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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

[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.

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[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, http://www.ashrae.org.

Occupant Requirement Scale		Facility Rating Scale
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.	9 ❑	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.
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.	8 ❑ 7 ❑	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. Terminology

3.1 *Definitions:*

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

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.
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.	4 ❑	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.
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.	2 ❑	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)*

3.1.1.1 *Discussion*—A facility may be within a building, a whole building, or a building with its site and surrounding environment; or it may be a construction that is not a building.

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)*

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.

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**

Occupant Requirement Scale		Facility Rating Scale
9 ❑ O 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. O 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 ❑	9 ❑ O 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. O 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. O 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. O 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 ❑ O OCCUPANT REACTION: Indoor air conditions must enable occupants to remain alert. O 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 ❑	7 ❑ O 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. O 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. O 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. O 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 ❑ O OCCUPANT REACTION: Occupants need to remain alert, but can tolerate occasional indoor air conditions in which some people feel a little drowsy. O CONTAMINANTS: Occupants can occasionally tolerate poor indoor air		5 ❑ O 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. O 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

Occupant Requirement Scale		Facility Rating Scale
5 continued conditions in some areas of the building, or contaminants caused by building finishes and materials or occupant operations. In spaces where there are no individual workplaces, e.g. archives file shelving, can tolerate some areas where airflow is less efficient because of this equipment, and some small stuffy areas.	**4** ❑	**5** continued some occupied parts of the facility, and this may allow migration of pollutants between zones. O **Exhaust to outside**: Contaminants that originate from occupant operations can be 100% exhaust vented directly to the outside from most locations on the floor, but added ductwork and rebalancing is always required. O **Smoking**: Smoking is not permitted within work areas or toilets, but is permitted in public and commercial areas. The system has been balanced to avoid air from smoking areas being mixed and recirculated to non-smoking areas.
3 ❑ O **OCCUPANT REACTION**: Occupants can tolerate poor indoor air conditions, e.g. that might make some people feel drowsy, or irritate eyes, throat or nose, etc. O **CONTAMINANTS**: Odors may be noticeable within 15 to 20 seconds after entering the building, and some symptoms of drowsiness, sore or irritated eyes, throat, nose, skin, or respiratory system may be experienced.	**2** ❑	**3** ❑ O **Effects on occupants**: Unpleasant odors are detected by most people working within the space. There are, or are likely to be, complaints of feeling unwell or tired, e.g. drowsiness, or irritation of the eyes, throat, nose, skin, respiratory system. O **Contaminants from building sources**: Many building finishes and materials, and occupant operations, are potential sources of indoor contamination, e.g. paint, glues, carpet, fiberglass, print shop, etc. The humidification system is only checked when a health problem occurs or during repairs. The air handling system requires balancing, as indicated by significant migration of pollutants between zones, or obvious imbalances in air distribution within some zones. O **Exhaust to outside**: Contaminants from occupant operations, e.g. wet process copiers or diazzo printers, can only be directly 100% vented to the outside from a few specific locations on the floor. O **Smoking**: Air from zones where smoking is permitted is part of the air recirculated through the building.
1 ❑ O **OCCUPANT REACTION**: Condition of indoor air is not a concern but must not be a health hazard, e.g. situations in which occupants are seldom present, or building is used mainly for storage or equipment. O **CONTAMINANTS**: Condition of indoor air is not a concern but must not be a health hazard, e.g. situations in which occupants are seldom present, or building is used mainly for storage or equipment.		**1** ❑ O **Effects on occupants**: Air is stale or obviously contaminated. Odors are obvious. There are, or are likely to be, frequent complaints of feeling unwell or tired if people were in the building all day, e.g. drowsiness, sore or irritated eyes, throat, nose, skin, respiratory system. O **Contaminants from building sources**: Many building finishes and materials are potential sources of indoor contamination, e.g. paint, glues, carpet, fiberglass, etc. The humidification system, if provided, is only checked when a health problem occurs. The air handling system is significantly out of balance, with obvious migration of pollutants between zones, and inappropriate air movement, e.g. strong draft through some doors. O **Exhaust to outside**: Contaminants from occupant operations, e.g. wet process copiers or diazzo printers, cannot be directly 100% vented to the outside from any location on the floor. O **Smoking**: Smoking may occur anywhere in the building, and air from all parts of the building is mixed and recirculated.

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

NOTES *Space for handwritten notes*

FIG. 2 Scale A.4.2 for Indoor Air Quality Conditions *(continued)*

Occupant Requirement Scale		Facility Rating Scale
9 ❑ O **QUALITY:** Require that ventilation air be of excellent quality; better than the level required by established industrial hygiene standards. O **QUANTITY:** Quantity of ventilation air must be sufficient to reach the breathing zone in all areas, with air movement occupants can perceive.		9 ❑ O **Quality of air in neighborhood**: Seasonal test reports and published official air quality ratings indicate incoming air quality is free of harmful contaminants at all times. The site is well clear of local sources of contaminants. O **Location of outdoor air intake**: Outdoor air intake and other sources of infiltration, e.g. doors to outside, are ideally located, e.g. where there is no risk of entrainment of exhaust air from any building exhaust or chimney, or machine or vehicle exhaust, or manufacturing, or other operation, or from people smoking outside the building etc. O **Air filtration system**: Filters having efficiency of 99.97 efficiency or greater, and pre-filters having arrestance of at least 98% and atmospheric dust spot efficiency (test per ASHRAE 52.1) at least 85%. Examples include extended-area pleated HEPA-type filters, of wet-laid ultrafine glass fiber paper. Building operators maintain correct filter service. There is a documented record of regular replacement or service, subject to independent quality control. O **Proportion of outside air**: Building operating engineers know what proportion of outside air is needed to meet needs for all occupant activities, and for occupants in office areas, washrooms and other occupied spaces. The building never falls below this. O **Flushing**: The ventilation system is capable of flushing with 100% outside air, and returning to normal ambient temperature within 12 hours, except on the 10% of days with the most extreme temperatures. O **Distribution of ventilation air**: Test records indicate that ventilation air reaches the breathing zone in all areas with the existing fitup, and is likely to reach the breathing zone in all areas with many other fitup options. There is perceptible air movement. At all times, the air smells fresh with no unpleasant odors.
	8 ❑	
7 ❑ O **QUALITY:** Quality of ventilation air must meet established industrial hygiene standards at all times while the facility is occupied. O **QUANTITY:** Quantity of ventilation air must be sufficient to meet needs of occupant activities, and must reach the breathing zone in all individual workplaces, and all other work areas.		7 ❑ O **Quality of air in neighborhood**: Recent test reports and published official air quality ratings indicate contaminants in incoming air are always within established industrial hygiene standards. O **Location of outdoor air intake**: Outdoor air intake and other sources of infiltration, e.g. doors to outside, are well located, e.g. remote from all local sources of contaminants such as building exhaust or chimney, or machine or vehicle exhaust, or manufacturing, or other operations, etc. or from people smoking outside the building. O **Air filtration system**: Filters have thermal DOB method efficiency (of 0.3 μm or greater) of at least 10% and atmospheric dust spot efficiency (test per ASHRAE 52.1) greater than 80%, and arrestance (test per ASHRAE 52.1) greater than 99%. Examples include extended-surface supported and non-supported filters of fine glass fibers, fine electret synthetic fibers, or wet-laid paper of cellulose-glass, synthetic, or all-glass fibers. Building operators maintain correct filter service. There is a documented record of regular replacement or service. O **Proportion of outside air**: Building operating engineers know what proportion of outside air is needed to meet needs for all occupant activities, and for occupants in offices and washrooms. The building rarely falls below this. O **Flushing**: The ventilation system is capable of flushing with 100% outside air and returning to ambient temperature within 24 hours if flushing is conducted the during the two most moderate months of the year, and within 36 hours if flushing is conducted during the remaining months of the year. O **Distribution of ventilation air**: Test records indicate ventilation air reaches the breathing zone in all areas with the existing fitup. There is perceptible air movement. There is no complaint of stuffiness from the occupants.
	6 ❑	

FIG. 3 Scale A.4.3 for Ventilation (Air Supply)

Occupant Requirement Scale		Facility Rating Scale
5 ❑ O QUALITY: Raised levels of contaminants may occur, but very rarely. O QUANTITY: Quantity of ventilation air, required by occupant activities, must reach the breathing zone in all individual workstations, and most other areas.		5 ❑ O Quality of air in neighborhood: Recent test reports and published official air quality ratings indicate outdoor air is occasionally sufficiently contaminated to be cause for concern. O Location of outdoor air intake: Outdoor air intake is suitably located, e.g. away from a main road, garage, building exhaust or chimney, or a loading dock or area where people smoke outside the building. O Air filtration system: Filters having atmospheric dust-spot efficiency (test per ASHRAE 52.1) greater than 35%, and arrestance (test per ASHRAE 52.1) greater than 75%. Examples include pleated panel-type filters of fine denier non-woven synthetic and synthetic-natural fiber blends, or all natural fiber. Building operators maintain correct filter service. There is a documented record of regular replacement or service.
	4 ❑	O Proportion of outdoor air: Building operating engineers have been told what proportion of outdoor air is needed to meet activities of the occupants and removal of contaminants in offices and washrooms. The building rarely falls below this, except at extremes of hot or cold weather. O Flushing: The ventilation system is capable of flushing with 100% outdoor air. During the most moderate month of the year, recovery of normal operating temperatures may take up to 48 hours. O Distribution of ventilation air: Ventilation air can reach the breathing zone in all but a few areas. There are some localized problems in areas fitted out and furnished, e.g. some obstruction by shelving or storage, or short-cutting at ceiling. There is, or is likely to be, some complaints of odors from the occupants in a few areas.
3 ❑ O QUALITY: Raised levels of contaminants may occur occasionally. O QUANTITY: Quantity of ventilation air required by industrial hygiene standards must reach the breathing zone in individual workstations, most of the time.		3 ❑ O Quality of air in neighborhood: Outdoor air is sometimes significantly contaminated. O Location of outdoor intake: The outdoor air intake is poorly located, e.g. downwind from an air exhaust under some weather conditions, or near where people smoke outside the building. O Air filtration system: Filters have arrestance (test per ASHRAE 52.1) greater than 70%, and atmospheric dust spot efficiency (test per ASHRAE 52.1) greater than 25%. Examples include panel-type filters of spun glass, open cell foams, expanded metal screens, synthetics, textile denier woven and non-woven, or animal hair. Filters on supply air systems are properly installed but are not replaced on the recommended schedule.
	2 ❑	O Proportion of outdoor air: At some periods of the year, there is a low proportion of outdoor air to makeup air, e.g. often below 15%. Building operating engineers state that they provide at least a minimum limit of 7.5 1/sec/person incoming air in office areas as the basis for setting or operating building systems. O Flushing: The system is not capable of flushing with 100% outdoor air, but can flush one part of the building at a time during moderate outdoor temperatures. O Distribution of ventilation air: Occupants do not perceive they are receiving ventilation air in the breathing zone, when furniture and screens are in place.

FIG. 3 Scale A.4.3 for Ventilation (Air Supply) *(continued)*

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.

Occupant Requirement Scale	Facility Rating Scale
1 ❑ ○ **QUALITY**: Occupants can tolerate levels which are lower than that required by typical industrial hygiene standards for quality of ventilation air, e.g. sometimes significantly contaminated. ○ **QUANTITY**: Quantity of ventilation air may be less than that required by typical engineering standards, e.g. sometimes significant lack of ventilation. The building is used mainly for storage or equipment, or people are rarely present, and then only for brief periods.	1 ❑ ○ Quality of air in neighborhood: Outdoor air is significantly contaminated much of the time. ○ Location of outdoor air intake: The outdoor air intake is very badly located, e.g. downwind from a pollution source, or next to an air exhaust, loading dock, or a garage, or where people smoke outside the building. ○ Air filtration system: There are no filters, or filters are inadequately installed or maintained, or filters are not replaced periodically, and are contaminated. ○ Proportion of outdoor air: There is a very low proportion of outdoor air to makeup air, e.g. often below 10% of outside air, and not adjusted to meet requirements of activities or pollution removal. ○ Flushing: The system is not capable of flushing with 100% outdoor air. ○ Distribution of ventilation air: Ventilation air is not detectable in the breathing zone, even without furniture.

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

NOTES *Space for handwritten notes*

FIG. 3 Scale A.4.3 for Ventilation (Air Supply) *(continued)*

4.2 Each Facility Rating Scale (see Figs. 1-5) in this classification provides a means to estimate the level of serviceability of a building or facility for one topic of serviceability and to compare that level against any level of requirement of any occupant, or of any other building or facility.

4.3 This classification can be used for comparing how well different buildings or facilities meet a particular requirement for serviceability. It is applicable despite differences such as location, structure, mechanical systems, age, and building shape.

4.4 This classification can be used to estimate the amount of variance of serviceability from target or from requirement, for a single office facility, or within a group of office facilities.

4.5 This classification can be used to estimate the following:

4.5.1 Serviceability of an existing facility for uses other than its present use.

4.5.2 Serviceability (potential) of a facility that has been planned but not yet built.

4.5.3 Serviceability (potential) of a facility for which remodeling has been planned.

4.6 Use of this classification does not result in building evaluation or diagnosis. Building evaluation or diagnosis generally requires a special expertise in building engineering or technology, and the use of instruments, tools, or measurements.

4.7 This classification applies only to facilities that are building constructions, or part thereof. (While classification may be useful in rating the serviceability of facilities that are not building constructions, such facilities are outside the scope of this classification. See discussion under definition 3.1.1.)

4.8 This classification is not intended for, and is not suitable for, use for regulatory purposes nor for fire hazard assessment nor for fire risk assessment.

5. Basis of Classification

5.1 The scales in Figs. 1-5 contain the basis for classification.

5.2 Instructions for the use of this classification are contained in Practices E1334 and E1679.

6. Keywords

6.1 air quality; building; facility; facility occupants; function; humidity; indoor air; office performance; rating; rating scale; requirements; serviceability; temperature; thermal environment; ventilation

Occupant Requirement Scale		Facility Rating Scale
9 ❑ O **TEMPERATURE CONTROL**: Occupants need a high level of control of temperature in each enclosed room and at each individual workstation. O **AIR MOVEMENT CONTROL**: Air supply or exhaust is controllable from all meeting and training rooms and at each individual workstation. O **WINDOW MANAGEMENT**: Openable windows and solar control devices such as blinds or curtains controlled by occupants are required.	8 ❑	9 ❑ O **Temperature**: In open plan areas, the temperature is thermostatically controlled at each workstation. In each enclosed room, an occupant-controlled thermostat exists. O **Air movement**: The mechanical air supply and/or exhaust is adjustable with multi-speed fans from all meeting and training rooms. Individual workstations each have individual control of air movement. O **Windows**: Windows are openable and used by occupants when outdoor conditions permit. Solar control devices are operable by occupants and effective, e.g. automatic integrated proprietary blind/window system with integral reflective coatings. Solar reflective glass is an alternative. Window coverings are restrained to avoid movement when windows are open. There is a partial loss of view from window coverings.
7 ❑ O **TEMPERATURE CONTROL**: Occupants need some control of temperature, within rooms situated at the exterior of the building and in small zones; e.g. 3 workstations along the exterior, and 6 workstations in interior zones. O **AIR MOVEMENT CONTROL**: Air supply or exhaust is controllable from all meeting and training rooms, and from small zones in open plan, e.g. 3 workstations along the exterior and 6 interior workstations. O **WINDOW MANAGEMENT**: Openable windows and solar control devices such as blinds or curtains controlled by occupants are required.	6 ❑	7 ❑ O **Temperature**: In open plan areas, the temperature can easily be thermostatically controlled from within the occupied space in zones no larger than 3 workstations or one room along the exterior, and zones of 6 interior workstations. In each enclosed room, an occupant-controlled thermostat can easily be installed. O **Air movement**: The mechanical air supply or exhaust is adjustable from all meeting and training rooms, and capable of control from within occupied space, in zones no larger than 3 workstations along the exterior, and zones of 6 interior workstations. O **Windows**: Windows are openable and used by occupants when outdoor conditions permit. Solar control devices are operable by occupants and generally effective, e.g. integrated proprietary blind/window system with coating(s). Solar reflective glass is an alternative. Standard interior blinds or curtains are not restrained to avoid movement when windows are open. There is a partial loss of view from window coverings.
5 ❑ O **TEMPERATURE CONTROL**: Need control of temperature by the building systems, within zones no larger than 3 rooms or 3 workstations along the exterior or zones of 10 interior workstations. O **AIR MOVEMENT CONTROL**: Occupants do not require local control of air supply, but conference/boardrooms need to have additional exhaust, controlled by occupants. O **WINDOW MANAGEMENT**: There may be a requirement for some windows to open, but there is no general requirement for windows to open. Window coverings need to allow control of heat gain and glare, although obstructing the view.	4 ❑	5 ❑ O **Temperature**: In open plan areas, the temperature can easily be thermostatically controlled from within the occupied zones by contacting the building operator to have the temperature adjusted, in zones no larger than 3 rooms or 3 workstations along the exterior, and zones of 10 interior workstations, and for groups of enclosed rooms. O **Air movement**: There is no local control of the mechanical air supply or exhaust by occupants. Conference/boardrooms have additional supply or exhaust, controlled from within the space by occupants. O **Windows**: Windows may or may not be openable. Standard type window coverings allow partial control of solar gains and glare on east and west sides of the building, and on facade facing sun at mid-day, but only with a loss of view. Solar glazing is an alternative.

FIG. 4 Scale A.4.4 for Local Adjustments by Occupants

Occupant Requirement Scale		Facility Rating Scale
3 ❑ O TEMPERATURE CONTROL: Occupants do not require local control of temperature, mechanical air supply, or exhaust except by requesting the building manager to make a change. O AIR MOVEMENT CONTROL: Occupants do not require local control of temperature, mechanical air supply, or exhaust except by requesting the building manager to make a change. O WINDOW MANAGEMENT: Occupants do not require windows to open. Window coverings need to allow some control of heat gain and glare, although obstructing the view.	2 ❑	3 ❑ O Temperature: There is no local control of temperature by occupants, but thermostat control for not more than one quarter of one floor can be reset by building operator upon request by occupants. O Air movement: There is no local control of the mechanical air supply or exhaust by occupants, but building operator can respond within hours upon request by occupants. O Windows: Windows are not openable, and window coverings allow only minimal control of solar gains and glare on east and west sides of the building, and obstruct the view.
1 ❑ O TEMPERATURE CONTROL: Occupants do not require local control of temperature, mechanical air supply, or exhaust. O AIR MOVEMENT CONTROL: Occupants do not require local control of temperature, mechanical air supply, or exhaust. O WINDOW MANAGEMENT: Occupants do not require windows to open. Window coverings need to allow some control of heat gain and glare, although obstructing the view.		1 ❑ O Temperature: There is no local control of temperature by occupants, and no capability of the building operator to re-set thermostats or other control for zones of less than one quarter of one floor. O Air movement: There is no local control of the mechanical air supply or exhaust by occupants, nor by building operator for zones of less than one quarter of one floor. O Windows: Windows are not openable. There are no window coverings, or window coverings are not effective in the control of solar gains and glare.

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

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FIG. 4 Scale A.4.4 for Local Adjustments by Occupants *(continued)*

Occupant Requirement Scale	Facility Rating Scale
9 ❑ O **NATURAL VENTILATION**: Require sufficient openable windows, and floor plate dimensions to enable ventilation from outdoor air for all occupied spaces. O **MECHANICAL VENTILATION**: Require a complete mechanical HVAC system, to operate as a sealed building, when conditions are not appropriate for opening windows. O **VENTILATION OPERATION**: Require that when conditions are appropriate, occupants to be requested to use openable windows as the primary source of ventilation air. When windows remain closed, the mechanical HVAC system will operate. O **OPENABLE WINDOWS**: Require that openable windows be interlocked with supply ventilation systems, so both systems are not operating at the same time, and windows can be automatically closed after hours or at storm warnings.	9 ❑ O **Distance from openable windows**: Maximum two rows of desks from openable windows to corridor or central aisle. O **Building fabric**: No air infiltration from walls or through or around openable windows that are closed. O **Natural airflow**: Airflow tests indicate that natural ventilation airflow between open windows and building exhaust outlets effectively covers the entire occupied zone. The occupied zone is the occupied space from 0.075 m and 1.8 m (3 in and 72 in) and more than 0.6 m (24 in) from the walls or fixed air conditioning equipment. O **Mechanical controls**: Heating, cooling, and humidification systems for a space do not operate when signal indicates more than 10% of openable windows in that space are in use. Supply air from the mechanical system is reduced, and then discontinued as more than 50% of the windows are opened. O **Air cleaning**: Re-circulated air in the mechanical ventilation system is cleaned by filters and such other cleaning devices as required to remove contaminants. O **Window controls**: All openable windows have sensors connected to the automated building control system. Windows are interlocked in banks, with motorized controls, so occupants can open windows to any position with a local switch, and the building operator can close all windows in inactive hours.
8 ❑	
7 ❑ O **NATURAL VENTILATION**: Require sufficient openable windows, and floor plate dimensions to enable ventilation from outdoor air for most occupied spaces. O **MECHANICAL VENTILATION**: Require a mechanical HVAC system, to operate as a sealed building, when occupants are not opening windows during active hours. O **VENTILATION OPERATION**: Require that when conditions are appropriate, occupants to be encouraged to open windows as the primary source of ventilation air. When windows remain closed, the mechanical HVAC system will operate. O **OPENABLE WINDOWS**: Require that openable windows be interlocked with mechanical systems, so that mechanical systems do not 'fight' with the natural ventilation. Windows can be closed after hours by a signal from the building operator.	7 ❑ O **Distance from openable windows**: Maximum three rows of desks from openable windows to corridor or central aisle. O **Building fabric**: Minor air infiltration at openable windows. O **Natural airflow**: Airflow tests indicate that natural ventilation airflow between open windows and building exhaust outlets covers 80% (i.e. mainly) of the occupied zone. The occupied zone is the occupied space from 0.075 m and 1.8 m (3 in and 72 in) and more than 0.6 m (24 in) from the walls or fixed air conditioning equipment. O **Mechanical controls**: Heating, cooling, and humidification systems do not operate when signal indicates more than 20% of openable windows are open. Supply air from the mechanical system is discontinued in zones where more than 25% of the windows are opened. O **Air cleaning**: Re-circulated air in the mechanical ventilation system is cleaned by filters and such other cleaning devices to reduce the concentration of contaminants. O **Window controls**: All openable windows have sensors connected to the automated building control system. Occupants can open individual windows to any position manually. The building operator has a signal from each window left open, so they can be closed in inactive hours.
6 ❑	

FIG. 5 Scale A.4.5 for Ventilation with Openable Windows

Occupant Requirement Scale	Facility Rating Scale
5 ❑ O **NATURAL VENTILATION**: Require sufficient openable windows, and floor plate dimensions to enable ventilation from outdoor air for office rooms. O **MECHANICAL VENTILATION**: Requires a mechanical HVAC system, to operate as a sealed building, when occupants are not opening windows for several hours at a time. O **VENTILATION OPERATION**: Require that when conditions are appropriate, occupants to be allowed to use openable windows as a major source of ventilation air. When windows remain closed, the mechanical system can provide adequate ventilation for several hours. O **OPENABLE WINDOWS**: Require that openable windows be interlocked with heating system, so under-window heating will close when windows are open, and that openable windows are alarmed, indicating to the building operator on which floor windows have been left open after hours.	5 ❑ O **Distance from openable windows**: Maximum four rows of desks from openable windows to corridor. O **Building fabric**: Moderate air infiltration at openable windows. O **Natural airflow**: Airflow tests indicate that natural ventilation airflow between open windows and building exhaust outlets covers 60% (i.e. much) of the occupied zone. The occupied zone is the occupied space from 0.075 m and 1.8 m (3 in and 72 in) and more than 0.6 m (24 in) from the walls or fixed air conditioning equipment. 4 ❑ O **Mechanical controls**: Heating, cooling, and humidification systems do not operate when weather and air pollution reports indicate that outdoor air conditions are suitable for occupants to open windows. Supply air from the mechanical system is discontinued in the perimeter zones where open windows can supply sufficient ventilation air. O **Air cleaning**: Re-circulated air in the mechanical ventilation system is cleaned by filters to reduce the concentration of contaminants. O **Window controls**: All openable windows have sensors connected to the automated building control system. Occupants can open individual windows to any position manually. The building operator has a signal from each floor where windows have been left open, so they can be closed in inactive hours.
3 ❑ O **NATURAL VENTILATION**: Require sufficient openable windows, to provide ventilation from outdoor air for office spaces that are adjacent to the windows. O **MECHANICAL VENTILATION**: Require a mechanical HVAC system, to provide ventilation when occupants are not opening windows, and provide ventilation for spaces not receiving air from open windows. O **VENTILATION OPERATION**: Require that when conditions are appropriate, occupants to be allowed to use openable windows as a major source of ventilation air. When windows remain closed, the mechanical system can provide ventilation. O **OPENABLE WINDOWS**. Require that openable windows be the responsibility of the occupants to close windows at extreme temperatures, at stormy weather, and at the end of the working day.	3 ❑ O **Distance from openable windows**: Deep open office areas with 50% of desks remote from openable windows. O **Building fabric**: Noticeable air infiltration at wall perimeter and at openable windows. O **Natural airflow**: Airflow tests indicate that natural ventilation airflow between open windows and building exhaust outlets covers 35% (i.e. about a third) of the occupied zone. The occupied zone is the occupied space from 0.075 m and 1.8 m (3 in and 72 in) and more than 0.6 m (24 in) from the walls or fixed air conditioning equipment. 2 ❑ O **Mechanical controls**: Building operator can determine, or occupants can request that the heating, cooling, and humidification systems, and the mechanical supply air system in the perimeter zones, not operate when outdoor air conditions are suitable for occupants to open windows. O **Air cleaning**: There is no air cleaning device on the re-circulated air system. O **Window controls**: Openable windows do not have sensors connected to an automated building control system. Occupants can open individual windows to any position manually. The building operator depends on the occupants and the cleaning staff to ensure windows are closed in inactive hours.

FIG. 5 Scale A.4.5 for Ventilation with Openable Windows *(continued)*

Occupant Requirement Scale	Facility Rating Scale
1 ❑ O **NATURAL VENTILATION**: Require that existing windows be openable, to provide some ventilation from outdoor air for occupied spaces. O **MECHANICAL VENTILATION**: Require a mechanical system, to provide exhaust for air from openable windows, and for washroom exhaust. O **VENTILATION OPERATION**: Require that when conditions are appropriate, occupants will open windows for ventilation air. When windows remain closed, the mechanical system can provide minimum ventilation. O **OPENABLE WINDOWS**: Require that occupants use the available openable windows for their ventilation air, and that they be responsible for closing the windows at the end of the working day.	1 ❑ O **Distance from openable windows**: Deep open office areas with 75% of desks remote from openable windows. O **Building fabric**: Wall perimeter and windows contribute a major portion of the building ventilation. O **Mechanical controls**: Each mechanical system is independently controlled manually by the building operator. O **Air cleaning**: There is no air cleaning device on the re-circulated air system. O **Window controls**: Opening and closing windows is the responsibility of the occupants.

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

NOTES *Space for handwritten notes*

FIG. 5 Scale A.4.5 for Ventilation with Openable Windows *(continued)*