

War Department Specification

BLACKOUT OF BUILDINGS



U. S. OFFICE OF CIVILIAN DEFENSE

Washington, D. C.

The following other subjects are covered in specifications being prepared by the War Department:

- Street lighting during blackouts.
- Blackout requirements for highway movement.
- Blackout flashlights, lanterns, and flares.
- Traffic control during blackouts.
- Blackout of railroads.
- Luminescent materials.

The other specifications will be published as soon as completed.

The purpose of these specifications is threefold:

- To provide military and civilian authorities with authentic information on blackout equipment and its application.
- To assist commanders in insuring the military security of installations under their jurisdiction.
- To conserve the use of strategic and critical materials.

Prepared under the direction of the Chief of Engineers, United States Army, by the Engineer Board, with suggestions of the National Technological Civil Protection Committee, the National Defense Research Committee, and the National Bureau of Standards.

Foreword

The standards specified herein may be imposed by military authority during specified periods and in specified areas. Independent of such action these standards afford guides to civilian authorities as to measures that can be taken by them to conform their conduct with what may eventually be prescribed.

Due to the scarcity of certain critical materials which will be involved in the manufacture of the equipment called for in these specifications, it is probable that only the most exposed communities in the continental United States will be able to procure the equipment. For this reason these specifications are being given only a limited distribution at this time.

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BLACKOUT OF BUILDINGS

1. Scope

This specification applies to the interiors and exteriors of all military and civilian buildings and structures during those periods and within those areas specified by proper military authority.

2. Building Interiors

In building interiors, blackout requirements may be met by one or more of the three following methods:

a. Extinguishment of All Lights.—This method requires that all lights visible from the outside (except approved indoor blackout-lighting units¹ and low-intensity red exit lights²) be extinguished within 5 minutes after the official blackout signal is given, and remain extinguished for the duration of the blackout. Widespread application of this method causes serious disruption of normal military, industrial, commercial, and home activities with attendant confusion, accidents, and possibly lowered morale—the very objectives sought by enemy air raids. Turning off all lights during blackouts, therefore, is not generally desirable and is required only where provision has not been made for either of the two following blackout methods.

b. Obscuration.—This method requires that necessary advance preparations be completed to insure that windows, exterior doors, and other openings through which light might escape to the outside are made completely light-tight within 5 minutes after the official blackout signal is given. Obscuration may be accomplished by use of paint, adhesive coverings, screens and shutters, light locks, or any other means which will permit normal interior illumination without exposing any light on the outside. This is the method recommended for the more essential sections of industrial plants and other structures in which war activities are carried on. In residences, at least one room should preferably be so treated. The depressing effect resulting from the use of black obscuration materials may be overcome to a large extent by selecting materials which are light-colored on their inside

¹ See Paragraph 2 c.

² Interior exit lights in all public buildings should preferably be left burning during blackouts, with the restriction that each exit light shall be so located or shielded as to screen direct light from falling on windows and doors, and that it shall be equipped with one lamp of not more than 15 watts.

surface. When paint is used, an extra light-colored inside coat may be well worth while from this point of view. In order to minimize reflection, obscuration materials applied to cover skylights, or other glass areas that are not vertical, shall be applied on the exterior surface. Such materials shall conform to the following requirements:

(1) *Paint.*—Paint used to provide obscuration shall be weatherproof, lusterless (mat or low gloss), and drab in color. Paint should preferably be easily removable and require only one coat for complete opacity. Surfaces to be covered must be clean and free of oil, grease, and dirt. Careful application is necessary, with particular attention to complete coverage of corners and other "missed spots" which might permit passage of light. Paint may be applied to either or both sides of vertical glass surfaces. To reduce the danger of reflection, weatherproof paints should preferably be applied to the exterior surface of glass. Obscuration by use of paint alone has the disadvantage that once the painted glass is shattered, light may be exposed. Another disadvantage is the fact that when paint is used, artificial illumination will usually be required in the daytime. In hot weather, the increased inside temperature due to absorption of heat by some paints may be so great as to affect adversely the efficiency of essential activities carried on within the building. Caution should be observed in applying paint to glass when there is a likelihood that the absorption of solar radiation by the paint might be sufficient to result in breakage of glass due to temperature effects.

(2) *Adhesive coverings.*—When adhesive coverings are applied, prior cleaning is required, special care being taken to remove all grease. Such materials must be opaque, must adhere strongly to the glass and lap onto the supporting frame, and should possess considerable tensile strength or elasticity. Cloth, paper, or fibrous materials may be used. Weatherproof materials should preferably be applied on the exterior of the

glass to minimize reflection. Adhesive coverings have the same disadvantages for obscuration purposes as paint, with the possible exception that the danger from flying glass will not be quite as pronounced when a heavy adhesive covering is used.

(3) *Screens and shutters.*—When opaque shades, drapes, blankets, builder's paper or similar materials are used as screens to render openings opaque, they should be placed with an overlap of 6 to 8 inches on all sides to insure against light leakage around edges. Previously prepared rigid screens and shutters—formed of plywood, fibreboard, cardboard, or other similar materials, or by mounting any opaque material on light wooden frames—may also be used. Rigid screens or shutters must either fit neatly in channels designed for the purpose or sufficiently overlap the opening to avoid light leakage. It is desirable that such screens be held in place by flexible or elastic means to absorb some of the shock of blast concussion. Any type opaque covering material which meets the above conditions will be satisfactory.

(4) *Light locks.*—When obscuration is utilized, entrances, exits, and ventilation openings must be fitted with light locks. Such light locks consist essentially of passageways (or ventilation vents) having dull black surfaces, with inner and outer openings offset, and so constructed that no light, direct or reflected, is visible from the outside. Light sources near interior openings of light locks should be shielded to prevent direct light from entering the lock.

c. *Reduced Illumination.*—This method provides a small amount of controlled illumination, sufficient to permit reasonable facility of movement, without necessitating complete obscuration of doors and windows. Reduced illumination, without complete obscuration, shall be permitted only when the indoor lighting units used conform to the following requirements:

(1) *General requirements of indoor blackout lighting units.*—

Initial lumens—minimum $1\frac{1}{2}$, maximum 3 (light-adapted eye).

Initial candlepower at any angle—maximum 1 (light-adapted eye).

Light distribution—most of light in one hemisphere; in other hemisphere, not more than 0.15 lumen.

Color—orange or orange red.

Rugged construction and not subject to derangement, tampering, or misuse.

(2) *Special requirement of incandescent lamps.*—Where an incandescent lamp alone, without auxiliary reflector or shade, is used to meet the preceding requirements, the following lamp construction is specified:

Watts—not more than 15.

Base—medium screw.

Bulb—A 15.

Voltage rating—only one design voltage in each voltage group:

120 volts for general lighting service (lamp should be marked 115–125 volts).

240 volts for high voltage service (lamp should be marked 230–250 volts).

32 volts for country home and transportation service (lamp should be marked 30–34 volts).

Average laboratory life—1,000 hours or more at rated voltage.

Bulb coating—opaque except for circular aperture of the above color on bulb end.

Circular aperture—maximum diameter 1 inch.

Opaque coating material—black, resistant to scratching or removal. (Pinholes are permitted provided light distribution requirement under (1) above is complied with.)

(3) *Approval and marking.*—Approval of design of indoor blackout units (including incandescent lamps), and installation instructions to accompany these units, shall be based on reports submitted to the War Department by a testing laboratory accredited by the War Department. A list of the laboratories which have been accredited as of this date is attached hereto, but does not constitute a part of this specification. Approved units shall display the marking, "INDOOR BLACKOUT—WAR DEPT. STANDARD". Units shall also display code numbers

to be assigned by the War Department at time of approval which shall be placed directly beneath or after the word "Standard".

(4) *Authorized use.*—Indoor blackout units (including incandescent lamps) shall be used in accordance with the following directions:

(a) In any one room, only one unit is permitted to each two hundred square feet of floor area or a fraction thereof.

(b) Units shall be spaced not less than ten feet apart in any direction.

(c) In corridors, one row of units is permitted at a spacing of not less than fifteen feet.

(d) Units shall be placed at least 3 feet from any window, exterior door, or other opening.

(e) Units shall not be pointed toward any window, exterior door, or other opening.

(f) When openings are covered in the usual manner with drawn window shades, drapes, blinds, or even with one thickness of newspaper, or whenever each unit has a shade which screens the unit from outside observation above the horizontal, units may be installed at any height.

(g) When exterior openings are not covered, and when units are not otherwise shaded from outside observation above the horizontal, blackout units shall be located above the top of such openings.

3. Building Exteriors

All normal exterior lights, including advertising or display signs and show windows, shall be extinguished within 5 minutes after the blackout signal is given, and shall remain extinguished for the duration of the blackout. Where important operations make some exterior lighting necessary or desirable, such lighting shall conform to the War Department specification "Street Lighting During Blackouts."

4. Luminescent Materials

a. *Definition.*—Luminescent materials may be defined as those which can be made to emit visible light by means other than heating to incandescence. Luminescent materials may be classified as follows:

(1) *Phosphorescent.*—Phosphorescent materials are those which, having been excited to luminescence, continue to glow for some time after excitation has ceased.

(2) *Fluorescent.*—Fluorescent materials have the property of emitting visible light while excited by an external source of ultraviolet radiation (black light). As soon as the exciting source is extinguished or removed, fluorescent materials cease to glow.

(3) *Radioactive.*—Radioactive materials have the property of emitting visible light without external excitation.

b. Indoor Use of Luminescent Materials.—

(1) *Phosphorescence.*—Phosphorescent materials may be used to outline doors, doorknobs, switches, stairs, obstructions, elevators, railings, corridors, and paths to air raid shelters, rest rooms, first-aid rooms, etc. Phosphorescent materials may also be used for interior signs at locations where legibility distances of not more than 15 to 20 feet are required. Better grades of phosphorescent materials, in the form of decalcomania transfer, tape, paint, impregnated cloth, coated or transparent plastic, etc., will emit a visible glow in complete darkness for a period of several hours. In general, phosphorescent pigments applied by the manufacturer under controlled factory conditions are much superior to those applied at point of use.

(2) *Fluorescent.*—Since fluorescent materials require continuous application of ultraviolet radiation, their use under emergency conditions is limited. In case of power failure, fluorescent materials do not continue to glow as do phosphorescent or radioactive materials. In most instances, indoor blackout units will provide reduced illumination more efficiently than will a combination of ultraviolet radiation and fluorescent materials. However, when fluorescent materials are used for providing reduced illumination in the interior of buildings, at locations where their glow can be observed from outside the building, the surface brightness of these materials shall not exceed 0.001 footlamberts. The ultraviolet source used for exciting fluorescent materials in the interiors of buildings shall be completely invisible outside the building.

(3) *Radioactive.*—Where a continuous brightness higher than that available from phosphorescent materials is desirable, radioactive marker buttons or radioactive tape may be useful. However, because of the high cost of radioactive materials, their use inside buildings on a large scale is not normally justified.

c. Outdoor Limitations of Luminescent Materials.—The brightness of phosphorescent materials, even a few minutes after excitation, is so low that their visibility outdoors is not much greater than ordinary white paint under starlight. Many phosphorescent and fluorescent materials deteriorate so rapidly when exposed to sunlight and weather that they cannot be considered suitable for extended outdoor use. Radioactive materials, when used in the form of marker buttons of approved War Department design, have limited application for outdoor use at locations where little or no illumination is normally available from moonlight or starlight. Blackout requirements impose no limitations on the quantity or arrangement of radioactive and phosphorescent materials. Fluorescent materials, however, can be excited sufficiently to be visible from the air. To insure safety from aerial observation, it is therefore specified that the surface brightness of fluorescent materials used out-of-doors shall not exceed 0.0001

footlamberts. Ultraviolet sources used to excite fluorescent materials out-of-doors shall be shielded in such a way that no visible light from the source can be seen above the horizontal.

d. Handling Radioactive Materials.—Radioactive materials shall be used only in the form of markers, or tape, which have been approved by the War Department. If the protective covering on such equipment should become damaged, the damaged marker, or section of tape, should be buried or otherwise permanently disposed of. Large quantities of radioactive materials should be stored in lead lined boxes supplied by the manufacturer and should be kept at a distance from unexposed photographic film. Damaged radioactive equipment shall under no circumstances be placed where there is a possibility that it might be taken internally by any person.

e. Technical Characteristics of Luminescent Materials.—See War Department specification "Luminescent Materials."

APPENDIX

GLOSSARY OF LIGHTING TERMS

Candle.—The candle is the unit of light intensity. The unit used in the United States is a specified fraction of the average horizontal candlepower of a group of 45 carbon-filament lamps preserved at the National Bureau of Standards, when the lamps are operated at specified voltages.

Candlepower.—Candlepower is light intensity expressed in candles.

Footcandle.—The footcandle is the unit of illumination when the foot is taken as the unit of length. It is the illumination on a surface one square foot in area over which one lumen is uniformly distributed.

Footlambert.—The footlambert is a unit of brightness equal to the average brightness of any surface emitting or reflecting one lumen per square foot.

Lumen.—The lumen is the unit of light quantity. A uniform point source of 1 candle emits 12.56 lumens.

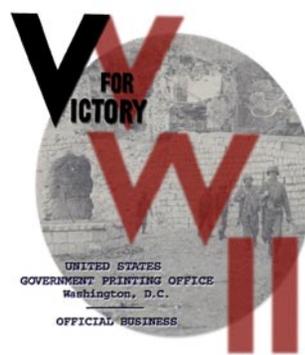
Luminaire.—A luminaire is a complete lighting unit consisting of a light source, together with its direct appurtenances, such as globe, reflector, refractor, housing and such support as is integral with the housing. In street-lighting units the pole, post, or bracket is not considered a part of the luminaire.

LABORATORIES ACCREDITED BY THE WAR DEPARTMENT:

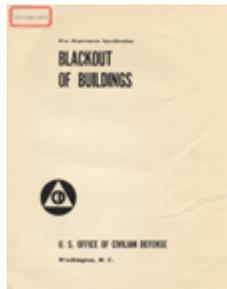
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United States. Office of Civilian Defense.

"Prepared under the direction of the Chief of Engineers, United States Army, by the Engineer Board, with suggestions of the National Technological Civil Protection Committee, the National Defense Research Committee, and the National Bureau of Standards."

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