Environmental design

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because the thermal steady state is not normally reached. It is often convenient for their resultant temperatures to be similar to those of adjoining spaces.

The summer comfort temperatures given in Table 1.5 apply to air conditioned buildings. Higher temperatures may be acceptable if full air conditioning is not present, and guidance on this may be found in section 1.4.2, with a detailed discussion of the adaptive approach in section 1.6.

The Fuel and Electricity (Heating) (Control) Order 1974[24] and the Fuel and Electricity (Heating) (Control) (Amendment) Order 1980[25] prohibit the use of fuels or electricity to heat premises above 19 °C. This does not mean that the temperature in buildings must be kept below 19 °C but only that fuel or electricity must not be used to raise the temperature above this level. In Table 1.5, for some applications, the recommended winter design temperatures exceed 19 °C. In these cases, it is assumed that the recommended temperatures can be maintained by contributions from heat sources other than the heating system. These may include solar radiation, heat gains from lighting, equipment and machinery and heat gains from the occupants themselves.

Table 1.5 Recommended comfort criteria for specific applications

Building/room type	Winter operative temp. range for stated activity and clothing levels*			Summer operative temp. range (air conditioned buildings†) for stated activity and clothing levels*			Suggested air supply rate / (L.s^{-1} per person) unless stated otherwise	Filtration grade‡	Maintained illuminance¶ / lux	Noise rating§ (NR)
	Temp. / °C	Activity / met	Clothing / clo	Temp. / °C	Activity / met	Clothing / clo				
Airport terminals:										
— baggage reclaim	12–19[1]	1.8	1.15	21–25[1]	1.8	0.65	10[2]	F6–F7	200	45
— check–in areas[3]	18–20	1.4	1.15	21–23	1.4	0.65	10[2]	F6–F7	500[4]	45
— concourse (no seats)	19–24[1]	1.8	1.15	21–25[1]	1.8	0.65	10[2]	F6–F7	200	45
— customs area	18–20	1.4	1.15	21–23	1.4	0.65	10[2]	F6–F7	500	45
— departure lounge	19–21	1.3	1.15	22–24	1.3	0.65	10[2]	F6–F7	200	40
Art galleries — see *Museums and art galleries*										
Banks, building societies, post offices:										
— counters	19–21	1.4	1.0	21–23	1.4	0.65	10[2]	F6–F7	500	35–40
— public areas	19–21	1.4	1.0	21–23	1.4	0.65	10[2]	F5–F7	300	35–45
Bars/lounges	20–22	1.3	1.0	22–24	1.3	0.65	10[2]	F5–F7	100–200[5]	30–40
Bus/coach stations — see *Railway/coach stations*										
Churches	19–21	1.3	1.15	22–24	1.3	0.65	10[2]	G4–F6	100–200	25–30
Computer rooms[6]	19–21	1.4	1.0	21–23	1.4	0.65	10[2]	F7–F9	300	35–45
Conference/board rooms	22–23	1.1	1.0	23–25	1.1	0.65	10[2]	F6–F7	300/500[7]	25–30
Drawing offices	19–21	1.4	1.0	21–23	1.4	0.65	10[2]	F7	750	35–45
Dwellings:										
— bathrooms	20–22	1.2	0.25	23–25	1.2	0.25	15 L·s^{-1}	G2–G4 (extract)[8]	150[4]	—
— bedrooms	17–19	0.9	2.5	23–25	0.9	1.2	0.4 –1 ACH to control moisture[8]	G2–G4	100[4]	25
— hall/stairs/landings	19–24[1]	1.8	0.75	21–25[1]	1.8	0.65	—	—	100	—
— kitchen	17–19	1.6	1.0	21–23	1.6	0.65	60 L·s^{-1}	G2–G4 (extract)[8]	150–300	40–45
— living rooms	22–23	1.1	1.0	23–25	1.1	0.65	0.4 –1 ACH to control moisture[8]	G2–G4	50–300	30
— toilets	19–21	1.4	1.0	21–23	1.4	0.65	> 5 ACH	G2–G4	100[4]	—
Educational buildings:										
— lecture halls[9]	19–21	1.4	1.0	21–23	1.4	0.65	10[2]	G4–G5	500[10]	25–35
— seminar rooms	19–21	1.4	1.0	21–23	1.4	0.65	10[2]	G4–G5	300[10]	25–35
— teaching spaces[9]	19–21	1.4	1.0	21–23	1.4	0.65	10[2]	G4–G5	300[10]	25–35
Exhibition halls	19-21	1.4	1.0	21–23	1.4	0.65	10[2]	G3–G4	300	40
Factories:										
— heavy work	11–14[11]	2.5	0.85	—[12]	—	—	—[13]	Depends on use	—[14,15]	50–65
— light work	16–19	1.8	0.85	—[12]	—	—	—[13]	Depends on use	—[14,15]	45–55
— sedentary work	19–21	1.4	1.0	21–23	1.4	0.65	—[13]	Depends on use	—[14,15]	45
Fire/ambulance stations:										
— recreation rooms	20–22	1.3	1.0	22–24	1.3	0.65	10[2]	F5	300	35–40
— watchroom	22–23	1.1	1.0	24–26	1.1	0.65	10[2]	F5	200	35–40

Table continues

Table 1.5 Recommended comfort criteria for specific applications — *continued*

Building/room type	Winter operative temp. range for stated activity and clothing levels*			Summer operative temp. range (air conditioned buildings†) for stated activity and clothing levels*			Suggested air supply rate / (L.s^{-1} per person) unless stated otherwise	Filtration grade‡	Maintained illuminance¶ / lux	Noise rating§ (NR)
	Temp. / °C	Activity / met	Clothing / clo	Temp. / °C	Activity / met	Clothing / clo				
Garages:										
— parking	—	—	—	—	—	—	6 ACH (extract)	—	75/300	55
— servicing	16–19	1.8	0.85	—	—	—	—	G2–G3	300/500	45–50
General building areas:										
— corridors	19–21	1.4	1.0	21–23	1.4	0.65	10[2]	—[16]	100	40
— entrance halls/lobbies	19–21	1.4	1.0	21–23	1.4	0.65	10[2]	—[16]	100/200[4]	35–40
— kitchens (commercial)	15–18	1.8	1.0	18–21	1.8	0.65	—[17]	G2–G4	500	40–45
— toilets	19–21	1.4	1.0	21–23	1.4	0.65	> 5 ACH	G4–G5	200	35–45
— waiting areas/rooms	19–21	1.4	1.0	21–23	1.4	0.65	10[2]	—[16]	200	30–35
Hospitals and health care buildings:										
— bedheads/wards	22–24	0.9	1.4	23–25	0.9	1.2	10[2]	F7–F9	—[18]	30
— circulation spaces (wards)[19]	19–24[1]	1.8	0.75	21–25[1]	1.8	0.65	10[2]	F7–F9	—[18]	35
— consulting/treatment rooms	22–24	1.4	0.55	23–25	1.4	0.45	10[2]	F7–F9	300/500[18]	30
— nurses' station[19]	19–22	1.4	0.9	21–23	1.4	0.65	10[2]	F7–F9	—[18]	35
— operating theatres	17–19	1.8	0.8	17–19	1.8	0.8	0.65–1.0 m^3.s^{-1}	F9	—[18]	30–35
Hotels:										
— bathrooms	20–22	1.2	0.25	23–25	1.2	0.25	12[2]	F5–F7	150	40
— bedrooms	19–21	1.0	1.0	21–23	1.0	1.2	10[2]	F5–F7	50/100	20–30
Ice rinks	12	—	—	—	—	—	3 ACH	G3	—[20]	40–50
Laundries:										
— commercial	16–19	1.8	0.85	—[12]	—	—	—[21]	G3–G4	300/500	45
— launderettes	16–18	1.6	1.15	20–22	1.6	0.65	—[21]	G2–G3	300	45–50
Law courts	19–21	1.4	1.0	21–23	1.4	0.65	10[2]	F5–F7	300	25–30
Libraries:										
— lending/reference areas[22]	19–21	1.4	1.0	21–23	1.4	0.65	10[2]	F5–F7	200	30–35
— reading rooms	22–23	1.1	1.0	24–25	1.1	0.65	10[2]	F5–F7	500[23]	30–35
— store rooms	15	—	—	—	—	—	—	F6–F8	200	—
Museums and art galleries:										
— display[24]	19–21	1.4	1.0	21–23	1.4	0.65	10[2]	F7–F8	200[25]	30–35
— storage[24]	19–21	1.4	1.0	21–23	1.4	0.65	10[2]	F7–F8	50[25]	30–35
Offices:										
— executive	21–23	1.2	0.85	22–24	1.2	0.7	10[2]	F7	300–500[7]	30
— general	21–23	1.2	0.85	22–24	1.2	0.7	10[2]	F6–F7	300–500[7]	35
— open–plan	21–23	1.2	0.85	22–24	1.2	0.7	10[2]	F6–F7	300–500[7]	35
Places of public assembly:										
— auditoria[26]	22–23[1]	1.0	1.0	24–25	1.1	0.65	10[2]	F5–F7	100–150[5]	20–30
— changing/dressing rooms	23–24	1.4	0.5	23–25	1.4	0.4	10[2]	F5–F7	300	35
— circulation spaces	13–20[1]	1.8	1.0	21–25[1]	1.8	0.65	10[2]	G4–G5	200	40
— foyers[27]	13–20[1]	1.8	1.0	21–25[1]	1.8	0.65	10[2]	F5–F7	200	40
— multi-purpose halls[28]	—	—	—	—	—	—	10[2]	G4–G5	300	—
Prison cells	19–21	1.0	1.7	21–23	1.0	1.2	10[2]	F5	100[4]	25–30
Railway/coach stations:										
— concourse (no seats)	12–19[1]	1.8	1.15	21–25[1]	1.8	0.65	10[2]	G4–G5	200	45
— ticket office	18–20	1.4	1.15	21–23	1.4	0.65	10[2]	G4–G5	300	40
— waiting room	21–22	1.1	1.15	24–25	1.1	0.65	10[2]	G4–G5	200	40
Restaurants/ dining rooms	21–23	1.1	1.0	24–25	1.1	0.65	10[2]	F5–F7	50–200[5]	35–40
Retailing:										
— shopping malls	12–19[1]	1.8	1.15	21–25[1]	1.8	0.65	10[2]	G4–G5	50–300	40–50
— small shops, department stores[22]	19–21	1.4	1.0	21–23	1.4	0.65	10[2]	F5–F7	500	35–40
— supermarkets[29]	19–21	1.4	1.0	21–23	1.4	0.65	10[2]	F5–F7	750/1000	40–45

Table continues

Table 1.5 Recommended comfort criteria for specific applications — *continued*

Building/room type	Winter operative temp. range for stated activity and clothing levels*			Summer operative temp. range (air conditioned buildings†) for stated activity and clothing levels*			Suggested air supply rate / (L.s^{-1} per person) unless stated otherwise	Filtration grade‡	Maintained illuminance¶ / lux	Noise rating§ (NR)
	Temp. / °C	Activity / met	Clothing / clo	Temp. / °C	Activity / met	Clothing / clo				
Sports halls[30]:										
— changing rooms	22–24	1.4	0.55	24–25	1.4	0.35	6–10 ACH	G3	100[20]	35–45
— hall	13–16	3.0	0.4	14–16	3.0	0.35	10[2]	G3–F5	300[20]	40–50
Squash courts[30]	10–12	4.0	0.25	—	—	—	4 ACH	G3	—[20]	50
Swimming pools:										
— changing rooms	23–24	1.4	0.5	24–25	1.4	0.35	10 ACH	G3	100[20]	35–45
— pool halls	23–26[31]	1.6	< 0.1	23–26[31]	1.6	< 0.1	0–15 L·s^{-1}·m^{-2} (of wet area)	G3	—[20]	40–50
Television studios[26]	19–21	1.4	1.0	21–23	1.4	0.65	10[2]	F5–F7	—[32]	25

Notes: Except where indicated[1], temperature ranges based on stated values of met and clo and a PMV of ± 0.25. Upper temperature of stated range may be increased and lower temperature decreased by approximately 1°C if PMV of ± 0.5 (i.e. 90 PPD) is acceptable (see section 1.3.2). Calculation assumes RH = 50% and v_r = 0.15 m·s^{-1}. Insulation value of chair assumed to be 0.15 clo for all applications except dwellings, for which 0.3 has been assumed.

* See section 1.4.3. for additional data and variations due to different activities and levels of clothing.

† Higher temperatures may be acceptable if air conditioning is not present, see section 1.3.1.

‡ See also chapter 8, Table 8.2, which gives requirements for specific pollutants.

§ Illumination levels given thus: 200–500 indicate that the required level varies through the space depending on function and/or task. Illumination levels given thus: 300/500, indicate that one or the other level is appropriate depending on exact function. Illumination levels in this table give only a general indication of requirements. Reference must be made to the table of recommended illuminances in the SLL *Code for lighting*[33] and CIBSE/SLL Lighting Guides for design guidance on specific applications (see notes to individual entries).

¶ See also Table 1.11.

[1] Based on PMV of ± 0.5

[2] Assumes no smoking. For spaces where smoking is permitted, see section 1.7.2.

[3] Based on comfort requirements for check-in staff

[4] Local illumination may be required for specific tasks

[5] Dimming normally required

[6] Follow computer manufacturers' recommendations if necessary, otherwise design for occupant comfort

[7] Refer to Lighting Guide LG7: *Office lighting*[34]

[8] Refer to The Building Regulations: Part F1: Means of ventilation[35]

[9] Podium may require special consideration to cater for higher activity level

[10] Refer to Lighting Guide LG5: *The visual environment in lecture, conference and teaching spaces*[36]

[11] The Workplace (Health, Safety and Welfare) Regulations 1992[37] require 13 °C where there is severe physical effort

[12] In the UK, air conditioning is not normally appropriate for this application. Cooling may be provided by local air jets. Some applications (e.g. steel mills, foundries) require special attention to reduce risk of heat stress

[13] As required for industrial process, if any, otherwise based on occupants' requirements

[14] Depends on difficulty of task

[15] Refer to Lighting Guide LG1: *The industrial environment*[38]

[16] Filtration should be suitable for the areas to which these spaces are connected

[17] See CIBSE Guide B[39], section 2.3.6.

[18] Refer to SLL *Code for lighting*[33]

[19] Design for clothing and activity levels appropriate to nurses

[20] Refer to Lighting Guide LG4: *Sports*[40]

[21] As required for removal of heat and moisture

[22] Based on comfort requirements of staff

[23] Study tables and carrels require 500 lux

[24] Conditions required for preservation/conservation of exhibits may override criteria for human comfort; abrupt changes in temperature and humidity should be avoided.

[25] Critical conservation levels may apply, refer to Lighting Guide LG8: *Lighting in museums and art galleries*[41]

[26] Performers may have wider range of met and clo values than audience, along with higher radiant component, necessitating special provision

[27] Dependent on use

[28] Design for most critical requirement for each parameter

[29] Special provision required for check-out staff to provide conditions as for small shops

[30] Audience may require special consideration depending on likely clothing levels

[31] 2 °C above pool water temperature, to a maximum of 30 °C

[32] Depends on production requirements