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YOUR GUIDE TO THE INDUSTRY
Directory 1990-91

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The cover features part of "Cosmos," an illuminated sculptural frieze in bronze and glass, created by Ray King, Ray King Studio, Philadelphia. The large structures are illuminated from within by white neon. Groups of smaller gold-plated forms cluster around and reflect the light spilling from the larger forms. The frieze was installed in November 1989 on a 30-foot high by 60-foot long wall in the main lobby of The Graduate Hospital in Philadelphia.

In this issue, we have included as companion pieces to the DIRECTORY, three reference-type articles. Next month, Architectural Lighting will return to its regular format. Design features will focus on merchandise lighting.

**REFERENCE ARTICLES**

16 **How To Become A Lighting Designer** James Benya takes a light-hearted-turned-serious look at what's involved in the practice of lighting design—technical, creative and professional aspects, educational requirements, and available opportunities for field experience.

20 **Will This Fixture Last?** Specifying long-lasting outdoor fixtures requires an understanding of how environmental conditions affect them. Jan Moyer provides details on water damage problems, drainage techniques, corrosion-resistant materials and finishes, and much more.

24 **How To Use Photometric Data** Alfred Borden's step-by-step explanations of what photometric data is and how to use it in selecting luminaires is accompanied by a sidebar in which Charles Linn presents information on the latest developments in near-field photometry.

**COLUMNS**

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LETTERS

Packaging—A Fact Of Life?

TO THE EDITOR:

Mr. Benya ["Getting Lighting Built Right—Part I," January, pages 36-38] makes many valid points. There is one point, however, to which we must take a very strong exception.

Mr. Benya says that "occasionally manufacturers' reps may use their access to the special products made by independent specification manufacturers to force the (lighting) designer to accept an entire fixture package." He goes on to say this is "sheer folly" not to account for "packaging" by a representative agency. He then proceeds to encourage designers to build their specification around a package.

We at Horton • Lees have not caved in on this subject and for the benefit of owners and users alike we encourage others to continue to resist "packaging."

Legitimate lighting designers are paid a fee by the owner to design and to specify a lighting system which best meets the owner's needs and budget. They are not paid to make life easier for the manufacturer's representative. It is rare that a single manufacturer or a single representative agency will have everything a specifier needs for a given project. When they do not, then the specifier, according to Mr. Benya's article, is compelled to select lesser quality fixtures in order to fit into the package. That obviously creates a conflict of interest and the specifier is doing a disservice to the client.

Any lighting designer is ever forced by the contractor, his subs, or manufacturer's reps to accept anything other than what he/she specifies if the specifications are written clearly, concisely, accurately, and without loopholes. It should never cost the client more money simply because the fixtures are not a part of a package. If the contractor is required to submit an itemized budget with the unit cost of fixtures separate from the installation cost, those prices can be checked. In our office we verify with the manufacturers, on a regular basis, fixture costs submitted by the contractor to make sure that the owner is paying a fair price.

Whether one specifies large or small quantities of light fixtures, if one gets to know the manufacturer's representatives and they understand that the specifier will not tolerate "packaging," they will not do it.

Jules G. Horton, FIALD, FIES
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Stephen W. Lees, IALD, MIES
Executive Vice-President
Denise Y. Bruya, IALD
Vice-President
Barbara L. Cianci, IALD
Vice-President
HORTON • LEES
LIGHTING DESIGN INC.
New York

IN RESPONSE:

I am certainly glad that leading professionals such as Horton • Lees do not cave in to "packaging." We, at Luminoe Souter, do not cove in either. But, I know for a fact that packaging is a powerful and omnipresent concern for the average specifier.

The relevancy of the issue of packaging varies with the project region's relative economy, strength of the reps to accept anything other than what he/she specifies if the specifications are written clearly, concisely, accurately, and without loopholes. It should never cost the client more money simply because the fixtures are not a part of a package. If the contractor is required to submit an itemized budget with the unit cost of fixtures separate from the installation cost, those prices can be checked. In our office we verify with the manufacturers, on a regular basis, fixture costs submitted by the contractor to make sure that the owner is paying a fair price.

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CONTINUED ON PAGE 12
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At Greenlee, we combine progressive engineering with years of experience in illumination design. The result is a line of superior landscape luminaires which our competitors can only envy—and which you can trust to meet your most exacting standards of quality and service. Greenlee's Composite Direct Burial—the powerful new standard in landscape lighting.
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James R. Benya, PE, IALD, IES
Senior Principal
LUMINAE SOULTER
LIGHTING DESIGN
San Francisco

Codes And The Real World

Dear Editor:

I was interested in your editorial on the New York State Energy Code in the June issue.

I do not profess to be a lighting expert, so cannot comment upon the code provisions and revisions. I do wonder, however, if these officials have any idea of what goes on in the real world. Undoubtedly, there are projects to which their regulations may be applied, but there are thousands to which enforcement is impractical, if not unenforceable.

Many of my clients put up buildings for speculation. No one has any idea who will occupy them. Some building departments require a "lighting budget" to conform to the code before they will issue a permit. The Architect has no choice but to design for an imaginary occupant. The actual occupant will have needs radically different from this, and will put in his own lighting. Some occupancies require special task lighting. These changes are made with no official approval whatsoever.

What happens to existing buildings when the occupancy changes? Does the state think the new occupant is going to rattle his brains or ask them how he should revamp his lighting?

Of course, the energy code is not alone in this. These comments could apply to aspects of other codes. It is only when the work requires a permit and the local official is aware of these restraints that the code is applied. In my experience this is rare.

Leon Rosenthal, AIA
LEON ROSENTHAL
Babylon, NY
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*High-Performance ballast made exclusively for Alkco by Radionic Industries.
Belgelli, the Italian leader in emergency lighting products, has now created a totally new kind of lamp: PRATICA BELLA, Practical and Beautiful. Practical because it is easy to install and maintain. Beautiful because it is a creation of Italian design, which adds a pleasant and elegant look to emergency lighting. A very special style that is capable of integration and provides the finishing touch to your important projects. PRATICA BELLA, available in black, white, and burgundy colors, is part of a complete line of lighting/emergency lighting products manufactured by Belgelli. These products, along with a commitment to quality/assistance and service, are now available in the United States. So, when you are thinking of an emergency lamp to complete your project, think of Belgelli, think of PRATICA BELLA.
EDITORIAL

Trade Show Trauma

We hope that one comprehensive show will be the outcome of this year's turmoil. This infighting gives the whole industry a black eye," writes Marvin Gelman, president of Lighting Services, in his recent "On Track" newsletter.

For those of you who've been in the Fiji Islands for the past year and out of touch with the industry, there are three major U.S. lighting shows this year run by two different managements. LightFair was held in April in New York; Lighting World was held in June in Chicago, with another to follow in October in Los Angeles.

"The costs have become prohibitive for manufacturers to participate in more than one trade show a year," says Gelman. He also feels that with the three shows, attendees no longer have the advantage of seeing all manufacturers at one location.

THE MORE THE MERRI

Well, there is a second opinion on this issue, held by some lighting professionals who have attended both shows. Anything that celebrates lighting is welcome. More trade shows mean the opportunity to spread more awareness of lighting. And if the industry can sustain more than one show, perhaps it is a sign of growth.

Also, attendees who could not afford to fly, for example, from one coast to another for a show would be assured of seeing a show each year closer to home. Combined attendance at all lighting shows would be increased.

FREE ENTERPRISE = BUYER BEWARE

Well, I've been thinking (always dangerous!), and have a third opinion on the subject. In a free enterprise system, you can't expect one show management or the other to throw in the towel if each believes it is serving the industry best.

Business is business—as long as both show managements believe there is a market for their services and have hopes of profits, they will continue. As long as manufacturers, lighting experts who speak at seminars, and attendees choose to participate in more than one show, there will be more than one.

IF THE SHOW FITS... 

How to solve the exhibitors' financial dilemma Gelman points up? Here's an analogy. Every field usually has a variety of magazines in which manufacturers can advertise to promote their products. Manufacturers study the readership, the publication's quality and content, and expenses involved in creating and running advertisements for each magazine in order to choose which vehicle(s) best fits the goals they want to achieve, and use their money wisely.

Trade shows are marketing tools, too. SO BE DEMANDING. Demand the trade show managements and sponsors tell you exactly:

- who the audience is for their show
- what the quality and content of the seminars will be in advance
- what their accommodations are for you as exhibitors
- how and to what extent they will promote the show.

When you expect less, you get less. Reserving booth space and adopting a "wait and see" attitude won't help your business, or sort this dilemma out.

Each trade show management has already put on a show this year. So there's no excuse for them not to have answers to questions on their show's focus, attendance, promotion, etc., right? If they don't have the answers, that tells you something, too.

By speaking out, letting show operators know how you feel, and demanding solid information and data before you commit to exhibiting again, you will help shape the future of lighting trade shows, instead of being at their mercy.

Perhaps the industry is too small to support more than one show. Perhaps one international show, and a few smaller regional shows are the answer. Perhaps one show should be geared toward end users, and another toward specifiers.

But it's up to you, the exhibitors, to take control. If you're fed up with being pushed into a corner, push back.

WANDA JANKOWSKI
EDITOR
How To Become A Lighting Designer

IN THE BEGINNING: Hints of a destiny in lighting design show up in childhood as an avid interest in electrical things.

BY JAMES R. BENYA
PE, IALD

This article began as a “career day” presentation to architectural and interior design students. However, at least twice a month, someone writes or calls me to ask, “How do I become a lighting designer?” When I found I was often supplying the same answer to each, it became time to write it down for general use. Here it is for anyone interested in the matter.

In the major fields of architecture and design, surely one of the newest and most exciting is architectural lighting design. In addition to sounding glamorous and trendy, there simply aren't enough professional designers to meet the demand. Every competent designer is busy, from New York to Hong Kong.

It isn't easy to become a lighting designer. Most practitioners don't have degrees in the field, especially some of the best current designers. So in order to help describe the process, the following steps are recommended.

1. BIRTH

This is generally the first step. Although a few of the New York lighting designers skipped this step (they were around for Genesis), most experience this. I'm told a few were actually hatched backstage in Broadway theaters.

2. CHILDHOOD

During early childhood, show an interest in electrical things like wires, light bulbs, TVs, and stereos. Learn the
SIXTEEN CANDLES:
A future lighting designer's adolescence brings appreciation of lighting's mood setting capabilities.

The difference between thrilling and shocking. Demonstrate acumen for tools and parts. Build sandcastles and play with building blocks. Enjoy Christmas tree lights and rainbows. These are the things of your future.

3. ADOLESCENCE
Begin to understand that light creates mood. Notice what happens when you turn down the lights at a party!

4. GO TO COLLEGE
Learn to study and think great thoughts. Learn to live on very little money and sleep. Learn to work against impossible deadlines set by uncaring ogres.

Seriously, though...

Becoming a lighting designer is a little bit proper education, a little bit luck, a little bit circumstances, and a whole lot of commitment. This seems to be a common element among the most successful lighting designers. Anyone looking for a normal, five-day, forty-hour-a-week job need not apply.

THE THREE FACETS OF LIGHTING DESIGN
Lighting design can be practiced as part of another major profession, such as architecture or electrical engineering. But for those who wish to practice as independent professional lighting designers, there are three major facets of preparation that must be learned and developed.

• Technical One must learn about the technology and science of light, lighting, and seeing. Implicit in this is all the physical and applied sciences. It is equally important to know how human vision works and how a building is built. Knowledge of electricity, energy, structure, and cost management significantly improves the effectiveness of the lighting designer.

• Creative and Aesthetic One must learn and develop acumen and skills in the art of illumination. This includes a broad range of capabilities, from the appropriate rendition of art and architecture to the intuitive creation of spaces and feeling.

• Professional Lighting design is not practiced in a vacuum. The practical elements of role and responsibility, of presentation and personality are part of the work.

EDUCATION FOUNDATIONS
Lighting design is a multi-disciplinary pursuit well suited for Renaissance men and women. An individual's base degree only begins the course of holistic and broad educational endeavor. The most common base degrees are:

• Architecture
• Interior Design
• Landscape Architecture
• Electrical and Architectural Engineering
• Illuminating Engineering
• Performing and Creative Arts (especially theater)

But remember: each base education is incomplete; to say...
any one is superior is not fair or correct. Base educations provide limited viewpoints, and teach as much prejudice as skill. If there was a good degree in “lighting design,” it would not be a degree in any of these, but would include considerable exposure to concepts, philosophies, and skills in each.

As a practical matter, one may wish to receive a degree in a major, licensed profession within the realm of construction, such as architecture or electrical engineering. Until lighting design becomes a legally recognized profession, the advantages of professional registration in one of these fields can be significant.

Several undergraduate programs have substantial lighting emphasis in the degrees of architecture, electrical engineering, or architectural engineering. These programs will be attractive to those wanting to develop technical skills, such as computer illumination analysis. Some of these schools include Penn State, and the universities of Colorado, Kansas, New Hampshire, and Illinois. A noteworthy number of successful lighting designers are graduates of these programs.

**GRADUATE DEGREES IN LIGHTING DESIGN**

At present, the most comprehensive programs involve master’s curricula. Candidates are required to have a base degree in an applicable field; the master’s program teaches both lighting design and lighting professionalism. Graduates from the Parsons program have been impressive; Rensselaer Polytechnic’s new program also appears excellent.

Graduates with master’s degrees will generally be the most “hireable” by lighting design firms, since the graduates have been exposed to studio and professional education.

**INTERNING**

The International Association of Lighting Designers (IALD) sponsors an annual summer intern program for students in design professions to serve as interns in lighting design firms.

The experience introduces the student to the professional environment of lighting design, and is an excellent way for a student to learn a lot about lighting design prior to committing to the field as a career. Compensation is paid to the intern. Design firms look upon this program as a non-commit­tal way to take a look at candidates’ capabilities.

But many, many lighting designers have begun as volunteer interns to lighting designers, working one or two days a week for the experience. I generally recommend this route for persons otherwise employed and looking to change into the field, or for students wanting to make this part of their academic experience. This type of interning trades work for education, and the intern is often not paid. Although this may seem unfair, remember that most lighting designers are besieged with job applications, and only the most diligent and available persons usually get a chance to intern with a major firm. Only well-credentialed candidates should consider looking for a lighting design job the normal way of sending resumes and cover letters.

**THE PERFECTLY PREPARED CANDIDATE**

I’d suggest that someone who wants to prepare to become a lighting designer consider doing as many of the following as possible:

1. Get a major degree in architecture, interior design, or engineering. Work in your major profession for five years.
2. Get a master’s in lighting design.
3. Take courses in theater lighting, and spend time working in college, community, or professional theater.
4. Intern or begin employment in a major metropolitan area with the best firm you can. For now, the best cities are New York, Los Angeles, San Francisco, and Dallas.
5. Topics to study while you’re at it: photography, psychology, physiology, botany, and the other major fields you didn’t major in.
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Will This Fixture Last?

BY JANET LENNOX MOYER
ASID, IES

The author is principal of Jan Moyer Design, Berkeley, CA.

Many factors affect how long an outdoor lighting fixture will last. Most of them revolve around the fixture’s ability to withstand environmental conditions. For example, the finish can fade due to an intolerance to ultraviolet light. Water causes corrosion when trapped by debris in a crevice of the fixture. The presence of water causes incompatible metals to fuse together preventing access to fixtures. The list goes on.

This article will address some issues that we all should be familiar with in specifying outdoor fixtures. As lighting professionals it is our responsibility to specify and install systems that will work.

PREVENTING WATER DAMAGE

Opinions vary in our industry on the subject of water penetration into the body of a light fixture. Some feel that a totally sealed and gasketed fixture provides the best protection against water damage to the fixture. Others feel that no matter how well constructed the fixture, water will enter it, if only in the form of condensation. If you accept this premise, then including drainage or breathing holes provides for removal of water from the fixture body. No conclusive information has convinced me that one or the other approach is exclusively correct.

Water entering the fixture’s lamp chamber may cause lamp or socket failure. But any type of failure causes interruption of the functioning of the lighting system.

Failure in MR 11 lamps may have to do with a combination of heat, water, lamp construction, and lamp mounting within the fixture. No conclusive information about the failure of these lamps has been presented.
PINS AND BRONZE: When a fixture installed for less than six months was opened, its MR 11 lamp (right) was loose and the pins came out of the socket easily. The end of the pin has a rough break indicating overhardening of the metal during manufacturing. From left to right, the first three MR 16 fixtures (below) have bronze powder coat finishes by different manufacturers. The last has an anodized bronze finish. It is not unusual to have such a disparity in color.

Lamp manufacturers question some fixtures’ ability to dissipate enough heat for the proper functioning of the lamps. Small-sized accent fixtures blend into the landscape well and their light weight lessens the impact on trees, but if they shorten lamp life, they become a liability. On an MR 11, according to manufacturers’ specifications for proper operation, the bulb wall temperature should meet or exceed 250°C and the pinch seal should not exceed 350°C. Exceeding the pinch seal temperature can cause premature failure. One advantage of drainage or breathing holes may be to allow air movement that adds to the cooling of the lamp compartment.

PIN PROBLEMS
Lamp manufacturers use a different metal for the MR 11 pins than for the MR 16. At least one manufacturer plates the metal for the pins. In the presence of moisture, this may cause galvanic action resulting in the lamp’s socket pins separating from the lamp base. In this case, the pins remain installed in the fixture socket. If the problem had been arcing, due to water presence, the pins would have been welded into the socket and difficult to remove.

On lamps that I have seen with the pins separated from the lamp body, the filament did not appear to be broken (although, this may not be evident to the eye) and the pins pulled out easily from the fixture socket. In this case, the problem could be caused by overhardening of metal due to excessive heat in manufacturing. This causes the pins to become brittle and break at the base of the lamp during operation. The break will be smooth or clean. In fixtures where the lamp is supported by the pins alone, vibration can cause a work-hardened break, which will show up as a jagged break in the pin at the lamp base. This problem may be lessened by adding some silicone between the socket and lamp bases.

Other water-related problems can occur. Turning off the
lamp causes a partial vacuum that can pull water along a path between the wire(s) and the wire jacketing into the fixture body. The best way to eliminate this problem of wicking is to solidly bond each bare wire and then pot all the wires in epoxy. Manufacturers often provide a separate compartment for this and call it an anti-wicking or anti-siphon chamber. Wicking can also occur by capillary action. In this case, the intrusion of water into the lamp compartment may not be evident immediately.

Many sites have poor drainage, and fixtures mounted above grade on spikes or junction boxes can become submersed. In considering which fixture to specify, evaluate geographical and climate conditions, as well as specific site conditions including valleys in topography at fixture locations. Combining a natural flow of water into an area with poor soil drainage allows water to build up. Regular irrigation spraying onto fixtures can also cause water penetration into fixtures.

**DRAINAGE FOR BELOW-GRADE FIXTURES**

Below-grade fixtures introduce a new set of considerations. In debating whether to use an open well type fixture or an enclosed fixture, look at the soil drainage of the site. When the soil retains water (heavy clay soils, for example), rain and irrigation water will be drawn to the hole in the earth. An accepted construction detail in our industry calls for increasing the hole in the earth below the fixture bottom by as much as 18 inches and then filling this additional space with drainage rock. With heavy soils this may simply fill up with water. With poor draining soils of any type, providing several horizontal drainage holes may provide relief to minimize or stop the hole from filling up with water. Test the soil. In any case, the lamp fixture housing within the well compartment must be submersible.

Totally enclosed fixtures eliminate water collecting in the fixture well, but the earth hole will still attract water. This build-up of water can displace the fixture, disturbing its aiming, and it can actually push fixtures up out of the hole. The displacement may be slight or dramatic. It can affect the physical appearance of the landscape during daylight hours and cause potential conflict with lawn mowers.

**USING CORROSION-RESISTANT MATERIALS**

Materials used in fixture construction play a large part in the endurance of a fixture. Aluminum well bodies can totally disintegrate. The corrosion occurs from exposure to a combination of water and soil along the fixture mass, as well as the added corrosion potential of salts and chemicals in the soil.

Many wells are now being manufactured from ABS or PVC plastics. These materials offer corrosion resistance to soils, as well as reduced material costs. Some manufacturers are making the bodies of enclosed fixtures out of these plastics, and then using stainless steel on the inside for the lamp compartment. This takes advantage of the corrosion resistance of both materials in protecting the operation of the fixture, with the plastics providing solid corrosion resistance, and stainless steel providing corrosion resistance to condensation or other water intrusion.

Corrosion is the main cause of failure in lighting equipment. It causes lamp failure, but it can also destroy the fixture itself. Complete disintegration of below grade fixtures made of unprotected or improperly protected metal is not unusual. Corrosion will occur between parts of a fixture when dissimilar metals are used in assembling a fixture. An aluminum housing with the brass bezel (face plate) will result in the fusing of the two parts, preventing access to the lamp inside the fixture. Screws of a differing metal from the part it
Attaches to can also cause seizing of the two metals if some kind of protection is not provided. Using galvanized or plastic coated screws eliminates the incompatibility. Often, gaskets or washers will separate the two incompatible metals, but these are easily lost when opening or closing the fixture. The fixtures can discolor due to rusting in steel and aluminum fixtures or chalking in the case of powder coat finishes using epoxy resin.

**DURABLE FIXTURE FINISHES**

This brings up the question of durable finishes for fixtures. After researching both anodized finishes and powder-coat paint finishes, current technology leans toward powder coat finishes. Both have varying levels of quality that partially depend on the process followed in cleaning and applying the finish, and partially on the materials chosen for the finish. Both depend heavily on a series of cleaning and pretreatment steps. Inferior finishers often skip steps, use lesser quality materials, or fail to adequately regulate the process. In powder coat, the strongest, most durable finish will be provided when a chromate conversion coating is used during the cleaning and pretreatment process. Other coatings are available, including phosphate and oxide conversion treatments, but they are not as durable or protective as chromate. With chromate, moisture cannot penetrate down to the metal. With other types, moisture will be able to penetrate to the metal causing corrosion that will result in flaking and bubbling of the paint finish, along with other corrosion systems.

Another key to the success of the powder coat finish is the actual powder resin used in the paint. Four basic categories exist: epoxy, urethane, polyester, and hybrid. For lighting fixtures, the characteristics that direct the choice include exterior stability, corrosion protection, and over-bake stability. Polyester is the resin of choice.

In anodized finishes, several factors influence the durability of the finish. The first factor is the actual process chosen. Of all the anodizing processes available, only duranodic or processes equal to duranodic (manufacturers’ names may vary) provide the benefits needed for lighting fixtures—UV resistance, corrosion resistance, and permanent color. Some of the lesser processes are not UV resistant or have a lesser penetration depth into the metal.

Ones to avoid include two-step, two-step electrolytic, and overdyeing processes. Also, some manufacturers skip one step called the hot nickel acetate bath, which blocks the pores of the aluminum and extends fade time. Another key to the effectiveness of a duranodic finish is the temperature control of the final hot water bath that seals the finish. If the temperature is not at 200°F, the bath will not protect sufficiently.

In comparing powder coat finishes to anodized finishes, powder coat painting provides more benefits. It is available in many more colors; when done with the chromate conversion process it provides greater finish strength to resist scratching, peeling, and corrosion of the base metal; it provides protection on the inside of the fixture without the actual paint coating because the parts are dipped in the chromate conversion bath and this provides ample protection for parts not directly exposed to weather. For example, it will protect the threads of a bezel and body attachment. Powder coat painting done in-house by the lighting manufacturer will be less costly than anodizing, but when a job shopper does it, anodizing will be slightly less expensive.

Because many factors impact our selection of fixtures, including the harsh and unforgiving outdoors, we need to evaluate fixtures closely to ensure that all aspects of the fixture are appropriate for each specific project. Nothing sours a good client relationship faster than a lighting system that doesn’t function properly.
The best way to decide which type of luminaire you want for a particular project is to get one and look it over. Judgements about visual proportions, quality of materials, and craftsmanship can truly be made only from a sample fixture. The problem with this method of choosing is the time it takes to visit a manufacturer, determine a fixture's availability, cost... the list goes on. The most practical way to narrow down luminaire choices is to use catalogs, which present available products and help narrow our choices to the few we may actually want to see and examine.

The same holds true for determining fixture performance. The fixtures in the best lighting designs distribute illumination to enhance the visual composition, while supporting the functional needs of the users. A full-scale mock-up of the installation with the final furniture and finishes is the best way to judge their effectiveness. You may even want the users to work in the space for a while and give you a post-occupancy evaluation. The logistical considerations associated with this kind of evaluation process obviously make it a poor way to begin selecting fixtures. The mock-up is usually the place to test the performance of fixtures which have already undergone some careful analysis. Of course you will want to light up some samples as part of this analysis, but first you must narrow your choices. This is why we all need photometric reports.

The centerpiece of a photometric report is the candela chart. This is a summary of the luminaire intensities at specific viewing angles. Essentially, measurements are made with an illuminance meter and converted to candela using the inverse square law calculation.

This method is only valid if the fixture is treated as a point source. This means that variations in performance that may occur across a large aperture fixture will not be expressed. According to Illuminating Engineering Society of North America (IESNA) standards, the distance between the fixture aperture and the meter must be at least five times that of the fixture aperture's maximum dimension. For example, a 2-foot by 4-foot troffer must be measured from at least 20 feet away.

The instrument used to take these readings has an appropriately large name—a goniophotometer. It comes in several versions, but the one most commonly used has a system of fixed and rotating mirrors to fold the effective test distance into a manageable space.

The test luminaire is mounted in a fixed location and the mirror rotates through regular intervals of vertical angles and horizontal planes, bouncing light to the meter. What results is a type "A" chart. It usually lists the candela in 10 degree vertical zones, from 0 degrees (straight down) to 180 degrees (straight up), and in three or five horizontal planes from 0 degrees (along the lamp axis). Fixtures that distribute light...
THE CANDELA DISTRIBUTION chart above was prepared using far-field photometry; the one below, near-field photometry. Note the candela distribution curves plotted using near-field are flatter and sharper. The actual candela quantities are also significantly different, even though the photometry. Note the candela distribution curves plotted (Equivalent candela distribution is a concept in which all photometric center of the luminaire at a given distance from the surface.)

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BEETTER MEASURES

For certain fixture types, high levels of accuracy in candela distribution charts are now possible with near-field photometry.

BY CHARLES LINN, AIA
EXECUTIVE EDITOR

The major purpose of a photometric report is to provide a designer with information on how a luminaire distributes light. A graphical plot included in the report can give a designer a quick idea of the luminaire's pattern of distribution. An accompanying table gives the angles at which the light was measured, as well as the quantity of light at those angles. Designers are able to use this information to assist them in selecting the right luminaire for a lighting application, as well as to give them pertinent data that will help them establish mounting heights, fixture spacings, and so on.

It is obvious that data for candela distribution charts must be extremely accurate. Traditionally, these measurements have been taken using a method known as far-field photometry. One type of photometer commonly in use for far-field testing is a moving mirror photometer. The photometer is placed in a darkened room, where the walls, ceiling, floor, and other surfaces have been painted black, thus eliminating any reflections that might affect the measurements. All other sources of incidental light are excluded from the room. Once the luminaire is placed on the photometer and stabilized, a large mirror rotates around the luminaire, and its light output is reflected back to a photocell, through which the measurements are gathered. The luminaire itself is outfitted with carefully selected lamps and ballasts, whose light output have been previously laboratory tested, and their electrical input is strictly regulated.

As the mirror rotates continuously around the luminaire, the photocell measures the light output of the luminaire, even up to one-half degree of vertical travel, for a possible total of 720 measurements per rotation. After the mirror has rotated around the luminaire once, the luminaire itself is rotated to another predetermined plane horizontally, and the mirror revolves around the luminaire...
PHOTOMETRIC REPORTS ARE generated using a moving mirror photometer. Light from the luminaire being tested (A) is reflected by a rotating mirror (B) to an illuminance meter (C) which measures the light at predetermined intervals. After the mirror has made a complete revolution the luminaire itself is rotated horizontally to a predetermined location, and the process is repeated.

PHOTOMETRIC REPORTS ARE generated using a moving mirror photometer. Light from the luminaire being tested (A) is reflected by a rotating mirror (B) to an illuminance meter (C) which measures the light at predetermined intervals. After the mirror has made a complete revolution the luminaire itself is rotated horizontally to a predetermined location, and the process is repeated.

BETTER MEASURES CONTINUED FROM PAGE 25

naire again. When the luminaire has made a complete rotation—its light output has been measured all the way around in up to 720 pre-determined increments—the process is complete. The numbers that actually appear in the candela distribution charts are the result of this intensive data gathering process.

Basic far-field photometry was developed for the testing of incandescent-lamped street lighting, and may even have been used at one time to test gas lights. Although the equipment that is available today is extremely complex, the principal has remained fundamentally unchanged for over 80 years.

The process has remained unchanged for so many decades because it does adequately measure the output and distribution of lighting fixtures that, when in use, are normally located some distance away from the surface at which the light is being projected.

Far-field photometry has its limitations, however, when it comes to measuring the light distribution of fixtures that are intended to be a short distance from the surface they illuminate. This is because the photocell is so far away from the luminaire and the position of the accompanying architectural reflecting surfaces—which is not used in the testing procedure—that the photocell cannot discern the true photometric characteristics of the luminaire. These fixtures may include wallwashers, sconces, some task lights, and indirect fluorescent luminaires.

Peerless Lighting, of Berkeley, CA, a manufacturer specializing in indirect lighting technology, has long been concerned about improving the accuracy of the photometric reports for indirect lighting products. Under the direction of its vice president for research and development, Peter Ngai, PE, FIES, the firm has spent the last several years conceptualizing and developing a new method of measuring candela distribution, called near-field photometry. Peerless has been using this method for testing its own luminaires since January of this year.

THIS NEAR-FIELD photometer uses a photocell (B) to take measurements from only 12" away from the test luminaire. The luminaire is rotated a predetermined distance horizontally after each pass of the photocell (A) is completed.
Basically, near-field photometry uses a photocell to directly measure the light output and distribution of a luminaire at distances that are close to where the luminaire would be directing the light—no mirror is used. By placing the rotation of the photocell as close as 8 inches from the luminaire, ceiling brightness ratios and maximum ceiling luminances can be predicted accurately. This data is critical to predicting the success of indirect lighting applications.

A new type of photometer was required to take these measurements, and was developed in 1985 by Peerless in collaboration with Independent Testing Laboratories, of Boulder, CO, and Lighting Optics, also of Boulder. In addition, Peerless developed a mathematical model for gathering these measurements, and a second mathematical model for interpreting them.

The differences in the candela distribution plots for the same indirect fixture that has been tested with both far- and near-field photometry are readily apparent when compared. The candela distribution plot generated using far-field photometry (see chart on page 25) has three plots: one using measurements taken parallel to the axis of the fixture’s fluorescent lamp, one taken at 45 degrees to the lamp, and one taken perpendicular to the axis of the lamp. All three plots have very rounded curves, with the center plot, where the candela distribution is taken parallel with the lamp, almost circular in shape.

The near-field test plots, also on page 25, are much flatter, and V-shaped, indicating that the fixture actually has a very different light distribution than the far-field plot would indicate, and that significantly less light is distributed directly over the fixture itself. The near-field distribution plot is more accurate than the far-field plot because measurements are made near the fixture—rather than from some 20 feet away—and it is here that the luminaire’s performance is critical.

According to Peter Ngoi, "The introduction of near-field photometry is important from two different perspectives. From a purely scientific point of view, it gives us a more accurate system of measurement, which is impossible to accomplish with traditional far-field measurement and calculation techniques."

"More important, the photometric reports it yields give designers a more precise picture of what indirect lighting fixtures, and therefore, indirect lighting schemes will—and will not—accomplish."

From 0 to 90 vertical degrees are called direct; those distributing light only above 90 degrees are indirect; those emitting light from 0 to 180 degrees are called direct/indirect.

The greater the number of angles and planes reported in the chart, the better the resulting description of the fixture's performance. Fixtures that have a symmetric distribution can be reported in one plane (0 degrees). An asymmetric distribution requires at least three planes (0, 45, 90). Five plane data is superior to three plane, but a highly asymmetric fixture may require measurements in planes at 10 degree intervals.

**Type “A” Versus Type “B”**

Type “A” photometry is most common since it is used for general lighting fixtures. A special case is type “B” photometry. This is often used for floodlighting fixtures. This method places the light center of the fixture at the goniophotometer center (0 degrees vertical by 0 degrees horizontal) and plots the readings in the angular coordinates surrounding these axes. The information that is derived from these readings is very specific to a floodlighting application, so for this discussion we will stay with the more common “A” chart.

**Graphic Representations**

Often, the photometric data that a manufacturer shows in its catalogue does not list candela values but plots them on a curve. The result is a graphic representation of the fixture distribution. This is great if you need a visual impression of the performance—a valuable aid to conceiving the effect upon a space. However, it is a very cumbersome and inexact way to report the actual performance. Most manufacturers will provide a candela chart if asked, but the “enlightened” ones include it on their standard catalogue sheets.

The candela values are used directly in luminance and illumination calculations of various kinds. These include simple hand-calculations such as the point-by-point inverse square law type or computer-based flux transfer methods. They are also the sources for other data listed on the report.

**Candela Begets Other Data**

These data can include zonal lumens, coefficients of utilization, average luminaire luminances, fixture efficiency, spacing-to-mounting height ratio, and visual comfort probability. They each describe a portion of the fixture's performance. Some give us application criteria and numbers to use in calculations, while others quantify the lighted appearance of the fixture. As a total package of information, it provides a good profile on the fixture. Reported separately, or without the candela chart, the individual tables only tell part of the story. They can even be misleading.

**Fixture Efficiency**

Fixture efficiency is just such a piece of data. This is the percentage of lamp lumens emitted by the fixture. It is often computed by summing the zonal lumens, dividing by the nominal lamp lumens, and multiplying by 100. Zonal lumens, calculated from the candela chart, are the quantity of
PHOTOMETRICS
CONTINUED FROM PAGE 27

lumens emitted by each angular zone on the chart. Simply stated, fixture efficiency tells you how much of the visible energy generated within the fixture is getting out to the space. It relates to electrical efficiency since the wattage consumed by the fixture should be effectively applied as light, not spent as heat.

Efficiency has often been used to select one fixture over another, but it is an incomplete criteria. Based on the calculation, the most efficient fixture will be a bare lamp. How many office lighting applications are best served by bare lamps? Obviously, efficiency must be evaluated along with the candela distribution and luminaire luminances as they relate to the application. Without this data for comparison, it has no meaning to the designer.

COEFFICIENT OF UTILIZATION

A coefficient of utilization (CU) is an extremely useful piece of information. This is the fraction of lamp lumens emitted by a fixture that ultimately reaches a task surface located within a room of specific proportions and surface reflectances. It is derived from the candela chart using a flux transfer calculation method. As a quantity, it relates the candela distribution of the fixture to its application. Coefficients used in zonal cavity calculations give designers a shorthand means to test their assumptions and compare the performance of alternate systems.

It is, however, a very narrow basis for comparison. The calculation assumes a symmetrical layout of fixtures in a room finished in Lambertian surfaces. It calculates one average footcandle value for the complete space. It does not address critical details such as surface luminances and brightness ratios. However, it is often good enough for an experienced designer who can intuitively add the details to their mental image of the lighted space.

Like fixture efficiency, the coefficient of utilization can be misapplied. Some specifiers use coefficients as criteria to judge the appropriateness of a fixture selection. That is, they target a coefficient as the minimum performance for fixtures in a specific application. This denies the possibility that fixtures with lower CDs, which may have lower aperture brightness, could produce higher levels of visibility—compare the CUs of lensed and louvered troffers.

SPACING CRITERIA

The fixture spacing-to-mounting height ratio is an aid to laying out a pattern of fixtures. Multiply the ratio by the mounting and you will get the maximum fixture spacing that will still provide even illumination.

The mounting height is the distance from the fixture to the surface you are lighting. This may be the office workplace or the floor of a corridor.

The ratio is a useful piece of information to consider if you are using zonal cavity calculations. The calculation will let you do a layout that meets your average footcandle criteria but exceeds the fixtures’ spacing ratio—just change those two-lamp fixtures to four-lamp fixtures. The result is shadowy
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PHOTOMETRICS CONTINUED FROM PAGE 28

lighting. This can be a real pitfall in open-plan offices with low partitions.

But be careful of lighting offices with fixtures having spacing ratios that exceed 1.4. This ratio means the fixture will emit more of its light at high vertical angles, which may produce a glare condition. Alternately, those fixtures with spacing ratios below 1.4 will have less vertical distribution. Perimeter walls will be in shadow unless the last row of fixtures is close by. This can happen with parabolic troffers, especially the small-cell type. You must pay attention to the perimeter spacing of these fixtures or the room could take on a gloomy appearance.

VISUAL COMFORT PROBABILITY

Visual Comfort Probability (VCP) is the measurement used to evaluate discomfort glare caused by luminaires directly in the field of view. It helps the designer determine whether a room occupant will find the fixture brightness acceptable. VCP values are derived from calculations that relate the candela chart to some room parameters and test data developed on actual lighting installations. The optimum condition scores a VCP of 100. The IES tells us a VCP of 70 or greater is acceptable to avoid direct glare, although a VCP above 80 is recommended for spaces using VDT equipment.

It is important to note that VCP values are presented for very specific conditions. Room reflectances are 80 percent for ceilings, 50 percent for walls, and 20 percent for floors. Horizontal illuminance is 100 footcandles at 30 inches above the floor. The tables list VCP values calculated for a fixed program of room lengths and widths, ranging from 20 feet \( \times \) 20 feet to 100 feet \( \times \) 100 feet, and for ceiling heights of 8.5, 10, 13, and 16 feet. Unfortunately, these parameters do not always relate to actual project conditions which may include rooms smaller than 20 feet \( \times \) 20 feet and illuminances less than 100 footcandles.

VCP is a fairly rigid metric since it cannot be directly converted to other room conditions. It is different from the other data on the photometric report because it does not directly describe the fixture or the room, but rather postulates the occupant's reaction to the lighting system. Consequently it has value only as a means to compare fixtures against a fixed set of criteria, apart from the project application.

FIXTURE LUMINANCE

With all the current interest in VDT (video display terminal) lighting, fixture luminance has become a prominent item on the photometric report—sometimes notable by its absence. If listed, the table of luminances on the report is generally the fixture's average luminous exitance expressed in lumens per square feet (footlamberts) as viewed from the listed angles. It tells us about the perceived brightness of the fixture from a particular viewpoint. A bright fixture in the field of view makes seeing difficult. A bright fixture aperture will also create an annoying reflection in a VDT screen. It is important to evaluate the apparent brightness of a fixture within the context of its application. Usually you need the seamless
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PHOTOMETRICS
CONTINUED FROM PAGE 30

appearance of “quiet” downlight apertures; sometimes you want things to “pop.” You can make this determination with the photometric report.

Even if the manufacturer has not provided a table of average footlamberts, you can calculate them from the candelas chart yourself. Candelas per square feet are luminous intensity. You can convert them to luminous flux through multiplication by $\pi$. As shown in Figure A, candelas charted for a particular angle should be divided by the fixture’s projected area at that angle. Multiply by $\pi$ and you have footlamberts for that viewing angle.

The biggest problem you will have is determining the actual area of the fixture aperture. Troffer manufacturers, for instance, list only the nominal door size—1 foot x 4 foot, 2 foot x 2 foot, etc. This is larger than the actual aperture. If you cannot get the actual size, a good estimate is to assume the aperture is about 2.5 inches or 0.2 feet smaller in width and length than the nominal door size—0.8 foot x 3.8 foot for a 1 foot x 4 foot. Downlight aperture sizes are normally listed, so your calculation can be quite accurate.

Statements about acceptable fixture luminances become quite specific when you are discussing a VDT space. Current IES recommendations are that the fixture should not present more than 250 footlamberts at 55 degrees and above. European standards are more stringent, calling out a maximum luminance of 200 candelas per square meter (approximately 60 footlamberts) at 55 degrees and above. There are no maximum luminance recommendations yet for fixtures in non-VDT areas, but follow the European standard if you want a very “quiet” look.

READ THE SUBTEXT

Manufacturers reveal a little about themselves by the way they format photometrics for their catalogues. The cut sheet that shows only a candelas curve (without values) and a CU table may come from a manufacturer who does not want to tell you very much about its fixture. A candelas chart with a 10-year-old test date portrays a manufacturer who either spends a long time between innovations or is not concerned with getting you the best information. Catalogue sheets that stress fixture efficiency or spacing criteria may indicate a manufacturer who misunderstands current design priorities. A manufacturer who lists VCP’s but not luminances does not understand the needs of the designer.

Designers must have complete and accurate information about the lighting fixtures they include in their specifications. It should be presented in a manner that allows them to manipulate the data to study and compare aspects of the fixture as they require. Manufacturers of high-quality products have nothing to fear from this process. It will reinforce their position by allowing designers to prove the quality for themselves.
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The DIRECTORY runs from the general—an alphabetical listing of manufacturers' names, addresses, and phone and FAX numbers, to the specific—listings by product type. For those specialized products which did not fall into any broad categories, we've devised a miscellaneous product-type section for easy reference.

Also included is a compilation of design centers around the country and a brief listing of lighting-related associations.

We hope you will keep this valuable resource on hand through this year and the next. And your suggestions are always welcome as to how we can make it even better in future editions.

WANDA JANKOWSKI
EDITOR
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Florida Power & Light, 8700 W. Flagler St., Ste. 200, Miami, FL 33174
(305) 227-4555

Focus Low Voltage Landscape Lighting, Focus Industries, Inc., 12117 E. Slauson Ave., Santa Fe Springs, CA 90670
(213) 696-3993
FAX: 213-943-8000

Forecast Lighting Co., 500 N. Oak St., Inglewood, CA 90302
(213) 678-5151
(800) 456-9990
FAX: 213-671-4987

Foremost Mfg. Co. Inc., 941 Ball Ave., Union, NJ 07083
(201) 687-4646
FAX: 201-687-4682

Forum, Inc., 214 N. Lexington Ave., Pittsburgh, PA 15208
(412) 244-8780
FAX: 412-244-9032

Freshman & O’Conner Mfg., 425 Martingale Dr., Schaumberg, IL 60173

(312) 240-2400
FAX: 312-240-2719

Future Classics, 155 E. 23rd St., New York, NY 10010
(212) 598-0486

G

GE Wiring Devices, General Electric Co., 225 Service Ave., Warwick, RI 02886
(401) 886-6200
FAX: 401-886-6250

GTE Sylvania Lighting, GTE Electrical Prods., 100 Endicott St., Danvers, MA 01925
(508) 777-1900
FAX: 508-750-2152

(same advertisement on pages 4-5)

SYLVANIA

GTE

THE POWER IS ON

Gammaxus Systems, 416 W. Maple Ave., Montanica, CA 91016
(818) 356-5996
(800) 356-3275
FAX: 818-357-1567

Garcy - Major Lighting, Liberty Lighting, PO Box 39510, Chicago, IL 60639
(312) 384-1000
FAX: 312-252-4366

Garco Lighting, 2661 Alvarado, San Leandro, CA 94577
(415) 357-6900

Gemco Studios, Inc., 321 Riverside Dr., Northampton, MA 01060
(413) 586-8710

General Electric Lighting Business Group, Nela Park, Cleveland, OH 44112
(216) 286-2121
(888) 523-5520
FAX: 216-206-6346

(same advertisement on pages 10-11)

General Electric Co./Lighting Systems Dept., P.O. Box 4506, Spartanburg Hwy., Hendersonville, NC 28793
(704) 693-2000
FAX: 704-693-2112

Georgian Art Lighting Design, PO Box 325, Lawrenceville, GA 30046
(404) 964-6221
(800) 241-8126
FAX: 404-964-6225

Gilbert Emergency Lighting, Don Gilbert Inds., Inc., 5611 W. Greenway Rd., Phoenix, AZ 85053
(602) 949-3200
(602) 949-3222

(see advertisement on page 9)

H

Hacker Inds., 1501 Westcliff Dr., PO Box 3, Littlestone, CA 96302
(415) 231-1060
(800) 551-2425

Guth Lighting, Jacobsen Ind., 2615 Washington Blvd., Saint Louis, MO 63103
(314) 533-5200

Halo Lighting, Cooper Lighting, 400 Busse Rd., Elk Grove Village, IL 60007
(708) 956-8400
FAX: 708-456-1537

Hanover Lantern, Hoffman Prods., Inc., 470 High St., Hanover, PA 17311
(717) 632-6464
(800) 235-7196
FAX: 717-632-5059

(same advertisement on pages 6-7)

H august 1990

H.W. Harris Lighting, 4015 Airport Exit Rd., Monroe, NC 28110
(704) 285-7477
(800) 942-9345
FAX: 704-285-0880

Hi-Lite Mfg. Co., Inc., 8515 Chetle Ave., Santa Fe Springs, CA 90670
(213) 945-5608

Hinkley Lighting, 12600 Brea Rd., Cleveland, OH 44111
(216) 671-3500
FAX: 216-671-4537

(same advertisement on page 60)

Holophane Co., Inc., 214 Oakwood Ave., Newark, OH 43055
(614) 345-9631
FAX: 614-549-4486

Honeywell, Inc., Residential/Build. Controls, 1985 Douglas Dr, Minneapolis, MN 55422 (612) 542-7277
FAX: 612-542-6982

Hubbell Inc., State St. & Bostwick Ave., Bridgeport, CT 06605
(203) 333-1181
FAX: 203-368-6245

Hubbell Lighting, Hubbell Inc., 2000 Electric Way, Christiansburg, VA 24073
(540) 582-0111
TELEX: 24-707-719
FAX: 703-382-1526

Humphrey Prods Co., PO Box 2008, Kalamazoo, MI 49003-2008
(616) 381-5500
FAX: 616-381-4113

Hunter Fan Co., 2500 Frisco Ave., Memphis, TN 38114
(901) 745-1560
FAX: 901-745-9376

Hydrel, 12881 Bradley St., Sylmar, CA 91342
(818) 362-9465
FAX: 818-362-6548

(see advertisement on page 29)
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Fax 516-378-0624

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K
KS-H, Inc., ICI, 10091
Manchester Rd., Saint Louis,
MO 63122 (314) 966-3111
(800) 325-9577
FAX: 314-966-6134
Kalwall Corp., PO Box 237,
Manchester, NH 03051
(800) 258-9777
Kenee Lighting Prod., 45
Industrial Ave., Wilmington,
MA 01887 (508) 657-7600
FAX: 508-658-2388
Kelsey-Kane Lighting, 451 N.E.
11th Ave., Oakland Park, Fl.
33334 (305) 772-5187
(800) 4445-5117
FAX: 305-782-8408
Kenro Light, Inc., 8067 Melrose
Ave., #B404, Los Angeles,
CA 90069 (213) 695-6510
FAX: 213-159-1708
Kennedy Intl., Hunter-Melnor
Inc., 11660 Central Pkwy.,
Jacksonville, FL 32216
(904) 642-4340
FAX: 904-642-4340
Kichler Lighting, 1541 E. 88th
St., Cleveland, OH 44139
(216) 431-5400
(800) KICHLER
FAX: 216-431-4765
Kim Lighting, 1655 E. Gale
Ave., City of Industry, CA
91749 (818) 968-5666
FAX: 818-330-8861
King Luminare Co., Inc., Stress
Crete Ltd., PO Box 266,
1353 State, Rt. 46N,
Jefferson, OH 44047
(216) 576-9073
FAX: 216-576-9073
The Kirlin Co., 5401 E. Jefferson
Ave., Detroit, MI 48207
(313) 259-6400
FAX: 313-259-3121
Koch & Lowy, Inc., 21-24 39th
Ave., Long Island City, NY
11101 (718) 786-3520
FAX: 718-937-7608
Kohsun Ind., Inc., 2145 E.
Sacramento St., Los Angeles,
CA 90021 (213) 627-9102
Komotech, 447 W. Garvey Ave.,
Monterey Park, CA 91754
(818) 571-1729
Kosemp Mfg. Co., 3760 M St.,
Philadelphia, PA 19124
(215) 533-7110

(800) 733-7122
FAX: 215-744-5220
Kreon, 41 E. 11th St., New York,
NY 10003 (212) 593-3540

LEE Colortron Inc., LEE
Panavision Intl., Inc., 1015
Chesnut St., Burbank, CA
91506 (818) 843-1200
FAX: 818-954-8520
LSI Lighting Systems, LSI
Inds., 10,000 Alliance Rd.,
Cincinnati, OH 45242
(513) 793-5320
FAX: 513-793-0147

(see advertisement on page 19)
LTM Corp. of America, 11646
Pendleton St., Sun Valley,
CA 91352 (818) 767-1513
(818) 762-4291
FAX: 818-767-1442
LUMAX Inds., Inc., Chesnut
Ave. & Fourth St., Altoona,
PA 16605 (814) 944-4257
FAX: 814-944-6413

Lumari Lighting, Jac. Jacobsen
Inds., Inc., PO Box 111,
Wakefield, MA 01880
(714) 549-9765
FAX: 714-452-1901
Lamar Lighting Co., 88 Albany
Ave., Freeport, NY 11520
(516) 379-4200
FAX: 516-379-4205
Laser Media Inc., 6585 Arizona
Circle, Los Angeles, CA
90045 (213) 338-2290
FAX: 213-338-9221
Lavery Lighting, Casablanca
Inds., 15747 Strathern St.,
Van Nuys, CA 91406
(818) 786-7850
(800) 888-8814
FAX: 818-786-0954

Levin Diccioco, 455 Business
Ctr. Dr., Horsham, PA
19044 (215) 672-4800
Leviton Mfg., Co., Inc., 50-25
Little Neck Pkwy, Little
Neck, NY 11362
(718) 229-4040
(800) 824-3005
TELEX: 710-582-2632
FAX: 800-824-9538
Lexalite Intl., Co., PO Box 498,
Charlevoix, MI 49720
(616) 547-6854
FAX: 616-547-5833

Light Design Corp., 4201
Salzato St., Coral Gables, Fl.
33147 (305) 858-6819
FAX: 305-445-0474
Light Space Design, 2111 Vine
St., Ste. B, Berkeley, CA
94709 (415) 843-8530
(800) 779-8899
FAX: 415-540-6025
Light Standard By Scholl, P.O.
Box 704, Bergen St.,
Baltimore, PA 18016
(800) 529-9622
FAX: 215-867-7147

Lighting Analysts Inc., 10572
Park Mountain Rd.,
Littleton, CO 80127 (303) 972-8852
FAX: 303-972-8851

(see advertisement on page 57)
Lighting Bug Ltd., 320 W.
202nd St., Chicago Heights,
IL 60411 (312) 755-2100
(800) 323-5226
FAX: 772-5543
FAX: 312-421-5444
FAX: 415-540-6025
Lighting Industries By DeBaun
Lighting, DeBaun Lighting
Co., Inc., 240 S. Raymond
Ave., Alhambra, CA 91801
(818) 529-9622
FAX: 215-867-7147

Lighting Sciences, Inc., 7830 E.
Espresso Ave., Lomita, CA
90717 (510) 579-8139
FAX: 510-579-8139
FAX: 714-598-7815
Lightcontrol Corp., PO Box 100
48121, 100 Hawks Ave.,
Hanson, MA 02341-0100
(617) 294-0100
FAX: 617-295-2849
Litelab Corp., 251 Elm St.,
Buffalo, NY 14205
(716) 856-4300
FAX: 716-856-0156
Littell Suppl., 1524 S. Peoria St.,
Chicago, IL 60610
(312) 421-7753
(800) 24-LIGHT
FAX: 312-421-5444
Litetouch, Inc., 3783 S. 500 W.,
#7, Salt Lake City, UT
84115 (801) 268-8668
FAX: 801-268-9200
Lighttronics Intl., RCS Industries,
Inc., 517 W. 123rd St.,
Aspen, IL 60658
(708) 371-4955
(800) 523-3392
TELEX: 140344 LITE
FAX: 708-571-0627
Lithonia Lighting, PO Box A,
1355 Industrial Blvd.,
Conyers, GA 30097-0067
(404) 922-9000
TELEX: 261881
FAX: 404-922-1841

(see advertisement on Cov. A)
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Today, the rich traditions of these brands have been combined to form Voltarc Technologies, an integrated manufacturer of state-of-the-art lighting components with an unflagging dedication to provide superior user value and trademark service to lighting designers the world over.

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R

RBT, 12 Executive Campus, Cherry Hill, NJ 08002
(609) 488-5500
FAX: 609-488-1424

R.D.S Lighting Inc., 413 S. 21st Ave., Hollywood, FL 33020
(305) 922-5011
FAX: 305-921-0154

RLS Corp Welsbach Light, 240 Sargent Dr., New Haven, CT 06511
(203) 789-1710
FAX: 203-770-0944

Radio Ind., Inc., 2525 W. Moffat St., Chicago, IL 60647
(312) 252-3400
TELEX: 272742
FAX: 312-252-3515

Ransbusch Lighting, Ransbusch Decorating Co., 40 W. 13th St., New York, NY 10011
(212) 675-0400
(212) 828-9007
FAX: 212-620-4087

Raztech Lighting, 1192 Riechert, Breck, IL 60417
(708) 672-4325

Regis U.S.A., Lighthouse of Cornwall, 65 River Rd., New Windsor, NY 12550
(914) 656-6500
FAX: 914-962-3282

Rejuvenation Lamp & Fixture, Rejuvenation House Parts Co., 901 N. Skidmore, Portland, OR 97217
(503) 249-0774
FAX: 503-281-7948

Rejuvenation Lighting, 4200 Sepulveda Blvd., Culver City, CA 90230
(213) 836-1572
FAX: 213-836-1578

Roberts Step-Lite Systems, P.O. Box 18796, 4501 N. Western Ave., Oklahoma City, OK 73154
(405) 528-7738
(800) 654-8268
FAX: 405-528-7753

Rohm & Haas, Adv. Dept., 4th Fl., Independence Mall West, Philadelphia, PA 19105

Rosser Fabbric Int'l., 524 W. Peachtree St., N.W., Atlanta, GA 30308
(404) 876-3800
FAX: 404-872-9279

(718) 392-5060
FAX: 718-392-9811

Royaltye P.O. Box 472, Highland Park, NJ 08904
(201) 846-1212, 846-2199
FAX: 201-846-5414

Ruwad Lighting, Inc., 9201 Washington Ave., Racine, WI 53406
(414) 866-1900
(800) 236-7000
FAX: 414-886-1395

S

SF 12V Inc., 1053 Howard St., San Francisco, CA 94103
(415) 761-6484
FAX: 415-255-4703

SPI Lighting Inc., 10400 N. Enterprise Dr., McQueen, WI 54392
(414) 242-1420
FAX: 414-244-6144

SRB Technologies Inc., 2580 Landmark Dr., Winston Salem, NC 27103
(919) 659-2610
(800) 552-0098
FAX: 919-768-7720

Saxe-Patterson, P.O. Box 15, Taos, NM 87571
(505) 758-9513
FAX: 505-758-4336

Schlage Lock Co., Santa Clara, CA 95054

Schol Light Standards, Scholl Lumber Co., 16121 S. Sepulveda Blvd., Culver City, CA 90230
(213) 787-4131
FAX: 213-867-7147

Shonbek Worldwide Lighting Inc., 4-8 Ind. Blvd., W., Plattsburgh, NY 12901
(518) 563-7500
FAX: 518-563-4228

Self Powered Lighting, Inc., 8 Westchester Pk., Elmsford, NY 10523
(914) 592-8230

Sensor Switch, P.O. Box 1088, School Ground Rd., Brandford, CT 06405
(203) 483-5057
FAX: 203-483-1901

Sentinel Lighting, Airey Thompson Co., 5053 Sierra Pine Ave., Los Angeles, CA 90025
(213) 264-1553
(800) 421-6196
FAX: 213-265-1929

Sentry Electric Corp., 185 Buffalo Ave., Freeport, NY 11520
(516) 379-4600

Scherwill Technologies, Corporation Way, Palo Alto, CA 94303
(415) 962-1111
(800) 365-8794
TELEX: 548357
FAX: 415-967-8713

Southwest Art Lighting, P.O. Box 7428, Albuqueruque, NM 87191
(505) 344-7374

Sparkle Plenty, Inc., 101 E. Ontario St., Chicago, IL 60611
(312) 266-1740
(800) 621-6660
FAX: 312-266-9446

Spaulding Lighting, Inc., Hanson, 1736 Drexam Ave., Cincinnati, OH 45223
(513) 541-4486
FAX: 513-541-4454

Specialty Lighting Systems, P.O. Box 258, New Hudson, MI 48165
(313) 547-7061
(800) 365-1505
FAX: 313-547-7069

Spring City Electric Mfg. Co., Hall & Main Sts., PO Drawer A, Spring City, PA 19475
(215) 948-4000
FAX: 215-948-5577

Spring Lighting Co., Forget Me Not Fashions Inc., 182 E. Jefferson Blvd., Los Angeles, CA 90011
(213) 251-5171

Staff Lighting Corp., P.O. Box 1020, 168 W. N. Highland, Birmingham, AL 35228
(205) 691-6262
FAX: 941-691-6260

Standard Electric Fixture Co., 2150 N.W. Miami Ct., Miami, FL 33127
(305) 573-2020
FAX: 305-576-3575

Starbrite Lighting, 145 Sawmill River Rd., Yonkers, NY 10701
(914) 965-7465
(800) 221-3116
FAX: 914-965-7483

Sternberg Corp., 8501 N. Tripp Ave., Chicago, IL 60646
(312) 477-4777
FAX: 312-267-2055

Stern Lighting Systems, 351 Lewis Ave., Winsted, MN 55595
(612) 485-2141
(800) 328-7480
FAX: 800-328-3635
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(312) 520-1060
(800) 634-0007
FAX: 512-520-1730

The Watt Watcher, 296 Brokaw Rd., Santa Clara, CA 95050
(408) 988-5331
(800) 879-8585
FAX: 408-988-5531

Weirton Steel Corp., 400 Three Springs Dr., Weirton, WV 26062
(304) 797-2941
(800) 624-5480
FAX: 304-797-2267

Wendellighting Jacken, International, 244 N. Naomi St., Burbank, CA 91504
(818) 955-8066
(800) 528-0101
FAX: 818-987-2257

Western Circle, 6700 Northwest 36th Ave., Miami, FL 33147
(800) 842-8251

Western Lighting Inds., Inc., 3540 W. Valhalla Dr., Burbank, CA 91505
(818) 841-7966
FAX: 818-841-8910

Westron Corp., 75 Ninth Ave., New York, NY 10011

Wide-Lite, Genlyte, P.O. Box 606, San Marcos, TX 78667
(512) 392-5821
(800) 782-7653
FAX: 512-352-5822

John Wiley & Sons, Inc., 605 Third Ave., New York, NY 10158
(212) 850-6748
FAX: 818-767-0395

Yorklite Electronics Inc., JSB Electrical Ltd., 3161 State Rd., Bensalem, PA 19020
(215) 244-4201
FAX: 215-244-4208

Xenotech Inc., 11229 Vinedale Ave., San Valley, CA 91352
(818) 767-0395
FAX: 818-767-0395

Yorklite Electronics Inc., JSB Electrical Ltd., 3161 State Rd., Bensalem, PA 12020
(215) 244-4201
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and get the advantages of Aluminination:

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- Easy care in a host of applications: Use with fluorescent, incandescent, HID, quartz and other light
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  HGS-03/R specular is guaranteed to have 88% minimum total reflectivity as measured on the Technidyne TR2
  Total Reflectometer.
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Metalloxyd Anodized Aluminum the original, the best. Our quality shines.

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### BALLASTS

<table>
<thead>
<tr>
<th>PRODUCT TYPE</th>
<th>COMPANY NAME</th>
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</thead>
<tbody>
<tr>
<td>fc — fluorescent, compact</td>
<td>ARC Sales, Inc.</td>
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<td>fd — fluorescent, dimming</td>
<td>Advance Transformer Co., North America Philips Corp.</td>
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<td>fem — fluorescent, electromagnetic</td>
<td>BKL Inc.</td>
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<tr>
<td>fet — fluorescent, electronic</td>
<td>The Bodine Co.</td>
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<td>hem — HID, electromagnetic</td>
<td>CEW Lighting</td>
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<td>hen — HID, electronic</td>
<td>Chloride Systems (fc)</td>
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<td><strong>CONTROLS SYSTEMS</strong></td>
<td>Day-Brite Lighting, Thomas Inds., Inc. (fet)</td>
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<td>b — building energy management systems</td>
<td>Dynamic Energy Prods., Inc., 3M (fc,fem,fet,fd)</td>
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<td>dcm — dimming controls, manual</td>
<td>Elsco Lighting Prods., Inc. (fc)</td>
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<tr>
<td>dcp — dimming controls, preset</td>
<td>Etta Inds., Inc. (fcd,fed,fet)</td>
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<td>dwc — dimming controls, wallbox</td>
<td>GE Lighting Systems, General Electric (hem)</td>
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<tr>
<td>os — occupancy sensors</td>
<td>Globe Lite, Standard Electric Fixture Co. (hem)</td>
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<tr>
<td>pc — photoelectric controls</td>
<td>Globe Lite, Standard Electric Fixture Co. (hem)</td>
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<tr>
<td>s — switches</td>
<td>Globe Lite, Standard Electric Fixture Co. (hem)</td>
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### COMPUTER SOFTWARE LIGHTING PROGRAMS

<table>
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<th>COMPANY NAME</th>
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<td>Abolite Lighting, Inc., LSI Inds.</td>
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<td>Advanced Control Technologies Inc.</td>
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<td>American Electric</td>
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<td>Capri Lighting, Thomas Industries</td>
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<td>Day-Brite Lighting, Thomas Inds., Inc.</td>
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<td>Design Osaka</td>
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<td>Elite Software</td>
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<tr>
<td>GE Lighting Systems, General Electric</td>
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<td>GTE Sylvania Lighting, GTE Electrical Prods.</td>
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<tr>
<td>Holophane Co., Inc.</td>
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<tr>
<td>Joline Corp.</td>
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<tr>
<td>The Kirlin Co.</td>
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<tr>
<td>Laser Media Inc.</td>
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### LIGHTING ANALYSTS INC.

- Speaking of lighting design software...
- 303/972-8852
- fax 303/972-8851

### DECORATIVE LIGHTING

<table>
<thead>
<tr>
<th>COMPANY NAME</th>
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<tbody>
<tr>
<td>American Fluorescent Corp.</td>
</tr>
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</table>
American Lantern Co. (p,s,t)
Antique Street Lamps Inc. (a)
Appleton Lamplighter, Aries Fabrication Corp. (p,s)
Architectural Cathode Lighting
Architectural Lighting Systems (p,s)
Ardee Lighting/USA (t)
Arroyo Craftsman Lighting (a,p,s)
Art Directions Inc. (a,p,s)
Art Specialty Co., Inc. (a,f,t,l)
Artemide, Inc. (f,p,s,t,l)
Atelier Intl. Ltd., Steelcase Inc. (f,p,s,t,l)
Baldinger Architectural Lighting, Inc. (p,s)
Louis Baldinger & Sons Inc. (a,f,p,s)
Bega/FS, Armstrong World Inds. (p,s)
Norbert Belfer Lighting (s)
Boyd Lighting Co. (f,p,s,t,l)
Brass Light Gallery (a,f,p,s,t,l)
Brass Reproduction (a,f,p,s,t,l)
CSL Lighting Mfg. Inc. (p,s,t,l)
Caribbean Worldwide (p,s,t,l)
Casablanca Fan Co., Casablanca Inds., Inc. (f,t,l)
ChiaroIntl., Chiaro srI (a,f,p,s,d)
Classic Lamp Posts, Rotocast (a)
C.W. Cole & Co. (a,p,s)
Columbia Lighting, USI Lighting Inc. (p,s)
Crystorama Inc. (a,f,p,s)
Custom Lighting Concepts, Lighting Concepts Inc. (a,f,p,s,t,l)
Dayton Lighting, Yosgd Lighting Inds., Inc. (p,s)
Dazor Mfg. Corp. (f,t,l)
Design Lighting Prods. Co. (f,p,s,t)
Dreamscape Lighting (p,s,t,l)
Dynasty Classics (f,p,s,t,l)
ELA Co., Environmental Lighting For Arch. (a,f,p,s,t,l)
ElliptiPar Inc. (s)
Elresco Lighting Prods., Inc. (a)
Enco Inds. Inc. (f,t,l)
Esco Intl., Duray Fluorescent Mfg. Co. (s)
FLOS Inc. (f,p,s,t,l)
Feiss Inds. (f,p,s,t,l)
Feiss Industries (a,f,p,s,t,l)
Forecast Lighting Co. (p,s,t)
Future Classics (s)
GE Lighting Systems, General Electric (a)
Garcy - Major Lighting, Liberty Lighting (t)
Gemma Studios, Inc. (f,p,s,t,l)
Georgian Art Lighting Design (a,p,s,t,l)
Gilway Technical Lamp (f,p,s,t,l)
Gross Chandelier Co. (a,p,s)
Hadco, Genlyte (a)
Halo Lighting, Cooper Lighting (p,s,t)
Hanover Lantern, Hoffman Prods., Inc. (a,p)
Hinkley Lighting (p,s)
Holophane Co., Inc. (p,s,t,l)
Hunter Fan Co. (s,t)
Idaho Wood (p,s)
Illuminating Experiences, Inc. (f,p,s,t,l)
Justice Design Group (s)
Kenroy Light, Inc. (f,p,s,t,l)
Kenroy Intl., Hunter-Melnor Inc. (f,p,s,t,l)
Kichler Lighting (p,s)
Koch & Lowy, Inc. (f,p,s,t,l)
Kosempel Mfg. Co. (p)
Lamar Lighting Co. (s)
Lavery Lighting, Casablanca Inds. (f,p,s,t,l)
Lazin Lighting, Inc. (p,s,t,l)
Leiter Lites, Elias J Leiter Co. (f,p,s,t,l)
Light Design Corp. (s)
Lighting Bug, Ltd. (f,p,s,t,l)
Lighting Innovations by DeBaun Lighting, DeBaun Lighting Co., Inc. (a)
Lightolier Inc., Genlyte (a,f,p,s,t)
L'Image Inds., Inc. (f,p,s,t,l)
Lite Source Inc. (f,t,l)
Litecontrol Corp. (s)
Liteline Ltd. (f,t,l)
Robert Long Lighting (a,f,p,s,t,l)
Lucifer Lighting Co. (t)
Luxo Lamp Corp. (t)
M2 Designer's Studio, Inc. (p,s,t)
Marissa Contract Lighting Company, Standard Electric Fixture Co., Inc. (a,f,p,s)
Derek Marshall Lamps & Accessories (s,d)
Matthew Lighting Studio Inc., Standard Electric Fixture Co., Inc. (a,p,s)
MetLux Lighting, Cooper Lighting (t)

**Guaranteeing:**
- Integrity of design
- Professional staff
- Engineering
- Quality materials & products
- American craftsmanship
- Affordability
- North American wide representation
- Delivery

**APPLETON Lamplighter**

The first choice of the design community for custom lighting, architectural metal fabrication.

**AL 615 CC**
2'6" x 2'6"
Painted aluminum, acrylic lens
Six A-19 amps

**AL 405 WS**
1'0" x 6'5" x 6"
Painted steel
One PL-13 lamp

**AL 402 WS**
1'2" x 8'5" x 6"
Painted steel
Two PL-13 lamps

**Circle No. 31 on product card.**
Metropolitan Lighting, Fixture Co., Inc. (a,p,s,t)
Michaels Lighting (a,p,t)
Miniature Lighting Technology Inc. (t)
Modulightor Inc. (p,t)
Morrison (f,p,s,t)
Multiworld Lighting (f,p,s,t)
Neoamericana (s)
Neonetics Inc. (f,s,t)
Nessen Lamps, Inc., Jac Jacobsen Inds, Inc. (f,p,s,t)
Noral Lighting Inc. (a)
Nova Lighting, Inc. (s)
Nulco Mfg. Co. (p,t)
O'Ryan Industries
Peerless Lighting Corp. (s)
Poulson Lighting, Inc., Louis Poulson & Co. (p,s,t)
Premiere Chandelier Inc. (a,p,s)
Progress Lighting (a,p,s)
Prudential Lighting (s)
Rambusch Lighting, Rambusch Decorating Co. (a,p,s)
Fredrick Ramond, Inc. (f,p,t)
Reggiani U.S.A., Lighthouse of Cornwall (p,t)
Rejuvenation Lamp & Fixture, Rejuvenation House Parts Co. (a,f,p,s,t)
Staff Lighting Corp. (s,t)
Starbright Lighting (t)
Sternberg Lanterns, Inc. (a)
Sterner Lighting Systems (p,s)
Stoneaulds Ltd. (s)
sun Valley Lighting (a,s)
Sur-Fin Chemical Corp. (p)
Swivelier Co. (t)
Tech Lighting Inc. (f,p,t)
Teron Lighting Corp. (s,t)
Thomas Inds. Inc. (Corporate) (a,p,s,t)
Thorn Lighting Ltd., Thorn EMIL (f,p,t)
Times Square Lighting (t)
Tivoli Inds., Inc. (t)
Tumblehouse Corp. (p,s)
USI Lighting, Inc., Hansen (p,t)
Union Metal Corp. (a)
Urban Archaeology (a,s,t)
VDBCO (a)
Vida Lighting Corp. (p,s)
Visual Comfort Lighting, Aluminum Louvre Corp. (p,s)
Waldmann Lighting Co. (t)
Western Lighting Inds., Inc. (t)
B-K Lighting (l)
Baldinger Architectural Lighting, Inc. (ed)
Louis Baldinger & Sons Inc. (ed)
Bega/FS, Armstrong World Inds. (b,f,ed,fl,ls)
Beta Lighting (b,f,ed,fl,hr)
Bronzelite, Genlyte (bf,l,s)
CPI Concrete Prods. (b)
Caribbean Worldwide Lighting (b,f,ed,fl)
Carlon, Laarum & Sessions (bf,ed)
Celestial Prod. (l)
Classic Lamp Posts, Rotocast Lighting (b)
C.W. Cole & Co. (b,ed,fl)
Columbia Lighting, USI Lighting Inc. (i)
Crouse-Hinds, Cooper Lighting (bf,fl,hr)
Custom Lighting Concepts, Lighting Concepts Inc. (i)
Dayton Lighting, Vograd Lighting Inds., Inc. (b,f)
DesignPlan Lighting (b,f)
Devine Lighting (b,fl)
Dinico Products, Inc. (h,f)
Dreamscape Lighting (b,ed,fl)
Day-Brite Lighting Inc., Thomas Inds., Inc. (b,h)
Dynasty Classics (ed)
ELA Co., Environmental Lighting For Arch. (ed,lf)
Elliptipar Inc. (b,f)
Elseco Lighting Prods., Inc. (b,f,ed,lf,hr)
Emco Environmental Lighting, Thomas Inds., Inc. (b,h,fl,hr)
Engineered Lighting Prod.
Esco Intl., Inc., Duray Lighting Co. (ed,lf,hr)
Floursam inc. (b,f)
Giacomo Lighting, Genlyte (bf,fl)
Greenlee Landscape Lighting, Mfg., LSI Industries (b,l)
Hadco, Genlyte (b,f,ed,lf,hr)
Hanover Lantern, Hoffman Prods., Inc. (bf,l)
W.F. Harris Lighting (bf,ed)
Hinkley Lighting (l)
Holophane Co., Inc. (b,f,ed,lf,ls)
Hubbell Lighting, Hubbell Inc. (b,f,ed,lf,ls)
Hunter Fan Co. (ed)
Hydrel (l,s)
Idaho Wood (b,fl)
Jammarr Lighting (ed)
John Watson Landscape Illumination (l)
Kelsey-Kane Lighting (b,lf,fl)
Kenro Light, Inc. (b,l)
Kim Lighting (b,f,ed,fl,ls)
King Luminaire Co., Inc, Stress Crete Ltd. (b)
The Kirlin Co. (ed)
Kosempel Mfg., Co. (ed,lf,hr)
LSI Lighting Systems, LSI Inds. (bf,ed,lf)
LUMAX Inds., Inc. (b,ed)
Laser Media Inc. (bf,ed)
Light Design Corp. (ed)
Light Innovations by DeBaun Lighting, DeBaun Lighting Co., Inc. (l)
Lightolier Inc., Genlyte (b,ed,lf,hr)

EXTERIOR
ARCHITECTURAL.

b—bollards
bf—building floodlighting
ed—exterior downlighting
hf—HID & fluorescent parking lot/area lighting
hr—HID roadway
i—incandescent strip lighting
l—landscape lighting
s—submersible

ABEC Lighting, Inc. (b,l)
ARC Sales, Inc. (bf)
Abolute Lighting, Inc., LSI Inds. (ed)
Accent Lite, Linear Lighting Corp. (i)
American Electric (bf,fl,hr)
American Fluorescent Corp. (bf,fl)
American Lantern Co. (i)
Antique Street Lamps Inc. (bf,fl,hr)
Appleton Lamplighter, Aries Fabrication Corp. (b)
Architectural Area Lighting, Hanson Inds. (b,fl,hr)
Architectural Cathode Lighting
Arroyo Craftsman Lighting (ed,l)

B-K Lighting (l)
Baldinger Architectural Lighting, Inc. (ed)
Louis Baldinger & Sons Inc. (ed)
Bega/FS, Armstrong World Inds. (b,f,ed,fl,ls)
Beta Lighting (b,f,ed,fl,hr)
Bronzelite, Genlyte (bf,l,s)
CPI Concrete Prods. (b)
Caribbean Worldwide Lighting (b,f,ed,fl)
Carlon, Laarum & Sessions (bf,ed)
Celestial Prod. (l)
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C.W. Cole & Co. (b,ed,fl)
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Crouse-Hinds, Cooper Lighting (bf,fl,hr)
Custom Lighting Concepts, Lighting Concepts Inc. (i)
Dayton Lighting, Vograd Lighting Inds., Inc. (b,f)
DesignPlan Lighting (b,f)
Devine Lighting (b,fl)
Dinico Products, Inc. (h,f)
Dreamscape Lighting (b,ed,fl)
Day-Brite Lighting Inc., Thomas Inds., Inc. (b,h)
Dynasty Classics (ed)
ELA Co., Environmental Lighting For Arch. (ed,lf)
Elliptipar Inc. (b,f)
Elseco Lighting Prods., Inc. (b,f,ed,lf,hr)
Emco Environmental Lighting, Thomas Inds., Inc. (b,h,fl,hr)
Engineered Lighting Prod.
Esco Intl., Inc., Duray Lighting Co. (ed,lf,hr)
Floursam inc. (b,f)
Giacomo Lighting, Genlyte (bf,fl)
Greenlee Landscape Lighting, Mfg., LSI Industries (b,l)
Hadco, Genlyte (b,f,ed,lf,hr)
Hanover Lantern, Hoffman Prods., Inc. (bf,l)
W.F. Harris Lighting (bf,ed)
Hinkley Lighting (l)
Holophane Co., Inc. (b,f,ed,lf,ls)
Hubbell Lighting, Hubbell Inc. (b,f,ed,lf,ls)
Hunter Fan Co. (ed)
Hydrel (l,s)
Idaho Wood (b,fl)
Jammarr Lighting (ed)
John Watson Landscape Illumination (l)
Kelsey-Kane Lighting (b,lf,fl)
Kenro Light, Inc. (b,l)
Kim Lighting (b,f,ed,fl,ls)
King Luminaire Co., Inc, Stress Crete Ltd. (b)
The Kirlin Co. (ed)
Kosempel Mfg., Co. (ed,lf,hr)
LSI Lighting Systems, LSI Inds. (bf,ed,lf)
LUMAX Inds., Inc. (b,ed)
Laser Media Inc. (bf,ed)
Light Design Corp. (ed)
Light Innovations by DeBaun Lighting, DeBaun Lighting Co., Inc. (l)
Lightolier Inc., Genlyte (b,ed,lf,hr)
<table>
<thead>
<tr>
<th>Company Name</th>
<th>Contact Information</th>
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<tbody>
<tr>
<td>Lumark Cooper Lighting</td>
<td>(b,bf,ed,hf)</td>
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<tr>
<td>Lumiere Design &amp; Mfg., Inc.</td>
<td>(b,bf,ed,lf)</td>
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<tr>
<td>M2 Designer's Studio, Inc.</td>
<td>(i)</td>
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<tr>
<td>Marissa Contract Lighting Company, Standard Electric Fixture Co., Inc.</td>
<td>(bf,ed,lf)</td>
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<tr>
<td>Matthew Lighting Studio Inc., Standard Electric Fixture Co., Inc.</td>
<td>(b,bf,ed,lf)</td>
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<td>McGraw-Edison, Cooper Lighting</td>
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<tr>
<td>Miroflector</td>
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<tr>
<td>Scholl Light Standards, Scholl Lumber Co.</td>
<td>(i)</td>
</tr>
<tr>
<td>Sentinel Lighting, Airey-Thompson Co.</td>
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<tr>
<td>Spring City Electric Mfg. Co.</td>
<td>(bf,ed,lf)</td>
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<tr>
<td>Staff Lighting Corp.</td>
<td>(bf,ed)</td>
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<tr>
<td>Starbrite Lighting</td>
<td>(i)</td>
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<td>Sternberg Lanterns, Inc.</td>
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<td>Sterner Lighting Systems</td>
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<td>Stonco Lighting, Gensyte</td>
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<td>Street Lighting Equipment Corp.</td>
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<td>Sun Valley Lighting</td>
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<td>Swivelier Co.</td>
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<td>Sylvan Designs, Inc.</td>
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<td>Technical Glass Prods.</td>
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<td>Musco Sports-Lighting Inc., Musco Corp.</td>
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<td>Natl. Specialty Lighting Co., Inc.</td>
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<td>Nightscape, Loran Inc.</td>
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<td>Noral Lighting, Inc.</td>
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<td>North Star Lighting Inc.</td>
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<td>Northern Lighting, A.M.I.</td>
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<td>Nova Lighting, Inc.</td>
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<td>Paramount Inds. Corp.</td>
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<td>Phoenix Prods., Co.</td>
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<td>Popovitch Assocs. Inc.</td>
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<td>Poulsen Lighting, Inc., Louis Poulsen &amp; Co.</td>
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<td>RLS Lighting Inc.</td>
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<td>Rambusch Lighting, Rambusch Decorating Co.</td>
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<tr>
<td>Roberts Step-Lite Systems</td>
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<td>Ruud Lighting, Inc.</td>
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<td>Ryther-Purdy Lumber Co.</td>
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<tr>
<td>Saxe-Patterson</td>
<td>(bf,ed,lf)</td>
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<tr>
<td>Sternberg Lighting Controls</td>
<td>(bf,ed,lf)</td>
</tr>
<tr>
<td>Crestron Lighting Controls</td>
<td>(bf,ed,lf)</td>
</tr>
</tbody>
</table>

**Designing Architectural Dimming Systems?**

Keep your most creative ideas from ending up like this.

Crestron Lighting Controls provide price, performance and elegance that turn your best ideas into reality. Take advantage of our unique support team. Call the control hotline today 1 800 237-2041.
FIXTURE COMPONENTS/ACCESSORIES

- lb — louvers/handles
- pd — plastic lenses/diffusers
- rm — reflectors/reflector materials
- r — replacement glass lenses/diffusers

A.L.P. Lighting & Ceiling Prod., Inc. (lb, pd, rm)
ARC Sales, Inc. (lb, pd, rm)
Aluminum Coil Anodizing Corp. (rm)
American Louver Co. (lb)
Amerlux (lb)
Art Specialty Co., Inc. (lb, rm, r)
Brass Reproduction (r)
Dayton Lighting, Yosgad Lighting Inds., Inc. (pd)
Dynamic Energy Prods., Inc., 3M (lb, rm)
Enco Environmental Lighting, Thomas Inds., Inc. (lb, pd, rm, r)
Foremost Mfg. Co. Inc. (lb, rm)
Garcy · Major Lighting, Liberty Lighting (lb, pd, rm, r)
The Great American Market
Holophane Co., Inc. (pd, rm)
Interlock
K-S-H, Inc., ICI (pd)
Kosempel Mfg. Co. (rm)
Light Space Design (lb)
Lighting Services, Inc. (lb, pd, rm, r)
Litelab Corp. (lb, pd)
Lumark, Cooper Lighting MEROFORM/MERO Structures, Inc.
ML Systems, Aluminum Co. of America (rm)
Maximum Tech. (pd, rm)
Metalloxid Inc.
Mid-West Chandelier (lb, rm)
Norton Inds. (lb, pd)
Ottone Co. (r)
Parke Inds. (rm, r)
Pre Finish Metals, Material Sciences Corp. (lb, pd, rm)
Ruid Lighting, Inc. (lb, r)
Siltron Illumination, Inc. (r)
Specialty Lighting Systems (lb, pd, rm)
Spring Lighting Co., Forget Me Not Fashions Inc. (r)
Standard Electric Fixture Co. (lb, pd, r)
Sterner Lighting Systems (lb, pd, r)
Swivelier Co. (lb)
TLA Lighting Castles, Inc. (rm)
Technical Glass Prods.
Tek-Tron Ent., Inc. (rm, r)
Teron Lighting Corp. (lb, pd, rm)
3M Construction Mkt., 3M (rm)
Amerlux (fs, ft, fh, hr)
Amerlux (fs, ft, fh, hr, im, it)
Appleton Lampights, Arses Fabrication Corp. (fs, fi, ii)
Architectural Area Lighting, Hanson Inds. (hi)
Architectural Area Lighting, Hanson Inds. (hi, hi, im)
Arco Lighting (fs, fh, hr, it)
Arco Lighting (fs, fh, hr, it, im)
Arco Lighting/USA (ii, ir, il)
Arroyo Craftsmen Lighting (im)
Art Directions Inc. (fc, vi)
Art Specialty Co., Inc. (fc, fi, fs, fh, hr, im, it)
Baldinger Architectural Lighting, Inc. (fs, fi, fm, hi, im)
Baldinger Architectural Lighting, Inc. (fs, fi, fm, hi, im)
Bega/FS, Armstrong World Inds. (fs, fi, fs, fh, hr, im, it)
Bega/FS, Armstrong World Inds. (fs, fi, fs, fh, hr, im, it)
Beta Lighting (fc, fi, il)
Brass Reproduction (ii)
Brookline Lighting (fs)
Capri Lighting, Thomas Industries (fc, fs, fh, hr, it, ir)
Caribbean Worldwide (fs)
Celestial Prod. (it, ii, ir, il)
Chiaro Intl., Chiaro srl (fs, fm, hi, it, im)
Columbia Lighting, USI Lighting Inc. (fc, fi, fs, fm, hr)
Con-Tech, Conservation Technology Ltd. (it, im)
Crescent Lighting, Genlyte (fs, ft, fm)
Crouse-Hinds, Cooper Lighting (bh, hr)
Cryostoraltr Inc. (im)
Day-Brite Lighting, Thomas Inds., Inc. (fc, fi, fs, ft, fm, bh, hi, hr, hm)
DesignPlan Lighting (fs, fm, hm)
Dreamscape Lighting (fs, il)
Dry-Brite Lighting, Thomas Inds., Inc. (fc, fi, fs, ft, fm, bh, hi, hr, hm)
Dynamic Energy Prods., Inc., 3M (fc, fs, ft, fm, hh, hi, hm, im)
Dynasty Classics (hr, it)
Eastrock Mfg. & Tech. Inc. (fs, fm)
Edison Price Lighting (fc, fi, fh, it, ir, im)
Elliptpar Inc. (fc, fi, fs, fh, hr, i, il)
Elco Lighting Prods., Inc. (bh, bh, hr, hr, hm)
Enco Inds. Inc. (hr, it, ir, im)
Energy Saving Devices Inc. (fc)
Engineered Lighting Prod. (fs, ft, fm, it, ir)
Esco Intl., Inc., Duray Fluorescent Mfg Co. (fs, ft, fm, hr, hm)
FLOs Inc. (fs, ji, ii)
Feiss Industries (it, ii, ir)
Fiberstars (il)
Fibrelite Corp. (hm)
On track with the Nineties...  

NEW DECADE

track lights are specifically designed to use the most advanced tungsten-halogen lamps. The modern 120 V Mini-PAR16, MR16 low voltage and T4 flood lamps provide brilliant, energy efficient task or accent lighting for practically any application.

Cost effective, yet top-quality constructed, these NEW DECADE track lights are commercial grade throughout. Select from contemporary square or cylindrical shapes. Low voltage models feature an integral transformer. A complete line of accessories and track is available.

Just call or write for complete specifications and prices.

Circle No. 33 on product card.
<table>
<thead>
<tr>
<th>PRODUCT TYPE</th>
<th>LAMPS</th>
<th>SYLVANIA</th>
<th>LAMPS</th>
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<tbody>
<tr>
<td>SPI Lighting Inc.</td>
<td>(6f, 6h, 6i, 6i, 6m, 6n)</td>
<td>Sylvania Designs, Inc.</td>
<td>(1t, 1v)</td>
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<tr>
<td>Saxe-Patterson</td>
<td>(6f, 6h, 6i, 6i, 6m, 6n)</td>
<td>Sylvania Lighting, Inc.</td>
<td>(1t, 1v)</td>
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<tr>
<td>Schonbek Worldwide Lighting Inc.</td>
<td>(6f, 6h, 6i, 6m, 6n)</td>
<td>Tek-Tron Ent. Inc.</td>
<td>(1t)</td>
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<tr>
<td>Sentinel Lighting, Airey-Thompson Co.</td>
<td>(6f, 6h, 6i, 6m, 6n)</td>
<td>Thorn Lighting Ltd., Thorn EMI</td>
<td>(1t, 1v)</td>
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<td>Siltron Illumination Inc.</td>
<td>(6f, 6h, 6i, 6m, 6n)</td>
<td>Precision Architectural Lighting</td>
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<tr>
<td>Spaulding Lighting, Inc., Hanson Hi.</td>
<td>(6f, 6h, 6i, 6m, 6n)</td>
<td>Progress Lighting</td>
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<td>Specialty Lighting Systems</td>
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<td>Progress Lighting</td>
<td>(1t)</td>
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<tr>
<td>Spring Lighting Co., Forget Me Not Fashions Inc.</td>
<td>(6f, 6h, 6i, 6m, 6n)</td>
<td>Prentissen Lighting, Inc.</td>
<td>(1t)</td>
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<tr>
<td>Staff Lighting Corp.</td>
<td>(6f, 6h, 6i, 6m, 6n)</td>
<td>Progress Lighting</td>
<td>(1t)</td>
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<tr>
<td>Standard Electric Fixture Co.</td>
<td>(6f, 6h, 6i, 6m, 6n)</td>
<td>Precision Architectural Lighting</td>
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<td>Starbrite Lighting</td>
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<td>Progress Lighting</td>
<td>(1t)</td>
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<td>Sterner Lighting Systems</td>
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<td>Stonco Lighting, Genlyte</td>
<td>(6f, 6h, 6i, 6m, 6n)</td>
<td>Progress Lighting</td>
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<td>Strand Electro Controls, Sub. Rank America</td>
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<td>Precision Architectural Lighting</td>
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<td>Swivelco</td>
<td>(6f, 6h, 6i, 6m, 6n)</td>
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<td>Sylvan Designs, Inc.</td>
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<td>Targetti Inc.</td>
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<td>Tek-Iron Ent., Inc.</td>
<td>(6f, 6h, 6i, 6m, 6n)</td>
<td>Precision Architectural Lighting</td>
<td>(1t)</td>
</tr>
<tr>
<td>Teron Lighting Corp.</td>
<td>(6f, 6h, 6i, 6m, 6n)</td>
<td>Progress Lighting</td>
<td>(1t)</td>
</tr>
<tr>
<td>Thomas Inds., Inc. (C.operative)</td>
<td>(6f, 6h, 6i, 6m, 6n)</td>
<td>Precision Architectural Lighting</td>
<td>(1t)</td>
</tr>
<tr>
<td>Alcan Lighting, Inc.</td>
<td>(6f, 6h, 6i, 6m, 6n)</td>
<td>Precision Architectural Lighting</td>
<td>(1t)</td>
</tr>
<tr>
<td>AC Lighting</td>
<td>(6f, 6h, 6i, 6m, 6n)</td>
<td>Precision Architectural Lighting</td>
<td>(1t)</td>
</tr>
<tr>
<td>American Electric</td>
<td>(6f, 6h, 6i, 6m, 6n)</td>
<td>Precision Architectural Lighting</td>
<td>(1t)</td>
</tr>
<tr>
<td>American Fluorescent Corp.</td>
<td>(6f, 6h, 6i, 6m, 6n)</td>
<td>Precision Architectural Lighting</td>
<td>(1t)</td>
</tr>
<tr>
<td>Amerlux</td>
<td>(6f, 6h, 6i, 6m, 6n)</td>
<td>Precision Architectural Lighting</td>
<td>(1t)</td>
</tr>
<tr>
<td>Appleton Lamplighter, Aries Fabrication Corp.</td>
<td>(6f, 6h, 6i, 6m, 6n)</td>
<td>Precision Architectural Lighting</td>
<td>(1t)</td>
</tr>
<tr>
<td>Architectural Area Lighting, Hanson Inds.</td>
<td>(6f, 6h, 6i, 6m, 6n)</td>
<td>Precision Architectural Lighting</td>
<td>(1t)</td>
</tr>
<tr>
<td>Ardec Lighting/USA</td>
<td>(6f, 6h, 6i, 6m, 6n)</td>
<td>Precision Architectural Lighting</td>
<td>(1t)</td>
</tr>
<tr>
<td>Beghelli Inc.</td>
<td>(6f, 6h, 6i, 6m, 6n)</td>
<td>Precision Architectural Lighting</td>
<td>(1t)</td>
</tr>
</tbody>
</table>
Norbert Belfer Lighting
Beta Lighting (ls)
Bristolite Skylights
CEW Lighting (ls)
Carlon, Lamson & Sessions (lm,ls)
Chloride Systems (lm,le)
C.W. Cole & Co. (le,lb,ls)
Crouse-Hinds, Cooper Lighting (ls)
DesignPlan Lighting (ls)
Devine Lighting (le)
Dual-Lite, General Signal Corp. (lm,le)
Eastrock Mfg. & Tech Inc. (le)
Elliptipar Inc. (le,ls)
Elsco Lighting Prods., Inc. (le,ls)
Emergi-Lite (lm,le)
Enco Inds. Inc. (ls)
Energy Saving Devices Inc. (le)
Engineered Lighting Prod. (le)
Exitronix, Barron Manufacturing Corp. (lm,le)
Fiber Optic Systems, Inc. (f)
Fiberstars (f)
Fibrelite Corp. (flh)
GE Lighting Systems, General Electric (ls)
Gilbert Emergency Lighting. Don Gilbert Inds. Inc. (lm,le)
Globe Lite, Standard Electric Fixture Co. Inc. (lm,le)
The Great American Market Gross Chandelier Co. (lm,ls)
Halo Lighting, Cooper Lighting (lm,le,ls)
W.F. Harris Lighting (lm,ls)
Hinkley Lighting (lm,ls)
Holophane Co., Inc. (lm,le,ls)
Hubbell Lighting, Hubbell Inc. (lm,le,ls)
Idaho Wood (lh)
Illumination Concepts & Engineering (lm,le)
Isolite Corp. (lm,le)
Kim Lighting (le,ls)
The Kirlin Co. (le,ls)
LUMAX Inds. Inc. (le,ls)
Lamar Lighting Co. (lm)
Laser Media Inc. (f)
Lighting Bug, Ltd. (lm,ls)
Lighting Innovations by DeBaun Lighting, DeBaun Lighting Co., Inc. (lm,ls)
Litecontrol Corp. (lm,le,ls)
Lithonia Lighting (lm,le,ls)
Lumark, Cooper Lighting (ls)
Lumenyte Intl. Corp. (flh)
Lumiere Design & Mfg., Inc. (lh,ls)
McGraw-Edison, Cooper Lighting (ls)
Miniature Lighting Technology Inc. (lm)
Morrison (lm)
Mule Emergency Lighting Inc. (lm,le)
Natl. Specialty Lighting Co., Inc. (lm)
Neonetics Inc. (lm)
Northern Lighting, A.M.I. (flh)
Nova Lighting, Inc. (lm)
PEP Lighting, Powered Emergency Prods. (lm,le)
Paramount Inds. Corp. (ls)
Phoenix Prods. Co. (ls)
Progress Lighting (lm,le,lb,ls)
RLS Lighting Inc. (ls)
Rambusch Lighting, Rambusch Decorating Co. (lm,lt)
Roberts Step-Lite Systems (lm,lt)
Rudal Lighting, Inc. (ls)
SPI Lighting Inc. (lm)
SRB Technologies Inc. (lm,le)
Shield Source Inc. (le)
Siltron Illumination, Inc. (lm,le,ls)
Sparkle Plenty, Inc. (lm,le,ls)
Specialty Lighting Systems (lm,le)
Starbrite Lighting (lh,ls)
Sterner Lighting Systems (lh,ls)
Sure-Lites, Cooper Lighting (lm,le)
Teron Lighting Corp. (lm,le,ls)
Thomas Inds. Inc. (Corporation) (lm,le,ls)
Thorn Lighting Ltd., Thorn EMI (ls)
Times Square Lighting (flh)
Tivoli Inds., Inc. (lm)
Trimblehouse Corp. (ls)

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Blacklights—Times Square Lighting

Bulk heads—Caribbean Worldwide

Chandeliers—Tivoli Industries, Inc.

Cleaners—Sparkle Plenty, Inc. (lense & crystal)

Cold Cathode—Architectural Cathode Lighting

Components—A.L.P Lighting & Ceiling Products, Inc. (Wraparound replacements)

Computer program services—Honeywell, Inc. (payback analysis), Joline Corp. (pen plotting systems for CADD), The Kirtlin Co. (point by point lighting), Lighting Technologies (analysis), Lithonia Lighting (point by point, economic analysis, luminaire schedules), Macro Electronics Corp. (lighting management systems), Rosser Fabrap Intl. (fixture schedules), Vertex Design Systems (drawing & management systems)

Concealed track lighting—Allco

Controls—Area Lighting Research Inc. (time clocks), Carlson (touch controls), Cresson Electronics Inc. (power switching systems), Enercon Data Corp. (low voltage), Holophane Co., Inc. (thi-fo aiming for HID), Honeywell, Inc. (ballast dimming controls, low-voltage switching), Lazen Lighting (floor & table lamp portable dimmers), LiteTouch, Inc. (micro-processor based), Lithonia Lighting (relay panels, digital controls), Monarch Lighting Co. (flame effect), Paragon Electric (electromechanical & electronic), Wide-Lite (HID dimming)

Custom fixtures—Appleton Lamplighter, Architectural Area Lighting, Design Osaka (fixture design), ELA Co., Gross Chandelier Co., Lumiere Design & Mfg. Inc., Michaels’ Lighting, Mor-
rison, Paramount Industries, Rambusch Lighting, Sterner Lighting Systems

Decorative fixture finishes—Sur-Fin Chemical Corp.

Electroluminescence—Eltech

Emergency—Holophane Co., Inc. (power supplies, inverters), Siltron (emergency & exit signs, power supplies, inverters)

Entertainment—GE Lighting Systems (photo, stage & studio), Laser Media Inc., Litclab Corp., O’Ryan Industries

European lamps in U.S. voltage—Aamsco Group


Fans, ceiling—Beverly Hills Fan Co., Casablanca Fan Co., Feiss Industries

Fluorescent track luminaires—Janmar Lighting

Glass, filters—Lighting Services, Inc. (glass color filter), Technical Glass products (high-clarity & high-temperature uv filtration glass), Times Square Lighting (color gel).


Lampholders—ARC Sales, Inc., Voltare Technologies Inc.

Low-voltage—Accent Lite, Ardee Lighting/USA, Norbert Beller Lighting (strips), FOCUS Low Voltage Landscape Lighting (also security lighting); compact fluorescent, miniature, and tungsten halogen light sources), Lumiere Design & Mfg., Inc., Miniature Lighting Technology Inc., National Specialty Lighting Co., Inc. (light rope), SF 12V Inc. (cable systems), Starbrite Lighting (tubes), Vista Mfg., Co. (exterior)

Materials—Dayton Lighting (marbleized sheets, formed products), Light Design Corp. (weather-proof concrete blocks), Weirton Steel Corp. (tin & steel products, plates)

Neon—Architectural Cathode Lighting, Neonotics Inc. (art)

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Plastic-coated lamps—Shar-R-Shield, Inc.

Power reducers—Energy Saving Devices Inc., Globe Lite

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