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February 1989
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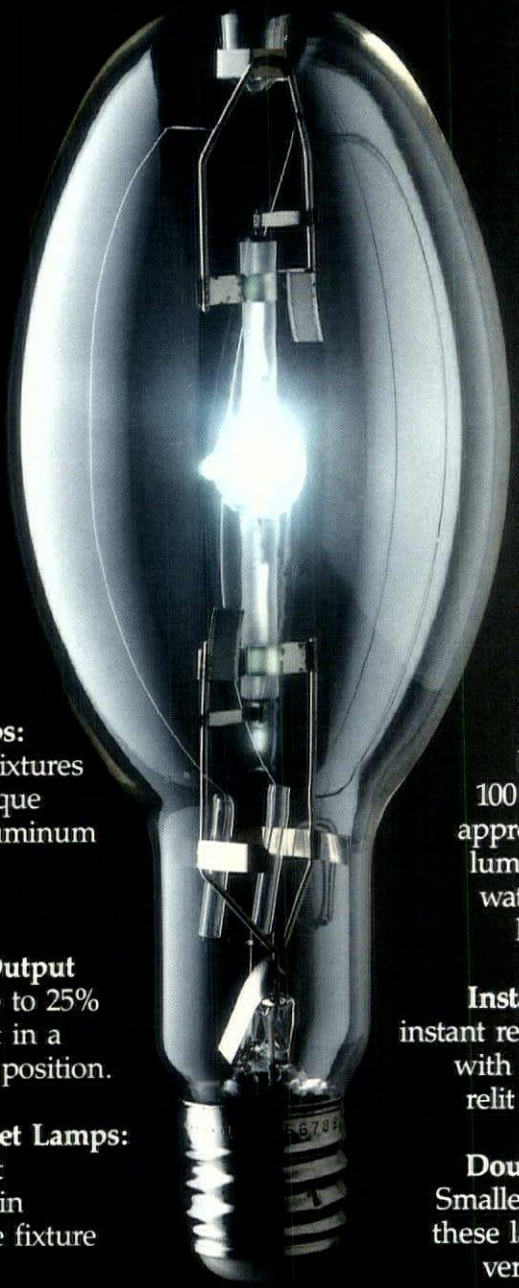

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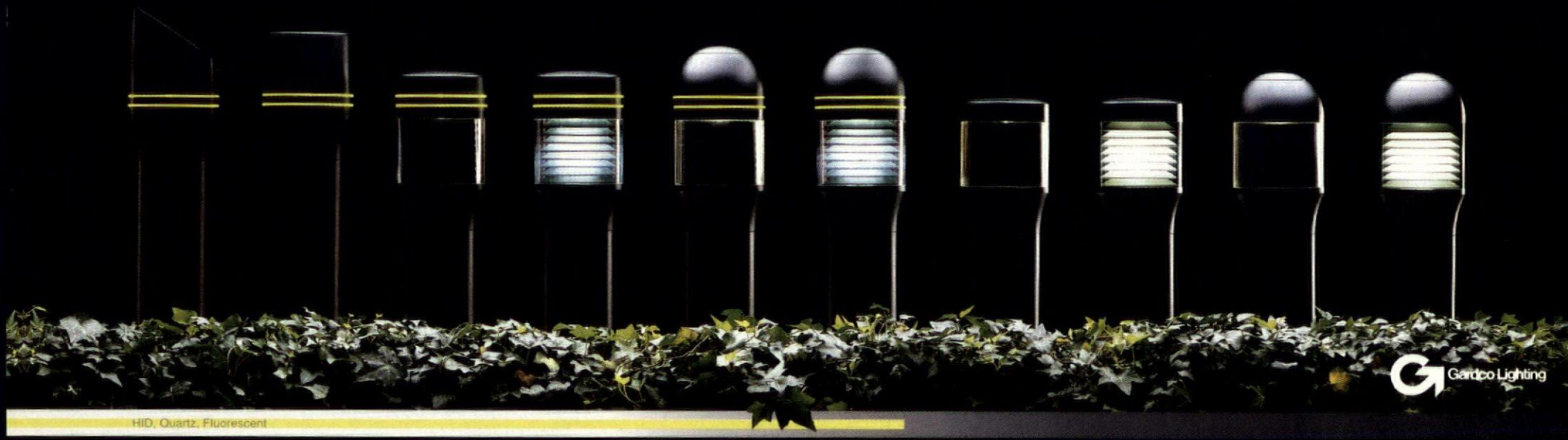

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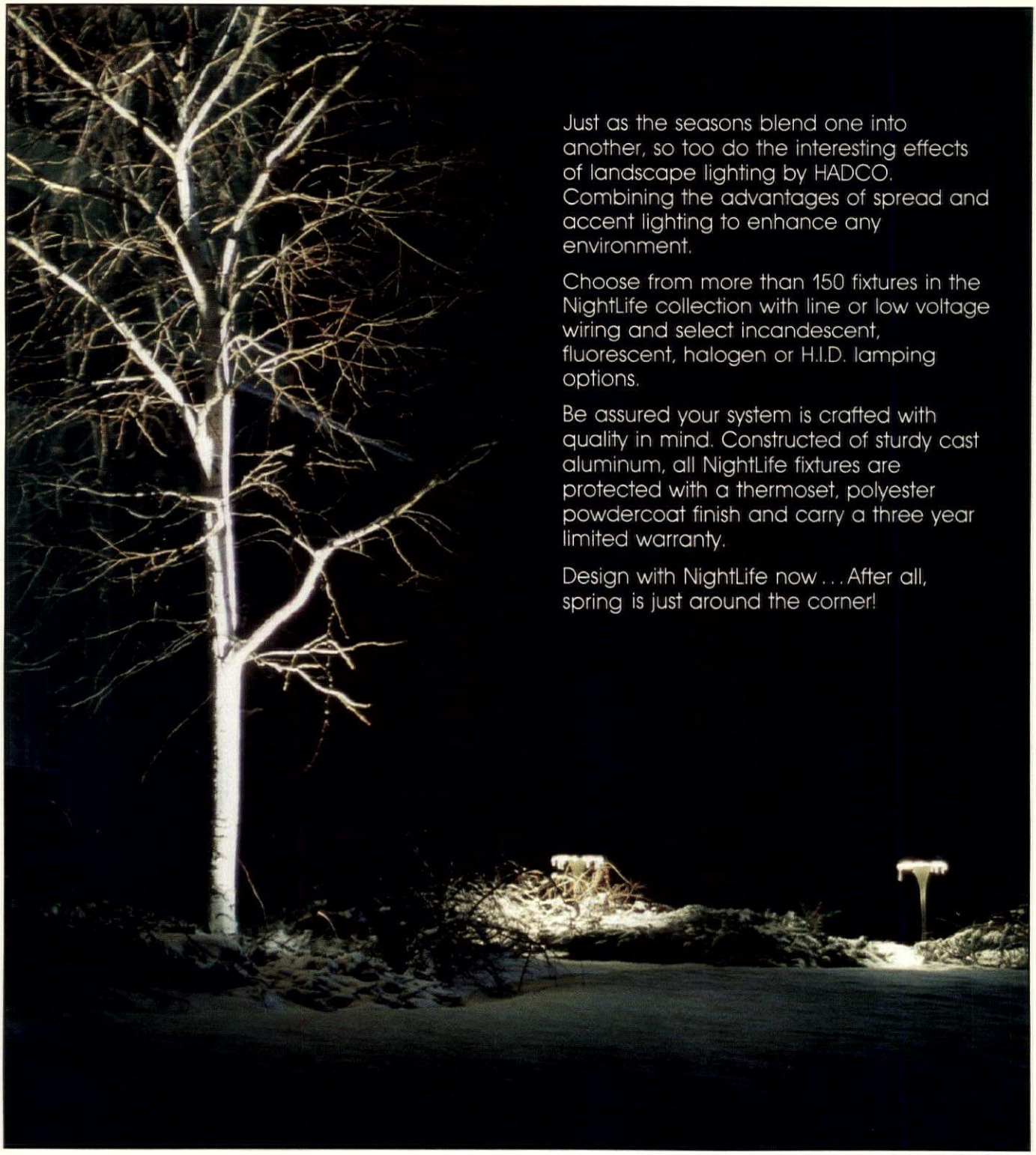

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ARCHITECTURAL LIGHTING

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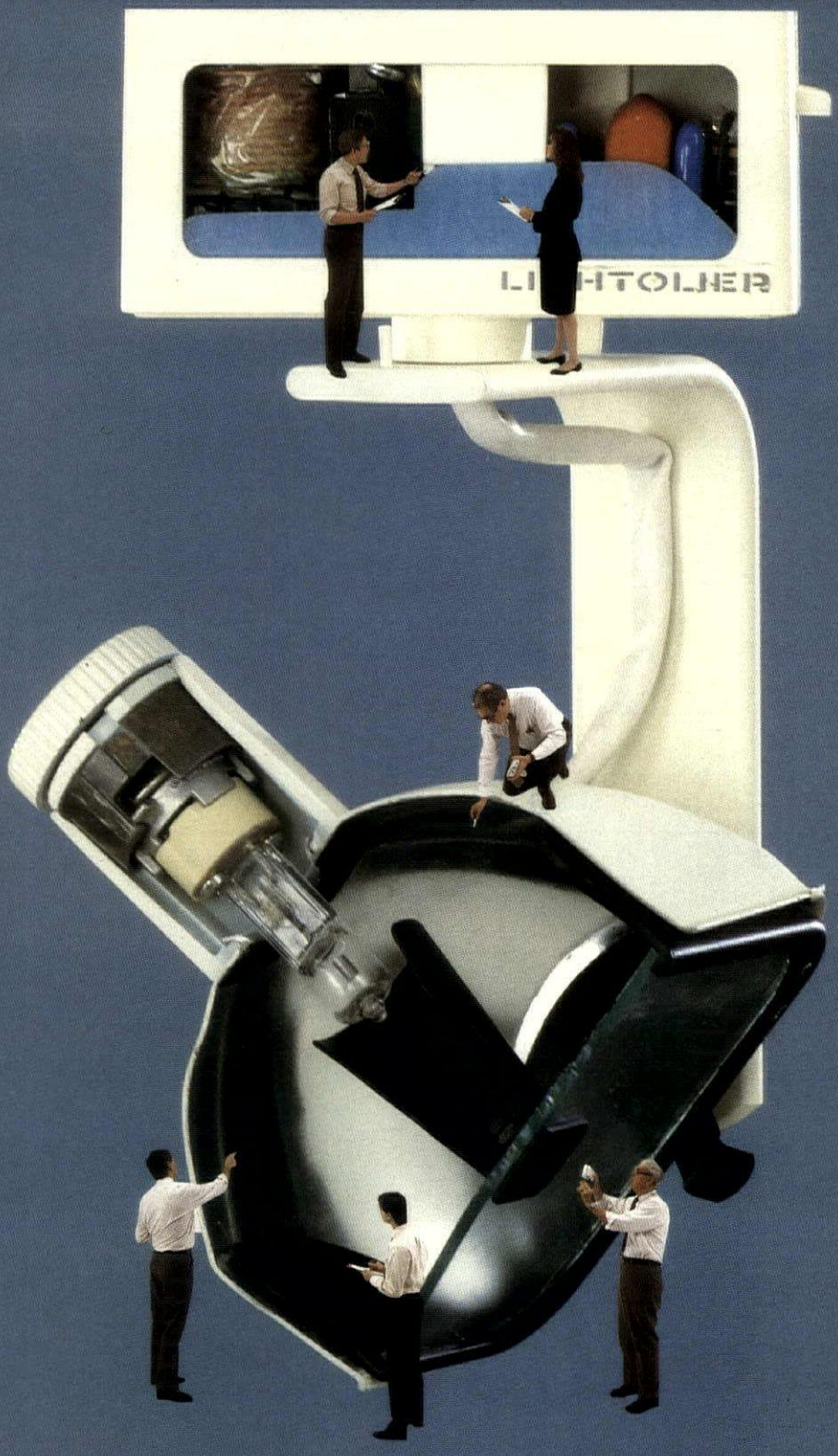
Super Beamer The New Way to Light with Low Voltage



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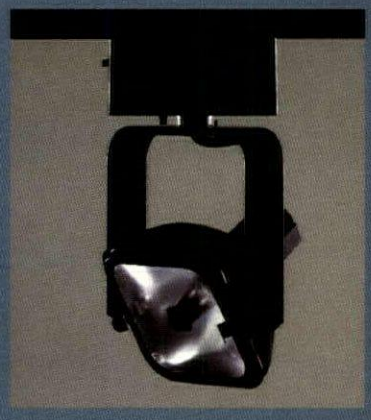

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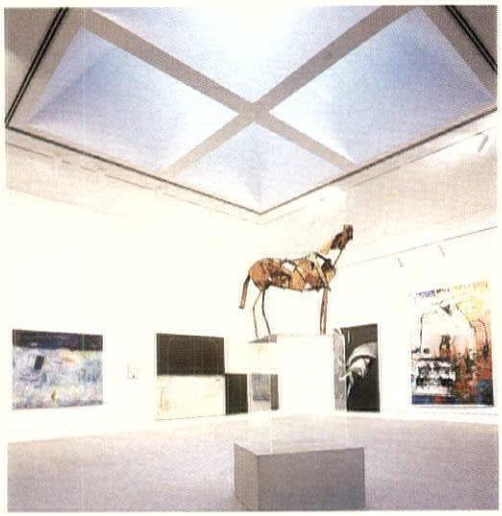
Circle 8

ARCHITECTURAL
LIGHTING

February 1989
Volume 3, Number 2



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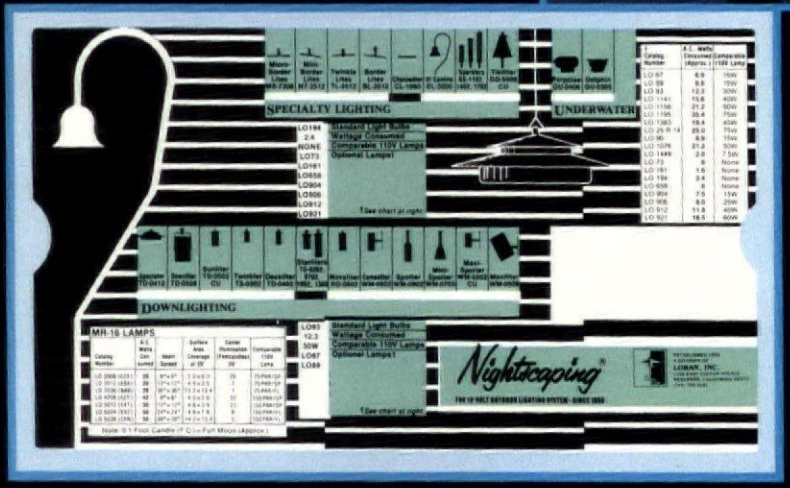

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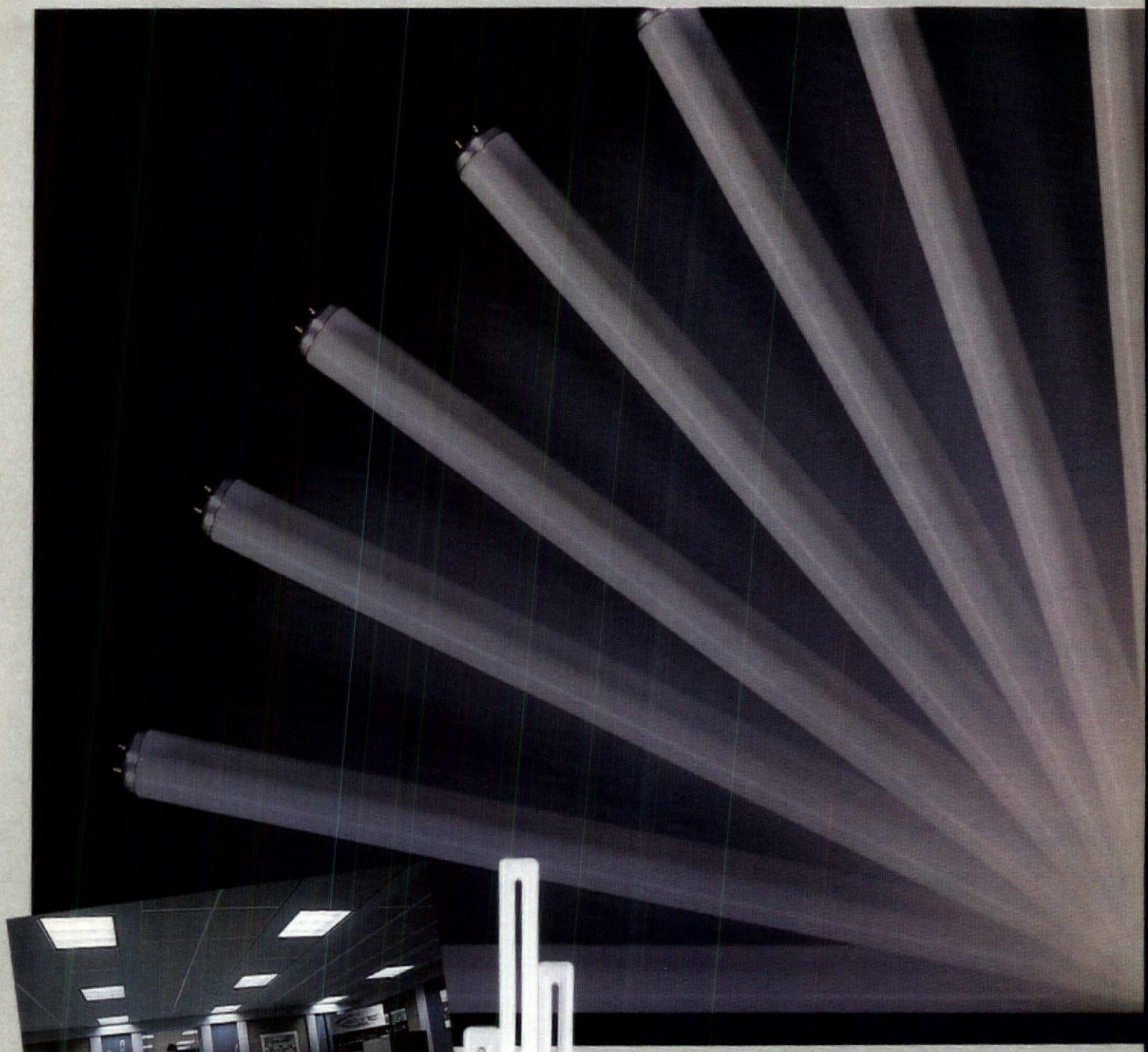
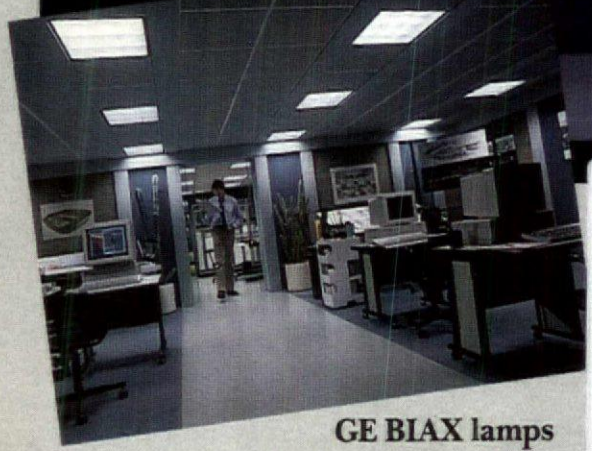
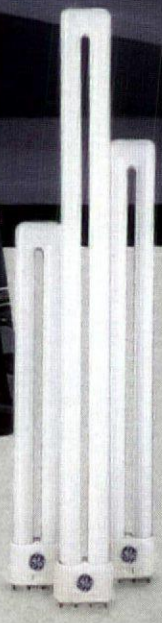




GE BIAX lamps make everybody and everything, including operating costs, look better.



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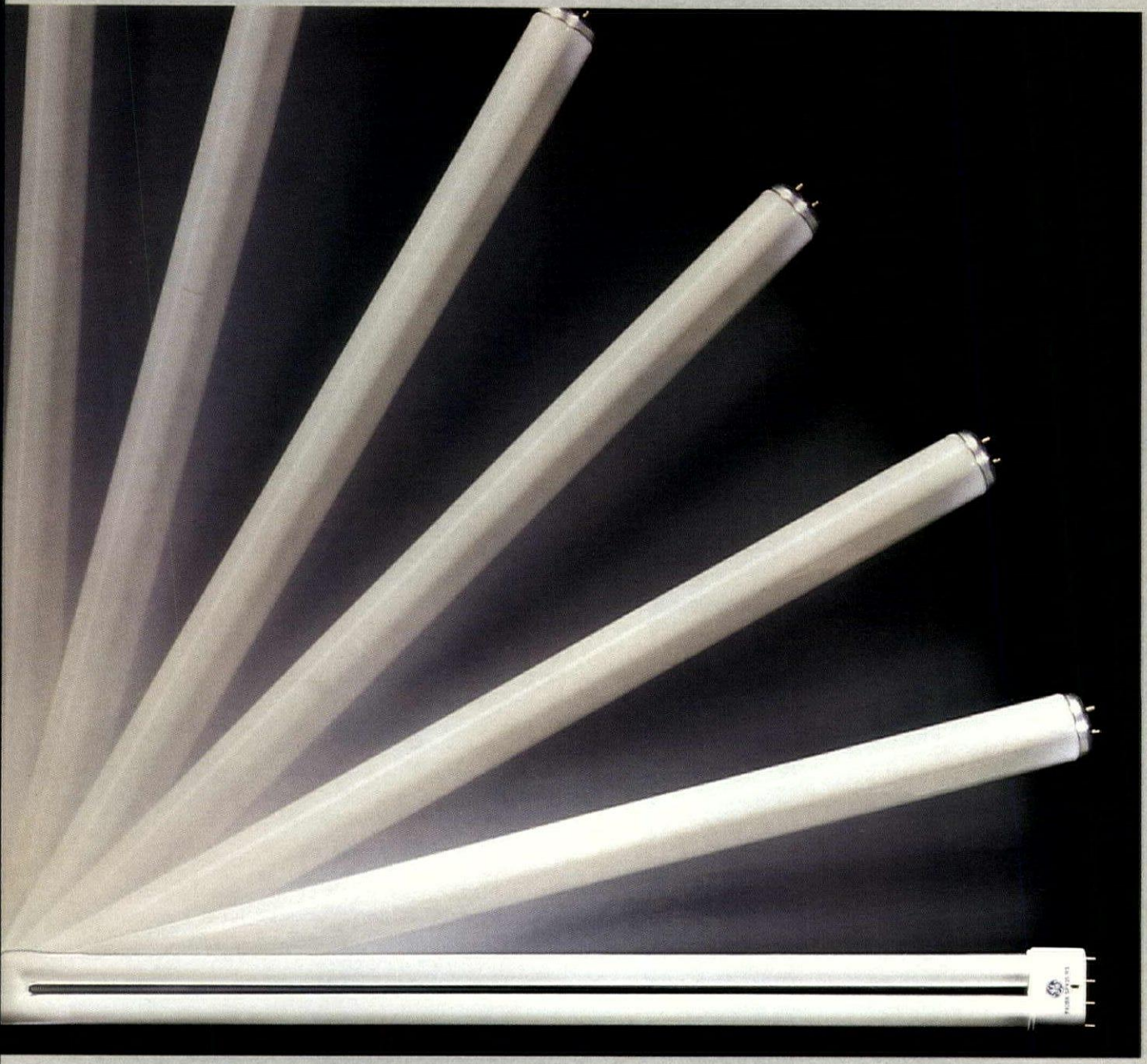

cents can, the lighting you design will make the environment and the people who work in it more attractive.

Equally attractive is the amount your clients will save on operating costs. GE BIAX 40-watt lamps, you see, last up to 8,000 hours longer than conventional U-shaped tubes. And 13 times longer than incandescents.

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Circle 10

From the Editor

As I mentioned in this column last October, when editorial submissions begin developing a pattern of similarity, we take notice. This month's cover story is the result of just such a pattern. Three daylit art museums — each worthy of a cover story in its own right — arrived in our mailbox within weeks of each other. That presented an opportunity we don't get very often: to look at three entirely different, state-of-the-art solutions to a single, classic design problem.

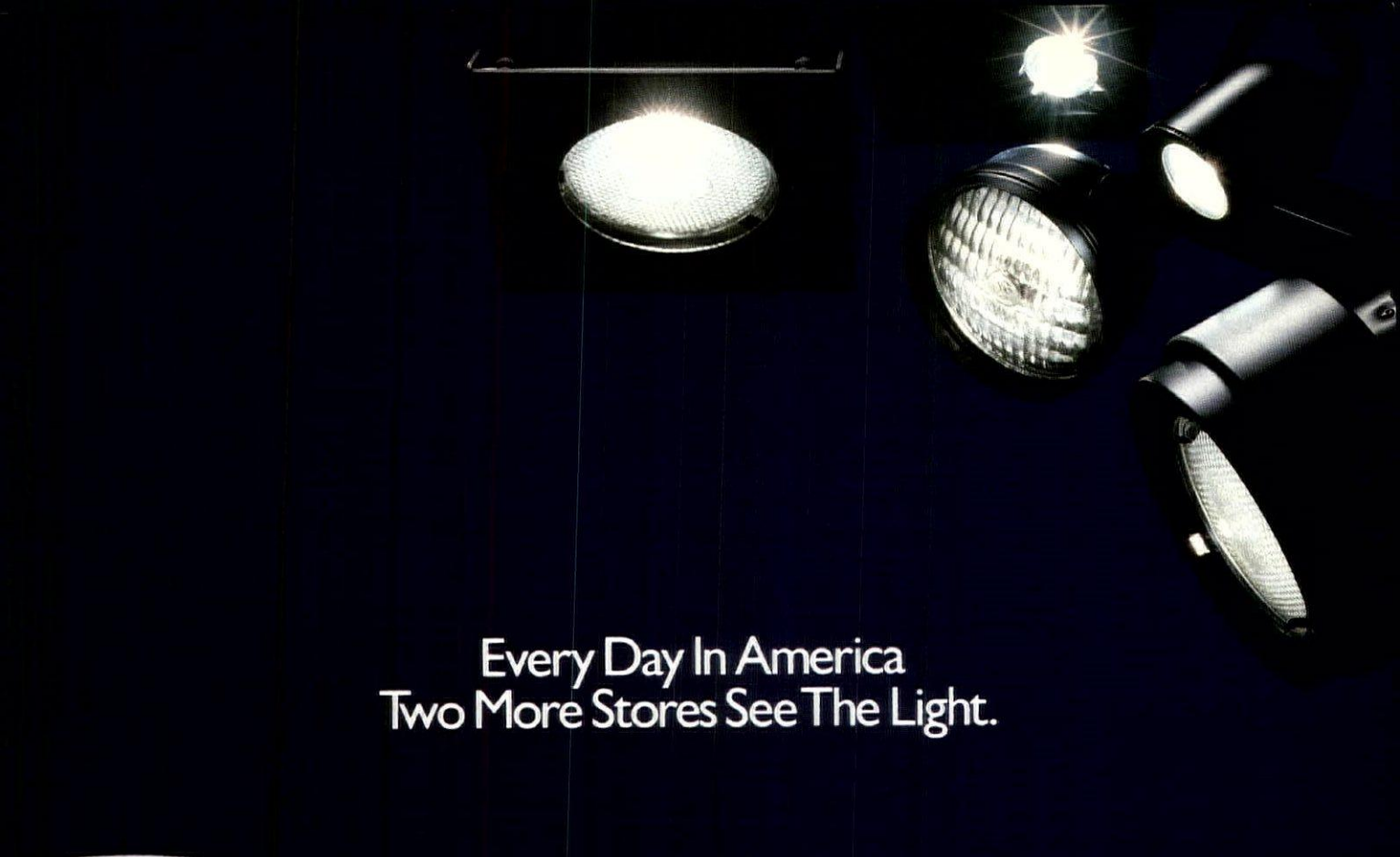
I wanted to publish all three of these projects. But, although I'm always overjoyed at the acquisition of *any* project worthy of publication, I couldn't have *Architectural Lighting* looking like a museum magazine. That could happen if I published the projects in successive months. Publishing the projects in separate issues would also diminish what readers can learn by looking at them together and comparing them. And putting all of them in one magazine would create a "theme" issue; I don't like theme issues because they serve only a fraction of our diverse audience at a time.

So we put the three museums together in one article: the newly renovated Art Institute of Chicago, the widely acclaimed National Gallery of Canada, and the Triton Museum of Art (cover photo) in Santa Clara, California. As the article points out, the needs of art conservation conflict with the desirability of daylight as a source of illumination in art museums. Yet daylight is, in the opinion of many museum curators, the ideal source of illumination for many works of art.

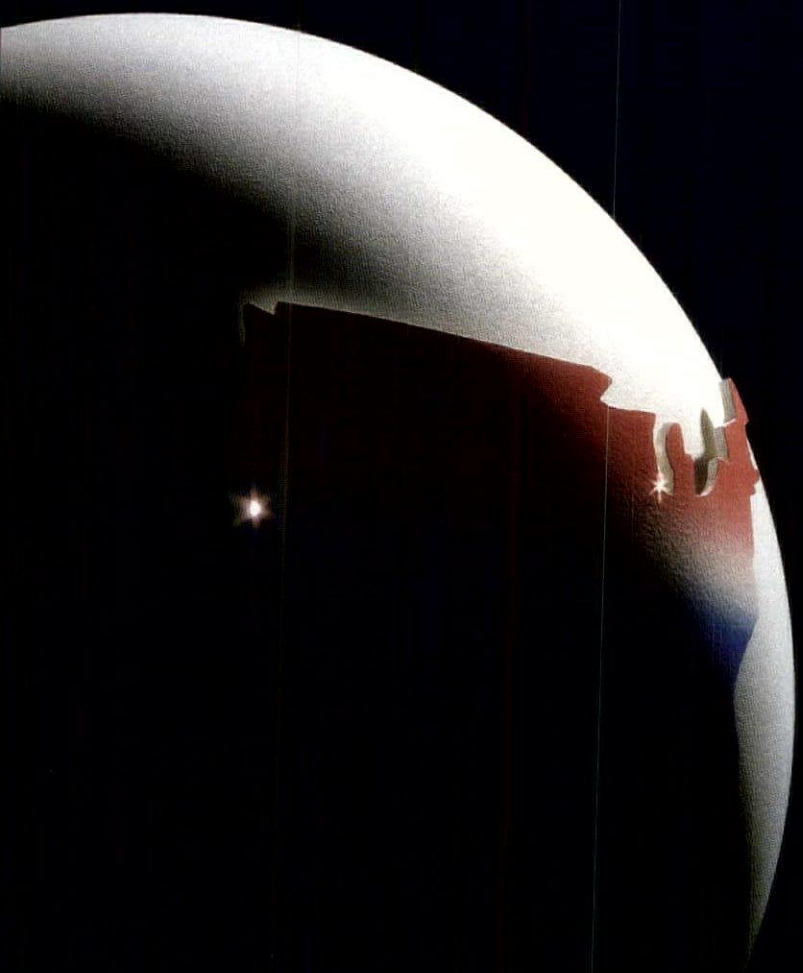
The problem, which has been ingeniously overcome by the designers of these three projects, is distributing that daylight evenly over large volumes of space in quantities low enough to satisfy conservation needs, but high enough to permit viewing.

I've often noted with some chagrin that lighting designers are seldom asked to give design input on the fenestration systems that permit daylight to enter architectural structures; these projects are notable exceptions. My hat's off to the architectural and lighting designers who have worked together to meet that challenge on these projects. I hope it bodes well for collaboration between architectural and lighting designers on other daylighting applications in the future.

Charles Linn, AIA



Every Day In America Two More Stores See The Light.



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Letters

Halogen lamp-life problems

The October 1988 Lighting Clinic column, "Troubleshooting halogen lamp-life problems," may be clarified by the following comments.

Excessive heat. Lamp failure with the filament still intact is a typical indicator of excess seal temperature. There is an upper temperature limit on the seal area of a tungsten halogen lamp base. A principal result of insufficient luminaire cooling is excess seal temperature with consequent short lamp life. Luminaire manufacturers normally address proper cooling of the base area by adequate ventilation, heat sinking the socket, and other measures.

Seating lamp in socket. If the lamp base contact surface of a failed lamp appears damaged, make certain that the socket is disconnected from the power source and examine the socket contact. If poor contact exists between the lamp base and the socket, the additional contact resistance can cause further socket area heating, a frequent cause of excessive lamp base temperature. Once the socket contact is damaged by overheating, it can cause rapid destruction of good lamps. Replace any socket whose contacts appear pitted, corroded, or discolored by heat; otherwise, lamp life problems will continue.

Variations in line voltage. Incandescent lamps are very sensitive to voltage variations. Near rated voltage, for example, a 1 percent change in voltage causes about a 13 percent change in lamp life. Because of this sensitivity, a highly accurate voltmeter is needed to evaluate an overvoltage problem. And, because power system voltage varies throughout each day and each week, a recording voltmeter should be used to determine whether a short life problem is related to voltage. To be of value, voltage determinations must be made carefully.

Dimming for extended periods. A minimum bulb wall temperature, typically 250 degrees Celsius, is necessary for good performance when a lamp is operating at or somewhat below rated conditions. That temperature is not necessary, however, when operating a lamp *sufficiently* below its rating. Low voltage, including dimming to extinction, generally is acceptable because the bulb wall temperature commonly is well above the minimum required temperature for rated operation in most luminaires. Blackening [tungsten deposits] on the bulb wall indicates operation at too low a bulb wall temperature. The deposited tungsten normally can be cleaned up by operating the lamp at its rating for a short time.

Robert E. Levin, Senior Scientist
GTE Products Corporation, Salem, Massachusetts

Questions on psychology of light column

As a teacher of lighting design, I was most interested in Mr. Benya's column on the psychology of light in the November 1988 issue. Questions: Has he written more extensively on the subject? Has he compiled anything of a bibliography? Can you point me to the published work of Professor John Flynn?

Ernest E. Jacks, Professor, Associate Dean
School of Architecture, University of Arkansas
Fayetteville, Arkansas

The columnist responds

Thank you for your interest. The late Professor John Flynn of Penn State was the primary researcher in the field of lighting and

psychology. A brief description of his life and major works appeared in an August 1988 Guest Editorial. In "Designing for people: Applying psychology of light research" (November 1987), Craig A. Bernecker discussed Flynn's theories and how to apply them. His article includes illustrations and a short bibliography. A letter from Gary Steffy in the October 1988 issue discusses current research and education continuing from Flynn's work.

As a lighting designer, I feel that we have only begun to discover reasonable scientific correlations between illumination and psychological impacts. The reason I wrote that particular column was to express a *practical* point of view on the subject. My column does not require the scientific backup and thoroughness of Flynn's work. It is strictly my opinion. This way, I can share an idea and philosophy with students and clients right now, rather than wait for years of testing and experiments to support my contentions.

That is not to say that I disagree with Flynn; in fact, my opinions correlate very well with John's research results. But it is extremely important to recognize Flynn's work for its thoroughness. Lighting, as I'm sure you know, has been a poorly researched field and is still full of charlatans. For instance, a large number of people still believe John Ott's "research" on health and light, even though it has been disproved (*Journal of the IES* 1987).

James R. Benya, PE, IALD, Senior Principal
Luminae Souter Lighting Design, San Francisco, California

Decorator fluorescents

I was really impressed by Charles Linn's editorial in the November 1988 issue. Recently, I had occasion to remodel my home and redo the lighting. My wife's decorator was made aware of the fact that we are fluorescent component suppliers and that I wanted the lighting in my home to reflect that. Our designer said that "fluorescents are commercial" and we would have a fight on our hands if I insisted on them. Since I was paying the bill, we eventually got a high percentage of fluorescents into my home. The designer agreed that he learned that there are applications where fluorescents are superior to incandescents.

We have 40 or more downlights in our home. The designer was shocked to find that there are adapters that accept compact fluorescent lamps in these downlights. His only objection became the color and the lack of dimming controls for the compact fluorescent lamps.

He has shown a number of customers the perimeter lighting that we put in our living room, which gives great ambient lighting. There again, the only problem became the fact that we had to put some 30-watt lamps in with the 40-watt lamps in order to have even light all the way around the room; the problem is that there are dimming controls for 40-watt lamps but not for the 30-watters. I'd bet that loads of people would be shocked at how you can use fluorescents for most applications — if you just know what is available.

W.M. Brown, President
A.L.P. Lighting & Ceiling Products, Inc., Niles, Illinois

Receptacle choice not such a good idea

It has come to our attention that one of your articles recommends using a general use NEMA receptacle configuration in an application for which it is not intended and could potentially result in

damage or unsafe conditions. In The Lighting Design Professional [August 1988], James R. Benya discusses low-voltage dimming and writes, "install unusual receptacles (NEMA 6-15R, for example) to indicate the dimmed circuits, and equip portable lights with matching unusual plugs."

NEMA 6-15R configuration receptacles are designated for *general use* 15-ampere, 250-volt applications. While Mr. Benya may consider these receptacles "unusual," they are commonly used with portable air conditioners and similar 250-volt appliances found in offices and residences. Someone who unintentionally plugs a lower voltage portable light equipped with Mr. Benya's recommended plug into a mating receptacle legitimately providing 250-volt power may very likely damage the portable light. Furthermore, the portable light may not withstand the electrical stress; fire or shock hazard may result. Likewise, 250-volt motor- or transformer-equipped appliances unintentionally plugged into a dimming circuit receptacle may overheat or experience brown-out failure.

NEMA recommends the use of a *specific use* NEMA locking configuration receptacle and plug for such applications. These are available from a variety of manufacturers. We further suggest that even these receptacles and plugs, as "unusual" as they may be in those settings, should be explicitly and permanently labeled as to their special purpose. This degree of facilities control will both contribute to safe usage and achieve Mr. Benya's desired goal.

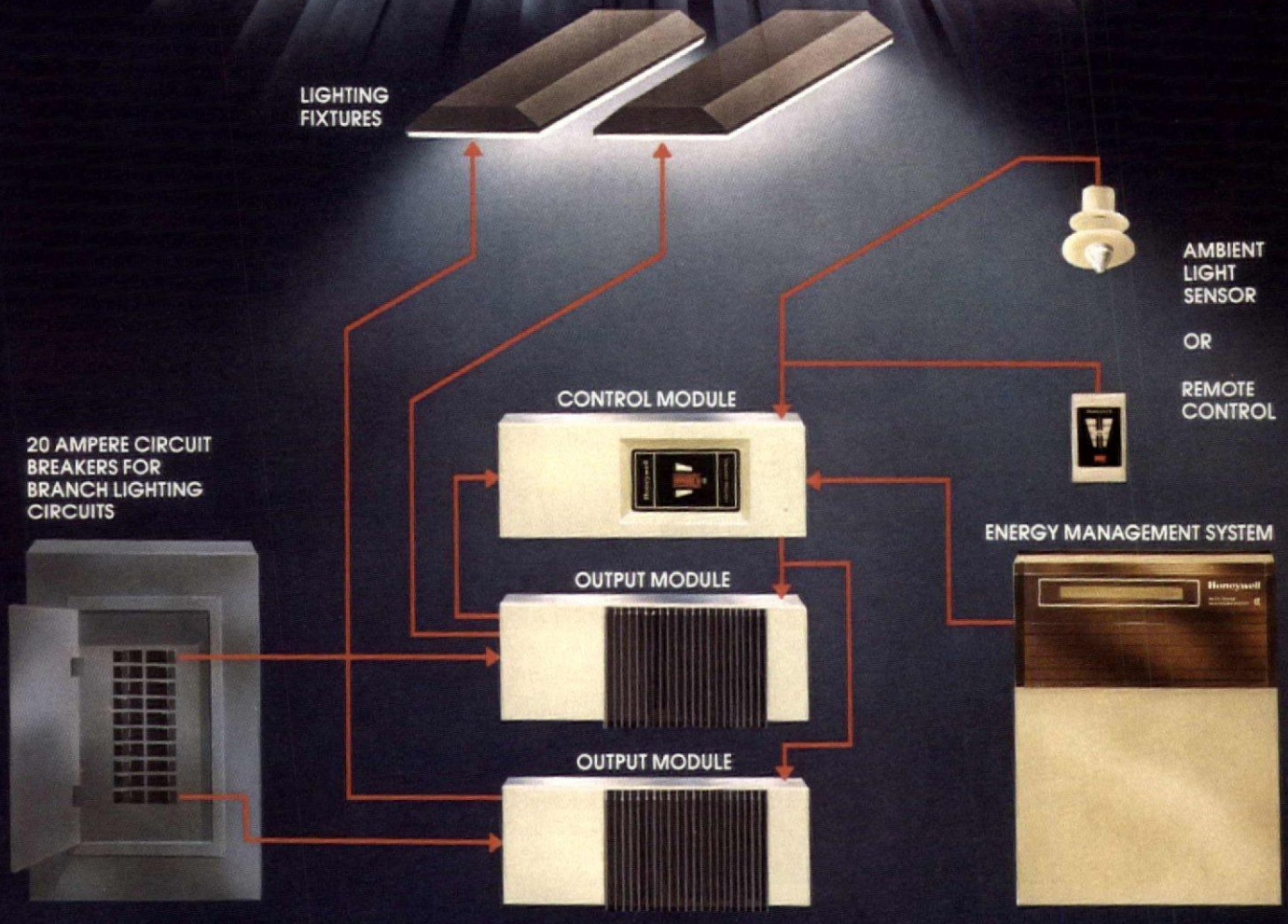
Carrol Burtner, PE, Senior Staff Engineer
National Electrical Manufacturers Association, Washington, DC

Why it works

The problem is that I often need a good-looking receptacle, and they don't make twist-locks in designer colors and the Decora series. Besides, most of my applications are in centrally air-conditioned homes where the owner has nothing else to plug into that outlet in his living room or bedroom except a heavy duty table saw — which is awfully unlikely.
James R. Benya, PE, IALD

The editors welcome your letters, which help to keep us responsive to our readers' needs and interests. Please address your letters to Charles Linn, AIA, Editor, Architectural Lighting, *859 Willamette Street, P.O. Box 10460, Eugene, OR 97440. All letters are subject to editing.*

Honeywell Lighting Control System



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Circle 17

Dramatic neon, bright ambient lighting score music sales

Project: Camelot Music prototype superstore
Location: Columbus, Ohio
Client: Camelot Enterprises, Inc.
Lighting, Interior Design: Retail Planning Associates, Inc.
Electrical Engineer: Stanley J. Kmonk, PE
Photos: Bob Krusey

Eye-catching blue neon streaks from a metallic disk above the heads of customers entering Camelot Music. It zigzags across an open, black ceiling toward a wall of 16 video monitors at the store's center, and disappears into blackness. "We wanted to create a directional force with the neon leading to that video wall as a focal point," says interior designer Ken Chance.

The client wanted a theatrical look that would attract customers to the prototype superstore and also wanted a maintained light level of 70 footcandles in the main merchandise area. That way, the labels on album, cassette, and compact disc packages are easy to read. "In a nutshell," says Chance, "the owner's requirements were focus, appearance, comfort of the customer, readability of the merchandise, and cost-efficiency."

Over the video wall area, the central portion of the white metal ceiling grid looks as if it has been ripped away, leaving an open black space spanned by supports for track fixtures. The designers left this part of the ceiling unlit to emphasize the neon streak and the monitors. "It directs people toward the video wall," says vice president of lighting Vincent Faiella. "The absence of ambient light in that part of the store allows the neon to be more dramatic and more powerful. Neon loses its effectiveness in the presence of ambient light sources."

Low-voltage track fixtures with very narrow spot lamps highlight promotional merchandise in bins around the video wall. Because such merchandise is often moved around, "We used a structural gridwork so we can attach track lights anywhere along that grid," says Chance. Fixtures are positioned directly over bins so that their light shines straight down, away from consumers' eyes.

Lighting in the rest of the store contrasts dramatically with the darkened video wall area. The designers chose 2-foot-square recessed troffers with nine-cell parabolic louvers because of their low surface brightness and minimal glare. They also used track-mounted PAR 38 incandescent spotlights along walls to accent merchandise and light graphics on perimeter fascia. "The store caters to people age 12 and up, so eye level is unpredictable," says Faiella. "Customers' heights vary so much that we positioned the PAR 38s so that the angle of incidence is toward the floor.

"The client wanted a dramatic look, but also wanted the merchandise lit effectively. That's really the trick. If you don't light the merchandise correctly, you've defeated the whole purpose of a lighting system," he says. The dramatic neon and the contrasting bright and dark spaces create a theatrical effect that draws customers into the store and then turns their attention to the merchandise. "The neon actually leads people in," says Faiella. "You follow the neon, like the yellow brick road." ■

—Susan Degen

For product information, turn to page 62 and see Manufacturers.

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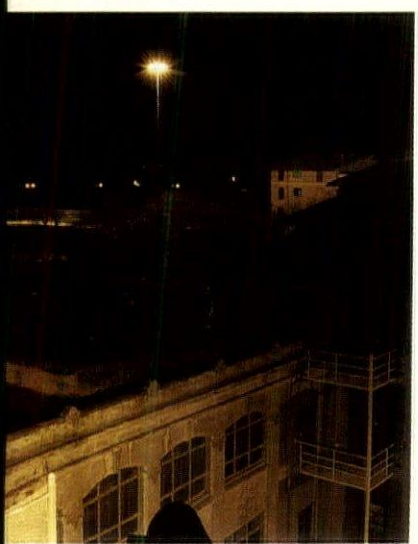
Prison lighting reassures community leaders



Project: Eastern Oregon Correctional Institute
Location: Pendleton, Oregon
Client: Oregon Department of Corrections
Architects: Wegroup; James Bernhard, Richard Williams, Michael Marczuk, and Philip J. Gall, principals-in-charge
Electrical Engineer: Balzhiser/Hubbard Engineering, James Krumsick, project engineer; Stan Hayden, project designer
Photos: Richard Carlson

When the Oregon Department of Corrections converted a mental hospital into a medium-security prison, city leaders in nearby Pendleton wanted assurance that the prison would have plenty of exterior night lighting. The need to consider citizen nervousness, and tightly budgeted funds rationed out through construction phases, influenced the choice between two proposed lighting schemes engineer James Krumsick and designer Stan Hayden recommended to the architects.

Along with attention to color rendering and state-required light levels, the architects also considered aesthetics. The building dates from early in the century and is visible from the freeway. Hayden showed a variety of HPS fixtures for 400-watt perimeter floodlights, and architect Michael Marczuk chose one with a cylindrical shape to offset the harsh angles of the perimeter fence. Hayden favors the luminaire for its superior aimability and its prismatic lens design. By spreading the light, the lens prevents the hot spots and glare typical of most floodlights.

Eighty-six fixtures on 43 poles are evenly spaced on 100-foot centers around the mile-long perimeter. With crisscross aiming for maximum overlap, they deliver 2–10 footcandles to the outer fence, a fairly uniform 7 footcandles to the inner fence line, and 0.25–0.5 footcandles up to 150 feet in from the luminaires. They are placed and aimed to provide optimum visibility for the officers who circle the grounds in roving patrol cars every three minutes.

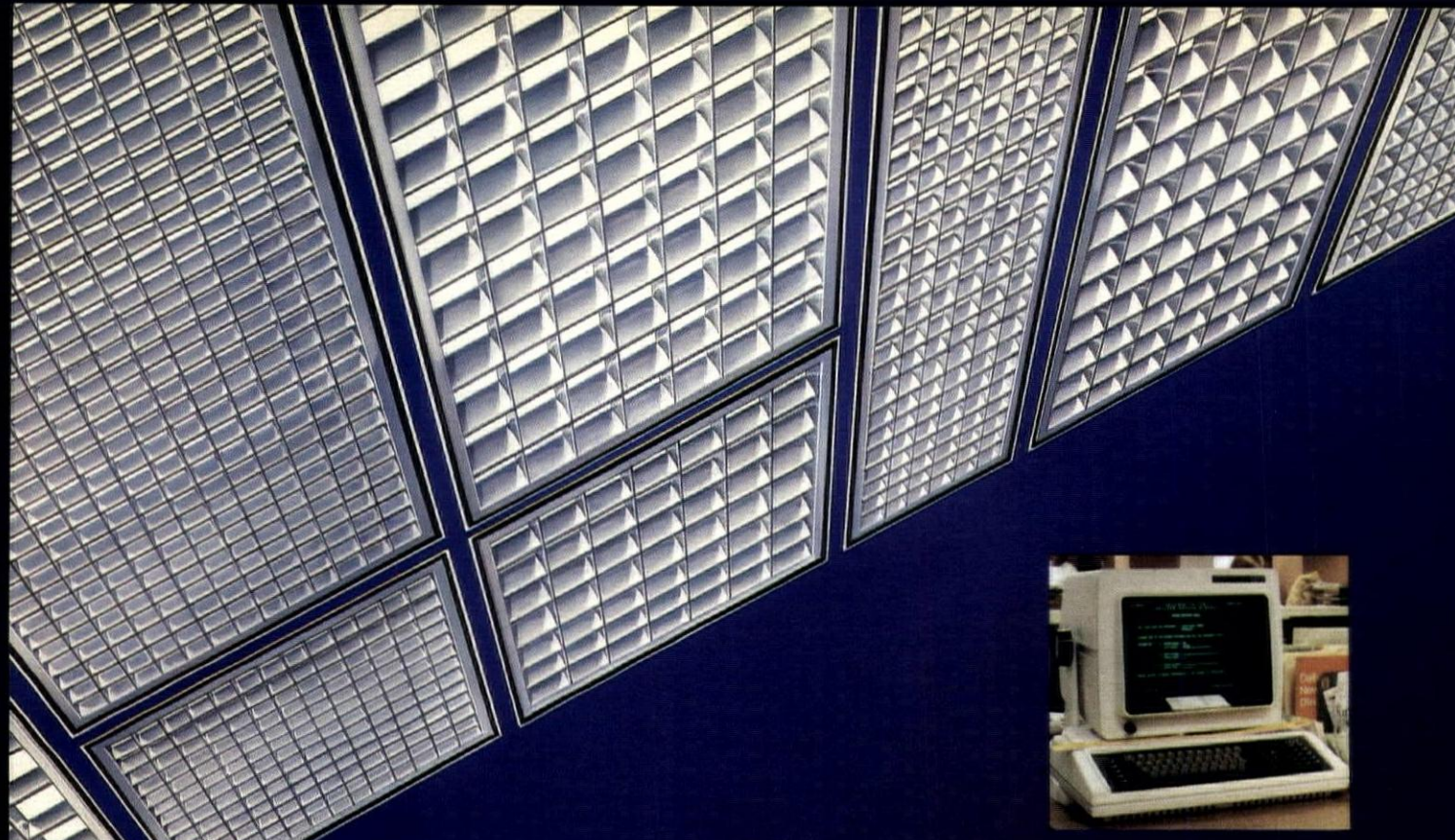
Two high-mast fixtures provide the 200,000-square-foot general-circulation area with 1–3 footcandles, using less than 0.08 watts of electricity per square foot. They also light most of the south roof surface. Configuration of complementary lamps on the high mast maintains high and even light levels when a source burns out. Each 100-foot-tall tapered, round steel pole supports eight 1000-watt refractor-type HPS luminaires. They come with tamperproof hardware and a lowering unit for relamping and maintenance. Alleys between buildings are out of range for the high masts, so there Hayden specified the same floods used on the perimeter, but with 250-watt sources.

On most dormitory floors, the light coming through the windows from outside sources is high enough to satisfy the low light level required for security during sleeping hours. Because a backup generator supports all the exterior lighting, interior security remains stable even if the interior emergency lighting is interrupted.

The medium-security design has a maximum-security exception: the segregation area for troublesome inmates. There, instead of the standard acrylic-lensed fluorescent luminaires used in other parts of the institution, corner-mounted, three-lamp fixtures are of 14-gauge steel with a night light and an acrylic diffuser with a tempered glass lens. The cost of the abuse-resistant fixtures is high, but necessary.

—Mike Heffley

For product information, turn to page 62 and see Manufacturers.



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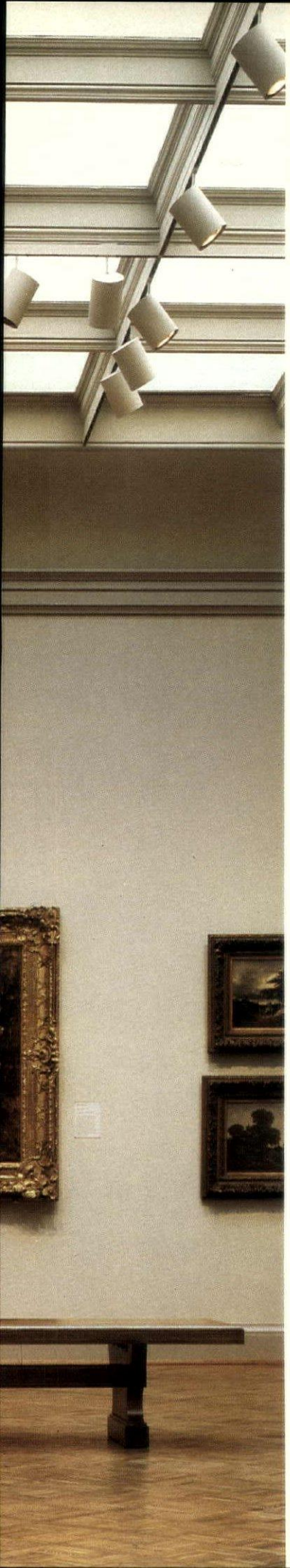


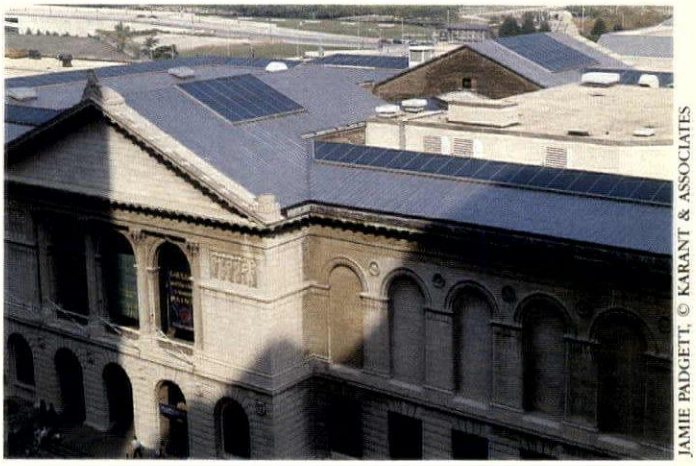
Daylit art museums: Three case studies

STORY BY
GARETH FENLEY

Curators know that daylight can damage art, and they often fear that the technology used to tame the sun's rays will prove unreliable, prohibitively expensive, or both. Many art museums still banish it from their galleries, but daylighting is making a comeback. Its unmatched, "natural" aesthetic qualities are cherished in an institution devoted to visual experience. After all, most works of art were created in daylit studios, so the only way to see what the artist saw is to use daylight.

Technical research has established light levels and exposure times that are considered an acceptable trade-off between the aesthetic requirements of exhibition and the realities of conservation. The human eye readily adapts to various levels of illumination, so museums can exhibit light-sensitive art at low illumination levels.

Electrical fixtures are indeed safer for this art than *badly designed* daylighting because they simply cannot produce comparably intense levels of visible and ultraviolet radiation. With the skilled teamwork of architects and lighting consultants, however, daylighting can be effectively controlled at a cost acceptable to many clients. This article presents three recently completed projects with diverse budgets and program requirements: a historic renovation, a technologically advanced masterwork, and a modest new building for a small museum.



JAMIE PADGETT, © KARANT & ASSOCIATES

Passively controlled daylighting illuminates galleries at the Art Institute of Chicago.

Illuminating galleries with daylight is largely a problem of distribution. A low average intensity of light in a room can be achieved easily by putting in a small window, but spreading that light evenly around a large space takes ingenuity. The galleries at all three of these museums have coved or vaulted ceilings with central diffusing elements, but they take widely different approaches to distribution: a light attic, a mirrored shaft, and a light well with a baffle. Each of these configurations reduces incoming visible light to a level safe for paintings.

The design techniques used in art galleries can be applied to other project types. "General daylighting designs draw much from museum design principles, because most contemporary architecture uses art in its

Project: European galleries, Art Institute of Chicago
Location: Chicago, Illinois
Architect: Shepley, Rutan & Coolidge
Renovation Architect: Skidmore, Owings & Merill
Lighting Designer: Jules Fisher & Paul Marantz, Inc.
Photos: © Jim Hedrich, Hedrich-Blessing

space," says architect Wayne Barcelon, who designed the Triton Museum of Art (cover photo). "People are opting for daylight everywhere much more nowadays. Its new resurgence in galleries and museums signals a celebration of the presence of people there."

The Art Institute of Chicago

A newly renovated daylighting system at the Art Institute of Chicago transmits a carefully calibrated amount of light onto sculpture and paintings. The passive system, which is built to provide a fixed level of control without moving parts, is tailored for the museum's permanent European collection.

The original 1893 building, like many Beaux Arts museums of the time, had a sloped glass roof, an attic space meant to function as a huge light diffuser, and a series of coffered laylights (glazed ceiling panels) over the upper-level galleries. During the 1950s, renovators painted over many of the laylights and replaced others with an opaque grid. This obliteration was consistent with a widespread, but by no means universal, trend toward preserving art by protecting it from daylight.

Thirty years later, the Art Institute assigned further renovation of the second-floor galleries to Skidmore, Owings & Merrill (SOM). With lighting consultants at Jules Fisher & Paul Marantz, SOM returned daylight to the galleries.

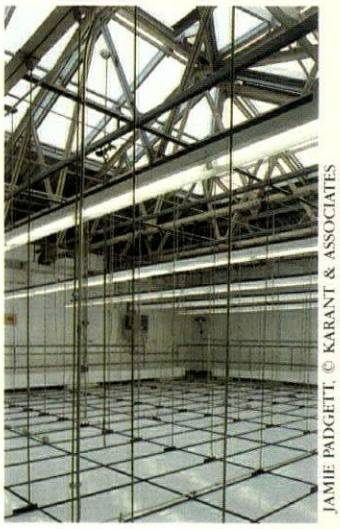
In an art gallery, the daylight factor — the percentage of outdoor illumination measured at a point inside the room — should typically be less than 1 percent. The precise percentage varies with geographic location and the maximum light level desired on the exhibition walls. In conjunction with the conservation staff, the design team for the Art Institute renovation began its work by determining a maximum level that would yield an acceptable annual exposure for the European collection. "On June 21, if it's sunny out, the maximum light level on the walls will be 40 footcandles," says Charles Stone of Fisher Marantz. "On a sunny day in December, it's down to 4 or 5 footcandles."

The lighting consultant's challenge was then to design a system that would yield the desired quantity of light. "We wanted to use white glass in the skylight," says Stone, "because we didn't want direct sunlight casting shadows of trusses and ducts on the laylight. We knew an economical way to do white glass, but if we used it for the whole skylight, we'd have too much light. So we covered about 40 percent of the roof with opaque gray spandrel glass."

To reach the gallery walls, light has to pass through an obstacle course of 11 layers of material. The "white glass" in the skylight is actually a 1-inch-thick insulating unit consisting of a top layer of quarter-inch tinted gray glass, a half-inch air space, and a laminated panel of two clear lights sandwiching three layers of translucent white polyvinyl butyral (PVB) film that blocks ultraviolet rays. The entire unit has only 15 percent transmittance, but does not significantly change the color qualities of the light that passes through.

Light that makes it to the floor of a sloping 15- to 20-foot attic reaches another sandwich of materials: a matte white acrylic overlay, a conical prismatic lens, and then the laylight itself, a laminated unit consisting of a 1/8-inch layer of low-iron glass (which is less green than common float or annealed glass), a clear PVB interlayer, and finally patterned glass. In the afternoon and evening, the daylight is supplemented by timer-controlled fluorescent strips in the attic.

Response to the reintroduction of daylight has been dramatic. One visitor exclaimed, "You've cleaned all the paintings!"



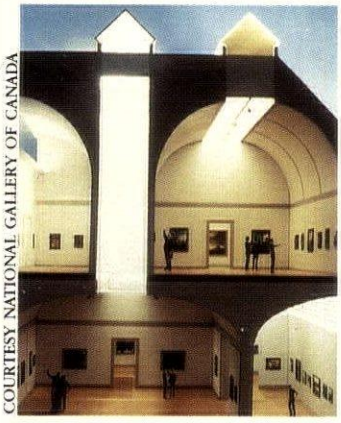
JAMIE PADGETT, © KARANT & ASSOCIATES

Thirty years ago, the Art Institute's old laylights were blocked out in favor of an all-incandescent system (top). Now, daylighting is restored to large upper-level galleries, connected by electrically lit corridor galleries for more light-sensitive art objects (left). Eleven layers of light-transmitting material allow less than 1 percent of available daylight to reach the objects on display in the gallery. The new light-diffusing skylights and laylights form the ceiling and floor of a huge attic (above).

National Gallery of Canada

"There is no question in my mind that for almost all visual arts the ideal condition for experiencing and appreciating a richness of form and color is through daylight," declares architect Moshe Safdie, who designed the National Gallery of Canada. "The richness and range of color perception, even the variation through different seasons and hours of the day, all enrich the experience as compared with fully controlled and constant electric light."

Project: National Gallery of Canada
Location: Ottawa, Ontario
Architect: Parkin/Safdie Architects and Planners; Moshe Safdie, design architect
Lighting Designer: Jules Fisher & Paul Marantz, Inc.
Photos: Timothy Hursley, The Arkansas Office



COURTESY NATIONAL GALLERY OF CANADA

At the frontier of daylighting design, the National Gallery of Canada has an elaborate control system that incorporates computer-controlled blinds. Skylights admit light into unconventional mirrored shafts, as the model (above) demonstrates. The shafts guide light deep into the building to lower-level Canadian galleries (top left). Upper-level European galleries have a traditional light well (top).

The National Gallery incorporates spectacularly daylit public spaces and galleries, although some galleries for fragile works are lit entirely by electrical fixtures. Among several daylighting techniques, the most unusual is a mirrored shaft that guides light down to the lower-level galleries of Canadian art.

Working with lighting designers Paul Marantz, Charles Stone, and Susan Brady at Fisher Marantz, Safdie staggered the galleries so that a shaft traveling down between two upper-level galleries would open into the middle of a lower-level gallery's ceiling. The 6-foot-wide shaft, which runs the length of the gallery, is lined with a silver-impregnated polyester film that is conventionally used in solar collection apparatus. The mirror-like film has a nearly flat reflectance curve across the solar spectrum, so light bouncing down the shaft retains its spectral balance. Upper galleries have a more familiar white-painted light well.

Conventional A-shaped skylights are constructed of a glass and PVB sandwich similar to that in the Art Institute. To balance the illumination delivered to the spaces below, skylights over the upper galleries have a 40 percent transmittance, while skylights over shafts to the lower galleries have a 60 percent transmittance. The design team made extensive use of sun-path diagrams and on-site research throughout the year — especially the winter — using models and an elaborate full-scale mock-up.

All gallery daylighting is actively controlled by automatic devices. Just below each skylight are motorized roller blinds made of a white Teflon-coated fabric similar to that used in airplane window shades. A photocell near the bottom of the shaft or light well triggers a custom-built daylight controller, which the curators set for a predetermined light level. A time delay prevents nuisance operation when clouds pass. Each gallery has a manual override and a meter that displays illuminance levels. The controllers interface with computerized building control systems; they are set, for example, to black out skylights when the galleries close.

Beams across the transverse skylights shield visitors from a line of glare as they look down the skylight's axis. The beams also hold electrical lighting equipment: indirect fluorescents above, dual-circuit tracks below. In the lower-level galleries, the laylight has a special clear, ribbed, UV-stabilized polycarbonate prismatic lens that spreads the daylight in a bat-wing distribution to the walls.

"Some conservators argue that only artificial light gives the kind of control safe for the preservation of works of art and that, therefore, daylight should be sacrificed for the sake of preservation," Safdie says. "We are convinced that shading devices and variable apertures in skylights can control light levels and meet the objectives of the conservators."

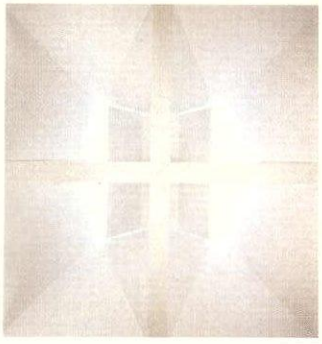
The Triton Museum of Art

A small museum in Santa Clara, California, demonstrates that daylighting design can be simple, functional, and economical. Passive control at the Triton Museum of Art provides a safe environment for exhibits that can handle up to 40 footcandles, and active control allows temporary reduction of light levels for both aesthetic and pragmatic reasons.

When architects Barcelon + Jang first proposed daylighting, museum board members were interested, but wary. They worried that daylighting might actually jeopardize the institution. "A small museum like Triton seeks loaned exhibits to supplement its own exhibition schedule," Wayne Barcelon explains. "Some lending agreements stipulate either that no daylighting is allowed, or that it has to be controlled."

Project: Triton Museum of Art
Location: Santa Clara, California
Architect: Barcelon + Jang; L. Wayne Barcelon and Darlene Jang, principals in charge
Electrical Lighting Designer: Richard C. Peters
Daylighting and Energy Consultant: BETA
Photos: © Christopher Irion

In the search for a fully controllable, affordable system, the architects studied 20 to 30 aperture and light-well configurations. They sought expert assistance from BETA lighting consultants for computer simulation of the best options. "We had to educate ourselves as well as the client in the design process," says Barcelon. The selected configuration, used in three galleries, keeps intense light off exhibition walls every day of the year. Ultraviolet light is filtered out by PVB film in a pyramidal skylight.



The modest Triton Museum of Art makes use of daylighting on a simple and economical scale. It combines passive control with an active component: a motorized adjustable baffle. Even with the baffle fully open (left), light stays at levels that will not damage the collection. Partly closed (above, looking directly up into light well), the baffle sculpts light in the space. The curator can also use it to shut out daylight completely.

Simplicity is the key to the active control element, a motorized baffle. "We've found in our travels that people don't know how to use some of the daylighting control systems that have been installed in museums," says Barcelon. "They tend to leave them either closed or open because they're too much trouble to figure out. We wanted something the owner would feel comfortable to play with."

At Triton, the skylight baffle is controlled by a manual switch located right in the gallery. Each of the baffle's two wings can be independently set at any position, allowing the curator to put more light on one wall than another or to close out daylight completely. The motors and switches are standard, off-the-shelf components.

The overall configuration of the museum anticipates the way people will move through the space. By stepping down light levels gradually from the skylit entry rotunda to the galleries, the architects helped visitors make the visual transition from the bright, sunny Santa Clara outdoors.

"Sometimes, admittedly, designers have gone too far, by daylighting a space so much that it really can't perform its intended function properly," Barcelon says. "And the problem of visual shock in moving between widely disparate light levels isn't always solved. But I think that, with the current technology, those who are still adamantly against daylighting art are in the minority."

The problems and the promise of daylighting are issues of primary concern in art museums, where conservation of the art work and visual perception are fundamental missions. Although they have unusually restrictive lighting requirements, art museums can serve as models for the distribution of daylight in any building. These three projects demonstrate that even under the most difficult circumstances, daylighting is worth the trouble. They reaffirm daylighting's traditional role in buildings by putting technology not in daylighting's place, but at its service. ■

For product information, turn to page 62 and see Manufacturers.

Crackle neon crowns balanced design

Mark Kruger

Mark Kruger is principal of Kruger Associates Inc., a New York lighting and interior design company.

Traditional nightclub lighting consists of a well-lit dance floor and shadowy areas where people sit and talk. This dark club concept seems rooted in a 1970s aesthetic, and perhaps is linked to the idea that a shadowy environment is needed for shadowy goings-on. When Miles Berger, CEO of Berger Hotel Corporation, asked us to renovate his popular Zanzibar nightclub, we decided it was time for something new.

Because our client commissioned us to design both the interiors and the lighting, we were free to pursue two lighting goals with a singular vision. One was to integrate the lighting with the architectural form, both physically and conceptually, using lighting to bring architecture to life. The other was to democratize the environment by redistributing the lighting energy, the classic balance of dance floor and social areas.

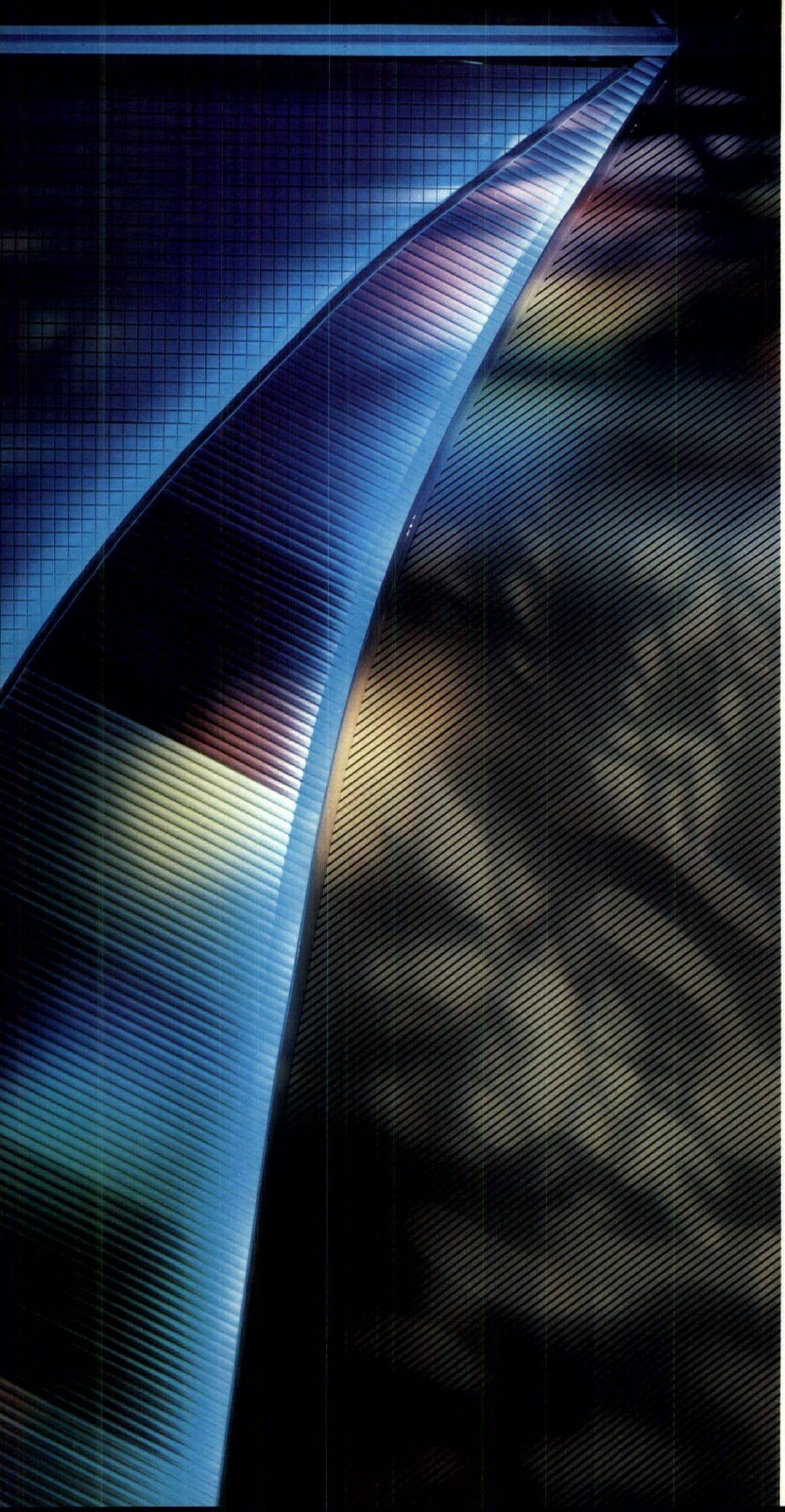
One of our strategies was to place clusters of dual-scan pin beams — fixtures moved by two different motors, one from left to right, the other up and down, to trace figure eights — in asymmetrical positions around the perimeter of the room, and in a dense pack over the dance floor. Using separate circuiting and control, we focused some of the beams from above the dance floor onto the entrance hallway; those over the entry we aimed at the dance floor and adjacent seating banquettes. In short, we redistributed the focus pattern and net effect of "the look" over every part of the space.

Two elements distinguish the dance floor from the other areas. Both are "shin busters," that is, fixtures emitting light from floor level, a source location common in the theatrical lighting of dance but rare in nature. One is a 10,000-watt, 20-inch-diameter movie Fresnel housed under the raised floor of the DJ booth and concealed behind a metal mesh scrim. Switched on and off by an industrial contactor, this single unit projects an enormous blast of primary blue light across the floor that engulfs the dancers and washes over half the club.

The other shin buster concept

Above, PAR 36 pin beams aim colored light through this ceiling's painted trusswork in random directions to redistribute the dance floor's usual lion's share of light. At right, laser-etched diffractors produce fixed rainbow halations from PAR 46 pin beams that match the moving patterns produced by dual-scan units throughout the club.

Project: Zanzibar nightclub
Location: Newark, New Jersey
Client: Berger Hotel Corporation
Lighting and Interior Designer: Kruger Associates Inc.; Mark Kruger, principal in charge
Photos: Elliott Kaufman



is fulfilled with an array of PAR 46 motorized police car beacons built into mirrored coffers under 18-inch-high seating platforms around the dance floor. The primary light sources are clear, but the mirrors are colored, producing secondary sweeps in a warm and cool palette. The whipping streaks of light create the effect of separating the dancers from their feet at about ankle height.

We allocated as much programmable control — a cycle-fading controller with background dimming — to purely architectural lighting as we did to the dance-floor lighting. Only the work lights, exit signs, step lighting, and bar downlighting were omitted from the control system. The overall architectural and ambient lighting slowly fades through a series of changes to subliminally shift the visual emphasis from area to area throughout the space.

One of the major architectural lighting features is the placement of 60 PAR 36 pin beams aimed through the ceiling's exposed trusswork: 29 2-foot-deep trusses, in colors that range from pale lavender through purple and pale silver-green through teal. We colored half the pin beams in matching gels; the other half we put behind diffraction grating in radial and starburst patterns. All of them shine through the trusswork, casting shadows onto the

Recessed crackle tubes (left) produce rippling lines of multicolored light from behind textured, overlapping wall surfaces. Cycle-fading coils of crackle neon and argon/mercury in uranium glass sit upon a bed of prisms, dichroic mirror, and glass beads in the sunken center of a custom table (above right) in the VIP area. A clear top of 1-inch-thick acrylic separates the patrons from the display.

walls in random patterns with splashes of prismatic color and complementary tones. The entire configuration is on the control system, which slowly produces a series of accentuated looks.

At the bar we wanted an atmosphere conducive to lingering. We lit it with PAR 46 pin beams behind linear diffraction grating with a lateral axis. We used the same diffraction medium elsewhere in the club, so the rainbow halations it produces tie the bar into the architectural lighting. The center island we accented with other pin beams, template lekos, and the dual-scan unit.

The north wall consists almost exclusively of plate glass windows. We accented their brushed aluminum blinds with custom-built strands of Christmas tree lights on 1-foot centers. The strands were dipped in liquid color media in warm pink and cool pale green and swagged behind the perforated blinds. We circuited each color separately and put the strands onto channels of the cycle-fading controller. The lights bring the wall to life with hot spots of color, each with its own meteor trail of light simulated by the perforations and the repeated curvilinear shape of the segmented blinds.

The raised seating platform spanning the north end of the room doubles as a performance stage. The lighting plan for performances uses large ellipsoidal units as diagonal front lights, batteries of 10-inch scoops as downlights, and line-voltage PAR 46 units as side lights. The scoops act as a soft area light for the platform when it is used for seating.

Perhaps the single most effective lighting element is the crackle neon embedded in the walls. Our crackle neon consists of cold cathode–sized neon tubing with phosphorated and clear glass beads, shards, and smaller-diameter tubing hand-packed inside it. The arc of excited gas is forced to find a path through and around these obstructions. The agitation of the gas is controlled by varying the voltage to the cathodes and the size and coloration of the obstructions. The effect is of animated, agitated, multicolored lines of light built into overlapping segments of wall. The wall surfaces are of laminated tambours in grid, linear, and half-round patterns in pale greens, lavenders, gray-blues, and similar tones. The interaction of textured surfaces and "textured" light is breathtaking.

The crackle neon is also in a custom-built coffee table in the VIP seating area. The table features a basin of glass beads, prisms, and pieces of dichroic mirror reflecting ultraviolet light, and cycle-fading coils of crackle neon and mercury in uranium glass. A 1-inch-thick sheet of acrylic shields customers from the high-voltage circuitry.

The first weekend that it was open after remodeling, Zanzibar had the largest gross in its nine-year history. The success of the design scheme was obvious in the dazzled reactions of the patrons. The effect of a totally integrated lighting and architectural design was all that we, and our client, had hoped for. ■

For product information, turn to page 62 and see Manufacturers.

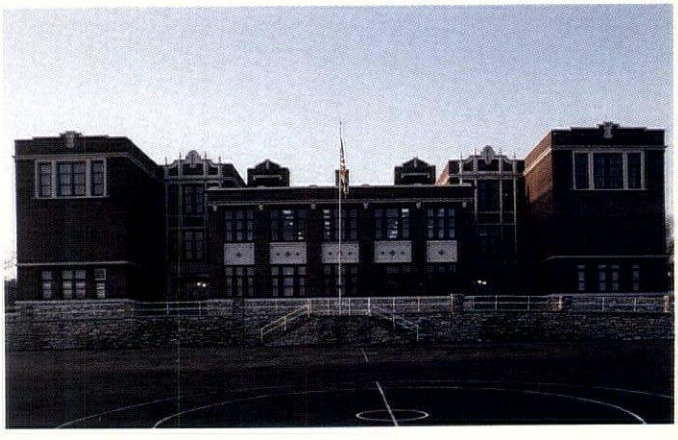
Lighting plans give new life to inner-city schools

Improved lighting helped to dramatically transform two dreary, dilapidated inner-city elementary schools into bright, appealing spaces for learning. The schools — still in use after more than 60 years of abuse, neglect, and "deferred maintenance" — were completely renovated as part of a court-ordered desegregation plan in Kansas City, Missouri. Equal opportunity in public education, the court decreed, involves not only well-trained teachers and up-to-date study materials but also a decent physical environment that encourages learning.

Inadequate, glary lighting in the old inner-city school buildings with their leaking roofs and peeling paint created unequal learning conditions for children, according to expert witnesses. "I was, quite frankly, appalled at the condition of the schools," said Craig Eppes, one of the district's expert witnesses and a project architect on the schools. "It's difficult enough to attract kids from the suburbs back to the center-city schools, but it's impossible when the facilities are substandard. They have to be suburban-comparable to some degree."

Susan Degen

Susan Degen is assistant editor of Architectural Lighting.

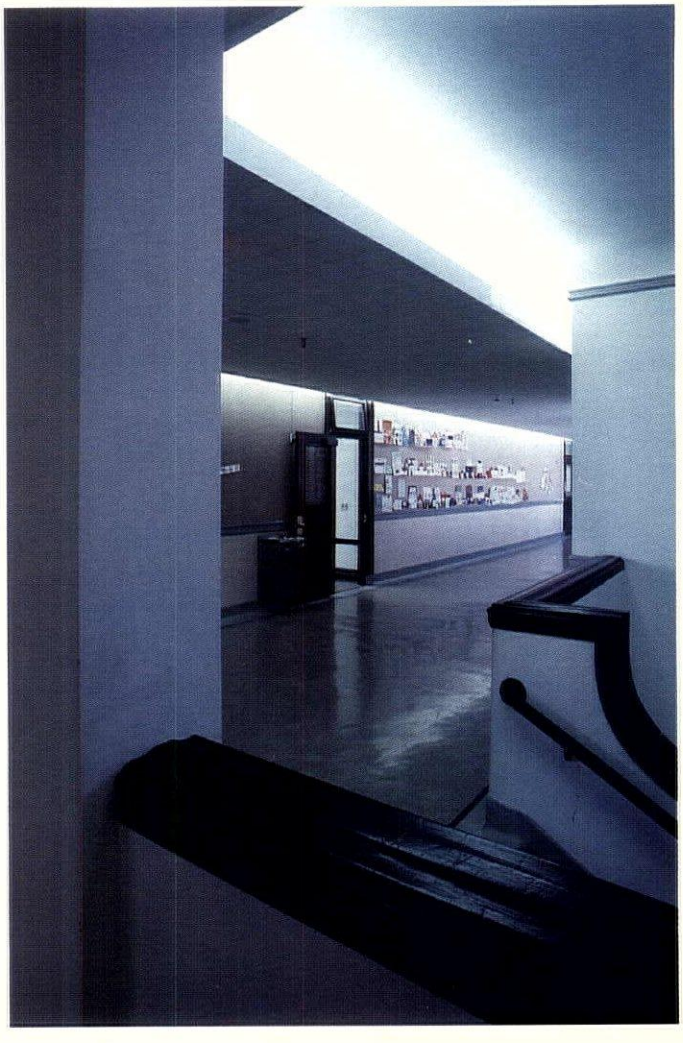


Corridors at Bryant School were once lit with exposed incandescent globe fixtures. Now lay-in ceilings conceal new sprinkler systems, wiring, and fluorescent fixtures. They were a cost-saving alternative to tearing up existing plaster ceilings.

Lighting School Corridors

William Cullen Bryant School is a three-story structure of brick, terra cotta, and concrete; and Hale H. Cook School is a one-story Gothic-inspired structure of brick and stone with a tower near its main entrance. Both were built in the 1920s, and both still had plenty of life. Like many other older buildings, however, the two schools had dimly lit, high-ceilinged corridors to channel the flow of students between classrooms and other areas. Now these same corridors glow softly with indirect lighting and pastel colors.

The corridors at Bryant School had been "just a big open ceiling," according to principal architect Kite Singleton. Where exposed incandescent globe fixtures used to run down the middle of corridor ceilings, cove lighting now washes corridor walls. Lay-in ceilings — a cost-effective alternative to tearing up existing plaster ceilings — conceal new sprinkler pipes, wiring, and the corridor's cove lighting system. Mounted beside the lay-in ceilings, hidden runs of standard strip fluorescent fixtures gently outline corridor walls and the curved wall opposite the principal's office near the school's main entrance. Light-colored tack boards covered with sound-absorbing fabric help reflect light throughout the space.



Projects: William Cullen Bryant and Hale H. Cook schools
Client: The School District of Kansas City, Missouri
Architect: Abend Singleton Associates Incorporated; Kite Singleton, principal-in-charge; Craig Eppes, project architect
Electrical Engineer: Massaglia-Neustrom-Bredson, Incorporated
Photos: Douglas Kahn

Cook School's high-ceilinged corridors once had skylights. To break up the monotony of long corridors and give them a more human scale, the architects dropped the ceiling height with a series of soffits. "We took out the skylights and used the space for mechanical equipment, but we continued the concept that had been there by putting coffers over doorways," says Singleton. Gridlike coffers mark entrances to classrooms and public spaces like the auditorium and cafeteria. Strip fluorescent fixtures, mounted above beams that crisscross each coffer, uplight the area. For added interest, each coffer was painted a slightly different pastel color.

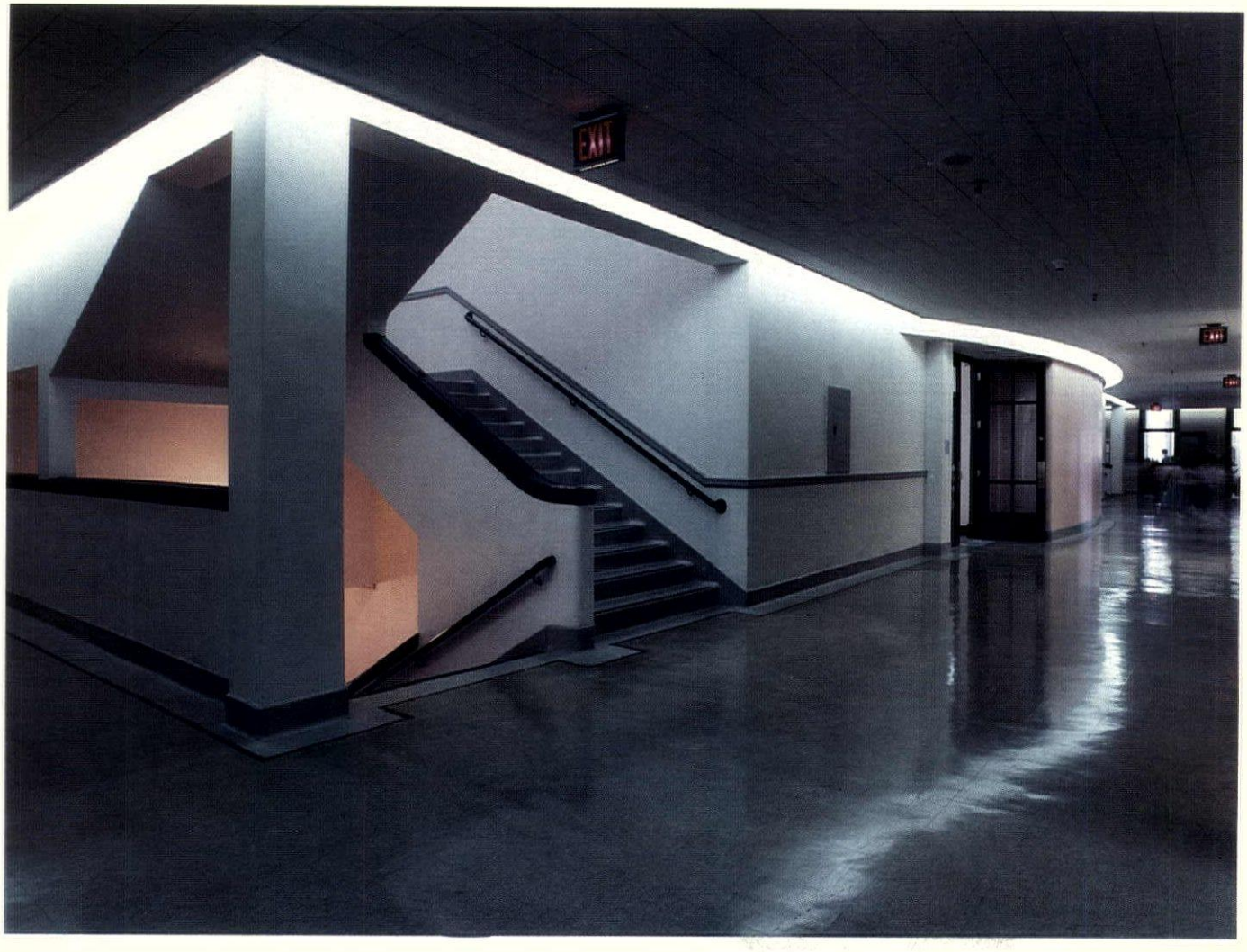
Bryant's Classrooms

Changes in the classrooms were even more dramatic. "The lighting systems were generally awful," says Eppes. "Bryant and Cook both had in the neighborhood of 15 to 20 footcandles in the classrooms, which were lit with four or six incandescent fixtures. Much of the wiring was bad and had to be replaced."

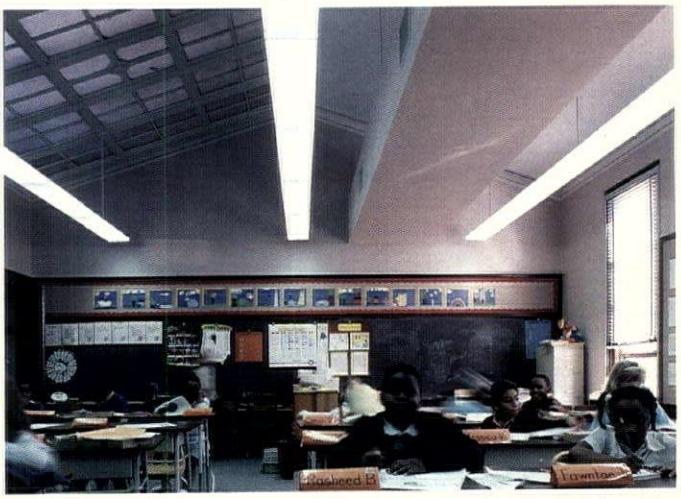
In place of old-fashioned 300-watt milk glass globe fixtures, Bryant's classrooms now have custom-designed indirect systems. The architects achieved the look of an indirect linear system at a considerably lower cost with a bit of ingenuity: they had sheet metal covers made for simple strip fluorescent fixtures. The covers were formed into half cylinders on an old gutter-bending machine. Three pairs of the lavender-painted enclosures — five 4-foot cool white lamps per side for each pair — stretch across a classroom.

"All of Bryant's classrooms have 10-foot-high ceilings, so we could put in pendant-mounted fixtures and use indirect lighting reflected off the smooth plaster ceiling," says Eppes. "With the indirect lighting you can eliminate veiling reflections. You stand at the chalkboard and there aren't any shadows. The fixtures also enliven the classrooms that otherwise would be simple boxes with windows on one side and chalk and tack boards all around. If we had the chance to do indirect lighting in classrooms all the time, we would do it because there's no glare, and the light's very well diffused — better than anything you could do otherwise."

Each classroom's linear fluorescent system consumes about 1000 more watts than its old incandescent system did. "Although this represents a 56 percent increase in power input for lighting, the result speaks for itself," says Singleton. "The original produced from 5 to 35 footcandles at the work plane with a lot of glare and strong shadows. The new system pro-



Hidden behind lay-in ceilings, runs of standard strip fluorescent fixtures gently outline corridor walls and the curved wall opposite the principal's office near Bryant School's main entrance.



Classrooms at Cook School have gabled roofs and north-facing double-glazed skylights. The heavy, pebbled glass of the interior skylight diffuses direct sunlight and minimizes glare. The architects added three rows of pendant-mounted fluorescent luminaires with wraparound prismatic lenses to reduce brightness contrasts between the skylight and the rest of the ceiling.

vides more than 75 footcandles at the work plane with no glare, and it feels much more comfortable because the entire room is lighted to an acceptable level." The lavender fixtures and custom brackets, yellow all-thread hanger rods, and aqua mounting plates add colorful, decorative touches to the white semigloss ceilings and upper wall surfaces of the classrooms.

Like many schools in the district, Bryant's classrooms have large windows. To discourage vandalism, acrylic panels are used instead of glass. To control glare from direct sunlight, teachers can adjust 2-inch-wide venetian blinds. "The windows are very effective in providing most of the light needed," says Singleton, "so the new lighting system has two-level switching. Often only one circuit is needed for all or most of the school day."

Cook's Classrooms

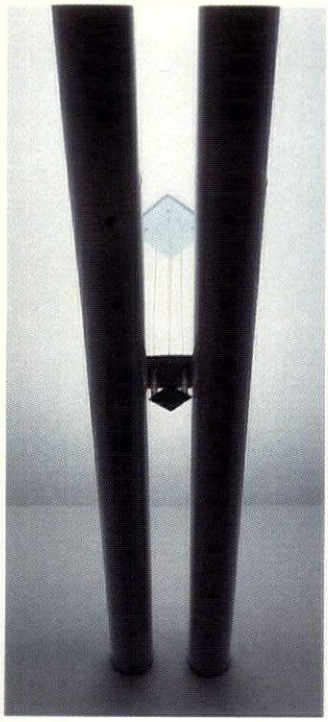
A unique feature of Hale H. Cook School is the design of its classrooms, each of which has a gabled roof and a north-facing double-glazed skylight. Unfortunately, the skylights had been covered over with a 2-by-4 lay-in ceiling, undoubtedly because they caused too many problems. "They probably had difficulty with glare, heat gain, and leaking. We convinced the district to restore the skylights," says Singleton. Glare and the other problems are surmountable with glare-reduction material and today's glazing systems.

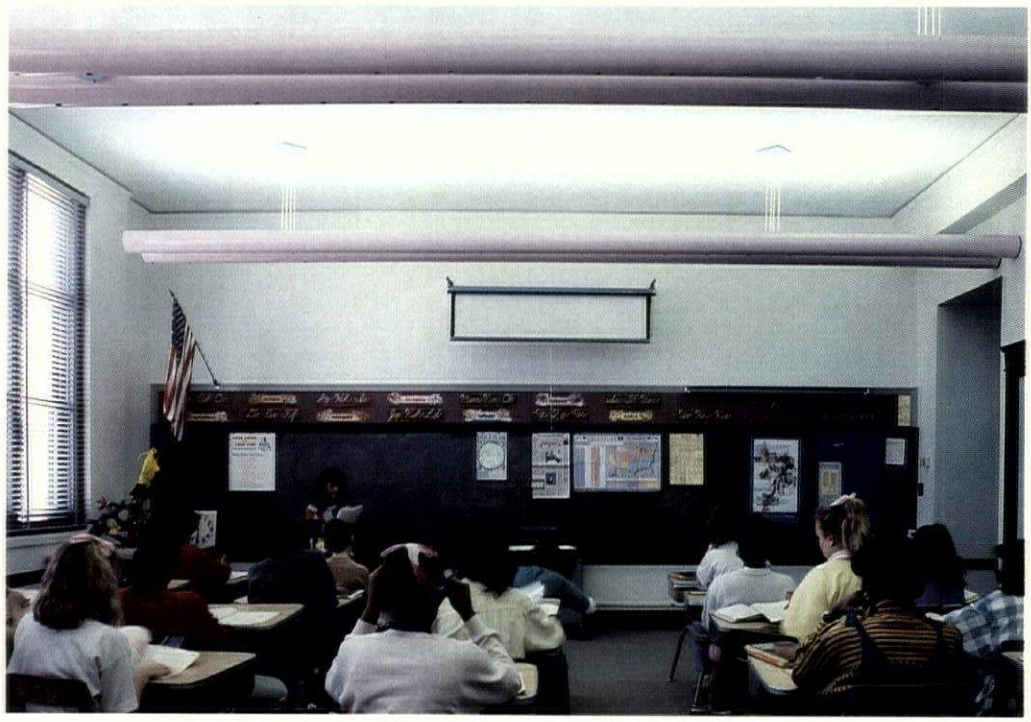
"We wanted to get rid of the lay-in ceiling because the classroom space was really rather nice," says Eppes. "Cook had very little window area in the classrooms, but it had the skylights. Those are some of the nicest classrooms I've seen, partially because they're different. They're gabled and they have a nice double-glazed skylight on one side." The architects inspected the condition of each skylight's interior and exterior glazing. "Very few panes of glass were broken, the wood was good, and the plaster was in surprisingly good condition given that the building had a lot of roof leaks," says Eppes. To make the exterior weathertight, the skylight's exterior glazing now has acrylic panels in aluminum frames. The interior glazing needed only minor repairs and a thorough cleaning.

The heavy, pebbled glass of the existing interior skylight diffuses direct sunlight and minimizes glare. To further reduce the brightness contrast between the skylight and the rest of the ceiling, the architects used three rows of pendant-mounted fluorescent luminaires with wraparound prismatic lenses. Mounted at the height of the former lay-in ceiling, they produce 90 percent diffused downlight and 10 percent uplight.

Other Improvements

The most dramatic changes to both schools were in the classrooms and corridors, but the district's program included complete interior and exterior renovation at both schools. At night, the ornate building exteri-





The old incandescent milk glass globe fixtures in Bryant's classrooms produced 15 to 20 footcandles on work surfaces. New custom-designed indirect luminaires (above right) provide more than 75 footcandles. The luminaires look like a tubular fluorescent system, but are actually standard strip fluorescent fixtures concealed in a custom-fabricated cover formed on a gutter-bending machine. The lavender fixtures and custom brackets, yellow all-thread hanger rods, and aqua mounting plates add colorful, decorative touches (above left). Cook School's corridors once had skylights. The architects added a series of soffits and coffers to break up long, monotonous corridors and give them a more human scale (right). Gridlike coffers painted in pastel colors mark entrances to classrooms and public spaces. Fluorescent strip fixtures, which are mounted on crossbeams, provide uplighting.

ors are washed by floodlights. Set away from school buildings, the floodlights also provide security lighting.

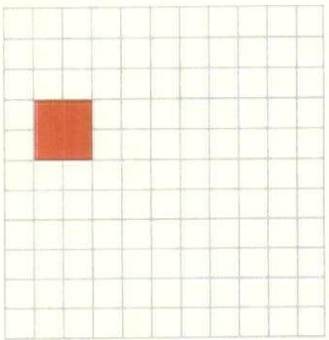
At Bryant, linear fluorescents uplight the 7-foot-wide stairwells. The fixtures are similar to those used in the classrooms but strong enough to span the distance wall-to-wall without additional support. At Cook, decorative fixtures lend a high-quality touch to special areas: pendant-mounted polished brass uplights in the entry lobby, suspension lamps in entry vestibules, and decorative wall sconces in the teachers lounge.

"Renovating the schools brings our school district up to suburban standards so that suburban children will not lose anything by coming to the Kansas City, Missouri, magnet schools," says Mary Ball, the district's director of communications. Indeed, hopes are that bringing inner-city schools up to suburban standards will both improve educational opportunities for Kansas City's urban children and help attract non-minority children back into the district's schools.

The improvements have already begun to affect the morale of everyone at the schools. "They're thrilled," says Walter Houston of the district's school facilities division. "Even the kids sense something new; they have more of a sense of taking care of their school now that it's been done." It is hoped that the renovations that make these two Kansas City schools better, brighter places to learn will lead to further progress — the heightened goals and achievements of the children who pass through their doors. ■

For product information, turn to page 62 and see Manufacturers.

Landscape Lighting



How plants direct the approach to lighting them

Janet Lennox Moyer, ASID

Janet Lennox Moyer is principal of Jan Moyer Design, Oakland, California.

Last month, I discussed becoming familiar with the appearance, growth characteristics, and intended maintenance of plants intended for a garden you are about to light. These data help to give you a three-dimensional view of the garden. With this view in your mind, you can start formulating the lighting pattern for the garden.

The size and shape of a plant directs our approach to lighting it. Plants with a narrow, upright shape and dense branching best express their texture and shape when lit by a grazing light.

Some yews, for example, have a stiff upright shape; when they are pruned to maintain that shape, lighting fixtures can be placed close to the edge of the tree, bringing out the rough texture of their branching habit. The upright shape allows light to reach the tree top. Use a lamp with a narrow beam spread on upright trees, especially on tall palms.

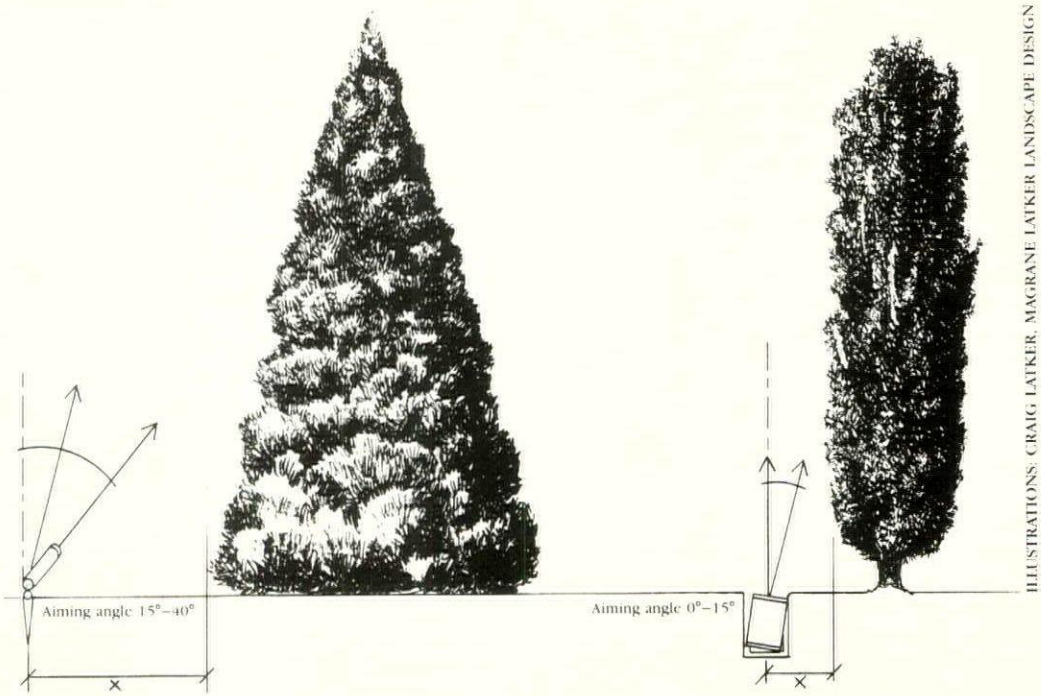
Trees with a more pyramidal shape, such as many redwoods, are best lit with fixtures moved back from the edge of the tree. Optimum distance varies — from a few feet to 10 or 20 feet — with the angle of the tree's overall shape as well as with the tree's height.

Plants that have a rounded form with dense leaf overlap and thick leaf structure benefit from a wall wash technique. Lights placed under the canopy are typically wasted because the leaf overlap is too dense to allow light to filter up into the canopy. Moving fixtures out away from the canopy, as shown in the accompanying illustration, accentuates the shape of the tree. Remember that as you move the fixture away from the edge of the leaves, the effect of texture will be diminished. When selecting lamp wattage, remember to consider the effect of the reflectance value of a plant's leaves. It's also important to consider the "finish" of the leaves — are they matte or specular — because those factors affect the preferred aiming angle of the fixture as well as lamp wattage.

To capture the full effect of trees that have a rounded shape with medium to open leaf overlap and translucent leaves, place light fixtures under the tree canopy. This filters light up through the branches, accentuating the tree shape and enhancing the three-dimensional qualities of the tree. Small trees with a canopy width of 5 to 15 feet require two to four fixtures. Trees with canopy widths from 15 to 50 feet may require 5, 10, or more fixtures — depending on the size and shape of the specimen at maturity.

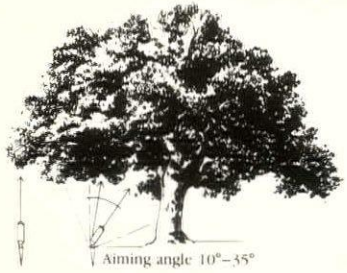
With careful placement and attention to a tree's structure, a small number of fixtures may be used on a large tree. This creates a dramatic effect on the tree, because parts of the tree will be left dark. Generally, though, when a small number of lights are used, the result is a tree that looks disfigured.

An exception to locating lights directly under the canopy applies when rounded, open-type trees have interest at the outer edge of the canopy. The crape myrtle (*Lagerstroemia indica*), for example, produces long conical flowers at the ends of branches; it has an open form with medium-sized leaves. Locating fixtures outside the canopy edge to light the flowers still allows light to filter through the canopy. Lights encircling the tree, as shown in the diagram, provide depth and fullness. Moving the fixtures out to

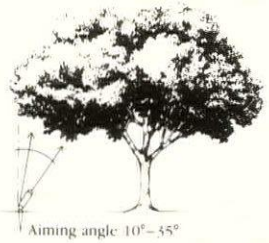


ILLUSTRATIONS: CRAIG LATKER, MAGRANE LATKER LANDSCAPE DESIGN

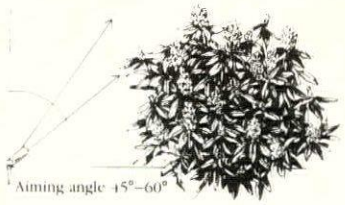
Washing its surface with lights aimed at an angle from 15 to 40 degrees from the vertical captures the shape of the giant sequoia (Sequoiadendron giganteum) *tree pictured at left. In contrast, grazing the narrow, upright Irish yew* (Taxus fastigiata) *tree with narrow beam lights aimed at an angle about 15 degrees from vertical brings out its texture. The distance from the trees and the choice of stake-mounted or direct burial fixtures differs, depending upon the growth habit of the plant, the amount of texture, and the maintenance plans for the trees.*



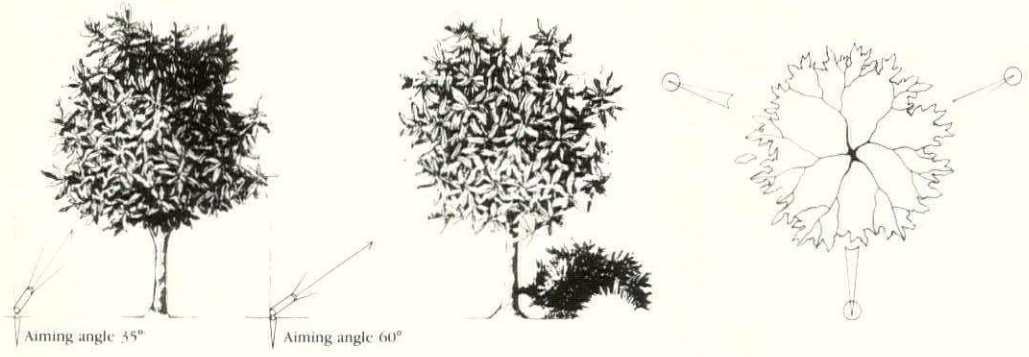
*Large, open-form trees require 5, 10, or more fixtures to cover the entire canopy area, as shown with this California live oak (*Quercus agrifolia*). The aiming angle is from 10 degrees to 35 degrees; one fixture, shown at far left, is aimed straight up at the edge of the canopy.*



*Trees that have flowers at the ends of their branches, such as crape myrtle (*Lagerstroemia indica*), need fixtures located at the outer edge of the canopy, or out away from the canopy, to highlight the flowers in bloom. The aiming angle is from 10 degrees to 35 degrees.*



With dense planting that allows only frontal viewing of a plant with a dense habit and branches to the ground (such as this rhododendron), one fixture may be used. As a rule, it's a good idea to use an aiming angle of about 45 degrees to 60 degrees.



*Trees with dense, rounded forms, such as the southern magnolia (*Magnolia grandiflora*), require multiple fixtures outside the canopy. When the tree will be viewed at close range (when it's near a walkway, for example), from several sides, and/or if no object will block a view of the fixture face, use 35 degrees from vertical as the maximum aiming angle. If something blocks the view of the fixture face, the angle can be increased to as much as 60 degrees.*

the canopy edge provides accenting light on the beautiful flowers when the tree is in bloom and full, balanced light for the tree when it is not in bloom.

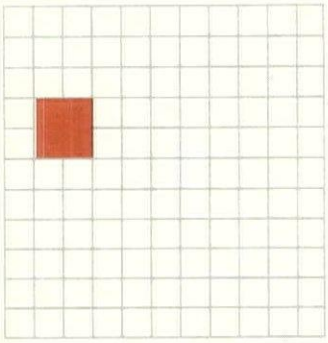
When trees are close to a wall, fewer fixtures may be needed because the canopy size has been reduced. Consider washing or grazing the trunk softly with one or more of the lights to tie the tree to the ground. The side of the trunk you light depends upon the direction (or directions) from which the tree is viewed and the effect you are attempting to create. Trunk lighting techniques include side lighting to create crisp edges, silhouetting the trunk against a light surface beyond, and front lighting for detail and color.

When the tree produces branches close to the ground, fixtures should be placed farther from the canopy in order to completely light the tree from the ground to the top. The angle can be relatively flat — about 45 degrees from vertical — because the tree will block glare for viewers on the opposite side of the tree. Plants that start branching a foot or more above the ground, however, need a steep aiming angle — one no more than 35 degrees from vertical — to avoid creating glare and to minimize lighting fixture surface brightness. When other plants or objects block the view of these fixtures, the angle may be more horizontal.

Trees or shrubs that are dense and have leaves down to ground level often serve as a secondary focal plant in a lighting plan and create a bridge between two larger specimen trees. Often these occur in a border and will be viewed basically from one direction. In this case, the light should be located back away from the plant. A relatively horizontal aiming angle is acceptable because the plant itself shields the lamp brightness from creating glare.

We are just beginning to look at techniques for lighting plants. Next month, I will delve further into uplighting, continuing to present options for specific situations. Uplighting — in the differing forms presented — is only one approach. Downlighting, when possible, creates a more natural effect, and a combination of both techniques always creates the most interesting lighting. ■

The Lighting Design Professional



Making a living at lighting

James R. Benya, PE, IALD

James R. Benya is senior principal and CEO of Luminae Souter, San Francisco. He is on the faculty of the California College of Arts and Crafts, is active in IES and Designers Lighting Forum of Northern California, and teaches lighting design classes for the ASID, IBD, and the American Lighting Association.

Lighting design was once a small part of the job of architects, electrical engineers, and other design professionals. The lighting "system" of a commercial building was a grid of fluorescent troffers designed to give 100 footcandles. The lighting of a home was task oriented, meaning that the primary purpose of light was to allow the performance of tasks with a visual component, such as cooking, sewing, or climbing stairs. Until recently, many people thought "lighting design" was picking pretty fixtures from lighting catalogs.

But in all of architecture and design today, lighting is the most talked-about and exciting specialty. Fueled by a proliferation of new products and applications in the past decade, lighting has begun to reach its first mature period as an art form and as a profession. A large portion of the lighting fixtures and electric lamps used today in homes and businesses didn't even exist only 15 years ago. And, for the first time outside the theater and art worlds, the effects of light are considered legitimate elements of design, just as walls, windows, and roofs are.

Much of the lighting in the world today is still designed by sales personnel.

The rapid acceleration in lighting equipment and techniques, coming in addition to advances in other aspects of building technology and environmental design, has made it extremely difficult for the practicing architect or interior designer to stay proficient. Architects and interior designers therefore often learn to use the resources of sales reps, consultants, and others to aid them in the design of lighting. It's not that the well-trained architect or interior designer can't do the design properly; rather, the intelligent use of assistance saves precious research and experimentation time.

Several new kinds of specialists have appeared on the scene to provide lighting design assistance. They generally fall into two categories: those who provide lighting design as a sales incentive, and those who provide lighting design for a fee.

Lighting Design as a Sales Incentive

Until recently, lighting sales personnel were the only lighting specialists available to architects and designers. A large percentage of the lighting designed in the world today is still provided through people whose primary mission is the sale of lighting products. Several principal groups provide design services.

Showroom and distributor salespeople. Many homeowners, interior designers, and architects rely upon sales personnel trained to sell lighting equipment directly to the buyer. The American Lighting Association (formerly the American Home Lighting Institute), a trade organization whose members include manufacturers and sales organizations, offers classes in lighting design. Often the salesperson can access goods from many different manufacturers, thus offering a wide range of possible selections.

Manufacturers' representatives and factory designers. For commercial projects, the lighting sales rep provides design consultation and assistance, computer analysis, and a number of other services to architects, engineers, and interior designers. The rep is often supported by the companies he or she represents, whose factory engineers and designers can provide additional information and design assistance.

Captive consultants. A few companies provide turn-key lighting design and construction. Many concentrate on specialized types of lighting, such as sports lighting or certain types of exterior landscape lighting.

All sales-oriented design services are paid for as part of the price of equipment. The salesperson provides as much help as possible within the likely profit margin of the sale. There is also an implicit expectation that once engaged to help, a salesperson can expect to get the job — with minimum cost competition for the actual materials.

Burying the cost of design in the cost of construction materials is an attractive proposition for the design professional whose own fee is limited. An architect, for example, seldom can convince a client that an additional fee is needed for a lighting specialist. By using a sales-oriented designer, the architect actually passes the additional cost of lighting design along to the client in another way.

Although profit is the primary motivation of the sales-oriented lighting specialist, good lighting design services are often the result. Many a sales rep has sat quietly in the room while an architect or engineer accepts a lighting design award for a project on which the rep contributed a great deal of design.

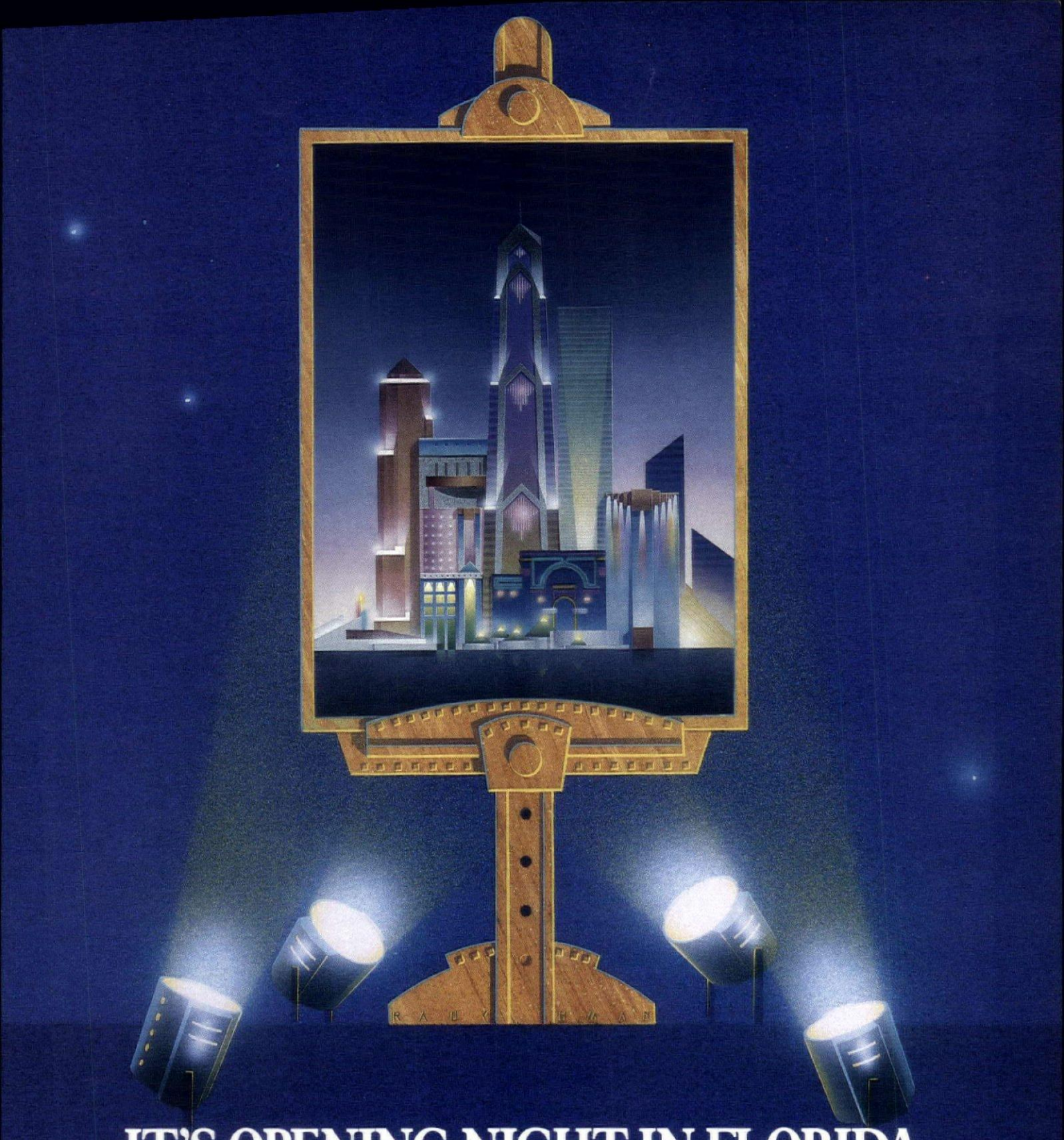
Lighting Design as a Profession

Traditionally, architects and designers have turned to consulting engineers, especially electrical engineers, to design lighting. Of all the consultants actually hired to design lighting, electrical engineers still represent the greatest number because most lighting is, after all, electrical.

Consulting engineers. As electrical engineering becomes specialized, illumination specialists — especially illuminating engineers — are increasing in number. Consulting engineering firms are now hiring lighting specialists and offering lighting design as part of their normal services.

Lighting consultants. Recently, completely independent lighting consultants and consulting firms have evolved, and offer design services for a fee. These firms are usually small organizations, and their principals may be former architects, engineers, interior designers, or theater designers.

For the finest projects, where fee is a secondary issue, independent lighting consultants have established a credible position. Most sophisticated developers and architects interview and retain lighting consultants on the basis of reputation and port-



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folio. In fact, the use of lighting consultants has become common on major projects in some metropolitan design communities, particularly New York and San Francisco. For projects with tighter fee budgets, engineering firms with in-house lighting expertise enjoy a distinct marketing advantage over competitors without it.

Lighting design is a part of architectural design; competent practice requires technical and professional knowledge of architecture.

The International Association of Lighting Designers (IALD) is a professional organization of independent lighting designers and consultants. To date, IALD membership is the only available assurance that a lighting consultant is independent rather than sales-oriented.

If You Want to Be a Lighting Designer

Becoming a lighting consultant seems like a glamorous, fame-and-fortune opportunity to designers and design students, especially those in the overpopulated fields of architecture and interior design. Lighting design is, in fact, a growing field, and properly trained professionals will be able to find sales-oriented or independent employment. But the number of truly glamorous design positions is still limited by the economics of the building construction system.

Some aspiring lighting designers also have a misconception that lighting systems are simple, needing only a minimum of support and wiring to work. In fact, lighting design is a part of architectural design, and competent practice requires knowledge of building systems and structures as well as professional understanding of contracts, the construction process, and management. For this reason alone, many of the most effective lighting consultants are architects or have worked in an architectural office.

But perhaps the most intriguing aspect of lighting design is its appeal to the "Renaissance man" in all of us. It is both an art and a science, encouraging practitioners to be part artist, part engineer. And with the welter of genuine discoveries and nonsense on such topics as the health-and-light issue, lighting designers need to combine academic discipline and horse sense to offer good advice.

No single educational program is best for all prospective lighting designers. One can opt for coursework that is specialized, such as lighting design or illumination engineering, or general, such as electrical engineering, architecture, interior design, or fine arts. If you pick specialized training in college, it is important to get generalized training on the job, and vice versa.

Many professionals want to become lighting designers after a number of years as an architect, interior designer, or engineer. Each of these candidates may have gained the important experience needed in the construction professions, but needs to retrain for lighting design. The primary areas of special skill and knowledge include the following.

Science of illumination. A lighting professional should be well versed in illumination science and engineering, beginning with the physics of light and continuing through the computer analysis of lighting designs. Concepts such as candlepower, lumen output, and watts per square foot should be thoroughly understood and easily used.

Art of illumination. Background and experience in creating moods and environments is extremely useful. Theater is an ideal training ground. A lighting professional should be able to use the color, color temperature, direction, and intensity of light to evoke feelings.

Architectural design. The history of architecture provides perspective and reference; knowledge of aesthetics, structure, and almost every other aspect of building design enable technical coordination between lighting and the building. Many architectural design issues, such as codes and zoning, affect lighting.

Electrical engineering. Because most lighting is electrical, detailed knowledge of electrical codes and circuit design is a necessity.

Construction management and administration. The practical matters of construction, such as shop drawings, field problems, punch listing, adjustments, contracting and payments, and related issues affect both the execution of the design intent and the long-term viability of the installation.

Background and experience in other specialized areas, including landscape architecture, are important if one chooses to design exterior lighting. In addition, many lighting designers have benefited from experiences in photography, physiology, psychology, and philosophy that helped them gain a broader understanding of how light affects people, objects, and environments. ■

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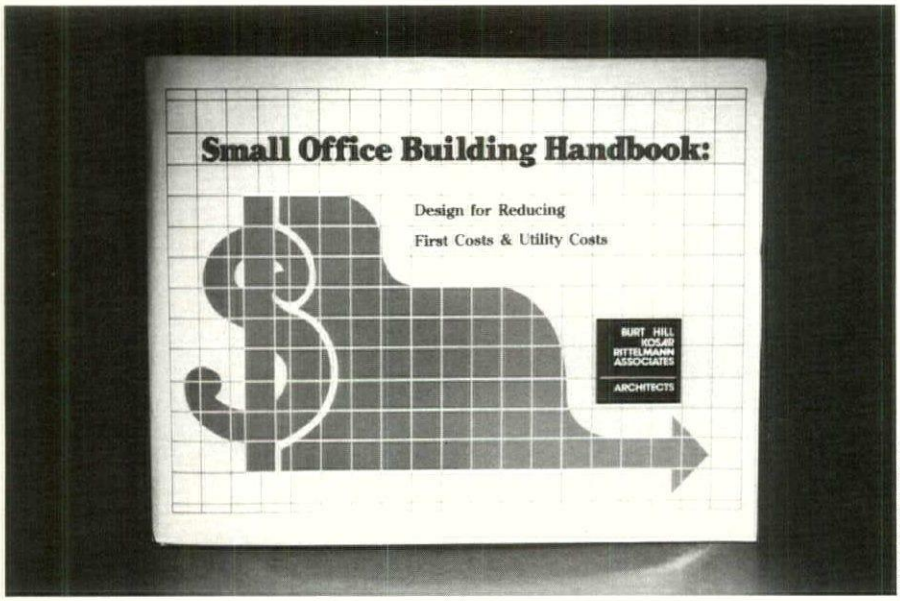

WILLIAM BRITTON

Dozens of energy-saving designs are listed in this book, which treats many lighting issues in satisfying detail.

Small Office Building Handbook: Design for Reducing First Costs and Utility Costs, by Burt Hill Kosar Rittelmann Associates. New York: Van Nostrand Reinhold Company, 1985. 318 pages.

Arguments for saving energy may lack a sense of urgency while oil prices are low, but reducing first costs always makes sense to building owners and designers. In addition to saving energy and money, better lighting and HVAC design can result in increased worker satisfaction and comfort.

Lighting design strategies figure prominently in the Small Office Building Handbook.

The *Small Office Building Handbook* was written by the staff of a well-known architectural research firm. Because the authors focus on small commercial buildings, improved lighting design strategies figure prominently in the book. Lighting not only consumes electricity directly, but also generates heat that must be removed by the HVAC system.

The handbook's recommendations for improving energy efficiency are based on good design and improved equipment alone, nothing exotic. The handbook starts with the premise that good current practice roughly matches ASHRAE Standard 90-75, Energy Conservation in New Building Design, and goes on to suggest additional levels of savings. Dozens of energy-saving designs are listed, including some that cost virtually nothing to implement. The recommendations are based on comparative computer simulations and the professional judgment of a wide range of building experts.

An almost classic example, and one of the simplest lighting improvements, is the installation of high-efficiency ballasts in fluorescent fixtures. Along with electrical load reductions come the downsizing of HVAC equipment, including cooling plant, ducts, and fans. In the typical building, this can mean many thousands of dollars in first-cost savings. Savings are typically large enough not only to pay for the higher efficiency ballasts but also to finance other energy improvements as well.

Other lighting issues are treated in satisfying detail: replacement of standard fluorescent lamps with high-efficiency lamps, installation of automatic daylight dimmers, design of nonuniform lighting systems to match occupant needs, and the installation of skylights and daylight dimmers in one-story buildings. The handbook shows how to quantify the energy and cost consequences of each of these recommendations.

The heart of the handbook is the "selector process," which is based on a series of forms and worksheets to help the designer select a set of energy conservation strategies. A clear example is worked out for a 40,000-square-foot office building in Washington, D.C. The authors use a decision tree to assist in comparing options based on actual energy costs. They strongly emphasize using analysis, not intuition, to identify energy conservation priorities. According to a recent poll, fewer than one architect or engineer in ten could correctly guess the annual utility bill of a small commercial office building. Only one in five could guess the most significant energy problem of that building.

If an engineering-design firm is contemplating the aggressive pursuit of energy-conserving design, this book is necessary reading. The semitechnical nature of the *Small Office Building Handbook* makes the information accessible to the architect and at the same time partially satisfies the engineer. However, the designer-engineer who wants to implement energy analysis will need more tools than this single volume supplies. The short glossary in the handbook will be useful to beginners, but a bibliography for further reading in this complex and technical field is needed. Emerging computer software is making energy analysis easier, but computer programs do not lessen the need to read books such as this. The *Small Office Building Handbook* helps to develop professional judgment and gives an overview of practical energy considerations not available elsewhere.

—David Lord

David Lord is a professor of architecture at California Polytechnic State University, San Luis Obispo.

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Product Showcase

■ Table lamp

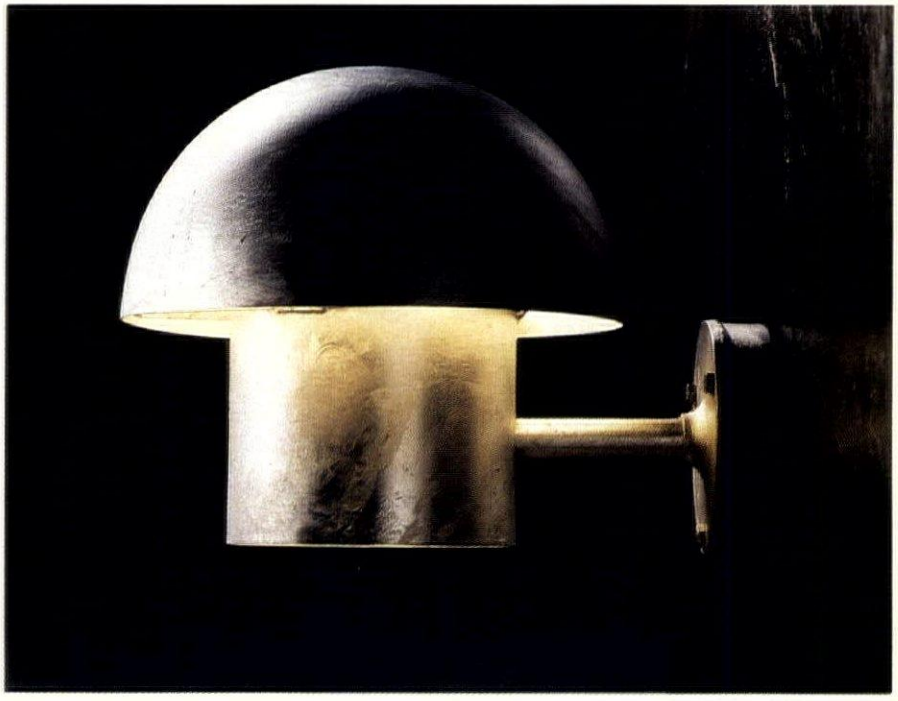
Lightning Bug offers Tre Ci Luce's Solaris table lamp, which has an adjustable arm and a swivel head. The luminaire comes in four finishes and uses a low-voltage halogen lamp. Matching floor lamps, wall- and ceiling-mounted fixtures, and clip-on versions are available. Lightning Bug, Ltd., Hazel Crest, IL.

Circle 60

■ Bollard

Ruud Lighting offers a bollard designed for the company's line of HPS, metal halide, fluorescent, and incandescent security lights. Available in single- and double-fixture styles, it is made of heavy gauge aluminum and finished with a bronze powder coat thermoset paint. A large wiring chamber with a removable front panel permits easy installation. Ruud Lighting, Racine, WI.

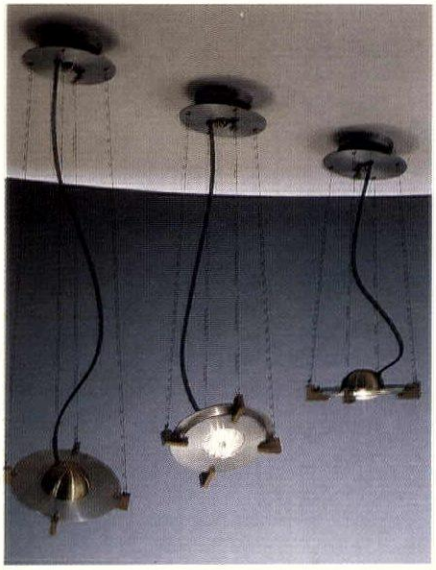
Circle 61



■ Exterior wall-mounted luminaire

The Bjarne Bech wall-mounted luminaire from Poulsen Lighting is a rounded, lantern-shaped luminaire of heavy-gauge sheet steel finished in a natural hot-dipped, galvanized coating. Light that strikes the reflector's inner surface is redirected out and down; the cylindrical concealing collar under the reflector is open at the bottom to provide downlight. Models are available for HID and incandescent lamps. Poulsen Lighting Inc., Miami, FL.

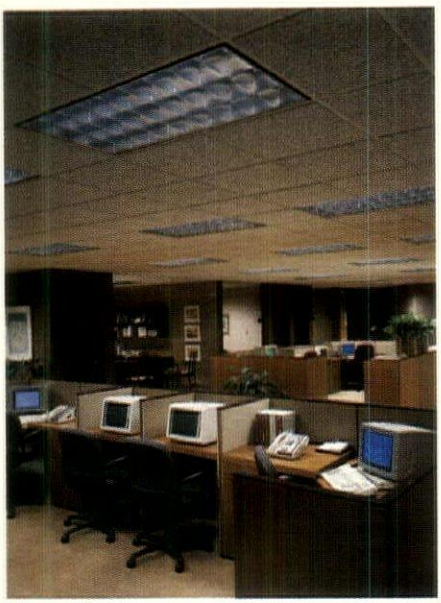
Circle 62



■ Tilting pendant lamp

Doyle Crosby designed Boyd Lighting's Tilt 36, a brass and aluminum double-disk pendant lamp suspended on four steel cables. It can be tilted for multidirectional control of the light beam and is counterbalanced to keep the angle stationary. The ceiling canopy contains a miniature solid-state transformer and a switch that locks the angle into permanent position in vulnerable locations. The lamp comes in two finishes and accommodates one 50-watt, 12-volt PAR 36 lamp. Boyd Lighting, San Francisco, CA.

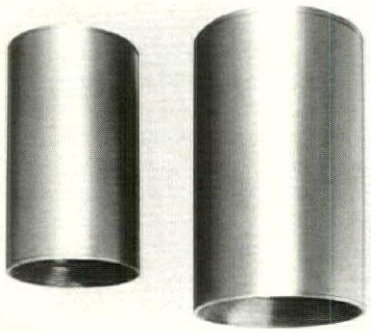
Circle 63



■ VDT lighting system

The Optimax luminaire from Lithonia Lighting has specular aluminum parabolic louvers set at computer-developed shielding angles for precise light control. Designed to prevent glare on VDT screens, the energy-efficient luminaire delivers 70 footcandles of uniform lighting to work surfaces while consuming only 1.5 watts of energy per square foot. The luminaire comes in two sizes to fit most standard lay-in ceiling grids. Lithonia Lighting, Conyers, GA.

Circle 64



■ High-wattage luminaires

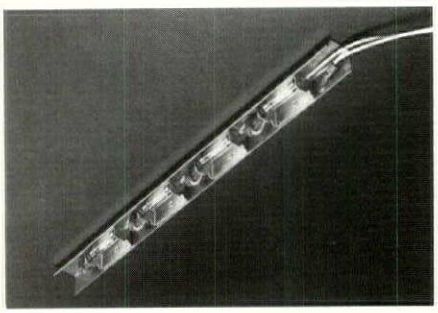
Devine Design's B1017 and B1321 heavy-gauge aluminum outdoor luminaires accept HID sources of 250 and 400 watts, respectively, and feature a finned top cap for heat dissipation and long lamp and ballast life. The cylinders are sealed and gasketed against moisture, dust, and insects, and come in pole-, ceiling-, wall-, and pendant-mount configurations. Both are UL listed for wet locations. Devine Design, North Kansas City, MO.

Circle 65

■ Spotlight

The compact, specification-grade 280 series spotlight from Lighting Services accommodates a 50- or 75-watt PAR 30 halogen lamp. Features include a self-locking steel yoke, an on-off switch on most mounting types, and accessory clips. The lightweight unit is suitable for short-throw applications where a moderate-intensity spot or flood beam is needed. Standard track fittings, other mounting devices, and a variety of accessories are available. Lighting Services Inc., Stony Point, NY.

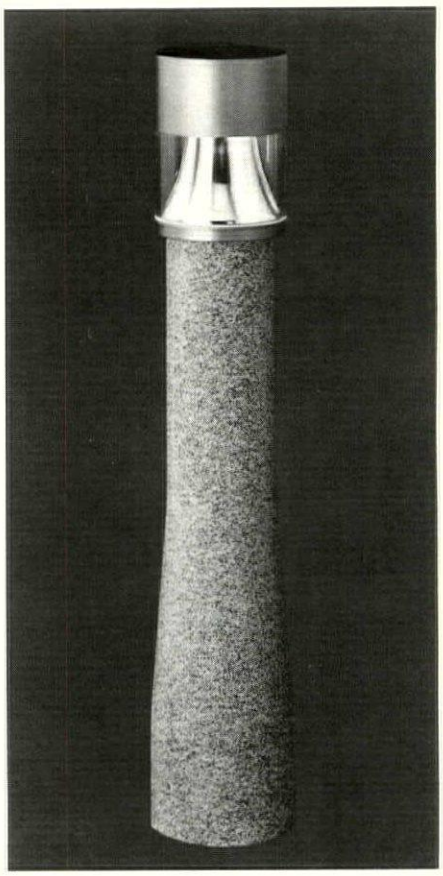
Circle 66



■ Low-voltage strip lights

Wendelighting offers Phantom Strips in three models: two for glare-free cabinet lighting and a silhouette strip for lighting coves and counter-tops. The metal strips are made to specified lengths, are available in two standard finishes, and accommodate 5- and 10-watt incandescent lamps in two voltages. Solid brass or stainless steel options are available. Wendelighting, Burbank, CA.

Circle 67

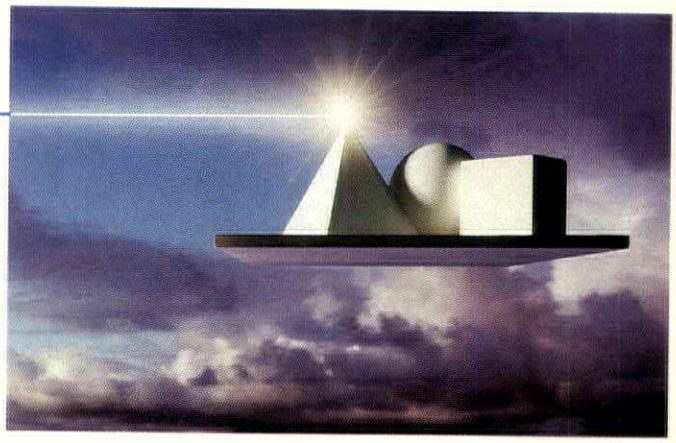


■ Bollard

Emco's bollards provide glare-free, low-level illumination and come in a variety of shapes and finishes to meet most architectural specifications. Shown is a round, tapered-base bollard of polymer concrete. Five optical systems include cone reflectors and cast louvers. The bollards accommodate incandescent and most HID sources; optional uplighting and house-side shields are available. Emco Environmental Lighting, Milan, IL.

Circle 68

LIGHTING WORLD INTERNATIONAL



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Circle 22

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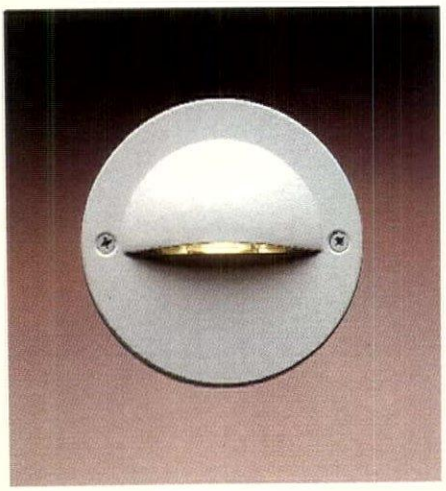
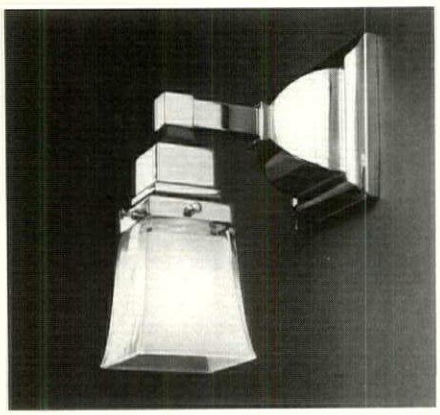


■ Step, aisle light

The Scoop from Norbert Belfer Lighting is a miniature low-voltage recessed step and aisle light for interior or exterior areas that require a high level of illumination. A single remote 24-volt transformer can operate several of the rugged 5-inch-diameter units. Each unit accommodates two 3.75-watt lamps. Norbert Belfer Lighting, Ocean, NJ.

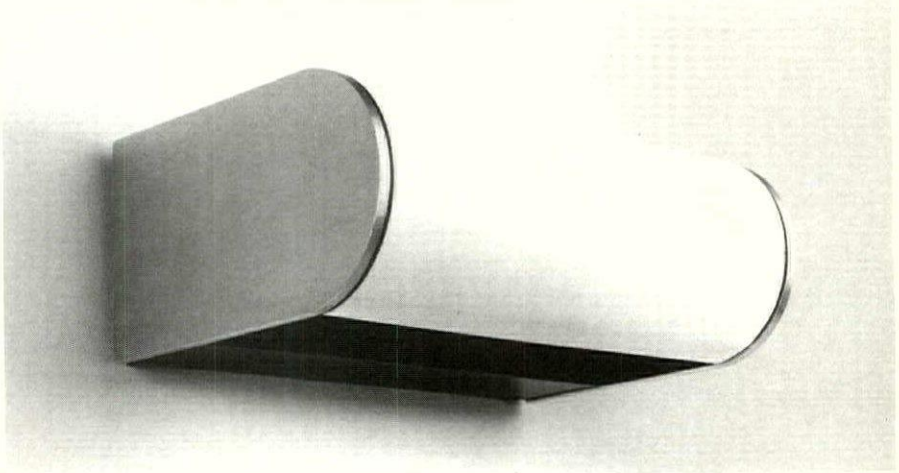
Circle 69



■ Brass sconce

The solid brass Evanston sconce from Brass Light Gallery's Goldenrod Collection has a classic design suitable for both new and restoration projects. It can be mounted with the glass shade aimed up or down; matching double-lamp and chandelier models are available. The sconce comes in contemporary white and four metal finishes. Brass Light Gallery, Milwaukee, WI.

Circle 70



■ HQI sconce

Elliptipar's Ensconce sconces are designed to use Osram's HQI metal halide lamps in applications previously limited to incandescents. Their reflectors project light in an asymmetrical pattern for even distribution over a large area from one side of that area. Elliptipar Inc., West Haven, CT.

Circle 71

■ Self-luminous markers

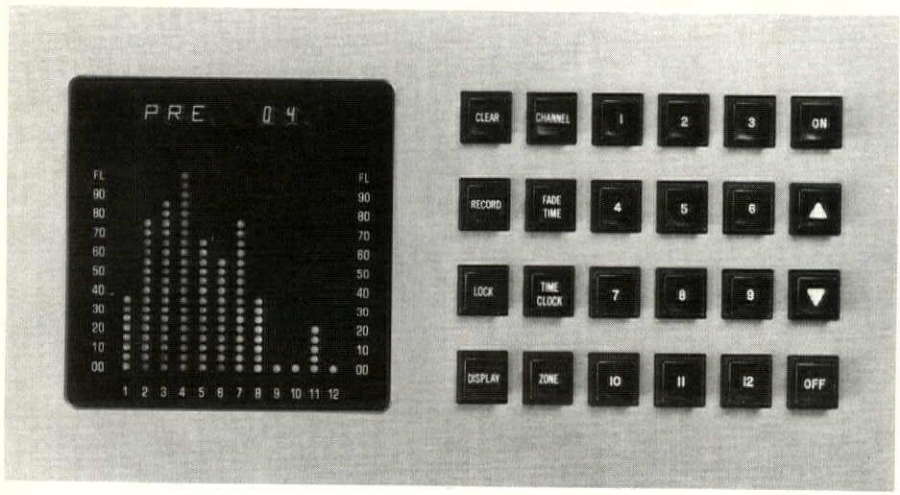
AisleMark self-luminous aisle and safety markers from SRB Technologies require no electric power, wiring, or batteries. Illumination comes from sealed borosilicate glass capsules coated internally with phosphor and filled with tritium gas. The units are always lit, but are visible only when ambient light is dim. They are available with and without legends and directional arrows. SRB Technologies, Danbury, CT.

Circle 72

■ Emergency lighting system

Bodine's HID 1600 emergency lighting system eliminates the need for auxiliary emergency lighting systems where HID lamps are used, according to the manufacturer. It has a DC power supply and remote ballasts, enabling it to provide continuous power for both normal and emergency lighting. When AC power drops or fails, current automatically flows from the battery until power is restored. Other fixtures are not affected if one fails. The Bodine Company, Collierville, TN.

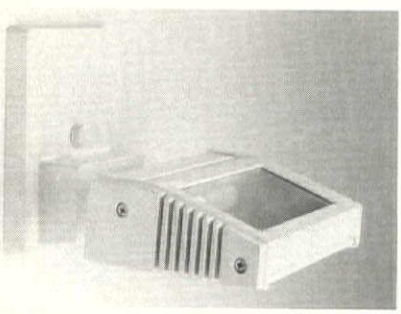
Circle 73



■ Lighting control system

The EPC-1 from Macro Electronics is a computer-based lighting management system; it can operate an unlimited number of lighting circuits on 12 control channels and 14 programmable presets, according to the manufacturer. The programmable master station operates alone or with remote control stations. Presets can be selected manually or automatically, and each has a fade rate that can be adjusted from one second to 60 minutes. Macro Electronics, Austin, TX.

Circle 74



■ Indirect fixture

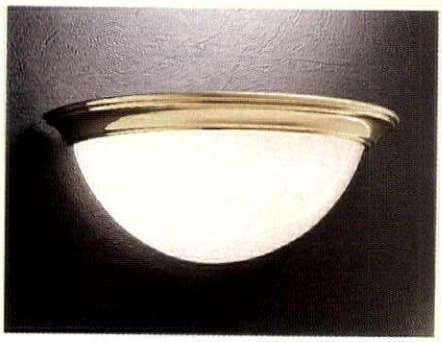
The Lite-Pak indirect uplight is the smallest fixture in Rambusch's Pan-A-Lux series. It has an extruded aluminum body, an anodized specular aluminum reflector, and a heat-resistant glass lens. The unit accommodates a 150-watt quartz lamp. Options include an ultraviolet-absorbing glass enclosure and barn doors; a wall-washing version is available. Rambusch Lighting, New York, NY.

Circle 75

■ Floodlight

Emco's compact Articulight floodlight has an integral yoke that lets users aim it up or down in a 90-degree range. It is designed for easy relamping and can be realigned on site. The floodlight has a tamper-proof, die-cast aluminum housing, a one-piece impact- and vandal-resistant tempered glass lens, silicone rubber gaskets, and an Alzak aluminum reflector available in several beam patterns. It accommodates metal halide and high pressure sodium lamps and comes in configurations for ground, pole, and wall mounting. Emco Environmental Lighting, Milan, IL.

Circle 76



■ Wall sconce

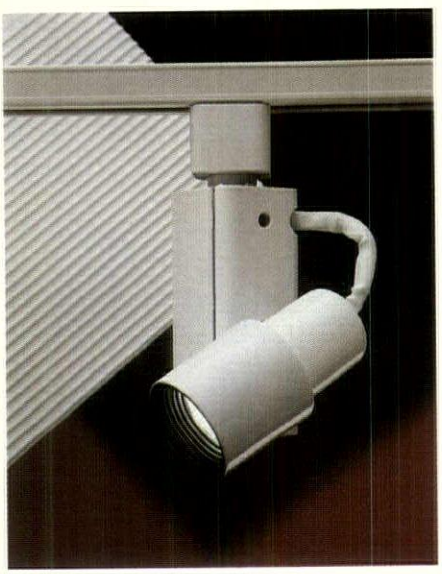
SPI Lighting's Renaissance wall sconce is from the Renaissance family of commercial fixtures. Its design features a quarter sphere of white acrylic or metal attached to a decorative trim ring. The sconce's polished aluminum forward-throw optical system accommodates a high pressure sodium, metal halide, or compact fluorescent lamp; a secondary fluorescent source illuminates the sphere itself for a subtle accent. SPI Lighting, Mequon, WI.

Circle 77

■ Custom bollard

Custom bollards from Ryther-Purdy are made to individual design specifications. Pictured is a bollard of kiln-dried western red cedar, which resists insects and decay and can be stained or left to weather to a silver gray. It comes in pedestal-mounted and direct-burial models, most of which accommodate an incandescent, fluorescent, or low-wattage HID source. Ryther-Purdy Lumber Co., Inc., Old Saybrook, CT.

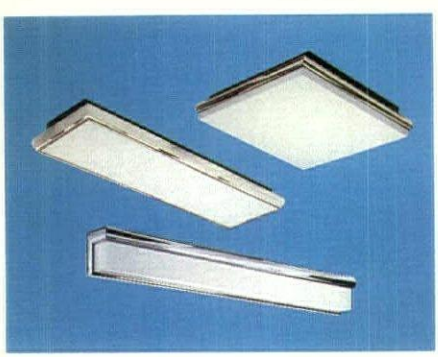
Circle 78



Low-voltage lamp holder

The L2711 low-voltage lamp holder from Halo Lighting's Power-Trac series delivers crisp, white light in applications where heat, color, temperature, or spill light are critical considerations. The lamp holder accommodates Q20 and Q35 MR11 lamps in narrow spot, spot, and narrow flood beam patterns. It can be used with compatible 1- and 2-circuit tracks and comes in two finishes. Halo Lighting, Elk Grove Village, IL.

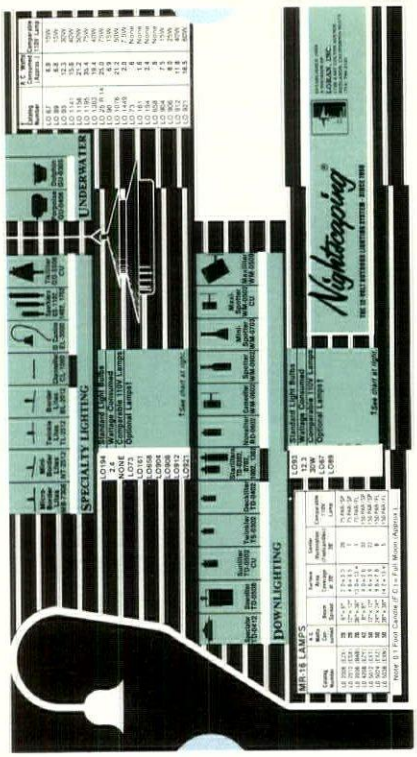
Circle 79



Decorative fluorescents

LaMar Lighting has introduced a line of decorative fluorescent luminaires in designs for contemporary interiors. The luminaires have acrylic diffusers and come in metallic chrome and brass finishes. Many sizes and combinations are available. LaMar Lighting Co., Inc., Freeport, NY.

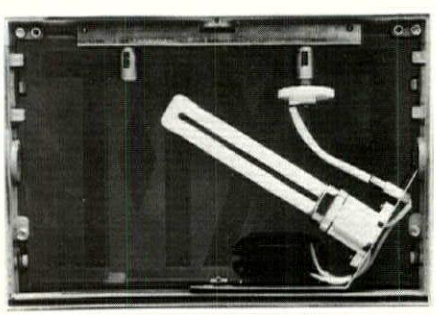
Circle 80



Lighting slide chart

A compact slide chart from Nightscaping provides key installation information on landscape lighting fixtures and applications. The chart covers backlighting, uplighting, downlighting, and path, specialty, and underwater lighting. Data include low-voltage lamp characteristics, wattages, wire sizing, and comparisons of lumens for line- and low-voltage lamps. Nightscaping, division of Loran Inc., Redlands, CA.

Circle 81



Exit sign conversion kit

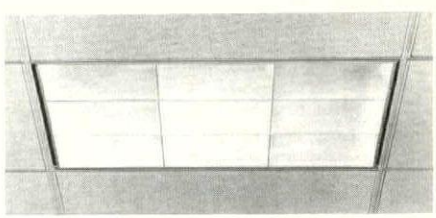
GTE's energy-saving fluorescent exit sign conversion kit replaces the standard incandescent lamp used in many exit signs. It consists of a compact fluorescent lamp, a ballast, a ballast mounting bracket, and socket adapters for converting from incandescent to fluorescent lighting. The manufacturer rates the unit's life at 10,000 hours. GTE/Sylvania, Danvers, MA.

Circle 82

Decorative MRI sconce

Appleton Lamplighter's AL-213-MRI sconce is made of nonferrous materials that will not distort equipment readouts in MRI (magnetic resonance imaging) rooms. It has a one-piece solid brass back-plate and bottom, a ribbed glass diffuser, and a silver-soldered, metal-finished bottom trim. A clear urethane coating protects the polished brass from corrosion. The fixture comes in two diameters and uses an A19 lamp. Appleton Lamplighter, Appleton, WI.

Circle 83



Parabolic fixture

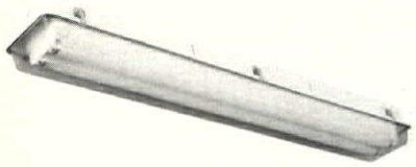
The Deepcel parabolic fixture from Lightolier is designed to accept three 31-watt compact U-shaped or three 40-watt biaxial fluorescent lamps in its $5^1/_4$-inch-deep chassis. The fixture's 9-cell low-iridescence louver configuration provides a combination of photometrics and sources that produces a lumen output comparable to that of a conventionally lamped 18-cell, three-lamp 2-by-4 fixture, according to the manufacturer. Lightolier, Secaucus, NJ.

Circle 84

■ Pen plotter

Ioline's high-performance LP3700 plotter draws on any size bond, vellum, double-matte polyester film, or acetate film from 1 1/2 inches square to 37-inch-wide continuous roll stock. Its axial speed is 10 inches per second with .001-inch resolution. The plotter holds up to 20 pens and stores customized plot parameters in a nonvolatile memory. It emulates HP-GL and DM/PL plotter languages, uses HP-compatible plotting pens, and is compatible with the IBM PC, PC compatibles, Apple Macintosh, and systems using RS-232 hardware interface. Ioline Corporation, Kirkland, WA.

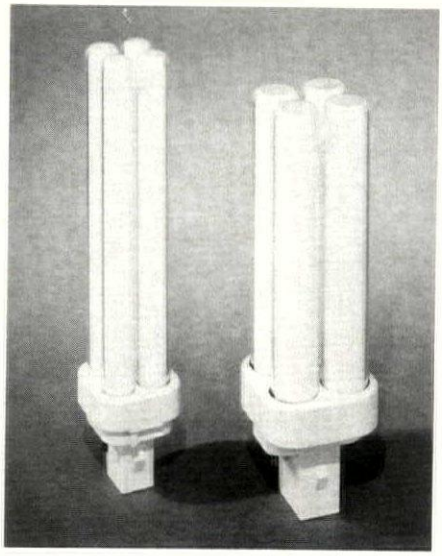
Circle 85



■ Industrial luminaire

The Series 86 line of industrial luminaires from H.E. Williams includes a model UL-listed for wet locations with factory-installed watertight fittings. Its acrylic lens attaches to the housing with tamper-resistant tension clamp latches, and the lamps are accessible without tools. The luminaire accommodates one or two rapid-start, slimline, or high-output fluorescent lamps in an enclosure listed by the National Sanitation Foundation. H.E. Williams, Carthage, MO.

Circle 86



■ Compact fluorescent

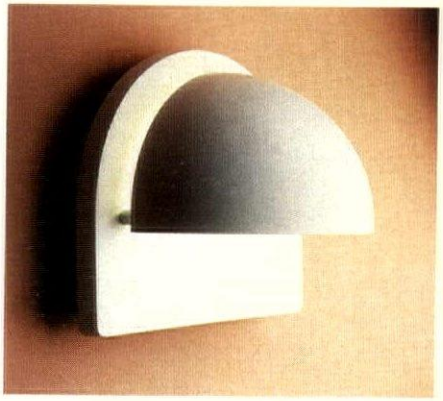
PLC quad compact fluorescent lamps from Philips Lighting can be used to replace incandescent sources from 40 to 100 watts. The lamps have a color rendering index of 82 and a Kelvin temperature of 2700. A 10-millimeter size comes in wattages from 10 to 26, and a shorter, wider 15-millimeter size comes in 14 and 20 watts. Philips Lighting Company, Somerset, NJ.

Circle 87

■ Solar number light

Sunergy's Digilite is a wireless solar-powered number light that provides a full night's illumination after 1 1/2 hours of exposure to sunlight, according to the manufacturer. The housing is waterproof, and the light can display as many as five 4-inch red digits. The unit comes with mounting hardware and spike or can be attached to mailbox, house front, tree, or soffit. Sunergy, Inc., Princeton, NJ.

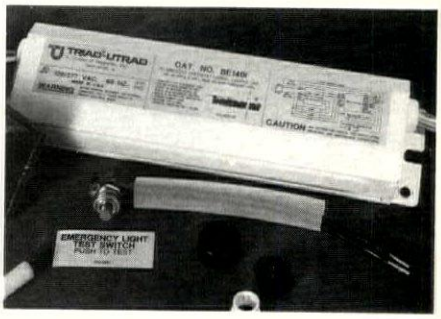
Circle 88



■ Wall-mounted luminaire

Poulsen Lighting's Homann M2 wall-mounted luminaire is made of die-cast aluminum and features a quarter sphere connected by three spacer rods to a rounded rectangular backplate. The luminaire accommodates a 7-watt compact fluorescent lamp and comes in two finishes. Matching name plates and a vandal-resistant clear polycarbonate shield are available. Poulsen Lighting Inc., Miami, FL.

Circle 89



■ Emergency lighting pack

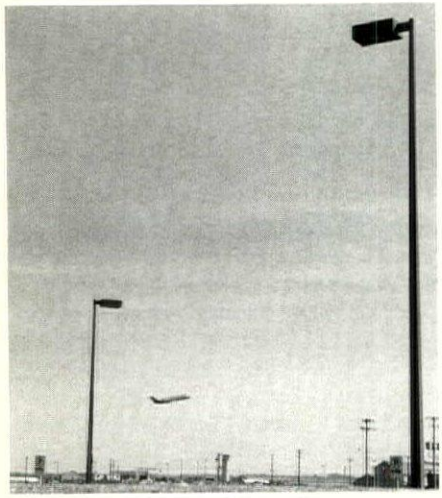
MagneTek Triad's Ballastar emergency lighting pack powers 90 minutes of lighting when AC power fails, according to the manufacturer. The one-piece, self-contained pack uses a 10-year maintenance-free nickel-cadmium battery. It is compatible with one-, two-, or three-lamp standard and solid-state ballasts. The pack comes in three models that each produce 545 to 1100 lumens, depending on the source. MagneTek, Inc., Huntington, IN.

Circle 90

■ Low-level area lighting

Luminaires in Kim Lighting's Site Lightforms series provide cutoff illumination for pathways, entrances, courtyards, atria, and landscaped areas. Pictured is the SL5 model, which features a half-rounded cast aluminum head and extruded aluminum shaft. The luminaires accommodate HID, compact fluorescent, and incandescent sources. Kim Lighting, City of Industry, CA.

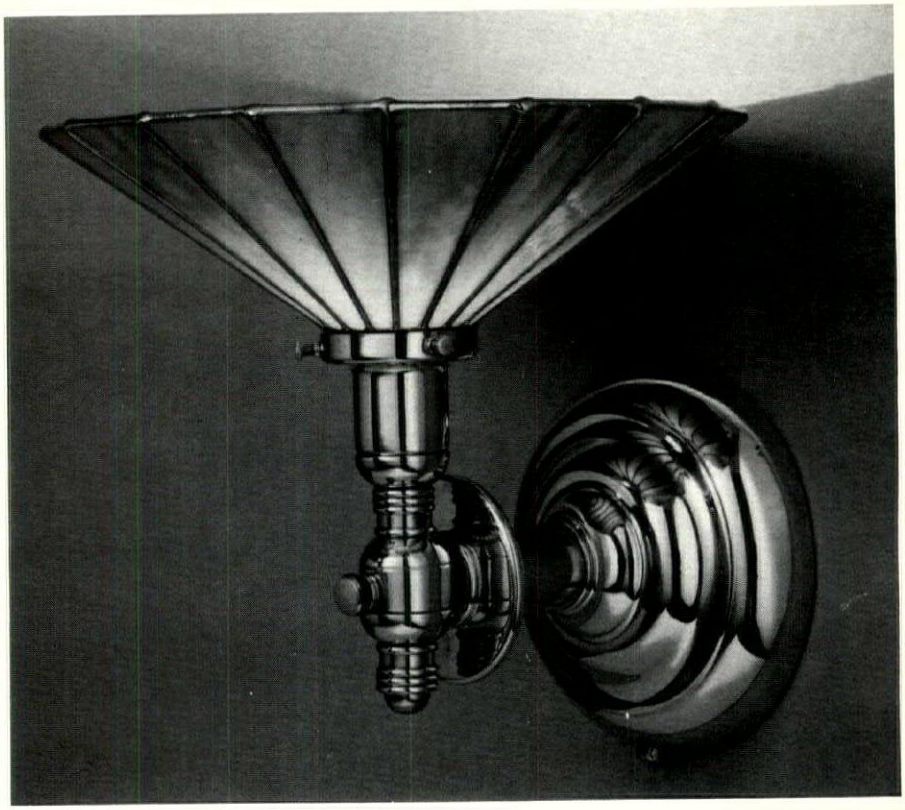
Circle 91



■ Concrete poles

Prestressed concrete light poles from CPI come in heights to 65 feet with exposed aggregate finishes. Their 14 colors are cast throughout the concrete for a maintenance-free permanent finish that needs no paint and neither peels nor rusts. CPI Concrete Products, Memphis, TN.

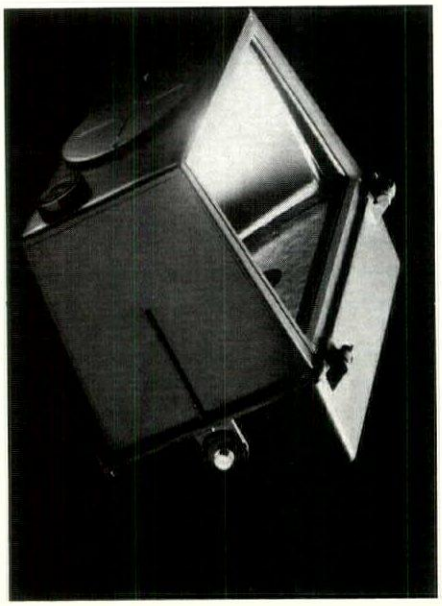
Circle 92



■ Handcrafted glass lamp

The Wall Torch from Gemma Studios, part of the Gemma Collection of handcrafted glass lamps, is designed with high reflectivity for large areas. The sconce will take a lamp up to 100-watts but satisfies most lighting needs with a 40- to 75-watt standard clear incandescent lamp, according to the manufacturer. The fixture can be wired directly into the wall for series operation or plugged into an outlet for individual use. Gemma Studios, Northampton, MA.

Circle 93



■ HPS floodlight

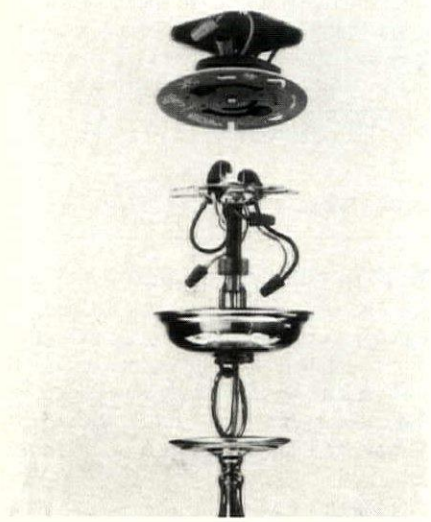
American Electric's Ultra Flood HPS floodlight meets or exceeds all NEMA specifications for heavy-duty floodlighting. A parabolic aluminum reflector maximizes lumen output; an optional plastic lens shields a high-impact, thermal shock–resistant glass lens against weather and vandalism. The fixture accepts sources up to 1000 watts. The die-cast aluminum housing comes in 12 colors. American Electric Commercial and Industrial Lighting Group, Memphis, TN.

Circle 94

■ Brass pendant

The Schoolhouse is a solid brass, single-pole fixture with a hand-blown glass shade and a lacquered finish. The UL-listed fixture is 12 inches high and 35 inches long and takes a 150-watt standard incandescent lamp. Shades are available in several sizes. Rejuvenation Lamp & Fixture Company, Portland, OR.

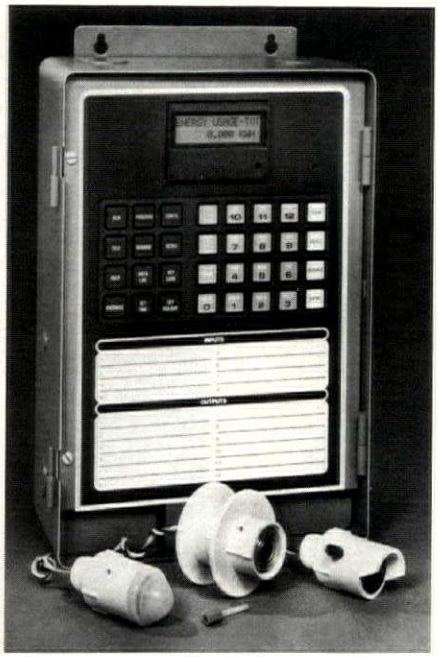
Circle 95



■ Ceiling-fixture jack

Wiremold's Wire Light ceiling-fixture jack is a two-piece system with a mounting plate and a jack. Installation involves inserting the jack into a mounting plate, pushing up, and twisting it to make electrical and mechanical connections. The pieces disconnect easily for removal, relamping, or cleaning. The Wiremold Company, West Hartford, CT.

Circle 96



■ Light sensors

Paragon Electric has three light sensors that interface directly with the company's EC128 energy monitoring and control system. The LS-O sensor monitors outdoor light levels and controls outdoor lighting, the LS-I monitors indoor light levels and controls indoor perimeter lights, and the LS-S monitors skylight light levels and controls indoor lighting. All sensors are programmable to desired light levels. Paragon Electric Company, Inc., Two Rivers, WI.

Circle 97

■ Outdoor reflector luminaire

Architectural Area Lighting's aluminum reflector hood with a sag diffuser is supported by a cast aluminum arm that can be mounted to posts or walls. It is available in single and multiple configurations, comes in a variety of finishes, and accommodates HID sources. Architectural Area Lighting, Inc., La Mirada, CA.

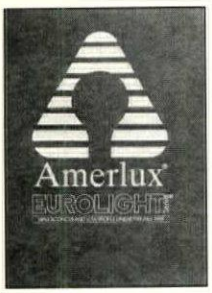
Circle 98

■ Compact HPS unit

CEW Lighting's compact, screw-base Daylux-50 combines a 50-watt high pressure sodium lamp, ballast, and reflector in one unit. It can fit completely inside most recessed R40 can-type fixtures designed to take 150-watt incandescent lamps. The unit has a color rendering index of 82, a color temperature of 2500K, and a 12,000-hour lamp life. It is available with a spot or flood reflector. CEW Lighting, Dallas, TX. ■

Circle 99

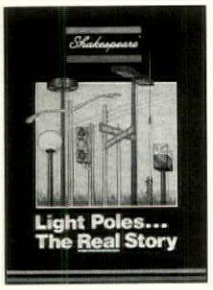
Product Literature



Decorative luminaires

The Eurolight Series includes wall sconces, wall brackets, desk lamps, and floor lamps in eight styles. An illustrated 12-page brochure contains photographs, dimensional sketches, and lamp requirements. Amerlux, Fairfield, NJ.

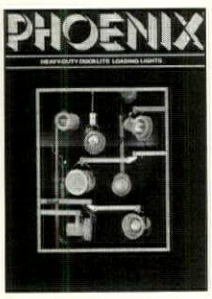
Circle 120



Fiber glass poles

An illustrated color brochure discusses the advantages of lightweight fiber glass light poles. It shows standard colors, finishes, bases, and accessories for tapered round and square models. Shakespeare, Newberry, SC.

Circle 121



Heavy-duty loading lights

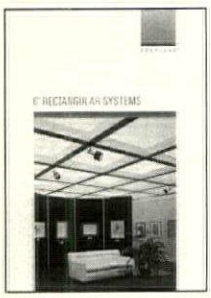
Docklite loading lights provide controlled lighting that meets OSHA requirements for loading areas, according to the manufacturer. A 16-page brochure profiles models in several mounting configurations, including a pull-down unit. Phoenix Products Company, Inc., Milwaukee, WI.

Circle 122

Ornamental outdoor lighting

Sentry Lighting's 1989 ornamental lighting catalog shows outdoor fixtures, poles, and standards. A variety of styles include Art Deco, traditional bishop's crook, and recent designs for New York's Central Park and Battery Park City. Sentry Lighting, Freeport, NY.

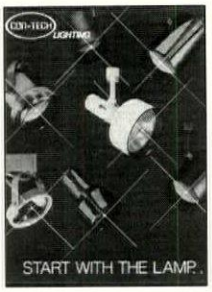
Circle 123



Fluorescent system

A 6-inch rectangular fluorescent system is available in depths of 4¾, 6, and 8 inches. A brochure shows possible configurations of up- and downlighting and combinations of both. Peerless Lighting Corporation, Berkeley, CA.

Circle 124



Track lighting

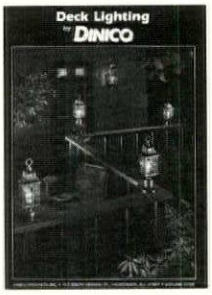
A 12-page color brochure describes and illustrates Con-Tech's track fixtures, including HyTech universal and gimbal lamp holders. It lists dimensions, finishes, accessories, and lamp requirements. Con-Tech Lighting, Deerfield, IL.

Circle 125

Chandeliers

A 42-page catalog from Gross Chandelier contains sketches and color photos of contemporary and traditional chandeliers and matching wall sconces, some with a choice of shades. It includes dimensions, finishes, and lamp requirements. Gross Chandelier Company, St. Louis, MO.

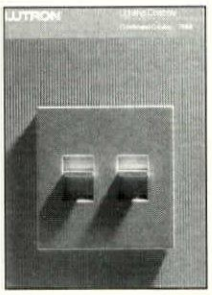
Circle 126



Deck lighting

Dinico luminaires are designed to light decks, landscapes, and other outdoor entertainment areas. A color brochure with illustrations presents fixtures, components, and accessories. Dinico Products Inc., Hackensack, NJ.

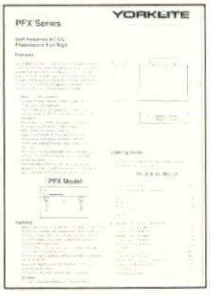
Circle 127



Lighting controls

Lutron offers a 32-page condensed catalog of dimmers, switches, fan speed controllers, and lighting control systems for most line- and low-voltage sources. It includes charts, tables, and photographs. Lutron, Coopersburg, PA.

Circle 128



Exit, emergency sign

The PFX series self-powered AC/DC exit sign uses two 5-watt compact fluorescent lamps for low energy and maintenance costs. A data sheet contains dimensional and cutaway drawings, features, and options. York-Lite Electronics, Inc., Austin, TX.

Circle 129

■ Streetlighting

Welsbach Lighting's line of HID streetlights includes contemporary and historic fixtures, bollards, posts, brackets, and pier bases. A brochure contains photos and dimensions of each style. Welsbach Lighting Inc., New Haven, CT.

Circle 130

■ Landscape lighting

Hadco offers 72-hour delivery of architectural outdoor lighting equipment. A color brochure presents technical and ordering details for fixtures for incandescent, fluorescent, and HID sources. Hadco, Littlestown, PA.

Circle 131

■ Decorative luminaires

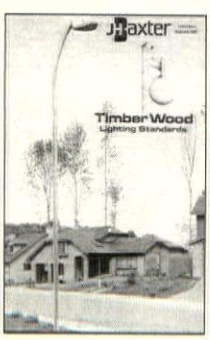
Casablanca Lighting's 44-page color catalog profiles decorative ceramic, Murano glass, and Irish lead crystal pendants, ceiling lamps, sconces, and table lamps. Casablanca Lighting, Valley Forge, PA.

Circle 132

■ Recessed downlights

A brochure from Omega Lighting presents the Quicklights collection of recessed incandescent downlighting fixtures and accessories for both low and line voltage. Omega Lighting, Emerson Electric Co., Melville, NY.

Circle 133



■ Wooden standards

A four-page color brochure describes the Timber Wood line of wooden lighting standards and includes dimensions of straight laminated, pressure-treated Douglas fir standards and crossarms. J.H. Baxter & Company, Eugene, OR. ■

Circle 134

Calendar

March 13–15, 1989	**Reflector design — Theory and practice,** seminar, Stapleton Plaza Hotel, Denver. Contact: TLA–Lighting Consultants, Inc., 72 Loring Ave., Salem, MA 01970, (508) 745-6870.
March 14, 1989	**Kitchens and baths,** DLF event. Contact: Designers Lighting Forum of Northern California, P.O. Box 1429, San Francisco, CA 94101-1429, (415) 824-8310.
March 15, 1989	**The great outdoors — Landscape lighting product revue 1989,** joint DLF-IES event, International Design Center, Long Island City, NY. Contact: Keesler Cronin, Lighting Dynamics of New York, 70 W. 36th St., Suite 605, New York, NY 10018, (212) 268-9222.
March 15, 1989	**Lighting corporate headquarters,** DLF event. Contact: Sy Bollinger, president, Designers Lighting Forum of New York, Inc., 58 Stratford Ave., Greenlawn, NY 11740, (212) 255-8555.
March 20–21, 1989	**Lighting conference for architectural consultants,** Philips Lighting Center, Somerset, NJ. Contact: Sherry Bachman, Philips Lighting Center Coordinator, Philips Lighting Company, P.O. Box 6800, Somerset, NJ 08875-6800, (201) 563-3600.
April 4–6, 1989	**RHIDEC,** international hotel and restaurant design exposition and conference, Los Angeles Convention Center. Contact: National Expositions Company, Inc., 15 W. 39th St., New York, NY 10018, (212) 391-9111.
April 5–9, 1989	**19th annual NEMRA conference,** Marriott Hotel & Marina, San Diego, CA. Contact: Henry P. Bergson, National Electrical Manufacturers Representatives Association, 222 Westchester Ave., Suite 330, White Plains, NY 10604, (914) 428-1307.
April 5–12, 1989	**World Light Show '89,** Hanover Fair, Hanover, West Germany. Contact: Terence Coe, 103 Carnegie Center, Princeton, NJ 08540, (609) 987-1202.
April 10–12, 1989	**Designing electrical systems for hazardous locations,** course, University of Wisconsin, Madison. Contact: E.K. Greenwald, Engineering Professional Development, University of

Continued on page 61

Classified Directory

ACCENT AND DISPLAY LIGHTING (INTERIOR)

AMERLUX, 23 Daniel Rd., Fairfield, NJ 07006 ..... 201/882-5010

BEND-A-LITE (see ad this section)

CUSTOM NEON Mfg., install interior neon portable & wall-mount art & signs. 213/937-6366

DANALITE, 16392 Gothard St. #A, Huntington Beach, CA 92647 ..... FAX 714/848-1669 714/841-4325
Low voltage/slim profile linear lighting system/high intensity halogen lamps/extensive apps.

FIBERSTARS, 47456 Fremont Blvd., Fremont, CA 94538 ..... 800/327-7877

MIROFLECTOR CO., 40 Bayview Ave., Inwood, Long Island, NY 11696 ..... 516/371-1111
Full line of recessed accent lights, down lights & wall washers. Architectural cylinders for HQI, incandescent compact quad fluorescents and HID lamp sources.

NATIONAL SPECIALTY LIGHTING (see ad this section)

NL CORP., 14901 Broadway, Cleveland, OH 44137 ..... FAX 216/662-9069 or 216/662-2080
Recessed HID and incandescent; decorative; custom; church; 20, 30, & 60 amp track; fluorescent lighting systems. Call for more information.

E.G. SCHLESSELMAN, INC., 2778 Banning Rd., Cincinnati, OH 45239 FAX 513/923-1654 513/923-1144
Designer & Manufacturer of Special & Standard Lighting Fixtures for the Display Industry.

ACCESSORIES AND COMPONENTS

AMERICAN LOUVER CO., Skokie, IL, Louvers and Lenses ..... 800/323-4250 or 312/470-3300

LEXALITE INT. CORP., P.O. Box 498, Charlevoix, MI 49720 ..... FAX 616/547-5833 or 616/547-6584
Custom and Proprietary Injection Molded Lighting Products. (For information call Cheryl Barron.)

MAXIMUM TECHNOLOGY, 60 Industrial Way, Brisbane, CA 94005 ..... 415/468-2560

AMBIENT LIGHTING SYSTEMS (INTERIOR)

DAY-BRITE/McPHILBEN/OMEGA—Complete fixture needs. ..... Fax 601/841-5501 or Call 601/842-7212

H.E. WILLIAMS INC., P.O. Box 837, Carthage, MO 64836 ..... 417/358-4034

LITHONIA LIGHTING. We cover the lighting spectrum 404/922-9000

NORBERT BELFER LIGHTING MFG., Cove & Linear Lighting Products 201/493-2666

PEERLESS LIGHTING CORP., P.O. Box 2556, Berkeley, CA 94702 ..... 415/845-2760

AREA LIGHTING (EXTERIOR)

ADJUSTA-POST MFG. CO., P.O. Box 71, Norton, Ohio 44203 ..... FAX 216/745-9746 800/321-2132
Residential & commercial outdoor fixtures. Stds. & Acces., HID, fluorescent, low volt. & incandescent.

AMERICAN ELECTRIC, 1555 Lynnfield Rd., Memphis, TN 38119 ..... 901/682-7766
HID luminaires for area, facade, roadway, sports, and industrial lighting applications.

C.P.I. CONCRETE PRODUCTS, P.O. Box 13324, Memphis, TN 38113 ..... FAX 901/775-9883 or 901/775-9880
Concrete light poles & bollards. Fourteen decorative colors & exposed aggregate finishes such as dark bronze, black, & granite to match any setting. Square tapered design up to 65 ft.

ELA CO., 17891 Arenth Ave., City of Industry, CA 91748 ..... 818/965-0821 FAX 818/965-9494
Mfgs. of decorative outdoor fixtures, poles and arms for the commercial and residential mkts. Custom designing and mfg. of decorative interior/exterior fixtures.

EMCO ENVIRONMENTAL LIGHTING, 7300 50th St., P.O. Box 1640, Milan, IL 61264 ..... 309/799-3111

HOLOPHANE, 214 Oakwood Ave., Newark, OH 43055 ..... 614/345-9631

J.H. BAXTER & COMPANY, P.O. Box 10797, Eugene, Oregon 97440 ..... 503/689-3020
Manufacturer of Timberwood Lighting Standards. A superior pressure-treated Douglas fir laminate for decorative outdoor lighting support. Contact Richard Baxter.

PEMCO CORP., Philadelphia, PA, Exterior HID & Custom Lighting & Poles 215/236-9020

RUUD LIGHTING, 9201 Washington Ave., Racine, WI 53406 ..... 800/558-7883

RWL CORP., 240 Sargent Dr., New Haven, CT 06511 ..... 203/789-1710

STONCO, 2345 Vauxhall Rd., Union, NJ 07083. Contact Phil Henry at 201/964-7000
Outdoor lighting; fixtures and accessories for industrial, commercial and residential markets.

UNION METAL CORP., 1022 9th St. SW, Canton, OH 44707 ..... 216/456-7653
Steel, aluminum and concrete poles for area, roadway and sports lighting. Hi-mast raise-lower systems. Ornamental nostalgia lighting poles and luminaires.

W.F. HARRIS LIGHTING, 4015 Airport Ext. Rd., Monroe, NC 28110 ..... 704/283-7477
Indoor/outdoor decorative & vandal-resistant rustproof lighting for wall, ceiling, post & landscape applications. U.L. listed H.I.D., FL, INC & emergency fixtures.

CONTROLS

LEE COLORTRAN, Inc., 1015 Chestnut St., Burbank, CA 91506 ..... FAX 818/954-8520 or 818/843-1200
VIEWPOINT, a field-configurable system of off-the-shelf Architectural Dimming and Control Components from Lee Environmental Lighting—a division of Lee Colortran, Inc.

LUTRON ELECTRONICS, 205 Sutter Rd., Coopersburg, PA 18036 ..... 215/282-3800

STRAND ELECTRO CONTROLS, 2975 S. 300 W. Salt Lake City, UT 84115 ..... 801/487-6111
Manufacturing full line of lighting controls and dimmers for Restaurants, Hotels, Board Rooms, etc.

DAYLIGHTING PRODUCTS

MULTIPOINT CONTROL SYSTEMS, 3101 111th St. SW #A, Everett, WA 98204 ..... 206/347-3499
Full line of adjustable photocell lighting control sensors & systems for indoor/outdoor applications.

DECORATIVE LUMINAIRES (INTERIOR)

BRASS REPRODUCTIONS, 9711 Canoga Ave., Chatsworth, CA 91311. Decorative Fixtures. 800/828-5858

DESIGN SOFTWARE & TESTING/MEASURING INSTRUMENTS

INTERNATIONAL LIGHT, Dexter Industrial Green, Newburypost, MA 01950 ..... 617/465-5923
Radiometers, photometers, spectroradiometers, laser power meters for radiometry, photometry, UV curing, UVA/B phototherapy, germicidal radiometry & UV hazard use.

LAMPS

GENERAL ELECTRIC, Ad Response Dept., Nela Park #4151, Cleveland, OH 44112 ..... 216/266-3200

GTE/SYLVANIA LIGHTING, Sylvania Lighting Center, Danvers, MA 01923 ..... 617/777-1900

OSRAM CORP., P.O. Box 7062 Jeanne, Newburgh, NY 12550 ..... 914/564-6300

PHILIPS LIGHTING CO., 200 Franklin Square Dr., Somerset, NJ 08875 ..... 800/631-1259 800/752-2852

USHIO AMERICA, 20101 S. Vermont Ave., Torrance, CA 90502 ..... FAX 213/329-3641 or 213/329-1960
Manufacturer of MR11, MR16, T3 Quartz, Minican and DC Bayonet Halogen Lamps.

VENTURE LIGHTING INTL., 625 Golden Oak Pkwy., Cleveland, OH 44146 ..... 800/437-0111
Metal Halide, High and Low Pressure Sodium, Mercury, MR-16 and MR-11 Display Lamps. Many new and unique products not available from other manufacturers.

LANDSCAPE LIGHTING

ABEC LIGHTING, 4084 Arnold Ave., #8, Naples, FL 33942 ..... 813/643-4242 or 813/643-3305
Quality outdoor landscape & security lighting. PVC construction. Fluorescent/low voltage available—all styles. Custom color & design. Commercial, residential, marine.

DINICO PRODUCTS, INC., 123 So. Newman St., Hackensack, NJ 07601 ..... 201/488-5700

ELECTRO-ELF, 10011 Olive St., Temple City, CA 91780 ..... 818/286-5002 Fax 818/579-1333
Energy Efficient Fluorescent lighting. Sealed Waterproof Fixtures available in many styles and colors.

HADCO, P.O. Box 128, 100 Craftway, Littlestown, PA 17340 ..... 717/359-7131

IDAHO WOOD, Sandpoint, ID, Landscape Lighting (Wood) ..... 800/635-1100 or 208/263-9521

NIGHTSCAPING, 1705 E. Colton Ave., Redlands, CA 92373 ..... 714/974-2121

LIGHTING DESIGNERS AND CONSULTANTS

FREDRICK RAMOND INC., 16121 S. Carmenita Rd., Cerritos, CA 90701 ..... FAX 926-1015 213/926-1361

LIGHTSPACE DESIGN, 2111 Vine, Suite B, Berkeley, CA 94709. Consultant & MFG 415/540-6023

LIGHTING POLES (WOODEN)

WOODFORM, INC., Portland, OR 97220-1230 ..... 800/624-5091

OEM MANUFACTURERS

EDWIN GAYNOR CO., 200 Charles St., Stratford, CT 06497 ..... 203/378-5545 or FAX 203/381-9019
For more information about fluorescent wiring devices, switches and lamp holders, call and ask for Jill Sapak.

OTHER LIGHTING SYSTEMS AND LUMINAIRES

KOR-LITE Fluorescent Emergency Lighting Systems ..... ***Phone: 408/727-0314 FAX 408/492-1403***
LIGHTING TECHNOLOGIES INC., 2540 Frontier, Suite 107, Boulder, CO 80301 ..... ***303/449-5791***
Complete luminaire design and lighting system analysis software and consulting service.

REFLECTOR MATERIALS

ALCOA, Sheet & Plate Division, P.O. Box 8025, Bettendorf, IA 52722 ..... ***319/344-3007***
ALUMINUM COIL ANODIZING CORP., 501 E. Lake St., Streamwood, IL 60107 ..... ***800/289-2645***
Pre-anodized lighting sheet: specular, semi-specular, low iridescent, hammertone, diffuse, Everbriter.

THEATRICAL/STAGE LIGHTING

CAREER OPPORTUNITIES

West-Coast Manufacturer of Specification Grade Emergency Lighting seeks a sales professional with an entrepreneurial bent and good technical credentials to broaden our market and enhance our product line. Send resume and references in confidence to: Career Development Center, P.O. Box 10460, Dept. AL-989, Eugene, OR 97440.

LIGHTING SPECIALIST

Iowa Power, the electric utility serving central and southwest Iowa, is seeking an experienced Lighting Specialist to join its Marketing Services Staff. Responsibilities include providing interior and exterior lighting design and support service to large commercial customers.

The successful candidate should possess a BSEE or BSIE degree with experience in commercial and facade lighting design. Additional experience in sales is desirable. Must possess outstanding customer relation skills.

Iowa Power offers an excellent compensation package, including a comprehensive benefits program. Interested persons should submit resume and salary history to: Human Resources Administrator, P.O. Box 657, Des Moines, IA 50303. Equal opportunity employer.

The Classified Directory is a monthly feature of ***Architectural Lighting,*** offering readers easy access to lighting products and services for commercial, industrial, and institutional applications. Listings in this reference section are sold on an annual basis at the rates outlined below. For full information and closing dates, contact Gordon Exe, (800) 822-6678 or (503) 343-1200.

FIRST LINE—$990/12 issues
BOLDFACE, ALL-CAP ITALIC LISTING or Boldface, Upper/Lower Case Italic.
ADDITIONAL LINES—$690/12 issues
REGULAR, ALL-CAP LISTING or Regular, Upper/Lower Case.
MINI-DISPLAY CLASSIFIED/Call For Details

VISA MasterCard AMERICAN EXPRESS *accepted*

Continued from page 59

Wisconsin–Madison, 432 N. Lake St., Madison, WI 53706, (608) 262-1299.

April 11, 1989 — **Lighting yesterday's home today,** DLF event. Contact: Designers Lighting Forum of Northern California, P.O. Box 1429, San Francisco, CA 94101-1429, (415) 824-8310.

April 15, 1989 — **Lighting calculations I,** IES lighting seminar, Holiday Inn O'Hare, Rosemont, IL. Contact: Richard N. Miller, Teng and Associates, Inc., 220 S. State St., Chicago, IL 60604, (312) 341-0101.

April 17–19, 1989 — **Lux Pacifica** lighting congress, Shanghai Science Hall, Shanghai, China. Contact: James E. Jewell, IESNA International Relations Committee, (415) 282-3135, or IESNA, 345 E. 47th St., New York, NY 10017, (212) 705-7916.

April 17–20, 1989 — **Electrical systems design for the nonelectrical engineer,** course, University of Wisconsin, Madison. Contact: E.K. Greenwald, Engineering Professional Development, University of Wisconsin–Madison, 432 N. Lake St., Madison, WI 53706, (608) 262-0573.

April 22, 1989 — **Lighting calculations II,** IES lighting seminar, Holiday Inn O'Hare, Rosemont, IL. Speaker: Richard Miller. Contact: Richard N. Miller, Teng and Associates, Inc., 220 S. State St., Chicago, IL 60604, (312) 341-0101.

April 26, 1989 — **Restaurant lighting,** DLF event. Contact: Sy Bollinger, president, Designers Lighting Forum of New York, Inc., 58 Stratford Ave., Greenlawn, NY 11740, (212) 255-8555.

April 27, 1989 — **24th annual Lumen Awards dinner,** International Design Center, Long Island City, NY. Contact: Michael Cahana, Wheel Gersztoff Friedman Associates, 30 W. 22nd St., New York, NY 10010, (212) 807-7727.

April 28, 1989 — **Entry deadline,** 2nd annual PC GlassBlock design awards. Contact: Pittsburgh Corning Corporation, 800 Presque Isle Dr., Pittsburgh, PA 15239, (800) 992-5769.

May 10–12, 1989 — **Lighting World International,** Javits Convention Center, New York City. Cosponsors: IALD, IESNA, IES New York. Contact: Jacqueline Illonardo, Show Manager, National Expositions Company, Inc., 15 W. 39th St., New York, NY 10018, (212) 391-9111.■

In This Issue

Manufacturers

Page 18. *Dramatic neon, bright ambient lighting score music sales* (Camelot Music, Columbus, Ohio).
GTE/Sylvania: T8 fluorescent U lamps, halogen PAR 38 lamps.
Indy Lighting: Parabolic fixtures, fluorescent wall washers, track fixtures.

Page 20. *Prison lighting reassures community leaders* (Eastern Oregon Correctional Institution, Pendleton, Oregon).
Fail-Safe: Impact-resistant fixtures.
Holophane: High pressure sodium luminaires, poles, lowering devices.
Lithonia: Fluorescent fixtures.

Page 22. *Daylit art museums: Three case studies* (Second-floor galleries, Art Institute of Chicago).
Edison Price: Track fixtures.
KSH: Prismatic lens and acrylic overlays for skylight.
Monsanto: Saflex PVB film interlayers.
Philips: Fluorescent lamps.
Solakleer: Low-iron glass.
(National Gallery of Canada, Ottawa, Ontario).

3M: Reflective film for light shafts.
Edison Price: Lens in light shaft laylight.
Lightolier Canada Inc.: Luminaires.
Metalumen Inc.: Luminaires.
Monsanto: Saflex PVB film interlayers.
Technical Blinds: Automated roller-blind system.
(Triton Museum of Art, Santa Clara, California).
DFW, Inc.: Custom fabrication of motorized skylight baffles.
Monsanto: Saflex PVB film interlayers.
O'Keefe Company: Pyramidal UV-blocking skylights.
Peerless: Suspended light tube system with uplights.
Prescolite: Two-circuit track and R40 wall washers.

Page 30. *Crackle neon crowns balanced design* (Zanzibar nightclub, Newark, New Jersey).
Altman Stage Lighting: Ellipsoidal spotlights, 5-kilowatt Fresnel.
Bestek Theatrical Productions: Custom dual-scan PAR 36 and PAR 46 fixtures.
Diversitronics: Strobe fixtures and controls.
Levelor Lorentzen: Perforated metallic blinds.

Litelab: Cycle-fading controllers, dimmers.
Lumitrol: PAR 36 and PAR 46 fixtures.
Upham-Longacre Associates: Custom neon fabrication.

Page 34. *Lighting plans give new life to inner-city schools* (William Cullen Bryant School and Hale H. Cook School, Kansas City, Missouri).
Artemide: Egina suspension lamps.
GE: Lexan 1/4-inch polycarbonate sheet, F40 cool white lamps, T12 light white lamps in coves.
H.E. Williams: Pendant-mounted fluorescent luminaire with wraparound prismatic diffuser.
Levelor: Venetian blinds.
Lithonia: Fluorescent strip fixtures.
Peerless: Two-lamp fixtures over stairways.
Ron Rezek: Wall sconces.
Visa: Pendant uplights.

Manufacturer credits reflect the products specified for the projects; it is possible that other products were installed during construction or maintenance.

Photographers

Richard Carlson, Manville Corporation, 717 17th Street, Denver, CO 80203, (303) 978-3354

Jim Hedrich, Hedrich-Blessing, 11 West Illinois Street, Chicago, IL 60610, (312) 321-1151

Timothy Hursley, The Arkansas Office, 1911 West Markham, Little Rock, AR 72205, (501) 372-0640

Christopher Irion, 183 Shipley Street, San Francisco, CA 94107, (415) 896-6572

Douglas Kahn, 1014 Canyon Road, Santa Fe, NM 87501, (505) 983-7010

Elliott Kaufman, 255 West 90th Street #5C, New York, NY 10024, (212) 496-0860

Bob Krusey, Retail Planning Associates, Inc., 645 South Grant Avenue, Columbus, OH 43206, (614) 461-1820

Jamie Padgett, Karant & Associates, Inc., 215 West Ohio Street #5W, Chicago, IL 60610, (312) 527-1880

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