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Designation: E2320 – 04

An American National Standard

Standard Classification for Serviceability of an Office Facility for Thermal Environment and Indoor Air Conditions[1, 2]

This standard is issued under the fixed designation E2320; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This classification contains pairs of scales for classifying an aspect of the serviceability of an office facility, that is, the capability of an office facility to meet certain possible requirements for suitable thermal environment and indoor air conditions.

1.2 Within this aspect of serviceability, each pair of scales, shown in Figs. 1-5[3], is for classifying one topic of serviceability. Each paragraph in an Occupant Requirement Scale (see Figs. 1-5) summarizes one level of requirement for serviceability on that topic, which occupants might require. The matching paragraph in the Facility Rating Scale (see Figs. 1-5) is a translation of the requirement into a description of certain features of a facility which, taken in combination, indicate that the facility is likely to meet that level of required serviceability.

1.3 The paragraphs in the Facility Rating Scale (see Figs. 1-5) are indicative and not comprehensive. They are for quick scanning to estimate approximately, quickly, and economically how well a facility is likely to meet the needs of one or another type of occupant group over time. The paragraphs are not for measuring, knowing, or evaluating how an office facility is performing.

1.4 This classification can be used to estimate the level of serviceability of an existing facility. It can also be used to estimate the serviceability of a facility that has been planned but not yet built, such as one for which schematic or preliminary drawings and outline specifications have been prepared.

1.5 This standard indicates what would cause a facility to be rated (classified) at a certain level of serviceability but does not state how to conduct a serviceability rating or how to assign a serviceability score. That information is found in Practice E1334. The scales in this classification are complimentary to and compatible with Practice E1334. Each requires the other.

1.6 This standard indicates what would cause a requirement to be classified as being at a specific level, but does not state how to ascertain a requirement, or how to assign a specific level. This information is found in Practice E1679. The scales in this classification are complimentary to and compatible with Practice E1679. Each requires the other.

1.7 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory requirements prior to use.*

2. Referenced Documents

2.1 *ASTM Standards:*[4]

E631 Terminology of Building Constructions

E1334 Practice for Rating the Serviceability of a Building or Building-Related Facility

E1480 Terminology of Facility Management (Building-Related)

E1679 Practice for Setting the Requirements for the Serviceability of a Building or Building-Related Facility

2.2 *ASHRAE Standards:*[5]

ANSI/ASHRAE 52.1-1992 Gravimetric and Dust-Spot Procedures for Testing Air-Cleaning Devices used in General Ventilation for Removing Particulate Matter

ANSI/ASHRAE 55-1992 Thermal Environmental Conditions for Human Occupancy

ANSI/ASHRAE 62-2001 Ventilation for Acceptable Indoor Air Quality

3. Terminology

3.1 *Definitions:*

[1] This classification is under the jurisdiction of ASTM Committee E06 on Performance of Buildings and is the direct responsibility of Subcommittee E06.25 on Whole Buildings and Facilities.

Current edition approved May 1, 2004. Published May 2004. DOI: 10.1520/E2320-04.

[2] Portions of this document are based on material originally prepared by the International Centre For Facilities (ICF) and © 1993 by ICF and Minister of PUBLIC Works and Government Services Canada. Their cooperation in the development of this standard is acknowledged.

[3] Text in Figs. 1–5 is derived from Davis, et al., *Serviceability Tools, Vol 2, Scales for Setting Occupant Requirement and Rating Buildings*, International Centre for Facilities, Ottawa, Ontario, Canada, 1993, 2003, and Davis, et al., *Serviceability Tools, Vol 4, Requirement Scales for Office Buildings,* and *Vol 5, Rating Scales for Office Buildings*, International Centre for Facilities, Ottawa, Ontario, Canada, 1993, 2003.

[4] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

[5] Available from American Society of Heating, Refrigerating, and Air-Conditioning Engineers, Inc. (ASHRAE), 1791 Tullie Circle, NE, Atlanta, GA 30329.

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Occupant Requirement Scale		Facility Rating Scale
9 ❑		9 ❑
O **THERMAL COMFORT FOR OCCUPANTS:** The temperature should feel comfortable at all times. No hot or cold areas near windows or external walls. O **THERMAL CONDITIONS FOR MACHINES:** Require conditions in the typical range specified for large computers, servers and printers, e.g. ambient temperatures not greater than 30°C (86°F) in all areas where these computers are operated. Require not greater than 35°C (95°F) in all other areas where personal computers are operated. O **HUMIDITY FOR OCCUPANTS:** Levels of humidity should be comfortable at all times. No stuffy areas. O **HUMIDITY FOR MACHINES:** Require conditions in the range specified for large computers, servers and printers, e.g. effective control of relative humidity in range of 40% to 70% in all areas where these computers are operated. Require in range of 20% to 80% in all other areas where personal computers are operated. Require conditions that do not cause problems for other humidity-sensitive equipment. O **AIR MOVEMENT:** Air movement should normally be barely perceptible. No drafty areas.		O **Air temperature**: Temperatures throughout the facility and in different zones are very similar and are comfortable throughout the facility at all times. Targets are met, e.g.: 20-23.5°C (68-75°F) in winter and 23-26°C (73-79°F) in summer. O **Solar gain near window**: There are no complaints. External walls and windows are very well insulated and screened from solar gains by suitable materials or devices. O **Heat loss near windows and external walls**: There are no complaints, e.g. occupants do not complain of feeling cold even during very cold weather. O **Humidity**: Humidity control is provided where required, and is effective. The building is not stuffy in any areas. In spaces for large computers and servers, humidity is within range of 40% to 70%. O **Air movement**: Air movement is just perceptible in all zones without the use of portable fans. Air movement is increased in hot humid weather. The building is not stuffy in any area, and there are no drafts.
8 ❑		
7 ❑		7 ❑
O **THERMAL COMFORT FOR OCCUPANTS:** An acceptable range of thermal comfort must be met almost all the time, at almost all workplaces, except when outdoor conditions are extreme, e.g. met for all but a few workstations, for all but a few hours at a time on all but a few working days each year, and then only minor discomfort. O **THERMAL CONDITIONS FOR MACHINES:** Require conditions in the range specified for desktop computers and printers, e.g. temperatures not greater than 35°C (95°F) in all areas where these computers are operated. O **HUMIDITY FOR OCCUPANTS:** Can tolerate minor discomfort when outdoor conditions are extreme, e.g. insufficient dehumidification when 80% relative humidity creates a stuffy feeling. O **HUMIDITY FOR MACHINES:** Require conditions in the range specified for desktop computers and printers, e.g. relative humidity in range of 20% to 80% in all areas where these computers are operated. O **AIR MOVEMENT:** There should be no drafts in the building.		O **Air temperature**: Temperatures throughout the building and in different zones are similar, and almost always within an acceptable range for comfort. Targets, e.g.: 20-23.5°C (68-75°F) in winter and 23-26°C (73-79°F) in summer, are met for all but a few hours at a time on all but 3 days or less per year. O **Solar gain near window**: There are very few complaints. External walls and windows are well insulated and screened from solar gains by suitable materials or devices. O **Heat loss near windows and external walls**: There are few complaints, e.g. a few occupants may sometimes feel cold during very cold weather. O **Humidity**: In very dry or very humid climates, humidification or dehumidification is only partly effective during peak heat or cold, and adequately effective during balance of the year. O **Air movement**: Air movement is just perceptible in most areas without the use of portable fans. The building is not stuffy and there are no drafts.
	6 ❑	

FIG. 1 Scale A.4.1 for Temperature and Humidity

3.1.1 *facility*—a physical setting used to serve a specific purpose.

3.1.1.1 *Discussion*—A facility may be within a building, a whole building, or a building with its site and surrounding

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Occupant Requirement Scale	Facility Rating Scale
5 ❑ ❍ **THERMAL COMFORT FOR OCCUPANTS:** An acceptable range of comfort must be met almost all the time. Can tolerate minor differences in temperature between parts of the building. Can tolerate minor discomfort some days, e.g. on about 10 working days per year in very cold weather, possibly chilly near external walls. ❍ **THERMAL CONDITIONS FOR MACHINES:** Require conditions in the range specified for desktop computers and printers, e.g. temperatures not greater than 40°C (104°F) in all areas where these computers are operated not more than 5 days per year. ❍ **HUMIDITY FOR OCCUPANTS:** Can tolerate moderate discomfort when outdoor conditions are extreme, e.g. insufficient dehumidification in 80% relative humidity. ❍ **HUMIDITY FOR MACHINES:** Require conditions in the range specified for desktop computers and printers, e.g. relative humidity normally in range of 20% to 80% in all areas where these computers and printers are operated, except 10% to 90% not more than 5 days per year. ❍ **AIR MOVEMENT:** Some slightly drafty areas are acceptable, but not where individuals must sit or stand.	5 ❑ ❍ **Air temperature**: Minor discrepancies in air temperatures exist throughout the building and in different zones, mostly within an acceptable range for comfort. Targets, e.g.: 20-23.5°C (68-75°F) in winter and 23-26°C (73-79°F) in summer, are met for all but a few hours at a time on all but 10 days or less per year. ❍ **Solar gain near window**: There are few complaints. External walls and windows are acceptably insulated and screened from solar gains by suitable materials or devices. ❍ **Heat loss near windows and external walls**: There are some complaints in some parts of the facility, e.g. feel cold near external walls when windows are in shade or during very cold weather. ❍ **Humidity**: In very dry weather, insufficient humidification, or insufficient dehumidification in very humid weather. ❍ **Air movement**: There is no local control of the mechanical air supply by occupants. Conference rooms and boardrooms have additional supply or exhaust, controlled from within the space by occupants. There are some minor drafts, but few at individual workstations.
4 ❑	
3 ❑ ❍ **THERMAL COMFORT FOR OCCUPANTS:** Can tolerate building temperature that is moderately uncomfortable in some areas, e.g. differences in air temperature in various parts of the facility, or overheating on sunny side of a building, or feeling chilled near windows and external walls. ❍ **THERMAL CONDITIONS FOR MACHINES:** Can tolerate temperature not greater than 40°C (104°F), and lack of air movement. ❍ **HUMIDITY FOR OCCUPANTS:** Can tolerate poor humidity control. ❍ **HUMIDITY FOR MACHINES:** Can tolerate relative humidity normally in range of 10% to 90%. ❍ **AIR MOVEMENT:** Can tolerate lack of apparent air movement from building systems.	3 ❑ ❍ **Air temperature**: There are some complaints, e.g. overheating and being cold in different parts of the facility at the same time. Adjustments in one zone can worsen conditions in others. ❍ **Solar gain near window**: There are more than a few complaints, e.g. overheating due to solar gains near east and west facing windows. ❍ **Heat loss near windows and external walls**: There are more than a few complaints, e.g. if working near external walls in shade, sometimes feel cold during cold weather, and frequently feel cold at some locations in the building during very cold weather. There are some drafts. ❍ **Humidity**: In very dry or very humid climates, humidification or dehumidification is installed but it is inoperable or only partly effective. ❍ **Air movement**: In some areas there is no perceptible air movement, or too much air movement. Portable fans are common. The building is stuffy or drafty in many places, including at individual workstations.
2 ❑	
1 ❑ ❍ **THERMAL COMFORT FOR OCCUPANTS:** Air temperature same as exterior is acceptable when temperatures are above freezing. ❍ **THERMAL CONDITIONS FOR MACHINES:** Air temperature same as exterior is acceptable when temperatures are above freezing.	1 ❑ ❍ **Air temperature**: There are frequent complaints, e.g. occupants on one side of the building feel cold while occupants in another part feel hot. Adjustments in one zone worsen conditions in others.

FIG. 1 Scale A.4.1 for Temperature and Humidity *(continued)*

environment; or it may be a construction that is not a building. The term encompasses both the physical object and its use. E631

3.1.2 *facility serviceability*—the capability of a facility to perform the function(s) for which it is designed, used, or required to be used.

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Occupant Requirement Scale	Facility Rating Scale
1 continued ❍ **HUMIDITY FOR OCCUPANTS:** Humidity control is not required. Extreme humidity or dryness would not affect operations. ❍ **HUMIDITY FOR MACHINES:** Humidity control is not required. Extreme humidity or dryness would not affect operations. ❍ **AIR MOVEMENT:** Operations do not require air movement.	**1** continued ❍ **Solar gain near window:** There are many complaints, e.g. overheating if working near windows on the east, west, or south, due to uncontrolled solar gains. ❍ **Heat loss near windows and external walls:** There are many complaints, e.g. feeling cold near external walls or windows in shade, or during cold weather. ❍ **Humidity:** In very dry or very humid climates, no humidity control is installed. ❍ **Air movement:** There is no perceptible air movement, and many portable fans are used throughout the building. The building is generally stuffy or excessively drafty, including near windows and external walls in cold weather.

❑ Exceptionally important. ❑ Important. ❑ Minor Importance.	
Minimum Threshold level =	❑ NA ❑ NR ❑ Zero ❑ DP

NOTES *Space for handwritten notes*

FIG. 1 Scale A.4.1 for Temperature and Humidity *(continued)*

3.1.2.1 *Discussion*—The scope of this performance is of the facility as a system, including its subsystems, components and materials and their interactions, such as acoustical, hydrothermal, air purity, and economic; and of the relative importance of each performance requirement. **E631**

3.1.3 *office*—a place, such as a room, suite, or building, in which business, clerical, or professional activities are conducted. **E631**

3.1.4 For standard definitions of additional terms applicable to this classification, see Terminologies E631 and E1480.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *air, ventilation*—that portion of supply air that is outdoor air plus any recirculated air that has been treated for the purpose of maintaining acceptable indoor air quality. **ASHRAE 62-2001**

3.2.1.1 *Discussion*—This definition contains the term, "acceptable indoor air quality," which is defined by ASHRAE 62-2001 as, "air in which there are no known contaminants at harmful concentrations as determined by cognizant authorities and with which a substantial majority of the people exposed (80 % or more) do not express dissatisfaction."

3.2.2 *breathing zone*—the region in a workplace between desktop or tabletop and standing height, for example, between 0.7 m and 1.8 m above the floor, containing the air that occupants breathe in while working at their workplace.

3.2.3 *contaminant*—an unwanted airborne constituent that may reduce acceptability of the air. **ASHRAE 62-2001**

3.2.4 *dust*—an air suspension of particles (aerosol) of any solid material, usually with particle size less than 100 micrometres (µm). **ASHRAE 62-1999**

3.2.5 *filter efficiency*—percentage efficiency measured by ANSI/ASHRAE Standard 52.1-1992 Gravimetric and Dust-Spot procedures for Testing Air-Cleaning Devised Used in General Ventilation for Removing Particulate Matter.

3.2.6 *flushing*—running a building air conditioning system with 100 % outdoor air, and no recirculated air, in order to dilute the indoor air contaminants in the occupied zone (assuming well-mixed conditions in the occupied zone, so ventilation effectiveness approaches 100 %).

3.2.6.1 *Discussion*—In cold or hot weather, some buildings do not have sufficient heating or cooling capacity to maintain indoor temperatures within target range concurrently with flushing, or to bring it back within a recovery time acceptable to the building owner or occupants.

3.2.7 *fumes*—airborne particles, usually less than 1 micrometre in size, formed by condensation of vapors, sublimation, distillation, calcination, or chemical reaction. **ASHRAE 62-1999**

3.2.8 *HVAC*—heating, ventilating, and air conditioning equipment or system.

3.2.9 *occupied zone*—the region within an occupied space between planes 0.075 and 1.8 m (3 and 72 in.) above the floor and more than 0.6 m (2 ft) from the walls or fixed air conditioning equipment. **ASHRAE 62-2001**

3.2.10 *odor*—a quality of gasses, liquids, or particles that stimulates the olfactory organ. **ASHRAE 6-2001**

4. Significance and Use

4.1 Each Occupant Requirement Scale (see Figs. 1-5) in this classification provides a means to set the required level of serviceability of a building or facility for one topic of serviceability and to compare that level against any level of any other occupant, or of any building or facility

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Occupant Requirement Scale		Facility Rating Scale
9 ❑		9 ❑
❍ **OCCUPANT REACTION:** Occupants need to remain very alert at all times. Indoor air conditions that might cause people to be temporarily drowsy cannot be tolerated under any circumstances. ❍ **CONTAMINANTS:** Air reaching occupants must be free from noxious odors, from contaminants from building finishes and materials, and from contaminants produced by occupant operations.	8 ❑	❍ **Effects on occupants**: Indoor air conditions in the facility would never cause occupants to feel unwell or tired. There are no unpleasant odors or discernible contaminants. The air in the occupied zone smells fresh to the occupants. ❍ **Contaminants from building sources**: The facility has few finishes or materials that are likely sources of contaminants. When building materials are installed, e.g. painting, carpeting, or remodeling, air from affected zones is not recirculated until off-gassing has stabilized. The humidification system is checked for biological contaminants weekly. The cooling tower management includes a quarterly check for biological contaminants. Report within last twelve months indicates air balance is maintained at design level, and migration of pollutants between zones is prevented, without need for special discipline about keeping certain doors closed or open. ❍ **Exhaust to outside**: Contaminants that originate from occupant operations can be 100% exhaust vented directly to the outside from any location on the floor. Duct capacity is adequate for this, but rebalancing will be required if added volumes are large. ❍ **Smoking**: Smoking is not permitted within the building, or, smoking is only permitted in certain designated spaces, which do not include work areas, toilets or lobbies. Smoking areas are kept under air pressure that is negative to the rest of the building, and exhausted directly to the outside.
7 ❑		7 ❑
❍ **OCCUPANT REACTION:** Indoor air conditions must enable occupants to remain alert. ❍ **CONTAMINANTS:** Occupants must seldom notice odors in the air. Building finishes and materials contribute only minor contaminants to the air. Air reaching occupants must be free from contaminants produced by occupant operations.	6 ❑	❍ **Effects on occupants**: Indoor air conditions in the facility would never cause occupants to feel unwell or tired. There are few unpleasant odors or discernible contaminants. ❍ **Contaminants from building sources**: The facility has few finishes or materials that are likely sources of contaminants. Temporary enhanced ventilation can be provided in affected areas while freshly installed building materials are off-gassing, and can avoid recirculating air from affected areas. The humidification system is checked for biological contaminants monthly. The cooling tower management includes a semi-annual check for biological contaminants. Recent report indicates that to maintain air balance at design level, and prevent migration of pollutants between zones, occupants must comply with special discipline about keeping certain doors closed or open. ❍ **Exhaust to outside**: Contaminants that originate from occupant operations can be 100% exhaust vented directly to the outside from any location on the floor, but ducts may need to be realigned from an adjacent bay, and rebalanced. ❍ **Smoking**: Smoking is not permitted within work areas, toilets, or building lobby areas, but is permitted in commercial areas. Air from zones where smoking is permitted is kept separate from air from the rest of the building, and is exhausted directly to the outside.
5 ❑		5 ❑
❍ **OCCUPANT REACTION:** Occupants need to remain alert, but can tolerate occasional indoor air conditions in which some people feel a little drowsy. ❍ **CONTAMINANTS:** Occupants can occasionally tolerate poor indoor air		❍ **Effects on occupants**: Indoor air conditions in the facility occasionally cause occupants to feel unwell or tired. Indoor air does not smell noticeably contaminated or stale, except occasionally in a few parts of the facility. ❍ **Contaminants from building sources**: Some building finishes and materials are probable sources of indoor contamination, e.g. paint, glues, carpet. Temporary enhanced ventilation can be provided in affected areas while freshly installed building materials are off-gassing. The humidification system is checked for biological contaminants quarterly. The cooling tower management includes an annual check for biological contaminants. Recent report indicates air balance is not always maintained at design level, or not in

FIG. 2 Scale A.4.2 for Indoor Air Quality Conditions

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