

Australian Standard[®]

Computer accommodation

This Australian Standard was prepared by Committee IT/2, Computer Installations. It was approved on behalf of the Council of Standards Australia on 9 May 1995 and published on 5 August 1995.

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Air-conditioning and Refrigeration Equipment Manufacturers Association of Australia
Australian Bankers Association
Australian Construction Services
Australian Fire Authorities Council
Australian Information Industry Association
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This Standard was issued in draft form for comment as DR 93223.

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Computer accommodation

PUBLISHED BY STANDARDS AUSTRALIA
(STANDARDS ASSOCIATION OF AUSTRALIA)
1 THE CRESCENT, HOMEBUSH, NSW 2140

PREFACE

This Standard was prepared by the Standards Australia Committee IT/2 on Computer Installations to supersede AS 2834—1985.

This Standard is based on the requirements of computer technology at the time of preparation. However, it is recognized that this technology is rapidly changing and the requirements in this Standard may be subject to further development.

The objective of this Standard is to provide a guide to requirements for the accommodation of computer equipment. The wide diversity of equipment configurations possible and the way in which these alter to meet changing technology or system demands make it very difficult to create a simple Standard which is universally applicable. This Standard contains many recommendations which should be understood fully by both user and supplier so that early agreement can be reached on requirements for the specific installation being considered.

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Originated as AS 2834—1985.
Second edition 1995.

STANDARDS AUSTRALIA

Australian Standard

Computer accommodation

SECTION 1 SCOPE AND APPLICATION

1.1 SCOPE This Standard sets out the requirements and recommendations for the accommodation of computers in buildings. It is not intended for application to—

- (a) personal or home computers;
- (b) remote computer terminals;
- (c) equipment of similar construction (unless so specified by the supplier); or
- (d) equipment located on factory floors, in public access areas, in the open air or in similar uncontrolled environments.

1.2 APPLICATION It is intended that this Standard be used as a basis for planning a computer installation. Where recommendations given are not adopted in a design or construction, documented reasons should be included in a project file.

This Standard may be applied to existing installations at the time of renovation or extension.

NOTE: Appendix A gives guidance on facility design.

1.3 REFERENCED AND RELATED DOCUMENTS

1.3.1 Referenced documents The following documents are referred to in this Standard:

AS

1020	The control of undesirable static electricity
1132	Methods of test for air filters for use in air conditioning and general ventilation
1132.5	Part 5: Determination of arrestance efficiency, average arrestance efficiency, dust-holding capacity, and dust-holding capacity per unit of effective face area for test dusts Nos 1, 2 and 3
1170	Minimum design loads on structures (known as the SAA Loading Code)
1170.1	Part 1: Dead and live loads and load combinations
1307	Surge arrestors (diverters)
1324	Air filters for use in air conditioning and general ventilation
1428	Design for access and mobility
1530	Methods for fire tests on building materials, components and structures
1530.4	Part 4: Fire-resistance test of elements of building construction
1668	The use of mechanical ventilation and airconditioning in buildings
1668.2	Part 2: Mechanical ventilation for acceptable indoor-air quality
1670	Automatic fire detection and alarm systems—System design, installation and commissioning

AS

- 1680 Interior lighting
- 1680.1 General principles and recommendations
- 1680.2.2 Part 2.2: Office and screen-based tasks
- 1680.2.3 Part 2.3: Educational and training facilities
- 1735 Lifts, escalators, and moving walks (Known as the SAA Lift Code)
- 1735.11 Part 11: Fire-rated landing doors
- 1768 Lightning protection
- 1850 Portable fire extinguishers—Classification, rating and performance testing
- 1851 Maintenance of fire protection equipment
- 1905 Components for the protection of openings in fire-resistant walls
- 1905.1 Part 1: Fire-resistant doorsets
- 2107 Acoustics—Recommended design sound levels and reverberation times for building interiors
- 2118 Automatic fire sprinkler systems (Known as the SAA Code for Automatic Fire Sprinkler Systems)
- 2201 Intruder alarm systems
- 2293 Emergency evacuation lighting in buildings
- 2293.1 Part 1: Design and installation
- 2444 Portable fire extinguishers—Selection and location
- 2926 Standard voltages—Alternating (50 Hz) and direct
- 3000 Electrical installations—Buildings, structures and premises (known as the SAA Wiring Rules)
- 3080 Telecommunications installations—Integrated communications cabling systems for commercial premises
- 3590 Screen-based workstations
- 3590.2 Workstation furniture
- 4154 General access floors (elevated floors)
- 4155 Test methods for general access floors
- 4155.6 Method 6: Test for floor resistance for electrostatic control
- 4214 Gaseous fire extinguishing systems

AS/NZS

- 1044 Limits and methods of measurement of radio interference characteristics of household electrical appliances, portable tools and similar electrical apparatus
- 1052 CISPR specification for radio interference measuring apparatus and measurement methods

ASTM

- 2240-86 Test Method for Rubber Property—Durometer Hardness

AIRAH Design Data Book

Building Code of Australia

1.3.2 Related documents Attention is drawn to the following related documents:

AS

- 1188 Radio transmitters and similar equipment—Safe practices

AS

- 1603 Automatic fire detection and alarm systems
- 1603.1 Part 1: Heat detectors
- 1603.2 Part 2: Point type smoke detectors
- 1603.4 Part 4: Control and indicating equipment
- 2107 Acoustics—Recommended design sound levels and reverberation times for building interiors
- 2743 Stabilized power supplies—a.c. output
- 2785 Suspended ceilings—Design and installation

1.4 DEFINITIONS For the purpose of this Standard, the definitions below apply.

1.4.1 Airconditioning

1.4.1.1 *Air plenum*—enclosed volume of supply air under higher than ambient pressure used in some airconditioning systems to provide forced ventilation.

1.4.1.2 *Ambient air temperature*—temperature of the air in or around a building.

1.4.1.3 *Commercial grade airconditioning*—term applied to an air conditioning plant that is designed for specific applications, usually the conditioning of office and commercial premises.

1.4.1.4 *Computer room airconditioning*—term applied to commercial grade airconditioning specifically designed for use in computer areas.

1.4.1.5 *Dehumidification*—process of removing moisture from the air.

1.4.1.6 *Environment type*—classification of a computer room or computer area according to the total sensible heat load of its contents and the environmental requirement of the most critical device therein.

1.4.1.7 *Humidification*—process of adding moisture to the air.

1.4.1.8 *Latent heat*—heat that does not affect the temperature of a substance but changes the state when added to or removed from it.

1.4.1.9 *Relative humidity (RH)*—ratio of the actual water vapour pressure of the air to the saturated water vapour pressure of the air at the same temperature.

1.4.1.10 *Sensible heat*—heat that changes the temperature of a substance when added to or removed from it.

1.4.1.11 *Sensible heat factor*—ratio of sensible heat to total heat.

1.4.1.12 *Supply air*—air introduced into an enclosure by mechanical means.

1.4.1.13 *Total heat*—summation of sensible and latent heat.

1.4.1.14 *Vapour barrier*—barrier which is impervious to the transmission of moisture.

1.4.2 Building elements

1.4.2.1 *Acoustically treated wall*—wall which has been treated with materials to enhance the sound absorption or sound isolation of the wall, or both.

1.4.2.2 *Acoustic ceiling*—ceiling which has enhanced sound absorption or sound isolation, or both.

1.4.2.3 *Computer area*—space within a building which houses a computer system, associated media storage and support services and includes, where provided, the computer room.

NOTE: The term ‘computer area’ is assumed to refer to one continuous area, sections of which may or may not be independently sealed for the purposes of fire protection or the environment, or both.

1.4.2.4 Computer room—room whose sole function is to house a computer system and provide the required operating and non-operating environment.

1.4.2.5 Concentrated live load—load concentration presented by each foot or wheel of each unit.

1.4.2.6 Elevated floor (also known as access floor, false floor or raised floor)—type of flooring that creates a void or space above the structural floor, to be used to route and protect cables or create a plenum for air distribution, or both. (See Figure 1.1).

1.4.2.7 Finished ceiling height—height from finished floor height to the underside of the finished ceiling.

1.4.2.8 Finished floor height—height from the top of the structural floor to the top of the floor on which equipment will be installed.

1.4.2.9 Fire door—doorset, single or multileaf which, except when varied as permitted by AS 1735.11 or AS 1905.1, is identical in assembly, construction and installation with a prototype that has established its fire-resistance when submitted to a fire test as set out in AS 1530.4.

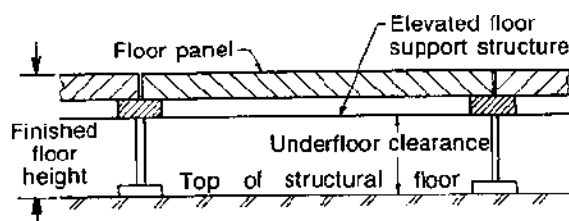
1.4.2.10 Fire-resistant wall—wall, either loadbearing or non-loadbearing, capable of satisfying for stated periods the criteria of fire resistance with respect to stability, integrity and thermal insulation.

1.4.2.11 Luminaire—light fitting which distributes, filters or transforms the light given by a lamp or lamps.

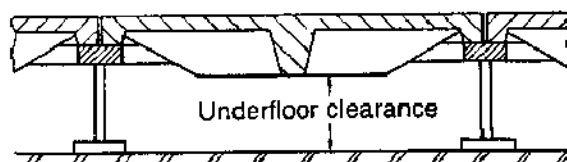
1.4.2.12 Solid floor—normal structural floor onto which elevated floors can be installed or the computer system itself may be positioned.

1.4.2.13 Stringers—structural cross-members of an elevated floor that form a grid and give rigidity and strength to the floor's construction.

1.4.2.14 Structural floor—loadbearing building element providing the lower horizontal surface of a building space.



(a) Underfloor clearance where support structure is lowest element



(b) Underfloor clearance where part of floor panel protrudes below support structure

FIGURE 1.1 FLOOR HEIGHT AND UNDERFLOOR CLEARANCE

1.4.2.15 *Suspended ceiling*—ceiling forming a void which may accommodate services such as electrical and data cables, fire services, airconditioning services, plumbing, or form a plenum for air delivery or return.

1.4.2.16 *Underfloor clearance*—distance between the top surface of the structural floor and the underside of the support structure or panels of the elevated floor.

1.4.3 Electrical

1.4.3.1 *Bulk resistance*—resistance of a material measured between a specified electrode placed on the surface of the sample and the safety earth of the building.

1.4.3.2 *Decibel*—scale unit used in the comparison of voltages or currents. The number of decibels is 20 times the logarithm to the base 10 of the ratio of the voltages or currents.

NOTE: Electrical noise attenuation by any device is given as the ratio of the input to output noise voltages expressed in decibels.

1.4.3.3 *Dedicated line*—separate set of power conductors, plus a dedicated safety earth, routed directly from the building's main switchboard, major distribution panel or computer line conditioner to the computer system distribution panel or to the computer equipment itself. Only computer equipment may be connected to it.

1.4.3.4 *Dedicated safety earth*—separate safety earth system which ideally has a single connection to the safety earth, and which features insulated conductors presenting a low impedance to earth for high frequency noise. It is normally used to earth only computer equipment.

1.4.3.5 *Earth loop*—condition where two or more components in a computer system have earth points connected together by two or more conductor paths.

NOTE: Cyclic noise currents may be generated in the loops so formed.

1.4.3.6 *Harmonic voltage distortion (U_n)*—r.m.s. value of a harmonic voltage, of order n , expressed as a percentage of the r.m.s. value of the fundamental.

1.4.3.7 *Safety earth*—electrical installation earthing system to which are connected parts that are earthed in accordance with AS 3000.

1.4.3.8 *Surface resistance*—resistance of a sample measured between two specified electrodes placed a nominated distance apart on the surface of the sample.

1.4.3.9 *Total harmonic voltage distortion (U_r)*—calculated from the expression—

$$U_r = \sqrt{\sum_{n=2}^{n=\infty} U_n^2} \text{ and expressed as a percentage of the fundamental.}$$

NOTE: Generally, it is sufficient to use values of n up to 25.

1.4.4 Fire protection

1.4.4.1 *Fire detector*—device which gives a signal in response to a predetermined change in one or more ambient conditions in the vicinity or within the range of the detector, due to a fire.

1.4.4.2 *Gas flooding system*—gas fire extinguishing system that has a total blanketing effect within a confined area.

1.4.4.3 *Manual override*—an option available to prevent gas flooding systems from operating unnecessarily.

1.4.5 Organizations

1.4.5.1 *Equipment supplier*—the organization that supplies units of computer equipment.

1.4.5.2 *User*—the organization that uses the computer system.

1.4.6 Vibration—regular or impulse-type mechanical movement transmitted to the computer equipment from the external environment. It may be of varying amplitudes and frequencies.

1.5 CLASSIFICATION OF ENVIRONMENT TYPES Computer equipment shall be classified by the suppliers in accordance with the environment type in which the units are designed to operate. Information on airconditioning requirements for these environment types is given in Clause 2.7. The environment types are as follows:

- (a) *Environment Type 1* Computer room in which tight control is maintained over temperature, humidity and air quality. It has an airconditioning system, usually with standby capacity. Access to the computer room is limited to essential personnel, and eating, drinking and smoking are prohibited. Limited access provides a measure of security, but also keeps the ingress of unfiltered, unconditioned air and contaminants to a minimum. An elevated floor is recommended and, in some cases, the supplier may require it.
- (b) *Environment Type 2* Computer room in which either all or the most critical parts of a computer system are installed. It has an airconditioning system to ensure proper and efficient cooling and filtration, although the requirements are not as strict as for Environment Type 1. An elevated floor may be installed, but is usually not warranted. The room may have limited accommodation for operations staff, and the equipment may operate unattended.
- (c) *Environment Type 3* Typically, an airconditioned office that can handle small amounts of computer equipment provided that the total heat load does not exceed the capability of the office airconditioning to maintain the optimum conditions. Air filtration is generally less efficient and there is the risk of contamination from food, drink and smoke.

NOTES:

- 1 In practice, there are large variations in office conditions, e.g. small room with a door or a large open-plan area. Some parts of the office may have adequate air flow for heat removal, whereas other parts may become 'hot-spots' owing to the build-up of heat generated by the equipment.
- 2 If there is doubt that the system will operate efficiently in an Environment Type 3, all or part of the equipment should be classified as suitable for use in Environment Type 2.
- (d) *Environment Type 4* Typically, an office environment that has no airconditioning, except possibly for heating in winter. It is generally suitable only for equipment which produces little heat, such as small terminals.

NOTE: If the equipment heat output is high, the room temperature may rapidly rise beyond the upper limit of the operating range, the maximum rate of change may be exceeded and the environment could become uncomfortable for the office staff.

1.6 DOCUMENTATION Operating and maintenance instructions for all plant and equipment shall be part of all goods supplied.

For an airconditioning plant, instructions shall include design data, field commissioning test results, fluid flows and temperatures, as-installed drawings as well as plant item locations where these are not immediately obvious.

NOTE: It is strongly recommended that all such instructions, results and drawings are retained on site so that they may be made available when maintenance or future system expansion is being considered.

SECTION 2 ENVIRONMENTAL REQUIREMENTS

2.1 FLOORS

2.1.1 General Floors shall be one of the following types:

- (a) Elevated.
- (b) Solid.

NOTES:

- 1 This Clause is intended to be applied primarily to Environment Types 1 and 2, but may have application to Environment Types 3 and 4.
- 2 Refer to Appendix A for details relating to vapour barrier requirements.
- 3 Appendix B gives guidelines for the design of floors.

2.1.2 Conductivity The surface of the floor shall provide a limited electrical conductivity between all persons and equipment making contact with the floor to prevent the accumulation of undesirable electrostatic charges. In the interests of electrical safety, exposed, earthed metal shall not appear at the floor surface. For a conductive floor with an earthed undersurface (e.g. an elevated floor with earthed substructure or carpet laid directly on a concrete slab), the bulk resistance of the floor is its more important resistive property. Where the conductive floor is laid over an insulating surface (e.g. carpet on a rubber underlay), then the surface resistance is the more important parameter.

The surface or bulk resistance of the floor or floor panels shall be not less than 500 k Ω and not greater than 20 G Ω when measured in accordance with AS 4155.6.

NOTES:

- 1 The requirements of this Clause are consistent with good practice when installing or renovating a floor for computer usage. They may also be specified as mandatory by the suppliers of some computer equipment. However, the trend in computer design is towards equipment that is less sensitive to electrostatic charges. In some cases, therefore, an existing floor that does not meet the requirements below may, nevertheless, satisfy the requirements of the equipment supplier.
- 2 The minimum value of 500 k Ω is specified as a protection against electrical shock.
- 3 The maximum value of 20 G Ω is specified as a protection against the build-up of undesirable electrostatic charges.
- 4 Floor coverings that meet these criteria are commercially available.

2.1.3 Elevated floors Elevated floors shall be designed and tested in accordance with AS 4154.

2.1.4 Underfloor clearance The preferred underfloor clearance shall be 300 mm but in no case less than the following:

- (a) When used as an airconditioning plenum . . . not less than 250 mm.
- (b) When only conduits, small diameter pipes and signal cables are installed . . . not less than 150 mm.

NOTES:

- 1 Any obstructions, which may adversely affect air flow or limit the laying or relocation of cables, may require minimum underfloor clearances, greater than those stated above.
- 2 Where adequate ceiling height permits, a minimum underfloor clearance of 300 mm is recommended. For ceiling height restrictions, see Clause 2.3.1.
- 3 Some suppliers may have specific requirements.

2.1.5 Underfloor treatment Where the space beneath the elevated floor is used as an air plenum and the surface of the structural floor is concrete, the structural floor shall be sealed to prevent dust and moisture ingress. Other types of structural surface should be treated as required to provide a firm and non-contaminating surface.

2.1.6 Earthing of elevated floors Metal components of the elevated floor substructure shall be securely connected to safety earth in order to earth the entire elevated floor sub-surface effectively. The resistance between such metal components of the elevated floor and earth shall not exceed 1Ω .

2.1.7 Solid floors Solid floors shall be capable of withstanding the applied loads (existing and anticipated).

NOTE: For determining loads, see AS 1170.1.

2.2 WALLS All perimeter walls, enclosing computer rooms requiring an Environment Type 1 or Type 2 and all storage areas that share the same environment, shall be constructed so as to extend from the structural floor to the underside of the roof or the underside of the structural floor of the next storey, as appropriate, to ensure the integrity of thermal and vapour barriers.

NOTES:

- 1 See Appendix A in relation to vapour barrier requirements.
- 2 The type of wall construction and materials used will generally depend on exposure, security requirements, fire resistance, dust suppression, vapour sealing, sound transmission and environmental and building codes.

2.3 CEILINGS

2.3.1 Ceiling height The minimum ceiling height shall comply with the requirements of the regulatory authority. Greater ceiling heights may be required if—

- (a) the equipment supplier specifies a greater height; or
- (b) additional space is required for airconditioning ductwork, cable trays, sprinkler head clearance, and the like.

2.3.2 Material Suspended ceilings and their linings shall be non-combustible as required by the regulatory authority. Linings should not give rise to the production of dust. Non-combustible mineral fibre or fibreglass filling inserted in ceiling tiles (e.g. for acoustic or air balancing reasons) shall be contained in sealed bags of minimal fire-propagating properties.

NOTES:

- 1 Some sprayed ceiling finishes, insulating materials and the damaged edges of ceiling tiles may shed dust or particles.
- 2 Acoustic properties of a ceiling should be considered.
- 3 If the ceiling is of concrete, the surface should be sealed to prevent dust and moisture ingress.
- 4 See Appendix A in relation to vapour barrier requirements.

2.3.3 Cable trays Where a significant quantity of cables are to be laid over a suspended ceiling, the use of earthed cable trays, fixed to the building structure, is recommended.

2.4 LIGHTING

2.4.1 General Lighting shall comply with the requirements of AS 1680.1, AS 1680.2.2, and AS 1680.2.3, as applicable.

NOTES:

- 1 Modern office buildings normally have a fixed grid of ceiling luminaires throughout, which are designed to provide uniform illumination in accordance with AS 1680.1. The installation of equipment, such as a row of tall computer cabinets, could disrupt the uniformity. This situation can be avoided by taking existing lighting into consideration when designing the equipment layout and by the provision of local lighting.

- 2 Where lighting does not already exist, it may be designed to fit in with the layout in order to meet the requirements of this Clause.
- 3 Users and designers should ensure that the lighting is adequate in areas where service personnel will be required to work particularly in underfloor areas. Local (task) lighting may be required (see Clause 2.4.2).

2.4.2 Local lighting Notwithstanding Clause 2.4.1, the equipment supplier may require a higher level of illumination to be associated with certain equipment. This may be provided through local lighting in accordance with AS 1680.1. In such cases, the supplier shall provide details of the location and level of the illumination required.

2.4.3 Unwanted reflections Care shall be taken when designing equipment layout and lighting to avoid unwanted reflections which would interfere with the visual efficiency or comfort of computer room personnel.

NOTES:

- 1 AS 1680.1 gives guidance on dealing with unwanted reflections.
- 2 Particular note should be taken of reflections from equipment viewing windows, especially inclined or horizontal windows such as often found on printers.

2.4.4 Emergency evacuation lighting When required by the regulatory authority, or to meet insurance requirements, the emergency evacuation lighting system shall comply with AS 2293.1.

2.5 DOORS Access doors into the computer area shall be of adequate width and height to allow convenient movement of computer and associated equipment. Doors shall not be under-cut or fitted with grilles. The fire resistance shall be equal to the surrounding wall construction.

NOTES:

- 1 See Appendix A for guidance on accessibility.
- 2 Where existing door sizes are found to be adequate, no changes are recommended. However, for new computer rooms and where existing doors require replacement, a door width giving a clear opening of 900 mm or larger is recommended.

2.6 FIRE PROTECTION Computer areas with Environment Types 1 and 2 and areas under an elevated floor and above a false ceiling shall be provided with a fire protection system encompassing detection and suppression.

Fire detection systems, where provided, shall comply with AS 1670. Sprinkler installations, where fitted, shall comply with AS 2118. Fire extinguishing systems using gaseous suppressants shall comply with the relevant parts of AS 4214.

Computer rooms shall be provided with portable fire extinguishers, the ratings, quantity and distribution of which shall be in accordance with AS 1850 and AS 2444.

NOTE: All fire protection equipment should be installed and maintained in accordance with the appropriate parts of AS 1851 and the Building Code of Australia.

2.7 VENTILATION AND AIRCONDITIONING

2.7.1 General Ventilation systems within computer areas shall comply with AS 1668.2, where applicable.

NOTE: See Appendix C for guidelines on airconditioning systems and information on the particulate and chemical contamination of fresh air.

2.7.2 Environmental conditions

2.7.2.1 Maximum sensible heat load of system Individual units may be rated by the equipment supplier to operate in a particular environment type. Notwithstanding this individual rating, if such a piece of equipment is connected with other equipment of a higher rating, or if the total heat load of a number of similarly rated units exceeds the capacity of the relevant environment, then the system as a whole should be promoted to a higher rating.

NOTES:

- 1 The 'maximum sensible heat load of system' in Table 2.1 is intended as a guide to indicate which type of environment would be the most suitable in such circumstances.
- 2 As stated in Clause 1.5, Items (c) and (d), the maximum heat handling capabilities of some environments are subject to wide variations. Hence, the values in Table 2.1 for Environment Types 3 and 4 are typical only, and may vary according to circumstances.

2.7.2.2 Temperature and relative humidity ranges Table 2.1 specifies the requirement for each type of environment. Equipment shall always be operated at the optimum temperature and relative humidity. The operating ranges are intended solely as a short-term emergency buffer in the event of airconditioning failure.

NOTE: Operation outside the operating ranges, or for long periods above or below optimum conditions, may produce the following effects:

- (a) Stressing or premature ageing of some components, leading to premature or intermittent failures. Often these problems do not manifest themselves until several weeks or months after the event.
- (b) Electrical contact problems.
- (c) Static electricity problems.

The upper operating temperature limits specified in Table 2.1 are effective up to an altitude of 500 m above mean sea level. Above 500 m, the upper limit is derated linearly to 2500 m (the highest land-based altitude in Australia) by a value of 2°C per 1000 m. This is due to lower atmospheric pressure and air rarefaction affecting cooling capabilities.

EXAMPLE: An Environment Type 2 sited at an altitude of 2000 m would require an upper operating temperature limit derated to 29°C.

2.7.2.3 Condensation Condensation shall never be permitted to occur in any computer environment (unless specifically permitted by the equipment supplier).

NOTE: If an Environment Type 4 is operating simultaneously at high temperature and high relative humidity, relatively small changes in temperature can cause condensation to occur. Consequently, equipment in these environments should not be operated in such conditions.

This problem should not occur with Environment Types 1, 2 or 3 provided that they are maintained within their specified limits.

2.7.2.4 Optimum temperature and relative humidity The ranges of optimum temperature and relative humidity are those over which most computer equipment operates most reliably for long periods. Where airconditioning is used, it shall be designed to maintain the environment at the centrepieces of these ranges under all ambient conditions throughout the year and at all likely loads.

2.7.2.5 Maximum temperature and relative humidity gradients The rates of change of temperature and relative humidity shall not exceed the gradients specified in Table 2.1. Rapid changes can damage components and media when equipment is operating and, in some cases, may cause condensation.

TABLE 2.1
REQUIREMENTS FOR ENVIRONMENT TYPES*

Characteristics	Environment type			
	Type 1	Type 2	Type 3	Type 4
Maximum sensible heat load of system	N/A	N/A	2000 W	500 W
Operating temp. range	18°C to 26°C	16°C to 32°C	16°C to 32°C	15°C to 35°C
Operating relative humidity range	40% to 60%	40% to 70%	40% to 70%	20% to 80%
Optimum temperature	23 ±1°C	23 ±2°C	23 ±4°C	23 ±4°C
Optimum relative humidity	50 ±5%	50 ±10%	50 ±10%	50 ±10%
Maximum temperature gradient	1°C per 10 min	1°C per 6 min	1°C per 6 min	1°C per 6 min
Maximum relative humidity gradient	5% per hour	10% per hour	10% per hour	†
Floor plenum conditions: (a) Minimum temperature (b) Maximum relative humidity	† 15°C 80%	† 15°C 80%	N/A	N/A
Minimum settling period	†	†	30 min	N/A
Filtration type (AS 1324)	Type 1 Class A, B	Type 1 Class A, B	See Clause 2.7.2.8(b)	N/A
Filter minimum efficiency ‡	20%	20%	See Clause 2.7.2.8(b)	N/A

* Refer to equipment supplier for non-operating environmental limits.

† Due to wide variety of conditions encountered, it is recommended that appropriate criteria values be agreed upon between the user and the equipment supplier.

‡ In accordance with AS 1132.5, using Test Dust No. 1 or other standard specified by the equipment supplier.

2.7.2.6 Air plenum conditions Where an elevated floor is used as an air distribution plenum, the temperature of the air in the underfloor area shall be no less than and the relative humidity shall be not greater than the values specified in Table 2.1 at any room-entry location, unless otherwise specified by the computer equipment supplier.

2.7.2.7 Minimum settling period When an environment has been allowed to go outside the operating temperature and humidity ranges with the computer equipment turned off (e.g. overnight, weekend), there shall be a settling period after the environment has returned to normal conditions before power may be applied to the computer equipment. This period is to permit the media and equipment interior conditions to stabilize in the operating environment.

In addition, for Environment Types 1 and 2, the airconditioning should continue to operate for at least 30 min after computer power-off (or as recommended by the equipment supplier).

NOTES:

- 1 When airconditioning is first turned on in such circumstances, there will be a rapid change in temperature and relative humidity such that the maximum operating gradients may be exceeded. The airconditioning system should be designed such that condensation cannot occur.
- 2 To avoid unnecessary delays due to the settling period, a time switch may be fitted to the airconditioning system such that the latter will be switched on and off at the appropriate times in relation to the scheduled operating times for the computer.
- 3 A better (and preferred) solution is to operate the airconditioning continuously, even during weekends when the computer is not turned on. This method avoids the problem of the settling period entirely. With correct system design, running costs are not very much greater. As there is no load from the system, the airconditioning will be mostly providing ventilation only. This method may not be practicable for Environment Type 3 where an office may be a large open area or where the main building airconditioning is used to cool the equipment.