IND 17

STATE OF WISCONSIN }
DEPT. OF INDUSTRIAL COMMISSION } SS.

TO ALL TO WHOM THESE PRESENTS SHALL COME, GREETINGS:

I, Helen E. Gill, Secretary of the Industrial Commission of Wisconsin, and custodian of the official records of said commission, do hereby certify that the attached orders Ind 17.01 to 17.13, inclusive, known as the School Lighting Code, were adopted by the Industrial Commission on December 27, 1956, and will become effective on the first day of the month following their publication in the Wisconsin Administrative Code, namely December 1, 1957.

I further certify that said copy has been compared by me with the original on file in this commission, and that same is a true and exact copy thereof.

IN TESTIMONY WHEREOF, I have hereunto set my hand and affixed the official seal of the department at the Capitol in the City of Madison, this 14th day of November, A. D., 1 9 5 7.

Helen E. Gill
Secretary

INDUSTRIAL COMMISSION
OF
WISCONSIN

WISCONSIN SCHOOL LIGHTING CODE

Revised 1957

Issued by
INDUSTRIAL COMMISSION OF WISCONSIN
Madison, Wisconsin

1957

AUTHORITY

The Wisconsin School Lighting Code has been adopted by the Industrial Commission in discharge of its duties under Section 101.01 to 101.28, inclusive, of the Statutes of Wisconsin.

HISTORY

The Wisconsin School Lighting Code first issued by the Industrial Commission became effective October 6, 1921. The code was revised in 1943 and became effective February 7, 1944.

In 1950, the supply of copies of the code was used up. Discussion of the code indicated that the advisory committee should be reorganized. In June, 1954, the interested organizations were contacted. Later, each organization was asked to nominate representatives to serve on a new advisory committee. The personnel of this advisory committee is as follows:

A. L. Buechner, Madison, Representing the Department of Public Instruction (Chairman).
Joseph G. Durrant, Boscobel, Representing the American Institute of Architects.
Dr. C. W. Aageson, Madison, Representing the State Medical Society of Wisconsin.
C. N. Laupp, Milwaukee, Representing the Illuminating Engineering Society.
H. G. Thayer, Madison, Representing the State Board of Vocational and Adult Education.
R. G. Hein, Waukesha, Representing the Wisconsin Association of School Administrators.
Miss Marie Kennedy, Shell Lake, Representing the Wisconsin Association of County Superintendents.
E. G. McKean, Tomah, Representing the Wisconsin Education Association.
John E. Wise, Madison, Electrical Engineer, Representing the Industrial Commission (Secretary).

On December 27, 1956 the commission voted to repeal safety orders, known as the School Lighting Code, 2175–2189, inclusive, and to adopt orders Ind 17.01–17.13, inclusive, to be known as the School Lighting Code. These orders became effective the first of the month, following their publication in the Wisconsin Administrative Code, namely, December 1, 1957.

ADMINISTRATION

The Wisconsin School Lighting Code has been enforced by the Industrial Commission and the Department of Public Instruction with the cooperation of municipal and other local officials who, by law, are required to enforce all orders which are germane to their respective duties (Wisconsin Statutes, Section 101.28)

APPEAL

Any person who considers any part of the Wisconsin School Lighting Code or any official's interpretation of this code to be unreasonable may appeal to the Industrial Commission to interpret, modify or suspend same. (Wisconsin Statutes, Section 101.15 to 101.17, inc.)

Chapter 17

SCHOOL LIGHTING CODE

Ind 17.01 Application and scope. This code sets forth the minimum requirements for the daylighting and electric lighting of school buildings including public, parochial and private schools. Unless specifically stated to the contrary, all sections of this code apply to new construction, to reconstruction of and additions to existing buildings, and to changes in electric lighting installations. Existing electric lighting and daylighting installations shall be made to comply with the terms of this code as far as may be directed by the industrial commission or other state departments having jurisdiction and within the time determined by such departments.

History: Cr. Register, November, 1957, No. 23, eff. 12–1–57.

Ind 17.02 Definitions. (1) BILATERAL SYSTEM. The daylight illumination of school rooms from more than one side.

(2) CANDLE; CANDLE POWER. The unit of luminous intensity maintained by the United States Bureau of Standards. It is approximately equal to the intensity of light emitted in a horizontal direction by a standard candle. Thus a lamp is said to have a light intensity of 100 candle power in the direction of some given object, when it gives 100 times as much light to this object as would be given to it by a standard candle.

(3) CLERESTORY. That part of a building which rises clear of the roofs of the other parts and whose walls contain windows for daylighting the interior.

(4) DISTRIBUTION CURVE. A photometric analysis of the distribution of light from a luminaire. It indicates the candle power distribution in all directions as well as the lumen output in various zones. It also indicates the efficiency of the luminaire. Brightness measurements of the luminaire at various angles are usually included on all curves furnished by acceptable laboratories which are satisfactory to the Wisconsin industrial commission.

(5) FOOT-CANDLE. The unit of illumination when the foot is the unit of length. It is the illumination on a surface one square foot in area on which is uniformly distributed a flux of one lumen. It equals one lumen per square foot.

(6) FOOT LAMBERT. The unit of photometric brightness that is de-ed as being one lumen per square foot emitted or reflected from a rface. The measurement of brightness of a surface in foot lamberts equal to the illumination of the surface in foot-candles multiplied the reflection factor of the surface.

Vote: (One candle per square inch equals 452 foot lamberts.)

(7) GLARE. High brightness ratios in the field of vision.

(8) ILLUMINATION AT THE WORK. The illumination of or at the portant plane or planes of the actual visual task.

Vote: (In average classrooms the work plane is normally 30" above the or.)

(9) LAMP. An electric light source exclusive of any other parts con-tuting a luminaire.

(10) LIGHT METER. An instrument used in measuring the illumina-n on a surface. Most accurate readings are obtained from a light ter having both cosine and color correction accessories.

(11) LUMEN. The unit of luminous flux which equals the flux itted through a unit solid angle (one steridian) from a uniform int source of one candle. The term lumen is used to define the al light output of an electric light source.

(12) LUMINAIRE. A complete lighting unit including lamp, globe, flector, refractor, housing or louvers, and such support as is in-ded with the housing.

(13) LUMINOUS CEILING. A lighting system having practically wall wall luminous elements made up of louvers, plastic or glass diffus-s above which light sources are installed.

(14) REFLECTION FACTOR. The ratio of total luminous flux reflected a surface to the luminous flux incident upon it.

(15) SHIELDING. Refers to those portions of a luminaire which ve to screen out the light source and minimize glare from normal gles of vision.

(16) SUPPLEMENTARY LIGHTING. The lighting provided by a special pe of luminaire usually located at or near eye level and intended illuminate a limited area.

(17) TOP LIGHTING UNIT. A daylighting device mounted in the ling.

(18) UNILATERAL SYSTEM. The daylight illumination of school oms from one side only.

History: Cr. Register, November, 1957, No. 23, eff. 12–1–57.

Ind 17.03 Electric lighting. GENERAL REQUIREMENTS. All rooms and aces of school buildings shall be equipped with means for supplying ctric illumination in the quantity required for the purpose to which ch room or space is devoted.

History: Cr. Register, November, 1957, No. 23, eff. 12–1–57.

Ind 17.04 Character of lighting to be supplied. (1) The principal irce of electric illumination of all rooms and spaces of school ildings shall be from overhead lighting systems. When a combina-n of overhead and supplementary lighting is employed, the illumi-tion at the work received from the overhead lighting, shall in no se be less than the intensities set forth in section Ind 17.05.

(2) Where supplementary lighting is used in combination with overhead lighting, particular care shall be exercised to eliminate glare at other points in the room. Adequate shielding and careful adjustment of the direction shall be provided to minimize both direct and reflected glare.

History: Cr. Register, November, 1957, No. 23, eff. 12–1–57.

Ind 17.05 Illumination at the work. Electric illumination at the point of work in rooms and spaces of school buildings shall be supplied and maintained in accordance with the minimum values shown in the following table:

Room or space to be illuminated	Minimum maintained illumination at the work, foot-candles
(1) Classrooms—all spaces used for study or instructions excepting (3) & (4).	30 f.c.
(2) Study halls, lecture rooms, offices, laboratories and libraries.	30 f.c.
(3) Sight saving classrooms.	50 f.c.
(4) Drafting, typing and sewing rooms.	50 f.c.
(5) Gymnasiums and natatoriums. It is recommended that consideration be given to underwater lighting for natatoriums.	25 f.c.
(6) Auditoriums (not for study), cafeterias, locker rooms, wash rooms, corridors containing lockers and stairways.	10 f.c.
(7) Other corridors and store rooms.	5 f.c.
(8) Shops—vocational training and industrial arts	
(a) Bench and machine areas	50 f.c.
(b) General areas	30 f.c.

Note: The values are minimum, not average.

Where it is desired to see objects in their daylight hues, as for example, art work, the use of electric light having an approximate daylight spectrum is suggested; increased illumination is usually desirable.

In planning electric lighting, allowance of at least 30% should be made for depreciation from dirt and other causes.

History: Cr. Register, November, 1957, No. 23, eff. 12–1–57.

Ind 17.06 Shielding of lamps. No exposed lamps or tubes having a brightness greater than 1200 foot lamberts shall be installed in rooms used for study or vocational training purposes. All sources having brightness in excess of 1200 foot lamberts shall be provided with suitable shielding either as a component of the luminaire or as a structural element, so that occupants will be protected from direct glare. Where fluorescent lamps are used, the minimum shielding shall be 25° lengthwise and 35° crosswise of the source measured below the horizontal line. Surface brightness of the shielding elements, if of the diffusing type, shall not exceed 1200 foot lamberts.

History: Cr. Register, November, 1957, No. 23, eff. 12–1–57.

Ind 17.07 Distribution of light. Luminaires or luminous ceilings shall be so installed in regard to mounting height, location, and spacing as to provide uniform distribution of illumination at the work.

Note: Section Ind 17.07 does not apply to toilet rooms, cloak rooms, store rooms, boiler rooms and other spaces devoted to similar purposes.

History: Cr. Register, November, 1957, No. 23, eff. 12–1–57.

Ind 17.08 Diffusion of light. Luminaires shall be so installed in regard to mounting height, location and spacing as to avoid sharply

efined and deep shadows from overhanging structural parts or ersons in normal working positions.

Note: Section Ind 17.08 does not apply to toilet rooms, cloak rooms, store ooms, boiler rooms and other spaces devoted to similar purposes.

Note: Deep shadows interfere with work in the shaded area and are a train on the eyes. In general, some shadows may be present, in fact, they id in observing objects in 3 dimensions, but they should be soft and minous.

History: Cr. Register, November, 1957, No. 23, eff. 12–1–57.

Ind 17.09 Emergency lighting. (1) EXIT, STAIR AND CORRIDORS. The ghting in all stairways and exits and in the passageways leading ereto shall be connected independently of the room lighting. Such ghting and exit lights shall comply with the terms of the Wisonsin state building code and the Wisconsin state electrical code and all be so supplied as not to be subject to failure because of the ailure of the room lighting from internal causes.

(2) NATATORIUMS. In all natatoriums the lighting shall be connected with the emergency lighting.

History: Cr. Register, November, 1957, No. 23, eff. 12–1–57.

Ind 17.10 Daylight. (1) WHERE REQUIRED. All rooms and spaces f school buildings used for instruction and study purposes shall e provided with at least a minimum vision area or windows except ymnasiums, auditoriums, cafeterias, lunch rooms, music rooms, vo-ational shops and similar areas.

(2) VISION AREA OR WINDOWS. The minimum vision area or windows all be not less than 3′0″ in height with the window head at least 8″ and the sill not more than 3′0″ above the floor. The cumulative ngth of the vision area shall be not less than 2/3 the length of the utside wall containing the vision area, windows, or the equivalent.

(3) GLASS BLOCK CONSTRUCTION. (a) Glass block construction for ll spaces to which this code applies, may be used under the re-trictions of the Wisconsin state building code and those imposed y this code in so far as they apply.

(b) Glass block wall panels exposed to direct sun rays and above ie 5 foot level shall be of a type capable of directing the light rays orizontally or upward.

(4) BRIGHTNESS CONTROL. In class or study rooms, all windows, kylights, clerestories, top lights and other openings containing clear lass or equivalent translucent material which is exposed to the irect or reflected (as from snow) rays of the sun shall be provided ith an effective means of brightness control. Opaque shades shall e used only where it is necessary to darken the room for visual struction.

History: Cr. Register, November, 1957, No. 23, eff. 12–1–57.

Ind 17.11 Windows in front wall prohibited. Windows shall not be cated in the front wall of classrooms, recitation rooms and study alls.

Note: By front wall is meant the wall pupils face directly when in their eats.

History: Cr. Register, November, 1957, No. 23 eff. 12–1–57.

Ind 17.12 Location of chalkboards and bulletin boards. Chalkboards and bulletin boards shall not be located in the same wall with windows. Chalkboards shall not be located within 6 feet of any window.

History: Cr. Register, November, 1957, No. 23, eff. 12–1–57.

Ind 17.13 Finish of walls and ceilings. (1) CEILINGS. Ceilings of all instruction and study spaces shall be finished with a matte (dull) or semi-matte surface having an initial coefficient of reflection (see Ind 17.02 definition (14)) of at least 0.75.

(2) WALLS OF ROOMS. Walls of all instruction and study spaces, from ceiling down to top of chalkboard, or to a height of 2′8″ above the floor, where chalkboards are not used, shall be finished with a matte (dull) or semi-matte surface having an initial reflection factor of not less than 0.45 nor more than 0.60; below this level a darker finish may be used.

(3) TRIM. Trim of all instruction and study spaces shall be finished in a matte or semi-matte surface.

Note: Finishes, such as spar varnish, may be rubbed to a dull surface.

(4) WALLS OF LIGHT COURTS. Walls of light courts shall be finished with a surface having a high initial coefficient of reflection (0.60 to 0.70), but care must be taken to avoid glare.

(5) REFLECTION FACTOR. The following table presents figures which are the result of a considerable number of tests of different authorities, and are representative average values of the coefficient of reflection for various colors. Since it is not possible to accurately describe colors verbally, a range in values is given for each color.

Color	Coefficient of Reflection
White, new	0.75 to 0.85
White, old	0.70 to 0.77
Cream	0.66 to 0.76
Buff	0.44 to 0.59
Ivory	0.66 to 0.76
Gray	0.15 to 0.67
Light Green	0.43 to 0.67
Dark Green	0.10 to 0.22
Light Blue	0.31 to 0.57
Pink	0.32 to 0.57
Dark Red	0.12 to 0.27
Yellow	0.55 to 0.70
Dark Tan	0.27 to 0.41
Natural wood brown stain	0.15 to 0.26
Light wood varnish	0.36 to 0.44

History: Cr. Register, November, 1957, No. 23, eff. 12–1–57.

Note: A DISCUSSION OF SCHOOL LIGHTING GOALS

Research results indicate that optimum brightness-difference conditions for visual efficiency exist when the task and surrounding areas are of a uniform brightness. This condition is not feasible in a schoolroom because of the physical limitations which cannot be overcome. An environment having absolute conditions of brightness-balance, therefore, is not possible in a schoolroom; hence unity of brightness cannot be considered as a practical goal. It is desirable,

owever, to reduce brightness-differences to a reasonable minimum y eliminating the sources of excessively high brightness and by in-reasing the brightness of the dark areas within the total visual nvironment.

Where critical seeing tasks are being performed, desirable bright-ess-difference goals for the total visual environment are as follows:

Goal A—A foot-lambert brightness of any surface viewed from any normal standing or sitting position in the schoolroom should not exceed 10 times the foot-lambert brightness of the poorest lighted task in the room.

Goal B—The foot-lambert brightness of any surface viewed from any normal standing or sitting position in the schoolroom should not be less than one-third the foot-lambert brightness of the poorest lighted task in the room.

Goal C—The foot-lambert brightness of any surface immediately adjacent to the task should not exceed 3 times the task bright-ness.

Goal D—Brightness-difference between adjacent surfaces should be reduced to a minimum.

Goal E—The brightness goals stated above assume a lighting system that provides from 20 to 40 foot-candles on the poorest lighted task. As foot-candle levels are increased sources of high brightness should be controlled to approach more nearly the brightness of the task. The extent of the area of the surface producing brightness has a measurable effect upon visual com-fort. Generally, small areas of either extremes of brightness are less noticeable than are large areas of the same brightness.

Goal F—Light distribution from any light source should be of such a nature that direct and specular glare are eliminated for the observer to the greatest possible degree.

Goal G—These objectives or goals should be achieved without the loss of a cheerful, friendly and esthetically pleasing class-room environment and with the need in mind for a balanced and acceptable thermal and auditory environment.

The term "task", as used in the foregoing definitions of goals, is nterpreted to include any visual task which may be encountered in a choolroom. For example, a "task" might be a book on the student's esk, the written symbols on the chalkboard, demonstration or experi-ental apparatus in a laboratory, an art assignment on an easel or xhibit materials on a tackboard, a motion picture or a lantern slide.)n the basis of this concept, it is apparent that the tasks may be in ither a horizontal or a vertical plane and may require the pupil o face any direction. Visual tasks in schoolrooms range in brightness-ifference from reading black symbols on white paper to sewing with lack thread on black cloth. Other factors remaining constant, visual omfort and efficiency increase with the increase in brightness-ifference within the task.