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THE GENERAL ASSEMBLY OF PENNSYLVANIA

HOUSE BILL

No. 552 Session of 1977

INTRODUCED BY MESSRS. ITKIN, B. F. O'BRIEN, MISCEVICH, ABRAHAM, TRELLO, GAMBLE, McCALL, LEHR, SWEET AND J. L. WRIGHT, MARCH 7, 1977

AS RE-REPORTED FROM COMMITTEE ON MINES AND ENERGY MANAGEMENT, HOUSE OF REPRESENTATIVES, AS AMENDED, NOVEMBER 21, 1977

AN ACT

Providing for the regulation for energy conservation purposes of the construction of buildings, the establishment of a Building Energy Conservation Committee, appeals and for penalties.

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The General Assembly of the Commonwealth of Pennsylvania

hereby enacts as follows:

CHAPTER 1

GENERAL PROVISIONS

Section 101. Short title.

This act shall be known and may be cited as the "Building Energy Conservation Act."

Section 102. Legislative findings and declaration of purpose.

(a) Findings.--The Legislature hereby determines that:

(1) Energy shortages in the domestic supply present far-reaching problems that promise to persist. These energy shortages effect the continued efficient operation of the Commonwealth's economy and social structure.

(2) It is the Commonwealth's responsibility to provide for energy conservation through regulation of design and construction standards.

(3) The Legislature intends, by this act, to respond to these shortages by devising a specific responsible energy conservation policy for building systems.

(b) Purpose.--The purpose of this act is to grant to the Commonwealth of Pennsylvania and direct it to exercise specific authority in building construction to assure that such construction is performed using materials and techniques that will provide for energy conservation in the future operation and maintenance of said structure.

Section 103. Definitions.

The following words and phrases when used in this act shall have, unless the context clearly indicates otherwise, the meanings given to them in this section:

"Building." Any structure that provides facilities or shelter for public assembly or for educational, business,

mercantile, institutional, warehouse or residential occupancy, or industrial use including, but not limited to, those portions of factory and industrial occupancy such as office space except for:

(1) Buildings and structures or portions thereof whose peak design rate of energy usage is less than one watt per square foot or 3.4 BTU/hr per square foot of floor area for all purposes.

(2) Structures or those portions of structures used for manufacturing or processing and whose manufacturing or processing procedures require the use of substantial heat producing energy to create their product.

(3) Buildings which are neither heated nor cooled.

(4) Historic buildings.

"Construction." The erection, fabrication or renovation of a building.

"Department." The Pennsylvania Department of Labor and Industry EXCEPT THAT FOR ALL UNITS SUBJECT TO THE ACT OF MAY 11, 1972 (P.L.286, NO.70), KNOWN AS THE "INDUSTRIALIZED HOUSING ACT," AND ALL BUILDINGS CLASSIFIED AS USE GROUP R-3, HEREIN, DEPARTMENT MEANS THE PENNSYLVANIA DEPARTMENT OF COMMUNITY AFFAIRS. <——

"Design." Calculations and resultant drawings and specifications which are used for the construction of a building.

"Historic building." Any building which is deliberately preserved beyond its normal term of use because of historic associations, architectural interest, or public policy; or which qualifies for special historic building code provisions.

"LICENSED DESIGN PROFESSIONAL." A PERSON LICENSED AS AN <——

ARCHITECT OR PROFESSIONAL ENGINEER PURSUANT TO THE APPROPRIATE LICENSURE ACT.

"Life-cycle cost." The cost of a building including its initial cost, the cost of the energy consumed over its economic life and the cost of its operation and maintenance.

"Performance standards." Parameters within which designers of buildings shall work. The specific practices that a designer employs shall not be prescribed as long as the result is within the parameters established by the standards.

"Renovation." The rehabilitation of an existing building ~~to reasonably place it in its original structural condition and~~ which requires more than 25% of the gross floor area or volume of the entire building to be rebuilt. <—

CHAPTER 2

ENERGY CONSERVATION STANDARDS

Section 201. Provisions.

The following provisions regulate the design and construction of the exterior envelopes and selection of HVAC, service water heating, electrical distribution, and illumination systems and equipment required for the purpose of effective use of energy and shall govern the construction of all buildings, or portions thereof, as provided herein.

SUBCHAPTER A

PLANS AND SPECIFICATIONS

Section 202. Submission.

Plans, specifications and necessary computations together with the necessary certification required by section 305 shall be submitted to indicate conformance with this chapter and other applicable chapters of this act.

Section 203. Contents.

The plans and specifications shall show in sufficient detail all pertinent data and features of the building and the equipment and systems as herein governed, including but not limited to: exterior envelope component materials, U values of elements, R values of insulating materials, size and type of apparatus and equipment, equipment and system controls and other pertinent data to indicate conformance with the requirements herein.

SUBCHAPTER B
DEFINITIONS RELATING TO
ENERGY CONSERVATION STANDARDS

Section 204. Definitions relating to standards.

The following words and phrases when used in this chapter shall have, unless the context clearly indicates otherwise, the meanings given to them in this section:

"Coefficient of beam utilization" (CBU). The ratio of the luminous flux (lumens) reaching a specified area directly from a floodlight or projector to the total beam luminous flux.

"Coefficient of performance" (COP) - cooling: The ratio of the rate of net heat removal to the rate of total energy input, expressed in consistent units and under designated rating conditions.

"Coefficient of performance" (COP) - heat pump, heating: The ratio of the rate of net heat output to the rate of total energy input, expressed in consistent units and under designated rating conditions.

The rate of net heat output shall be defined as the change in the total heat contents of the air entering and leaving the equipment not including supplementary heat.

Total energy input shall be determined by combining the

energy inputs to all elements, except supplementary heaters, of the heat pump, including, but not limited to, compressors, pumps, supply air fans, return air fans, outdoor air fans, cooling tower fans and the heating, ventilating and air conditioning system equipment control circuit.

"Coefficient of utilization" (CU). The ratio of the luminous flux (lumens) from a luminaire received on the work plane to the lumens emitted by the luminaire's lamps alone.

"Color rendition." General expression for the effect of a light source on the color. Appearance of objects in conscious or subconscious comparison with their color appearance under a reference light source.

"Degree day, heating." A unit, based upon temperature difference and time, used in estimating fuel consumption and specifying nominal heating load of a building in winter. For any one day, when the mean temperature is less than 65 F., there exists as many degree days as there are Fahrenheit degrees difference in temperature between the mean temperature for the day and 65 F.

"Energy efficiency ratio" (EER). The ratio of net cooling capacity in Btuh to total rate of electric input in watts under designated operating conditions.

"Equivalent sphere illumination" (ESI). The level of sphere illumination which would produce task visibility equivalent to that produced by a specific lighting environment.

"Exterior envelope." The elements of a building which enclose conditioned spaces through which thermal energy may be transferred to or from the exterior.

"Floodlighting." A lighting system designated to light an area using projector type luminaires usually capable of being

pointed in any direction.

~~"Flood~~ "FLOOR area, gross." Gross floor area shall be the <—
floor area within the perimeter of the outside walls of the building under consideration, without deduction for hallways, stairs, closets, thickness of walls, columns or other features.

"Illumination." The density of the luminous flux incident on a surface. ~~it~~ IT is the quotient of the luminous flux by the <—
area of the surface when the latter is uniformly illuminated.

"Light loss factor" (LLF). A factor used in calculating the level of illumination after a given period of time and under given conditions. It takes into account temperature and voltage variations, dirt accumulation on luminaire and room surfaces, lamp depreciation, maintenance procedures and atmosphere conditions.

"Luminaire." A complete lighting unit consisting of a lamp or lamps together with the parts designed to distribute the light, to position and protect the lamps and to connect the lamps to the power supply.

"Packaged terminal air conditioner." A factory selected combination of heating and cooling components, assemblies or sections, intended to serve a room or zone.

"Power." In connection with machines, power is the time rate of doing work. In connection with the transmission of energy of all types, power refers to the rate at which energy is transmitted; in customary units, it is measured in watts (W) or British thermal units per hour (Btuh) and in SI units is measured in watts (W).

"Reflectance." The ratio of the light reflected by a surface to the light falling upon it.

"Reheat." The application of sensible heat to supply air

that has been previously cooled below the temperature of the conditioned space by either mechanical refrigeration or the introduction of outdoor air to provide cooling.

"Residential buildings." All buildings and structures or parts thereof shall be classified in the residential (R) use group in which families or households live, or in which sleeping accommodations are provided for individuals with or without dining facilities, excluding those that are classified as institutional buildings.

Use group R-1 structures. This use group shall include all hotel and motel buildings, lodging houses, boarding houses and dormitory buildings arranged for the shelter and sleeping accommodation of more than 20 individuals.

Use group R-2 structures. This use group shall include all multiple-family dwellings having more than two dwelling units; and shall also include all dormitories, boarding and lodging houses arranged for shelter and sleeping accommodation by more than five and not more than 20 individuals.

Use group R-3 structures. This use group shall include all buildings arranged for the use of one or two family dwelling units including not more than five lodgers or boarders per family.

"Resistance, thermal" (R). A measure of the ability to retard the flow of heat. The R value is the reciprocal of a heat transfer coefficient, as expressed by U. R = 1/U.

"Thermal transmittance" (U). Overall coefficient of heat transmission or thermal transmittance (air to air) expressed in units of BTU per hour per square foot per degree F. It is the time rate of heat flow. The U value applies to combinations of different materials used in series along the heat flow path and

also to single materials that comprise a building section and include cavity air spaces and surface air films on both sides.

"Thermal transmittance" (Uo). Overall (average) heat transmission or thermal transmittance of a gross area of the exterior building envelope, expressed in units of BTU per hour per square foot per degree F.

The Uo value applies to the combined effect of the time rate of heat flows through the various parallel paths, such as windows, doors and opaque construction areas, comprising the gross area of one or more exterior building components, such as walls, floor or roof/ceiling.

"Thermostat." An instrument which measures changes in temperature and controls devices for maintaining a desired temperature.

"Veiling reflections." Regular reflections superimposed upon diffuse reflections from an object that partially or totally obscure the details to be seen by reducing the contrast. This sometimes is called "reflected glare."

"Work plane." The plane at which work usually is done and at which the illumination is specified and measured. Unless otherwise indicated, this is assumed to be a horizontal plane 30 in. (0.76 m) above the floor.

"Zone." A space or group of spaces within a building with heating or cooling requirements sufficiently similar so that comfort conditions can be maintained throughout by a single controlling device.

SUBCHAPTER C

BUILDING ENVELOPE

Section 205. General provisions.

(a) Purpose of subchapter.--The intent of this subchapter is

to provide minimum requirements for exterior envelope construction in the interest of energy conservation.

In addition to the criteria set forth in this subchapter the proposed design may take into consideration the thermal mass of the building in considering energy conservation.

(b) Thermal performance.--All buildings and structures that are heated or mechanically cooled shall be constructed so as to provide the required thermal performance of the various components.

The required thermal transmittance value (Uo) of any one component, such as roof/ceiling, wall or floor may be increased and the Uo value for other components decreased provided that the overall heat gain or loss for the entire building envelope does not exceed the total resulting from conformance to the required Uo values.

(c) Different requirements.--A building that is designed to be both heated and cooled shall meet the more stringent of the heating or cooling requirements of the exterior envelope as provided in this subchapter when requirements differ.

(d) Exterior walls.--For the purpose of this subchapter the gross area of exterior walls consists of all opaque wall areas, including foundation walls above grade, peripheral edges of floors, window areas including sash, and door areas, where such surfaces are exposed to outdoor air and enclose a heated or mechanically cooled space.

(e) Roof assembly.--For the purpose of this subchapter a roof assembly shall be considered as all components of the roof/ceiling envelope through which heat flows, thereby creating a building transmission heat loss or gain, where such assembly is exposed to outdoor air and encloses a heated or mechanically

cooled space.

The gross area of a roof assembly consists of the total interior surface of such assembly, including skylights, exposed to the heated or mechanically cooled space.

Where air ceiling plenums are employed, the roof or ceiling assembly shall:

(1) For thermal transmittance purposes not include the ceiling proper nor the plenum space as part of the assembly.

(2) For gross area purposes be based upon the interior face of the upper plenum surface.

Section 206. Criteria for residential buildings.

(a) Applicability.--The requirements herein shall apply to all buildings and structures or portions thereof of use groups R-1, R-2 and R-3 that are heated or mechanically cooled when not more than 3 stories or 40 feet in height.

(b) Walls.--The gross area of exterior walls above grade, including foundation walls, shall have a combined thermal transmittance value (Uo) not exceeding those specified in Table 1. ~~with the following exceptions:~~ <—

~~(1) In locations with less than 500 heating degree days there shall not be a maximum Uo requirement if only heating is provided and the Uo shall be 0.30 maximum if the building is mechanically cooled.~~

~~(2) The opaque exterior wall areas may be constructed having thermal transmittance (U) values in conjunction with glazed opening areas in accordance with Table 2.~~

Table 1

Maximum Allowable "Uo" Values for

Gross Exterior Wall Assemblies

	Detached	All other

Annual heating degree days*	one & two family	residential
~~500~~	~~0.30~~	~~0.38~~
~~1000~~	~~0.29~~	~~0.37~~
~~2000~~	~~0.28~~	~~0.35~~
~~3000~~	~~0.26~~	~~0.33~~
4000	0.25	0.31
5000	0.23	0.29
6000	0.22	0.27
7000	0.20	0.26
~~8000~~	~~0.19~~	~~0.24~~
~~9000~~	~~0.17~~	~~0.22~~
~~10,000 or more~~	~~0.16~~	~~0.20~~

*As specified in Chapter 43 ASHRAE Handbook-Systems.

~~Table 2~~

~~Maximum Allowable "U" Values for Above-Grade Exterior Wall Sections and Corresponding Maximum Allowable Glazed Opening Areas~~

~~Required "U" opaque walls Btuh per square foot per degree F. (3 stories or less)~~

~~Yearly degree days~~	~~Glazed openings~~	~~Use group R-3 per cent glazed opening~~			
		~~10~~	~~15~~	~~20~~	~~25~~
~~2500 or Less~~	~~Single~~	~~.21~~	~~.15~~	~~.09~~	~~.03~~
	~~Double~~	~~.26~~	~~.24~~	~~.21~~	~~.18~~
~~2501 to 4500~~	~~Single~~	~~.17~~	~~.12~~	~~.06~~	~~.02~~
	~~Double~~	~~.23~~	~~.20~~	~~.18~~	~~.14~~
~~4501 to 6000~~	~~Single~~	~~.14~~	~~.08~~	~~.02~~	~~NP~~
	~~Double~~	~~.19~~	~~.17~~	~~.14~~	~~.10~~
~~6001 to 8000~~	~~Single~~	~~.12~~	~~.06~~	~~.01~~	~~NP~~

		Double	.17	.14	.11	.08
8001 to 10,000		Single	.09	.02	NP	NP
		Double	.14	.11	.08	.04
10,000 or more		Single	.05	NP	NP	NP
		Double	.11	.07	.04	NP
Yearly		Glazed	All other residential			
degree days		openings	per cent glazed opening			
			15	20	25	30
2500 or Less		Single	.25	.19	.13	.07
		Double	.33	.31	.29	.27
2501 to 4500		Single	.20	.14	.08	.03
		Double	.29	.26	.24	.21
4501 to 6000		Single	.15	.09	.03	NP
		Double	.24	.21	.18	.15
6001 to 8000		Single	.13	.07	.01	NP
		Double	.21	.19	.16	.13
8001 to 10,000		Single	.08	.02	NP	NP
		Double	.17	.14	.10	.06
10,000 or more		Single	.04	NP	NP	NP
		Double	.12	.09	.05	NP

Note 1. NP - Not Permitted.

Note 2. For glazed opening percentages other than those specified above, linear interpolation may be utilized.

Note 3. For combinations of single and double glazing, the "U" values above may be interpolated in proportion to the single and double glazed areas utilized.

Note 4. To obtain credit for triple glazing or superior quality sash, or to utilize combinations of single and double glazing not permitted by this table, use Table 1.

Note 5. Interpolation between given "U" values and between

~~degrees days is not permitted.~~

(c) Roof/ceiling.--The roof/ceiling assemblies shall have a combined thermal transmittance value (Uo) NOT TO EXCEED 0.05 EXCEPT THAT ROOF/CEILING ASSEMBLIES IN WHICH THE FINISHED INTERIOR SURFACE IS ESSENTIALLY THE UNDERSIDE OF THE ROOF DECK, SUCH AS A WOODEN CATHEDRAL CEILING, MAY HAVE A "UO" VALUE NOT TO EXCEED 0.08. THESE VALUES PRESUME NO SIGNIFICANT THERMAL TRANSMISSION THROUGH FRAMING MEMBERS, SKYLIGHTS OR OTHER INTERRUPTIONS IN THE ROOF ENVELOPE. IF SUCH INTERRUPTIONS OCCUR, CALCULATIONS MUST BE MADE SHOWING CONFORMANCE TO THE REQUIRED "UO" VALUES. ~~or shall be provided with thermal insulation having an "R" value as specified in Table 3 with the following exception:~~

~~Roof/ceiling assemblies in which the finished interior surface is essentially the underside of the roof deck, such as a wooden cathedral ceiling, may have a "Uo" value not to exceed 0.08 BTU per hour per square foot per degree F. for any heating degree day area.~~

~~Table 3~~

~~Maximum Allowable "Uo" Values and Alternative Minimum Allowable "R" Values of Added Insulation for Roof/Ceiling Assemblies~~

~~Annual heating degree days~~	~~Maximum "Uo"~~	~~Minimum "R"~~
~~8000 or Less~~	~~0.05~~	~~19~~
~~More than 8000~~	~~0.04~~	~~22~~

~~Note 1. These values presume no significant thermal transmission through framing members, skylights or other interruptions in the roof envelope. If such interruptions occur, calculations must be made showing conformance to the required "Uo" values.~~

(d) Floors over unheated spaces.--The floor of a heated or mechanically cooled space located over an unheated space shall have a combined thermal transmittance value (Uo) ~~or shall be provided with thermal insulation having an "R" value as specified in Table 4.~~ NOT TO EXCEED 0.08.

~~Table 4~~

~~Maximum Allowable "Uo" Values and Alternative Minimum Allowable "R" Values of Added Insulation for Floors over Unheated Spaces~~

~~Annual heating degree days~~	~~Maximum "Uo"~~	~~Minimum "R"~~
~~500*~~	~~0.36~~	~~--~~
~~1000~~	~~0.32~~	~~--~~
~~2000~~	~~0.25~~	~~4~~
~~3000~~	~~0.18~~	~~6~~
~~4000~~	~~0.11~~	~~9~~
~~4500 or More~~	~~0.08~~	~~11~~

~~*Table values may be interpolated.~~

(e) Slab-on grade floors.--

(1) For slab-on grade floors, the perimeter of the floor shall be insulated with a material having a thermal resistance value (R) not less than those specified in Table ~~5~~ 2.

Table ~~5~~ 2

Minimum Allowable "R" Values of Perimeter Insulation for Slab-On Grade Floors

Annual heating degree days	Heated slab	Unheated slab
~~500*~~	~~2.9~~	~~--~~
~~1000~~	~~3.3~~	~~--~~
~~2000~~	~~4.0~~	~~--~~
~~3000~~	~~4.8~~	~~2.8~~

4000	5.5	3.5
5000	6.3	4.2
6000	7.0	4.9
7000	7.8	5.5
~~8000~~	~~8.5~~	~~6.2~~
~~9000~~	~~9.3~~	~~6.8~~
~~10,000 or more~~	~~10.0~~	~~7.5~~

*Table values may be interpolated.

(2) The insulation shall extend downward from the top of the slab for a minimum distance of 24 inches or downward to the bottom of the slab then horizontally beneath the slab for a minimum total distance of 24 inches.

Section 207. Other buildings.

(a) Coverage.--The heating and cooling requirements herein shall govern all buildings and structures or portions thereof other than defined by section 206.

(b) Heating criteria for walls.--All buildings and structures that are heated shall have a combined thermal transmittance value (Uo) for the gross area of exterior walls not exceeding those specified in Table ~~6~~ 3.

Table ~~6~~ 3

Maximum Allowable "Uo" Values

for Gross Exterior Wall Assemblies

Annual heating degree days	3 stories or 40 ft. or less	More than 3 stories or 40 ft.
~~500~~	~~0.38~~	~~0.47~~
~~1000~~	~~0.37~~	~~0.46~~
~~2000~~	~~0.35~~	~~0.43~~
~~3000~~	~~0.33~~	~~0.41~~

4000	0.31	0.38
5000	0.29	0.36
6000	0.27	0.33
7000	0.26	0.31
~~8000~~	~~0.24~~	~~0.28~~
~~9000~~	~~0.22~~	~~0.28~~
~~10,000 or more~~	~~0.20~~	~~0.28~~

(c) Heating criteria for roof/ceiling.--All buildings and structures that are heated shall have combined thermal transmittance value (Uo) for roof/ceiling assemblies not exceeding those specified in Table ~~7~~ 4.

Table ~~7~~ 4

Maximum Allowable "Uo" Values for Roof/Ceiling Assemblies

Annual heating degree days	Maximum Uo
~~3000 and less*~~	~~0.10~~
~~4000~~	~~0.092~~
4000*	0.092
5000	0.084
6000	0.076
7000	0.068
~~8000 and more~~	~~0.06~~

*Table values may be interpolated.

(d) Heating criteria for floors over unheated spaces.--The floor of a heated space located over an unheated space shall have a thermal transmittance value (Uo) not exceeding ~~those specified in Table 8~~ 0.08.

~~Table 8~~

~~Maximum Allowable "Uo" Values for Floor Assemblies over Unheated Spaces~~

Annual heating degree days	Maximum Uo
500*	0.36
1000	0.32
2000	0.25
3000	0.18
4000	0.11
4500 or more	0.08

*Table values may be interpolated.

(e) Heating criteria for slab-on grade floors.--For slab-on grade floors, the perimeter of the floor shall be insulated with a material having a thermal resistance value (R) not less than those specified in Table 9 5. <—

The insulation shall extend downward from the top of the slab for a minimum distance of 24 inches or downward to the bottom of the slab then horizontally beneath the slab for a minimum total distance of 24 inches.

Table 9 5 <—

Minimum Allowable "R" Values of Perimeter Insulation for Slab-On Grade Floors

Annual heating degree days	Heated slab	Unheated slab	
500*	2.9	--	<—
1000	3.3	--	
2000	4.0	--	
3000	4.8	2.8	
4000	5.5	3.5	
4000*	5.5	3.5	<—
5000	6.3	4.2	
6000	7.0	4.9	
7000	7.8	5.5	
8000	8.5	6.2	<—

~~9000~~	~~9.3~~	~~6.8~~
~~10,000 or more~~	~~10.0~~	~~7.5~~

~~*Table values may be interpolated.~~

(f) Cooling criteria for walls.--All buildings and structures that are mechanically cooled shall have an overall thermal transfer value for the gross area of exterior walls not exceeding ~~those specified in Table 10.~~ <—

~~Table 10~~

~~Maximum Overall Thermal Transfer Values for Gross Exterior Walls~~

~~Degrees north latitude~~	~~Maximum overall thermal transfer value Btuh per square foot~~
~~24~~	~~29.0~~
~~32~~	~~31.3~~
~~40~~	~~33.5~~
~~48~~	~~35.7~~
~~56~~	~~38.0~~

33.5 BTU'S PER HOUR PER SQUARE FOOT BASED ON THE FOLLOWING <— EQUATION:

$$OTTV = \frac{(UW \times AW \times TDEQ) + (AF \times SF \times SC) + (UF \times AF \times DELTA\ T)}{AO}$$

OTTV = OVERALL THERMAL TRANSFER VALUE WHERE:

UW = THE THERMAL TRANSMITTANCE OF ALL ELEMENTS OF THE OPAQUE WALL AREA BTU/H. FT2.F (W/M2K)

AW = OPAQUE WALL AREA, FT2 (M2)

UF = THE THERMAL TRANSMITTANCE OF THE FENESTRATION AREA BTU/H. FT2.F (W/M2K)

AF = FENESTRATION AREA, FT2 (M2)

TDEQ = VALUE GIVEN IN THE FOLLOWING TABLE,F(OC):

TABLE FOR TEMPERATURE DIFFERENCE

WALL CONSTRUCTION-MASS PER UNIT AREA		TDEQ	
16/FT2	KG/M2	F	C
0-25	0-125	44	24.5
26-40	126-195	37	21.0
41-70	196-345	30	17.0
71 AND ABOVE	346 AND ABOVE	23	13.0

WEIGHT OF WALL CONSTRUCTION SHALL BE DETERMINED FROM THE 1972 ASHRAE HANDBOOK OF FUNDAMENTALS, CHAPTER 22.

SC = SHADING COEFFICIENT OF THE FENESTRATION

DELTA T = TEMPERATURE DIFFERENCE BETWEEN EXTERIOR AND INTERIOR DESIGN CONDITIONS, F, FOR WHICH THE FOLLOWING TEMPERATURES SHALL APPLY:

	INDOOR		OUTDOOR
	F	OC	
WINTER	72	22.0	97 1/2%
SUMMER	78	25.5	2 1/2%

SF = SOLAR FACTOR VALUE GIVEN BTU/H.FT2 (W/M2). (USE 127 BTU/H.FT2)

AO = GROSS AREA OF EXTERIOR WALLS, FT2 (M2). THE GROSS AREA OF EXTERIOR WALLS CONSISTS OF ALL OPAQUE WALL AREAS (INCLUDING FOUNDATION WALLS, BETWEEN FLOOR SPANDRELS, PERIPHERAL EDGES OF FLOORS, ETC.), WINDOW AREAS (INCLUDING SASH), AND DOOR AREAS, WHERE SUCH SURFACES ARE EXPOSED TO OUTDOOR AIR AND ENCLOSE A HEATED AND/OR MECHANICALLY COOLED SPACE (INCLUDING INTERSTICIAL AREAS BETWEEN TWO SUCH SPACES).

NOTE: WHERE MORE THAN ONE TYPE OF WALL AND/OR FENESTRATION IS USED, THE RESPECTIVE TERM OR TERMS SHALL BE EXPANDED INTO SUB-ELEMENTS, AS:

(UW X AW X TDEQ) + (UW2 X AW2 X TDEQ2), ETC.

(g) Cooling criteria for roof/ceilings.--All buildings and structures that are mechanically cooled shall have a combined thermal transmittance value (Uo) for roof/ceiling assemblies the same as specified in Table ~~7~~ 4 for heating. <——

Section 208. Air leakage.

(a) Application.--The requirements of this section shall apply to all buildings and structures and apply only to those locations separating outdoor ambient conditions from interior spaces that are heated or mechanically cooled and are not applicable to separation of interior spaces from each other.

(b) Standard.--Compliance with the criteria for air leakage shall be determined by ASTM E-283, Standards Method Test for Rate of Air Leakage through Exterior Windows, Curtain Walls and Doors, at a pressure differential of 1.567 lb/ft2 which is equivalent to the effect of a 25 m.p.h. wind.

(c) Acceptance criteria.--The following criteria shall represent the maximum allowable air leakage:

(1) The air infiltration rate for windows shall not exceed 0.5 cfm per foot of sash crack.

(2) The air infiltration rate for sliding glass doors in residential buildings shall not exceed 0.5 cfm per square foot of door area.

(3) The air infiltration rate for swinging doors in residential buildings shall not exceed 1.25 cfm per square foot of door area.

(4) The air infiltration rate for swinging, revolving or sliding doors in other than residential buildings shall not exceed 11 cfm per lineal foot of door crack.

(d) Caulking and sealants.--Exterior joints around windows and door frames, between wall cavities and window or door

frames, between wall and foundation, between wall and roof, between wall panels, at penetrations or utility services through walls, floors and roofs, and all other openings in the exterior envelope shall be caulked, gasketed, weatherstripped, or otherwise sealed.

SUBCHAPTER D

WARM AIR HEATING, VENTILATING AND AIR CONDITIONING SYSTEMS AND EQUIPMENT

Section 209. General provisions.

This subchapter applies to air duct systems employing mechanical means for the movement of air used for warm air heating, ventilating, air conditioning systems, exhaust systems and combination heating and air conditioning systems, except that this subchapter shall not apply to systems for the removal of flammable vapors or residues or to systems for conveying dust, stock or refuse by means of air currents. Heating, ventilating and air conditioning systems of all buildings and structures or portions thereof shall be designed and installed for efficient use of energy as herein provided. For special applications such as hospitals, laboratories, thermally sensitive equipment, computer rooms, and manufacturing processes, the design concepts and parameters shall conform to the requirements of the application at minimum energy levels.

Section 210. Design requirements.

In determining design conditions for calculations under this section the following design temperatures shall apply:

(1) Outdoor design temperature shall be selected for listed locations in Chapter 33 of the ASHRAE handbook of Fundamentals, from columns of 97 1/2% values for heating and 2 1/2% values for cooling.

(2) Indoor design temperature shall be 70 degrees F. for heating and 78 degrees F. for cooling.

(3) Indoor design relative humidity for heating shall not exceed 30%. For cooling the actual design relative humidity within the comfort envelope as defined in ASHRAE Standard 55-74 "Thermal Environmental Conditions for Human Occupancy" shall be selected for the minimum total heating, ventilating, and air conditioning system energy use.

Section 211. Cooling with outdoor air.

(a) Fan system design.--Each fan system shall be designed to use up to and including 100% of the fan system capacity for cooling with outdoor air automatically whenever its use will result in lower usage of energy than would be required under its normal operation.

(b) Exceptions.--Cooling with outdoor air is not required under any one or more of the following conditions:

(1) Fan system capacity less than 5,000 Cfm or 134,000 Btu/Hr total cooling capacity.

(2) The quality of the outdoor air is so poor as to require extensive treatment of the air.

(3) The need for humidification or dehumidification requires the use of more energy than is conserved by outdoor air cooling.

(4) The use of outdoor air cooling may affect the operation of other systems (such as return or exhaust air fans or supermarket refrigeration) so as to increase the overall energy consumption of the building.

(5) Internal/external zone heat recovery or other energy recovery is used.

~~(6) Annual heating degree days are less than 2,500.~~ <—

~~(7)~~ (6) When all space cooling is accomplished by a circulating liquid which transfers space heat directly or indirectly to a heat rejection devise such as a cooling tower without the use of a refrigeration system.

Section 212. Mechanical ventilation.

Each mechanical ventilation system shall be equipped with a readily accessible means for either shut-off or volume reduction and shut-off when ventilation is not required.

Section 213. Simultaneous heating and cooling.

Systems that employ both heating and cooling simultaneously in order to achieve comfort conditions within a space shall be limited to those situations where more efficient methods of heating and air conditioning cannot be effectively utilized to meet system objectives. Simultaneous heating and cooling by reheating or recooling supply air or by concurrent operation or independent heating and cooling systems serving a common zone shall be restricted as follows:

(1) Recovered energy, provided the new energy expended in the recovery process is less than the amount recovered, may be used for control of temperature and humidity. New energy is defined as energy, other than recovered, utilized for the purpose of heating or cooling.

(2) New energy may be used, when necessary, to prevent relative humidity from rising above 60% for comfort control or to prevent condensation on terminal units or outlets.

(3) New energy may be used for control of temperature if minimized as specified in sections 214 through 218.

Section 214. Reheat systems.

Systems employing reheat and serving multiple zones, other than those employing variable air volume for temperature

control, shall be provided with control that will automatically reset the system cold air supply to the highest temperature level that will satisfy the zone requiring the coolest air. Single zone reheat systems shall be controlled to sequence reheat and cooling.

Section 215. Dual duct and multizone systems.

These systems shall be provided with control that will automatically reset the cold deck air supply to the highest temperature that will satisfy the zone requiring the coolest air and the hot deck air supply to the lowest temperature that will satisfy the zone requiring the warmest air.

Section 216. Recooling systems.

Systems in which heated air is recooled directly or indirectly, to maintain space temperature, shall be provided with control that will automatically reset the temperature to which the supply air is heated to the lowest level that will satisfy the zone requiring the warmest air.

Section 217. Multiple zones.

For systems with multiple zones, one or more zones may be chosen to represent a number of zones with similar heating or cooling characteristics. A multiple zone heating, ventilating and air conditioning system that employs reheating or recooling for control of not more than 5,000 Cfm or 20% of the total supply air of the system, whichever is less, shall be exempt from the supply air temperature reset requirements of sections 214 through 216.

Section 218. Concurrent operation.

Concurrent operation of independent heating and cooling systems serving common spaces, and requiring the use of new energy for heating or cooling shall be minimized by one or both

of the following:

(1) By providing sequential temperature control of both heating and cooling capacity in each zone.

(2) By limiting the heating energy input, through automatic reset control of the heating medium temperature (or energy input rate), to only that necessary to offset heat loss due to transmission and infiltration and, where applicable, to heat the ventilation air supply to the space.

Section 219. Equipment performance requirements.

(a) Application.--The requirements of this section apply to equipment and component performance for heating, ventilating and air conditioning systems. Where equipment efficiency levels are specified, data furnished by the equipment supplier or certified under a nationally recognized certification program or rating procedure shall be used to satisfy these requirements.

(b) Electric system equipment.--Heating ventilating and air conditioning systems equipment whose energy input in the cooling mode is entirely electric shall ~~slow~~ SHOW a coefficient of performance (COP) and energy efficiency ratio (EER) not less than the values specified in Table ~~11~~ 6. These requirements apply to, but are not limited to, unitary cooling equipment (air and water source); packaged air conditioners; and room air conditioners. These requirements do not apply to equipment used in areas having open refrigerated food display cases. For determining coefficient of performance (COP), the rate of net heat removal shall be defined as the change in the total heat contents of the air entering and leaving the equipment (without reheat). Total energy input shall be determined by combining the energy inputs to all elements of the equipment, including but not limited to, compressors, pumps, supply-air fans, cooling

tower fans and the system equipment control circuit.

Table ~~11~~ 6 <—

Minimum EER and COP for Electric Heating, Ventilating and Air Conditioning System Equipment

Standard rating capacity	Eer	Cop
Under 65,000 Btu/hr (19,050 watts)	6.1	1.8
65,000 Btu/hr (19,050 watts) and over	6.8	2.0

(c) Other system equipment.--Heat operated cooling equipment shall show a coefficient of performance (COP) in the cooling mode not less than the values specified in Table ~~12~~ 7. These <— requirements apply to, but are not limited to, absorption, engine-driven and turbine-driven equipment. The coefficient of performance (COP) is determined excluding the electrical auxiliary inputs.

Table ~~12~~ 7 <—

Minimum COP for Heating, Ventilating and Air Conditioning System Heat Operated Cooling Equipment

Heat source	Minimum cop
Direct fired (gas, oil)	0.40
Indirect fired (steam, hot water)	0.65

(d) System components.--Heating, ventilating and air conditioning system components whose energy input in the cooling mode is entirely electric shall show a coefficient of performance (COP) and energy efficiency ratio (EER) not less than the values specified in Table ~~13~~ 8. For determining <— coefficient of performance (COP), the rate of heat removal is defined as the difference in total heat contents of the water or refrigerant entering or leaving the component. Total energy input shall be determined by combining the energy inputs to all elements and accessories of the component, including but not

limited to, compressors, internal circulating pumps, condenser-air fans, evaporative-condenser cooling heater pumps, purge, and the component control circuit.

Table ~~13~~ 8 <—

Minimum COP for Electrically Driven Heating, Ventilating and Air Conditioning System Components

Component	Condensing means	Air Eer	Air Cop	Water Eer	Water Cop	Evaporation Eer	Evaporation Cop
Self-contained water chillers	Centrifugal	7.5	2.2	12.9	3.8		
	Positive displacement	7.2	2.1	10.9	3.2		
Condenserless water chillers	Positive displacement	8.9	2.6	10.9	3.2		
Compressor and condenser units 65,000 Btu/hr. ~~(19.050 watts)~~ (19,050 WATTS) and over	Positive displacement	7.8	2.3	11.3	3.3	11.3	3.3

<— <—

(e) Heat pumps.--Heat pumps whose energy input is entirely electric shall show a coefficient of performance (COP), heating, not less than the values specified in Table ~~14~~ 9. <—

Table ~~14~~ 9 <—

Minimum COP for Heat Pumps, Heating Mode

Source and outdoor temperature (degree F.)	Minimum cop
Air source--47 DB/43 WB	2.2
Air source--17 DB/15 WB	1.2
Water source--60 entering	2.2

(f) Supplementary heater.--The heat pump shall be installed

with a control to prevent supplementary heater operation when the heating load can be met by the heat pump alone. Supplementary heater operation is permitted during transient periods, such as start-ups, following room thermostat setpoint advance, and during defrost. A two-stage room thermostat, which controls the supplementary heat on its second stage, shall be accepted as meeting this requirement. The cut-on temperature for the compression heating shall be higher than the cut-on temperature for the supplementary heat, and the cut-off temperature for the compression heating shall be higher than the cut-off temperature for the supplementary heat. Supplementary heat may be derived from any source of electric resistance heating or combustion heating.

(g) Combustion heating equipment.--All gas and oilfired comfort heating equipment shall show a minimum combustion efficiency of 75% at maximum rated output. Combustion efficiency shall be determined in accordance with the ASHRAE Standard 90.

Section 220. Duct insulation.

(a) Insulation.--All duct systems, or portions thereof, exposed to nonconditioned spaces shall be insulated to provide a thermal resistance, excluding film resistance, of

$$R = \frac{ti - to}{15} \text{ (hr) (sq.ft) (F)/BTU}$$

where ti-to is the design temperature differential (absolute value) between the air in the duct and the surrounding air with ~~certain exceptions, duct~~ THE FOLLOWING EXCEPTIONS. DUCT <— insulation, except when needed to prevent condensation, is not required in any of the following cases:

(1) Where ti-to is 25 degrees F. or less.

(2) When the heat gain or loss of the ducts, without insulation, will not increase the energy requirements of the building.

(3) Exhaust air ducts.

(4) Supply or return air ducts installed in crawl spaces with insulated walls, basements or cellars in one and two-family dwellings.

(b) Vapor barriers.--Where required to prevent condensation, insulation with vapor barriers shall be installed in addition to insulation required above.

Section 221. System controls.

(a) Application.--All heating, ventilating and air conditioning systems shall be provided controls as specified herein.

(b) Temperature.--Each heating, ventilating and air conditioning system shall be provided with at least one thermostat for the regulation of temperature. Each thermostat shall be capable of being set from 55 degrees F. to 75 degrees F. where used to control heating only and from 70 degrees F. to 85 degrees F. where used to control cooling only. Where used to control both heating and cooling it shall be capable of being set from 55 degrees F. to 85 degrees F. and shall be capable of operating the system heating and cooling in sequence. It shall be adjustable to provide a temperature range of up to 10 degrees F. between full heating and full cooling, except as allowed in section 218.

(c) Humidity.--If a heating, ventilating and air conditioning system is equipped with a means for adding moisture to maintain specific selected relative humidities in spaces or zones, a humidistat shall be provided. This device shall be

capable of being set to prevent new energy from being used to produce space relative humidity above 30% R.H. Where a humidistat is used in a heating, ventilating and air conditioning system for controlling moisture removal to maintain specific selected relative humidities in spaces or zones, it shall be capable of being set to prevent new energy from being used to produce a space relative humidity below 60%.

(d) Temperature zoning.--

(1) In all buildings and structures of use group R-3, at least one thermostat for regulation of space temperature shall be provided for each separate heating, ventilating and air conditioning system. In addition, a readily accessible manual or automatic means shall be provided to partially restrict or shut-off the heating or cooling input to each zone or floor, excluding unheated or uncooled basements and garages.

(2) In all buildings and structures of use group R-2, each individual dwelling unit shall be considered separately and shall meet the requirements for one and two-family dwellings above.

(3) In all buildings and structures other than use group R-3 and in spaces other than dwelling units in use group R-2, at least one thermostat for regulation of space temperature shall be provided for each separate heating, ventilating and air conditioning system and for each floor of the building.

(e) Set-back and shut-off.--

(1) In all buildings and structures, or portions thereof of use group R-3, the thermostat, or an alternate means such as a switch or a clock, shall provide a readily accessible, manual or automatic means for reducing the energy required

for heating and cooling during periods of nonuse or reduced need.

(2) In all other buildings and structures, or portions thereof each heating, ventilating and air conditioning system shall be equipped with a readily accessible means of reducing the energy used for heating, ventilating and air conditioning during periods of nonuse or alternate uses of the building spaces or zones served by the system, such as with manually adjustable automatic timing devices, manual devices for use by operating personnel, or automatic control systems.

(3) Lowering thermostat set points to reduce energy consumption of heating systems shall not cause energy to be expended to reach the reduced setting.

Section 222. Steam and hot water heating piping.

(a) Piping insulation.--All piping serving as part of a heating or cooling system installed to serve buildings and within buildings shall be thermally insulated as shown in Table ~~15~~ 10. <—

Table ~~15~~ 10 <—

Minimum Pipe Insulation

Piping system types	Fluid temperature range, F.	Insulation thickness in inches for pipe sizes					
		Runouts up to 2"	1" and less	1 1/4-2	2 1/2-4	5&6	8" and larger
Heating systems							
Steam & hot water							
High pressure/temp	306-450	1 1/2	1 1/2	2	2 1/2	3 1/2	3 1/2

Med. pressure/							
temp	251-305	1 1/2	1 1/2	2	2 1/2	3	3
Low pressure/							
temp	201-250	1	1	1 1/2	1 1/2	2	2
Low tem-							
perature	120-200	1/2	3/4	1	1	1	1 1/2
Steam con-							
densate (for feed water)	Any	1	1	1	1 1/2	1 1/2	2
Cooling systems							
Chilled water,	40-55	1/2	1/2	3/4	1	1	1
Refrigerant, or brine	Below 40	1	1	1 1/2	1 1/2	1 1/2	1 1/2

Insulation thicknesses are based on insulation having thermal resistances in the range of 4.0 to 4.6 per inch of thickness on a flat surface at a mean temperature of 75 degrees F. Minimum insulation thickness shall be increased for materials having R values less than 4.0 or may be reduced for materials having R values greater than 4.6 per inch of thickness as follows:

(b) High thermal resistance.--For materials with thermal resistance greater than R=4.5, the minimum insulation thickness may be reduced as follows:

$$\frac{\text{4.6 x Table } \sout{15}\ 10 \text{ Thickness}}{\text{Actual R}} = \text{New Minimum Thickness} \quad \longleftarrow$$

(c) Low thermal resistance.--For materials with thermal resistance less than R=4.0 the minimum insulation thickness shall be increased as follows:

$$\frac{\text{4.0 x Table } \sout{15}\ 10 \text{ Thickness}}{\text{Actual R}} = \text{New Minimum Thickness} \quad \longleftarrow$$

Piping insulation, except when needed to prevent condensation, is not required in any of the following cases:

(1) Piping installed within heating, ventilating and air conditioning equipment.

(2) Piping at temperatures between 55 degrees F. and 120 degrees F.

(3) When the heat loss or heat gain of the piping, without insulation, does not increase the energy requirements of the building.

(4) Piping installed in basements or cellars in one and two-family dwellings.

(d) Vapor barriers.--Where required to prevent condensation, insulation with vapor barriers shall be installed in addition to insulation required above.

SUBCHAPTER E
PLUMBING SYSTEMS

Section 223. Purpose.

This subchapter sets forth provisions for design and equipment selection for energy conservation in service water heating systems.

Section 224. Fixtures.

(a) Lavatories.--Lavatories in restrooms of public facilities shall be equipped with self-closing outlet devices which limit the flow of hot water to a maximum of 0.5 Gpm, devices which limit the outlet temperature to a maximum of 110 degrees F. and selfclosing valves which limit the quantity of hot water to a maximum of 0.25 gallons.

(b) Showers.--Showers used for other than safety reasons shall be equipped with flow control devices to limit total flow

to a maximum of 3 Gpm per shower head.

Section 225. Insulation.

(a) Piping insulation.--Piping in required return circulation systems shall be insulated so that heat loss is limited to a maximum of 25 Btuh per square foot of external pipe surface for above ground piping and a maximum of 35 Btuh per square foot of external pipe surface for underground piping. Maximum heat loss shall be determined at a temperature differential equal to the maximum water temperature minus a design ambient temperature no higher than 65 degrees F. except that conformance with table ~~15~~ 10 for "low temperature piping system" shall be deemed as complying with this section. <——

(b) Tanks.--Unfired hot water storage tanks shall be insulated so that heat loss is limited to a maximum of 15 Btuh per square foot of external tank surface area. For purposes of determining this heat loss, the design ambient temperature shall be no higher than 65 degrees F.

Section 226. Equipment.

(a) Pump operation.--Circulating hot water systems shall be arranged so that the circulating pump can be conveniently turned off either automatically or manually when the hot water system is not in operation.

(b) Electric water heaters.--All automatic electric storage water heaters shall have a stand-by loss not exceeding 4 watts per square foot of tank surface area. The method of test of stand-by loss shall be as described in section 4.3.1 of ANSI C72.1 Household Automatic Electrical Storage-Type Water Heaters.

(c) Gas and oil-fired water heaters.--All gas and oil-fired automatic storage heaters shall have a recovery efficiency, ER, not less than 75% and a stand-by loss percentage S, not

exceeding S=2.3+67/V where V=rated volume in gallons. The method of test of ER and S shall be as described in section 2.7 of ANSI Z21.10.3 Circulating Tank, Instantaneous and Large Automatic Storage Type Water Heaters, Approval Requirements for Gas Water Heaters.

Section 227. Controls.

(a) Temperature controls.--All hot water supply systems shall be equipped with automatic temperature controls capable of adjustments from the lowest to the highest acceptable temperature settings for the intended use.

(b) Shut down.--A separate switch shall be provided to terminate the energy supplied to electric hot water supply systems. A separate valve shall be provided to turn off the energy supplied to the main burner of all other types of hot water supply systems.

SUBCHAPTER F
ELECTRICAL SYSTEMS

Section 228. System requirements.

(a) Power factor.--The power factor of the overall electrical distribution system in a building shall be not less than 90% under rated design installed load of the building, either by utilization equipment design or by the use of power factor corrective devices. The power factor corrective devices may be installed on individual equipment, rated greater than 1,000 watts and switched therewith, regionally grouped, located at the service equipment or power factor correction achieved by other equivalent means. The choice among these corrective methods should be made based upon an engineering evaluation of each distribution system.

(b) Service voltage.--Where a choice of service voltage is

available, the voltage resulting in the least energy loss shall be used.

(c) Voltage drop.--In any building, the maximum total voltage drop shall not exceed 3% in branch circuits or feeders, for a total of 5% to the farthest outlet based on steady state design load conditions.

(d) Lighting switching.--Switching shall be provided for each lighting circuit, or for portions of each circuit, so that the partial lighting required for custodial or for effective complementary use with natural lighting may be operated selectively.

(e) Separate metering.--In all multi-family ~~dwelling~~ <—
DWELLINGS provisions shall be made to determine the electrical <—
energy consumed by each tenant.

SUBCHAPTER G
LIGHTING

Section 229. Light power budget.

A lighting power budget is the upper limit of the power to be available to provide the lighting needs in accordance with a given set of criteria and given calculation procedure.

Section 230. Calculation methods.

The criteria specified below shall be utilized for computation of the lighting power budget. All calculations shall be in accordance with accepted engineering practice. When insufficient information is known about the specific use of the building space (e.g., number of occupants, space function, location of partitions), the budget shall be based on the apparent intended use of the building space.

Section 231. Building interiors.

(a) Procedure.--The allowable electric power for lighting

shall be established by using the criteria and the calculation procedures specified in section 234. The value shall be based on the use for which the space within the building is intended and on efficient energy utilization.

(b) Illumination level criteria.--For the purpose of establishing a budget, levels of illumination shall be those listed in fig. 9-80 of the IES Lighting Handbook, and those levels shall be used as follows:

(1) For task lighting, the levels of illumination listed are for specific tasks. These levels are for the task areas defined in the IES Lighting Handbook or, where not defined, at all usable portions of task surfaces. In some cases, the levels of illumination are listed for locations (e.g., auditoriums). These levels are to be considered as average levels.

(2) For general lighting, in areas surrounding task locations, the average level of general lighting, for budget purposes only, shall be one-third the level for the tasks performed in the area but in no case less than 20-foot candles. Where more than one task level occurs in a space, the general level shall be one-third the weighted average of the specific task levels.

(3) For noncritical lighting, in circulation and seating areas, where no specific visual ~~task~~ TASKS occur, the average level of illumination shall be one-third of the average general lighting in the adjacent task spaces but in no case less than ten-foot candles. <—

(4) For the purpose of establishing a power budget, only lamp efficacies and coefficients of utilization (CU) specified in Table ~~16~~ 11, shall be assumed. <—

Section 232. Building exteriors.

(a) Basis on use.--In exterior spaces, the lighting power budget shall be based on the use of which the space is intended (for task performance, safety, or security) and on efficient energy utilization.

(b) Criteria.--The same criteria as those for interior spaces apply for illumination levels and lighting systems with the addition of luminaires for flood lighting. For power budget purposes floodlighting shall be selected with luminaires having a greater percentage of their beam lumens restricted to the area to be lighted. Such luminaires are defined as those with at least the minimum efficiencies listed in the IES Lighting Handbook.

(c) Facade lighting.--Facade lighting for budget purposes shall be no greater than 2% of the total interior load of the building.

(d) Calculation procedure.--In establishing a lighting power budget the following procedures shall be used:

(1) For overhead lighting the procedure specified in section 234 shall be followed, but using reflectances as found.

(2) For flood lighting the beam lumen method, as shows in the IES Lighting Handbook and a coefficient of beam utilization (CBU) of 0.75 shall be used for floodlighting calculations.

Section 233. Exceptions to criteria.

(a) Interiors.--The criteria of section 231 shall not apply to the following areas when calculating the load.

(1) Portions of residential occupancies except for kitchens, bathrooms, and laundry areas and public spaces

including lobbies, halls, stairways, basement areas, and utility rooms.

(2) Residential type spaces similar to those stated in paragraph (1) in institutions, such as hospitals, hotels, funeral homes, churches, museums, etc.

(3) Theater auditoriums, entertainment and audiovisual presentations where the lighting is an essential technical element for the function performed.

(b) Exteriors.--The criteria of section 232 shall not apply to the following lamps and luminaries; however, their use shall be accounted for in the calculation of task lighting loads for specific tasks. The allowable load shall be based on the luminary wattage to achieve the levels of illumination as covered in section 231 using a point calculation method given in the IES Lighting Handbook. The excepted lamps and luminaries are as follows:

(1) Luminaries for medical and dental purposes.

(2) Luminaries for highlighting applications, such as sculpture exhibits, art exhibits, and individual items of display merchandise.

(3) Luminaries for specialized lighting applications (color matching, where electrical interference cannot be tolerated, etc.).

(c) Control of reflectances.--The criteria of Table ~~16~~ 11 <— shall not apply in spaces where it is impractical to control reflectances and where a dirty atmosphere cannot be avoided. Where this condition exists, the values for reflectances and light loss factors shall be those expected to be found and shall be approved by the department. The calculation shall make a note of this deviation.

Section 234. Calculation procedure.

(a) Illumination levels and areas.--To establish illumination levels and areas, the following procedure shall be used:

(1) Determine the visual tasks that are expected to be performed in each space and the number of planned work locations where tasks will be performed. If assumptions are made, their bases shall be indicated.

(2) Select the illumination level, in foot-candles for those expected tasks in accordance with section 231(b)(1).

(3) Calculate total task areas to be illuminated to the same level by multiplying the number of work locations by 50 square feet per work location. (Total task areas shall not exceed actual total space area). If actual task area is greater than 50 square feet the actual area shall be used. If special task lighting or localized lighting is to be employed, use the actual task areas and point calculation procedures.

(4) Calculate the level of general lighting by multiplying the task lighting level by one-third, where there is only one task level, or by taking one-third of the sum of the products of the task levels as provided for in paragraph (2) and their areas as provided for in paragraph (3) divided by the total task areas.

(5) Calculate the level of noncritical lighting.

(b) Lighting system data.--To establish lighting system data, the following shall be used:

(1) Light source and luminaire types to use.

(2) Lamp lumens per watt and luminaire coefficients of utilization for room and luminaire mounting height

dimensions. Luminaire CUs shall be selected from the IES Lighting Handbook. In all cases, no luminaire shall have a CU for RCR = 1 of less than that given in Table ~~16~~ 11 lamp efficacies for the appropriate space. <—

(c) Allowable wattage.--To establish allowable wattage, the following shall be used:

(1) Using data from subsection (b), the illumination levels and areas determined in subsection (a), and the criteria of Table ~~16~~ 11 on Reflectance, calculate the allowable wattages using the lumen method. <—

(2) Calculate the total space wattage by adding the task, general and noncritical lighting loads.

(3) Add the wattage of luminaries allowed in section 233(b).

Table ~~16~~ 11 <—

(a) Lamp efficacies.--The following are initial lumen output per watt input, including ballast losses:

Application	Lumens per Watt
Where moderate color rendition is appropriate	55
Where good color rendition is appropriate	40
Where high color rendition is appropriate, spaces are less than 50 square feet or where use of low wattage High Intensity Discharge (HID) lamps under 250 W or fluorescent lamps under 40 W is appropriate	25

(b) Luminary coefficients of utilization (CU).--Coefficients of utilization (CUs) are to be for luminaries for use in the types of spaces listed below, and those luminaries shall have a CU of no less than that listed below (for each type space) for a

Room Cavity Ratio (RCR) of 1 and reflectances as in (c).

Space Use	Minimum CU ~~(at RCR = 1)~~ (AT RCR = 1)
For spaces with tasks subjected to veiling reflections where design levels of illumination are listed in terms of ~~equivalents~~ EQUIVALENT sphere illumination (ESI) and where visual comfort is important.	0.55
For spaces without tasks, or with tasks not subjected to veiling reflections, but where visual comfort is important.	0.63
For spaces without tasks and where visual comfort is not a criterion	0.70

(c) Other criteria; reflectances.--For interior spaces, the following initial cavity and surface reflectances shall be assumed:

Ceiling cavity reflectance	80%
Wall reflectance	50%
Floor cavity reflectance	20%

Light Loss Factor. A light loss factor (LLF) of 0.70 shall be used.

SUBCHAPTER H
ALTERNATIVE SYSTEMS

Section 235. Performance alternative.

Alternative building systems and equipment design may be approved by the department when they can be shown to have energy consumption not greater than that of a similar building with similar forms of energy requirements, designed in accordance with the provisions of this act OR WHEN THEY CAN BE SHOWN TO

HAVE ENERGY CONSUMPTION NOT GREATER THAN THAT WHICH SHALL BE ESTABLISHED BY THE DEPARTMENT WITH THE APPROVAL OF THE BUILDING ENERGY CONSERVATION COMMITTEE, FOR THE PURPOSES OF THIS SECTION.

Section 236. Nondepletable sources.

When such alternative systems utilize solar, geothermal, wind or other nondepletable energy sources for all or part of its energy sources, such nondepletable energy supplied to the building shall be excluded from the total energy chargeable to the proposed alternative design.

Section 237. Documentation.

Proposed alternative designs, submitted as requests for exception to the standard design criteria, must be accompanied by an energy analysis prepared in accordance with the ASHRAE Standard ~~90~~ 90-75. <—

CHAPTER 3

APPLICATION OF STANDARDS: ESTABLISHMENT OF COMMITTEE AND PENALTIES

Section 301. Modification of standards; criteria.

The department, with the approval of the Building Energy Conservation Committee, established pursuant to section 304, after one or more public hearings, may recommend to the General Assembly modifications to the energy conservation standards CONTAINED IN CHAPTER 2 HEREOF. Any recommended modification to <— the energy conservation standards shall meet the following criteria:

(1) It shall be consistent with the latest and most effective technology.

(2) It shall not be in conflict with existing safeguards for public health and safety.

(3) It shall be economically feasible as determined by

life-cycle-cost procedures.

(4) It shall be sufficiently stringent to effect a significant savings of energy resources.

(5) It shall be a performance standard for the design of buildings and systems within buildings to assure maximum practical conservation of energy.

(6) Consideration shall be given to building and energy standards promulgated by National and other state governmental agencies, private organizations and any other available energy data, as well as the total energy allocation approach.

Section 302. Application of energy conservation standards.

The energy conservation standards contained herein OR AS PROMULGATED BY THE DEPARTMENT WITH THE APPROVAL OF THE BUILDING ENERGY CONSERVATION COMMITTEE shall apply to new buildings or to renovations on which actual construction and/or design has not commenced prior to their effective ~~date~~ DATES.

Section 303. Energy conservation manual for buildings.

(a) Production of manual.--Concurrent with the adoption of the energy conservation ~~code~~ CODES required by this act, the department shall produce an energy conservation manual for use by designers, builders, and contractors of residential and nonresidential buildings. This manual shall contain the established standards and accepted practices. The manual shall be furnished upon request to members of the public at a price sufficient to cover the cost of printing.

(b) Review of manual.--The manual shall be reviewed by the department and the Building Energy Conservation Committee at least annually and shall be updated as significant new energy conservation information becomes available.

Section 304. Building Energy Conservation Committee.

(a) Composition of committee.--In order to further the coordinated and effective administration of this act, there is hereby established a Building Energy Conservation Committee. It shall consist of at least ~~15~~ 25 members and no more than ~~25~~ 35 members, the membership of which shall be appointed by the ~~Secretary of Labor and Industry~~ GOVERNOR and shall include a representative of each of the following entities or their successors:

(1) Department of Education.

(2) Governor's Energy Council.

(3) Department of General Services.

(4) Department of Labor and Industry.

(5) Department of Community Affairs.

(6) Pennsylvania Builders Association.

(7) Pennsylvania Associated Builders and Contractors, Inc.

(8) Pennsylvania Building Officials Conference.

(9) Mechanical Contractors Association of America.

(10) Pennsylvania Chamber of Commerce.

(11) General Contractors Association of Pennsylvania.

(12) Pennsylvania Society of Architects.

(13) Pennsylvania Society of Professional Engineers.

(14) AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR CONDITIONING ENGINEERS, INC..

(15) PENNSYLVANIA GAS ASSOCIATION.

(16) PENNSYLVANIA ELECTRIC ASSOCIATION.

(17) INDUSTRIALIZED HOUSING MANUFACTURERS ASSOCIATION.

(18) THERMAL INSULATION MANUFACTURERS ASSOCIATION.

~~(14)~~ (19) Representatives of such other agencies and

organizations or individuals as the ~~secretary~~ GOVERNOR may <—
find are necessary and proper to carry out the purposes of the committee including, but not limited to, labor organizations, financial and lending institutions, and ~~organizations directly involved in the supply of energy~~ <—
~~throughout the Commonwealth.~~ CONSUMER GROUPS. <—

(b) Powers and duties.--In addition to the powers and duties enumerated in this act, the Building Energy Conservation Committee shall ~~perform the following duties:~~ <—

~~(1) The committee shall~~ be responsible for the regular exchange of information and plans regarding building energy conservation, for the development, ~~and review~~ REVIEW AND <—
APPROVAL of proposed and existing standards, guidelines, regulations, and manuals. ~~and shall make recommendations to~~ <—
~~the Industrial Board of the Department of Labor and Industry consistent with the provisions of this act.~~

~~(2) Said committee shall act as an advisory committee to the Industrial Board of the Department of Labor and Industry and the Advisory Board in the Department of Labor and Industry in matters of building energy conservation and may recommend to the Industrial Board variances from standards, guidelines, regulations and manuals after consultation within the committee or with any person affected by such standards, guidelines, regulations or manuals.~~

(c) Expenses.--The members of the committee shall not receive any compensation for their services but shall be reimbursed for their actual and necessary expenses incurred in the performance of their duties. Provided, however, when acting ~~as an advisory committee to the Industrial Board or the Advisory~~ <—
~~Board~~ on matters concerning variances ~~which have been referred~~ <—

~~to the Industrial Board,~~ they shall receive $50 per day plus their actual and necessary expenses.

Section 305. Certification.

(a) Compliance with act.--It shall be the duty of the architect retained in connection with the DESIGN, construction or renovation of a building to certify the drawings, specifications and other data showing compliance with the provisions of this act. <—

(b) Inspection.--Each architect, ~~or his~~ OTHER LICENSED DESIGN PROFESSIONAL RETAINED BY THE OWNER IN LIEU OF AN ARCHITECT, OR THE ARCHITECT'S designee shall make periodic inspections of the building progression to insure compliance with this act. <—

(c) Final certification.--Each architect OR OTHER LICENSED DESIGN PROFESSIONAL RETAINED BY THE OWNER IN LIEU OF AN ARCHITECT shall make a final certification of every completed building showing compliance with the provisions of this act. <—

(d) Certification by builder~~; bonds~~.--If an architect OR OTHER LICENSED DESIGN PROFESSIONAL is not retained in connection with the DESIGN, construction or renovation of a building, it shall be the responsibility of the builder to perform the inspections and certification required by this section. ~~and to file with the department an indemnity bond in such amount as the department shall require indemnifying the owner for any costs said owner may incur in bringing the building into compliance with this act, should the department find it to be in noncompliance. Said indemnity bond shall remain in full force and effect for a period of two years from the date of completion of the construction or renovation of the building.~~ <—

Section 306. Variances.

(a) Requests.--Any request for a variance from the energy conservation standards contained herein shall be made to the ~~Industrial Board of the Department of Labor and Industry.~~ <—
BUILDING ENERGY CONSERVATION COMMITTEE. <—

(b) Criteria.--A variance shall be granted only if it is found that:

(1) compliance with the provisions of this act would result in extreme hardship to the owner; and

(2) the granting of such variance would not result in a significant increase in the energy usage of the building.

Section 307. Building permits.

Any building permit issued by the Commonwealth or any of its political subdivisions shall have printed upon its face notice that the provisions of this act must be complied with.

Section 308. Permits for use or occupancy.

Before any building or structure hereafter constructed or renovated shall be used or opened for occupancy, the owner thereof shall notify the department of ~~Labor and Industry~~ of the <— completion of the building and submit the necessary certification therewith. WITHIN 30 DAYS OF RECEIPT OF THE <— CERTIFICATION THE DEPARTMENT SHALL FORWARD NOTICE OF RECEIPT OF SUCH CERTIFICATION TO THE OWNER. No permit for use or occupancy shall be granted until such submission has been made. No building official of the Commonwealth or any of its political subdivisions shall issue a permit until he has received proof of compliance.

Section 309. Failure to submit certification.

Whenever the owner of any building or structure shall fail to notify the department of the completion of the building and to submit the necessary certification and shall nevertheless

proceed with the use or occupancy of the building, the department or the political subdivision shall serve notice on the said owner ~~to immediately cease using or occupying said building and a notice shall be placed on the premises prohibiting such use or occupancy until such certification has been submitted.~~ THAT HE IS IN VIOLATION OF THIS ACT AND ORDER HIM TO COMPLY THEREWITH.

Section 310. Inspections.

The department may inspect within two years of the date of completion of construction or renovation any building constructed or renovated after the effective date of this act to determine compliance with the provisions of this act.

~~Section 311. Failure to comply with provisions of this act.~~

~~Whenever the owner of any building, as described in this act, shall fail to comply with the provisions of this act, or the rules and regulations of the department formulated under the authority of this act, and upon whom a written order shall be served by the department to comply with the said provisions of this act and the rules and regulations of the department and who nevertheless shall have failed to comply with the said written order within the time specified in the same, the department shall be authorized to immediately order the building or structure to be vacated or placed out of service until such time as the requirements of this act and the rules and regulations of the department shall have been fully complied with.~~

Section ~~312~~ 311. Appeals.

Review of any decisions rendered under the provisions of this act shall be brought in the court of common pleas of the county wherein the building is situated. Such review shall be limited to determining whether any such decision was arbitrary and

capricious.

Section ~~313~~ 312. Penalties. <—

(a) Violations of act.--Any person who shall violate any of the provisions of this act, or the rules and regulations or the orders for the enforcement of the said provisions or rules and regulations issued by duly authorized officers of the department or who shall hinder, delay or interfere with any officer charged with the enforcement of this act in the performance of his duty, shall, upon conviction thereof, be punished by a fine of NOT MORE THAN $300 and costs, or not more than three months imprisonment in the county jail, or either, or both, in the discretion of the court. IN THE EVENT OF VIOLATION OF MORE THAN ONE PROVISION OF THIS ACT, THE VIOLATION OF EACH PROVISION SHALL BE DEEMED A SEPARATE AND DISTINCT OFFENSE FOR THE PURPOSES OF THIS SECTION. <—

~~(b) Refusal to vacate.--Any person who shall fail or refuse to vacate a building or portion of a building, or who shall fail to vacate or place out of service any building, after due notice having been served upon him by an officer of the department and proper notice having been placed upon the building or structure by such officer, shall be liable for a penalty of $100 a day for each day he shall have so failed or refused to vacate, or place out of service the building, portion of building upon which such notice has been placed, the said penalty to be collectible in the same manner as any fine payable to the Commonwealth.~~ <—

~~(c)~~ (B) Institution of proceedings.--Prosecutions for violations of this act, or the rules and regulations of the department may be instituted by the Secretary of Labor and Industry OR THE SECRETARY OF COMMUNITY AFFAIRS, or under his directions by an authorized representative of the department. <—

Upon conviction after a hearing the sentences provided in this act shall be imposed, and shall be final unless an appeal be taken in the manner prescribed by law.

~~(d)~~ (C) Disposition of fines.--All fines collected under this act shall be forwarded to the department who shall pay the same into the State Treasury for the use of the Commonwealth. <—

~~(e)~~ (D) False certification.--Any architect OR OTHER LICENSED DESIGN PROFESSIONAL who willfully provides a false certification for any building subject to the provisions of this act shall be subject to the suspension or revocation of his license by the State Board of Examiners of Architects OR OTHER APPLICABLE STATE LICENSING BOARD. <—

Section ~~314~~ 313. Enforcement. <—

(a) Applicability.--The provisions of this act shall apply to every building enumerated in this act, except buildings owned by the Federal Government, including buildings owned in whole or in part by the Commonwealth or any political subdivision thereof, and shall be enforced by the Secretary of Labor and Industry OR BY THE SECRETARY OF COMMUNITY AFFAIRS, by and through his authorized representatives. <—

(b) Powers of officers.--For the purpose of enforcing the provisions of this act, all the officers charged with its enforcement shall have the power to enter any of the buildings enumerated in this act, and no person shall hinder or delay, or interfere with any of the said officers in the performance of his duty, nor refuse any pertinent information necessary to determine whether the provisions of this act and the rules and regulations herein provided for, are or will be complied with.

CHAPTER 4 <—

DEPARTMENT'S STANDARD

SECTION 401. ADOPTION AND PROMULGATION OF STANDARDS.

THE DEPARTMENT, WITH THE APPROVAL OF THE BUILDING ENERGY CONSERVATION COMMITTEE, SHALL, AFTER ONE OR MORE PUBLIC HEARINGS, ADOPT AND PUBLISH ENERGY CONSERVATION STANDARDS FOR ALL BUILDINGS COVERED BY THIS ACT IN ACCORDANCE WITH THE PROVISIONS OF THE ACT OF JULY 31, 1968 (P.L.769, NO.240), KNOWN AS THE "COMMONWEALTH DOCUMENTS LAW," THE PURPOSE OF SUCH STANDARDS IS TO REDUCE WASTEFUL OR UNECONOMIC CONSUMPTION OF ENERGY BY BALANCING THE COST OF ENERGY PROCUREMENT AGAINST THE COST OF ENERGY-CONSERVING BUILDING PRACTICES. THE ENERGY CONSERVATION STANDARDS SHALL MEET THE FOLLOWING CRITERIA:

(1) THEY SHALL BE CONSISTENT WITH THE LATEST AND MOST EFFECTIVE TECHNOLOGY.

(2) THEY SHALL NOT BE IN CONFLICT WITH EXISTING SAFEGUARDS FOR PUBLIC HEALTH AND SAFETY.

(3) THEY SHALL BE ECONOMICALLY FEASIBLE AS DETERMINED BY LIFE-CYCLE-COST PROCEDURES.

(4) THEY SHALL BE SUFFICIENTLY STRINGENT TO EFFECT A SIGNIFICANT SAVINGS OF ENERGY RESOURCES.

(5) THEY SHALL BE A PERFORMANCE STANDARD FOR THE DESIGN OF BUILDINGS AND SYSTEMS WITHIN BUILDINGS TO ASSURE MAXIMUM PRACTICAL CONSERVATION OF ENERGY.

(6) CONSIDERATION SHALL BE GIVEN TO BUILDING AND ENERGY STANDARDS PROMULGATED BY NATIONAL AND OTHER STATE GOVERNMENTAL AGENCIES, PRIVATE ORGANIZATIONS AND ANY OTHER AVAILABLE ENERGY DATA, AS WELL AS THE TOTAL ENERGY ALLOCATION APPROACH.

Section ~~315~~ 402. Effective date. <—

This act shall take effect as follows:

~~(1) Chapter 2 shall take effect in six months.~~ <—

~~(2) All other provisions of this act shall take effect immediately.~~

(1) CHAPTER 2 SHALL TAKE EFFECT IN SIX MONTHS AND SHALL REMAIN IN FULL FORCE AND EFFECT FOR A PERIOD OF ONE YEAR AFTER WHICH TIME THE PROVISIONS OF CHAPTER 2 SHALL HAVE NO LEGAL EFFECT. <——

(2) SECTION 301 SHALL TAKE EFFECT IMMEDIATELY AND ITS PROVISIONS SHALL REMAIN IN FULL FORCE AND EFFECT FOR A PERIOD OF 18 MONTHS AFTER WHICH TIME SAID PROVISIONS SHALL HAVE NO LEGAL EFFECT.

(3) CHAPTER 4 SHALL TAKE EFFECT IN 18 MONTHS.

(4) ALL OTHER PROVISIONS OF THIS ACT SHALL TAKE EFFECT IMMEDIATELY.