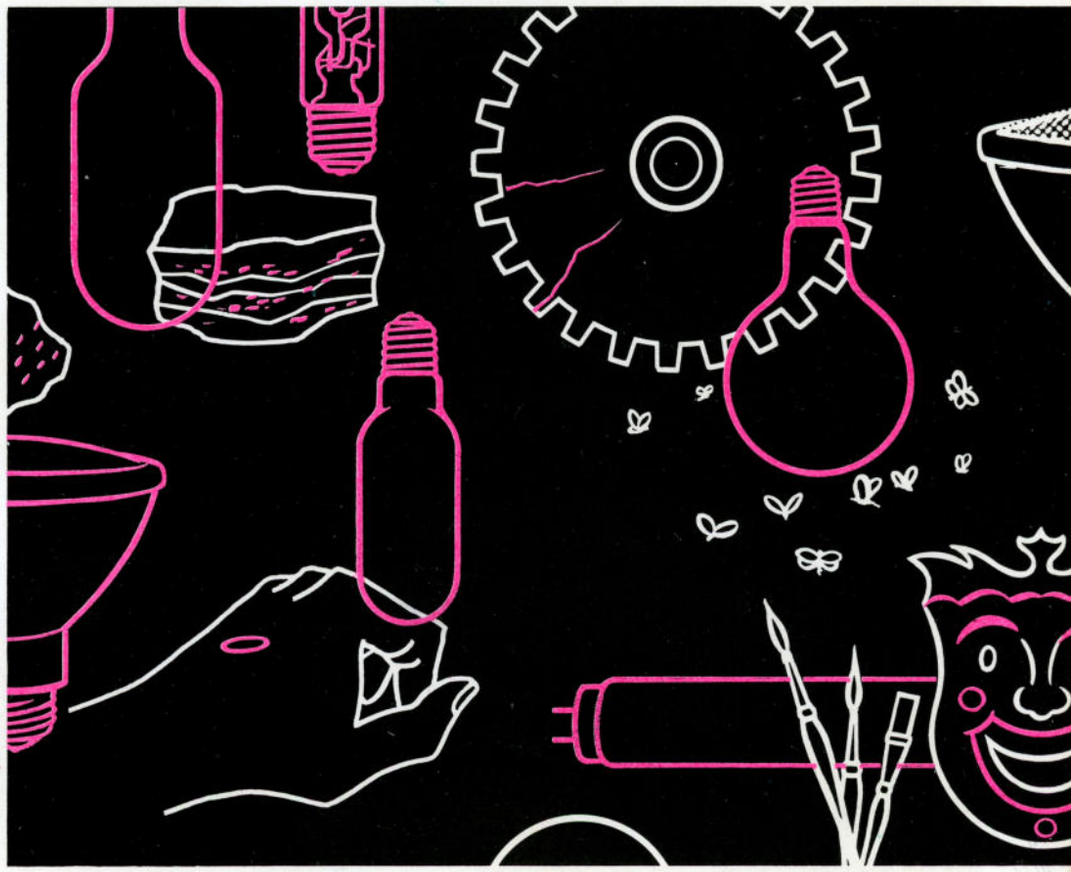
black

LIGHT



TP-125

LARGE LAMP DEPARTMENT

GENERAL ELECTRIC

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An architectural rendering (shown) or model treated with fluorescent paint and irradiated with black light will give a client a realistic impression of how a full-scale completed project will look lighted at night. Also, with the rendering or model, the architect can demonstrate dramatic uses of black light in show window displays, advertising signs, special decorative effects for holidays, etc.

BLACK LIGHT

NEAR-ULTRAVIOLET radiant energy (energy not visible to the human eye) causes certain materials to fluoresce or emit visible light. The normal human eye is sensitive only to radiant energy between 400 and 700 millimicrons in wavelength. Thus, lamps which produce primarily near-ultraviolet radiant energy in the 320 to 380-millimicron range are popularly called "black" lights. This term is quite descriptive since the ultraviolet energy from the "light" source cannot be seen by the human eye, but the effects of the light on special materials can be visually dramatic.

When black light is directed at a fluorescent material, an energy conversion takes place. The material or chemical sensitive to ultraviolet energy absorbs the energy, then reradiates it at longer wavelengths (in the 400 to 700-millimicron range) to which the eye is sensitive. The energy conversion is similar to that which takes place in fluorescent lamps, i.e., ultraviolet energy in the lamp activates the fluorescent phosphor coating to produce visible light in white or any other color.

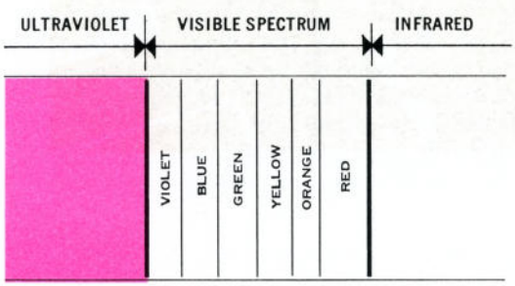
APPLICATIONS

Many materials fluoresce under black light without the need for special treatment. Commonly used types of lubricating or cutting oils fluoresce, so black light can be used to detect oil leaks or stains. In the textile industry, black light is used to detect oil stains, to reveal invisible fluorescent markings that outline stitching or cutting lines, and for grading inspection of raw materials.

Fluorescing dyes, added to paint, or clear lacquers or varnishes, permit checking for completeness and uniformity of coverage after they have been applied to a surface. Under black light the treated surfaces glow; uncovered portions remain dark. Common applications of this are found in the theater, ice shows, advertising displays, etc.

Black light can also be used to detect cracks, pits, or other defects in metal parts. Non-magnetic metals are coated with a fluorescing penetrant. The excess is removed and surface cracks appear as luminous streaks when irradiated with ultraviolet.

A somewhat different process is used for inspection of metals that can be magnetized. The area to be inspected is first magnetized. Defects that cause a break in the magnetic path create a leakage magnetic field. Ferrous particles treated with a fluorescing dye are then applied. When the excess is removed, the particles will remain at the defective areas and are revealed under black light.



SOURCES

Black light fluorescent and mercury lamps are used for most black light applications. Filament lamps are sometimes used as sources of black light, but they are weak and inefficient.

INCANDESCENT LAMPS: The General Electric 250-watt Purple X incandescent (or filament) lamp is made specifically for black light service. It features a special filter-glass bulb that transmits near-ultraviolet energy but absorbs nearly all of the visible light produced by the filament. Because of the heat thus confined, the lamp should be operated intermittently (5 minutes ON and 10 minutes OFF) and must always be installed in a porcelain socket. Since the bulb may fail if heated, the lamp should be used in a reflector covered by a metal screen.

Although filament lamps are inherently weak and inefficient sources of black light, the Purple X lamp is useful for such purposes as close-range examination of minerals and other materials for fluorescence. For viewing sketches drawn with fluorescent inks, paints, or chalks, a single lamp in a suitable reflector is sufficient to irradiate an area up to 3 feet square.

MERCURY LAMPS: Most mercury lamps produce both visible and black light. Those designed for black light applications are made with bulbs that transmit a high percentage of the near-ultraviolet energy generated by the mercury arc. With the exception of the H100BL38-4 lamp (which has a filter-glass bulb that absorbs nearly all of the visible light generated), all mercury lamps used for black light applications require external filters.

For developing black light effects over large areas, such as ice rinks and theater stages, the H250A37-5 lamp and, to a lesser extent, the H400A33-1, have been widely used in the past. However, the more efficient black light fluorescent lamps are now largely replacing mercury lamps for such service. Mercury lamps are still the preferred sources wherever high concentrations of black light are needed over relatively limited areas. For small installations, particularly where mounting space is at a premium, the compact H100PSP38-4 spot lamps or the H100PFL38-4 flood lamps are recommended. Both types of lamps are designed with PAR-38 hard-glass bulbs on which filter roundels can be clipped.

One disadvantage of mercury lamps is that they require several minutes warm-up time to reach full black light (or visible light) output.

FLUORESCENT LAMPS: There are two kinds of black light fluorescent lamps: BL and BLB types. The BL lamps differ from standard fluorescent lamps only in the composition of the phosphor which radiates most of its energy in the near-ultraviolet region, peaking at about 350 millimicrons.

The BLB lamps are much like the BL lamps but have an added feature in that the tubes are made from a special filter glass. The glass absorbs nearly all of the visible light and transmits a high percentage of near-ultraviolet energy thus making external filters unnecessary.

FILTERS: Most sources of black light produce some visible light which, in most applications, is undesirable. If the visible light is not filtered out, it reduces brightness contrasts and makes the display less effective. Therefore, a light-absorbing filter is usually used between the black light source and irradiated surface. With the BLB fluorescent lamps, the H100BL38-4 mercury lamps, and the Purple X filter lamp, the filter is an integral part of the lamp.

Transmission characteristics of filters depend on composition and thickness. Composition determines the relative spectral transmission of the filter, i.e., the relative amounts of radiant energy of various wavelengths that it transmits. Some filters, for example, pass virtually no visible light and not much ultraviolet either, while others (deep-blue sheet glasses) transmit appreciable visible light and a great deal of near-ultraviolet.

Scientifically designed black light filters are available in molded squares or roundels and in sheet glass. They are used in all black light applications that require a high degree of absorption of the visible light. Some of the deep-blue sheet glasses are being used as black light filters although they were not originally intended as such. However, since their near-ultraviolet transmission is high and their cost low, they are used in many applications in which some visible light can be tolerated.

Here are the G-E lamps most commonly used as black light sources. Additional information on ballasts and circuits is available from your G-E lamp representative. Relative black light energy data are based on the output of the F40BL fluorescent as 100; the data represent radiation from 320-420 millimicrons for incandescent and fluorescent, and 320-400 millimicrons for mercury.

Types of Black Light Lamps

INCANDESCENT

Advantages of incandescent black light lamps:

1. They require no ballast or transformer.
2. They are low in cost and lightweight.
3. They have their own filters.
4. They deliver full black light output as soon as they are turned ON.

MERCURY

Advantages of black light mercury lamps:

1. The larger sizes are the most powerful sources of black light in common use.
2. They are relatively compact, lend themselves to good optical control, and permit longer throws of light than are possible with fluorescent lamps.
3. They are available with built-in reflectors in PAR-38 spots and floods.
4. The H100BL38-4 is available with a filter-glass bulb.

FLUORESCENT

Advantages of black light fluorescent lamps:

1. They are the most efficient source of black light.
2. There is virtually no visible light radiated by BLB lamps.
3. BL lamps radiate relatively little visible light and permit inexpensive sheet glass filters to be used in many applications.
4. The linear sources ensure an even and and efficient distribution of black light on elongated surfaces.
5. They are relatively cool sources.
6. They deliver full UV output as soon as they are turned ON.
7. Rapid start 40-watt BL and BLB lamps can be dimmed and flashed.

Lamp Ordering Code	M.O.L. Inches	Nom. Bulb Diam. Inches	Base	Nom. Lamp Watts	Relative Black Light Energy
250A21/60	4 15/16	2 5/8	Medium	250	6
H85A3	5 5/8	1 1/4	Medium	85	62
H85A3/UV	5 5/8	1 1/4	Medium	85	62
H100A4/T	5 5/8	1 1/4	Admedium	100	68
H100A38-4	7 1/4	3 1/8	Mogul	100	68
H100BL38-4	5 1/2	2	Admedium	100	9
H100PSP38-4	5 7/16	4 3/4 (1)	Admed. Skt.	100	18
H100PFL38-4	5 7/16	4 3/4 (1)	Admed. Skt.	100	18
H175A39-22	8 1/4	3 1/2	Mogul	175	120
H250A37-5	8 1/4	3 1/2	Mogul	250	165
H400A33-1	11 5/16	4 5/8	Mogul	400	270
H400A33-1/T16	7	2	Mogul	400	260
H700A35-18	14 5/16	5 3/4	Mogul	700	495
H1000A34-12	15 1/16	7	Mogul	1000	750
H1000A36-15	15 1/16	7	Mogul	1000	765
F4T4/BL	5 1/4	1/2	Oval small 4-Pin	4	4
F4T5/BL	6	5/8	Min. Bipin	4	4
F4T5/BLB	6	5/8	Min. Bipin	4	3
F6T5/BL	9	5/8	Min. Bipin	6	7
F6T5/BLB	9	5/8	Min. Bipin	6	6
F8T5/BL	12	5/8	Min. Bipin	8	13
F8T5/BLB	12	5/8	Min. Bipin	8	8
F14T8/BL	15	1	Med. Bipin	14	21
F15T8/BL	18	1	Med. Bipin	15	25
F15T8/BLB	18	1	Med. Bipin	15	20
F20T12/BL	24	1 1/2	Med. Bipin	20	42
F20T12/BLB	24	1 1/2	Med. Bipin	20	31
F25T12/BL/28	28	1 1/2	Med. Bipin	25	53
F25T12/BL/33	33	1 1/2	Med. Bipin	25	57
F30T8/BL	36	1	Med. Bipin	30	65
F30T8/BLB	36	1	Med. Bipin	30	54
F40BL/5	48	1 1/2	Med. Bipin	65	130 (2)
F40BL	48	1 1/2	Med. Bipin	40	100
F40BLB	48	1 1/2	Med. Bipin	40	81
F48T12/BL/HO	48	1 1/2	Recessed D.C.	60	120
F64T12/BL/HO	64	1 1/2	Recessed D.C.	80	170
F72T12/BL/HO	72	1 1/2	Recessed D.C.	85	190
F48PG17/1PR	48	2 1/8	Recessed D.C.	110	220 (3)
F42T6/BL	42	3/4	Single Pin	33 (4)	74 (4)
F64T6/BL	64	3/4	Single Pin	50 (4)	110 (4)
F96T8/BL	96	1	Single Pin	65 (4)	150 (4)
F40T12/BL/IS	48	1 1/2	Med. Bipin	40	92
FC8T9/BL	8(diam.)	1 1/8	4-Pin	22	38
FC12T10/BL	12(diam.)	1 1/4	4-Pin	32	63
FC12T10/BL/HO	12(diam.)	1 1/4	4-Pin HO	50	83

(1) PAR-38 bulb.
(2) Operate lamp with two 40W preheat ballasts in parallel.
(3) Lamp operation at 3.0 amps = 285.
(4) 300 ma lamp current.

DETECTION

FOODS:

Black light is used to inspect shelled pecans to detect borers which, in visible light, are the same color as the nut meats. Under black light, the pecan meats fluoresce a deep blue, and the borers glow a brilliant white.

Contamination of flour and grain from liquid excreta of rodents is readily detectable under black light. Black light is effective in revealing ring rot in diseased seed potatoes. Mold formation and fungus growth on many varieties of food show up prominently under black light.

Breaks in the hulls of seed beans can be detected easily under black light because the bean meat fluoresces while the hull does not. Sour eggs are detected by egg-candling devices that project a narrow beam of black light through the eggshell. At the breaking tables, black light from overhead luminaires makes it easy to recognize sour eggs which fluoresce green or blue.

TEXTILES:

Black light is used to detect oil stains in gray goods, to reveal invisible fluorescent pattern markings applied to fabrics for stitching or cutting, and during various grading inspections of raw materials. Both BLB fluorescent and mercury lamps are suitable for these applications.

SANITATION:

Black light is used in restaurants to reveal food deposits clinging to cooking utensils and tableware after washing. It is used in public rest rooms to check cleanliness (urine splatterings, soap, and grease smears fluoresce). Hotels, industrial plants, and other establishments track down rodents by black light fluorescing their urine trails. Dairies use black light units to inspect stalls, equipment, and animals.

MINERALOGY:

Black light is used by prospectors, geologists, and hobbyists as an effective means of locating and identifying various minerals many of which fluoresce in characteristic colors.

ABOVE — Black light reveals fluorescent crayon pleat marks which would be invisible under ordinary light. *BELOW* — Flaws and breaks in solder connections in printed circuit boards are easy to detect using black light.

INSPECTION

CAST AND MACHINED PARTS:

Two inspection techniques involving black light are widely used in industry today. One, used with magnetic materials, requires that a strong magnetic field be set up in the part to be inspected. Cracks or other discontinuities in the part interrupt the magnetic field and force the flux lines outside the part. These leakage fields, acting as local magnets, attract and hold fluorescent ferromagnetic particles used to coat the part. When the part is inspected under black light, flaws are revealed wherever the fluorescent particles have concentrated in or near a discontinuity in the material.

The other method consists of coating a metallic or nonmetallic part with a fluorescent penetrant. The penetrant is drawn into surface defects by capillary action and becomes visible when viewed under black light.

PROTECTIVE COATINGS:

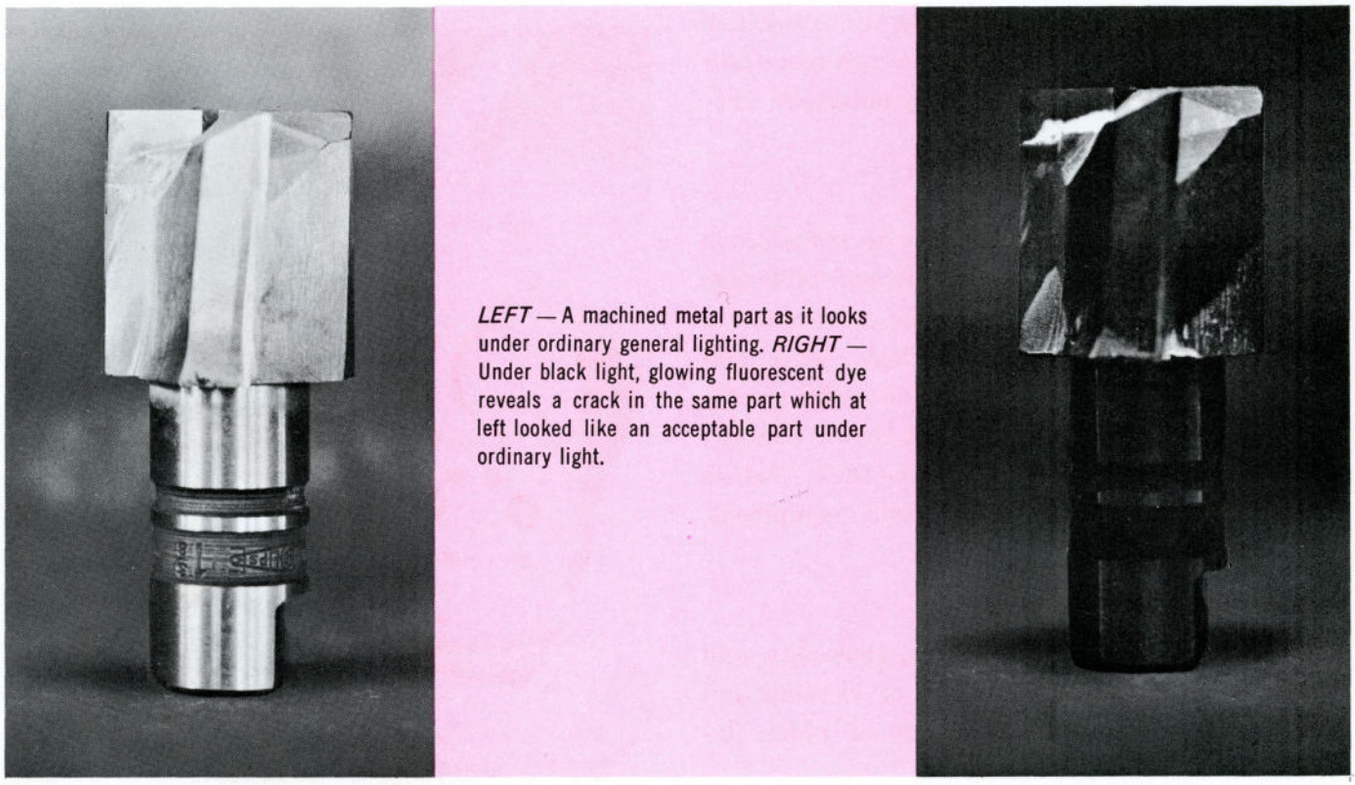
Fluorescent dyes, colorless in visible light, are frequently added to clear lacquers and varnishes to permit checking for completeness and uniformity of coverage after the coatings have been applied to surfaces. When examined under black light, the treated surfaces glow while the uncovered portions remain dark.

FLUID POWER SYSTEMS:

Black light is used to detect leaks in hydraulic systems, tanks, and pipe lines after adding fluorescent tracer dyes to the liquid in the system. Where oil is the fluid used, the natural fluorescence of the oil makes black light inspection particularly desirable. Aircraft fuel tanks and refrigerating systems are regularly inspected with the aid of black light.

EMBALMING:

Fluorescent chemicals are added to the embalming fluid injected into the circulatory system of a body. The body extremities are then examined under black light to determine whether the embalming fluid has been uniformly distributed.



LEFT — A machined metal part as it looks under ordinary general lighting. *RIGHT* — Under black light, glowing fluorescent dye reveals a crack in the same part which at left looked like an acceptable part under ordinary light.

IDENTIFICATION

LAUNDRY:

Black light makes possible the use of invisible laundry marks which are highly desirable from the standpoint of appearance of finished work. Conventional laundry marks are always unsightly and cannot be applied to all pieces of laundry. Invisible marks, however, may be stamped conveniently across the front of garments and on flat work where they are easily seen under black light.

For the sorting operation, fixtures with 100-watt mercury lamps have been used over the laundry bins. In some cases, the fixtures are mounted on electrified ducts to permit moving them across or along the aisle between bins to cut down on the number of fixtures required. A more practical arrangement, since the development of the black light fluorescent lamps, is to mount aluminum reflectors containing these lamps over the aisles between bins. Positioning and spacing of the fixtures must be determined by the size and disposition of the bins. Fixtures must be close enough to ensure getting the radiation to all bin openings.

VENDOR PARTS:

Black light has enabled many prime contractors to distinguish between identical parts supplied by several subcontractors. Each subcontractor's products are marked in some distinctive way with invisible fluorescent ink. Later, after the parts have been assembled, the prime contractor has only to examine the assembly under black light to determine at a glance the origin of the several components. If any of them is defective or not as specified, he knows which subcontractor is responsible.

CHARTS:

Maps and charts irradiated by black light can be studied or referred to in the dark. They can be printed in fluorescent ink, or conventional maps can be made fluorescent by swabbing the under surface with fluorescent lacquer.

Reference marks and data notations on radar plotting screens are easily seen and distinguished under black light when made by fluorescent crayons of various colors.

CRIMINALS:

Finely ground fluorescent powder is used to identify criminals. The powder is dusted on money, securities, and other valuables and around places where they are kept. If a theft occurs and there are suspects, examination of their hands under black light will help identify the thief. The same technique is often used to identify persons who have turned in false fire alarms. Fluorescent tracer pastes are used in similar ways.

STAMP COLLECTIONS:

Philatelists have found that examination of stamps under black light reveals types of tampering. For example, washed-off cancellation marks, invisible in ordinary light, are plainly seen under black light. Several commercially available devices for examining stamps and other small objects employ one or two low-watt BL or, more commonly, BLB black light fluorescent lamps.

LEFT — Invisible fluorescent ink marks which glow under black light are used at this amusement park as a re-admission control system.

REPROGRAPHICS

Black light fluorescent lamps find wide application today as sources of near-ultraviolet energy in whiteprint or diazo copying machines. (For many years these copying processes have been referred to as photoreproduction, but more recently the industry is using the term reprographics.) The spectral emission of these lamps is a close match to the spectral sensitivity of most diazo materials, thus making them very efficient for this application. Whiteprint machines utilizing black light fluorescent lamps are considerably slower than machines using high-pressure linear mercury arcs. However, these machines offer the advantages of small size, portability, low price, and on-the-job copying. Various equipments are available for reproducing single-sided translucent or transparent originals from 8½ x 11 inches in size up to originals 42 inches in width by any reasonable length.

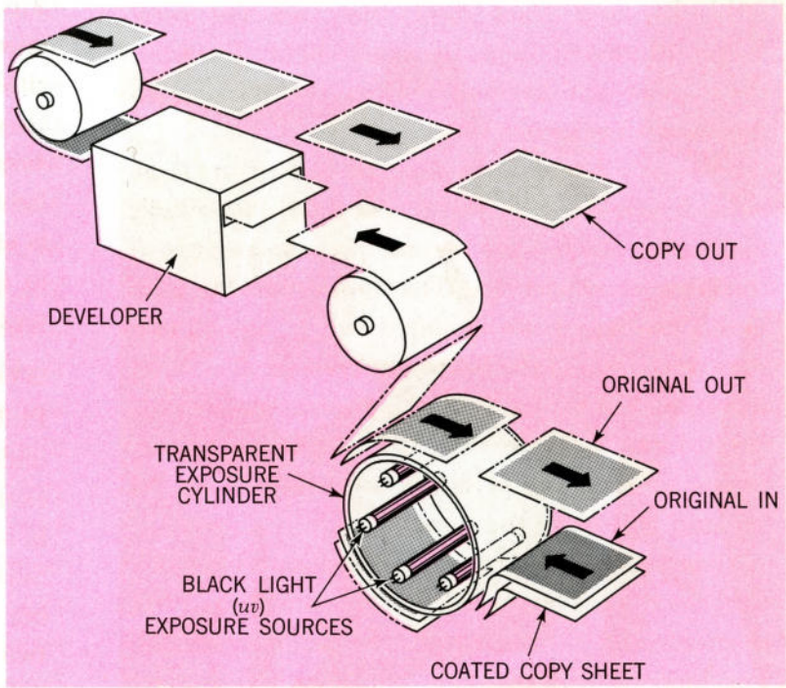
Other reprographic processes which may employ black light fluorescent lamps are:

1. Pre-sensitized offset plates. 2. "One-shot" contact printers. 3. Silk screen printing. 4. Photoresist. 5. Photo templates. 6. Ultraviolet photography.

USEFUL "LIGHTED" LENGTH OF BLACK LIGHT FLUORESCENT LAMPS FOR REPROGRAPHIC APPLICATIONS

Lamp Type	Watts	Useful Length (inches)
F14T8/BL	14	9
F15T8/BL & BLB	15	13
F30T8/BL & BLB	30	30
F20T12/BL & BLB	20	18½
F25T12/BL/28	25	22½
F25T12/BL/33	25	27½
F40BL & BLB	40	42½
F40BL/5	65	42½
F42T6/BL	32*	34
F64T6/BL	48*	54
F96T8/BL	65*	88
F48T12/BL/HO	60	40
F64T12/BL/HO	80	56
F72T12/BL/HO	85	64
F48PG17/1PR	110	37

* Watts are for 300 ma. operation.



RIGHT — Diazo copying equipment requires a source of near-ultraviolet energy. To make a copy, a transparent or translucent original is positioned over a specially coated copy sheet; both sheets are fed into the copier. The ultraviolet energy in the machine de-activates or "kills" photosensitive diazonium salts on all areas of the coated sheet not blocked by printing, artwork, etc., on the original. Where the ultraviolet rays are blocked, the salts remain "alive" ready to form a visible image when developed by one of three processes — dry, moist, or thermal.

DISPLAY

OUTDOOR SIGN BOARDS:

Black light on outdoor sign boards represent one of the fastest-growing display techniques. To be really effective, a black light sign must be located in relatively dark surroundings.

Often, the signs are lighted by both black light and visible light. The black light is usually applied continuously, and the visible light, from filament lamps, is flashed ON and OFF automatically by a timing mechanism. However, the recent development of circuits and equipment for flashing and dimming rapid-start fluorescent lamps now makes it possible to flash the black light.

The appearance of the sign is different under black light than under visible light and is still different under a combination of the two. It is possible, therefore, to show three distinct messages and scenes. Fluorescent figures, letters, or designs can be made in invisible colors or can be camouflaged by being painted on a nonfluorescent background of the same color. When these designs are illuminated by visible light (or by the combination of visible and black light) they are not seen. When irradiated only by black light, however, they stand out brilliantly from the dark, nonfluorescent background.

Mercury lamps have long been used on large outdoor signs, but in recent years the black light fluorescent lamps have become popular because of their higher efficiencies. The 40-watt size is used most. The lamps are mounted end to end in two rows at the top of the board in parabolic aluminum reflectors. Often, for brilliant displays or for displays located where there are competing brightnesses, double rows of lamps are mounted at the top and bottom of the signs.

For permanent outdoor installations using black light fluorescent lamps, the BL lamps with separate sheet-glass filters are generally the most economical. For indoor displays where enclosing fixtures are not needed, the convenience of integral-filter lamps often justifies using the more costly BLB types.

Wattage requirements for sign boards irradiated by black light fluorescent lamps are approximately 2 to 5 watts per square foot of board.

SHOW WINDOWS:

In store show windows, black light displays are much more effective at night than during the day and are most effective in windows that are at least somewhat removed from other brightly lighted windows or signs. BLB fluorescent lamps are recommended for irradiating backgrounds or providing an over-all wash of black light. H100PSP38-4 PAR-38 mercury lamps or H250A37-5 mercury lamps in concentrating reflectors are best for spotlighting. These lamps require external filters.

CHRISTMAS DECORATIONS:

Christmas tree ornaments and other holiday decorations may be painted, sprayed, or dipped in fluorescent chemicals and then irradiated with black light. With Christmas tree ornaments, the black light sources are usually located on the floor at the foot of the tree. For the home, either 15 or 20-watt BLB fluorescent lamps in aluminum reflectors, or 100-watt PAR-38 mercury lamps with filters are suitable. The size and proportions of the tree and the number of black light units used determine whether concentrated or flood distribution is best. The display is most effective in a darkened room.

MURALS:

Black light murals are effective in theaters, nightclubs, and cocktail lounges and where there is little general illumination. Elongated lamps are well adapted to lighting elongated surfaces. Since fluorescent lamps are linear sources that produce black light much more efficiently than mercury lamps, they are the logical choice for most mural lighting installations. Both the BL and BLB types are suitable. The BLB is the easier to use, especially where space is at a premium, because it requires no external filter. Mercury lamps are useful when relatively long throws of light are necessary and where a round beam pattern is better

suited to filling the space to be irradiated.

The black light sources should be mounted at either the top or bottom of the mural and well away from it. Often, the bottom position must be ruled out because of the difficulty of mounting the lamps far enough away from the wall.

Ceiling-mounted black light fluorescent lamps are usually concealed in a cove or above a suspended ceiling section. Mercury lamps are often recessed in the ceiling.

Fluorescent ceiling decorations are treated in much the same manner as murals. The black light sources, however, must be mounted on the walls or on columns, usually in some sort of decorative bracket or molding.

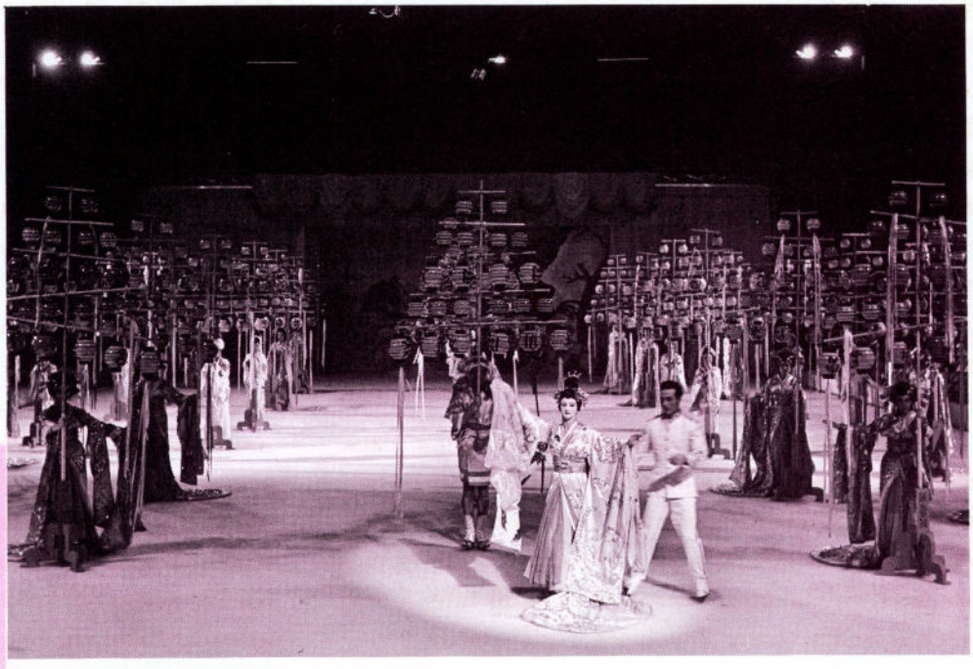
Reflectors should be used with both mercury and fluorescent lamps to ensure maximum utilization of the ultraviolet energy. The PAR-38-bulb mercury lamps have built-in reflectors and require much less space than lamps that use external reflectors. Usually, concentrating types of reflectors are used with fluorescent lamps.

The filter tubes of BLB fluorescent lamps provide adequate filtering for most mural applications. Relatively dense filters should be used with other black light lamps since little visible light can be tolerated in such applications.

Some care should be taken in widespread use of black light in public areas. Modern laundry detergents generally contain fluorescent materials ("whiteners") which remain embedded in the fibers of washed fabrics. When black light concentrations are high in public spaces, the effect may be to reveal feminine undergarments prominently through sheer dresses and blouses, with resultant embarrassment.

COSTUMES AND UNIFORMS:

Spectacular stage effects are among the oldest and most familiar of the black light display techniques. Although they no longer offer the same elements of mystery and novelty that they once did, they still make possible weirdly beautiful colored lighting effects that cannot be produced in any other way. BLB fluorescent lamps have largely replaced filtered mercury lamps in such applications. Filtered carbon-arc sources are still used for black light spotlighting where long throws of light are required.



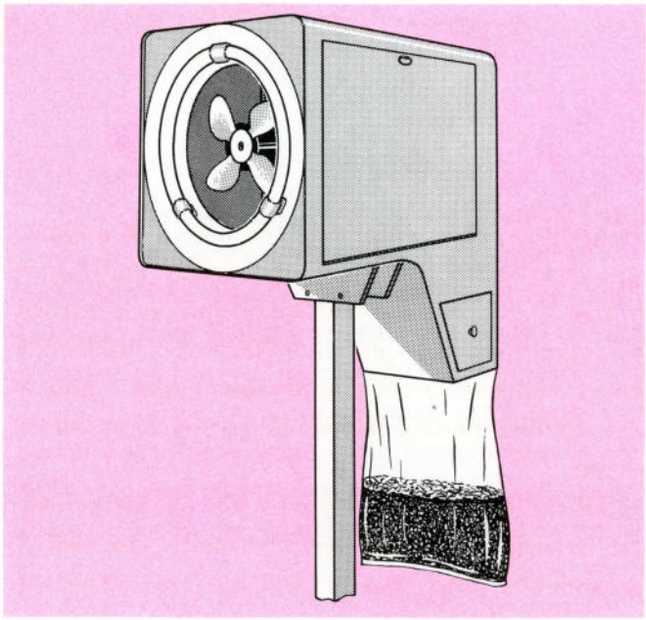
RIGHT — Black light productions are musts in successful ice extravaganzas. Audiences are thrilled and delighted by the beauty of the colors fluorescing under black light.

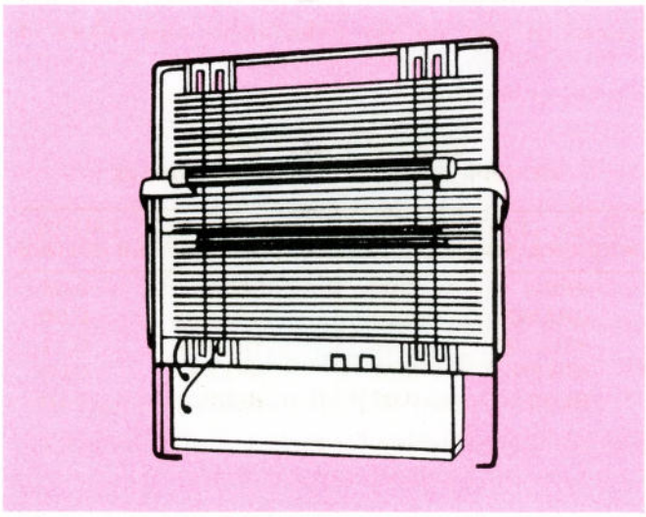
INSECT TRAPS

Black light is becoming more and more widely used in insect control. Since the eyes of many night-flying insects are particularly sensitive to near-ultraviolet and blue light, black-light lamps are used in many types of electric insect traps. Some of these black-light traps use a combination of one or more types of fluorescent tubes to attract the insects and either electric grids to kill them or containers to trap them for identification and counting. The tube-type fluorescent black-light lamps, are available in 15-inch to 4-foot lengths as well as 8 and 12-inch diameter circular shapes.

Black-light insect traps offer a new means for controlling night-flying pests and moths. Experiments are being conducted in various parts of the country in farms and gardens. Etomologists use black-light traps to capture and identify insects when they first appear to help determine when crop dusting and spraying are needed to prevent infestation. For example, in tobacco fields, these traps are highly effective against moths and tobacco hornworm. Home owners use black-light traps to make outdoor living enjoyable after dark, and owners of amusement parks, miniature golf links, marinas, motels, and refreshment stands use them to attract insects away from customers.

While black-light lamps attract insects away from areas of human activity, the areas themselves should be lighted by lamps which emit colors invisible to the insects, i.e., predominantly yellow. Thus, a combination of such lamps provides the most effective bug control.





TOP — A black-light, suction-type insect trap. Insects, attracted to the ultraviolet lamp, are sucked into the container by the draft from the fan. *CENTER* — A black-light, electric-grid type insect trap. The insects, attracted by the lamp, are killed when they contact the charged grid. *BOTTOM*—Gravity flow type trap for collecting tobacco hornworm insects alive for U. S. Department of Agriculture studies. A F15T8 black light lamp is mounted in the center of four baffles, which the insects hit, are stunned, and fall down the funnel into the cage.

DESIGN AND MAINTENANCE

So many variables enter into the design of a black light installation that it is often easier and faster to use a simple trial-and-error approach rather than spending a large amount of time on complicated theory and engineering principles. Pages 4 and 5 are valuable guides in determining which light source to use.

Filters range from high to low in ultraviolet and/or visible transmission. The higher the visible transmission, the greater will be the effect of "masking brightness" on the nonluminous surfaces of the irradiated area. This effect, however, will depend in part on the reflectances and colors of these surfaces, on the surrounding brightnesses, and, of course, on the nature and purpose of the installation. Basic information appears at the bottom of page 4 plus a table below on filter factors for various black-light transmitting glass filters.

Many different types of black light materials are available. A partial list of suppliers is shown on page 14 for black light fluorescent paints, lacquers, water colors, inks, dyes, chalks, papers, fabrics, phosphors, etc. Below a table is given on glow factors of typical fluorescent materials which gives a designer a general feel of the relative responses to be expected from various colors.

GLOW FACTORS
OF TYPICAL FLUORESCENT MATERIALS

BLACK LIGHT PAINTS, LACQUERS, WATER COLORS		DAYLIGHT TYPE PAINTS, LACQUERS, WATER COLORS	
RED	0.02	RED	0.03
ORANGE	0.04	ORANGE	0.06
YELLOW	0.08	YELLOW	0.11
GREEN	0.07	GREEN	0.09
BLUE	0.02	BLUE	0.03

APPROXIMATE FILTER FACTORS
For Various Black-Light Transmitting Glass Filters
(Based on transmission at 350-360 millimicrons)

FLAT SHEET GLASS		ROUNDELS		
Various "Pot-Blue" Glasses	0.60-0.85		Corning	Kopp
Kokomo #400	0.75	#5876	#61	0.65
Corning #5874	0.65	#5874	#41	0.50
6½-INCH MOLDED SQUARES		#5873	#51	0.30
Corning #5970	0.80	TUBULAR FILTERS		
Corning #5840	0.65	Corning filter-glass tubes for use over BL fluorescent lamps are made in various sizes and densities.		
Corning #5874	0.50			
Corning #5860	0.30			

MAINTENANCE:

Like conventional lighting systems, black light installations are subject to deterioration. Black light output of the lamps gradually decreases, and dust and dirt accumulate on lamps and reflectors. In fact, the output of black light fluorescent lamps depreciates more rapidly than that of conventional fluorescent lamps. Fading of the irradiated fluorescent materials is an added cause of depreciation. This may be slow or rapid, depending on the material and the conditions of use (whether indoor or outdoor, for example). Information on deterioration of fluorescent chemicals in their various forms and uses should be obtained from the manufacturers.

If a black light installation is to be kept in service for an appreciable length of time, design allowances should be made for depreciation in black light output. Initially, the output of the installation should be higher than what might be considered necessary to compensate for output depreciation as time passes. The number of variables involved makes it difficult to give accurate maintenance factor information that applies to all cases. However, maintenance factors of 0.5 for black light fluorescent lamps and 0.6 for mercury lamps are suggested for permanent installations that are cleaned twice a year and are located in areas which are not unusually dirty.

BLACK LIGHT EQUIPMENT

SUPPLIERS OF BLACK LIGHT EQUIPMENTS AND FLUORESCENT MATERIALS

(This list is not necessarily complete. Additions and corrections to it will be welcomed.)

	Indoor Fluorescent Lamp Equipments	Outdoor Fluorescent Lamp Equipments	Portable A-C Fluorescent Lamp Equipments	Portable Battery-Powered Fluors. Lamp Equips.	Mercury Lamp Equipments	Fluorescent Paints, Lacquers, Water Colors, Etc.	Fluorescent Inks	Fluorescent Dyes	Fluorescent Chalks, Crayons, Pencils, Etc.	Fluorescent Papers	Fluorescent Fabrics	Fluorescent Powders	Fluorescent Phosphors	Black Light Filters
ALPHA RESEARCH AND ENGINEERING, Midland, Texas				•										
AMERICAN CRAYON CO., Sandusky, Ohio									•					
ASSOCIATED FABRICS, New York, N. Y.											•			
BLACK LIGHT EASTERN CORP., Westbury, N. Y.	•	•	•	•	•	•	•	•	•	•	•	•	•	•
BLACK LIGHT PRODUCTS, Chicago, Ill.	•	•	•	•	•	•	•	•	•	•	•	•		•
BLICK DICK CO., Galesburg, Ill.	•	•			•	•			•	•	•			
BURTON MFG. CO., Van Nuys, Calif.	•		•	•	•		•		•	•	•	•		•
G. F. BUSH ASSOCIATES, Princeton, N. J.	•		•				•	•	•			•	•	•
CALIFORNIA ULTRAVIOLET CO., San Francisco 11, Calif.	•	•	•	•	•	•	•	•	•	•	•	•	•	•
CENTURY LIGHTING, INC., New York 18, N. Y.	•	•	•	•	•	•	•	•	•	•	•	•		•
CHARLOTTE CHEMICAL LABS, Charlotte, N. C.	•													
CRAFTINT MFG. CO., Cleveland, Ohio						•								
DEE-LITE INDUSTRIES, INC., Brooklyn 4, N. Y.	•		•		•	•	•	•	•	•	•	•		•
EASTMAN KODAK CO., Rochester, N. Y.						•								
EXETER PAPER CO., Chicago, Ill.								•		•				
FARGO CO., San Francisco, Calif.			•	•										
G. W. GATES CO., Franklin Square, L. I., N. Y.	•		•		•									•
GEOSCOPE INC., Dallas, Texas			•											
GRIMES MFG. CO., Urbana, Ohio			•											
HERBACH & RADEMAN, Philadelphia, Pa.	•		•	•	•									
J. HERSHKOWITZ, INC., Brooklyn 12, N. Y.	•		•						•					
INFRARED INDUSTRIES, Waltham, Mass.														•
JAY PRODUCTS, Cincinnati, Ohio						•								
KOKOMO OPALESCENT GLASS CO., Kokomo, Ind.														•
LAWTER CHEMICALS, INC., Chicago, Ill.	•	•	•			•	•			•		•	•	
MAGNAFLUX CO., Chicago, Ill.					•			•						•
MALLINCKRODT CHEMICAL WORKS, St. Louis, Mo.						•	•	•						
MENLO RESEARCH LAB., Menlo Park, Calif.			•	•										
POLLAK LUMINESCENT CORP., Chicago, Ill.						•		•				•	•	
RADIANT COLOR CO., Richmond, Calif.						•	•	•		•	•	•		
RAYTECH EQUIPMENT CO., Somers, Conn.	•	•	•	•										•
ROBBOY ELECTRIC, Cleveland, Ohio	•													
SAMPSON CHEMICAL & PIGMENT CO., Chicago, Ill.						•						•	•	
SHANNON LUMINOUS MATERIALS CO., Hollywood, Calif.	•	•	•		•	•	•	•	•	•	•	•	•	•
STROBLITE CO. INC., New York, N. Y.	•		•		•	•	•	•	•	•	•	•		•
STOCKER & YALE INC., Marblehead, Mass.	•													
STONCO ELEC. PRODUCTS CO., Kenilworth, N. J.					•									
SWAN PENCIL CO., New York, N. Y.									•					
SWITZER BROS., Cleveland, Ohio	•		•	•	•	•	•	•	•	•	•	•		•
TRIPPELWARE CORP., Brooklyn, N.Y.							•		•			•		
ULTRAVIOLET PRODUCTS, Inc., San Gabriel, Calif.	•	•	•	•	•	•	•	•	•	•	•	•	•	•
UNION INK CO., New York, N. Y.							•							
U. S. RADIUM CORP., New York, N. Y.						•						•	•	
WABASH INSTRUMENTS & SPECIALTIES, Wabash, Ind.	•		•		•		•	•	•					•
O. C. WHITE CO., Worcester, Mass.	•													

OTHER G-E PUBLICATIONS
ON LIGHTING AND LAMPS

TP-101 . . . GENERAL LIGHTING DESIGN
Contains basic information about the lumen method of general lighting design. Booklet includes tables for footcandle levels, room ratios, coefficients of utilization on luminaires, as well as lighting comfort design data. (16 pages)

TP-109 . . . MERCURY LAMPS
Covers all mercury lamp types, design characteristics, and operating features. G-E and ASA mercury lamp designation systems are explained. Information is included on auxiliary equipment, spectral data, as well as effects of variations in line voltage, over-wattage operation, power interruptions, etc. (16 pages)

TP-110 . . . INCANDESCENT LAMPS
Describes in introduction evolution of today's incandescent lamps from Edison's first electric filament source. Basic lamp parts, how lamps are made, types of filaments, bulbs, bases, and filling gas are thoroughly discussed. General classes of lamps and operating characteristics are described. (32 pages)

TP-111 . . . FLUORESCENT LAMPS
Explains that fluorescent lamps are popular and widely used because of their high efficiency, long life, low brightness, minimum heat, and wide choice of sizes, shapes, and colors. There is a thorough but concise coverage of lamp parts and operation, phosphor materials and spectral data, classes of lamps, basic lamp systems, ballasts, and other lamp characteristics. (24 pages)

TP-118 . . . LIGHT MEASUREMENT AND CONTROL
Covers fundamental terminology used in light measurement and control. Readily available portable light-measuring are discussed plus precision laboratory equipment. Six basic methods of controlling light after it is emitted are explained. (24 pages)

LARGE LAMP DEPARTMENT

GENERAL ELECTRIC

GENERAL ELECTRIC LARGE LAMP SALES AND SERVICE DISTRICT OFFICES

CITY	SALES DISTRICTS (To Obtain Sales and Technical Information)	ZIP No.	Telephone No.	SERVICE DISTRICTS (To Order Lamps and to Obtain Shipping Information. Local Warehouse Stocks maintained at these Points)	ZIP No.	Telephone No.
ALBANY, N. Y.	879 Madison Ave.	12208	482-3345	Buffalo Serv. Dist., 98 Hydraulic St., Buffalo, N.Y.	14210	856-0800
ATLANTA, GA.	120 Ottley Drive	30324	875-0921	120 Ottley Drive—P.O. Box 13917	30324	875-0921
BALTIMORE, MD.	1401 Parker Rd.—P.O. Box 7427	21227	242-5700	1401 Parker Rd.—P.O. Box 7427	21227	242-5700
BOSTON, MASS.	50 Industrial Pl., Newton Upper Falls, Mass.	02164	332-6200	50 Industrial Place, Newton Upper Falls, Mass.	02164	332-6200
BUFFALO, N. Y.	625 Delaware Ave.	14202	883-7381	98 Hydraulic St.	14210	856-0800
CHARLOTTE, N. C.	1001 Tuckaseegee Rd.—P.O. Box 2144	28201	376-6585	1001 Tuckaseegee Rd.—P.O. Box 2144	28201	376-6585
CHICAGO, ILL.	550 West Jackson Blvd.	60606	332-4712	4201 So. Pulaski Rd.	60632	254-6161
CINCINNATI, OHIO	990 Nassau St.	45206	961-4343	49 Central Ave.	45202	421-6810
CLEVELAND, OHIO	12910 Taft Ave.—P.O. Box 2494	44112	266-4264	12910 Taft Ave.—P.O. Box 2422	44112	266-4404
DALLAS, TEXAS	6500 Cedar Springs Rd.	75235	351-3725	6500 Cedar Springs Rd.—P.O. Box 35425	75235	351-3725
DENVER, COLO.	6501 E. 44th Ave.	80216	388-4611	6501 E. 44th Ave.	80216	388-4611
DETROIT, MICH.	15135 Hamilton Ave.	48203	883-0200	15135 Hamilton Ave.	48203	883-0200
HOUSTON, TEXAS	4219 Richmond Ave.—P.O. Box 22286	77027	667-7595	5534 Armour Dr.—P.O. Box 18265	77023	923-2549
INDIANAPOLIS, IND.	2511 E. 46 St.	46205	547-5511	Cincinnati Serv. Dist., 49 Central Ave., Cincinnati, O.	45202	421-6810
N. KANSAS CITY, MO.	200 East 16th Ave.	64116	471-3568	200 East 16th Ave.	64116	471-3568
LOS ANGELES, CALIF.	2747 South Malt Ave.	90022	723-2541	2747 South Malt Ave.	90022	723-2541
MEMPHIS, TENN.	2011 So. Latham St.	38109	948-2642	2021 So. Latham St.	38109	948-2642
MIAMI, FLA.	1310 N.W. 74th St.—P.O. Box 47-796	33147	757-8481	1340 N.W. 74th St.,—P.O. Box 47-796	33147	757-8481
MILWAUKEE, WIS.	5300 N. Sherman Blvd.—P.O. Box 299	53201	462-3860	5300 N. Sherman Blvd.—P.O. Box 299	53201	462-3860
MINNEAPOLIS, MINN.	500 Stinson Blvd.	55413	331-4050	500 Stinson Blvd.	55413	331-4050
NEWARK, N. J.	26 Washington St., East Orange, N.J.	07017	824-5200	133 Boyd St.	07103	824-5200
NEW HAVEN, CONN.	135 College St.	06510	562-9828	N.Y. Serv. Dist., 75-11 Woodhaven Blvd., Glendale, N.Y.	11227	896-6000
NEW ORLEANS, LA.	4800 River Rd.—P.O. Box 10236	70121	835-6421	4800 River Rd.—P.O. Box 10236	70121	835-6421
NEW YORK, N. Y.	219 East 42 Street	10017	751-1311	75-11 Woodhaven Blvd., Glendale, N.Y.	11227	896-6000
OAKLAND, CALIF.	999 – 98th Ave.	94603	569-3422	999 – 98th Ave.	94603	569-3422
PHILADELPHIA, PA.	Rt. 202 at Expressway, P.O. Box 299 King of Prussia, Pa.	19406	688-5900	Rt. 202 at Expressway, P.O. Box 299 King of Prussia, Pa.	19406	688-5900
PITTSBURGH, PA.	238 W. Carson St.	15219	471-9050	238 W. Carson St.	15219	471-9050
PORTLAND, ORE.	2800 N.W. Nela St.	97210	223-2101	2800 N.W. Nela St.	97210	223-2101
RICHMOND, VA.	1510 Willow Lawn Drive, P.O. Box 8627	23226	282-7644	Baltimore Serv. Dist., P.O. Box 7427, Baltimore, Md.	21227	242-5700
ROCK ISLAND, ILL.	101-31st Ave.—P.O. Box 66	61202	788-3405	Milwaukee Serv. Dist., 5300 N. Sherman Blvd. Milwaukee, Wis.—P.O. Box 299	53201	462-3860
SEATTLE, WASH.	2400 Sixth Ave., South	98134	622-8081	2400 Sixth Ave., South	98134	622-8081
ST. LOUIS, MO.	1530 Fairview Ave.	63132	429-6930	1530 Fairview Ave.	63132	429-6930
TAMPA, FLA.	815 North 26th St.—P.O. Box 5147	33605	248-1171	815 North 26th St.—P.O. Box 5147	33605	248-4174

In addition to the Sales District Headquarters cities listed above, G-E Lamp Salesmen are resident in 93 other cities. Consult your telephone directory under General Electric Company Lamp Division.