

**INTERPRETATION IC 55-2004-1 OF
ANSI/ASHRAE STANDARD 55-2004
THERMAL ENVIRONMENTAL CONDITIONS FOR HUMAN OCCUPANCY**

Date Approved: June 25, 2005

Request from: Larry Spielvogel, PE, Engineer, 31343 Valley Forge Circle, King of Prussia, PA 19406.

Reference: This request for interpretation refers to the requirements in ANSI/ASHRAE Standard 55-2004, Sections 5.2.1.1 and 5.2.2, and Figure 5.2.1.1 relating to the acceptable range of operative temperature and humidity.

Background: The upper limit of humidity shown in the referenced sections corresponds to a humidity ratio of 0.12. This high humidity level may result in condensation on building surfaces which in turn can lead to microbial growth.

Interpretation: The upper humidity limit in Standard 55 is based on achieving conditions acceptable for human comfort. Addressing the potential for condensation that can lead to biological contamination is beyond the scope of Standard 55.

Question: Is the interpretation correct?

Answer: Yes.

Comments: Standard 55 provides guidance on humidity limits only as supported by the available thermal comfort research. Users of the Standard seeking guidance on humidity limits relating to issues other than thermal comfort should rely on the appropriate ANSI/ASHRAE Standards and ASHRAE Handbooks. For issues relating to microbiological amplification and indoor air quality, two appropriate standards are ANSI/ASHRAE Standard 62.1 *Ventilation for Acceptable Indoor Air Quality* and ANSI/ASHRAE Standard 62.2 *Ventilation and Acceptable Indoor Air Quality in Low-Rise Residential Buildings*.

**INTERPRETATION IC 55-2004-2 OF
ANSI/ASHRAE STANDARD 55-2004
THERMAL ENVIRONMENTAL CONDITIONS FOR HUMAN OCCUPANCY**

Date Approved: January 27, 2007

Request from: Brad Trott (brad.trott@pwgsc.gc.ca), Public Works & Government Services Canada, Telus Plaza North, 5th Floor, 10025 Jasper Avenue, Edmonton, Alberta T5J 1S6.

Reference: This request for interpretation refers to the requirements in ANSI/ASHRAE Standard 55-2004, Section 5.2.4.1, Table 5.2.4.1 and Figure 5.2.4.1 relating to the allowable radiant temperature asymmetry.

Background: Section 5.2.4.1 of ASHRAE Standard 55-2004 provides limits on the temperature of cold and hot surfaces around the body based on the difference to the operative temperature. However the Standard does not provide any information on percentage of area, distances, or angle factors of the surface. Also, there is no allowance for composite conditions that may provide for flexibility in design of systems such as radiant ceiling panel heating systems.

Interpretation No. 1: In our geographic area it has become common practise to design hot water radiant heating systems to offset skin losses of the building. Typically the radiant panel will be approximately 16 inches wide installed in the ceiling of the perimeter zone. Based on the prescriptive requirements in Table 5.2.4.1 of the Standard, this means that the maximum design temperature of the radiant ceiling system is to be no more than 5°C (for a warm ceiling) above the operative temperature, regardless of the area of the ceiling that this element may comprise.

Question No. 1: Is the interpretation correct?

Answer No. 1: No.

Comments No. 1: The radiant temperature asymmetry and the plane radiant temperature are defined in Section 2 of the Standard and further treated in Section 5.4. The ceiling in its entirety is subject to the limits on radiant temperature asymmetry, not a discreet portion of it. The plane radiant temperature of the ceiling is limited to no more than 5°C above the plane radiant temperature of the floor. The space needs to be evaluated with respect to this and all other requirements of the Standard, including vertical temperature difference in the occupied zone. The Standard provides direct reference to information on angle factor calculations in ASHRAE Fundamentals Handbook in Section 5.4.

Interpretation No. 2: Similarly, Table 5.2.4.1 of the Standard seems to imply that the window surface may be no more than 10°C colder (for a cool wall) than the operative temperature. Even with thermal breaks, the window mullion will be much colder than the glazed surface. Although this mullion area is a small portion compared to the wall area for that space, again is it to be interpreted that regardless of percentage of area, the stated limits are absolutes.

Question No. 2: Is the interpretation correct?

Answer No. 2: No.

Comments No. 2: See Comment One.

Interpretation No. 3: The above examples are relative to a body being exposed to a nearby surface as stated. The same would apply to a body at some distance or some angle from the hot or cold surface.

Question No. 3: Is the interpretation correct?

Answer No. 3: No.

Comments No. 3: See Comment One. Angle factor calculations will change.

Interpretation No. 4: Is it acceptable to consider composite conditions in the space to compensate for the design of a system or selection of a component that does not meet the prescriptive requirements of this particular section of the Standard.

Question No. 4: Is the interpretation correct?

Answer No. 4: No

Comments No. 4: There is no requirement for a single component to meet prescriptive requirements. Composite conditions are addressed by the angle factor calculations to which the Standard refers.

**INTERPRETATION IC 55-2004-3 OF
ANSI/ASHRAE STANDARD 55-2004
THERMAL ENVIRONMENTAL CONDITIONS FOR HUMAN OCCUPANCY**

Date Approved: November 26, 2010

Request from: Laura Petrillo (lpetrillo@ahrinet.org), Air-Conditioning, Heating, and Refrigeration Institute, 2111 Wilson Boulevard, Suite 500, Arlington, VA 22201 submitted on behalf of AHRI's Humidifiers Product Section, the past Chair of TC 2.1, Dr. Eric W. Adams (eric.adams@carrier.utc.com), and the current Vice-Chair of TC 2.1, Mark Jackson (mark.jackson@LennoxInd.com).

Reference: This request for interpretation refers to the requirements in ANSI/ASHRAE Standard 55-2004, Section 5.2.2, relating to a lower humidity limit for thermal comfort.

Background: ASHRAE Technical Committee 2.1 (TC 2.1) has sponsored research that shows that people can be thermally neutral at very low levels of humidity. It is our understanding that the "lower" humidity bound in Standard 55 was removed as a result. In paragraph 2 of Section 5.2.2 of Standard 55 (2004 version) "There are no established lower humidity limits for thermal comfort; consequently, this standard does not specify a minimum humidity level. However, non-thermal comfort factors such as skin drying, irritation of mucus membranes, dryness of the eyes, and static electricity generation, may place limits on the acceptability of very low humidity environments."

We believe this paragraph to be contradictory to Section 1 of Standard 55 (Purpose), which states: "The purpose of this standard is to specify the combination of indoor thermal environmental factors and personal factors that will produce thermal environmental conditions acceptable to a majority of the occupants within the space." The purpose does not limit the acceptability criteria to thermal comfort.

Interpretation: We interpret the purpose of Standard 55 to mean the standard should specify the thermal environmental conditions for all types of acceptability reasons, such as static electricity, skin dryness, eye and nose dryness, etc. (not just thermal).

Question: Is the interpretation correct?

Answer: No, the interpretation is not correct.

Comments:

1. Factors referred to in the standard are thermal factors; that is they concern themselves exclusively with occupant perceptions of heating and cooling comfort. Other environmental conditions (static electricity) and physiological responses (skin drying, irritation of mucous membranes, dryness of the eyes) potentially attributable in part to the thermal conditions fall outside the purpose and scope of the standard.
2. Supporting text and commentary

- a. Section 2.1 states, *“The environmental factors addressed in this standard are temperature, thermal radiation, humidity, and air speed; the personal factors are those of activity and clothing.”*
 - i. Based on section 2.1, the purpose (section 1) is served when the standard is used to, *“... specify the combinations of indoor thermal environmental factors and personal factors that will produce thermal environmental conditions acceptable to a majority of the occupants within the space.”*
- b. Section 2.4 states, *“This standard does not address such nonthermal environmental factors as air quality, acoustics, and illumination or other physical, chemical, or biological space contaminants that may affect comfort or health.”*
- c. Section 3. Definitions states, **“environment thermal:** *the characteristics of the environment that affect a person's heat loss”*
 - i. Equations and theory contained in the subsequent body of the standard are based on heat loss and the resulting effect on thermal comfort.

**INTERPRETATION IC 55-2010-1 OF
ANSI/ASHRAE STANDARD 55-2010
THERMAL ENVIRONMENTAL CONDITIONS FOR HUMAN OCCUPANCY**

Date Approved: June 3, 2014

Request from: Ronald B. Bailey (Ron@baileyeng.com), Bailey Engineering Corporation, 860 Jupiter Park Drive, Jupiter, FL 33458.

Reference: This request for interpretation refers to requirements in ANSI/ASHRAE Standard 55-2010, Section 5.1 (Page 4) relating to humidity and related steady state conditions.

Background: According to Section 5.1 “There are six primary factors that must be addressed when defining conditions for human comfort.” One of those factors is shown as item “6. Humidity.”

The Standard goes on to state that “all six of these factors may vary with time. However this Standard only addresses thermal comfort in a steady state (with some limited specifications for temperature variations with time in Section 5.2.5).”

Under Section 5.4 (Page 12) “Description of thermal Environmental Variables.” It states “Humidity...” “It is spatially and temporally averaged in the same manner as air temperature.”

The Standard sets an upper recommended humidity limit of 0.012 humidity ratio with no recommended lower humidity limits shown in Figure 5.2.1.1 “Acceptable range of operative temperature and humidity for spaces that meet the criteria specified in Section 5.2.1.1” (Page 5). The humidity limit is boxed by operative temperatures on these charts. “Steady State” is not found as a defined term in the standard.

Interpretation: The humidity, like the temperature must be in a “steady state” with some limited variations for the temperature much like is discussed with the temperature in Section 5.2.5 of the Standard. The humidity ratio should not be considered to be dynamic in the ranges of the comfort “envelope” even if they stay within the limits as defined by the envelope of parameters shown in Figure 5.2.1.1.

In other words, the humidity ratio would not be expected to change much if any under “steady state” conditions in a 15 minute period. Cyclic variation over a time period such as 15 minutes is not anticipated by ASHRAE Standard 55-2010 as being a “steady state”.

Question: Is the interpretation correct?

Answer: No, Standard 55 has no requirements for the rate of change of humidity. Thus there is no requirement for humidity to be in steady state. It is permitted to assume a single value for humidity that is averaged spatially and temporally as described in Section 5.4. For clarification, the upper humidity limit of 0.012 humidity ratio only applies to the graphical method in 55-2010.

**INTERPRETATION IC 55-2013-1 OF
ANSI/ASHRAE STANDARD 55-2013
THERMAL ENVIRONMENTAL CONDITIONS FOR HUMAN OCCUPANCY**

Date Approved: September 8, 2014

Request from: Robert Bean (k9cave@shaw.ca), Indoor Climate Consultants Inc., 347 Willow Ridge Pl. S.E., Calgary, Ab. T2J 1N2.

Reference: This request for interpretation refers to requirements in ANSI/ASHRAE Standard 55-2013, Sections 1 and 2 (Page 4), relating to the purpose and scope of Standard 55-2013.

Background: It has been the experience of this user that ANSI/ASHRAE Standard 55, *Thermal Environmental Conditions for Human Occupancy*, is incorrectly deemed by building officials, regulators, designers and others involved in housing to be not applicable to residential construction. Reference to the Standard is absent from such housing programs as LEED, RESNET and ENERGY STAR et al and from building code sections addressing residential construction. Additionally, a typical building code statement addressing thermal conditions in homes is, "...required heating facilities shall be capable of maintaining an *indoor air temperature of not less than 22°C (71.6°F)* in all living spaces." (ref.: NBC of Canada). Such statements ignore at least 9 other thermal comfort parameters identified in the 55 Standard. Furthermore in ASHRAE's recent publication, "Final Report: ASHRAE and the Residential Construction Market" there is not (as far as I could tell) a single reference to thermal comfort. Nor (as far as I could tell) is there a Standard 55 Purpose and Scope representative in the exhaustive list of committee members and invited stakeholders.

Interpretation: Despite the absence of reference to thermal comfort in residential codes, building programs and housing reports, I am interpreting ANSI/ASHRAE Standard 55, *Thermal Environmental Conditions for Human Occupancy*, as applicable to single and multi-family residential construction excluding those activities and clothing ensembles defined by Section 5.2.2.3 Limits of Applicability.

Question: Is the interpretation correct?

Answer: Yes; ANSI/ASHRAE Standard 55, *Thermal Environmental Conditions for Human Occupancy*, is applicable to single and multi-family residential construction excluding those activities and clothing ensembles defined by Section 5.2.2.3 Limits of Applicability."

**INTERPRETATION IC 55-2013-2 OF
ANSI/ASHRAE STANDARD 55-2013
THERMAL ENVIRONMENTAL CONDITIONS FOR HUMAN OCCUPANCY**

Date Approved: May 4, 2015

Request from: Lawrence J. Schoen, Schoen Engineering Inc., 10478 Waterfowl Terrace, Columbia, MD 21044.

Reference: This request for interpretation refers to requirements in ANSI/ASHRAE Standard 55-2013, Section 5.4.1a, relating to the applicability of the method described in Section 5.4.

Background: A system meets Standard 62.1 using a dedicated outdoor air system (DOAS) with cooling and heating sized and controlled so that the outdoor air does not impose a thermal load on the space. Standard 55-2013 Section 5.4.1 states that Section 5.4 applies only to “...**spaces** that meet all of the following criteria: a. There is no mechanical cooling system (e.g., refrigerated air conditioning, radiant cooling, or desiccant cooling) installed. No heating system is in operation.”

Interpretation No.1: A DOAS sized and dynamically controlled only to counteract thermal loads of outdoor air and not to cool the space loads meets the requirement in the first sentence of 5.4.1a.

Question No.1: Is the interpretation correct?

Answer No.1: No.

Comments No.1: This interpretation is not correct. A mechanical cooling system is installed.

Interpretation No.2: A DOAS dynamically controlled only to counteract thermal loads of outdoor air and not to heat the space meets the requirement in the second sentence of 5.4.1a, even when it is in operation.

Question No.2: Is the interpretation correct?

Answer No.2: No.

Comments No.2: This interpretation is not correct. A heating system is in operation.