
THE GENERAL ASSEMBLY OF PENNSYLVANIA

HOUSE BILL

No. 552

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

AS AMENDED ON THIRD CONSIDERATION, HOUSE OF REPRESENTATIVES,
JUNE 7, 1978

AN ACT

1 Providing for the regulation for energy conservation purposes of
2 the construction of buildings, the establishment of a
3 Building Energy Conservation Committee and a Board on
4 Variances, appeals and for penalties.

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16 The General Assembly of the Commonwealth of Pennsylvania

17 hereby enacts as follows:

18 CHAPTER 1

19 GENERAL PROVISIONS

20 Section 101. Short title.

21 This act shall be known and may be cited as the "Building

22 Energy Conservation Act."

23 Section 102. Legislative findings and declaration of purpose.

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

25 (1) Energy shortages in the domestic supply present far-

26 reaching problems that promise to persist. These energy

27 shortages affect the continued efficient operation of the

28 Commonwealth's economy and social structure.

29 (2) It is the Commonwealth's responsibility to provide

30 for energy conservation through regulation of design and

1 construction standards.

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

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

11 Section 103. Definitions.

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

15 "Building." Any structure that provides facilities or
16 shelter for public assembly or for educational, business,
17 mercantile, institutional, warehouse or residential occupancy,
18 or industrial use including, but not limited to, those portions
19 of factory and industrial occupancy such as office space except
20 for:

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

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

29 (3) Buildings which are neither heated nor cooled.

30 (4) Historic buildings.

1 (5) Buildings owned by the Federal Government.

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

4 "Department." The Pennsylvania Department of Labor and
5 Industry except that for all units subject to the act of May 11,
6 1972 (P.L.286, No.70), known as the "Industrialized Housing
7 Act," all units subject to the act of May 11, 1972 (P.L.281,
8 No.69), known as the "Uniform Standards Code for Mobile Homes,"
9 and all buildings classified as Use Group R-3, herein,
10 department means the Pennsylvania Department of Community
11 Affairs.

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

15 "Historic building." Any building determined by the State
16 Historic Preservation Officer to meet the criteria for listing
17 on the National Register of Historic Places but only to the
18 extent that compliance with this act would prevent preservation
19 of the historic or architectural integrity of the building.

20 "Licensed design professional." A person licensed as an
21 architect or professional engineer pursuant to the appropriate
22 licensure act.

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

26 "Municipality." A city, borough, incorporated town or
27 township.

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

1 the parameters established by the standards.

2 "Renovation." (a) The rehabilitation of an existing
3 building which requires more than 25% of the gross floor area or
4 volume of the entire building to be rebuilt; or

5 (b) any addition to an existing building: Provided, however,
6 That the provisions of this act shall only apply to such portion
7 of the building being renovated and not to the entire building.

8 CHAPTER 2

9 ENERGY CONSERVATION STANDARDS

10 SUBCHAPTER A

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11 GENERAL PROVISIONS

12 Section 201. Provisions.

13 ~~The~~ EXCEPT FOR USE GROUP R-3, THE following provisions
14 regulate the design and construction of the exterior envelopes
15 and selection of HVAC, service water heating, electrical
16 distribution, and illumination systems and equipment required
17 for the purpose of effective use of energy and shall govern the
18 construction of all buildings, or portions thereof, as provided
19 herein.

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20 THE PROVISIONS REGULATING THE CONSTRUCTION OF BUILDINGS
21 CLASSIFIED AS USE GROUP R-3 ARE CONTAINED IN SUBCHAPTER J,
22 SECTION 240.

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23 SUBCHAPTER A B

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24 PLANS AND SPECIFICATIONS

25 Section 202. Submission.

26 (a) Plans.--Plans, specifications, computations where
27 necessary, and any changes thereto together with the necessary
28 certification required by section 305 shall be submitted for all
29 buildings except those classified as Use Group R-3 to indicate
30 conformance with this chapter and other applicable chapters of

1 this act, except as provided in subsections (b) and (c).

2 (b) Standard design.--Whenever a person is constructing a
3 building in accordance with plans, specifications and
4 computations which he has submitted within the previous two
5 years, such plans need not be resubmitted but such person shall
6 indicate upon the certificate required by section 305 that they
7 meet the standards currently in effect and identify the
8 previously submitted plans, specifications and computations.

9 (c) Prescriptive standards.--When the prescriptive standards
10 provided in the Energy Conservation Manual established by
11 section 303 are employed in the construction of a building only
12 such information as shall be required by the department shall be
13 submitted. THE PRESCRIPTIVE STANDARDS APPLICABLE TO USE GROUP R- <—
14 3, BUILDINGS ARE CONTAINED IN SECTION 240.

15 Section 203. Contents.

16 The plans and specifications, where required by section 202,
17 shall show in sufficient detail all pertinent data and features
18 of the building and the equipment and systems as herein
19 governed, including but not limited to: exterior envelope
20 component materials, U values of elements, R values of
21 insulating materials, size and type of apparatus and equipment,
22 equipment and system controls and other pertinent data to
23 indicate conformance with the requirements herein.

24 SUBCHAPTER C
25 DEFINITIONS RELATING TO
26 ENERGY CONSERVATION STANDARDS

27 Section 204. Definitions relating to standards.

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

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

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

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

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

15 Total energy input shall be determined by combining the
16 energy inputs to all elements, except supplementary heaters, of
17 the heat pump, including, but not limited to, compressors,
18 pumps, supply air fans, return air fans, outdoor air fans,
19 cooling tower fans and the heating, ventilating and air
20 conditioning system equipment control circuit.

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

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

28 "Degree day, heating." A unit, based upon temperature
29 difference and time, used in estimating fuel consumption and
30 specifying nominal heating load of a building in winter. For any

1 one day, when the mean temperature is less than 65 F., there
2 exist as many degree days as there are Fahrenheit degrees
3 difference in temperature between the mean temperature for the
4 day and 65 F.

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

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

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

14 "Floodlighting." A lighting system designated to light an
15 area using projector type luminaires usually capable of being
16 pointed in any direction.

17 "Floor area, gross." Gross floor area shall be the floor
18 area within the perimeter of the outside walls of the building
19 under consideration, without deduction for hallways, stairs,
20 closets, thickness of walls, columns or other features.

21 "Illumination." The density of the luminous flux incident on
22 a surface. It is the quotient of the luminous flux by the area
23 of the surface when the latter is uniformly illuminated.

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

30 "Luminaire." A complete lighting unit consisting of a lamp

1 or lamps together with the parts designed to distribute the
2 light, to position and protect the lamps and to connect the
3 lamps to the power supply.

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

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

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

15 "Reheat." The application of sensible heat to supply air
16 that has been previously cooled below the temperature of the
17 conditioned space by either mechanical refrigeration or the
18 introduction of outdoor air to provide cooling.

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

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

30 (2) Use group R-2 structures. This use group shall include

1 all multiple-family dwellings having more than two dwelling
2 units; and shall also include all dormitories, boarding and
3 lodging houses arranged for shelter and sleeping accommodation
4 by more than five and not more than 20 individuals.

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

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

12 "Thermal transmittance" (U). Overall coefficient of heat
13 transmission or thermal transmittance (air to air) expressed in
14 units of BTU per hour per square foot per degree F. It is the
15 time rate of heat flow. The U value applies to combinations of
16 different materials used in series along the heat flow path and
17 also to single materials that comprise a building section and
18 include cavity air spaces and surface air films on both sides.

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

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

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

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

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

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

13 SUBCHAPTER D

14 BUILDING ENVELOPE

15 Section 205. General provisions.

16 (a) Purpose of subchapter.--The intent of this subchapter is
17 to provide minimum requirements for exterior envelope
18 construction in the interest of energy conservation.

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

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

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

1 required Uo values.

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

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

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

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

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

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

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

27 Section 206. Criteria for residential buildings.

28 (a) Applicability.--The requirements herein shall apply to
29 all buildings and structures or portions thereof of use groups
30 R-1, R-2 and R-3 that are heated or mechanically cooled when not

1 more than 3 stories or 40 feet in height.

2 (b) Walls.--The gross area of exterior walls above grade,
3 including foundation walls, shall have a combined thermal
4 transmittance value (U_o) not exceeding those specified in Table
5 1.

6 Table 1

7 Maximum Allowable " U_o " Values for
8 Gross Exterior Wall Assemblies

9		Detached	All other
10	Annual heating degree days*	one & two family	residential
11	4000	0.25	0.31
12	5000	0.23	0.29
13	6000	0.22	0.27
14	7000	0.20	0.26

15 *As specified in Chapter 43 ASHRAE Handbook-Systems.

16 (c) Roof/ceiling.--The roof/ceiling assemblies shall have a
17 combined thermal transmittance value (U_o) not to exceed 0.05
18 except that roof/ceiling assemblies in which the finished
19 interior surface is essentially the underside of the roof deck,
20 such as a wooden cathedral ceiling, may have a " U_o " value not to
21 exceed 0.08. These values presume no significant thermal
22 transmission through framing members, skylights or other
23 interruptions in the roof envelope. If such interruptions occur,
24 calculations must be made showing conformance to the required
25 " U_o " values.

26 (d) Floors over unheated spaces.--The floor of a heated or
27 mechanically cooled space located over an unheated space shall
28 have a combined thermal transmittance value (U_o) not to exceed
29 0.08.

30 (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 2.

Table 2

Minimum Allowable "R" Values of Perimeter

Insulation for Slab-On Grade Floors

Annual heating degree days	Heated slab	Unheated slab
4000*	5.5	3.5
5000	6.3	4.2
6000	7.0	4.9
7000	7.8	5.5

*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 (U_o) for the gross area of exterior walls not exceeding those specified in Table 3.

Table 3

Maximum Allowable " U_o " Values

for Gross Exterior Wall Assemblies

	3 stories or less	More than 3 stories or
Annual heating degree days	40 ft. or less	3 stories or

1			40 ft.
2	4000	0.31	0.38
3	5000	0.29	0.36
4	6000	0.27	0.33
5	7000	0.26	0.31

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

10 Table 4

11 Maximum Allowable " U_o " Values
12 for Roof/Ceiling Assemblies

13	Annual heating degree days	Maximum U_o
14	4000*	0.092
15	5000	0.084
16	6000	0.076
17	7000	0.068

18 *Table values may be interpolated.

19 (d) Heating criteria for floors over unheated spaces.--The
20 floor of a heated space located over an unheated space shall
21 have a thermal transmittance value (U_o) not exceeding 0.08.

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

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

30 Table 5

Minimum Allowable "R" Values of Perimeter

Insulation for Slab-On Grade Floors

Annual heating degree days	Heated slab	Unheated slab
4000*	5.5	3.5
5000	6.3	4.2
6000	7.0	4.9
7000	7.8	5.5

*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 33.5 BTU's per hour per square foot based on the following equation:

$$OTTV = \frac{(U_w \times A_w \times TDEQ) + (A_f \times S_f \times S_c) + (U_f \times A_f \times \Delta T)}{A_o}$$

OTTV = Overall thermal transfer value where:

U_w = The thermal transmittance of all elements of the opaque wall area Btu/h. ft².F (W/m²K)

A_w = Opaque wall area, ft² (m²)

U_f = The thermal transmittance of the fenestration area Btu/h. ft².F (W/m²K)

A_f = Fenestration area, ft² (m²)

TDEQ = Value given in the following table, F, (c):

TABLE FOR TEMPERATURE DIFFERENCE

Wall Construction-mass per unit area		TDEQ	
LB/FT ²	Kg/m ²	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 C	
Winter	72 22.0	97 1/2%*
Summer	78 25.5	2 1/2%*

* Values from 1972 ASHRAE Handbook of
Fundamentals, Chapter 33.

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 span-
drels, 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
interstitial 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:

$(U_w \times A_w \times TDEQ) + (U_{w2} \times A_{w2} \times TDEQ2), \text{ etc.}$

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

1 Section 208. Air leakage.

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

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

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

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

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

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

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

25 (d) Caulking and sealants.--Exterior joints around windows
26 and door frames, between wall cavities and window or door
27 frames, between wall and foundation, between wall and roof,
28 between wall panels, at penetrations or utility services through
29 walls, floors and roofs, and all other openings in the exterior
30 envelope shall be caulked, gasketed, weatherstripped, or

1 otherwise sealed.

2 SUBCHAPTER E

3 WARM AIR HEATING, VENTILATING AND AIR CONDITIONING

4 SYSTEMS AND EQUIPMENT

5 Section 209. General provisions.

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

20 Section 210. Design requirements.

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

23 (1) Outdoor design temperature shall be selected for
24 listed locations in Chapter 33 of the ASHRAE Handbook of
25 Fundamentals, from columns of 97 1/2% values for heating and
26 2 1/2% values for cooling.

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

29 (3) Indoor design relative humidity for heating shall
30 not exceed 30%. For cooling, the actual design relative

1 humidity within the comfort envelope as defined in ASHRAE
2 Standard 55-74 "Thermal Environmental Conditions for Human
3 Occupancy" shall be selected for the minimum total heating,
4 ventilating, and air conditioning system energy use.

5 Section 211. Cooling with outdoor air.

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

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

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

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

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

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

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

26 (6) When all space cooling is accomplished by a
27 circulating liquid which transfers space heat directly or
28 indirectly to a heat rejection device such as a cooling tower
29 without the use of a refrigeration system.

30 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 specified herein.

Section 214. Recovered energy.

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.

Section 215. New energy.

(a) Prevention of excess humidity.--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.

(b) Control of temperature.--New energy may be used for control of temperature if minimized as specified in sections 216 through 220.

Section 216. 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

1 reset the system cold air supply to the highest temperature
2 level that will satisfy the zone requiring the coolest air.
3 Single zone reheat systems shall be controlled to sequence
4 reheat and cooling.

5 Section 217. Dual duct and multizone systems.

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

11 Section 218. Recooling systems.

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

17 Section 219. Multiple zones.

18 For systems with multiple zones, one or more zones may be
19 chosen to represent a number of zones with similar heating or
20 cooling characteristics. A multiple zone heating, ventilating
21 and air conditioning system that employs reheating or recooling
22 for control of not more than 5,000 Cfm or 20% of the total
23 supply air of the system, whichever is less, shall be exempt
24 from the supply air temperature reset requirements of sections
25 216 through 218.

26 Section 220. Concurrent operation.

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

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

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

8 Section 221. Equipment performance requirements.

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

15 (b) Systems equipment - electrical.--Heating ventilating and
16 air conditioning systems equipment whose energy input in the
17 cooling mode is entirely electric shall show a coefficient of
18 performance (COP) and energy efficiency ratio (EER) not less
19 than the values specified in Table 6. These requirements apply
20 to, but are not limited to, unitary cooling equipment (air and
21 water source); packaged air conditioners; and room air
22 conditioners. These requirements do not apply to equipment used
23 in areas having open refrigerated food display cases. For
24 determining coefficient of performance (COP), the rate of net
25 heat removal shall be defined as the change in the total heat
26 contents of the air entering and leaving the equipment (without
27 reheat). Total energy input shall be determined by combining the
28 energy inputs to all elements of the equipment, including but
29 not limited to, compressors, pumps, supply-air fans, cooling
30 tower fans and the system equipment control circuit.

Table 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 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 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 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-

1 air fans, evaporative-condenser cooling heater pumps, purge, and
 2 the component control circuit.

3 Table 8

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

6 Component	7 Condensing means	8 Air	9 Water	10 Evaporation
		ERR COP	EER COP	EER COP
8 Self-contained	Centrifugal	7.5 2.2	12.9 3.8	
9 water chillers				
10	Positive			
11	displacement	7.2 2.1	10.9 3.2	
12 Condenserless	Positive			
13 water chillers	displacement	8.9 2.6	10.9 3.2	
14 Compressor and				
15 condenser units	Positive			
16 65,000 Btu/hr.	displacement	7.8 2.3	11.3 3.3	11.3 3.3
17 (19,050 watts)				
18 and over				

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

22 Table 9

23 Minimum COP for Heat Pumps, Heating Mode

24 Source and outdoor temperature (degree F.)	25 Minimum COP
26 Air source--47 DB/43 WB	2.2
27 Air source--17 DB/15 WB	1.2
28 Water source--60 entering	2.2

29 (f) Supplementary heater.--The heat pump shall be installed
 30 with a control to prevent supplementary heater operation when
 the heating load can be met by the heat pump alone.

1 Supplementary heater operation is permitted during transient
2 periods, such as start-ups, following room thermostat setpoint
3 advance, and during defrost. A two-stage room thermostat, which
4 controls the supplementary heat on its second stage, shall be
5 accepted as meeting this requirement. The cut-on temperature for
6 the compression heating shall be higher than the cut-on
7 temperature for the supplementary heat, and the cut-off
8 temperature for the compression heating shall be higher than the
9 cut-off temperature for the supplementary heat. Supplementary
10 heat may be derived from any source of electric resistance
11 heating or combustion heating.

12 (g) Combustion heating equipment.--All gas and oilfired
13 comfort heating equipment shall show a minimum combustion
14 efficiency of 75% at maximum rated output. Combustion efficiency
15 shall be determined in accordance with the ASHRAE Standard 90.
16 Section 222. Duct insulation.

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

20
$$t_i - t_o$$

21
$$R = \frac{t_i - t_o}{15} \text{ (hr) (sq.ft) (F)/BTU}$$

22
$$15$$

23 where $t_i - t_o$ is the design temperature differential (absolute
24 value) between the air in the duct and the surrounding air with
25 the following exceptions. Duct insulation, except when needed to
26 prevent condensation, is not required in any of the following
27 cases:

28 (1) Where $t_i - t_o$ is 25 degrees F. or less.

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

1 building.

2 (3) Exhaust air ducts.

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

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

9 Section 223. System controls.

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

13 (b) Temperature.--Each heating, ventilating and air
14 conditioning system shall be provided with at least one
15 thermostat for the regulation of temperature. Each thermostat
16 shall be capable of being set from 55 degrees F. to 75 degrees
17 F. where used to control heating only and from 70 degrees F. to
18 85 degrees F. where used to control cooling only. Where used to
19 control both heating and cooling it shall be capable of being
20 set from 55 degrees F. to 85 degrees F. and shall be capable of
21 operating the system heating and cooling in sequence. It shall
22 be adjustable to provide a temperature range of up to 10 degrees
23 F. between full heating and full cooling, except as allowed in
24 section 220.

25 (c) Humidity.--If a heating, ventilating and air
26 conditioning system is equipped with a means for adding moisture
27 to maintain specific selected relative humidities in spaces or
28 zones, a humidistat shall be provided. This device shall be
29 capable of being set to prevent new energy from being used to
30 produce space relative humidity above 30% R.H. Where a

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

6 (d) Temperature zoning.--

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

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

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

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

25 (1) In all buildings and structures, or portions thereof
26 of use group R-3, the thermostat, or an alternate means such
27 as a switch or a clock, shall provide a readily accessible,
28 manual or automatic means for reducing the energy required
29 for heating and cooling during periods of nonuse or reduced
30 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 224. 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 10.

Table 10

Minimum Pipe Insulation

Insulation thickness in inches

Fluid		for pipe sizes						
Piping temperature								
system range,	Runouts	1" and	1 1/4-	2 1/2-	5"	8" and		
types F.	up to 2"	less	2	4	6	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		

1	Low pressure/								
2	temp	201-250	1	1	1 1/2	1 1/2	2	2	
3	Low tem-								
4	perature	120-200	1/2	3/4	1	1	1	1 1/2	
5	Steam con-								
6	densate	Any	1	1	1	1 1/2	1 1/2	2	
7	(for feed								
8	water)								
9	Cooling systems								
10	Chilled								
11	water,	40-55	1/2	1/2	3/4	1	1	1	
12	Refrigerant,								
13	or brine	Below 40	1	1	1 1/2	1 1/2	1 1/2	1 1/2	

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

20 (b) High thermal resistance.--For materials with thermal
21 resistance greater than R=4.6, the minimum insulation thickness
22 may be reduced as follows:

$$23 \quad \frac{4.6 \times \text{Table 10 Thickness}}{\text{Actual R}} = \text{New Minimum Thickness}$$

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

$$28 \quad \frac{4.0 \times \text{Table 10 Thickness}}{\text{Actual R}} = \text{New Minimum Thickness}$$

30 Piping insulation, except when needed to prevent condensation,

1 is not required in any of the following cases:

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

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

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

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

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

14 SUBCHAPTER F

15 PLUMBING SYSTEMS

16 Section 225. Purpose.

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

20 Section 226. Fixtures.

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

27 (b) Showers.--Showers used for other than safety reasons
28 shall be equipped with flow control devices to limit total flow
29 to a maximum of 3 Gpm per shower head.

30 Section 227. Insulation.

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

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

16 Section 228. Equipment.

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

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

26 (c) Gas and oil-fired water heaters.--All gas and oil-fired
27 automatic storage heaters shall have a recovery efficiency, ER,
28 not less than 75% and a stand-by loss percentage S, not
29 exceeding $S = 2.3 + 67/V$ where V=rated volume in gallons. The method
30 of test of ER and S shall be as described in section 2.7 of ANSI

1 Z21.10.3 Circulating Tank, Instantaneous and Large Automatic
2 Storage Type Water Heaters, Approval Requirements for Gas Water
3 Heaters.

4 Section 229. Controls.

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

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

14 SUBCHAPTER G

15 ELECTRICAL SYSTEMS

16 Section 230. System requirements.

17 (a) Power factor.--The power factor of the overall
18 electrical distribution system in a building shall be not less
19 than 90% under rated design installed load of the building,
20 either by utilization equipment design or by the use of power
21 factor corrective devices. The power factor corrective devices
22 may be installed on individual equipment, rated greater than
23 1,000 watts and switched therewith, regionally grouped, located
24 at the service equipment or power factor correction achieved by
25 other equivalent means. The choice among these corrective
26 methods should be made based upon an engineering evaluation of
27 each distribution system.

28 (b) Service voltage.--Where a choice of service voltage is
29 available, the voltage resulting in the least energy loss shall
30 be used.

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

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

10 (e) Separate metering.--In all multi-family dwellings
11 provisions shall be made to determine the electrical energy
12 consumed by each tenant.

13 SUBCHAPTER H

14 LIGHTING

15 Section 231. Light power budget.

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

19 Section 232. Calculation methods.

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

27 Section 233. Building interiors.

28 (a) Procedure.--The allowable electric power for lighting
29 shall be established by using the criteria and the calculation
30 procedures specified in section 236. 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 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 11, shall be assumed.

Section 234. Building exteriors.

(a) Basis on use.--In exterior spaces, the lighting power

1 budget shall be based on the use of which the space is intended
2 (for task performance, safety, or security) and on efficient
3 energy utilization.

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

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

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

17 (1) For overhead lighting the procedure specified in
18 section 236 shall be followed, but using reflectances as
19 found.

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

24 Section 235. Exceptions to criteria.

25 (a) Interiors.--The criteria of section 233 shall not apply
26 to the following areas when calculating the load:

27 (1) Portions of residential occupancies except for
28 kitchens, bathrooms, and laundry areas and public spaces
29 including lobbies, halls, stairways, basement areas, and
30 utility rooms.

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

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

7 (b) Exteriors.--The criteria of section 234 shall not apply
8 to the following lamps and luminaries; however, their use shall
9 be accounted for in the calculation of task lighting loads for
10 specific tasks. The allowable load shall be based on the
11 luminary wattage to achieve the levels of illumination as
12 covered in section 233 using a point calculation method given in
13 the IES Lighting Handbook. The excepted lamps and luminaires are
14 as follows:

15 (1) Luminaires for medical and dental purposes.

16 (2) Luminaires for highlighting applications, such as
17 sculpture exhibits, art exhibits, and individual items of
18 display merchandise.

19 (3) Luminaires for specialized lighting applications
20 (color matching, where electrical interference cannot be
21 tolerated, etc.).

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

29 Section 236. Calculation procedure.

30 (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 233(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

1 for RCR = 1 or less than that given in Table 11 lamp
2 efficacies for the appropriate space.

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

5 (1) Using data from subsection (b), the illumination
6 levels and areas determined in subsection (a), and the
7 criteria of Table 11 on Reflectance, calculate the allowable
8 wattages using the lumen method.

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

11 (3) Add the wattage of luminaires allowed in section
12 235(b).

13 Table 11

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

16 Application	17 Lumens per Watt
18 Where moderate color rendition is appropriate	55
19 Where good color rendition is appropriate	40
20 Where high color rendition is appropriate, 21 spaces are less than 50 square feet or where 22 use of low wattage High Intensity Discharge 23 (HID) lamps under 250 W or fluorescent 24 lamps under 40 W is appropriate	25

25 (b) Luminary coefficients of utilization (CU).--Coefficients
26 of utilization (CUs) are to be for luminaires for use in the
27 types of spaces listed below, and those luminaires shall have a
28 CU of no less than that listed below (for each type space) for a
29 Room Cavity Ratio (RCR) of 1 and reflectances as in (c).

30 Space Use	Minimum CU
--------------	------------

(at RCR = 1)

For spaces with tasks subjected to veiling reflections where design levels of illumination are listed in terms of 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 I

ALTERNATIVE SYSTEMS

Section 237. 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:

1 Provided, however, That for all buildings classified as Use
2 Group R-3 alternate building systems and equipment design which
3 satisfy the criteria of this section shall not require the
4 approval of the department but the use of such an alternate
5 building system or equipment design shall be indicated in the
6 warranty provided in section 306.

7 Section 238. Nondepletable sources.

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

13 Section 239. Documentation.

14 Proposed alternative designs, submitted to the department as
15 requests for exception to the standard design criteria, must be
16 accompanied by an energy analysis prepared in accordance with
17 the ASHRAE Standard 90-75.

18 SUBCHAPTER J

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19 USE GROUP R-3 PRESCRIPTIVE STANDARDS

20 SECTION 240. MINIMUM INSULATION REQUIREMENTS FOR USE GROUP R-3.

21 USE GROUP R-3 BUILDINGS SHALL BE CONSTRUCTED UTILIZING THE
22 FOLLOWING MINIMUM INSULATION STANDARDS:

23 CEILINGS R - 19

24 EXTERIOR WALLS R - 13

25 FLOORS OVER UNHEATED BASEMENTS

26 AND CRAWL SPACES * R - 11

27 * BASEMENTS CONTAINING A FURNACE

28 AND/OR HOT WATER HEATER MAY BE

29 CONSIDERED HEATED

30 EDGE INSULATION FOR:

1	HEATED SLABS	R - 6.3
2	UNHEATED SLABS	R - 4.2
3	WINDOWS	DOUBLE GLAZED**
4	** WINDOWS MAY BE SINGLE GLAZED	
5	WHEN STORM WINDOWS ARE USED	
6	ENTRANCE DOORS	R - 2.5
7	SLIDING GLASS DOORS (IF APPLICABLE)	DOUBLE GLAZED
8	DUCTS IN UNHEATED AREAS	R - 3

9 CHAPTER 3

10 APPLICATION OF STANDARDS: ESTABLISHMENT

11 OF COMMITTEE AND PENALTIES

12 Section 301. Modification of standards; criteria.

13 The department, with the approval of the Building Energy
14 Conservation Committee established pursuant to section 304,
15 after one or more public hearings, may recommend to the General
16 Assembly modifications to the energy conservation standards
17 contained in Chapter 2 hereof. Any recommended modification to
18 the energy conservation standards shall meet the following
19 criteria:

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

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

24 (3) It shall be economically feasible as determined by
25 life-cycle-cost procedures.

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

28 (5) It shall be a performance standard for the design of
29 buildings and systems within buildings to assure maximum
30 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 dates. NO DEPARTMENT, BOARD, AGENCY OR COMMISSION OTHER THAN AS PROVIDED HEREIN, SHALL PROMULGATE OR ADOPT ANY RULES OR REGULATIONS WHICH DEAL WITH ANY SUBJECT MATTER CONTAINED IN THIS ACT.

Section 303. Energy conservation manual for buildings.

(a) Production of manual.--Concurrent with the adoption of the energy conservation 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, and municipalities of the Commonwealth. This manual shall contain the established standards and accepted practices. The manual shall further contain prescriptive standards which, if complied with, will result in conformance with the performance standards contained herein or as promulgated by the department and shall be written in such manner as to be easily understood by persons possessing a minimal technical background. 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

1 department and the Building Energy Conservation Committee at
2 least annually and shall be updated as significant new energy
3 conservation information becomes available.

4 (c) Educational programs.--The department shall provide
5 seminars and other educational programs throughout the
6 Commonwealth to provide information and counseling to builders,
7 architects, other licensed design professionals, local building
8 officials and other persons affected by this act on the
9 standards contained herein or as promulgated by the department.

10 Section 304. Building Energy Conservation Committee.

11 (a) Composition of committee.--In order to further the
12 coordinated and effective administration of this act, there is
13 hereby established a Building Energy Conservation Committee. It
14 shall consist of at least 30 members and no more than 40
15 members, the membership of which shall be appointed by the
16 Governor and shall include a representative of each of the
17 following entities or their successors:

- 18 (1) Department of Education.
- 19 (2) Governor's Energy Council.
- 20 (3) Department of General Services.
- 21 (4) Department of Labor and Industry.
- 22 (5) Department of Community Affairs.
- 23 (6) Pennsylvania Builders Association.
- 24 (7) Pennsylvania Associated Builders and Contractors,
25 Inc.
- 26 (8) Pennsylvania Building Officials Conference.
- 27 (9) Mechanical Contractors Association of America.
- 28 (10) Pennsylvania Chamber of Commerce.
- 29 (11) General Contractors Association of Pennsylvania.
- 30 (12) Pennsylvania Society of Architects.

- 1 (13) Pennsylvania Society of Professional Engineers.
- 2 (14) American Society of Heating, Refrigerating and Air
- 3 Conditioning Engineers, Inc..
- 4 (15) Pennsylvania Gas Association.
- 5 (16) Pennsylvania Electric Association.
- 6 (17) Industrialized Housing Manufacturers Association.
- 7 (18) Thermal Insulation Manufacturers Association.
- 8 (19) Pennsylvania Building Trades Council.
- 9 (20) Consulting Engineers Council of Pennsylvania.
- 10 (21) Pennsylvania League of Cities.
- 11 (22) Pennsylvania State Association of Boroughs.
- 12 (23) Pennsylvania State Association of Township
- 13 Commissioners.
- 14 (24) Pennsylvania State Association of Township
- 15 Supervisors.

16 25 Representatives of such other agencies and

17 organizations or individuals as the Governor may find are

18 necessary and proper to carry out the purposes of the

19 committee including, but not limited to, labor organizations,

20 financial and lending institutions, and consumer groups.

21 (b) Powers and duties.--In addition to the powers and duties

22 enumerated in this act, the Building Energy Conservation

23 Committee shall:

24 (1) Be responsible for the regular exchange of

25 information and plans regarding building energy conservation,

26 for the development, review and approval of proposed and

27 existing standards, guidelines, regulations, and manuals.

28 (2) Elect from its members a Board on Variances.

29 (c) Expenses.--The members of the committee shall not

30 receive any compensation for their services but shall be

1 reimbursed for their actual and necessary expenses incurred in
2 the performance of their duties. Provided, however, when acting
3 on matters concerning variances members of the Board on
4 Variances shall receive \$50 per day plus their actual and
5 necessary expenses.

6 Section 305. Certification.

7 (a) Applicability.--The provisions of this section shall
8 apply to all buildings subject to this act except those
9 classified as Use Group R-3.

10 (b) Compliance with act.--It shall be the duty of the
11 licensed design professional retained in connection with the
12 design or construction of a building to certify the drawings,
13 specifications and other data showing compliance with the
14 provisions of this act, except as provided in subsection (e). If
15 the building is subject to the provisions of the act of April
16 27, 1927 (P.L.465, No.299), referred to as the Fire and Panic
17 Act, the certification required hereunder shall be submitted on
18 a form with the application for plan approval under the said
19 Fire and Panic Act.

20 (c) Inspection.--Each licensed design professional retained
21 by the owner or his designee, where any of such are retained
22 during the construction of a building, shall make periodic
23 inspections of the building progression to insure compliance
24 with this act, except as provided in subsection (e).

25 (d) Final certification.--Each licensed design professional
26 retained by the owner shall make a final certification of every
27 completed building showing compliance with the provisions of
28 this act, except as provided in subsection (e).

29 (e) Certification by builder.--If a licensed design
30 professional is not retained in connection with the design and

1 construction of a building, it shall be the responsibility of
2 the builder or owner, if he is the builder, to perform the
3 inspections and certification required by this section.

4 Section 306. Use Group R-3; notice; warranty.

5 (a) Notice.--Prior to construction of any building
6 classified as Use Group R-3, the builder shall notify the
7 department by certified mail of his intent to begin
8 construction. Such notice shall contain the name of the owner of
9 the building and its location.

10 (b) Warranty.--At the time a contract for the construction
11 of any building classified as Use Group R-3 is entered into, the
12 builder shall warrant to the owner in writing that the building
13 shall be constructed in accordance with the provisions of this
14 act. Such warranty shall be a document separate from the
15 contract and shall be in the following form:

16 I, (Builder) , hereby warrant to (Owner) that the
17 premises known as (Description)
18 shall be constructed in accordance with the provisions of the
19 Act of _____, 19__, No.____, known as the "Building Energy
20 Conservation Act." This law provides building and equipment
21 standards to make your home energy efficient and also provides
22 you with legal remedies if your home is not built according to
23 the State standards. If you would like the State to do an
24 energy audit of your home to determine if it conforms to State
25 standards, you may call the Pennsylvania Department of
26 Community Affairs at (Telephone) , and they will perform an
27 inspection of your home for a fee of \$25.00.

28 Indicate if alternate building system or equipment design is
29 being employed.

30 (c) If the builder is also the owner of the building at the

1 time of construction, he shall provide the warranty required by
2 subsection (b) at the time of its initial sale to a new owner.
3 Such warranty shall be in substantially the same form as
4 provided in subsection (b).

5 (d) Failure to provide notice.--The Department of Community
6 Affairs, after hearing, may assess a civil penalty payable to
7 the Commonwealth of Pennsylvania not to exceed \$100 upon any
8 builder who fails to give the notice required by subsection (a).
9 In determining the amount of the civil penalty, the Department
10 of Community Affairs shall consider the wilfulness of the
11 violation and the cost incurred by the department in discovering
12 the violation.

13 (e) Failure to provide warranty.--Whenever a builder fails
14 to provide the warranty required by subsections (b) or (c) such
15 required warranty shall constitute an implied warranty and the
16 owner's right to proceed under section 315(a) shall not be
17 affected. If it is established by a preponderance of the
18 evidence that the builder's failure to provide the warranty was
19 wilful, then damages in twice the amount provided in section 315
20 may be awarded.

21 Section 307. Variances.

22 (a) Requests.--Any request for a variance from the energy
23 conservation standards contained herein shall be made to the
24 Board on Variances of the Building Energy Conservation Committee
25 and a decision on such request shall be made within 30 days of
26 its filing.

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

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

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

3 Section 308. Building permits.

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

7 Section 309. Permits for use or occupancy.

8 Before any building or structure hereafter constructed, other
9 than a building classified as Use Group R-3, shall be used or
10 opened for occupancy, the owner thereof shall notify the
11 department of the completion of the building for the purposes of
12 this act and submit the necessary certification therewith:

13 Provided, however, That if a municipality elects to administer
14 the provisions of this act under Chapter 5 such notice and
15 certification shall be submitted to the municipality which shall
16 forward a copy of the notice to the department. No permit for
17 use or occupancy shall be granted until such submission has been
18 made. No building official of the Commonwealth or any of its
19 political subdivisions shall issue a permit until he has
20 received proof of such compliance. Where the certificate has
21 been submitted to the department, presentation to the building
22 official of the mailing receipt together with a copy of the
23 certification required by section 305 shall establish proof of
24 compliance for the purposes of this section. Upon such
25 presentation any building official of the Commonwealth or any of
26 its political subdivisions shall issue a permit for use or
27 occupancy, provided all other criteria for such a permit have
28 been satisfied and said building official shall notify the
29 department that he has issued the same.

30 Section 310. Failure to submit certification.

1 Whenever the owner of any building, other than a building
2 classified as Use Group R-3, shall fail to give the notice and
3 submit the necessary certification in accordance with section
4 309 and shall nevertheless proceed with the use or occupancy of
5 the building, the department or the municipality shall serve
6 notice on the said owner that he is in violation of this act and
7 order him to comply therewith.

8 Section 311. Inspections.

9 The department may perform a nondestructive inspection within
10 two years of the date of completion of construction of any
11 building constructed after the effective date of this act to
12 determine compliance with the provisions of this act, provided
13 at least 30 days notice has been given to the owner. The
14 department may also perform such inspections at the request of
15 the owner of any building subject to this act for a fee of
16 \$25.00.

17 Section 312. Appeals.

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

23 Section 313. Penalties.

24 (a) Applicability.--The provisions of this section shall
25 apply to all buildings subject to this act except those
26 classified as Use Group R-3.

27 (b) Violations of act.--Any person who shall willfully or
28 negligently violate any of the provisions of this act, or the
29 rules and regulations or the orders for the enforcement of the
30 said provisions or rules and regulations issued by duly

1 authorized officers of the department or who shall hinder, delay
2 or interfere with any officer charged with the enforcement of
3 this act in the performance of his duty, shall, upon conviction
4 thereof, be punished by a fine of not more than \$300 and costs.
5 In the event of violation of more than one provision of this
6 act, the violation of each provision shall be deemed a separate
7 and distinct offense for the purposes of this section.

8 (c) Institution of proceedings.--Prosecutions for violations
9 of this act or the rules and regulations of the department may
10 be instituted by the Secretary of Labor and Industry or under
11 his directions by an authorized representative of the
12 department. Upon conviction after a hearing in a court of
13 competent jurisdiction, the sentences provided in this act shall
14 be imposed and shall be final unless an appeal be taken in the
15 manner prescribed by law.

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

19 (e) False certification.--Any architect or other licensed
20 design professional who willfully provides a false certification
21 for any building subject to the provisions of this act shall be
22 subject to the suspension or revocation of his license by the
23 State Board of Examiners of Architects or other applicable State
24 licensing board.

25 Section 314. Enforcement.

26 (a) Applicability.--The provisions of this act shall apply
27 to every building enumerated in this act, including buildings
28 owned in whole or in part by the Commonwealth or any political
29 subdivision thereof, and for all buildings, other than those
30 classified as Use Group R-3 shall be enforced by the Secretary

1 of Labor and Industry, by and through his authorized
2 representatives.

3 (b) Powers of officers.--For the purpose of enforcing the
4 provisions of this act, all the officers charged with its
5 enforcement shall have the power to enter any of the buildings
6 enumerated in this act, and no person shall hinder or delay, or
7 interfere with any of the said officers in the performance of
8 his duty, nor refuse any pertinent information necessary to
9 determine whether the provisions of this act and the rules and
10 regulations herein provided for, are or will be complied with.
11 Section 315. Civil action.

12 (a) Use Group R-3.--The owner of any building subject to the
13 requirements of section 306 who is aggrieved as the result of
14 such building not being properly designed or constructed in
15 conformance with this act shall have a right of action for
16 breach of warranty. Remedies may include specific performance or
17 an award of damages in an amount not less than \$300. Attorney's
18 fees shall be recoverable in any action in which the owner
19 prevails. Any such award shall further provide for payment of
20 the actual costs in excess of \$25 incurred by the department if
21 it inspected the building for the owner and the owner shall
22 remit such amount to the department.

23 (b) Other buildings.--The owner of any building, other than
24 a building classified as Use Group R-3, at the time of its
25 design or construction under the provisions of this act who is
26 aggrieved as the result of such building not being properly
27 designed or constructed in conformance with this act shall have
28 a right of action against any person who is required to submit
29 the certificate required by section 305.

30 (c) Limitation of action.--No action brought under this

1 section shall be maintained unless brought within three years
2 from the date of completion of the building.

3 CHAPTER 4

4 ADOPTION OF FUTURE STANDARDS

5 Section 401. Adoption and promulgation of standards.

6 The department, with the approval of the Building Energy
7 Conservation Committee, shall, after one or more public
8 hearings, adopt and publish energy conservation standards for
9 all buildings covered by this act in accordance with the
10 provisions of the act of July 31, 1968 (P.L.769, No.240), known
11 as the "Commonwealth Documents Law." The purpose of such
12 standards is to reduce wasteful or uneconomic consumption of
13 energy by balancing the cost of energy procurement against the
14 cost of energy-conserving building practices. The energy
15 conservation standards shall meet the following criteria:

16 (1) They shall be consistent with the latest and most
17 effective technology.

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

20 (3) They shall be economically feasible as determined by
21 life-cycle-cost procedures.

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

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

27 (6) Consideration shall be given to building and energy
28 standards promulgated by national and other State
29 governmental agencies, private organizations and any other
30 available energy data, as well as the total energy allocation

1 approach.

2 CHAPTER 5

3 LOCAL ELECTION

4 Section 501. Election; Use Group R-3.

5 Any municipality of this Commonwealth may elect to administer
6 the provisions of this act relating to Use Group R-3 buildings,
7 as defined in section 103, except for units subject to the act
8 of May 11, 1972 (P.L.286, No.70), known as the "Industrialized
9 Housing Act" and the act of May 11, 1972 (P.L.281, No.69), known
10 as the "Uniform Standards Code for Mobile Homes." Such election
11 shall be made by resolution of the governing body of such
12 municipality which shall be in substantially the following form:

13 The (city, borough, town, or township) of _____
14 hereby elects to administer the provisions of the act
15 of _____, 1978, No. _____ known as the "Building Energy
16 Conservation Act" for Use Group R-3 buildings as defined
17 therein.

18 Section 502. Election; cities of the first, second and second
19 class A.

20 Any city of the first class, second class and second class A
21 may elect to administer the provisions of this act for all
22 buildings subject hereto, except for units subject to the act of
23 May 11, 1972 (P.L.286, No.70), known as the "Industrialized
24 Housing Act" and the act of May 11, 1972 (P.L.281, No.69), known
25 as the "Uniform Standards Code for Mobile Homes." Such election
26 shall be made by resolution of the governing body of such city
27 which shall be in substantially the following form:

28 The city of _____ hereby elects to administer the
29 provisions of the act of _____, 1978, No. _____ known as
30 the "Building Energy Conservation Act."

1 Section 503. Powers of municipalities.

2 Any municipality electing to administer the provisions of
3 this act under section 501 or 502 shall exercise the same powers
4 conferred upon the department by this act, including the power
5 to institute proceedings for violations of the act, with the
6 exception of those powers specified in sections 301, 303 and in
7 Chapter 4. In addition, any such municipality may exercise such
8 other administrative and enforcement procedures as it shall deem
9 necessary to effect the purposes of this act including, but not
10 limited to, prior plan approval, building permit requirements,
11 use or occupancy permit requirements and inspections during the
12 course of construction.

13 Section 504. Variances.

14 Any municipality electing to administer the provisions of
15 this act under section 501 or 502 shall establish a Board on
16 Variances to make determinations on request for variance from
17 the energy conservation standards contained herein or as
18 promulgated by the department with the approval of the Building
19 Energy Conservation Committee, and is authorized exclusive
20 jurisdiction to grant such variances, section 307(a)
21 notwithstanding. A variance shall only be granted if the
22 criteria of section 307(b) have been satisfied.

23 Section 505. Disposition of fines.

24 Any fines collected under this act by any municipality
25 electing to administer the provisions of this act under section
26 501 or 502 shall be retained by the municipality, section 313(c)
27 notwithstanding.

28 CHAPTER 6

29 REPORT TO GENERAL ASSEMBLY

30 Section 601. Report to General Assembly.

1 Thirty months after the effective date of this act, the
2 department shall report to the General Assembly the results of
3 the inspections it has performed under this act together with a
4 report on public compliance with this act.

5 Section 602. Effective date.

6 This act shall take effect as follows:

7 (1) Chapter 2 shall take effect in six months and shall
8 remain in full force and effect for a period of one year
9 after which time the provisions of Chapter 2 shall have no
10 legal effect.

11 (2) Section 301 shall take effect immediately and its
12 provisions shall remain in full force and effect for a period
13 of 18 months after which time said provisions shall have no
14 legal effect.

15 (3) Chapter 4 shall take effect in 18 months.

16 (4) All other provisions of this act shall take effect
17 immediately.