

EXTRACT FROM BRITISH STANDARD SPECIFICATION No.
307, 1927, FOR STREET LIGHTING *

I. DEFINITIONS

Illumination.

1. The term "illumination" in this specification denotes the illumination in foot-candles or in lumens per square foot of a surface situated at the ground level and parallel with the plane of the highway. Only light received directly from the installation alone is considered, light received by reflection from buildings and the like or that received from light sources not forming part of the installation being disregarded.

Unit of the System.

2. The term "unit of the system" in this specification, when a street-lighting system is regarded as a series of sources forming a repeat pattern, denotes a single unit of the repeat pattern.

The light sources forming the unit of the system for typical installations are indicated in Appendix II.

Test-point.

3. The term "test-point" in this specification denotes that point on the ground within the area to be illuminated which is equidistant and as far as possible from the light sources which form one complete unit of the system. The illumination at the test-point is approximately the minimum.

Note.—In order to avoid ambiguity, the position of the test-point is fixed definitely by Clause 10, and for convenience the distances are measured from points on the ground directly below the light sources.

Illumination at a Test-point.

4. The term "illumination at a test-point" in this specification denotes the illumination at one particular test-point as defined in Clause 3.

Mean Test-point Illumination.

5. The term "mean test-point illumination" in this specification denotes the mean of the illuminations at the test-points in one class of installation or agreed section thereof (see Clauses 18 and 20).

Rated Illumination.

6. The rated illumination is the illumination which would be produced if all the factors which govern the illumination were at their rated value.

* Appendices II and IV only of this Specification are included in this extract.

Service Illumination.

7. The service illumination is the illumination which prevails at any time during the operation of an installation.

Spacing-height Ratio.

8. The spacing-height ratio is the ratio of the distance between two adjacent light sources to the height of the light source from the ground immediately beneath it (see Clause 15).

II. SPECIFICATION

Classification of Installations.

9. British Standard Street-lighting Installations shall be grouped into eight classes, A, B, C, D, E, F, G and H, having a mean test-point illumination * of not less than the figures given for each Class in Table I.

TABLE I.

Class.	Rated Mean Test-point Illumination.*
A	2.0 foot candles and upwards.
B	1.0 foot candle.
C	0.5 " "
D	0.2 " "
E	0.1 " "
F	0.05 " "
G	0.02 " "
H	0.01 " "

* See Definition 5.

Note.—Class H installation is not recommended for streets which are likely to be used appreciably for through traffic.

In a Class A Installation the value of the mean test-point illumination with which the installation is to comply shall be specially prescribed. The clauses of this Specification then apply to such specially prescribed values as if the latter had been inserted in this table.

These classes are only used for reference purposes in this Specification and do not necessarily represent the relative merits of the installations.

Positions of Test-points.

10. In the case of installations having the light sources arranged as shown in Appendix II, the test-point shall be at the position corresponding with the points marked T (or alternatively T') in these diagrams. In other cases, and where the symmetry of an installation has to be materially disturbed to make provision for lighting the entrance to side streets, or for other reasons, the position of any test-point shall be that at which the

illumination due to the light sources under consideration would be a minimum, and this position shall be agreed by the parties concerned.

Variation in Rated Illumination at a Test-point.

11. Unless otherwise specially prescribed the illumination at any test-point under rated conditions shall not be less than one-half the rated mean test-point illumination specified for the appropriate class in Table I.

In the event of the illumination at any test-point exceeding the rated mean test-point illumination by more than 50 per cent., the value to be taken in calculating the mean test-point illumination in accordance with Clause 18 shall, nevertheless, be only 50 per cent. in excess of the value specified for the appropriate class in Table I.

Service Illumination.

12. In service the authority responsible for the maintenance of the installation shall not allow the mean test-point illumination in any class of installation given in Table I to fall below one-half the rated mean test-point illumination specified for that class. Unless otherwise specially prescribed, the illumination at any test-point under service conditions shall not be less than one-half the required service mean test-point illumination mentioned above, *i.e.*, the service illumination at any individual test-point shall not in any circumstances fall below 25 per cent. of the rated mean test-point illumination given in Table I.

In the event of the illumination at any test-point exceeding the service mean test-point illumination by more than 50 per cent., the value to be taken in calculating the mean test-point illumination in accordance with Clause 20 shall, nevertheless, be only 50 per cent. in excess of the value specified for the appropriate Class in Table I.

Note.—The difference between the values of the rated and the service mean test-point illuminations is necessary in order to allow for the unavoidable variations in the spacing and to provide for decrease of the candle-power of the light sources, variation due to replacements or incorrect adjustment of the light source in the fittings, soiling of glass and reflecting surfaces of the fittings, changes in voltage or gas pressure and other factors which may cause the service illumination to fall below the rated illumination.

Distribution of Illumination on the Ground.

13. The illumination on the ground shall be so graded as to avoid an abrupt change at any point. The illumination at any part of the ground, except within such shadows as shall be cast from the posts or other equipment, shall not be substantially less than the illumination prescribed for the test-points in the foregoing clauses.

Height of the Light Source above the Ground.

14. The minimum height of the luminous centre of the light source above the ground for each class of installation shall be as follows :—

TABLE II.

Class.	Minimum Height of the luminous centre of the Light Source above the Ground.
A	30 feet
B	25 "
C	21 "
D	18 "
E	15 "
F	13 "
G	13 "
H	Preferably 13 "

Note.—When the light sources are enclosed in large well-diffusing translucent envelopes it is recognised that the minimum heights given in the above Table may not be essential and a minimum height should be agreed by the parties concerned.

Maximum Spacing-height Ratio.

15. The spacing-height ratio should be chosen to give the best distribution of illumination having regard to all the circumstances of the case in question, but shall in no event exceed 12. In the higher classes of installation the spacing-height ratio will be appreciably less. In calculating the spacing-height ratio, the distance "1" as shown in Appendix II between adjacent light sources shall be taken.

Glare.

16. Installations should be as free as practicable from objectionable glare. An approximate estimate of the glare from a given installation should be made by the method indicated in Appendix IV.

III. TESTS

Climatic Conditions during Tests.

17. Illumination tests taken in the street shall be made only on nights when the climatic conditions are agreed to be satisfactory by the parties concerned.

Illumination Tests of an Installation under Rated Conditions.

18. When testing an installation, or part of an installation, for initial conformity with this specification under rated conditions, the mean

test-point illumination shall be determined by taking the average of the illuminations at the test-points in five or more units of the system as nearly consecutive as possible. In cases where, owing to disturbance in the symmetry of the installation, the position of the test-point has been agreed in accordance with Clause 10, agreement shall also be reached as to the number of test-points to be taken.

The tests shall be carried out in accordance with Appendix I, and appropriate corrections shall be applied to the results if the tests are carried out under other than rated conditions. Measured values in excess of 50 per cent. above the rated mean test-point illumination given in Table I shall be reduced in accordance with Clause 11 before the average value is calculated. The lamps, lanterns, glassware, burners and mantles shall be clean and adjusted in position in accordance with the manufacturer's instructions.

Laboratory Test for Conformity of the Apparatus with the Rated Conditions.

19. In cases where it is found to be impracticable to carry out the street tests described in Clause 18, or in cases of dispute, the following test shall be used to determine, by calculation, the rated mean test-point illumination, due attention being paid to the illumination which would be received at a test-point from both the adjacent lamps and others which materially contribute to the illumination.

The number of samples of the complete fitting to be selected shall be agreed between the parties concerned. These samples shall be selected at random by the purchaser and tested at the maker's works, or at an agreed testing laboratory, for consumption and for conformity with the light distribution necessary to provide the specified mean test-point illumination under rated conditions. The fitting shall be equipped with a light source of the type and rating prescribed by the manufacturer. In the case of electric lamps the luminous output of the light source shall be equivalent to the mean figure given in Col. 11 or 14 of Table II of the appropriate Schedule of B.S. Specification No. 161; in the case of gas lamps the lantern, reflector, burner and mantle shall be fixed and adjusted to suit the declared calorific value and the pressure of the gas.

Illumination Tests of an Installation under Service Conditions.

20. When testing an installation, or part of an installation, for conformity with this Specification under service conditions, the mean test-point illumination shall be determined by taking the average of the illuminations at the test-points in five or more units of the system as nearly consecutive as possible. In cases where, owing to disturbance in the symmetry of the installation, the position of the test-point has been agreed in accord-

ance with Clause 10, agreement shall also be reached as to the number of test-points to be taken. Measured values in excess of 50 per cent. above the minimum service mean test-point illumination shall be reduced in accordance with Clause 12 before the average value is calculated.

The time and locality of the test shall be at the discretion of the local lighting authority. The conditions of supply of gas or electricity shall not vary from the normal when the test is made (see Appendix I).

APPENDIX II

PLAN AND DIAGRAM ILLUSTRATING THE POSITIONS OF TYPICAL TEST-POINTS AND A SECTION OF THE THOROUGHFARE SHOWING THE LIGHT SOURCES FORMING THE UNIT OF THE SYSTEM.

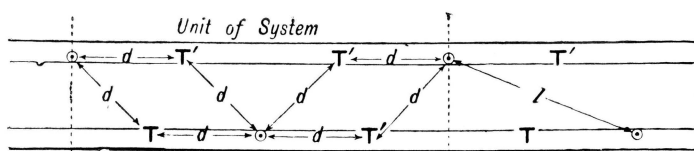


FIG. 2.

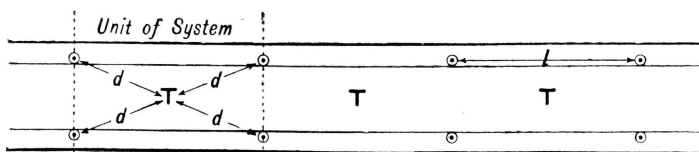


FIG. 3.

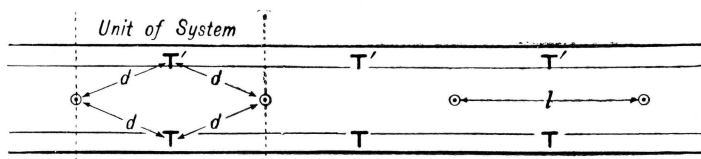


FIG. 4.

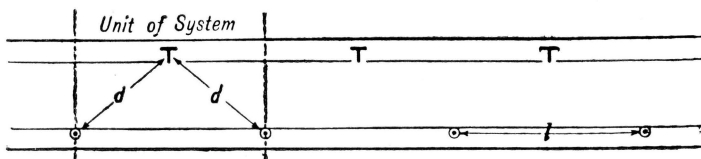


FIG. 5.

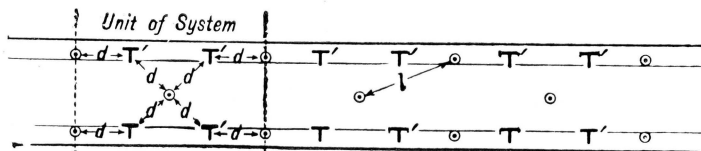


FIG. 6.

APPENDIX IV

GLARE.

(See Clause 16.)

The glare resulting from a given installation may be investigated by the following method.

For any position in a given installation it is possible to arrive at a coefficient G , which is approximately a measure of the effect of the glare on the ability of an observer to perceive detail. If this coefficient is found for several positions along the span, a curve may be plotted which will give a graphical representation of the approximate amount of glare along the street.

This coefficient is concerned only with the reaction of the eyes of an observer looking parallel to the street surface to the degree of glare in the artificially lighted street, which is only one of the influences which affect the visibility of objects. It is not to be taken as an overall figure of merit for the street-lighting installation, nor as a criterion of its revealing properties, in which it only enters as one of many factors.

The method of calculation is as follows :—

The luminous intensity, I , at each angle is given by the equipment on one post, as shown by its polar curve, is divided by the square of the height of the light source above the observer's eye (*i.e.*, the mounting height measured from the ground level and diminished by 5 feet). The values for each angle of the factor m as thus obtained (where $m = \frac{I}{(h-5)^2}$)

are plotted as a polar curve on the diagram.* On each of these diagrams in the specification will be found a series of lines corresponding to various values of the coefficient G , and from the intersection of the polar curve of m plotted on the diagram with these " G " lines the value of G corresponding to any angle can be found. It will be found more convenient in practice to read off the angle at which any given value of G is obtained.

This value may be plotted as a vertical ordinate at the point on a longitudinal section of the street corresponding to the position on the road at which an observer would have to stand in order that a ray of light at the angle in question should reach his eye.

In cases where the light distribution of the complete unit is asymmetric the polar curve used in the calculation must be that in a vertical plane containing the direction of maximum intensity.

Such evidence as is available tends to show that when the coefficient G does not exceed 10 the glare is not likely to be objectionable.

* See Figs. 15A, 16A and p. 676 for an example of the method.

The word "installation" in this Appendix implies the proposed equipment mounted at the proposed height and spacing.

Example I.

A street is to be illuminated to the intensity represented by Class C (Table I), using lanterns mounted at 25 feet from the ground at a spacing of 138 feet, the posts being placed alternately on opposite sides of the road. Let the light distribution of the complete units be as given in Table IV.

TABLE IV.

Angle from the downward vertical (degrees).	Luminous Intensity I (Candles).	Factor m . $\left(= \frac{I}{(h-5)^2} \right)$.
85	1580	3.9
80	2180	5.4
75	4000	10.0
70	5860	14.6
60	2470	6.2

When these values of m are plotted on the diagram relating to Class C (see Fig. 15A) it will be found that the values of G obtained are as follows :—

TABLE V.

Angle from the downward vertical (degrees).	Value of G .
75	6
73	7
68	8
65	7
62	6

The setting out of the curve of G from this table is shown in Fig. 16A, which is self-explanatory.

Example II.

A street is to be illuminated to the intensity represented by Class D (Table I), using lanterns mounted at 21 feet from the ground at a spacing of 146 feet, the units being centrally suspended above a road 100 feet wide. Let the light distribution of the complete units be as given in Table VI.

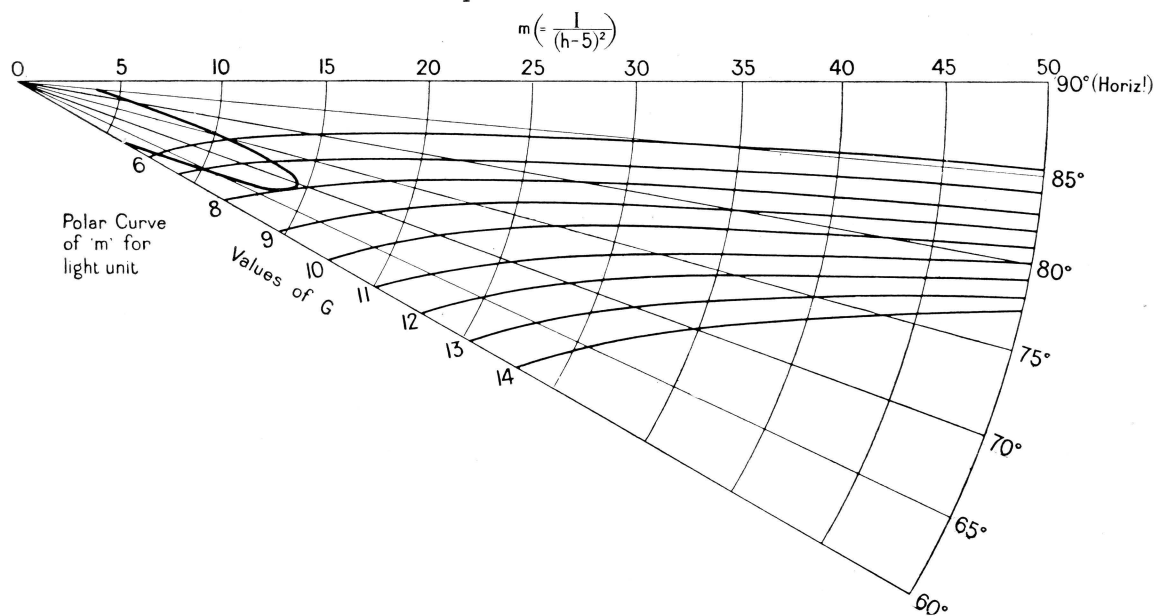


FIG. 15A.

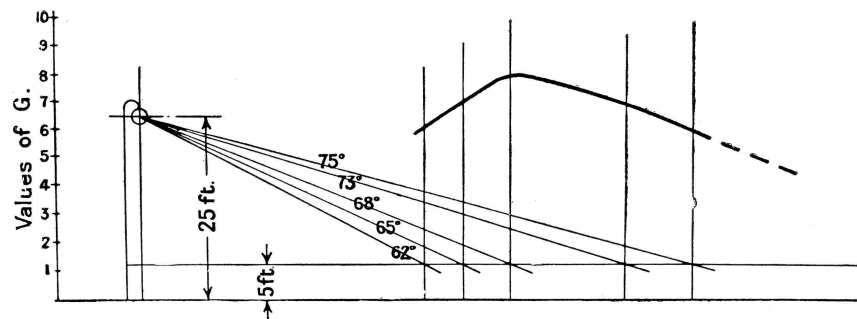


FIG. 16A.

Example II. Class of Installation D.

$$m = \frac{1}{(h-5)^2}$$

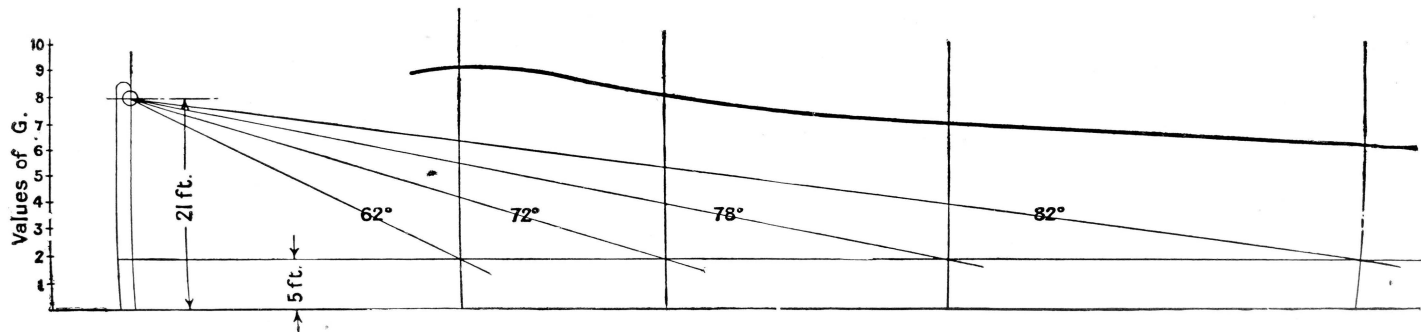
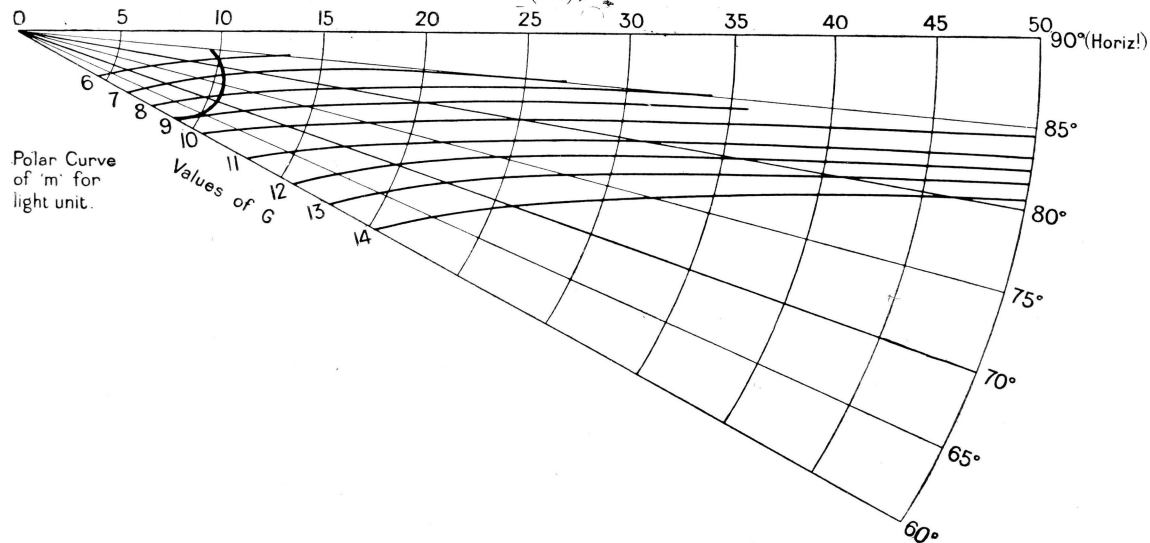


TABLE VI.

Angle from the downward vertical (degrees).	Luminous Intensity I (Candles).	Factor m . $\left(= \frac{I}{(h-5)^2} \right)$.
80	2610	10.2
75	2660	10.4
70	2660	10.4
60	2370	9.2 ₅

When these values are plotted on the diagram relating to Class D (see Fig. 15B), it will be found that the values of G obtained are as follows :—

TABLE VII.

Angle from the downward vertical (degrees).	Value of G.
82	6
78	7
72	8
62	9

The setting out of the curve of G from this table is shown in Fig. 16B.

Note.—It is not considered necessary to investigate the glare due to light reaching the observer's eyes at an angle less than 60° from the vertical, as such light is usually naturally obstructed when the head is erect.

BRITISH STANDARD SPECIFICATION No. 232 FOR INDUSTRIAL REFLECTOR FITTINGS FOR ELECTRIC LIGHTING (No. 1).

CORRIGENDA.

Page 680, Column 4 of Table, should read :—

Thickness (Gauge) of Steel used for making Reflector Fitting.		
in.		mm.
0.018	S.W.G.* 26	0.46
0.018		0.46
0.018		0.46
0.018		0.46
0.028	S.W.G.* 22	0.71
0.028		0.71
0.028		0.71

* There is a recognised tolerance on these gauges of 0.0025 inch.

Page 681, Clause 2 should read :—

“ or gauge ” after the word “ thickness ” in the second line of this clause.