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**NEW ZEALAND ELECTRICAL CODE OF PRACTICE**

**for**

**DETERMINATION OF MAXIMUM DEMAND**

**in**

**ELECTRICAL INSTALLATIONS**

Issued by the Office of  
The Chief Electrical Inspector,  
Energy and Resources Division, Ministry of Commerce  
Wellington, New Zealand

**THE ELECTRICITY ACT 1992**

**APPROVAL OF ELECTRICAL CODE OF PRACTICE**

**FOR**

**DETERMINATION OF MAXIMUM DEMAND**

**IN**

**ELECTRICAL INSTALLATIONS**

Pursuant to Section 36 of the Electricity Act 1992 (“the Act”)

On the 11th day of August 1994 the Secretary of Commerce issued the Electrical Code of Practice for Determination of Maximum Demand in Electrical Installations (“the Code”).

On the 25th day of August 1994, pursuant to Section 38 of the Act the Secretary published in the Gazette a notice of intention to apply to me for approval of the Code, and there has been consultations with such persons (or their representatives) as will be affected by the Code and they have had the opportunity to consider possible effects and comment on those effects.

I have considered the comments concerning those effects and where necessary amendments were made to the Code.

Therefore pursuant to section 38 of the Act, I, Douglas Lorimer Kidd, Minister of Energy, have this day approved the Code as attached to this approval, which Code shall come into force on the 1st day of April 1995.

Dated this 4th day of February 1995.

Douglas Lorimer Kidd  
Minister of Energy

## **COMMITTEE REPRESENTATION**

This Code of Practice was prepared by the Ministry of Commerce, Chief Electrical Inspector's Office with reference to the following organisations:

Electrical Consultants  
Electrical Supply Engineers' Association of NZ  
New Zealand Electrical Institute  
Electrical Contractors' Association of NZ Inc  
Electrical Engineers

## **ACKNOWLEDGEMENT**

The source material for this Code was derived from Section 2 of Australian Standard AS 3000-1991.

## **REVIEW**

This Code of Practice will be revised as occasions arise.

Suggestions for improvements of this Code are welcome. Send all comments in writing to: -

The Chief Electrical Inspector's Office  
Ministry of Commerce  
PO Box 1473  
WELLINGTON

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## **INTRODUCTION**

This Code is intended to assist in the determination of the maximum demands to be expected in mains, submains and final subcircuits. It also includes the current demands to be assumed for commonly used electrical appliances, in the determination of maximum demands in mains, submains and final subcircuits.

The current demand of a final circuit is determined by summing the current demands of all points of utilisation and electrical appliances in the circuit and, where appropriate, making an allowance for diversity.

This Code is based on Section 2 of AS 3000-1991 with amendments. It supports the move for trans-Tasman alignment on electrical safety criteria.

## **DETERMINATION OF MAXIMUM DEMAND IN ELECTRICAL INSTALLATIONS**

### **SECTION 1**

#### **SCOPE AND APPLICATION, REFERENCE DOCUMENTS, INTERPRETATION, GLOSSARY AND NUMBERING**

##### **1.1 SCOPE AND APPLICATION**

- 1.1.1 This Code outlines methods for determining the maximum demand in mains, submains and final subcircuits in electrical installations.
- 1.1.2 Due recognition has been made of the characteristics of electrical installations with appropriate diversity.

##### **1.2 REFERENCE DOCUMENTS**

The following Standards are referred to in this Code.

AS 1966	Electric Arc Welding Power Sources.
AS 3000	SAA Wiring Rules.

##### **1.3 INTERPRETATION**

For the purposes of this Code, the definitions given below shall apply.

- 1.3.1 Circuit-breaker - means a switch suitable for opening a circuit automatically, as a result of predetermined conditions, such as those of overcurrent or under-voltage, or by some form of external control and designed to interrupt excessive current up to its rupturing capacity.
- 1.3.2 Connected load - means the rating (in amperes or watts) of the electrical appliance(s).
- 1.3.3 Diversity - means a factor that may be applied to the total connected load in recognition of normal usage and of the fact that all electrical appliances are not drawing current at the same time.
- 1.3.4 Final subcircuit - means a circuit originating at a switchboard and to which electrical appliances are or will be connected.
- 1.3.5 Fuse - means a composite fitting for opening an electrical circuit by means of a conductor designed to interrupt the supply of electrical current by melting when an excessive current flows.

- 1.3.6 Mains - means those fittings forming part of an electrical installation that are used for the supply of electricity to the main switchboard of the installation.
- 1.3.7 Maximum demand - means the highest integrated rate of consumption of electricity over one of the following periods of time:
- (a) Instantaneous; or
  - (b) 15 minutes over any 12 hour period; or
  - (c) 30 minutes over any 24 hour period.
- 1.3.8 Point, in relation to fixed wiring, - means the termination of wiring:
- (a) At a fitting such as a socket-outlet, a lampholder, a permanent connection unit, an isolator or a ceiling rose; or
  - (b) Directly at the terminals of an electrical appliance or a luminaire.
- 1.3.9 Protective fitting - means a fitting that interrupts the flow of electricity to a circuit or part of a circuit under conditions of overload, short circuit or leakage to earth (i.e. a fuse or circuit-breaker).
- 1.3.10 Socket-outlet - means a fitting that-
- (a) Has contacts intended for making a detachable connection with the contacts of a plug; and
  - (b) Is, or is to be, fixed or suspended at the termination of fixed wiring.
- 1.3.11 Submain - means those fittings that-
- (a) Form part of an electrical installation; and
  - (b) Are used for the supply of electricity from the main switchboard to any other switchboard, whether or not through intermediate switchboards; and
  - (c) Have their origin at the load terminals of the associated protective fitting.
- 1.3.12 Unit - means a flat or a self-contained unit of domestic accommodation that contains an electrical installation.

**1.4 GLOSSARY OF ABBREVIATIONS USED IN THIS CODE**

A	Amperes
AS	Australian Standard
Hz	Hertz
kVA	Kilovolt-amps
kW	Kilowatts
m	Metres
SOs	Socket-outlets
V	Volts
W	Watts

**1.5 NUMBERING SYSTEM OF THIS CODE**

- 1.5.1 Sections are numbered from 1 to 5.
- 1.5.2 Subsections are numbered by one full stop between two numbers (eg: 1.4).
- 1.5.3 Clauses are numbered by two full stops between three numbers (eg: 2.1.1).
- 1.5.4 Subclauses are numbered by three full stops between four numbers (eg: 3.4.1.2).
- 1.5.5 Paragraphs contain numbering punctuated by one or more full stops together with a parenthesised letter.
- 1.5.6 Subparagraphs are represented by lower case roman numerals enclosed in parenthesis following paragraphs.
- 1.5.7 Unless otherwise specified, references in this Code to sections, subsections, clauses, subclauses, paragraphs, subparagraphs, Tables or Appendices are references to those of this Code.

## SECTION 2

### METHOD OF DETERMINING MAXIMUM DEMAND

#### 2.1 MAINS AND SUBMAINS

2.1.1 Subject to subclauses 2.1.2 and 2.1.3, maximum demand in mains and submains shall be determined by:

- (a) Assessment in accordance with subsection 3.1; or
- (b) Measurement in accordance with subsection 3.2; or
- (c) Limitation in accordance with subsection 3.3; or
- (d) Calculation in accordance with subsection 3.4.

2.1.2 Where an electrical installation comprises loads from both domestic and non-domestic electrical appliances, notwithstanding the options available in clause 2.1.1, subject to clause 2.1.4 the maximum demand shall be calculated by adding together the relevant values obtained from Tables 1 and 2.

2.1.3 Where a measured maximum demand in accordance with paragraph (b) of clause 2.1.1 is found to exceed that obtained by assessment or calculation in accordance with paragraphs (a) or (d) of that clause, the measured value shall be the maximum demand.

2.1.4 The maximum demand referred to in subclause 2.1.2 need not be greater than the sum of the current settings of the circuit-breakers protecting the final subcircuits where circuit-breakers are:

- (a) Of the fixed non-adjustable type; or
- (b) Of the adjustable type and have suitable sealing of the operating current and time settings.

#### 2.2 FINAL SUBCIRCUITS

Maximum demand of final subcircuits shall be determined by:

- (a) The sum of the connected load; or
- (b) Assessment in accordance with subsection 4.2; or
- (c) Limitation in accordance with subsection 4.3.

**SECTION 3****DETERMINATION OF MAXIMUM DEMAND IN MAINS AND SUBMAINS****3.1 ASSESSMENT**

3.1.1 Assessment for maximum demand in mains and submains shall be the demand of a similar electrical installation with allowance made for:

- (a) Differences because of the size and type of electrical appliances; or
- (b) Differences in the size of the electrical installation being assessed; or
- (c) The specialised nature of the electrical installation being assessed.

3.1.2 Assessments are advisable where:

- (a) The electrical appliance in an electrical installation operates under conditions of fluctuating or intermittent loading, and a definite duty cycle can be established; or
- (b) The electrical installation is large and complex.

**3.2 MEASUREMENT**

Maximum demand measurement of mains and submains shall be determined by a maximum demand indicator or recorder.

**3.3 LIMITATION**

3.3.1 The limitation of maximum demand in mains and submains shall be determined by:

- (a) The current rating of a fixed non-adjustable protective fitting in the main or submain; or
- (b) The load setting of an adjustable protective fitting, provided the current and time settings are suitably sealed.

**3.4 CALCULATION**

3.4.1 For single and multiple domestic electrical installations, calculation of the overall maximum demand of each phase shall be determined from Table 1 by:

- (a) Taking the sum of the values obtained through applying the appropriate instructions in Columns 2, 3, 4 or 5 of that Table; and
- (b) Applying them to the appropriate load groups of load groups A to G in Column 1 of that Table.

Examples of the calculation of maximum demand, using Table 1, for single and multiple domestic electrical installations, are given in Appendix A.

- 3.4.2 For communal services provided for single and multiple units, calculation of the overall maximum demand of each phase shall be determined from Table 1 by:
- (a) Taking the sum of the values obtained through applying the appropriate instructions in Columns 3, 4 or 5 of that Table; and
  - (b) Applying them to the appropriate load groups of load groups H to M in Column 1 of that Table.
- 3.4.3 For non-domestic electrical installations, calculation of the maximum demand of each phase of the electrical installation shall be determined from Table 2 by:
- (a) Taking the sum of values obtained through applying the appropriate instructions in Columns 2 and 3 of that Table, according to the type of electrical installation; and
  - (b) Applying them to the appropriate load groups in Column 1 of that Table.
- 3.4.4 For the purposes of the calculation, the load connected to each phase conductor shall be treated separately.

TABLE 1

## MAXIMUM DEMAND - SINGLE AND MULTIPLE DOMESTIC ELECTRICAL INSTALLATIONS

1		2	3	4	5
Load group		Individual domestic electrical Installation or single unit per phase	Complexes of units, <sup>a, b</sup> Loading Associated with individual units		
			2 to 5 units per phase	6 to 20 units per phase	21 or more units per phase
A	(i) Lighting Not including lighting that falls within subparagraph (ii) of this load group or load group J below <sup>c</sup>	3A for 1 to 20 points + 2A for each additional 20 points or part thereof	6A	5A + 0.25 A per unit	0.5A per unit
	(ii) Outdoor lighting exceeding 1,000W in total <sup>h, l</sup>	75% connected load	No assessment for the purpose of maximum demand (see load group H)		
B	(i) - Socket-outlets not exceeding 10A <sup>e</sup> - Fixed wired appliances not exceeding 10A and not included in other load groups <sup>m</sup>	15A for 1 to 20 points + 5A for each additional 20 points or part thereof	12A + 5A per unit	15A + 3.75A per unit	50A + 2A per unit
	(ii) Electrical installations including one or more 15A socket-outlets (other than socket-outlets provided to supply electrical appliances as set out in load groups C, D, E, F, G and L <sup>e, f</sup> )	10A	10A	10A	10A

1	2	3	4	5
Load group	Individual domestic electrical Installation or single unit per phase	Complexes of units, <sup>a, b</sup> Loading Associated with individual units		
		2 to 5 units per phase	6 to 20 units per phase	21 or more units per phase
(iii) Electrical installations including one or more 20A socket-outlets (other than socket-outlets provided to supply electrical appliances as set out in load groups C, D, E, F, G and L <sup>e, f</sup> )	15A	15A	15A	15A
C Electric ranges, cooking appliances, PCUs, clothes dryers or socket-outlets rated at more than 20A for their connection <sup>e</sup>	50% connected load	10A + 3A per unit	15A + 2A per unit	15A + 2A per unit
D Fixed wired space heating or air conditioning appliances or saunas <sup>e, g, k</sup> (i) controlled load	Where the full load current is less than the figure obtained under the other appropriate load groups, no assessment for the purpose of maximum demand. See footnote <sup>k</sup> .			
(ii) other types <sup>l</sup>	75% connected load	75% connected load	75% connected load	75% connected load
E Instantaneous water heaters <sup>l</sup>	33.3% connected load	5A + 5A per unit	6A per unit	100A + 1A per unit
F Storage water heaters (i) controlled load <sup>k</sup>	Where the full load current is less than the figure obtained under the other appropriate load groups, no assessment for the purpose of maximum demand. See footnote <sup>k</sup> .			
(ii) other types <sup>l</sup>	Full-load current	6A per unit	6A per unit	100A + 0.8A per unit
G Spa and swimming pool heaters <sup>k</sup>	Where only one spa or only one swimming pool is present, 75% of that spa or pool. Where more than one spa or more than one swimming pool is present, 75% of the largest spa or pool, plus 25% of each			

1	2	3	4	5
<b>Load group</b>	<b>Individual domestic electrical Installation or single unit per phase</b>	<b>Complexes of units,<sup>a, b</sup> Loading Associated with individual units</b>		
		<b>2 to 5 units per phase</b>	<b>6 to 20 units per phase</b>	<b>21 or more units per phase</b>
	other spa or pool. Where both spas and swimming pools are present, 75% of the largest spa, plus 75% of the largest swimming pool, plus 25% for each other other spa and swimming pool present.			

1	2	3	4	5
Load group	Individual domestic electrical Installation or single unit per phase	Communal services		
		LOADING NOT ASSOCIATED WITH INDIVIDUAL UNITS - CONNECTED TO EACH PHASE (PUBLIC LIGHTING, COMMUNAL LAUNDRY LOADINGS, LIFTS, MOTORS ETC)		
H Communal lighting <sup>h,1</sup>	Not applicable	Full connected load	Full connected load	Full connected load
I Socket-outlets not included in load groups J and M below <sup>d, e, f</sup> Fixed wired appliances not exceeding 10A	Not applicable	2A per point	2A per point	1A per point
J Electrical appliances rated at more than 10A and socket-outlets for their connection. (i) Clothes dryers, water heaters, self-heating washing machines, wash boilers <sup>e</sup>	Not applicable	50% connected load	50% connected load	50% connected load
(ii) Fixed wired space heating air conditioning appliances, saunas <sup>g</sup>	Not applicable	75% connected load	75% connected load	75% connected load
(iii) Spa and swimming pool heaters	Not applicable	<p>Where only one spa or only one swimming pool is present, 75% of that spa or pool.</p> <p>Where more than one spa or more than one swimming pool is present, 75% of the largest spa or pool, plus 25% of each other spa or pool.</p> <p>Where both spas and swimming pools are present, 75% of the largest spa, plus 75% of the largest swimming pool, plus 25% for each other other spa and swimming pool present.</p>		

1	2	3	4	5
<b>Load group</b>	<b>Individual domestic electrical Installation or single unit per phase</b>	<b>Communal services</b>		
		<b>LOADING NOT ASSOCIATED WITH INDIVIDUAL UNITS - CONNECTED TO EACH PHASE (PUBLIC LIGHTING, COMMUNAL LAUNDRY LOADINGS, LIFTS, MOTORS ETC)</b>		
K Lifts	Use Table 2.	No assessment for purpose of calculation of maximum demand. Use Table 2 for determination of size of submains.		
L Motors	Use Table 2, Column 2.	Use Table 2 Column 2.		
M Electrical appliances such as, pottery kilns, welding machines, radio transmitters, and the like, including socket-outlets other than those set out in load groups A to L above.	Connected load to 5A or less. No assessment for purpose of maximum demand.	Connected load 10A or less: No assessment for purpose of maximum demand.		
	Connected load over 5A. By assessment.	Connected load over 10A. By assessment.		

**FOOTNOTES TO TABLE 1**

- (a) For multiphase connections, divide the number of units by number of supply phases, e.g., 16 units on a three-phase supply,  $16 \div 3 = 6$  units on the heaviest loaded phase (column 4).
- (b) Where only a portion of the number of units in a complex of units equipped with fixed wired appliances, such as electric cooking ranges or space heating appliances, the number of electrical appliances in each category is divided over the number of phases, and the maximum demand determined as shown in Example 3 of Appendix A.
- (c) Lighting track systems shall be regarded as 2 points per metre of track.
- (d) This load group is not applicable to socket-outlets installed in communal areas and connected to the individual units. Such socket-outlets should be included in load group B.
- (e) For the purpose of determining maximum demand, a multiple combination socket-outlet shall be regarded as one point.
- (f) Where an electrical installation contains 15A or 20A socket-outlets covered by load group B(ii) or B(iii), the base loading of load group B shall be increased by 10A or 15A respectively. If both 15A and 20A socket-outlets are installed, the increase shall be 15A.  
Where more than two 15 or 20A socket-outlets are fitted the excess are regarded as 10A types for the purposes of the calculation.
- (g) Where an electrical installation includes an air-conditioning system for use in hot weather and a heating system for use in cool weather, only that system which has the greater load shall be taken into account.
- (h) Flood lighting, swimming pool lighting, tennis court lighting and the like.
- (i) Instantaneous water heaters plus "quick recovery" storage type water heaters having element ratings greater than 100 watt/litre.
- (j) Storage type water heaters, including "quick recovery" heaters not within the scope of footnote (i).
- (k) Controlled loading is taken to include only loading to which electricity supply is regularly controlled by the electricity supplier so that it is available only for a limited period of time each day. Where the full load current of the controlled load exceeds the maximum demand calculated using all the appropriate items of this Table, the full load current of the controlled load together with the calculations from load groups A(ii) and H shall be taken as the maximum demand for the electrical installation.
- (l) In the calculation of the connected load, the following ratings shall be assigned to lighting:
  - (i) Incandescent lamps. 60W or the actual wattage of the lamp to be installed, whichever is the greater, except where the design of the luminaire associated with the lampholder permits only lamps of less than 60W to be inserted in any lampholder, the connected load of that lampholder shall be the wattage of the highest rated lamp which may be accommodated. For multi-lamp luminaires, the load for each lampholder shall be assessed on this basis.
  - (ii) Lamps including auxiliary fittings. Full connected load, being the actual current consumed by the lighting arrangement having regard to auxiliary fittings such as ballasts and capacitors.
  - (iii) Lighting tracks. 0.5A/metre per phase of track or the actual connected load, whichever is the greater.

TABLE 2

## MAXIMUM DEMAND - NON DOMESTIC ELECTRICAL INSTALLATIONS

1		2	3
Load group		Residential Institutions, hotels, boarding houses, hospitals, accommodation houses, motels	Factories, shops, stores, offices, business premises
A	Lighting other than in load group F <sup>a, d</sup>	75% connected load	Full connected load
B	(i) Socket-outlets up to 10A other than those in load group B(ii) <sup>d</sup>	5A for first outlet plus 2A for each additional outlet	5A for first outlet plus 3A for each additional outlet
	(ii) Socket-outlets up to 10A in buildings provided with either separate fixed wired heating and/or cooling appliances or permanently installed heating and/or cooling appliances powered from other energy sources <sup>b, d</sup>	5A for first outlet plus 0.5A for each additional outlet	5A for first outlet plus 0.5A for each additional outlet
	(iii) Socket-outlets exceeding 10A <sup>d</sup>	Full current rating of highest rated socket-outlet plus 50% of full current rating of remainder	Full current rating of highest rated socket-outlet plus 75% of the full current rating to remainder
C	Electrical appliances for cooking, heating and cooling, including instantaneous water heaters, but not electrical appliances included in load groups D and J below.	Full load of highest rated appliance plus 50% of full load of remainder	Full load of highest rated appliance plus 75% of full load of remainder
D	Motors other than in load groups E and F below	Full load of highest rated motor plus 50% of full load of remainder	Full load of highest rated motor plus 75% of full load of second motor plus 50% of full load of remainder

1	2	3
Load group	Residential Institutions, hotels, boarding houses, hospitals, accommodation houses, motels	Factories, shops, stores, offices, business premises
E Lifts	(i) Largest lift motor - full-load current (ii) Next largest lift motor - 75% full-load current (iii) Remaining motors - 50% full-load current  For the purpose of this Load Group, the full-load current of a lift motor shall be the current taken from the electrical supply when moving maximum rated load at maximum rated speed.	
F Fuel dispensing units	(i) Motors: First motor - full-load current Second motor - 50% full-load current Additional motors - 25% full-load current  (ii) Lighting - full connected load.	
G Swimming pools, spas, saunas, thermal storage heaters including water heaters, space heaters, and similar arrangements <sup>c</sup>	(i) Continuous elements - full-load current in all cases (ii) Off-peak elements (including off-peak elements which may be connected to the electrical supply at other than off-peak times by means of a change-over switch or load control systems): 66.6% of full-load current where the demand of the rest of the electrical installation as calculated is not less than that of the off-peak element. Full-load current in all other cases.	
H Welding machines	In accordance with Appendix B, taking into account power factor correction.	
J X-ray units	50% of the full-load current of the largest X-ray unit, additional units being ignored.	
K Other electrical appliances not including those within the load groups above	By assessment.	

**FOOTNOTES TO TABLE 2**

- (a) In the calculation of the connected load, the following ratings shall be assigned to lighting:
- (i) Incandescent lamps. 60W or the actual wattage of the lamp to be installed, whichever is the greater, except where the design of the luminaire associated with the lampholder permits only lamps of less than 60W to be inserted in any lampholder, the connected load of that lampholder shall be the wattage of the highest rated lamp which may be accommodated. For multi-purpose luminaires, the load for each lampholder shall be assessed on this basis.
  - (ii) Lamps including auxiliary fittings. Full connected load, being the actual current consumed by the lighting arrangement having regard to auxiliary fittings such as ballasts and capacitors.
  - (iii) Lighting tracks. 0.5A/metre per phase of track or the actual connected load, whichever is the greater.
- (b) Load group B(ii) applies to buildings or portions of buildings incorporating fixed wired heating and/or cooling appliances specifically provided to render unnecessary the use of general purpose outlets for portable electric space heating or cooling appliances. The assessment of whether fixed wired appliances for heating, cooling, or heating and cooling are necessary to avoid the use of portable electrical appliances for such purposes, will depend on the location and climate involved.
- (c) Controlled loading is taken to include only loading to which supply is available for a limited period of time each day.
- (d) A socket-outlet installed more than 2.3 m above a floor for the connection of an electrical appliance rated at not more than 100W, or for a luminaire, may be included as a lighting point in load group A.

## **SECTION 4**

### **MAXIMUM DEMAND OF FINAL SUBCIRCUITS**

#### **4.1 GENERAL**

- 4.1.1 Where the methods referred to in clause 4.1.2 are not followed, the maximum demand of a final subcircuit shall be the full connected load.
- 4.1.2 The maximum demand of final subcircuits may be determined by any one of the methods described in subsections 4.2 to 4.6.

#### **4.2 ASSESSMENT**

Assessment of the maximum demand of final subcircuits is advisable:

- (a) Where the subcircuit has electrical appliances connected that operate under conditions of fluctuating or intermittent loading, and where a definite duty cycle can be established; or
- (b) Relate to the measured demand of a similar subcircuit with allowance made for any differences in electrical appliance characteristics.
- (c) Where an electrical installation has subcircuits controlled by circuit-breakers (of the kinds referred to in paragraphs (a) and (b) of clause 2.1.4,) and the assessment of the maximum demand on each subcircuit is less than the limits set by the circuit-breaker.

#### **4.3 LIMITATION**

- 4.3.1 The limitation of maximum demand of a final subcircuit may be determined by,-
- (a) The current rating of a fixed non-adjustable protective fitting; or
  - (b) The current rating of an adjustable protective fitting, provided that the calibration and adjustment is suitably sealed;
  - (c) The current rating of the electrical appliance or the loading equal to the full load rating of the terminal fitting for any type of protective fitting.

**4.4 ELECTRIC RANGES, OVENS AND HOBS IN DOMESTIC ELECTRICAL INSTALLATIONS**

4.4.1 For an electric range, oven, or hob installed in a domestic electrical installation, the maximum demand per phase shall be as follows:

- (a) For full-load phase rating not exceeding 5 kW ..... 16A
- (b) For full-load phase rating exceeding 5 kW  
but not exceeding 8 kW ..... 20A
- (c) For full-load phase rating exceeding 8 kW  
but not exceeding 10 kW ..... 25A
- (d) For full-load phase rating exceeding 10 kW  
but not exceeding 13 kW ..... 32A
- (e) For full-load phase rating exceeding 13 kW ..... 40A

4.4.2 An electric oven or hob unit, or a combination of such an oven and a hob unit, connected to a supply of electricity as a single electrical appliance, may be considered as an electric range for the purposes of this subsection.

**4.5 CIRCUITS TO WHICH MORE THAN ONE ELECTRICAL APPLIANCE OR SOCKET-OUTLET IS CONNECTED**

4.5.1 A final subcircuit to which more than one electrical appliance or socket-outlet is connected, shall have a maximum demand that is the lesser or equal to:

- (a) The current rating of the protective fitting for the circuit; or
- (b) The total actual loading of the electrical appliances and socket-outlets on the circuit.

4.5.2 For the purposes of paragraph (b) of clause 4.5.1, the loading of a socket-outlet, other than one installed for the connection of a fixed wired appliance, shall be the full load rating of the socket-outlet.

**4.6 INTERLOCKING**

Where more than one electrical appliance or motor is supplied from one final subcircuit but is interlocked so that only a limited number of such appliances and motors may be connected at any one time, the maximum demand of the final subcircuit may be the highest maximum demand obtainable from any possible combination of such electrical appliances and motors that may be connected at any one time.

**APPENDIX A****EXAMPLES OF MAXIMUM DEMAND CALCULATIONS****Calculation of maximum demand in single and multiple domestic electrical installations (Section 3 and Table 1)**

**Example 1** Determine the maximum demand of a single domestic electrical installation supplied by single-phase 230V with the following load:

24 light points  
 10m of lighting track  
 9 single SOs (10A)  
 8 double SOs (10A)  
 1 x 1 kW strip heater  
 1 x 50W exhaust fan  
 1 x 10 kW electric range  
 1 x 2.5 kW control load water heater

**Solution:** The method of determining demand in accordance with Table 1.

*Load Group A*

24 lighting points, plus  
 10m of lighting track, plus  
 50W exhaust fan = 45 points  
 $= 3 + 2 + 2 = 7A$

*Load Group B*

9 single SOs, plus  
 8 double SOs = 17 points  
 1000W strip heater = 1 point  
 $= 15A$

*Load Group C*

10 kW electric range =  $43.48 \times 0.5 = 21.7A$

*Load Group F(i)*

Control load water heater 2500W = 11A  
 Maximum demand = 0A (See footnote k to Table 1)

*Total Demand*

= Sum of load group demands =  $A + B + C + F(i)$   
 $= 7 + 15 + 21.7 + 0$   
 $= 44A$

**Example 2** Determine the maximum demand of the heaviest loaded phase in a three phase domestic electrical installation comprising:

- 26 lighting points (Two Phases)
- 24 SOs (Two Phases)
- 15A socket-outlet (Single Phase)
- 16.6 kW electric range (Two Phase)
- 4 kW air conditioning unit (Single Phase)
- 12.96 kW instantaneous water heater (Two Phase)
- 3.6 kW clothes dryer (Single Phase)

and arrange for connection across a three-phase supply as follows:

<i>Red</i>	<i>White</i>	<i>Blue</i>
	13 lights	13 lights
	15 SOs	9 SOs
15A socket-outlet		
10 kW hop elements		6.6 kW oven
	4kW air conditioner	
6.48 kW instantaneous water heater	6.48 kW instantaneous water heater	
		3.6 kW clothes dryer

**Solution:** The method of determining the demand in the heaviest loaded phase in accordance with Column 2 of Table 1 assuming that the electrical installation is balanced as far as practicable over the three phases, is as follows:

	<b>Load Group</b>	<b>Red (A)</b>	<b>White (A)</b>	<b>Blue (A)</b>
Lighting	A(i)		3	3
SOs (10A)	B(i)		15	15
15A socket-outlet	B(ii)	10		
Electric range	C	21.8		14.4
Air conditioner	D		13.0	
Water heater	E	9.4	9.4	
Clothes dryer	C			7.8
<b>TOTAL</b>		<b>41.2</b>	<b>40.4</b>	<b>40.2</b>

Total loading, heaviest loaded phase = Red phase, 41.2A

**Example 3** Determine the maximum demand of the heaviest loaded phase of a three phase supply to a complex of 80 units comprising the following loads:

Lighting .....	80 units
SOs (10A) .....	80 units
Electric ranges .....	17 units
2.5 kW (11A) Fixed wired strip heaters .....	80 units
Quick recovery water heaters .....	80 units

Loading not associated with the individual units (Communal Services):

House and public area lighting

80	lighting points at 60W each +
20	lighting points at 100W each (Total lighting 6.8 kW)
20	SOs (10A)
10	clothes dryers at 3.6 kW
2	lift motors each 12 kW
5.5 kW	three-phase pump motor
4 kW	three-phase water supply motor

**Solution:** The method of determining the demand of the heaviest loaded phase, assuming that the electrical installation is balanced as far as practicable over the three phases, in accordance with Table 1, is as follows:

Number of units per phase, three-phase supply =  $80/3 = 27$  units over each of two phases and 26 units on the other phase. The instructions given under column 5 of Table 1 would therefore be applicable to the electrical installation other than for the electric ranges.

The number of electric ranges per phase =  $17/3 = 6$  over each of two phases and 5 on the other phase. The instructions under column 4 of Table 1 would therefore be applicable to the Load Group C, electric ranges and cooking appliances.

**Individual Units**

	<b>Load Group</b>	<b>Column</b>	
Lighting	A(i)	5	$27 \times 0.5 = 13.5A$
SOs (10A)	B(i)	5	$50 + (27 \times 2) = 104A$
Electric ranges	C	4	$6 \times 2 + 15 = 27A$
Fixed wired strip heaters	D	5	$27 \times 11 \times 0.75 = 222.75A$
Quick recovery water heaters	E	5	$100 + (27 \times 0.8) = 121.6A$

*Total units loading for heaviest loaded phase = 489A*

**Communal Services**

The lighting is taken as being evenly balanced over the phases, i.e:

$$\frac{6,800}{3} = 2,266W \text{ per phase}$$

(Should the lighting load be arranged for connection to one phase, the loading for Load Group H would be 6800W).

The 20 SOs are taken as connected as follows: 7 over each of two phases and 6 on the other phases.

The 10 clothes dryers are taken as connected as follows: 3 over each of two phases and 4 on the other phase, with loading on heaviest loaded phase = 14 400W.

**Motors:**

5.5kW motor = 10.4A per phase (connected load)

4.0kW motor = 8.3A per phase (connected load)

	<b>Load Group</b>	<b>Column</b>	
Lighting	H	5	$\frac{2,266}{230} = 9.9A$
SO's (10A)	I	5	$7 \times 1 = 7.0A$
Clothes dryers	J(i)	3	$0.5 \times \frac{(14,400)}{(230)} = 31.3A$
Lifts	K	5	NIL
Motors	L	5	$10.4 + (8.3 \times 0.5) = 14.6A$

*Total communal services loading for heaviest loaded phase = 62.8A*

*Total loading for heaviest loaded phase:*

*= Units loading + communal services loading*

*= 489 + 62.8 = 552A*

**APPENDIX B****B.1 WELDING MACHINES**

B.1.1 For the purpose of Appendix B, the following definitions apply:

B.1.1.1 Duty cycle, in relation to electrical appliances with a fluctuating load function, such as welders, - means the ratio of the time during which current flows to the standard period of one minute, expressed as a percentage.

**EXAMPLES OF DUTY CYCLE CALCULATIONS****Example 1:**

*A spot welder supplied by a 50 Hz system (3,000 cycles/minute) making six 15-cycle welds per minute would have a duty cycle of:*

$$\frac{6 \times 15}{3,000} \times \frac{100}{1} \% = 3\%$$

**Example 2:**

*A seam welder operating 2 cycles "on" and 2 cycles "off" would have a duty cycle of 50 percent.*

B.1.1.2 Rated primary current - means:

- (a) For arc welding machines complying with AS 1966, the marked rated input current; or
- (b) For arc welding machines complying with AS 1966, but where the machine is fitted with power factor correction fittings, the marked corrected primary current; or
- (c) For all other welding machines, the current obtained by multiplying the rated kilovolt amperes (kVA) by 1,000, and dividing by the rated primary voltage (being the connected loading of the machine).

**B.1.2 ARC WELDING MACHINES**

B.1.2.1 The maximum demand of an individual arc welding machine shall be 100% of the rated primary current.

B.1.2.2 The maximum demand of two or more arc welding machines shall be:

- (a) Two largest welding machines 100% of each rated primary current; plus (where more than two)
- (b) Next largest welding machine 85% of the rated primary current; plus (where more than three)
- (c) Next largest welding machine 70% of the rated primary current; plus (where more than four)
- (d) All other welding machines 60% of the rated primary current

**B.1.3 RESISTANCE WELDING MACHINES**

B.1.3.1 The maximum demand for an individual resistance welding machine,-

- (a) Where of the type where the duty cycle is unknown, shall be measured as 70% of the rated primary current for seam and automatically fed machines, and 50% of the rated primary current for manually operated, non-automatic machines:
- (b) Where of the type where the duty cycle of the welder is known, shall be measured as the product of ‘a’ multiplied by ‘b’ where:  
 ‘a’ is the actual primary current, and  
 ‘b’ is the multiplier given below for the duty cycle:

Duty cycle (percent)	50	40	30	25	20	15	10	7.5	5 or less
Multiplier	0.71	0.63	0.55	0.50	0.45	0.39	0.32	0.27	0.22

B.1.3.2 The demand for two or more resistance welding machines shall be the sum of:

- (a) The value obtained in accordance with subclause B.1.3.1 for the largest welding machine supplied; and
- (b) 60% of the values obtained in accordance with subclause B.1.3.1 for all other welding machines supplied.