



New Zealand Standard

Energy Efficiency – Large buildings

Part 2: Lighting

Superseding NZS 4243:1996

NZS 4243.2:2007

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This Standard was prepared under the supervision of the Energy Efficiency – Large Buildings Committee (P4243) for the Standards Council established under the Standards Act 1988.

The committee consisted of representatives of the following nominating organisations:

Auckland University of Technology
BRANZ Ltd
Department of Building and Housing
Energy Efficiency and Conservation Authority
Glass Association of New Zealand
Illuminating Engineering Society of Australia and New Zealand Limited
Lighting Council of New Zealand

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The committee consisted of representatives of the following nominating organisations:

BRANZ Ltd
Building System Performance, Ministry of Business, Innovation and Employment
CoreNet Global New Zealand
Energy Efficiency and Conservation Authority
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Lighting Council New Zealand
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AMENDMENTS

No.	Date of issue	Description	Entered by, and date
1	April 2018	Amendment No. 1 includes updates to the lighting power density limits (LPDLs) of the standard, and subsequent areas of the standard that relate to the updated LPDLs, updates to terminology and definitions, and removal of all references to the calculation method within the standard.	Incorporated in this edition.

NZS 4243.2:2007
Incorporating Amendment No. 1

New Zealand Standard

**Energy Efficiency –
Large Buildings**

Part 2: Lighting

Superseding NZS 4243:1996

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REFERENCED DOCUMENTS

Reference is made in this document to the following:

NEW ZEALAND STANDARDS

NZS 4243: Energy efficiency – Large buildings
Part 1:2007 Building thermal envelope

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JOINT AUSTRALIAN/NEW ZEALAND STANDARDS

AS/NZS 1680:---- Interior and workplace lighting
Part 1:2006 General principles and recommendations
Part 2.1:2008 Specific applications – Circulation spaces and other general areas
Part 2.2:2008 Specific applications – Office and screen-based tasks
Part 2.3:2008 Specific applications – Educational and training facilities
Part 2.4:2017 Industrial tasks and processes
AS/NZS 1680:---- Interior lighting
Part 2.5:1997 Hospital and medical tasks

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LATEST REVISIONS

The users of this Standard should ensure that their copies of the above-mentioned New Zealand Standards are the latest revisions. Amendments to referenced New Zealand and Joint Australian/New Zealand Standards can be found on www.standards.govt.nz.

REVIEW OF STANDARDS

Suggestions for the improvement of this Standard are welcome. They should be sent to the Manager, Standards New Zealand, PO Box 1473, Wellington 6140.

FOREWORD

This lighting Standard is a companion to NZS 4243.1:2007 *Energy efficiency – Large buildings: Part 1 – Building thermal envelope*.

Over the last decade there have been major changes in lighting equipment, with the emergence of solid state lighting (SSL) LED light sources and luminaires as the predominant technology.

The scope of this amendment includes changes and improvements to:

- (a) Accommodate SSL LED technology;
- (b) Revise and tighten lighting power density limits;
- (c) Provide a more detailed range of spatial functions;
- (d) Remove the redundant calculation method;
- (e) Update terms and definitions;
- (f) Simplify application.

As a result of technological advancements the power requirements of lighting schemes have significantly reduced in recent times and thus the limits in this Standard are lower, resulting in lighting schemes, and buildings, with significantly improved energy efficiency. Lighting design is covered by the AS/NZS 1680 series. This recommends a maintained illuminance value for each type of installation, being the minimum average illuminance that can be tolerated. Using maintained illuminance levels ensures adequate illuminance even at the end of the effective life of the light source. NZS 4243.2 addresses requirements for the efficiency of artificial lighting that is used when daylight is not available or is insufficient. While the use of daylight is recognised as being the most efficient form of lighting, and is strongly encouraged, its provision is not covered by this part Standard. Guidance on the use of daylight is included in AS/NZS 1680.1, while reference should be made to building regulations for any statutory requirements for daylight within buildings.

It should be noted that this Standard provides guidance on lighting power density limits (LPDL) (W/m^2). This is not the same as energy use. Energy use (Wh or kWh) is determined when the lighting power load of a space is multiplied by the time span of operation (h).

The use of lighting control systems is an effective way of adjusting both lighting power load and time span of operation to reduce overlighting and consequently to reduce energy use. The application of modern control systems is beyond the scope of this Standard, but the effective use of control systems is encouraged.

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NEW ZEALAND STANDARD

ENERGY EFFICIENCY – LARGE BUILDINGS

PART 2: LIGHTING

1 GENERAL

1.1 SCOPE

1.1.1

This Standard specifies performance requirements for artificial lighting in large buildings to achieve an adequate level of energy efficiency.

This Standard applies to large buildings that have artificial lighting. The lighting power density limits may be applied to any large building.

NOTE – Regulation may make compliance with this Standard mandatory for certain classes of large building.

1.1.2

This Standard provides a method of demonstrating compliance. This power density limits method applies a limit to the power density of the fixed lighting for each area of a building depending on the spatial function of that area.

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1.2 DEFINITIONS

For the purposes of this Standard the following definitions shall apply:

ANCILLARY GEAR. Technology used to control lighting electrical loads over and above lighting switches, such as daylight switches, movement detectors, control electronics for switching relays and any equipment associated with monitoring the status of the complete lighting system.

CIRCULATION AREA. The area for pedestrian circulation including corridors, stairs, lobbies and foyers.

CLINICAL AREA. An area in which patients may be under diagnosis or an area in which patients may be in recovery immediately following surgery.

DAYLIT SPACE. The area from an outside window in a wall with at least 40 % glazing between floor and the top of the window to a depth equal to the height from the floor to the top of the window; alternatively an area with at least 10 % of rooflights.

DISPLAY LIGHTING. Lighting intended to highlight displays of merchandise or exhibits and that is distinct from the area or background lighting.

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FLOOR AREA. The area of floor within the spatial function.

ILLUMINANCE. The luminous flux arriving at a surface divided by the area of the illuminated surface. Unit: lux (lx). Symbol: E .

NOTE – $1 \text{ lx} = 1 \text{ lm/m}^2$.

ILLUMINANCE, MAINTAINED. The defined level below which the average illuminance of a specified surface shall not fall. It is the minimum illuminance at which maintenance operations, such as replacing light sources and cleaning the luminaires, windows, roof lights and room surfaces, are to be carried out.

LARGE BUILDING. Any building of floor area exceeding 300 m^2 but excluding housing.

LIGHTING POWER DENSITY LIMIT (LPDL). The limit that the lighting circuit load shall not exceed. It is set in terms of watts per square metre of lit area and based on recommended maintained illuminances and other factors.

LIT AREA. The floor area of a building within the spatial function, including partitions but excluding lift wells and service shafts.

LOCAL MANUAL SWITCHING. A switch or other manually-operated device that is located near the exit from a single-occupancy workspace and which controls the lighting that serves only that workspace and that makes insignificant contribution to the illumination of any other workspace.

MULTIPLE or ALTERNATIVE USES. A building space or area that can be used for more than one function or purpose.

NATURAL LIGHT AVAILABLE. An area where daylight is available from an outside window or roof light, or some other means.

PREDOMINANT USE. The primary activity that mainly occurs within the designated building floor area.

SPATIAL FUNCTION. The function or purpose of a building space or area.

1.3 INTERPRETATION

- 1.3.1** For the purposes of this Standard, the word 'shall' refers to requirements that are essential for compliance with the Standard, while the word 'should' refers to practices that are advised or recommended.
- 1.3.2** The term 'Informative' has been used in this Standard to define the application of the Appendix to which it applies. An 'Informative' Appendix gives additional information, and is only for guidance. It does not contain requirements.

2 COMPLIANCE REQUIREMENTS

All large buildings shall meet the lighting requirements to comply with this Standard. The lighting power density shall be obtained by dividing the total electrical load by the lit area under consideration. To achieve an adequate level of energy efficiency, the lighting power density for each spatial function in a building shall not exceed the limit determined using the method in 3.3.

Compliance with this Standard is based on lighting design in accordance with the AS/NZS 1680 series. The lighting electrical load, for the purposes of this Standard, shall be the total power required to operate the lighting circuits, including light source wattage, control gear losses and losses from other ancillary gear. For areas or spaces that may have multiple or alternative uses the predominant use shall be selected for the spatial function.

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3 COMPLIANCE METHODS

3.1 GENERAL

3.1.1 Compliance shall be demonstrated by using the power density limits method. Appendix A provides examples of the determination of lighting power density limits.

3.1.2 The lighting power density limit requirements apply to general and area lighting. They do not apply to:

- (a) Security lighting;
- (b) Emergency lighting (unless it also forms part of the general lighting);
- (c) Display lighting that is supplied from sub-circuits separate from those for other lighting and that is controlled separately from other lighting;
- (d) Exterior lighting, except for porticos;
- (e) Lighting for sports events or stage shows;
- (f) Special purpose lighting requiring illuminance on the task of 500 lux or more;
- (g) Lighting in lifts;
- (h) Places of detention;
- (i) Hospital clinical areas;
- (j) Backlit surfaces or luminous surface areas designed to be decorative, lit features. However, backlit surfaces that contribute to the general lighting shall fall within specific spatial functions of LPDL.

3.1.3 In the case of a task lighting installation, task lighting that is controlled at each individual workstation is excluded. However, the lighting power density limit for the area shall be based on the background illuminance recommended for the task lighting installation.

NOTE – AS/NZS 1680.1:2006 section 3.4 cautions that a task lighting installation does not necessarily achieve the necessary or desired visual appearance or comfort of a space.

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3.2 LIGHTING CONTROLS

- 3.2.1** Lighting shall be provided with controls to enable operation when and where required. This may be achieved using an automatic control system, or by manual switches for each partitioned space.
- 3.2.2** Local manual switching (when required) should be located in the proximity of the controlled area. The area controlled by local manual switching shall be selected having regard to the spatial function of the area, its likely pattern of partial occupancy, and the type of luminaire/s.

3.3 POWER DENSITY LIMITS METHOD

- 3.3.1** All spatial functions in the building shall be considered. Lighting power density limits for general spatial functions are provided in table 1. Table 2 describes the spatial functions found in various building types. Where the specific spatial function is not identified in table 1 or table 2, the unspecified spatial function limit shall be used.
- 3.3.2** Generally, circulation spaces may be included as part of the lit area of the main spatial function in their vicinity unless the designer has reason to consider them individually.

Table 1 – General spatial functions lighting power density limits

Category	General spatial function	LPDL (W/m ²)
1a	Commercial laundry	9
1b	Circulation area	7
1c	Data/IT server/security room	7
1d	Entrance/portico	13
1e	Goods loading bay	6
1f	Kitchen/kitchenette/common room	10
1g	Lounges/breakout room	11
1h	Main reception/lift lobby/concierge	10
1i	Plant room/boiler room	10
1j	Private car parking (indoor)	2
1k	Public car parking (indoor)	3
1l	Public rest room/staff toilet/shower facilities	7
1m	Storeroom	5

Table 2 – Building type lighting power density limits

Category	Building type	Spatial function	LPDL (W/m ²)
2	Café/restaurant/fast food outlet	Unspecified spatial function	9
2a		Commercial kitchen/food prep	10
2b		Self-serve food counter	9
2c		Seated/dining area	10
3	Assembly service	Unspecified spatial function	8
3a		Seated area – town hall/church/ events centre/whare rūnanga	10
3b		Ticketing hall	8
3c		Train concourse/platform	7
3d		Arrival/departure halls ≤ 5 m height	9
3e		Arrival/departure halls ≥ 5 m height	11
3f		Exhibition hall/gallery	8
3g		Museum	9
3h		Movie theatre	9
3i		Indoor swimming pool	9
4	Educational	Unspecified spatial function	9
4a		Classroom/science/technology	10
4b		Lecture theatre	11
4c		Gymnasium/fitness centre/auditorium	10
5	Emergency	Unspecified spatial function	9
5a		First response/emergency vehicle bay	9
6	General office	Unspecified spatial function	7
6a		Individual office ^a /meeting room (no natural light available)	9
6b		Individual office ^a /meeting room (natural light available)	7
6c		Open office (no natural light available)	9
6d		Open office (natural light available)	9
7	Healthcare	Unspecified spatial function	10
7a		Aged-care facility ^b	18
7b		Examination room	10
7c		Patient ward	5
7d		Ward lounge/whānau room	8
7e		Ward admin/office	10

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Table 2 – Building type lighting power density limits (continued)

Category	Building type	Spatial function	LPDL (W/m ²)
8	Hotel/motel/hostel	Unspecified spatial function	10
8a		Bar/lounge/casino area	10
8b		Banquet room/conference room/ function room/ballroom	10
8c		Hotel rooms/suites	6
9	Judicial/correctional	Unspecified spatial function	9
9a		Courtroom	14
10	Laboratory	Unspecified spatial function	11
11	Library	Unspecified spatial function	12
12	Retail bank/post office	Unspecified spatial function	10
13	Retail shopping/mega centre	Unspecified spatial function	13
13a		Pharmacy/convenience/general store	14
13b		Food court	10
13c		Supermarket	13
13d		Mega/furniture store	14
13e		Hardware/DIY store	13
14	Warehousing	Unspecified spatial function	8
14a		General storage	8
14b		Logistics/sorting	8
14c		Cold storage	8
15	Workshop	Unspecified spatial function	10
15a		Rough task (such as heavy equipment)	6
15b		Medium task (such as bench tasks)	9
15c		Fine task (such as inspection tasks)	12
a	Individual offices means an office of one-person occupancy.		
b	Aged-care facility refers to facilities whose primary function is senior long-term care, adult day care, senior support, or people with special visual needs (applies within the spatial function areas of these building types). For interior general spatial functions where the visually impaired circulate multiply the LPDL by a factor of 1.5.		

APPENDIX A

WORKED EXAMPLE – LIGHTING

(Informative)

A1 GENERAL

The following information provides details that can be followed as a worked example of a building lighting power density limit.

A2 EXAMPLE A

Consider the floor of an office building that uses a combination of artificial and natural light. The floor area is 650 m² (not counting the lift well and service ducts), and contains individual offices and meeting rooms (150 m²) and open-plan offices (380 m²). Staff toilets (50 m²) and circulation areas (70 m²) make up the rest of the floor area. The circulation areas are adjacent to the open-plan offices.

From tables 1 and 2, the relevant lighting power density limits are shown in table A1.

Table A1 – Example A

Spatial function	Area (m ²)	Category	LPDL (W/m ²)
General office, individual office/ meeting room (natural light available)	150	6b	7
General office, open office (natural light available) (includes circulation area (see 3.3.2))	380 + 70 = 450	6d	9
Staff toilet	50	1l	7

A3 EXAMPLE B

A building has shops on the ground floor, two floors of public car parking, four floors of naturally lit open-plan office accommodation, and one floor of classrooms for a language school.

Each floor has an area of 600 m², excluding the lift well and service ducts but including staff toilets of 50 m² per floor.

From tables 1 and 2, the relevant lighting power density limits are shown in table A2.

Table A2 – Example B

Spatial function	Area (m ²)	Category	LPDL (W/m ²)
Retail shopping, unspecified spatial function	$600 - 50 = 550$	13	13
Public car parking (indoor)	$2 \times (600 - 50) = 1,100$	1k	3
General office, open office (natural light available)	$4 \times (600 - 50) = 2,200$	6d	9
Educational, classroom	$600 - 50 = 550$	4a	10
Staff toilet	$8 \times 50 = 400$	1l	7

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