ANSI/ASHRAE/IES Addenda e, as, az, bg, bh, bj, bk, bl, bm, bo, bq, br, bv, and bw to ANSI/ASHRAE/IESNA Standard 90.1-2007

ASHRAE STANDARD

Energy Standard for Buildings Except Low-Rise Residential Buildings

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FOREWORD

Most buildings require outdoor air intake to meet the ventilation requirements as defined by ASHRAE 62.1. This air has to be heating, cooled and dehumidified which can result in significant energy use. Due to intake of outdoor air the HVAC system will also have to provide for exhausting air. There is a potential to recover both heating and cooling energy from the exhaust air and transfer it to the outdoor air. This addendum involves a change to the exhaust air energy recovery requirements in section 6.3.2 (e) and 6.5.6. Extensive energy analysis and economic justification has been performed to develop expanded requirements for energy recovery. They are now defined by the design supply fan airflow rate, climate zone, and the % outdoor air at full design airflow rate. The addendum also harmonizes the requirements in the simplified section 6.3.2 with the requirements in the 6.5 prescriptive path. These changes will result in significant energy savings for buildings with outdoor airflow rates 30% and greater.

Addendum e to 90.1-2007

Revise the Standard as follows (I-P units)

6.3.2 Criteria: HVAC system must meet ALL of the following criteria:

~~e. The *outdoor air* quantity supplied by the system shall be less than or equal to 3000 cfm and less than 70% of the supply air quantity at minimum *outdoor air* design conditions unless an energy recovery ventilation system is provided in accordance with the requirements in Section 6.5.6.~~

e. The system shall meet the energy recovery requirements of section 6.5.6.1.

Replace 6.5.6 in its entirety and add new Section 6.5.6 as follows:

6.5.6 Energy Recovery

6.5.6.1 Exhaust Air Energy Recovery. Each fan system shall have an energy recovery system when the system's supply air flow rate exceeds the value listed in table 6.5.6.1 based on the climate zone and percentage of *outdoor air* flow rate at design conditions.

Energy recovery systems required by this section shall have at least 50% energy recovery effectiveness. Fifty percent energy recovery effectiveness shall mean a change in the enthalpy of the *outdoor air* supply equal to 50% of the difference between the *outdoor air* and return air enthalpies at design conditions. Provision shall be made to bypass or control the energy recovery system to permit air economizer operation as required by 6.5.1.1.

Exceptions to 6.5.6.1:

a. Laboratory systems meeting 6.5.7.2.
b. Systems serving spaces that are not cooled and that are heated to less than 60°F.
c. Systems exhausting toxic, flammable, paint, or corrosive fumes or dust.
d. Commercial kitchen hoods used for collecting and removing grease vapors and smoke.
e. Where more than 60% of the *outdoor air* heating energy is provided from site-recovered or site solar energy.
f. Heating energy recovery in climate zones 1 and 2.
g. Cooling energy recovery in climate zones 3c, 4c, 5b, 5c, 6b, 7, and 8.
h. Where the largest source of air exhausted at a single location at the building exterior is less than 75% of the design *outdoor air* flow rate.
i. Systems requiring dehumidification that employ energy recovery in series with the cooling coil.
j. Systems expected to operate less than 20 hrs per week at the *outdoor air* percentage covered by table 6.5.6.1

TABLE 6.5.6.1 Energy Recovery Requirement (I-P)

Zone	% *Outdoor air* at full design airflow rate					
	≥30% and < 40%	≥40% and < 50%	≥50% and < 60%	≥60% and < 70%	≥70% and < 80%	≥80%
	Design Supply Fan airflow rate (cfm)					
3B, 3C, 4B, 4C, 5B	NR	NR	NR	NR	≥5000	≥5000
1B, 2B,5C	NR	NR	≥26000	≥12000	≥5000	≥4000
6B	≥11000	≥5500	≥4500	≥3500	≥2500	≥1500
1A, 2A, 3A, 4A, 5A, 6A	≥5500	≥4500	≥3500	≥2000	≥1000	>0
7,8	≥2500	≥1000	>0	>0	>0	>0

NR—Not required

Revise the Standard as follows (SI units)

6.3.2 Criteria: HVAC system must meet ALL of the following criteria:

~~e. The *outdoor air* quantity supplied by the system shall be less than or equal to 3000 cfm and less than 70% of the supply air quantity at minimum *outdoor air* design conditions unless an energy recovery ventilation system is provided in accordance with the requirements in Section 6.5.6.~~

e. The system shall meet the energy recovery requirements of section 6.5.6.1.

Replace 6.5.6 in its entirety and add new Section 6.5.6 as follows

6.5.6 Energy Recovery. Each fan system shall have an energy recovery system when the system's supply air flow rate exceeds the value listed in table 6.5.6.1 based on the climate zone and percentage of *outdoor air* flow rate at design conditions.

Energy recovery systems required by this section shall have at least 50% energy recovery effectiveness. Fifty percent energy recovery effectiveness shall mean a change in the enthalpy of the *outdoor air* supply equal to 50% of the difference between the *outdoor air* and return air enthalpies at design conditions. Provision shall be made to bypass or control the energy recovery system to permit air economizer operation as required by 6.5.1.1.

Exceptions to 6.5.6.1:

a. Laboratory systems meeting 6.5.7.2.
b. Systems serving spaces that are not cooled and that are heated to less than 15.5°C.
c. Systems exhausting toxic, flammable, paint, or corrosive fumes or dust.
d. Commercial kitchen hoods used for collecting and removing grease vapors and smoke.
e. Where more than 60% of the *outdoor air* heating energy is provided from site-recovered or site solar energy.
f. Heating energy recovery in climate zones 1 and 2.
g. Cooling energy recovery in climate zones 3c, 4c, 5b, 5c, 6b, 7, and 8.
h. Where the largest source of air exhausted at a single location at the building exterior is less than 75% of the design *outdoor air* flow rate.
i. Systems requiring dehumidification that employ energy recovery in series with the cooling coil.
j. Systems expected to operate less than 20 hrs per week at the *outdoor air* percentage covered by table 6.5.6.1

TABLE 6.5.6.1 Energy Recovery Requirement (SI)

Zone	% *Outdoor air* at design at full design airflow rate					
	≥30% and < 40%	≥40% and < 50%	≥50% and < 60%	≥60% and < 70%	≥70% and < 80%	≥80%
	Design Supply Fan airflow rate (L/sec)					
3B, 3C, 4B, 4C, 5B	NR	NR	NR	NR	≥2360	≥2360
1B, 2B,5C	NR	NR	≥12271	≥5663	≥2360	≥1888
6B	≥5191	≥2596	≥2124	≥1652	≥1180	≥708
1A, 2A, 3A, 4A, 5A, 6A	≥2596	≥2124	≥1652	≥944	≥472	>0
7,8	≥1180	≥472	>0	>0	>0	>0

NR—Not required

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FOREWORD

The lab working group with members from 90.1, TC9.10 (Lab Systems) and Labs 21 collectively developed the following changes to the standard:

1. Recognize "accreditation standards" so that designs that must follow these requirements are able to comply. This has been a problem for labs and health care, but may apply to other applications as well. In making these changes the working group discovered that some practitioners are utilizing constant volume reheat systems in hospitals. They have interpreted the accreditation standards to require absolute neutral pressure for rooms not specifically defined as having airflow out or into the room and have taken the exception in 6.5.2.1 Zone Controls citing variable volume systems as being impractical. The working group has spoken with the Facility Guidelines Institute (FGI) that maintains the AIA Guidelines for Design and Construction of Health Care Facilities, the TC for Standard 170 – Ventilation of Health Care Facilities and the Florida Health Care Administration (a state cited as being impacted by the proposed changes) and confirmed that there is not a requirement for absolute neutral pressure in their standards for spaces such as general patient rooms and that VAV systems can be utilized for such spaces. It was the opinion of the working group that the exception allowing constant volume reheat was no longer needed and has proposed removing it from the standard. The working group is aware of one state that does have code language for hospitals that states "neutral" pressure for some spaces such as general patient rooms. If this addendum is approved the working group will recommend to the SSPC to notify that state of the change in 90.1.

2. Revise paragraph 6.5.7.2 "Fume Hoods" to correct deficiencies in the requirements that are preventing some laboratory designs from complying. As currently written there are three (3) options to reduce energy for laboratory exhaust systems for systems larger than 15,000 cfm. One method is the ability to reduce exhaust and makeup air flow rates by at least 50%. This is the most utilized method for compliance however some designs (i.e. those with minimal exhaust hoods and equipment loads) have relatively low design airflow rates and turning down the airflow rates by 50% result in air changes that are extremely low and in some cases below levels required by accredited standards. Another method for compliance required a minimum 50% total heat recovery effectiveness which in most cases cannot be achieved by a run-around loop which is the predominant method of heat recovery for lab exhaust systems. The last method for compliance cannot be utilized for systems that must have dehumidification capability and as a result is not able to be utilized in many climate zones. In addition to revising these requirements the working group had consensus that the 15,000 cfm threshold should be reduced to 5,000 cfm in that systems of this size still represent multi hood and/or multi zone spaces and the components utilized in 5,000 cfm systems are normally the same type of components utilized in 15,000 cfm and larger systems.

Addendum as to 90.1-2007

Revise the Standard as follows (I-P units)

New Definition in Section 3.2:

***sensible recovery effectiveness*:** change in the dry-bulb temperature of the outdoor air supply divided by the difference between the outdoor air and return air dry-bulb temperatures, expressed as a percentage.

6.5.2.1 Zone Controls. *Zone* thermostatic controls shall be capable of operating in sequence the supply of heating and cooling energy to the *zone*. Such controls shall prevent

1. *reheating*,
2. *recooling*,
3. mixing or simultaneously supplying air that has been previously mechanically heated and air that has been previously cooled, either by mechanical cooling or by economizer systems, and
4. other simultaneous operation of heating and cooling systems to the same *zone*.

Exceptions to 6.5.2.1:

a) Zones for which the volume of air that is reheated, recooled, or mixed does not exceed the largest of the following

   1. 30% of the zone design peak supply rate,
   2. The ~~volume of~~ *outdoor air* flow rate required to meet the ventilation requirements of Section 6.2 of ASHRAE Standard 62.1 for the *zone*,
   3. Any higher rate that can be demonstrated, to the satisfaction of the *authority having jurisdiction*, to reduce overall system annual energy usage by offsetting reheat/recool energy losses through a reduction in *outdoor air* intake.
   4. The air flow rate required to comply with applicable codes or accreditation standards, such as pressure relationships or minimum air change rates.

b) Zones that comply with all of the following:

   1. The ~~volume of~~ air flow rate that is reheated, recooled, or mixed in *dead band* between heating and cooling does not exceed the largest of the following:

      a. 20% of the zone design peak supply rate,
      b. the ~~volume of~~ *outdoor air* flow rate required to meet the ventilation requirements of Section 6.2 of ASHRAE Standard 62.1 for the *zone*,
      c. any higher rate that can be demonstrated, to the satisfaction of the *authority having jurisdiction*,

to reduce overall system annual energy usage by offsetting reheat/recool energy losses through a reduction in *outdoor air* intake.

2. The ~~volume of~~ air flow rate that is reheated, recooled, or mixed does not exceed 50% of the zone design peak supply rate
3. Airflow between *dead band* and full heating or full cooling shall be modulated.

c) ~~*Zones* where special pressurization relationships, cross-contamination requirements, or code-required minimum circulation rates are such that variable air volume systems are impractical.~~ Laboratory exhaust systems that comply with 6.5.7.2.

d) *Zones* where at least 75% of the energy for reheating or for providing warm air in mixing systems is provided from a *site-recovered* (including condenser heat) or *site-solar energy source.*

6.5.7 Exhaust ~~Hoods~~ Systems

6.5.7.2 ~~Fume Hoods~~ Laboratory Exhaust Systems. Buildings with ~~fume hood~~ laboratory exhaust systems having a total exhaust rate greater than ~~15,000~~ 5,000 cfm shall include at least one of the following features:

~~a. VAV hood exhaust and room supply systems capable of reducing exhaust and makeup air flow rates to 50% or less of design values.~~

a. VAV laboratory exhaust and room supply system capable of reducing exhaust and makeup air flow rates and/or incorporate a heat recovery system to precondition makeup air from laboratory exhaust that shall meet the following:

$$A + B^*(E/M) \geq 50\%$$

Where:

A = Percentage that the exhaust and makeup air flow rates can be reduced from design conditions.

B = Percentage *sensible recovery effectiveness*.

E = Exhaust airflow rate through the heat recovery device at *design* conditions

M = Makeup air flow rate of the *system* at *design conditions*.

b. VAV laboratory exhaust and room supply systems that are required to have minimum circulation rates to comply with code or accreditation standards shall be capable of reducing *zone* exhaust and makeup air flow rates to the regulated minimum circulation values, or the minimum required to maintain pressurization relationship requirements. Non regulated *zones* shall be capable of reducing exhaust and makeup air flow rates to 50% of the zone design values, or the minimum required to maintain pressurization relationship requirements.

~~b~~c. Direct makeup (auxiliary) air supply equal to at least 75% of the exhaust air flow rate, heated no warmer than 2°F below room set point, cooled to no cooler than 3°F above room set point, no humidification added, and no simultaneous heating and cooling used for dehumidification control.

~~c. Heat recovery systems to precondition makeup air from fume hood laboratory exhaust in accordance with Section 6.5.6.1, Exhaust Air Energy Recovery, without using any exception.~~

Revise the Standard as follows (S-I units)

New Definition in Section 3.2:

sensible recovery effectiveness**:** change in the dry-bulb temperature of the outdoor air supply divided by the difference between the outdoor air and return air dry-bulb temperatures, expressed as a percentage.

6.5.2.1 Zone Controls. *Zone* thermostatic controls shall be capable of operating in sequence the supply of heating and cooling energy to the *zone*. Such controls shall prevent

5. *reheating*,
6. *recooling*,
7. mixing or simultaneously supplying air that has been previously mechanically heated and air that has been previously cooled, either by mechanical cooling or by economizer systems, and
8. other simultaneous operation of heating and cooling systems to the same *zone*.

Exceptions to 6.5.2.1:

a) Zones for which the volume of air that is reheated, recooled, or mixed does not exceed the largest of the following

1. 30% of the zone design peak supply rate,
2. The ~~volume of~~ *outdoor air* flow rate required to meet the ventilation requirements of Section 6.2 of ASHRAE Standard 62.1 for the *zone*,
3. Any higher rate that can be demonstrated, to the satisfaction of the *authority having jurisdiction*, to reduce overall system annual energy usage by offsetting reheat/recool energy losses through a reduction in *outdoor air* intake.
4. The air flow rate required to comply with applicable codes or accreditation standards, such as pressure relationships or minimum air change rates.

b) Zones that comply with all of the following:

4. The ~~volume of~~ air flow rate that is reheated, recooled, or mixed in *dead band* between heating and cooling does not exceed the largest of the following:

   a. 20% of the zone design peak supply rate,
   b. the ~~volume of~~ *outdoor air* flow rate required to meet the ventilation requirements of Section 6.2 of ASHRAE Standard 62.1 for the *zone*,
   c. any higher rate that can be demonstrated, to the satisfaction of the *authority having jurisdiction*, to reduce overall system annual energy usage by offsetting reheat/recool

energy losses through a reduction in *outdoor air* intake.

5. The ~~volume of~~ air flow rate that is reheated, recooled, or mixed does not exceed 50% of the zone design peak supply rate
6. Airflow between *dead band* and full heating or full cooling shall be modulated.

c. ~~*Zones* where special pressurization relationships, cross-contamination requirements, or code-required minimum circulation rates are such that variable air volume systems are impractical.~~ Laboratory exhaust systems that comply with 6.5.7.2.

d. *Zones* where at least 75% of the energy for reheating or for providing warm air in mixing systems is provided from a *site-recovered* (including condenser heat) or *site-solar energy source.*

6.5.7 Exhaust ~~Hoods~~ Systems

6.5.7.2 ~~Fume Hoods~~ Laboratory Exhaust Systems. Buildings with ~~fume hood~~ laboratory exhaust systems having a total exhaust rate greater than ~~7,078~~ 2,360 L/S shall include at least one of the following features:

~~a. VAV hood exhaust and room supply systems capable of reducing exhaust and makeup air flow rates to 50% or less of design values.~~

a. VAV laboratory exhaust and room supply system capable of reducing exhaust and makeup air flow rates and/or incorporate a heat recovery system to precondition makeup air from laboratory exhaust that shall meet the following:

$$A + B^*(E/M) \geq 50\%$$

Where:

A = Percentage that the exhaust and makeup air flow rates can be reduced from design conditions.

B = Percentage *sensible recovery effectiveness*.

E = Exhaust airflow rate through the heat recovery device at *design* conditions

M = Makeup air flow rate of the *system* at *design conditions*.

b. VAV laboratory exhaust and room supply systems that are required to have minimum circulation rates to comply with code or accreditation standards shall be capable of reducing *zone* exhaust and makeup air flow rates to the regulated minimum circulation values, or the minimum required to maintain pressurization relationship requirements. Non regulated *zones* shall be capable of reducing exhaust and makeup air flow rates to 50% of the zone design values, or the minimum required to maintain pressurization relationship requirements.

~~b~~c. Direct makeup (auxiliary) air supply equal to at least 75% of the exhaust air flow rate, heated no warmer than 1.1°C below room set point, cooled to no cooler than 1.7°C above room set point, no humidification added, and no simultaneous heating and cooling used for dehumidification control.

~~c. Heat recovery systems to precondition makeup air from fume hood laboratory exhaust in accordance with Section 6.5.6.1, Exhaust Air Energy Recovery, without using any exception.~~

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FOREWORD

Lighting controls must be functionally tested to ensure their proper use and appropriate energy savings. There are numerous examples of lighting controls being improperly used or disabled when they are not properly tested for functionality.

ENERGY SAVINGS:

- *5-15% according to Advanced Sensors and Controls for Building Applications: Market Assessment and Potential R&D Pathways. April 2005. Pacific Northwest National Lab for DOE.*
- *10-15% according to Managing Energy Costs in Retail Buildings. E Source. 2002.*
- *HMG sidelighting study and toplighting studying.*

Addendum az to 90.1-2007

Revise the Standard as follows (I-P and S-I units)

9.4.6 Functional Testing. Lighting control devices and control systems shall be tested to ensure that control hardware and software are calibrated, adjusted, programmed, and in proper working condition in accordance with the construction documents and manufacturer's installation instructions. When *occupant sensors*, time switches, programmable schedule controls, or *photosensors* are installed, at a minimum, the following procedures shall be performed:

a. Confirm that the placement, sensitivity and time-out adjustments for occupant sensors yield acceptable performance, lights turn off only after space is vacated and do not turn on unless space is occupied.

b. Confirm that the time switches and programmable schedule controls are programmed to turn the lights off.

c. Confirm that photosensor controls reduce electric light levels based on the amount of usable daylight in the space as specified.

The construction documents shall state the party who will conduct and certify the functional testing. The party responsible for the functional testing shall not be directly involved in either the design or construction of the project and shall provide documentation certifying that the installed lighting controls meet or exceed all documented performance criteria. Certification shall be specific enough to verify conformance.

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FOREWORD

Water-to-water heat pumps are used in many buildings covered by ASHRAE 90.1. These heat pumps use water to transfer energy throughout the building. In recent years, the demand for water to water heat pumps has increased significantly. However, the current ASHRAE 90.1 standard has no minimum energy efficiency requirements for this equipment.

This proposal establishes for the first time a product class for water- to-water heat pumps. The intent is to recognize the technology in Standard 90.1 by requiring minimum energy efficiency standards. Cooling EERs and heating COPs are proposed for products with cooling capacities below 135,000 Btu/h at standard rating conditions listed in ISO standard 13256-2. These minimums are proposed to become effective immediately upon publication of the addendum and will be subject to further review once a third-party certification is established and more data is available.

Addendum bg to 90.1-2007

Revise Table 6.8.1B as follows (IP)

TABLE 6.8.1B Electrically Operated Unitary and Applied Heat Pumps— Minimum Efficiency Requirements *(continued)*

Equipment Type	Size Category	Heating Section Type	Subcategory or Rating Condition	Minimum Efficiency[a]	Test Procedure[b]
Water source water to water (cooling mode)	<135,000 Btu/h	All	86°F entering water	10.6 EER	ISO-13256-2
Groundwater source water to water (cooling mode)	<135,000 Btu/h	All	59°F entering water	16.3 EER	ISO-13256-2
Ground source Brine to water (cooling mode)	<135,000 Btu/h	All	77°F entering water	12.1 EER	ISO-13256-2
Water source water to water (heating mode)	<135,000 Btu/h (cooling capacity)	---	68°F entering water	3.7 COP	ISO-13256-2
Groundwater source water to water (heating mode)	<135,000 Btu/h (cooling capacity)	---	50°F entering water	3.1 COP	ISO-13256-2
Ground source brine to water (heating mode)	<135,000 Btu/h (cooling capacity)	---	32°F entering water	2.5 COP	ISO-13256-2

Remainder of table unchanged

Revise Table 6.8.1B as follows (SI)

TABLE 6.8.1B Electrically Operated Unitary and Applied Heat Pumps—Minimum Efficiency Requirements *(continued)*

Equipment Type	Size Category	Heating Section Type	Subcategory or Rating Condition	Minimum Efficiency[a]	Test Procedure[b]
Water source water to water (cooling mode)	< 40 kW	All	30°C entering water	3.11 COP_C	ISO-13256-2
Groundwater source water to water (cooling mode)	< 40 kW	All	15°C entering water	4.78 COP_C	ISO-13256-2
Ground source Brine to water (cooling mode)	< 40 kW	All	25°C entering water	3.54 COP_C	ISO-13256-2
Water source water to water (heating mode)	< 40 kW (cooling capacity)	---	20°C entering water	3.7 COP_H	ISO-13256-2
Groundwater source water to water (heating mode)	< 40 kW (cooling capacity)	---	10°C entering water	3.1 COP_H-	ISO-13256-2
Ground source brine to water (heating mode)	< 40 kW (cooling capacity)	---	0.0°C entering water	2.5 COP_H-	ISO-13256-2

Remainder of table unchanged

Add the following reference to Chapter 12 under International Organization for Standardization

ISO 13256-2 (1998)Water-Source Heat Pumps—Testing and Rating for Performance—Part 2: Water-to-Water and Brine-to-Water Heat Pumps

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FOREWORD

HVAC system cooling supply air temperatures and peak airflow rates are generally selected to satisfy peak cooling loads. However, in most applications, for the majority of time, the load is well below peak conditions and a warmer supply air temperature can satisfy the cooling load. Multiple zone systems such as constant air volume reheat and variable air volume reheat systems often have some zones requiring cooling while others are in reheat. Those systems would save energy if the central supply air temperature is increased while still meeting the cooling needs of those zones requiring cooling. This addendum requires multiple zone HVAC systems (that include simultaneous heating and cooling) to include controls that automatically raise the supply-air temperature when the spaces served are not at peak load conditions. The supply air reset can be controlled in response to either representative building loads or outdoor air temperature at the discretion of the designer. Elevating the supply air temperature will decrease both cooling and reheat energy and increase effectiveness of economizers since they will be used at higher ambient temperatures. This strategy will increase fan energy, but analysis has demonstrated that there is a net energy savings in the climate zones where this strategy would be required. The energy analysis indicates that the whole building energy savings for buildings affected by this requirement is between 2.5% and 3%.

Since humidity control can be an issue when supply air temperature is raised, this proposal allows the option of raising supply air temperature only during colder outdoor condition, which makes humidity control less of a problem. It also allows an override of the temperature reset if a maximum space humidity setpoint is exceeded. There is an exception from this requirement for warm and humid climate zones 1a, 2a, and 3a.

Zones that are expected to experience relatively constant loads (such as electronic equipment rooms and some core zones) are required to be designed to meet load at the fully reset temperature so that reset can occur, which will require increased airflow to those zones. Such sizing practice would result in increased installation cost. Analysis of this design strategy shows that the economics meets the Standard 90.1 Committees threshold for cost effectiveness.

Similar requirements are already in code in several states including New York, Oregon, California, Washington, and Massachusetts, and are included in the baseline building requirements of Chapter 11 (ECB) and Appendix G.

Addendum bh to 90.1-2007

Revise the Standard as follows (IP and SI units)

6.5.3.3 Supply-air temperature reset controls. Multiple zone HVAC systems must include controls that automatically reset the supply-air temperature in response to representative building loads, or to outdoor air temperature. The controls shall reset the supply air temperature at least 25 percent of the difference between the design supply-air temperature and the design room air temperature. Controls that adjust the reset based on zone humidity are allowed. *Zones* which are expected to experience relatively constant loads, such as electronic equipment rooms, shall be designed for the fully reset supply temperature.

Exceptions to 6.5.3.3:

1. Climate zones 1a, 2a, and 3a
2. Systems that prevent re-heating, re-cooling, or mixing of heated and cooled supply air.
3. Systems in which at least 75 percent of the energy for reheating (on an annual basis) is from site recovered or site solar energy sources.

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FOREWORD

This addendum adds an exception within Appendix G that allows users to claim energy cost savings credit for the increased ventilation effectiveness of certain HVAC system designs. The best example is a displacement ventilation system. The use of the Standard 62.1 Ventilation Rate Procedure is required to claim this credit and the process for calculating the baseline ventilation rates is straightforward when using a software tool designed to perform these calculations. Historically Standard 90.1 has not allowed credit for reduced ventilation airflow rates and this proposal is a first step in allowing additional credit for high performance building systems that reduce ventilation intake airflow rates

Addendum bj to 90.1-2007

Revise the Standard as follows (IP and S-I units)

G3.1.2.5 Ventilation. Minimum ventilation system *outdoor air* intake flow, ~~ventilation rates~~ shall be the same for the *proposed* and *baseline building designs.*

Exceptions: ~~When modeling demand-control ventilation in the *proposed design* when its use is not required by Section 6.4.3.8.~~

a) When modeling demand-control ventilation in the *proposed design* when its use is not required by Section 6.3.2(p) or Section 6.4.3.9.

b) When designing systems in accordance with Standard 62.1 Section 6.2 Ventilation Rate Procedure, reduced ventilation airflow rates may be calculated for each HVAC zone in the *proposed design* with a zone air distribution effectiveness (Ez) > 1.0 as defined by Table 6-2 in Standard 62.1. Baseline ventilation airflow rates in those zones shall be calculated using the *proposed design* Ventilation Rate Procedure calculation with the following change only. Zone air distribution effectiveness shall be changed to (Ez)=1.0 in each zone having a zone air distribution effectiveness (Ez)>1.0. *Proposed design* and *baseline design* Ventilation Rate Procedure calculations, as described in Standard 62.1, shall be submitted to the rating authority to claim credit for this exception.

(This foreword is not part of this standard. It is merely informative and does not contain requirements necessary for conformance to the standard. It has not been processed according to the ANSI requirements for a standard and may contain material that has not been subject to public review or a consensus process. Unresolved objectors on informative material are not offered the right to appeal at ASHRAE or ANSI.)

FOREWORD

Section 313 of the Energy Independence and Security Act of 2007 (EISA 2007) mandates that the efficiency of general purpose motors (manufactured or imported) that

are rated at 1.0 horsepower and larger be increased for motors manufactured on or after December 19, 2010. In addition, there are new efficiency standards that are required for larger motors that may be used by commercial / industrial customers (sized greater than 200 horsepower and less than or equal to 500 horsepower). These updated motor efficiency standards have been vetted, analyzed, and agreed to by motor manufacturers.

Addendum "aj" to ASHRAE Standard 90.1-2007 first incorporated these changes into Standard 90.1-2007. However, this Addendum did not distinguish between Subtype I and Subtype II motors, which have different minimum efficiency requirements as called out in EISA 2007, Section 313 and clarified in the Federal Register.

This new Addendum includes the minimum efficiency requirements for both Subtype I and Subtype II motors as well as clarifies what specific motor types these requirements apply to. The motor efficiency information was separated into separate sections, before and after December 19, 2010, to clearly delineate the differing requirements for users of the Standard.

EISA 2007 can be downloaded from:

http://frwebgate.access.gpo.gov/cgi-bin/getdoc.cgi?dbname=110_cong_bills&docid=f:h6enr.txt.pdf

Reference Section 313 on "Electric Motor Efficiency Standards" in EISA 2007.

Recent clarifying rules for this section can be downloaded from the Federal Register at:

http://edocket.access.gpo.gov/2009/pdf/E9-5935.pdf

Additional information on motor efficiency requirements can be downloaded from:

http://www.nema.org/media/pr/20080327a.cfm

Finally, In order to clarify the intent of the new motor efficiency requirements, the words "manufactured alone or as a component of another piece of equipment" were also added into the text of Section 10.4.1.

According to a March 21, 2007 press release by the American Council for an Energy-Efficient Economy (ACEEE) and the National Electrical Manufacturers Association

(NEMA), the new motor efficiency standards will create a cumulative national energy savings of 8 quadrillion Btus over 20 years (2010 to 2030), with a net energy cost savings to commercial and industrial consumers of almost $500 million. These clarifying changes to Standard 90.1 will not affect the estimate of these savings.

Adding this clarifying information to amend Addendum "aj" to ASHRAE Standard 90.1-2007 will help designers, end-use customers, and code officials with motor specifications and verifications.

Addendum bk to 90.1-2007

Revise the Standard as follows (IP units)

Add the following Definitions to Section 3.2

General Purpose Electric Motor (subtype I) – any electric motor that meets the definition of "general purpose" motor as codified by the Department of Energy rule in 10 CFR 431 in effect on December 19, 2007.

General Purpose Electric Motor (subtype II) – any electric motor incorporating the design elements of a general purpose electric motor (subtype I) that are configured as:

- U-frame motor
- Design C motor
- Close-coupled pump motor
- Footless motor
- Vertical solid shaft normal thrust motor (tested in a horizontal configuration)
- 8 –pole motor (900 rpm)
- Poly-phase motor with voltage no more than 600 volts (other than 230 or 460 volts).

10. OTHER EQUIPMENT

10.4 Mandatory Provisions:

10.4.1 Electric Motors. ~~Until December 18, 2010, e~~Electric motors manufactured before December 19, 2010 shall comply with the requirements of the Energy Policy Act of 1992 where applicable, as shown in Table 10.8~~a~~A. Prior to December 19, 2010, motors not included in the scope of the Energy Policy Act of 1992 have no performance requirements in this section, such as but not limited to the following types:

- Footless designs
- Two-speed versions
- 50 Hertz
- 200/400 and 575 volt
- Design C and D
- Close coupled pump motors
- TEAO motors
- TENV motors

Electric motors manufactured alone or as a component of another piece of equipment ~~as of~~ on or after December 19, 2010, shall comply with the requirements of the Energy Independence and Security Act of 2007, as shown in Tables 10.8~~b~~B for *general purpose electric motors (subtype I)* and 10.8C for *general purpose electric motors (subtype II)*.

Fire pump motors and NEMA Design B, general purpose electric motors with a power rating of more than 200 horsepower, but no more than 500 horsepower, manufactured on or after December 19, 2010, shall have a minimum nominal full load efficiency that is not less than as shown in Table 10.8C.

Motors that are not included in the scope of the Energy Independence and Security Act of 2007, Section 313, have no performance requirements in this section.

10.5 Prescriptive Compliance Path: (Not Used)

10.6 Alternative Compliance Path: (Not Used)

10.7 Submittals: (Not Used)

10.8 Product Information:

Table 10.8a A Minimum Nominal Efficiency for General Purpose Design A and Design B Motors Rated 600 Volts or Less[a]

Minimum Nominal Full Load Motor Efficiencies (Manufactured before 12/19/2010)						
	Open Drip-Proof Motors			Totally Enclosed Fan-Cooled Motors		
Number of Poles ==>	2	4	6	2	4	6
Synchronous Speed (RPM) ==>	3600	1800	1200	3600	1800	1200
Motor Horsepower						
1	NR	82.5	80.0	75.5	82.5	80.0
1.5	82.5	84.0	84.0	82.5	84.0	85.5
2	84.0	84.0	85.5	84.0	84.0	86.5
3	84.0	86.5	86.5	85.5	87.5	87.5
5	85.5	87.5	87.5	87.5	87.5	87.5
7.5	87.5	88.5	88.5	88.5	89.5	89.5
10	88.5	89.5	90.2	89.5	89.5	89.5
15	89.2	91.0	90.2	90.2	91.0	90.2
20	90.2	91.0	91.0	90.2	91.0	90.2
25	91.0	91.7	91.7	91.0	92.4	91.7
30	91.0	92.4	92.4	91.0	92.4	91.7
40	91.7	93.0	93.0	91.7	93.0	93.0
50	92.4	93.0	93.0	92.4	93.0	93.0
60	93.0	93.6	93.6	93.0	93.6	93.6
75	93.0	94.1	93.6	93.0	94.1	93.6
100	93.0	94.1	94.1	93.6	94.5	94.1
125	93.6	94.5	94.1	94.5	94.5	94.1
150	93.6	95.0	94.5	94.5	95.0	95.0
200	94.5	95.0	94.5	95.0	95.0	95.0

[a] Nominal efficiencies shall be established in accordance with NEMA Standard MG1. Design A and Design B are National Electric Manufacturers Association (NEMA) design class designations for fixed frequency small and medium AC squirrel-cage induction motors.

NR—No requirement

Table 10.8b B Minimum Nominal Full Load Efficiency for General Purpose 60 HZ NEMA General Purpose Electric Motors (Subtype I) Premium Efficient Design A and Design B Motors Rated 600 Volts or Less (Random Wound)[a]

Minimum Nominal Full Load Efficiency (%) for Motors Manufactured as of on or after December 19, 2010						
	Open Drip-Proof Motors			Totally Enclosed Fan-Cooled Motors		
Number of Poles ==>	2	4	6	2	4	6
Synchronous Speed (RPM)==>	3600	1800	1200	3600	1800	1200
Motor Horsepower						
1	77.0	85.5	82.5	77.0	85.5	82.5
1.5	84.0	86.5	86.5	84.0	86.5	87.5
2	85.5	86.5	87.5	85.5	86.5	88.5
3	85.5	89.5	88.5	86.5	89.5	89.5
5	86.5	89.5	89.5	88.5	89.5	89.5
7.5	88.5	91.0	90.2	89.5	91.7	91.0
10	89.5	91.7	91.7	90.2	91.7	91.0
15	90.2	93.0	91.7	91.0	92.4	91.7
20	91.0	93.0	92.4	91.0	93.0	91.7
25	91.7	93.6	93.0	91.7	93.6	93.0
30	91.7	94.1	93.6	91.7	93.6	93.0
40	92.4	94.1	94.1	92.4	94.1	94.1
50	93.0	94.5	94.1	93.0	94.5	94.1
60	93.6	95.0	94.5	93.6	95.0	94.5
75	93.6	95.0	94.5	93.6	95.4	94.5
100	93.6	95.4	95.0	94.1	95.4	95.0
125	94.1	95.4	95.0	95.0	95.4	95.0
150	94.1	95.8	95.4	95.0	95.8	95.8
200	95.0	95.8	95.4	95.4	96.2	95.8
250	95.0	95.8	95.4	95.8	96.2	95.8
300	95.4	95.8	95.4	95.8	96.2	95.8
350	95.4	95.8	95.4	95.8	96.2	95.8
400	95.8	95.8	95.8	95.8	96.2	95.8
450	95.8	96.2	96.2	95.8	96.2	95.8
500	95.8	96.2	96.2	95.8	96.2	95.8

[a] Nominal efficiencies shall be established in accordance with NEMA Standard MG1. Design A and Design B are National Electric Manufacturers Association (NEMA) design class designations for fixed frequency small and medium AC squirrel-cage induction motors.

Table 10.8C Minimum Nominal Full Load Efficiency of General Purpose Electric Motors (Subtype II and Design B)[a]

Minimum Nominal Full Load Efficiency (%) for Motors Manufactured on or after December 19, 2010								
	Open Drip-Proof Motors				Totally Enclosed Fan Cooled Motors			
Number of Poles ==>	2	4	6	8	2	4	6	8
Synchronous Speed (RPM)==>	3600	1800	1200	900	3600	1800	1200	900
Motor Horsepower								
1.0	NR	82.5	80.0	74.0	75.5	82.5	80.0	74.0
1.5	82.5	84.0	84.0	75.5	82.5	84.0	85.5	77.0
2.0	84.0	84.0	85.5	85.5	84.0	84.0	86.5	82.5
3.0	84.0	86.5	86.5	86.5	85.5	87.5	87.5	84.0
5.0	85.5	87.5	87.5	87.5	87.5	87.5	87.5	85.5
7.5	87.5	88.5	88.5	88.5	88.5	89.5	89.5	85.5
10.0	88.5	89.5	90.2	89.5	89.5	89.5	89.5	88.5
15.0	89.5	91.0	90.2	89.5	90.2	91.0	90.2	88.5
20.0	90.2	91.0	91.0	90.2	90.2	91.0	90.2	89.5
25.0	91.0	91.7	91.7	90.2	91.0	92.4	91.7	89.5
30.0	91.0	92.4	92.4	91.0	91.0	92.4	91.7	91.0
40.0	91.7	93.0	93.0	91.0	91.7	93.0	93.0	91.0
50.0	92.4	93.0	93.0	91.7	92.4	93.0	93.0	91.7
60.0	93.0	93.6	93.6	92.4	93.0	93.6	93.6	91.7
75.0	93.0	94.1	93.6	93.6	93.0	94.1	93.6	93.0
100.0	93.0	94.1	94.1	93.6	93.6	94.5	94.1	93.0
125.0	93.6	94.5	94.1	93.6	94.5	94.5	94.1	93.6
150.0	93.6	95.0	94.5	93.6	94.5	95.0	95.0	93.6
200.0	94.5	95.0	94.5	93.6	95.0	95.0	95.0	94.1
250.0	94.5	95.4	95.4	94.5	95.4	95.0	95.0	94.5
300.0	95.0	95.4	95.4	NR	95.4	95.4	95.0	NR
350.0	95.0	95.4	95.4	NR	95.4	95.4	95.0	NR
400.0	95.4	95.4	NR	NR	95.4	95.4	NR	NR
450.0	95.8	95.8	NR	NR	95.4	95.4	NR	NR
500.0	95.8	95.8	NR	NR	95.4	95.8	NR	NR

[a] Nominal efficiencies shall be established in accordance with NEMA Standard MG1.

NR—No requirement

Revise the Standard as follows (SI units)

Add the following Definitions to Section 3.2

General Purpose Electric Motor (subtype I) – any electric motor that meets the definition of "general purpose" motor as codified by the Department of Energy rule in 10 CFR 431 in effect on December 19, 2007.

General Purpose Electric Motor (subtype II) – any electric motor incorporating the design elements of a general purpose electric motor (subtype I) that are configured as:

- U-frame motor
- Design C motor
- Close-coupled pump motor
- Footless motor
- Vertical solid shaft normal thrust motor (tested in a horizontal configuration)
- 8 –pole motor (900 rpm)
- Poly-phase motor with voltage no more than 600 volts (other than 230 or 460 volts).

10. OTHER EQUIPMENT

10.4 Mandatory Provisions:

10.4.1 Electric Motors. Until December 18, 2010, eElectric motors manufactured before December 19, 2010 shall comply with the requirements of the Energy Policy Act of 1992 where applicable, as shown in Table 10.8aA. Prior to December 19, 2010, motors not included in the scope of the Energy Policy Act of 1992 have no performance requirements in this section, such as but not limited to the following types:

- Footless designs
- Two-speed versions
- 50 Hertz
- 200/400 and 575 volt
- Design C and D
- Close coupled pump motors
- TEAO motors
- TENV motors

Electric motors manufactured alone or as a component of another piece of equipment as of on or after December 19, 2010, shall comply with the requirements of the Energy Independence and Security Act of 2007, as shown in Tables 10.8bB for *general purpose electric motors (subtype I)* and 10.8C for *general purpose electric motors (subtype II)*.

Fire pump motors and NEMA Design B, general purpose electric motors with a power rating of more than 149.2 kW, but no more than 373.0 kW, manufactured on or after December 19, 2010, shall have a minimum nominal full load efficiency that is not less than as shown in Table 10.8C.

Motors that are not included in the scope of the Energy Independence and Security Act of 2007, Section 313, have no performance requirements in this section.

10.5 Prescriptive Compliance Path: (Not Used)

10.6 Alternative Compliance Path: (Not Used)

10.7 Submittals: (Not Used)

10.8 Product Information:

Table 10.8a A Minimum Nominal Efficiency for General Purpose Design A and Design B Motors Rated 600 Volts or Less[a]

Minimum Nominal Full Load Motor Efficiencies (Manufactured before 12/19/2010)						
	Open Drip-Proof Motors			Totally Enclosed Fan-Cooled Motors		
Number of Poles ==>	**2**	**4**	**6**	**2**	**4**	**6**
Synchronous Speed (RPM) ==>	**3600**	**1800**	**1200**	**3600**	**1800**	**1200**
Motor Size kW						
0.7	NR	82.5	80.0	75.5	82.5	80.0
1.1	82.5	84.0	84.0	82.5	84.0	85.5
1.5	84.0	84.0	85.5	84.0	84.0	86.5
2.2	84.0	86.5	86.5	85.5	87.5	87.5
3.7	85.5	87.5	87.5	87.5	87.5	87.5
5.6	87.5	88.5	88.5	88.5	89.5	89.5
7.5	88.5	89.5	90.2	89.5	89.5	89.5
11.2	89.2	91.0	90.2	90.2	91.0	90.2
14.9	90.2	91.0	91.0	90.2	91.0	90.2
18.7	91.0	91.7	91.7	91.0	92.4	91.7
22.4	91.0	92.4	92.4	91.0	92.4	91.7
29.8	91.7	93.0	93.0	91.7	93.0	93.0
37.3	92.4	93.0	93.0	92.4	93.0	93.0
44.8	93.0	93.6	93.6	93.0	93.6	93.6
56.0	93.0	94.1	93.6	93.0	94.1	93.6
74.6	93.0	94.1	94.1	93.6	94.5	94.1
93.3	93.6	94.5	94.1	94.5	94.5	94.1
111.9	93.6	95.0	94.5	94.5	95.0	95.0
149.2	94.5	95.0	94.5	95.0	95.0	95.0

[a] Nominal efficiencies shall be established in accordance with NEMA Standard MG1. Design A and Design B are National Electric Manufacturers Association (NEMA) design class designations for fixed frequency small and medium AC squirrel-cage induction motors.

NR—No requirement

Table 10.8~~b~~ B Minimum Nominal Full Load Efficiency for ~~General Purpose~~ 60 HZ NEMA General Purpose Electric Motors (Subtype I) ~~Premium Efficient~~ ~~Design A and Design B~~ ~~Motors~~ Rated 600 Volts or Less (Random Wound)[a]

Minimum Nominal Full Load Efficiency (%) for Motors Manufactured ~~as of~~ on or after December 19, 2010						
	Open Drip-Proof Motors			Totally Enclosed Fan-Cooled Motors		
Number of Poles ==>	2	4	6	2	4	6
Synchronous Speed (RPM)==>	3600	1800	1200	3600	1800	1200
Motor Size kW						
0.7	77.0	85.5	82.5	77.0	85.5	82.5
1.1	84.0	86.5	86.5	84.0	86.5	87.5
1.5	85.5	86.5	87.5	85.5	86.5	88.5
2.2	85.5	89.5	88.5	86.5	89.5	89.5
3.7	86.5	89.5	89.5	88.5	89.5	89.5
5.6	88.5	91.0	90.2	89.5	91.7	91.0
7.5	89.5	91.7	91.7	90.2	91.7	91.0
11.2	90.2	93.0	91.7	91.0	92.4	91.7
14.9	91.0	93.0	92.4	91.0	93.0	91.7
18.7	91.7	93.6	93.0	91.7	93.6	93.0
22.4	91.7	94.1	93.6	91.7	93.6	93.0
29.8	92.4	94.1	94.1	92.4	94.1	94.1
37.3	93.0	94.5	94.1	93.0	94.5	94.1
44.8	93.6	95.0	94.5	93.6	95.0	94.5
56.0	93.6	95.0	94.5	93.6	95.4	94.5
74.6	93.6	95.4	95.0	94.1	95.4	95.0
93.3	94.1	95.4	95.0	95.0	95.4	95.0
111.9	94.1	95.8	95.4	95.0	95.8	95.8
149.2	95.0	95.8	95.4	95.4	96.2	95.8
186.5	95.0	95.8	95.4	95.8	96.2	95.8
223.8	95.4	95.8	95.4	95.8	96.2	95.8
261.1	95.4	95.8	95.4	95.8	96.2	95.8
298.4	95.8	95.8	95.8	95.8	96.2	95.8
335.7	95.8	96.2	96.2	95.8	96.2	95.8
373.0	95.8	96.2	96.2	95.8	96.2	95.8

[a] Nominal efficiencies shall be established in accordance with NEMA Standard MG1. ~~Design A and Design B are National Electric Manufacturers Association (NEMA) design class designations for fixed frequency small and medium AC squirrel-cage induction motors.~~

Table 10.8C Minimum Nominal Full Load Efficiency of General Purpose Electric Motors (Subtype II and Design B)[a]

Minimum Nominal Full Load Efficiency (%) for Motors Manufactured on or after December 19, 2010								
	Open Drip-Proof Motors				Totally Enclosed Fan Cooled Motors			
Number of Poles ==>	2	4	6	8	2	4	6	8
Synchronous Speed (RPM) ==>	3600	1800	1200	900	3600	1800	1200	900
Motor Size kW								
0.7	NR	82.5	80.0	74.0	75.5	82.5	80.0	74.0
1.1	82.5	84.0	84.0	75.5	82.5	84.0	85.5	77.0
1.5	84.0	84.0	85.5	85.5	84.0	84.0	86.5	82.5
2.2	84.0	86.5	86.5	86.5	85.5	87.5	87.5	84.0
3.7	85.5	87.5	87.5	87.5	87.5	87.5	87.5	85.5
5.6	87.5	88.5	88.5	88.5	88.5	89.5	89.5	85.5
7.5	88.5	89.5	90.2	89.5	89.5	89.5	89.5	88.5
11.2	89.5	91.0	90.2	89.5	90.2	91.0	90.2	88.5
14.9	90.2	91.0	91.0	90.2	90.2	91.0	90.2	89.5
18.7	91.0	91.7	91.7	90.2	91.0	92.4	91.7	89.5
22.4	91.0	92.4	92.4	91.0	91.0	92.4	91.7	91.0
29.8	91.7	93.0	93.0	91.0	91.7	93.0	93.0	91.0
37.3	92.4	93.0	93.0	91.7	92.4	93.0	93.0	91.7
44.8	93.0	93.6	93.6	92.4	93.0	93.6	93.6	91.7
56.0	93.0	94.1	93.6	93.6	93.0	94.1	93.6	93.0
74.6	93.0	94.1	94.1	93.6	93.6	94.5	94.1	93.0
93.3	93.6	94.5	94.1	93.6	94.5	94.5	94.1	93.6
111.9	93.6	95.0	94.5	93.6	94.5	95.0	95.0	93.6
149.2	94.5	95.0	94.5	93.6	95.0	95.0	95.0	94.1
186.5	94.5	95.4	95.4	94.5	95.4	95.0	95.0	94.5
223.8	95.0	95.4	95.4	NR	95.4	95.4	95.0	NR
261.1	95.0	95.4	95.4	NR	95.4	95.4	95.0	NR
298.4	95.4	95.4	NR	NR	95.4	95.4	NR	NR
335.7	95.8	95.8	NR	NR	95.4	95.4	NR	NR
373.0	95.8	95.8	NR	NR	95.4	95.8	NR	NR

[a] Nominal efficiencies shall be established in accordance with NEMA Standard MG1.

NR—No requirement

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FOREWORD

It was not the intent of the Standard to exempt all chillers with secondary coolants (glycol or brine) for freeze protection from coverage by table 6.8.1C with adjustments per 6.4.1.2 where applicable. This addendum corrects the intent of the Standard and removes ambiguity. It brings more chillers under the scope of the Standard and therefore will save some amount of energy.

For example, positive-displacement (both air- and water-cooled) chillers with glycol added for freeze protection when the unit is off or for winter operation, would likely have used a secondary coolant with a freeze point below 27°F [-2.8°C]. If the positive-displacement chiller were being designed to create a cooling temperature above 32°F [0°C], there is no reason it shouldn't be expected to comply with the Standard at the rating conditions and fluid listed in the referenced test procedure. Below 32°F [0°C], machine changes might hinder its ability to meet the requirements.

In addition, centrifugal chillers are outside the scope of this Standard when the design leaving fluid temperature is below 38°F [3.3°C], and the intent was that they would comply with water as the tested fluid at covered temperature and flow combinations. ARI Standard 550/590 does not allow for testing with secondary coolants, and it is impractical to require it in manufacturer's test facilities used for certification and performance tests.

This addendum changes footnote a to Table 6.8.1C in recognition of lower practical scope limits for positive displacement (both air- and water-cooled) and corrects for the lower limit introduced in Addendum M for centrifugal chillers.

Errors in the SI version of the example in 6.4.1.2 are also corrected.

Addendum bl to 90.1-2007

Revise the Standard as follows (I-P units)

6.4.1.2 Minimum Equipment Efficiencies—Listed Equipment—Nonstandard Conditions.

6.4.1.2.1 Water-cooled centrifugal chilling packages. Equipment ~~Water-cooled centrifugal water-chilling packages~~ not designed for operation at ARI Standard 550/590 test conditions ~~(and thus cannot be tested to meet the requirements of Table 6.8.1C)~~ of 44°F leaving chilled-water temperature and 85°F entering condenser water temperature with 3 gpm/ton condenser water flow *(and thus cannot be tested to meet the requirements of Table 6.8.1C)* shall have maximum full-load kW/ton and *NPLV* ratings adjusted using the following equation:

Adjusted maximum full-load kW/ton rating = (full-load kW/ton from Table 6.8.1C)/*Kadj*

Adjusted maximum NPLV rating = (IPLV from Table 6.8.1C)/*Kadj*

where

Kadj	=	6.174722 – 0.303668(X) + 0.00629466(X)^2 – 0.000045780(X)^3
X	=	*DTstd* + LIFT
DTstd	=	(24 + (full-load kW/ton from Table 6.8.1C) × 6.83)/Flow
Flow	=	Condenser ~~water~~ fluid flow (gpm)/ Cooling full-load capacity (tons)
LIFT	=	CEWT – CLWT
CEWT	=	Full-load condenser entering ~~water~~fluid temperature (°F)
CLWT	=	Full-load leaving chilled-~~*water*~~*fluid* temperature (°F)

The adjusted full-load and *NPLV* values are only applicable for centrifugal chillers meeting all of ~~over~~ the following full-load design ranges:

- ~~Minimum~~ Leaving Chille~~r~~*d* ~~Water~~*Fluid* Temperature*s*~~:~~ ≥38°F
- ~~Maximum~~ Condenser Entering ~~Water~~ *Fluid* Temperature*s*~~:~~ ≤102°F
- Condenser ~~Water~~ Fluid Flow*s*~~:~~ 1 to 6 gpm/ton
- *X* ≥ 39°F and ≤ 60°F

Centrifugal ~~C~~chillers designed to operate outside of these ranges ~~or applications utilizing fluids or solutions with secondary coolants (e.g., glycol solutions or brines) with a freeze point of 27°F or lower for freeze protection~~ are not covered by this standard.

Example: Path A 600 ton centrifugal chiller Table 6.8.1C efficiencies as of 1/1/2010

Full Load	=	0.570 kW/ton
IPLV	=	0.539 kW/ton
CEWT	=	80°F
Flow	=	2.5 gpm/ton
CLWT	=	42°F
LIFT	=	80 – 42 = 38°F
DT	=	(24 + 0.570 × 6.83)/2.5 = 11.16°F
X	=	38 + 11.16 = 49.16°F
Kadj	=	6.174772 – 0.303668(49.16) + 0.00629466(49.16)^2 – 0.00004578(49.16)^3 = 1.020
Adjusted full load	=	0.570/1.020 = 0.559 kW/ton
NPLV	=	0.539/1.020 = 0.528 kW/ton

6.4.1.2.2 Positive displacement (air- and water-cooled) chilling packages. Equipment with a leaving fluid temperature higher than 32°F, shall show compliance with Table 6.8.1C when tested or certified with water at standard rating conditions, per the referenced test procedure.

Revise footnote a to Table 6.8.1C as follows:

a. The centrifugal chiller equipment requirements after adjustment per 6.4.1.2 do not apply ~~for~~to chillers ~~used in low-temperature applications~~ where the design leaving fluid temperature is < 4~~0~~ 38°F. The requirements do not apply to positive displacement chillers with design leaving fluid temperatures ≤32°F. The requirements do not apply to absorption chillers with design leaving fluid temperatures < 40°F.

Revise the Standard as follows (S-I units)

6.4.1.2 Minimum Equipment Efficiencies—Listed Equipment—Nonstandard Conditions.

6.4.1.2.1 Water-cooled centrifugal chilling packages. Equipment ~~Water-cooled centrifugal water-chilling packages~~ not designed for operation at ARI Standard 550/590 test conditions ~~(and thus cannot be tested to meet the requirements of Table 6.8.1C)~~ of 6.7°C leaving chilled-water temperature and 29.4°C entering condenser water temperature with 0.054 L/s·kW condenser water flow *(and thus cannot be tested to meet the requirements of Table 6.8.1C)* shall have maximum full-load kW/ton and *NPLV* ratings adjusted using the following equation:

Adjusted minimum full-load COP rating =
(full-load COP from Table 6.8.1C) × *Kadj*

Adjusted maximum NPLV rating =
(IPLV from Table 6.8.1C) × *Kadj*

where

Kadj	=	6.174722 – 0.5466024(*X*) + 0.020394698(*X*)2– 0.000266989(*X*)3
X	=	*DTstd* + LIFT
DTstd	=	(0.267114 + 0.267088/(Full-load COP from Table 6.8.1C))/Flow
Flow	=	Condenser ~~water~~ fluid flow (L/s)/Cooling full load capacity (kW)
LIFT	=	CEWT – CLWT (°C)
CEWT	=	Full load condenser entering ~~water~~fluid temperature (°C)
CLWT	=	Full load leaving chilled-~~ water~~fluid temperature (°C)

The adjusted full-load and *NPLV* values are only applicable for centrifugal chillers meeting all of ~~over~~ the following full-load design ranges, regardless of fluids:

- ~~Minimum~~ Leaving Chille~~r~~*d* ~~Water~~Fluid Temperature*s*~~:~~ ≥ 3.3°C
- ~~Maximum~~ Condenser Entering ~~Water~~ Fluid Temperature*s*~~:~~ ≤ 39°C
- Condenser ~~Water~~ Fluid Flow*s*~~:~~ *0*.036 to *0*.0721 L/s·kW
- *X* ≥ 21.7°C and ≤ 33.3°C

Centrifugal ~~C~~*c*hillers designed to operate outside of these ranges ~~or applications utilizing fluids or solutions with secondary coolants (e.g., glycol solutions or brines) with a freeze point of -2.8°C or lower for freeze protection~~ are not covered by this standard.

~~Example: Path A 2110 kW centrifugal chiller~~
Table 6.8.1C efficiencies as of 1/1/2010

~~Full Load~~	=	~~6.170 COP~~
~~IPLV~~	=	~~6.525 COP~~
~~CEWT~~	=	~~26°C~~
~~Flow~~	=	~~0.05 L/s·kW~~
~~CLWT~~	=	~~5.5°C~~
~~LIFT~~	=	~~26 – 5.5 = 20.50°C~~
~~*DT*~~	=	~~(0.267114 + 0.267088/6.170)/0.05 = 6.208°C~~
~~*X*~~	=	~~21.11 + 6.208 = 27.319°F~~
~~*Kadj*~~	=	~~6.174722 – 0.5466024(27.319) + 0.020394698(27.319)2 – 0.000266989(27.319)3 = 1.031~~
~~Adjusted full load~~	=	~~6.170 × 1.031 = 6.359 COP~~
~~NPLV~~	=	~~6.525 × 1.031 = 6.725 COP~~

Example: Path A 2110 kW centrifugal chiller
Table 6.8.1C efficiencies as of 1/1/2010

Full Load	=	6.170 COP
IPLV	=	6.525 COP
CEWT	=	26°C
Flow	=	0.05 L/s·kW
CLWT	=	5.5°C
LIFT	=	26 – 5.5 = 20.50°C
DT	=	(0.267114 + 0.267088/6.170)/0.05 = 6.208°C
X	=	6.208 + 20.50 = 26.708°C
Kadj	=	$6.174722 - 0.5466024(26.708) + 0.020394698(26.708)^2 - 0.000266989(26.708)^3 = 1.03747$
Adjusted full load	=	6.170 × 1.037 = 6.40 COP
NPLV	=	6.525 × 1.037 = 6.77 COP

6.4.1.2.2 Positive displacement (air- and water-cooled) chilling packages. Equipment with a leaving fluid temperature higher than 0°C, shall show compliance with Table 6.8.1C when tested or certified with water at standard rating conditions, per the referenced test procedure.

Revise footnote a to Table 6.8.1C as follows:

a. The centrifugal chiller equipment requirements after adjustment per 6.4.1.2 do not apply ~~for~~to chillers ~~used in low-temperature applications~~ where the design leaving fluid temperature is < ~~4.4~~ 3.3°C. The requirements do not apply to positive displacement chillers with design leaving fluid temperatures ≤ 0°C. The requirements do not apply to absorption chillers with design leaving fluid temperatures < 4.4°C.

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FOREWORD

The intent of this addendum is to coordinate terminology for visible transmittance with NFRC 200.

Revise Section 3.2 as follows (IP and SI Units)

Addendum bm to 90.1-2007

<u>**Visible Transmittance,** ***VT*****:** The ratio of visible radiation entering the space through the fenestration product to the incident visible radiation, determined as the spectral transmittance of the total fenestration system, weighted by the photopic response of the eye and integrated into a single dimensionless value.</u>

Revise Section 3.3 as follows (IP and SI Units)

~~**VLT**~~ <u>**VT**</u> visible ~~light~~ transmittance

Editorially revise all references from VLT to VT, all sections, all appendices (IP and SI Units)

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FOREWORD

The following addendum is part of an ongoing effort to keep the requirements of Section 11 and Appendix G consistent with other addenda to the Standard. This addendum makes changes to Section 11 and G related to Addenda E, S, and U.

Addendum E previously revised the language in Section 6 related to energy recovery. Addendum S previously revised the language in Section 6 related to using terms such as IEER instead of EER. Addendum U previously revised language related to the performance limit on some cooling towers.

Addendum bo to 90.1-2007

Modify 11.3.2 (c) as follows (IP and SI Units)

11.3.2 HVAC Systems. The *HVAC system* type and related performance parameters for the *budget building design* shall be determined from Figure 11.3.2, the system descriptions in Table 11.3.2A and accompanying notes, and the following rules:

c. Where *efficiency* ratings, such as IEER and ICOP, include fan energy, the descriptor shall be broken down into its components so that supply fan energy can be modeled separately. Supply and return/relief system fans shall be modeled as operating at least whenever the spaces served are occupied except as specifically noted in Table 11.3.2A.

Modify footnote to Table 11.3.2A as follows (IP and SI Units)

e **Chilled water:** For systems using purchased chilled water, the chillers are not explicitly modeled and chilled water costs shall be based as determined in Section 11.2.3. Otherwise, the *budget building design's* chiller plant shall be modeled with chillers having the number as indicated in Table 11.3.2B as a function of *budget building design* chiller plant load and type as indicated in Table 11.3.2C as a function of individual chiller load. Where chiller fuel source is mixed, the system in the *budget building design* shall have chillers with the same fuel types and with capacities having the same proportional capacity as the *proposed building design's* chillers for each fuel type. Chilled-water supply temperature shall be modeled at 44°F design supply temperature and 56°F return temperature. Piping losses shall not be modeled in either building model. Chilled-water supply water temperature shall be reset in accordance with Section 6.5.4.3. Pump system power for each pumping system shall be the same as the *proposed building design*; if the *proposed building design* has no chilled-water pumps, the *budget building design* pump power shall be 22 W/gpm (equal to a pump operating against a 75 ft head, 65% combined impeller and motor *efficiency*). The chilled-water system shall be modeled as primary-only variable flow with flow maintained at the design rate through each chiller using a bypass. Chilled-water pumps shall be modeled as riding the pump curve or with variable-speed drives when required in Section 6.5.4.1. The heat rejection device shall be an axial fan cooling tower with two-speed fans if required in Section 6.5.5. and shall meet the performance requirements of Table 6.8.1G. Condenser water design supply temperature shall be 85°F or 10°F approach to design wet-bulb temperature, whichever is lower, with a design temperature rise of 10°F. The tower shall be controlled to maintain a 70°F leaving water temperature where weather permits, floating up to leaving water temperature at design conditions. Pump system power for each pumping system shall be the same as the *proposed building design*; if the *proposed building design* has no condenser water pumps, the *budget building design* pump power shall be 19 W/gpm (equal to a pump operating against a 60 ft head, 60% combined impeller and motor *efficiency*). Each chiller shall be modeled with separate condenser water and chilled-water pumps interlocked to operate with the associated chiller.

Modify Appendix G as follows (IP and SI Units)

G3.1.2.1 Equipment Efficiencies. All HVAC equipment in the *baseline building design* shall be modeled at the minimum *efficiency* levels, both part load and full load, in accordance with Section 6.4.Where *efficiency* ratings, such as IEER and ICOP, include fan energy, the descriptor shall be broken down into its components so that supply fan energy can be modeled separately.

G3.1.2.10 Exhaust Air Energy Recovery Exhaust air energy recovery shall be modeled for the *budget building design* in accordance with Section 6.5.6.1.

~~Individual fan systems that have both a design supply air capacity of 5000 cfm or greater and have a minimum outdoor air supply of 70% or greater of the design supply air quantity shall have an energy recovery system with at least 50% recovery effectiveness. Fifty percent energy recovery effectiveness shall mean a change in the enthalpy of the *outdoor air* supply equal to 50% of the difference between the *outdoor air* and return air at design conditions. Provision shall be made to bypass or control the heat-recovery system to permit air economizer operation, where applicable.~~

~~**Exception:** If any of these exceptions apply, exhaust air energy recovery shall not be included in the *baseline building design*:~~

~~a. Systems serving spaces that are not cooled and that are heated to less than 60°F.~~

~~b. Systems exhausting toxic, flammable, or corrosive fumes or paint or dust. This exception shall only be used if exhaust air energy recovery is not used in the *proposed design*.~~

~~c. Commercial kitchen hoods (grease) classified as Type 1 by NFPA 96. This exception shall only be~~

~~used if exhaust air energy recovery is not used in the *proposed design*.~~

~~d. Heating systems in climate zones 1 through 3.~~

~~e. Cooling systems in climate zones 3c, 4c, 5b, 5c, 6b, 7, and 8.~~

~~f. Where the largest exhaust source is less than 75% of the design outdoor airflow. This exception shall only be used if exhaust air energy recovery is not used in the *proposed design*.~~

~~g. Systems requiring dehumidification that employ energy recovery in series with the cooling coil. This exception shall only be used if exhaust air energy recovery and series-style energy recovery coils are not used in the *proposed design*.~~

~~h. Systems serving laboratories with exhaust rates of 5000 cfm or greater.~~

G3.1.3.11 Heat Rejection. The heat rejection device shall be an axial fan cooling tower with two-speed fans, and shall meet the performance requirements of Table 6.8.1G. Condenser water design supply temperature shall be 85°F or 10°F approaching design wet-bulb temperature, whichever is lower, with a design temperature rise of 10°F. The tower shall be controlled to maintain a 70°F leaving water temperature where weather permits, floating up to leaving water temperature at design conditions. The *baseline building design* condenser-water pump power shall be 19 W/gpm. Each chiller shall be modeled with separate condenser water and chilled-water pumps interlocked to operate with the associated chiller.

The remainder of Appendix G is unchanged

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FOREWORD

The retail lighting models used by the 90.1 Lighting Subcommittee were modified to make use of more recent lamp technology that is readily available including high performance T8s and ceramic metal halides.

Analysis indicated that use of these technologies allowed for the lower values proposed here while still meeting IESNA recommended light levels.

For Retail type "a" the existing LPD was based on 100% fluorescent (94% of the footcandles) for the "general" and 100% Halogen IR (6% of the footcandles) for the "feature" display. For this CMP the fluorescent was increased to "high-performance T8", and the "feature" display was changed to 100% CMH.

For Retail type "b" the existing LPD was based on 100% Metal Halide (77% of the footcandles) for the "general" and 100% Halogen IR (23% of the footcandles) for the "feature" display. For this CMP the Metal Halide was changed to 80% "high-performance T8" + 20% CMH accent, and the "feature" display was changed to 100% CMH.

For Retail type "c" the existing LPD was based on 50% halogen IR and 50% CFL (85% of the footcandles) for the "general" and 100% Halogen IR (15% of the footcandles) for the "feature" display. For this CMP the Halogen IR was changed to CMH for the "general", and the "feature" display was changed to 40% Halogen IR and 60% CMH.

For Retail type "d" the existing LPD was based on 100% halogen IR (80% of the footcandles) for the "general" and 100% Halogen IR (20% of the footcandles) for the "feature" displays. For this CMP, it was calculated by providing 40% of the footcandles from Halogen IR and 60% from CMH for both the "general" and "feature" displays.

Addendum bq to 90.1-2007

Modify Section as follows (IP)

Additional Interior Lighting Power Allowance = 1000 watts
+ (Retail Area 1 × ~~1.0~~ 0.6 W/ft^2)
+ (Retail Area 2 × ~~1.7~~ 0.6 W/ft^2)
+ (Retail Area 3 × ~~2.6~~ 1.4 W/ft^2)
+ (Retail Area 4 × ~~4.2~~ 2.5 W/ft^2),

Modify Section as follows (SI)

Additional Interior Lighting Power Allowance = 1000 watts
+ (Retail Area 1 × ~~1.0~~ 6.5 W/m^2)
+ (Retail Area 2 × ~~1.7~~ 6.5 W/m^2)
+ (Retail Area 3 × ~~2.6~~ 15 W/m^2)
+ (Retail Area 4 × ~~4.2~~ 27 W/m^2),

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FOREWORD

This change adds an exterior zone 0 to cover very low light requirement areas. This will help eliminate excessive use of light in areas where none is needed other than for location marking type. Prior to this, the choices for users were zone 1 or 3 which both have higher than needed allowances. The single 60 W luminaire per location allows the use of small HID from higher pole locations (i.e. at parking) and would allow incandescent in locations where cold weather inhibits the use of CFL technology.

Addendum br to 90.1-2007

Modify Section 9.4 as follows (IP and SI)

TABLE 9.4.5 Exterior Lighting Zones

Lighting Zone	Description
<u>0</u>	<u>Undeveloped areas within national parks, state parks, forest land, rural areas, and other undeveloped areas as defined by the authority having jurisdiction</u>
1	Developed areas of national parks, state parks, forest land, and rural areas
2	Areas predominantly consisting of residential zoning, neighborhood business districts, light industrial with limited nighttime use and residential mixed use areas
3	All other areas
4	High activity commercial districts in major metropolitan areas as designated by the local jurisdiction

TABLE 9.4.6 Individual Lighting Power Allowances for Building Exteriors

		Zone 0	Zone 1	Zone 2	Zone 3	Zone 4
Base Site Allowance (base allowance may be used in tradable or non-tradable surfaces)		**No Base Site in Zone 0**	500 W	600 W	750 W	1300 W
Tradable Surfaces (Lighting power densities for uncovered parking areas, building grounds, building entrances and exits, canopies and overhangs and outdoor sales areas may be traded.)	**Uncovered Parking Areas**	**No Tradable Surface allowances in Zone 0**				
	Parking areas and drives		0.04 W/ft^2	0.06 W/ft^2	0.10 W/ft^2	0.13 W/ft^2
	Building Grounds					
	Walkways less than 10 feet wide		0.7 W/linear foot	0.7 W/linear foot	0.8 W/linear foot	1.0 W/linear foot
	Walkways 10 feet wide or greater Plaza areas Special Feature Areas		0.14 W/ft^2	0.14 W/ft^2	0.16 W/ft^2	0.2 W/ft^2
	Stairways		0.75 W/ft^2	1.0 W/ft^2	1.0 W/ft^2	1.0 W/ft^2
	Pedestrian Tunnels		0.15 W/ft^2	0.15 W/ft^2	0.2 W/ft^2	0.3 W/ft^2
	Landscaping		0.04 W/ft^2	0.05 W/ft^2	0.05 W/ft^2	0.05 W/ft^2
	Building Entrances and Exits					
	Main entries		20 W/linear foot of door width	20 W/linear foot of door width	30 W/linear foot of door width	30 W/linear foot of door width
	Other doors		20 W/linear foot of door width	20 W/linear foot of door width	20 W/linear foot of door width	20 W/linear foot of door width
	Entry Canopies		0.25 W/ft^2	0.25 W/ft^2	0.4 W/ft^2	0.4 W/ft^2
	Sales Canopies					
	free standing and attached		0.6 W/ft^2	0.6 W/ft^2	0.8 W/ft^2	1.0 W/ft^2
	Outdoor Sales					
	Open areas (including vehicle sales lots)		0.25 W/ft^2	0.25 W/ft^2	0.5 W/ft^2	0.7 W/ft^2
	Street frontage for vehicle sales lots in addition to "open area" allowance		**No allowance**	10 W/linear foot	10 W/linear foot	30 W/linear foot

TABLE 9.4.6 Individual Lighting Power Allowances for Building Exteriors *(continued)*

		Zone 0	Zone 1	Zone 2	Zone 3	Zone 4
Non-Tradable Surfaces (Lighting power density calculations for the following applications can be used only for the specific application and can-not be traded between surfaces or with other exterior lighting. The following allowances are in addition to any allowance otherwise permitted in the "tradable Surfaces" section of this table.)	**Building Facades**	A single luminaire of 60 watts or less may be installed for each roadway/parking entry, trail head, and toilet facility, or other locations approved by the authority having jurisdiction	**No allowance**	0.1 W/ft^2 for each illuminated wall or surface or 2.5 W/linear foot for each illuminated wall or surface length	0.15 W/ft^2 for each illuminated wall or surface or 3.75 W/linear foot for each illuminated wall or surface length	0.2 W/ft^2 for each illuminated wall or surface or 5.0 W/linear foot for each illuminated wall or surface length
	Automated teller machines and night depositories		270 W per location plus 90 W per additional ATM per location	270 W per location plus 90 W per additional ATM per location	270 W per location plus 90 W per additional ATM per location	270 W per location plus 90 W per additional ATM per location
	Entrances and gatehouse inspection stations at guarded facilities		0.75 W/ft^2 of covered and uncovered area	0.75 W/ft^2 of covered and uncovered area	0.75 W/ft^2 of covered and uncovered area	0.75 W/ft^2 of covered and uncovered area
	Loading areas for law enforcement, fire, ambulance and other emergency service vehicles		0.5 W/ft^2 of covered and uncovered area	0.5 W/ft^2 of covered and uncovered area	0.5 W/ft^2 of covered and uncovered area	0.5 W/ft^2 of covered and uncovered area
	Drive-up windows/doors		400 W per drive-through	400 W per drive-through	400 W per drive-through	400 W per drive-through
	Parking near 24-hour retail entrances		800 W per main entry	800 W per main entry	800 W per main entry	800 W per main entry

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FOREWORD

The following addendum is part of an ongoing effort to keep the requirements of Section 11 and Appendix G consistent with other addenda to the Standard. This Addendum includes changes to Section 11 and appendix G due to Addendum Y, Addendum AJ, Addendum BK, and Addendum AX.

During review, it was realized that the prior use of "Section 10" in the text below did not address pool heaters, which were addressed by Addendum Y. Therefore the change was made to include all other receptacle and other loads in Sections 5 through 10.

Addenda AJ and BK add additional motor efficiency tables to Section 10. This addendum clarifies G3.1.2.9 System Fan Power by requiring the use of the correct motor table in Section 10 for purposes of calculating the baseline fan motor power allowance.

Addendum AX changes the requirements for kitchen exhaust systems in Section 6 and the changes to 11.3.2 and G3.1.1 reflect the new requirements as well as referencing to Section 6.5.7.1.3 for the maximum exhaust flow rate for the type of hood.

Addendum bv to 90.1-2007

Revise the Standard as follows

Modify Table G3.1 as follows: (I-P and SI units)

12. RECEPTACLE AND OTHER LOADS

Proposed Building Performance. Receptacle and process loads, such as those for office and other equipment, shall be estimated based on the building type or space type category and shall be assumed to be identical in the proposed and baseline building designs, except as specifically authorized by the rating authority. These loads shall be included in simulations of the building and shall be included when calculating the baseline building performance and proposed building performance.

Baseline Building Performance. Other systems, such as motors covered by Section 10, and miscellaneous loads shall be modeled as identical to those in the proposed design including schedules of operation and control of the equipment. Where there are specific efficiency requirements listed in Sections 5 through 10 ~~in Section 10~~, these systems or components shall be modeled as having the lowest efficiency allowed by those requirements. Where no efficiency requirements exist, power and energy rating or capacity of the equipment shall be identical between the baseline building and the proposed design with the following exception: variations of the power requirements, schedules, or control sequences of the equipment modeled in the baseline building from those in the proposed design may be allowed by the rating authority based upon documentation that the equipment installed in the proposed design represents a significant verifiable departure from documented conventional practice. The burden of this documentation is to demonstrate that accepted conventional practice would result in baseline building equipment different from that installed in the proposed design. Occupancy and occupancy-schedules may not be changed.

Modify Section G3.1.2.9 as follows (IP Units):

G.3.1.2.9 System Fan Power. System fan electrical power for supply, return, exhaust, and relief (excluding power to fan powered VAV boxes) shall be calculated using the following formulas:

For Systems 1 and 2,

$$P_{fan} = CFMs \cdot 0.3.$$

For systems 3 through 8,

$$P_{fan} = \text{bhp} \times 746 \text{ / Fan Motor Efficiency.}$$

where

P_{fan}	=	electric power to fan motor (watts)
bhp	=	brake horsepower of *baseline* fan motor from Table G3.1.2.9
Fan Motor Efficiency	=	the efficiency from Table 10.8B for the next motor size greater than the bhp using ~~the~~ a totally enclosed fan cooled motor at 1800 rpm.
CFMS	=	the baseline system maximum design supply fan airflow rate in cfm

Modify Section G3.1.2.9 as follows (SI Units):

G3.1.2.9 System Fan Power. System fan electrical power for supply, return, exhaust, and relief (excluding power to fan powered VAV boxes) shall be calculated using the following formulas:

For Systems 1 and 2,

$$P_{fan} = CFMs \cdot 0.3.$$

For systems 3 through 8,

$$P_{fan} = \text{bhp} \times 746 \text{ / Fan Motor Efficiency.}$$

where

P_{fan}	=	electric power to fan motor (watts)
input kW	=	input kW of *baseline* fan motor from Table G3.1.2.9
Fan Motor Efficiency	=	the efficiency from Table 10.8B for the next motor size greater than the input kW using ~~the~~ a

totally enclosed fan cooled motor at 1800 rpm.

CFMS = the baseline system maximum design supply fan airflow rate in L/s

Modify Section 11 as follows: (I-P and SI units)

11.3.2

k. For kitchens with a total exhaust hood airflow rate greater than 5,000 cfm (2,400 L/s), use a demand ventilation system on 75% of the exhaust air. The system shall reduce exhaust and replacement air system airflow rates by 50% for one half of the kitchen occupied hours in the baseline design. If the proposed design uses demand ventilation the same air flow rate schedule shall be used. The maximum exhaust flow rate allowed for the hood or hood section shall meet the requirements of Section 6.5.7.1.3 for the numbers and types of hoods and appliances provided in the *proposed design*.

Modify Section G3.1.1 as follows: (I-P and SI units)

G3.1.1

Exceptions:

e. For kitchens with a total exhaust hood airflow rate greater than 5,000 cfm (2,400 L/s), use system type 5 or 7 with a demand ventilation system on 75% of the exhaust air. The system shall reduce exhaust and replacement air system airflow rates by 50% for one half of the kitchen occupied hours in the baseline design. If the proposed design uses demand ventilation the same air flow rate schedule shall be used. The maximum exhaust flow rate allowed for the hood or hood section shall meet the requirements of Section 6.5.7.1.3 for the numbers and types of hoods and appliances provided for the in the *proposed design*. For all-electric buildings, the heating shall be electric resistance.

Exception C: Commercial kitchen hoods (grease) classified as Type 1 by NFPA 96. ~~This exception shall only be used if exhaust air energy recovery is not used in the *proposed design*~~.

(This foreword is not part of this standard. It is merely informative and does not contain requirements necessary for conformance to the standard. It has not been processed according to the ANSI requirements for a standard and may contain material that has not been subject to public review or a consensus process. Unresolved objectors on informative material are not offered the right to appeal at ASHRAE or ANSI.)

FOREWORD

On October 7, 2008, the Department of Energy (DOE) completed a long rulemaking and published a final rule establishing new federal minimum energy efficiency standards for package terminal air conditioners (PTACs) and heat pumps (PTHPs). The Department reviewed the minimum energy efficiency requirements of ASHRAE 90.1 and opted to adopt the ASHRAE efficiencies for non-standard size PTAC and PTHP. For standard-size products, DOE decided to adopt more stringent requirements than ASHRAE 90.1.

This proposal amends the minimum energy efficiency requirements for standard-size package terminal equipment to be consistent with the federal standards. The effective date of these new minimum efficiencies is October 8, 2012 to coincide with the effective date of the federal standards. This proposal is expected to save 0.032 quads of energy over the next 30 years.

Addendum bw to 90.1-2007

Revise the Standard as follows (I-P units)

Revise Table 6.8.1 D as follows:

TABLE 6.8.1D Electrically Operated Packaged Terminal Air Conditioners, Packaged Terminal Heat Pumps, Single-Package Vertical Air Conditioners, Single -Package Vertical Heat Pumps, Room Air Conditioners, and Room Air Conditioner Heat Pumps–Minimum Efficiency Requirements

Equipment Type	Size Category (Input)	Subcategory or Rating Condition	Minimum Efficiency	Test Procedure[a]
PTAC (Cooling Mode) Standard Size	All Capacities	95.0°F db Outdoor air	12.5 – (0.213 × Cap/1000)[c] EER (before 10/08/2012) 13.8 - (0.300 × Cap/1000)[c] EER (as of 10/08/2012)	AHRI 310/380
PTAC (Cooling Mode) Non-Standard Size[b]	All Capacities	95.0°F db Outdoor air	10.9 – (0.213 × Cap/1000)[c] EER	
PTHP (Cooling Mode) Standard Size	All Capacities	95.0°F db Outdoor air	12.3 – (0.213 × Cap/1000)[c] EER (before 10/08/2012) 14.0 - (0.300 × Cap/1000)[c] EER (as of 10/08/2012)	
PTHP (Cooling Mode) Non-Standard Size[b]	All Capacities	95.0°F db Outdoor air	10.8 – (0.213 × Cap/1000)[c] EER	
PTHP (Heating Mode) Standard Size	All Capacities		3.2 – (0.026 × Cap/1000)[c] COP (before 10/08//2012) 3.7 - (0.052 × Cap/1000)[c] COP (as of 10/08/2012)	
PTHP (Heating Mode) Non-Standard Size[b]	All Capacities		2.9 – (0.026 × Cap/1000)[c] COP	

Remainder of table unchanged

Revise the Standard as follows (S-I units)

Revise Table 6.8.1 D as follows:

TABLE 6.8.1D Electrically Operated Packaged Terminal Air Conditioners, Packaged Terminal Heat Pumps, Single-Package Vertical Air Conditioners, Single -Package Vertical Heat Pumps, Room Air Conditioners, and Room Air Conditioner Heat Pumps–Minimum Efficiency Requirements

Equipment Type	Size Category (Input)	Subcategory or Rating Condition	Minimum Efficiency	Test Procedure[a]
PTAC (Cooling Mode) Standard Size	All Capacities	35.0°C db Outdoor air	3.66 – (0.213 × Cap/1000)[c] COP_C (before 10/08/2012) 4.04 - (0.300 × Cap/1000)[c] COP_C (as of 10/08/2012)	
PTAC (Cooling Mode) Non-Standard Size[b]	All Capacities	35.0°C db Outdoor air	3.19 – (0.213 × Cap/1000)[c] COP_C	
PTHP (Cooling Mode) Standard Size	All Capacities	35.0°C db Outdoor air	3.60 – (0.213 × Cap/1000)[c] COP_C (before 10/08/2012) 4.10 - (0.300 × Cap/1000)[c] COP_C (as of 10/08/2012)	
PTHP (Cooling Mode) Non-Standard Size[b]	All Capacities	35.0°C db Outdoor air	3.16 – (0.213 × Cap/1000)[c] COP_C	AHRI 310/380
PTHP (Heating Mode) Standard Size	All Capacities		3.2 – (0.026 × Cap/1000)[c] COP_H (before 10/08/2012) 3.7 - (0.052 × Cap/1000)[c] COP_H (as of 10/08/2012)	
PTHP (Heating Mode) Non-Standard Size[b]	All Capacities		2.9 – (0.026 × Cap/1000)[c] COP_H	

Remainder of table unchanged

POLICY STATEMENT DEFINING ASHRAE'S CONCERN FOR THE ENVIRONMENTAL IMPACT OF ITS ACTIVITIES

ASHRAE is concerned with the impact of its members' activities on both the indoor and outdoor environment. ASHRAE's members will strive to minimize any possible deleterious effect on the indoor and outdoor environment of the systems and components in their responsibility while maximizing the beneficial effects these systems provide, consistent with accepted standards and the practical state of the art.

ASHRAE's short-range goal is to ensure that the systems and components within its scope do not impact the indoor and outdoor environment to a greater extent than specified by the standards and guidelines as established by itself and other responsible bodies.

As an ongoing goal, ASHRAE will, through its Standards Committee and extensive technical committee structure, continue to generate up-to-date standards and guidelines where appropriate and adopt, recommend, and promote those new and revised standards developed by other responsible organizations.

Through its *Handbook*, appropriate chapters will contain up-to-date standards and design considerations as the material is systematically revised.

ASHRAE will take the lead with respect to dissemination of environmental information of its primary interest and will seek out and disseminate information from other responsible organizations that is pertinent, as guides to updating standards and guidelines.

The effects of the design and selection of equipment and systems will be considered within the scope of the system's intended use and expected misuse. The disposal of hazardous materials, if any, will also be considered.

ASHRAE's primary concern for environmental impact will be at the site where equipment within ASHRAE's scope operates. However, energy source selection and the possible environmental impact due to the energy source and energy transportation will be considered where possible. Recommendations concerning energy source selection should be made by its members.