

## TERMINOLOGY

**Coefficient of Utilization (CU)**—Portion of lamp lumens which reach the work plane. Affected by fixture design, room proportions and room-surface reflectances.

**Light Loss Factor (LLF)**—Depreciation of initial lighting level due to Lamp Lumen Depreciation (LLD), and accumulation of dirt on the lamp and luminaire surface (Luminaire Dirt Depreciation—LDD). Affected by fixture design, lamp choice, number of burning hours and type of interior environment.

**Ballast Factor (BF)**—The commercial ballast performance relative to reference a ballast.  $LLF = LLD \times LDD \times BF$

## STANDARD FORMULAS

$$\text{Number of Luminaires} = \frac{(\text{Maintained Illuminance [FC] Desired} \times (\text{Area in Square Feet}))}{(\text{Lamp Lumens/Luminaire}) \times (\text{CU}) \times (\text{LLD}) \times (\text{LDD}) \times (\text{BF})}$$

$$\text{Maintained Illuminance} = \frac{(\text{Number of Luminaires}) \times (\text{Lamp Lumens/Luminaire}) \times (\text{CU}) \times (\text{LLD}) \times (\text{LDD}) \times (\text{BF})}{(\text{Area in Square Feet})}$$

## INDOOR LIGHTING CALCULATIONS

How to calculate number of fixtures using “Maintained Illumination Tables” in Day-Brite Catalog sheets.

### MAINTAINED ILLUMINATION TABLE SQUARE FEET/FIXTURE

- 80-50-20 reflectances (ceiling-wall-floor)
- LLF=0.77 2900 lumens/lamp—very clean
- Room width divided by room height =5 or more, 2 or 1

Fixture Size & No. of Lamps	Room Width Room Height	Approx. Area (sq. ft.) Per Fixture			
		30 ft-c	50 ft-c	70 ft-c	100 ft-c
2'x4' (3LP)	5	—	114	82	57
T-8 Electronic	2	132	79	57	40
01 Lens	1	97	58	42	—

### EXAMPLE

30'x30'x9' Classroom with 2'x4' grid tees. Approximately 70FC maintained is specified.

Selected: Day-Brite 2TG8332-01-1/3-EB. 2'x4', 3-Lamp Static Recessed 3-Lamp Troffer.

#### STEP 1:

Determine approximate footcandle level from the I.E.S.N.A. Illuminance (footcandle) recommendations on page 676-678 or by using the I.E.S.N.A. Lighting Handbook, 8th Edition, pages 460-475 for illuminance categories of other areas and activities.

**70FC**

#### STEP 2:

Divide room width (narrowest dimension) by room height and select closest ratio (5, 2 or 1) in the “Maintained Illuminance Table” of the catalog sheet for the Day-Brite fixture involved.

$$\frac{W}{H} = \text{Ratio}$$

$$30 \div 9 = 3.33$$

### NOTE:

In Day-Brite Catalog Sheets, the square feet/fixture values are calculated as follows:

Room Width/Room Height  
ratio of 5 = RCR of 1

Room Width/Room Height  
ratio of 2 = RCR of 4

Room Width/Room Height  
ratio of 1 = RCR of 7

#### STEP 3:

Select from the table the square feet/fixture value for the width/height ratio for the maintained footcandle level. Divide the square feet/fixture value into logical spacing dimensions.

Ratio	Area Per Fixture (Sq. Ft.)
5	82
$\frac{2}{3}$	$\frac{57}{25}$
3	<Difference between 2 & 5> 25

$$[3.33 \text{ is between } 2 \text{ \& } 5. \ 3.33 - 2 = 1.33 \\ 1.33 \div 3(5-2) = .44] \\ 25 \times .44 = 11 + 57 = 68$$

#### STEP 4:

Total number of fixtures per room is calculated by dividing the room area by the square feet per fixture.

$$\text{No. Fixtures} = \frac{\text{Area}}{\text{Sq. ft./Fixture}}$$

$$900 \div 68 = 13.2 \text{ Fixtures}$$

For typical tile ceiling conditions use 2' increment in one direction and either 2' or 4' (depending on luminaire) in the other direction. If continuous rows be careful not to have the rows exceed the maximum spacing of the luminaire.

**USE 12 LUMINAIRES. (3 rows of 4 on 8' x 10' centers)**

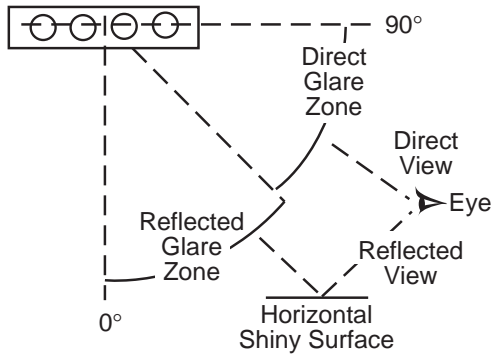
## VISUAL COMFORT—WHAT IS IT?

An important quality factor, achieved by minimizing fixture luminances (brightness) within the visual field that are generally above eye level. Fixture brightness can be distracting, cause visual discomfort, and in extremes cases result in loss of visibility.

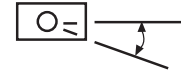
VCP values express the percentage of people who would rate a particular fixture as comfortable in a particular sized room. IES recommends that VCP's be 80 or higher in offices and other spaces containing video display terminals. Many school systems require VCP's of 70 or higher for classrooms.

## WHAT TO DO ABOUT IT:

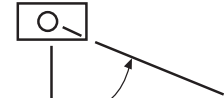
Select fixtures which have lower brightness in the direct-glare zone, to avoid excessive direct glare. Problem is prevalent in open areas involving critical, prolonged seeing, and considerable horizontal direction of view—such as working with computer screens, word processors and other visual display units.



**Note:** The direct and reflected glare zones are generally defined as shown by the diagram. It should be noted that there is no sharp line of demarcation between these zones at 45°.



**Shielding Angle:** (luminaire) The angle between a horizontal line through the light center and the line of sight at which the bare source first becomes visible.



**Cutoff Angle:** (luminaire) The right angle, measured up from nadir, between the vertical axis and the first line of sight at which the bare source is not visible.

Smaller, enclosed spaces, such as private offices are less likely to be a problem. Fewer fixtures are in the field of view, and they can be positioned to minimize both direct glare and veiling reflections. The latter reduce task contrast and reduce performance without causing visual discomfort.

Complete Visual Comfort Probability (VCP) tables are available from our Applications Engineering Department.

Recessed fluorescent fixtures with aluminum parabolic louvers or parabolic plastic molded louvers are frequently selected for such interiors. The following table gives VCP values for 100 footcandle installations of several Day-Brite fixtures, in rooms with 80% reflectance ceilings, 50% walls and 20% floors, and 8.5' and 10' ceiling heights.

**VISUAL COMFORT PROBABILITY TABLE**

Troffer & Enclosure Paralouver	30'x30' Room				60'x60' Room			
	Lengthwise		Crosswise		Lengthwise		Crosswise	
	8.5'	10'	8.5'	10'	8.5'	10'	8.5'	10'
<b>VDT Ultra Parabolic</b> 2'x4', 3-T8 Lamps, 27 Cell Specular Aluminum Louver	99	99	100	100	100	100	100	100
<b>P4 4" Parabolic</b> 2'x4', 3-T8 Lamps, 18 Cell Semi-Specular Aluminum Louver	90	86	93	88	95	92	97	95
<b>P3 3" Parabolic</b> 2'x4', 3-T8 Lamps, 18 Cell Semi-Specular Aluminum Louver	86	81	89	84	93	90	95	92
<b>LP3 3" Parabolic</b> 2'x4', 3-T8 Lamps, 18 Cell Softcell Aluminum Louver	82	77	84	79	91	86	91	87
<b>Designer VDT CF33, 1-1/2" Parabolic</b> 2'x4', 3-T8 Lamps, 105 Cell Specular Aluminum Louver	93	88	91	85	97	95	96	93
<b>Designer VDT CF15, 3/4" Parabolic</b> 2'x4', 3-T8 Lamps, 377 Cell Specular Aluminum Louver	94	89	92	87	97	95	97	94
<b>TG8-PL3 VDT Vacuum Metalized Plastic</b> 2'x4', 3-T8 Lamps Specular Aluminum Louver	92	86	91	86	97	94	96	94
<b>Designer Lensed Unit</b> 2'x4', 3-T8 Lamps Pattern 12 Prismatic Acrylic	56	61	54	59	48	51	46	49