20	—	20	21	—
2.5	21	—	19	—	13	—	12	—	29	—	29	28	—
4	28	—	24	—	18	—	15	—	37	—	37	36	—
6	36	—	30	—	22	—	19	—	46	—	46	45	—
10	49	—	42	—	31	—	26	—	63	—	63	62	—

TABLE 26(2)

DERATING FACTORS FOR GROUPS OF CIRCUITS

CABLE TYPES: SINGLE-CORE OR MULTICORE

INSTALLATION CONDITIONS: IN UNDERGROUND WIRING ENCLOSURES—MULTICORE CABLES ENCLOSED SEPARATELY OR MORE THAN ONE SINGLE-CORE CABLE PER WIRING ENCLOSURE



1	2	3	4	5
Number of circuits	Derating factor			
	Touching	Distance (*S*), m		
		0.30	0.45	0.60
2	0.90	0.93	0.95	0.96
3	0.83	0.88	0.91	0.93
4	0.79	0.85	0.89	0.92
5	0.75	0.83	0.88	0.91
6	0.73	0.82	0.87	0.90
7	0.71	0.81	0.86	0.89
8	0.70	0.80	0.85	0.89

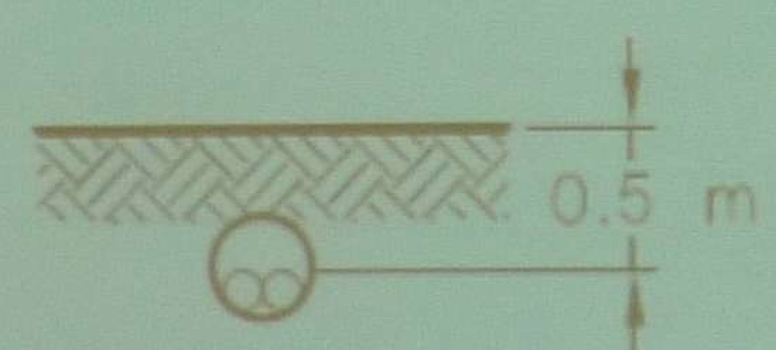
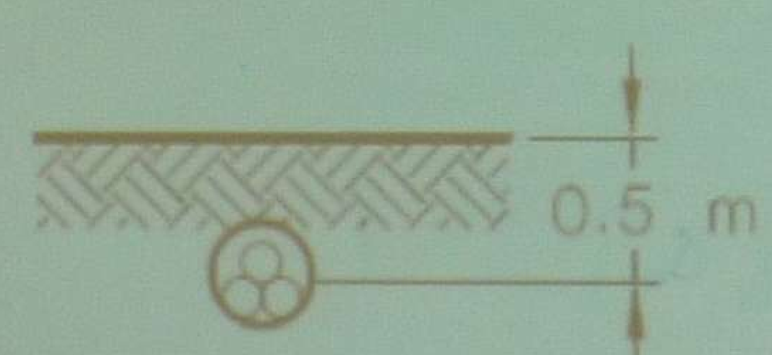
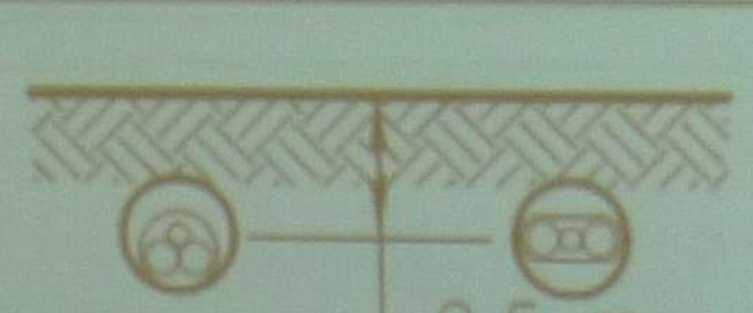
TABLE 8 (*continued*)

14	15	16	17	18	19	20	21	22	23	24	25	26	27	28
Conductor size	Current-carrying capacity, A													
	Enclosed			Thermal insulation				Buried direct		Underground wiring enclosure				
	Wiring enclosure in air			Partially surrounded by thermal insulation		Completely surrounded by thermal insulation								
	Cu		Al	Cu	Al	Cu	Al	Cu	Al	Cu		Al	Cu	Al
mm²	Solid/ Stranded	Flexible								Solid/ Stranded	Flexible			
1	15	15	—	12	—	8	—	18	—	18	19	—	22	—
1.5	18	19	—	15	—	10	—	22	—	22	23	—	27	—
2.5	25	24	—	20	—	14	—	31	—	31	30	—	38	—
4	33	31	—	26	—	19	—	40	—	40	38	—	49	—
6	42	41	—	34	—	24	—	50	—	50	49	—	60	—
10	56	55	—	45	—	32	—	67	—	67	66	—	79	—

Al

TABLE 3(4)

SCHEDULE OF INSTALLATION METHODS FOR CABLES DEEMED TO HAVE THE SAME CURRENT-CARRYING CAPACITY AND CROSS-REFERENCES TO APPLICABLE DERATING TABLES—UNDERGROUND WIRING ENCLOSURES

1	2	3	4	5	6	
Item No.	Cable details (see Note 1)	Reference drawing (see Note 2)	Current-carrying capacity table reference	Methods of installation for cables deemed to have the same current-carrying capacity (see Note 3)	Derating table for more than one circuit	
					in same enclosure	in separate enclosures
1	Two single-core cables		Tables 4 and 5 Columns 24 to 26 Table 6 Columns 16 and 17			
2	Three single-core cables		Tables 7 and 8 Columns 24 to 26 Table 9 Columns 16 and 17	Cables in a single enclosure laid— (a) a minimum of 0.3 m below continuous concrete paved areas; or (b) minimum 0.5 m in		
3	One two-core cable		Tables 10 and 11 Columns 25 to 27 Table 12			26(2)

2 *This Table does not limit cable sizes for extra-low voltage or switchboard wiring.*

NOTE: The size of unprotected consumers mains should be coordinated with the electricity distributor.

3.5.2 Neutral conductor

The minimum size of the neutral conductor shall be as follows:

(a) *Single-phase two-wire circuit* The neutral conductor or conductors of a single-phase consumers main, submain or final subcircuit shall have a current-carrying capacity not less than—

(i) the current-carrying capacity of the associated active conductor; or

(ii) the total current to be carried, where there is more than one active conductor.

(b) *Multiphase circuit* The current-carrying capacity of the neutral conductor of a multiphase circuit shall not be less than that determined in accordance with the following:

(iii) *Harmonic currents* Where a consumers main, submain or final subcircuit supplies a substantial load that generates harmonic currents, e.g. fluorescent lighting, computers, soft starters, variable speed devices or other electronic devices, the third and any higher order harmonic current generated in the equipment shall be added to the maximum out-of-balance load to determine the current to be carried by the neutral conductor.

For this purpose the third and any higher order harmonic current in the neutral conductor shall be taken as 100% of the highest load-generating harmonic currents on any phase.

NOTES:

1 A harmonic current load that constitutes not less than 40% of the total load on any single-phase is regarded as substantial.

any higher order harmonic current generated in the equipment shall be added to the maximum out-of-balance load to determine the current to be carried by the neutral conductor.

For this purpose the third and any higher order harmonic current in the neutral conductor shall be taken as 100% of the highest load-generating harmonic currents on any phase.

NOTES:

1 A harmonic current load that constitutes not less than 40% of the total load on any single-phase is regarded as substantial.

2 The third harmonic currents (and multiples thereof) are additive to the normal 50 Hz current to be carried. Therefore, it may be necessary for the capacity of a neutral conductor to be greater than that of the associated active conductors. Further information can be obtained from a number of sources including IEC 60364-5-52.

(iv) *Consumers mains, submains and final subcircuits* The current-carrying capacity of the neutral conductor of multiphase consumers mains, submains or final subcircuit shall be not less than that of the current-carrying capacity of the largest associated active conductor.

NOTE: Where more than one active conductor is connected to the one phase, the associated active conductor, for the purposes of this Clause, is the sum of the cross-sectional areas of all conductors connected to any one phase, e.g. conductors connected in parallel or separately metered portions of consumers mains operating on the same phase.

FINAL SUB CIRCUIT FAULT LOOP IMPEDANCE

① A FINAL SUB CIRCUIT SUPPLIES A LOAD CONSISTING OF A RANGE IN A DOMESTIC INSTALLATION AND IS PROTECTED BY 32 A TYPE (C) C.B DETERMINE THE MAXIMUM INTERNAL FAULT LOOP IMPEDANCE OF FINAL SUB CIRCUIT BASED ON 230V WHEN SUPPLY IS UNAVAILABLE.

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TABLE 8.1

TYPE (C)

32A ⟶ 0.96

B 5.2.1 (b) PAGE 365

$$Z_{INT} = 0.8 \frac{U_0}{I_a}$$

$= 0.8 \times 0.96$

$= 0.768\Omega$

② A FINAL SUB CIRCUIT SUPPLIES A LOAD CONSISTING OF 15 A SOCKET OUTLET IS PROTECTED BY 25 A HRC FUSE. DETERMINE THE MAXIMUM INTERNAL FAULT LOOP IMPEDANCE OF FINAL SUB CIRCUIT BASED ON 230V WHEN SUPPLY IS UNAVAILABLE.

HRC FUSE 0.4S

25A ⟶ 1.64Ω

TABLE 8.1 PAGE 343

B 5.2.1 (b) PAGE 365

$$Z_{INT} = 0.8 \frac{U_0}{I_a}$$

$= 0.8 \times 1.64 = 1.312\Omega$

TABLE 8.1

MAXIMUM VALUES OF EARTH FAULT-LOOP IMPEDANCE (Z_s at 230 V)

Protective device rating	Circuit-breakers			Fuses	
	Type B	Type C	Type D		
	Disconnection times				
	0.4 s			0.4 s	5 s
A	Maximum earth fault-loop impedance Z_s Ω				
6	9.58	5.11	3.07	11.50	15.33
10	5.75	3.07	1.84	6.39	9.20
16	3.59	1.92	1.15	3.07	5.00
20	2.88	1.53	0.92	2.09	3.59
25	2.30	1.23	0.74	1.64	2.71
32	1.80	0.96	0.58	1.28	2.19
40	1.44	0.77	0.46	0.96	1.64
50	1.15	0.61	0.37	0.72	1.28
63	0.91	0.49	0.29	0.55	0.94
80	0.72	0.38	0.23	0.38	0.68
100	0.58	0.31	0.18	0.27	0.48
125	0.46	0.25	0.15	0.21	0.43
160	0.36	0.19	0.12	0.16	0.30

The suitability of the particular overcurrent protective device depends on the value of the earth fault-loop impedance (Z_s).

A2 NOTE: Where the circuit protective device is an RCD, the measurement of earth fault-loop impedance is not necessary; however, it is recommended that such measurement be carried out so as to identify any abnormal circuit conditions which may be present.

B5 MAXIMUM CIRCUIT LENGTHS

B5.1 General

The information in Paragraph B5.2 may be used as a guide to provide a reasonably accurate assessment of maximum circuit lengths, in metres, that will ensure the correct operation of the protective device within the appropriate disconnection time to provide fault protection, in accordance with Clause 5.7.

B5.2 Calculation of maximum length of circuit

B5.2.1 *Determination of Z_{int}*

From Paragraph B4.4, $Z_s = Z_{ext} + Z_{int}$.

When an electrical installation is being designed, Z_{ext} may or may not be available (it will depend on the electricity distributor's transformer and supply cables). If it is not available Z_{int} may be determined by either of the following methods:

(a) When the length and cross-sectional area of conductors are known:

$$Z_{int} = Z_{CD} + Z_{EF} \quad \ldots \text{B5}$$

Where

Z_{CD} = impedance of the active conductors (C to D in Figure B5)

Z_{EF} = impedance of the protective earthing conductors (E to F in Figure B5)

NOTES:

that will ensure the correct operation of the protective device within the appropriate disconnection time to provide fault protection, in accordance with Clause 5.7.

B5.2 Calculation of maximum length of circuit

B5.2.1 *Determination of Z_{int}*

From Paragraph B4.4, $Z_s = Z_{ext} + Z_{int}$.

When an electrical installation is being designed, Z_{ext} may or may not be available (it will depend on the electricity distributor's transformer and supply cables). If it is not available Z_{int} may be determined by either of the following methods:

(a) When the length and cross-sectional area of conductors are known:

$$Z_{int} = Z_{CD} + Z_{EF} \quad \text{. . . B5}$$

Where

Z_{CD} = impedance of the active conductors (C to D in Figure B5)

Z_{EF} = impedance of the protective earthing conductors (E to F in Figure B5)

NOTES:

1 Consumers mains (Z_{BC} and Z_{FG}) form part of Z_{ext}.

2 Impedances for conductors are given in the AS/NZS 3008.1 series.

(b) When the length and cross-sectional area of the supply conductors are not known, it may be assumed that there will always be 80% or more of the nominal phase voltage available at the position of the circuit protective device. Therefore, Z_{int} should be not greater than 0.8 Z_s. This may be expressed as follows:

$$Z_{int} = 0.8\, U_o/I_a \quad \text{. . . B6}$$

EXERCISES

① A FACTORY INSTALLATION HAS A 3ϕ 400V SUPPLY WHICH HAS A MULTIPLE EARTHED NEUTRAL CONNECTION.
THE MAXIMUM DEMAND CURRENT OF THE INSTALLATION IS CALCULATED AT 150 A / ph. THE GREATER PORTION OF THE MAXIMUM DEMAND CURRENT CONSISTS OF 1ϕ LOAD
THE ACTIVE CONDUCTORS ARE 3 SINGLE CORE, V90 INSULATED COPPER CONDUCTORS. THEY ARE PLACED THEM IN RIGID THERMOPLASTIC CONDUIT, CLIPPED DIRECTLY TO AN INTERNAL WALL OPEN TO THE AIR, PROTECTED BY HRC FUSE. FIND THE CONDUCTOR SIZE FOR ACTIVE AND NEUTRAL CONDUCTOR.

② A FINA

FLOURESCENT

TYPE (C)

DETERMINE

FINAL SUB C

...PPLY WHICH HAS

...LATION IS
...N OF THE

...OAD

..., V90
...ACED THEM
...IRECTLY TO
...ROTECTED BY

...OR ACTIVE AND

(2) A FINAL SUB CIRCUIT SUPPLIES A LOAD CONSISTING OF FLOURESCENT LUMINAIRES AND IS PROTECTED BY A 10A TYPE (C) CIRCUIT BREAKER.

DETERMINE THE MAXIMUM INTERNAL FAULT LOOP IMPEDANCE OF FINAL SUB CIRCUIT BASED ON 230V WHEN SUPPLY IS UNAVAILABLE

$$\text{CURRENT IN LINE} = \frac{180\,A}{0.9}$$

$= 200A$ | PHASE WIR...

CABLE SIZE → TABLE 8 COL 24 → ...

↑ SOLID ST...

CSA TABLE COL 24

$70mm^2$ ← 203A

ACTIVE WIRE SIZE = $70mm^2$

NEUTRAL WIRE SIZE

AS3000:2007 {3.5.2 (b)(iv)}

NEUTRAL WIRE CURRENT IS ALSO 200A & SIZE $70mm^2$