STATE OF NEW JERSEY
DEPARTMENT OF LABOR & INDUSTRY
[redacted] *Commissioner*
Percy A. Miller, Jr.

ENGINEERING STANDARDS

Tentative

RULES AND REGULATIONS

Governing

LIGHTING

IN PLACES OF EMPLOYMENT AND PUBLIC ASSEMBLY

Bureau of Engineering and Safety
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C O N T E N T S

FOREWORD

Engineering for safe plant operation consists essentially of preparing a safe environment for the workman. The environment should be designed to match and to compensate for the limitations of human capability. On the other hand, the workman must understand his personal responsibilities regarding acts which might conceivably cause injury to himself or to others and carefully follow plant safety regulations.

However, as revealed by an analysis of accidents and their causes, this is but one phase of the safety problem. All personal injury accidents involve a combination of personal and mechanical causes. The chain of circumstances or series of causes which has brought a workman to the verge of an injury frequently can be broken only if the workman can see quickly and accurately the causes and hence act to prevent the accident.

Any factor which aids seeing will increase the probability that the man will detect the causes of an accident and act to avert it. It is realized that with rapidly-moving material, mechanical failures often result in accidents occurring too rapidly for any reaction on the part of the workman. However, mechanical failures of this nature are usually preceded by evidences of the existence of undue stresses or strains which may be detected if *sufficient illumination is provided.*

Illumination is a factor of primary importance which affects environment in every place of employment. The beneficial effects of good illumination, both natural and artificial, have been established in extensive tests over many years. The advantages are many and include:

1. *Greater safety.*
2. *Less eyestrain and fatigue among employees.*
3. *Improved moral among employees, resulting in decreased labor turnover.*
4. *More easily maintained cleanliness and orderliness in the plant.*
5. *Greater east of seeing, especially among older employees, thus making them more efficient.*
6. *Better supervision of workers.*
7. *Better utilization of floor space.*
8. *Greater operating efficiency.*
9. *Greater accuracy of workmanship, resulting in an improved quality of product with less spoilage and rework.*

The close correlation between the personal injury rates and illumination is not generally understood. In most cases where accidents are attributed to poor illumination they occur because there is improper quality of illumination or practically no illumination at all. Poor or indifferent lighting is a contributing cause of accidents, even though it may provide measurable quantities of light. Many factors associated with poor illumination, such as glare, light reflected from the work, and dark shadows, hamper seeing and cause after-images and excessive visual and physical fatigue which are important contributing causes of industrial accidents. Many accidents are also caused by delayed eye adaptation when coming from bright surroundings into dark interiors. Frequently accidents which are attributed to the individual's carelessness can actually be traced to difficulty of seeing.

One important cause of industrial losses is poor illumination resulting in minor accidents where the employee may or may not report for first aid but continues his work, but with a decrease in the quantity and quality of his work.

The condition of the illumination at the point of accident and in the surrounding area, should always be inspected and reported in accident investigations.

There are many factors involved in good illumination. These can be summed up under the headings of quality,

which includes its direction, diffusion, absence of glare, etc., and quantity or the amount of illumination.

The quality of the lighting whether natural or artificial is highly important in providing good seeing conditions. Glare, diffusion, direction and distribution have significant effects on visibility and the ability to see easily, accurately and quickly.

The desirable quantity of light for any particular installation depends primarily upon the work which is being done. The degree of accuracy, the fineness of detail to be observed, the color and reflectivity of the work as well as of the immediate surroundings materially affect the distribution of brightness which will produce maximum seeing conditions. Investigations in the field and laboratory have proved that as the illumination on the task is increased, the ease, speed and accuracy with which the task can be accomplished are increased. These tests have not yet established an upper limit but the harmful effects of low-footcandle values are well known.

These rules and regulations have been, in part, adapted from the publication of the Division of Labor Standards, United States Department of Labor entitled "Industrial Hygiene and Plant Efficiency Through Good Lighting" which is also a reprint of the "American Recommended Practice of Industrial Lighting" prepared under the sponsorship of the Illuminating Engineering Society and approved by the American Standards Association on March 17, 1942.

1. *Purpose*

1.1 The purpose of these rules and regulations is to make reasonable provisions for the safety of workers and the general public by requiring such illumination as may be necessary to conserve vision, to facilitate the utilization of eyesight for the prevention of accidents and to provide for safety to life and limb of persons using the premises.

2. *Scope*

2.1 These rules and regulations apply to all places of employment or public assembly.

2.2 In case of practical difficulty or unnecessary hardship, the Commissioner may grant exceptions from these rules and regulations provided that a request for such exceptions has been made in writing to the Director of the Division. Exceptions can only be granted when it is clearly evident that satisfactory safety is achieved, but cannot be granted in any case where conflict would be created with mandatory requirements of the law.

3. *Definitions*

3.1 *Commissioner* - the commissioner of Labor of the State of New Jersey or his authorized representative.

3.2 *Approved* - approved by the Commissioner.

3.3 *Division* - Division of Engineering and Safety of the Department.

3.4 *Emergency lighting service* - a service from a separate source of supply that will permit continuous energizing of the exit lighting upon failure of the regular lighting service. This service may be permanently connected to the separate source of supply or may be connected to the separate source of supply by means of an approved automatic changeover device which will function upon failure of the regular lighting service.

3.5 *Existing* - that which is in existence prior to the effective date of these rules and regulations including any work that has been approved prior thereto.

3.6 *General lighting* - the minimum or base quantity of light throughout a room or enclosure.

3.7 *Glare* - any brightness of such character within the field of vision that causes definite discomfort, annoyance, interference with vision or eye fatigue.

3.8 *Main service entrance* - the entrance point of lighting feeders at the meter or distributing panel for the building, floor or loft.

3.9 *New* - that which is constructed or installed subsequent to the effective date of these rules and regulations; alterations, but not repairs, shall be included within the meaning of this term.

3.10 *Place of employment* - every factory, workshop, mill or other place where goods are manufactured; laundry bakery, confectionery; newspaperplant; printery.

3.11 *Place of public assembly* - any structure or building which is used for the purpose of public entertainment of any kind and located in a municipality which has no local building supervision.

3.12 *Separate source of supply* - a separate service of electrical supply provided from any of the following sources:

(a) *A separate service entering the building.*

(b) *An independent connection to the main service entrance not subject to interruption from internal causes.*

(c) *Storage batteries with approved charging equipment of sufficient capacity to carry the connected emergency lighting load for a period of not less than 1½ hours with the final voltage not less than 87½% of the normal lamp voltage.*

(d) *A separate generating unit driven by a prime mover to provide maximum illumination not later than 15 seconds after power failure of the normal lighting service.*

3.13 *Shall* - the word "shall" is mandatory.

3.14 *Should* - where used is indicative of a practice recommended by the division.

3.15 *Supplemental lighting* - an increase in illumination over general lighting in restricted areas to provide additional or directive light.

3.16 *Photometric definitions:*

3.16.1 *Brightness:* the luminous intensity of any surface in a given direction per unit of projected area of the surface as viewed from that direction expressed in units of candles per unit area of surface; also, the intensity of sensation which results from viewing surfaces or spaces from which light comes to the eye, determined in part by the measurable brightness as herein before defined and by the state of adaptation of the eye.

3.16.2 *Footcandle:* the illumination produced at a surface, all points of which are at a distance of one foot from a uniform point source of one candle.

3.16.3 *Illumination:* the density of the luminous flux (light) on a surface and for which the unit is the foot-candle.

3.16.4 *Light:* radiant energy traveling in the form of electromagnetic waves and evaluated according to its capacity to produce visual sensation.

3.16.5 *Luminaire:* a complete lighting unit consisting of a light source and its appurtenances such as globe, reflector, refractor, housing and such support as is integral with the housing.

3.16.6 *Luminous flux:* the time rate of flow of light and for which the unit is the lumen.

3.16.7 *Luminous intensity:* the solid-angular flux density of a source of light in a given direction and for which the unit is the candle.

4. *General Provisions*

4.1 All rooms, structures or buildings in places of employment or public assembly shall be illuminated as prescribed in these rules and regulations in all areas of occupancy. (The presence of maintenance personnel does not constitute occupancy.)

4.2 All stairways and exits and the passageways appurtenant thereto shall be illuminated in an approved manner to facilitate egress and such illumination shall be continuous during the time that the conditions require that the exit ways in all places of employment or public assembly be open or available.

4.3 Artificial illumination shall be provided for all places of employment of public assembly as specified in sections 4.1 or 4.2 and illumination during occupancy shall be maintained therein to the full intensities specified in these rules and regulations.

4.4 General lighting shall be reasonably uniform and of at least minimum prescribed intensity so that light will be available when needed at any point in a room.

4.5 Supplemental lighting should be specifically designed for a particular visual task.

4.6 Fluorescent lamps shall be operated from appurtenances so that the stroboscopic effect will be at a practical minimum. The minimizing of stroboscopic effect is an important consideration for safety where moving objects are viewed or where the eye itself is moving rapidly. The stroboscopic effect shall be minimized by operating the lamps from ballasts designed so that the lamps will operate out of phase with each other on leading and lagging circuits by operating three adjacent lamps on a three phase circuit. This is normally accomplished by the use of standard two-lamp ballasts.

4.7 In all places of public assembly, there shall be placed over each exit a sign indicating the exit and a light which shall remain lighted while the building is occupied and until everyone has left the premises. (The presence of maintenance personnel does not constitute occupancy.)

4.8 No changes or alterations that will materially affect the general lighting shall be made except in conformity with the provisions of these rules and regulations.

4.9 A definite system of maintenance should be established so that all inside windows, lamps and accessories are kept clean, in proper adjustment and in good repair at all times.

4.10 Means for providing easy access to all lighting units should be provided for persons in charge of their maintenance.

4.11 Where indirect lighting systems are used, the ceiling should be kept clean and should be repainted in light tones at regular intervals.

4.12 For the purpose of measuring light, a properly calibrated light meter shall be used. The light meter shall be of photo-electric cell type equipped with a filter that is chemically and physically stable, for the purpose of correcting the spectral response of the photo-electric cells so that the sensitivity of the cells will duplicate that of the eye as defined by the international eye sensitivity curve.

4.13 Exceptions

4.13.1 Where the inherent characteristics of an operation require extremely low levels of illumination such as in photographic, photometric, glass working and similar processes, special precautions shall be taken to provide for the safety of employees.

4.13.2 In places of public assembly, the requirements of 4.1 are modified to suit the need in auditoriums and similar gathering places during the presentation of a performance.

5. *Minimum Standards of Illumination for General Lighting of Interiors of Places of Employment.*

NOTE: The values given are minimum operating values and apply to measurements of the lighting system in use and not necessarily when the lamps and reflectors are new and clean.
Values of footcandles are given for a point thirty inches above the floor.

TABLE 1

RECOMMENDED MINIMUM FOOTCANDLES IN SERVICE ILLUMINATION FOR INDUSTRIAL INTERIORS

NOTE: Minimum MANDATORY REQUIREMENTS for illuminations shall be NOT LESS THAN fifty percent (50%) of the values shown in this table.

	Minimum foot-candles in service
ASSEMBLY:	
Rough	10
Medium	20
Fine	B*
Extra Fine	A*
AUTOMOBILE MANUFACTURING:	
Assembly Line	B*
Frame Assembly	20
Body Manufacturing	
Parts	20
Assembly	20
Finishing and Inspecting	A*
BAKERIES:	20
BOOK BINDING:	
Folding, Assembling, Pasting, Etc.	10
Cutting, Punching & Stitching	20
Embossing	20
BREWERIES:	
Brew House	5
Boiling, Keg, Washing & Filling	10
Bottling	20
CANDY MAKING:	
Box Department	20
Chocolate Department--	
Husking, Winnowing, Fat extraction, Crushing & Refining, Feeding	10
Bean Cleaning & Sorting	
Dipping, Packing, Wrapping	20
Milling	30
Cream Making--	
Mixing, Cooking and Molding	20
Gum Drops and Jellied Forms	20

	Minimum foot-candles in service
Hand Decorating	50
Hard Candy--	
Mixing, Cooking and Molding	20
Die Cutting and Sorting	30
Kiss Making and Wrapping	30
CANNING AND PRESERVING:	20
CHEMICAL WORKS:	
Hand Furnaces, Boiling Tanks, Stationary Driers, Stationary and Gravity Crystallizers	5
Mechanical Furnaces, Generators and Stills, Mechanical Driers, Evaporators, Filtration, Mechanical Crystallizers, Bleaching	10
Tanks for Cooking Extractors, Percolators, Nitrators, Electrolytic Cells	15
CLAY PRODUCTS AND CEMENTS:	
Grinding, Filter Presses, Kiln Rooms	5
Molding, Pressing, Cleaning and Trimming	10
Enameling	15
Color and Glazing	20
CLEANING AND PRESSING INDUSTRY:	
Checking Sorting	20
Dry and Wet Cleaning and Steaming	10
Inspection and Spotting	A*
Pressing—	
Machine	20
Hand	50
Receiving and Shipping	10
Repair and Alterations	50
CLOTH PRODUCTS:	
Cutting, Inspecting, Sewing--	
Light Goods	20
Dark Goods	A*
Pressing, Cloth, Treating (Oil Cloth, etc.)--	
Light Goods	10
Dark Goods	20
COAL TIPPLES AND CLEANING PLANTS:	
Breaking, Screening & Cleaning	10
Picking	A*
CONSTRUCTION - INDOOR:	
General	10
Elevators - Freight and Passenger	10
ENGRAVING:	A*
FORGE SHOPS AND WELDING:	10
GARAGES - AUTOMOBILE:	
Storage - Live	10
Storage - Dead	2
Repair Department and Washing	30
GLASS WORKS:	
Mix and Furnace Rooms, Pressing and Lehr, Glass Blowing Machines	10
Grinding, Cutting Glass to size, Silvering	20
Fine Grinding, Polishing, Beveling, Etching and Decorating	50 C*
Inspection	B* C*
GLOVE MANUFACTURING:	
Pressing, Knitting, Sorting-	
Light Goods	10
Dark Goods	20
Cutting, Stitching, Trimming, Inspection--	
Light Goods	20
Dark Goods	A*
HANGARS--AEROPLANE:	
Storage - Live	10
Repair Department	50
HAT MANUFACTURING:	
Dyeing, Stiffening, Braiding, Cleaning and Refining--	
Light	20
Dark	30
Forming, Sizing, Pouncing, Flanging Finishing and Ironing—	
Light	20
Dark	30
Sewing--	
Light	20
Dark	A*
ICE MAKING-ENGINE & COMPRESSOR ROOM:	10
INSPECTION:	
Rough	20
Medium	30
Fine	B*
Extra Fine	A*
*IRON AND STEEL MANUFACTURING:***	
JEWELRY AND WATCH MANUFACTURING:	A*

	Minimum foot-candles in service
LAUNDRIES:	20
LEATHER MANUFACTURING:	
Vats	5
Cleaning, Tanning & Stretching	10
Cutting, Fleshing and Stuffing	20
Finishing and Scarfing	30
LEATHER WORKING:	
Pressing, Winding and Glazing--	
Light	10
Dark	A*
Grading, Matching, Cutting, Scarfing, Sewing--	
Light	20
Dark	A*
LOCKER ROOMS:	10
MACHINE SHOPS:	
Rough Bench and Machine Work	20
Medium Bench and Machine Work, Ordinary Automatic Machines, Rough Grinding Medium Buffing and Polishing	30
Fine Bench and Machine Work, Fine Automatic Machines, Medium Grinding, Fine Buffing and Polishing	B*
Extra Fine Bench and Machine Work Grinding--	
Fine Work	A*
MEAT PACKING:	
Slaughtering	10
Cleaning, Cutting, Cooking, Grinding, Canning, Packing	20
MILLING-GRAIN FOODS:	
Cleaning, Grinding and Rolling	10
Baking or Roasting	20
Flour Grading	30
OFFICES:	
Bookkeeping, Typing and Accounting	50
Business Machines--	
Power driven (Transcribing & Tabulating)--	
Calculators, Key Punch, Bookkeeping	8*
Conference Room--	
General Meetings	25
Office Activities-	
see desk work	
Corridors and Stairways	1.5 at floor level
Desk Work--	
Intermittent Reading and Writing	25
Prolonged Close Work, Computing, Studying, Designing, etc.	50
Reading Blueprints and Plans	30
Drafting--	
Prolonged Close Workart, Drafting and Designing in Detail	50
Rough Drawing and Sketching	30
Filing and Index References	25
Lobby	10
Mail Sorting	25
Reception Rooms	10
Stenographic Work	50
Vault	10
PACKING AND BOXING:	10
PAINT MIXING:	10
PAINT SHOPS:	
Dipping, Simple, Spraying, Firing--	10
Rubbing, Ordinary Hand Painting and Finishing Art, Stencil and Special Spraying	20
Fine Hand Painting and Finishing	B*
Extra Fine Hand Painting and Finishing (Automobile Bodies, Piano Cases, etc.)	A*
PAPER BOX MANUFACTURING:	
Beaters, Grinding, Calendering	10
Finishing, Cutting Trimming, Paper Making Machines	20
PLATING:	10
POLISHING AND BURNISHING:	20
POWER PLANTS, ENGINE ROOM BOILERS:	
Boilers, coal and Ash Handling, Storage Battery Rooms	5
Auxiliary Equipment, Oil Switches, and Transformers	10
Engines, Generators, Blowers Compressors	20
Switchboards	30
PRINTING INDUSTRIES:	
Type Foundries--	
Matrix Making, Dressing Type	A*
Front Assembly-Sorting	B*
Hand Casting	30
Machine Casting	20
PRINTING PLANTS:	
Presses	30
Imposing Stones A*	C*
Proof Reading	A*

	Minimum foot-candles in service*		Minimum foot-candles in service
ELECTROTYPING:			
Molding, Finishing, Leveling Molds, Routing, Trimming	B*		
Blocking, Tinning	30		
Electroplating, Washing, Backing	20		
PHOTO ENGRAVING:			
Etching, Staging	20		
Blocking	30		
Routing, Finishing, Proofing	B*		
Tint Laying	A*		
RECEIVING AND SHIPPING:	10		
RUBBER TIRE AND TUBE MFG.:			
Stock Preparation--			
Plasticating	20	20	
Milling		20	
Calendering		30	
Branbury		20	
Fabric Preparation--			
Stock Cutting		30	
Bead Building		30	
Tube Tubing Machines		20	
Tread Tubing Machines		20	
Tire Building			
Solid Tire		20	
Pneumatic Tire		50	
Curing Department			
Tube Curing		B*	
Casing Curing		B*	
Final Inspection			
Tube		B*	
Casing		A*	
Wrapping		20	
Warehouse		5	
MECHANICAL RUBBER GOODS:			
Stock Preparation--			
Plasticating		20	
Milling		20	
Calendering		30	
Branbury		20	
Fabric Preparation			
Stock Cutting		30	
Hose Looms		30	
Molded Products		B*	
Extruded Products		30	
Curing		B*	
Inspection		A*	
Boxing		20	
Warehouse		5	
SHEET METAL WORKS:			
Miscellaneous Machines, Ordinary Bench Work		20	
Punches, Presses, Shears, Stamps, Spinning, Medium Bench Work	20	C*	
Tine Plate Inspection	B*	C*	
SHOE MANUFACTURING (Leather):			
Cutting and Stitching--			
Cutting Tables		20	
Marking, Buttonholing, Skiving, Sorting, Vamping and Counting--			
Light Materials		20	
Dark Materials		50	
Stitching--			
Light Materials		50	
Dark Materials		B*	
Making and Finishing			
Stitchers, Nailers, Sole Layers, Welt Beaters & Scarfers, Trimmers, Welters, Lasters, Edge Setters, Sluggers, Randers, Wheelers, Treers, Cleaning, Spraying, Buffing, Polishing, Embossing--			
Light Materials		30	
Dark Materials		50	
Storage, Packing and Shipping		10	
SHOE MANUFACTURING (Rubber):			
Washing, Coating, Mill Run Compounding Varnishing, Vulcanizing, Calendering, Upper and Sole Cutting		30	
Sole Rolling, Lining Making and Finishing Processes		50	
SOAP MANUFACTURING:			
Kettle Houses, Cutting Soap Chip & Powder		10	
Stamping, Wrapping and Packing, Filling and Packing Soap Powder		20	
STAIRWAYS, PASSAGEWAYS:		5	
STONE CRUSHING AND SCREENING:			
Belt Conveyor Tubes, Main Line Shafting Spaces, Chute Rooms, Inside of Bins		5	
Primary Breaker Room, Auxiliary Breakers under Bins		5	
Screens		10	
STORAGE BATTERY MANUFACTURING:			
Molding of Grids		10	

	Minimum foot-candles in service
STORE AND STOCK ROOMS:	
Rough Bulky Material	5
Medium or Fine Material requiring Care	10
STRUCTURAL STEEL FABRICATION:	10
SUGAR GRADING:	30
TESTING:	
Rough	20
Fine	30
Extra Fine Instruments, Scales, etc.	A*
TEXTILE MILLS (Cotton):	
Opening, Mixing, Picking, Carding & Drawing	10
Slubbing, Roving, Spinning	20
Spooling, Warping on Comb	20
Beaming and Slashing on Comb	
Grey Goods	20
Denims	B*
Inspection	
Grey Goods (Hand Turning)	50
Denims (Rapidly Moving)	A*
Automatic Tying-in Weaving	B*
Drawing-in by Hand	A*
Weaving	25
SILK AND RAYON MANUFACTURING:	
Soaling, Fugitive Tinting, and Conditioning or Sett-of Twist	10
Winding, Twisting, Rewinding and Coning, Quilling, Slashing	30
Warping (Silk or Cotton System) on Creel, on Running Ends, on Reel, on Beam on Warp at Beaming	50
Drawing In	
On Heddles	A*
On Reed	A*
Weaving	
On Heddles and Reeds	10
On Warp Back of Harness	20
On Woven Cloth	30
WOOLEN:	
Carding, Picking, Washing, Combing	15
Twisting, Dyeing	15
Drawing in, Warping	A*
Weaving	
Light Goods	25
Dark Goods	50
Knitting Machines	20
TOBACCO PRODUCTS:	
Drying, Stripping, General	10
Grading and Sorting	A*
TOILETS AND WASH ROOMS:	10
UPHOLSTERING-AUTOMOBILE COACH FURNITURE:	20
WAREHOUSES:	5
WELDING:	30
WOODWORKING:	
Rough, Sawing, and Bench Work Sizing, Planing, Rough Sanding--	
Medium Machine and Bench Work, , Glueing, Veneering, Cooperage	20
Fine Bench and Machine Work	
Fine Sanding and Finishing	50

* *Lighting Recommendations for the more difficult seeing tasks, as indicated by A, B and C in the foregoing Table, are given in the following:*

GROUP A:

These seeing tasks involve (a) the discrimination of extremely fine detail under conditions of (b) extremely poor contrast, (c) for long periods of time. To meet these requirements, illumination levels above 100 footcandles are recommended.

To provide illumination of this order, a combination of at least 20 footcandles of general lighting plus specialized supplementary lighting is necessary. The design and installation of the combination systems must not only provide a sufficient amount of light but also must provide the proper direction of light, diffusion, eye protection, and insofar as possible must eliminate direct and reflected glare as well as objectionable shadow

GROUP B:

This group of visual tasks involves (a) the discrimination of fine detail under conditions of (b) a fair degree of contrast (c) for long periods of time. Illumination levels from 50 to 100 footcandles are required.

To provide illumination of this order a combination of at least 20 footcandles of general lighting plus specialized supplementary lighting is necessary. The design and installation of the combination systems must not only provide a sufficient amount of light but also must provide the proper direction of light diffusion, eye protection, and insofar as possible must eliminate direct and reflected glare as well as objectionable shado

GROUP C:

The seeing tasks of this group require the discrimination of fine details by utilizing (a) the reflected image of a luminous area or (b) the transmitted light from a luminous area.

The essential requirements are (1) that the luminous area shall be large enough to cover the surface which is being inspected and (2) that the brightness be within the limits necessary to obtain comfortable contrast conditions. This involves the use of sources of large area and relatively low brightness in which the source brightness is the principal factor rather than the footcandles produced at a given point.

6. *Minimum Standards of Illumination for Lighting of Places of Public Assembly.*

6.1 Each stairway and passageway and lobby shall have an intensity of illumination of not less than one and one-half footcandles in service measured at the floor level.

6.2 Places of public assembly that have courts, passages and outside stairways leading away from exit doors shall have intensities of illumination in such areas of not less than two-tenths of a footcandle for a distance of fifty feet from such doors or outlets.

7. *Exit Lighting.*

NOTE: All intensities of illumination are values in service measured at the floor level.

7.1 The floors of exitways of buildings shall be illuminated at all principal points such as angles and intersections of corridors and passageways, stairways, landings of stairs and exit doorways to intensities of not less than one and one-half footcandles.

7.2 The lighting and all control apparatus shall be installed so as to be under the supervision of and controlled only by authorized persons.

7.3 Exit signs, where electrically lighted, shall be connected with a separate source of supply as defined in Section 3.12.

7.4 Exit lighting service in all places of employment and public assembly shall be independently connected to the main service entrance for the building and shall not be subject to failure of the room or work-space lighting from internal causes.

7.5 Exit lighting circuits shall be separate branch circuits containing neither receptacles or convenience outlets for the attachment of portable or other devices nor other lights.

8. Emergency Lighting Service.

8.1 Emergency lighting service shall be provided for all places of public assembly excepting that the separate source of supply shall be restricted to storage batteries or a separate generating unit driven by a prime mover; where there are no balconies, the use of approved self-contained lighting units actuated by an automatic change-over device shall be permitted.

8.2 Emergency lighting service shall be provided in places of employment more than one-story in height in the high hazard classification and in such places where the classification is medium hazard occupancy and the concentration of workers is considered to be excessive.

8.3 A minimum intensity of 0.5 footcandle shall be provided by the emergency lighting service.

9. Diffusion and Distribution of Light.

9.1 Lighting, whether natural or artificial, shall be such as to provide good distribution and avoid glare, harsh and objectionable shadows, and extreme contrasts.

9.2 Light from supplementary lighting sources shall be confined to the immediate working area.

9.3 Direct general-lighting luminaires shall be mounted at a sufficient height to be well above the normal line of vision and shall be designed to limit both the brightness and quantity of light emitted in directions directly below the horizontal.

9.4 Bare light sources, such as exposed lamp filaments located within the ordinary field of the worker's vision, shall be prohibited in working areas.

9.5 High brightness contrasts shall be avoided.

9.6 The brightness ratio of the visual task to its immediate surroundings should not exceed three.

9.7 The brightness ratio of a light source or luminous portion of a luminaire in the normal field of vision to its background should not exceed three.

In artificial lighting systems, lamps shall be so installed in regard to height, location, spacing and reflectors, shades, or other suitable accessories, to meet the aforesaid requirements.

10. Adequate Electrical Wiring.

10.1 The installation of electrical wiring for lighting purposes shall in addition to conforming to requirements providing for protection against fire and safety to life and limb shall be adequate for the purposes of illumination.

10.2 The voltage drop at any utilization point shall be of such minimum value as not to seriously impair the efficiency of the light source.

10.3 Wiring installations shall be sufficiently flexible to permit for changes in utilization and should be of sufficient capacity for reasonable future requirements.

10.4 The number of convenience outlets included on one branch circuit depends entirely on conditions, but where no knowledge of conditions is available, should be limited to six for manufacturing and ten for storage areas, with at least one such outlet in every bay. Convenience outlets for small power loads or extension light cords should be on separate circuits from those used for general lighting.

10.5 The minimum wire size for convenience outlet branch circuits should be Number 12, with the exception that a minimum of Number 10 should be used if the run to the first outlet from panelboard exceeds 100 feet.

10.6 At least one panelboard shall be installed on each active floor.

10.7 On each panelboard there should be approximately one spare circuit position for every five circuits of the initial installation.

10.8 If possible, panelboards should be so located that branch circuit runs to first outlets should not exceed 100 feet.

10.9 Panelboards should always be easily accessible for the control of the lighting system and also for the replacement of fuses or the resetting of circuit breakers.

10.10 The feeder sizes should be based on the number of branch circuits supplied, assuming 1,000-watt load for each lighting and convenience outlet branch circuit, 500 watts for each spare circuit, and the actual load for any special circuit.

10.11 Provision for future growth should be made by the installation of oversize raceways for additional feeders, or by oversized feeders.

10.12 The switches which turn on and off the light in entrances and halls of buildings should be located near the point of entrance or exit and a switch which controls at least one circuit of lamps in a room should be located near each principal point of entrance when there are several.

10.13 In locating switches or control devices in factory and mill aisles, care should be exercised to arrange them systematically.

10.14 Approved wiring and equipment shall be installed in all hazardous locations.

10.15 In places of public assembly:

10.15.1 There shall be one separate source of supply for the stage and auditorium, and one separate source of supply for the halls, corridors, stairs, lobby and exit light. The latter source of supply may be supplemented as indicated in section 8.1

10.15.2 All stage lights shall have strong metal guards or screens.

10.15.3 All footlights shall be installed in troughs of fireproof material.