

Australian/New Zealand Standard™

Interior and workplace lighting

Part 2.4: Industrial tasks and processes



AS/NZS 1680.2.4:2017

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Interior and workplace lighting

Part 2.4: Industrial tasks and processes

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PREFACE

This Standard was prepared by the Joint Standards Australia/Standards New Zealand Committee LG-001, Interior and Workplace Lighting, to supersede AS/NZS 1680.2.4:1997.

The objective of this Standard is to set out recommendations aimed at the provision of a visual environment conducive to the safe and efficient performance of tasks associated with industrial activities and processes.

This Standard is intended to be read in conjunction with the general recommendations of AS 1680.1, *Interior and workplace lighting, Part 1: General principles and recommendations*, and with other specific recommendations in the AS/NZS 1680.2 series which may apply, depending on the function of the interior space or the specific visual tasks involved.

This Standard parallels the structure of AS 1680.1 and contains recommendations that either add to or vary the recommendations of that Standard. While the sections of this Standard correspond with those of AS 1680.1, the clauses within each section are numbered consecutively and do not directly relate to the clauses in AS 1680.1.

Changes from the previous edition are as follows:

- (a) 'Maintenance illuminance' has been changed to 'maintained illuminance' to conform with AS/NZS 1680.1.
- (b) Diagrams of old industrial processes have been replaced with descriptions of tasks.
- (c) Table E1 has been restructured to place the emphasis on task difficulty rather than try to capture all work tasks in every industry. This will allow adaption to changes in work practices and the increasing automation of industry.

The terms 'normative' and 'informative' have been used in this Standard to define the application of the appendix to which they apply. A 'normative' appendix is an integral part of a Standard, whereas an 'informative' appendix is only for information and guidance.

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STANDARDS AUSTRALIA/STANDARDS NEW ZEALAND

Australian/New Zealand Standard **Interior and workplace lighting**

Part 2.4: Industrial tasks and processes

SECTION 1 SCOPE AND GENERAL

1.1 SCOPE

This Standard sets out recommendations for the lighting of industrial tasks and processes that are carried out within buildings. For some tasks or processes, regulations may apply controlling the type of lighting equipment that should be used (e.g. in hazardous areas), or requiring the provision of a supplementary lighting system (e.g. safety lighting). These regulations need to be observed.

This Standard does not cover outdoor tasks.

NOTE: See AS/NZS 1680.5 for outdoor workplace lighting.

1.2 APPLICATION

This Standard should be read in conjunction with the general recommendations of AS/NZS 1680.1 and with any applicable specific recommendations in the AS/NZS 1680.2 series.

This Standard, in general, contains material that adds to or varies the recommendations of AS/NZS 1680.1. The use of this Standard without reference to AS/NZS 1680.1 is a misapplication of the Standard.

If any recommendation in this Standard differs from the general recommendations of AS/NZS 1680.1, the recommendation in this Standard should prevail.

Attention should be paid to Section 1 of AS/NZS 1680.1, which provides information that may be needed to correctly apply this Standard.

1.3 REFERENCED DOCUMENTS

The documents referred to in this Standard are listed in Appendix A.

1.4 DEFINITIONS

For the purposes of this Standard, the definitions given in AS 1680.1 and those below apply.

1.4.1 Safety lighting

A form of lighting, energized from an alternative power source, which is intended to ensure that operating personnel can move to a place of safety, or control or shut down the process in a safe manner, in the event of failure of the electrical supply to the normal lighting.

1.4.2 Standby lighting

A form of lighting, energized from an alternative power source, which in the event of failure of the electrical supply to the normal lighting, is intended to facilitate the continued performance of particular tasks or processes.

SECTION 2 GENERAL REQUIREMENTS FOR GOOD INTERIOR LIGHTING

This Section of AS/NZS 1680.1 applies.

SECTION 3 TASK VISIBILITY

3.1 GENERAL

This Section of AS/NZS 1680.1 applies, except as follows.

3.2 FACTORS THAT INFLUENCE TASK VISIBILITY

3.2.1 General

For many tasks, visibility depends on special factors such as the character or direction of the light, the use of special aids, or the avoidance of unnecessary distraction. Guidelines for the achievement of satisfactory visual conditions are given in Clauses 3.2.2 to 3.2.7 based on the particular type of treatment required.

The guidelines given are, of necessity, only of a general nature. It is therefore recommended that competent advice be sought on the type of treatment best suited to the characteristics of the particular tasks involved.

The lighting designer should clearly identify the visual elements of the actual task or process so that a lighting system of appropriate type is provided.

3.2.2 Provision of contrasting backgrounds

When the task has to be seen in outline only, the surface against which it is seen should contrast strongly with the task. For example, if the task is light in colour the background should be dark, and vice versa.

Contrast in tone is more effective for this purpose than contrast in hue, especially if the task is small in size. In most cases, a matt surface of suitable reflectance will give sufficient contrast; if not, a luminous background of the kind referred to in Clause 3.2.3 may be required.

Colour as part of the visual task can be effectively used to improve contrast. Likewise the colour of the light, modified if necessary by filters, can be used to increase the contrast.

3.2.3 Provision of luminous backgrounds

When the task is transparent or translucent, or when a particularly contrasting background is needed to show up the outlines of an object which does not transmit light, a luminous background will help to ensure maximum visibility.

A solid, non-transmitting surface, painted white and lit by concealed lamps, is suitable for transparent materials such as thin textiles and glassware.

Viewing of an object in silhouette can provide an effective means for the checking of contour or shape against a standard template. Illumination behind the template will show light where there is a difference between the contour of the standard and the object to be checked.

3.2.4 Use of magnifying devices

When task detail is just too small to be seen comfortably with the naked eye, a small degree of magnification will markedly improve visibility. However, to minimize visual fatigue, particularly where the task is performed for long periods, any optical device should permit the work to be viewed binocularly, without strain.

A small increase in the apparent size of the task detail can be much more effective than a large increase in the illuminance. Magnifiers may take the form of a binocular loupe worn by the operator, a fixed, bench-mounted single lens of adequate size to permit binocular vision, or screen-based equipment which optically or electronically displays a magnified image. Fixed magnifiers are not recommended for viewing rapidly moving tasks.

3.2.5 Elimination of distractions from surroundings

Sources of distraction should preferably be excluded from the task surroundings (i.e. from within 45 degrees of the line of sight). This is particularly important where the task requires close concentration for long periods.

NOTE: For a definition of 'task surroundings', see AS/NZS 1680.1.

Anything which moves irregularly or unexpectedly can be a source of distraction; the following are examples:

- (a) Machinery which starts and stops.
- (b) People passing to and from within the task area, or even the movement of their shadows.
- (c) Hand movements of people sitting opposite workers engaged in critical assembly tasks.
- (d) Flashing or flickering light sources.
- (e) The flashes of arc welding equipment reflected from the walls or roof.
- (f) The blades of a suspended ceiling fan rotating below or near a luminaire.

Some of these sources of distraction can be eliminated by the use of suitably positioned screens. Screens provided for the purpose of eliminating or controlling sources of distraction should not interfere with or reduce the effectiveness of guards provided for the safety of operators.

Provision of a plain background is particularly important when the task is small and held close to the eyes, well away from the surface behind it. Under these circumstances, the immediate surroundings (i.e. within 15 degrees of the line of sight), should be free of conspicuous detail. Distracting detail within the prescribed area can greatly increase the risk of eye fatigue.

A stroboscopic effect can be produced by the oscillation of light output from some types of lamps operating on alternating current supply. This effect is an illusion which makes a moving object appear to be either stationary or moving in a different manner from its actual movement, and can be dangerous where people are working near moving machinery. See Clause 9.2(g) for further information.

3.2.6 Production of helpful reflections for inspection of shiny surfaces

When task visibility depends on the creation of suitable reflections in the shiny surface of the work, the source producing such reflections should be reasonably uniform in brightness and of sufficient size, and so placed that its reflection fills the whole work surface when the latter is viewed from the normal working position.

Typical tasks benefiting from treatment of this kind include inspection of newly plated parts, and bright metal work generally. The method also applies to dark shiny surfaces, such as black leather or plastics.

In practice, a well-lit and light-coloured ceiling or wall surface, as recommended in Section 6 of AS/NZS 1680.1, will generally create the right kind of reflections; on the other hand, luminaires suspended from a dark ceiling tend to produce annoying glitter on the work. In some cases, it may be necessary to provide a special light source large enough to produce the required reflection conditions. Here, it is the angle subtended by the source that matters, rather than the source size. Hence a small, low-mounted (and suitably lit) canopy gives the same effect as the larger ceiling surface.

3.2.7 Revealing form, surface texture or irregularities

When it is necessary to reveal surface texture, or show up small irregularities in supposedly flat surfaces, the light should have a strong directional component skimming the surface under examination.

The luminaires should be capable of providing very high illuminances over the surface that is to be inspected. When the detail is minute and hard to see, all light should reach the work from the preferred direction.

Similarly, visibility of the form and texture of three-dimensional objects can be enhanced by careful attention to the directional components of the light reaching the object; i.e. by providing suitable highlights and shadows.

3.2.8 Inspection of moving parts

It is sometimes necessary to inspect and study moving parts while they are operating. This can be done with stroboscopic lighting which can be adjusted to 'stop' or 'slow up' the motion of constant speed, rotating and reciprocating machinery. Stroboscopic lamps give flashes of light at controllable intervals (frequencies). Their flashing can be so timed that, when the flash occurs, an object with a rotating or reciprocating motion is always in exactly the same position and appears to stand still.

NOTE: An appropriate sign may need to be provided to give warning of any hazards arising from the application of stroboscopic lighting.

Where a stroboscopic lighting system is employed, appropriate shielding should be provided to ensure that the flashing light source, or reflections of it, are not a source of distraction for other workers (see Clause 3.2.5).

3.2.9 Use of special light sources

Fluorescence under ultraviolet radiation is often useful in creating contrast. Surface flaws in metal and nonporous plastic and ceramic parts can be detected by the use of fluorescent materials. Precautions should be taken to prevent harm from UV radiation.

NOTE: An appropriate sign may need to be provided to give warning of any hazards arising from the application of the UV source.

The detection of internal stresses in glass and some other transparent materials may be facilitated by observing the effect of polarized light transmitted through the object under examination. The non-uniform spectral transmittance of areas under stress causes the formation of colour fringes that are visible to an inspector. With transparent models of structures and machine parts, it is possible to analyse stresses under operating conditions.

3.3 AUTOMATED PLANT OR PROCESSES

In areas that contain automated plant or processes, the illuminances required will depend on the frequency of human intervention and the nature of the specific visual tasks involved at those times, e.g. for setting up, monitoring or adjustment, or servicing or maintenance.

3.4 INDUSTRIAL TASKS AND PROCESSES

Appendix E provides recommendations for the lighting of specific industrial tasks and processes. The table is not exhaustive and the difficulty of visual tasks may change with different processes and working methods. The designer should use the table to find tasks of similar difficulty to determine the appropriate lighting requirements.

SECTION 4 DIRECTIONAL EFFECTS OF LIGHTING

4.1 GENERAL

This Section of AS/NZS 1680.1 applies, except as follows.

4.2 ADVERSE EFFECTS OF REFLECTIONS

Reflections of bright sources (e.g. luminaires, windows) appearing within the task or its immediate surrounds can—

- (a) mask visibility of essential detail; and
- (b) cause visual discomfort or distraction.

This applies particularly where the surfaces of the task or its surrounds are of a highly reflecting (i.e. glossy) nature.

4.3 REFLECTIONS IN SCREEN-BASED EQUIPMENT

Applications which involve desk-based visual display units are fully dealt with in AS/NZS 1680.2.2 and the recommendations of that Standard should be applied as far as circumstances permit. However, the variety of screen types and viewing conditions in industrial environments make it necessary to separately evaluate each application.

SECTION 5 UNWANTED REFLECTIONS

This Section of AS/NZS 1680.1 applies.

S E C T I O N 6 S U R F A C E S

6.1 GENERAL

This Section of AS/NZS 1680.1 applies, except as follows.

6.2 LIMITED ILLUMINANCE CONTRIBUTION FROM INTER-REFLECTION

For industrial applications that comprise large open spaces, reflections from interior surfaces will contribute little to the illuminance provided on the working plane. Consideration should therefore be given to designing the lighting system solely on the basis of the direct illuminance.

A similar circumstance exists in spaces (large or small) that are heavily obstructed, e.g. by machines, ductwork or racking systems, even if such obstructions are finished in a relatively light colour.

S E C T I O N 7 L I G H T S O U R C E C O L O U R

This Section of AS/NZS 1680.1 applies.