

USING FIBER OPTICS

NoUVIR lighting is easy to use and straight-forward, because what-you-see-is-what-you-get. *But this is not automatic.* Fiber optic lighting isn't like the lighting electricians have been installing for over half a century. It's not one-size-fits-all hardware. Aim, focus and control give you choices.

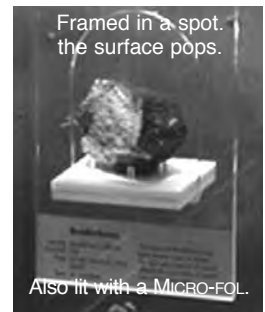
START WITH...“WHAT” YOU ARE LIGHTING?

Your artifacts will tell you the light levels you should set. Find the accepted recommended footcandle levels for exhibits by artifact and material type on the next page.



What if you are lighting a variety of objects? Identify the recommended footcandle level for *the most sensitive artifact*. No object in the room should be lit more than twice that light level. For example, what if your exhibit on Great Disasters has both a dinner place card from the *RMS Titanic* and a meteorite with a documented fall record? The paper card is extremely fragile with a recommended light level is 2 to 5 fc. (See the chart.) If you light the card at 5 fc, this limits the durable meteorite to 10 fc (5 x 2). If the card is at 2 fc, the meteorite is limited to just 4 fc (2 x 2).

What if you break the 2-to-1 rule and light the meteorite at a safe 25 or 30 footcandles? People's eyes will adjust to the bright illumination and the card will look dim and dark. The problem will not be too little light on the card, but too much light on the meteorite. Even though the space rock can be lit at 50 fc and up, the other objects in the exhibit limit its lighting level.



Can you go brighter than the recommended light level? Yes and no. Every type of object has a recommended light level *set by standard conservation practice through decades of museum experience*. But, those standards were set with conventional lighting. Using NoUVIR, you can easily raise footcandle levels by a factor of 3 and still be far below the damage rates of established recommended levels. Staying with recommended lighting levels lets you extend exhibit life, rather than increasing light exposure. The recommendations assume artifact rotation every 1 to 5 years, meaning the artifact is removed from exhibit, placed into archives and returned to display after 10 years. With NoUVIR you can safely extend the exhibit time or the display intensity or a little of both. You choose.

WHAT ABOUT THE AMBIENT LIGHT LEVELS?

The recommended light level also tells you the light levels for signs, backgrounds and graphics. They should be half of the closest object's recommended light level. If your signs are too bright, the objects they describe will seem to dim. Museums often increase the light on signs to make them more readable when they should be cutting the light levels to make the visitor's eyes adjust better. Signs should be a source of comfortable background information and not a source of glare. The floor should be half of the light level for the signs (1/4th of the light of the artifacts) or an average minimum of 1.5 fc to meet A.D.A. standards. These practices for lighting to work with the physiology of human vision are detailed in the *Illuminating Engineering Society Handbook* which is published every few years and available in many libraries.

WHERE WILL YOU INSTALL THE LUMINAIRES?

If you know where the luminaires will be installed, you know the distance from the fiber optic light to the artifacts. Use that distance and the photometry charts. Start with a spot luminaire photometry on page 9-4. At your distance, what beam and intensity will the spot produce? Remember you can overlap beams to achieve more light, or use a number of methods to dim the light. Need a bigger beam with less light? Look at a flood. Need more light in a smaller beam? Look at a pinspot. Need lots of light? Look at a PENTA-FOL or POWER-FOL luminaire. Need a smooth wash? Check out a SQUARE-BAR or overlap flood beams. Need dramatic lighting? Pick only spots and pinspots. Pick luminaire types by intensity and range of focus.

Now look at the structure. How mechanically will you install the lighting? (More about this in the next pages.) Choose a luminaire from the list above the photometry chart. Go to its catalog page and see 1:1 drawings of that specific luminaire. Will it fit? Is there a place to mount? Will light focus on the objects?

Have no clue what you will light? Determine the general ambient lighting for the room and design exhibits for twice the room's light level. Still guessing? Most museum exhibits light nicely at 10 to 15 fc.

Have no idea what control you will need? Spots do most jobs. Pinspots have the most flexibility. Watching the budget? Use fiber optic lighting for cases and artifacts and light signs, walls, floors and graphics with something else. But watch the spill light from other sources! Keep light levels at half to a quarter of case lighting.

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HOW TO LIGHT LARGER OBJECTS WITH TILING

Tiling is a printing technique. Huge posters, murals and bill boards are printed in sections. Lay the sections side-by-side like a tiled bathroom floor and the individual sheets disappear as they form a large image. In fiber optic lighting, lay beams side-by-side or superimpose them to layer intensity and you evenly can light a large object or diorama or create area fill lighting.

Tiled beams do not have to be the same size. Light spreads over objects at an angle. Light from a single source falls off in intensity at $1/r^2$. This is why large paintings have lighting balance problems. If you use typical tracklights, the light is far too bright at the top and too dim at the bottom. The sky is overwhelming and the foreground details disappear, lit at a fraction of the light levels of the sky. This is also a common problem with costumed figures creating overly-bright shoulders with hems and shoes that disappear.



And even project square beams. A slit will create a long, narrow slice of light showing off swords or rifles.

Tighten beam sizes so that luminaires with the longer throws have the same intensity as those closer. Use widen beams at the top, spreading intensity and tighten beams at the bottom, increasing intensity to eliminate the $1/r^2$ issue. See page 9-7 for an extreme example.

GET CREATIVE

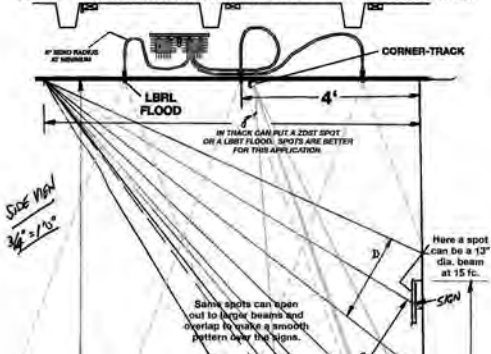
Who says lighting has to be from the top of a case? An AZ-EL mirror can reach from inside the edge of a case window. Who says beams have to be round? Black photographic tape on the edges of an AZ-EL mirror will crop a beam, shape it



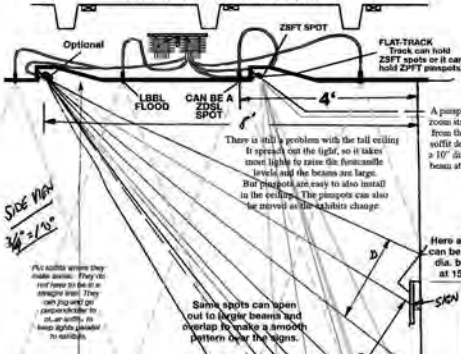
Who says a room has to be lit from the ceiling? Some of the best designs light "rooms" from behind signs, the tops of display walls, the edges of platforms or the tops of furniture or cases. Star ceilings are spectacular ways to make a gallery unique and memorable and provide subtle ambient lighting.

Lighting a historic room doesn't require construction. A portable bannister can protect and illuminate historic furnishings, paintings, automobiles, motorcycles, dioramas and even meeting rooms. At the same time bannisters assist the elderly and the handicapped

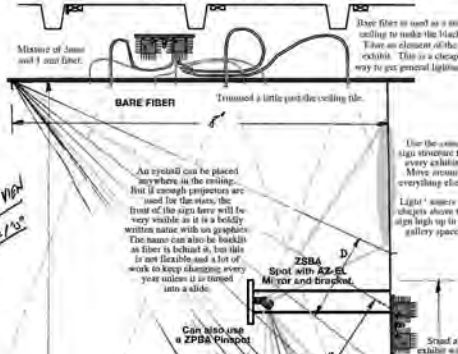
DESIGN 1 - GENERAL LIGHTING FROM CEILING, ARTIFACT LIGHTING FROM CORNER-TRACK



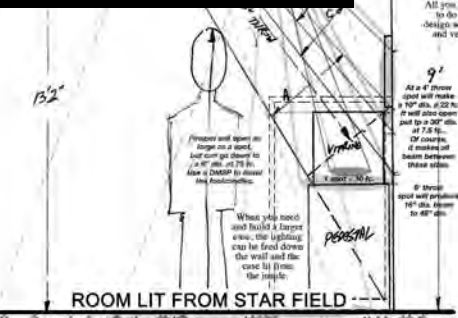
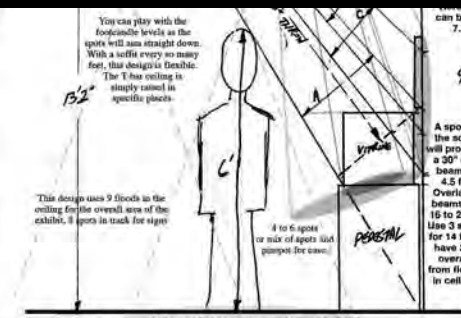
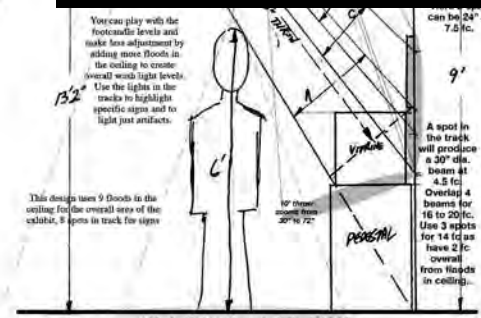
DESIGN 2 - SOFFITS WITH FLAT-TRACK



DESIGN 3 - LIGHT FROM SIGNS



Don't try to read these genuine designs for details. Just look at how the lighting was approached (location) and the types of products used.

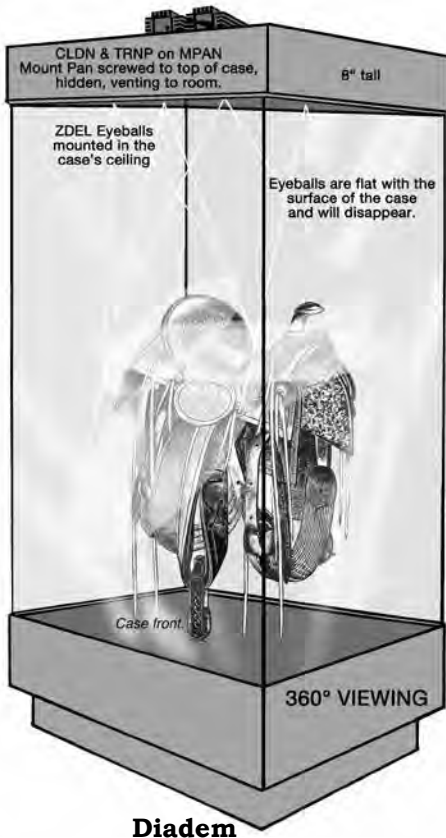


11 foot wide beam from single flood at 0.4 ft. At 3 foot centers, 1.5 ft across floor and about 2 ft on artifacts.

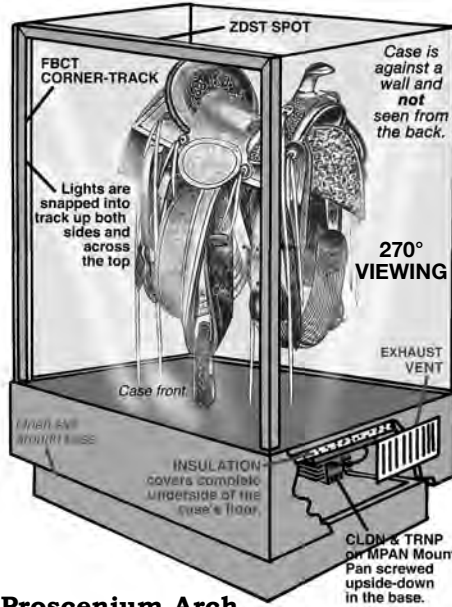
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CASE DESIGNS

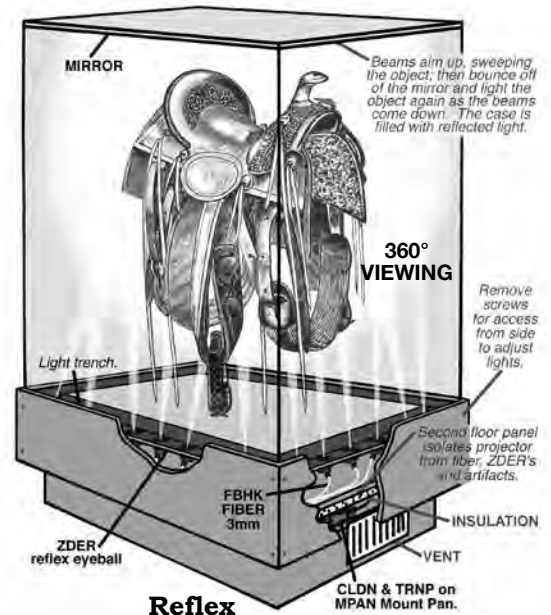
There are ONLY THREE TYPES OF CASES for lighting design. That's it! Out of thousands of styles, a case will have just one of three basic lighting approaches regardless of size, contents, construction or shape. Pick the right approach and you have your lighting design and your Bill of Materials. Your case is either a Diadem, a Proscenium Arch or a Reflex Case.



Diadem



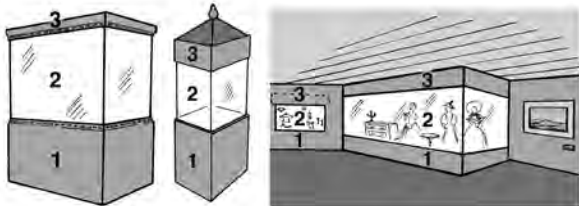
Proscenium Arch



Reflex

DIADEM CASES

CROWN OF LIGHT FROM THE TOP, A BASIC DESIGN BASED ON DOWNLIGHTS OR EYEBALLS.



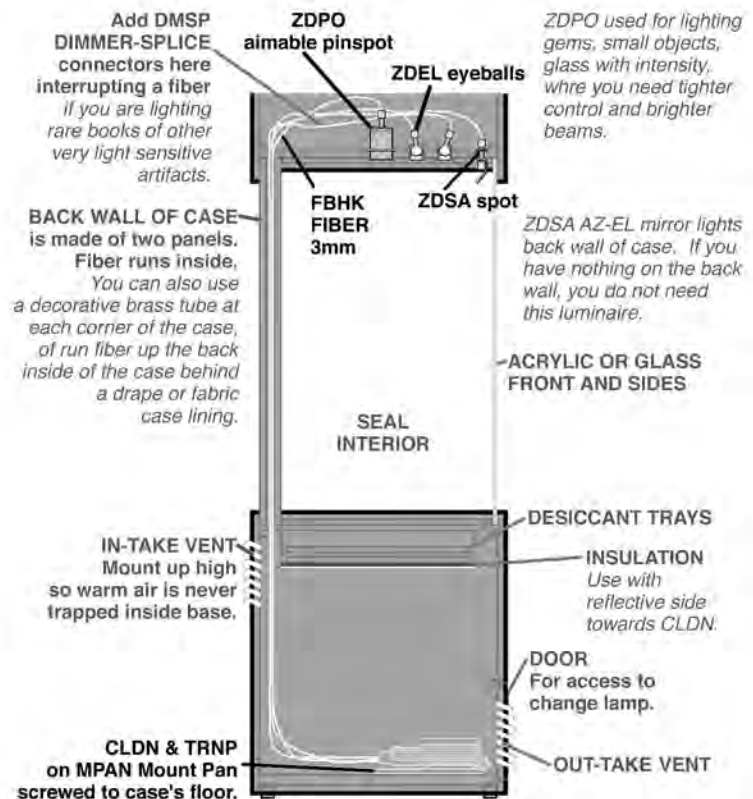
Diadem means "crown". Any case with all the lights mounted on the case's ceiling or placed inside the top of the case in a light attic is "lit from a crown" with lights aimed at artifacts from above at angles often under 30°. The case is basically three boxes set one on top of the other. Wide, skinny or the size of a room; the light is always from the top crown.

There is (1) a base, (2) an exhibit chamber and (3) the diadem top that contains the lighting. **The lights are usually flush mount downlights, eyeballs or AZ-EL mirror luminaires aimed through holes or glass.** They aim down. Best for lighting object on the floor of the case, it is often harder to get light on the upper back wall of the case. Diadem designs work well when objects on the case deck are the focal point and not things mounted on its back wall or sides.

Do not overpay for a fancy light attic. NoUVIR has no heat, so it needs no barriers in an attic. If seals are required, downlights or eyeballs mounted through holes seal automatically.

If a clear bonnet has enough height that most of the viewing is through the sides, fiber optic lights can sit on the case top, making a diadem. See page 1-8.

Diadem means "crown". Any case with all the lights mounted on the case's ceiling or placed inside the top of the case in a light attic is "lit from a crown" with lights aimed at artifacts from above at angles



IDEAS

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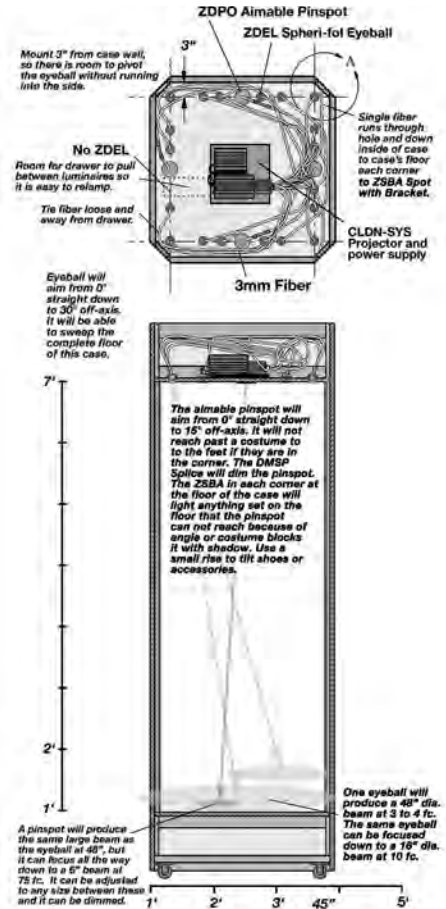


Be sure to watch for cases that get too shallow. Some museums have been taught that lighting from a tall ceiling diminishes IR. When light travels at 186,282 miles per second, the difference between 4 feet and 14 feet is meaningless. The beam spreads the IR over a larger surface at $1/r^2$. The sample may be smaller with the IR a bit harder to detect, but the raw percentage of heat is exactly the same. The total IR doesn't change. It just gets spread over more area by beams with less control.

Over the years as cases were retrofitted, moving the lighting out into galleries and tall ceilings, new case designs got shallow. Case depth shrunk to lessen shadows from the outside light sources. Other cases became bonnets as lids or caps with no structure. The graphics outside the cases grew into wall-sized art to give the spill and splash of light onto the walls something to light. Then these large, overlit graphics competed with and overwhelmed the artifacts. *This is old lighting design. Fiber optics give you the technology to change all of this and safely light to promote vision, presentation and communication.*

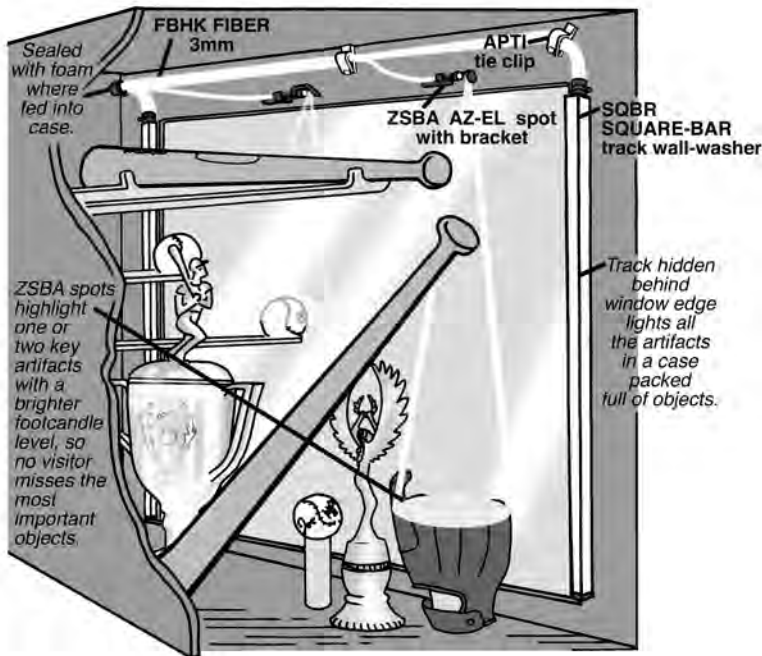
Better presentation is always gained by placing the lighting inside a case. NoUVIR lets you do that with absolute safety for your collection. Internally lit cases have less glare and reflection. Internally lit cases make dust, scratches or smudges on glazing unobtrusive. Internally lit cases put your collection center stage, making the objects the center of attention. But case depth is needed for good lighting angles and flexibility for future exhibits.

Design your cases as deep and wide as the space allows. Diadem cases are wonderful, but have limited lighting angles. Shallow cases cripple function.



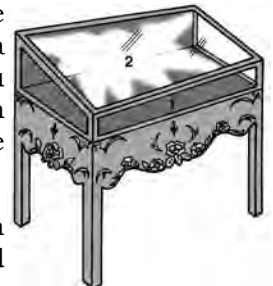
PROSCENIUM ARCH CASES

EASY TO USE, A RING OF BRACKETED LIGHTS OR A WINDOW FRAME OF TRACK LIGHTS IT ALL .

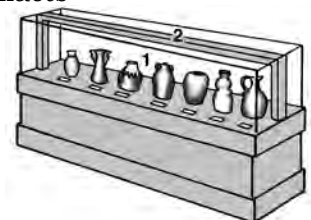


Unlike a diadem case with light from just the case ceiling, a proscenium arch design surrounds all or part of the viewing window. A "proscenium" is the arch that separates a stage from its audience. It's the traditional place for theatrical lights.

Cases literally become a stage which says "ta-dum!" These cases can be lit dozens of different ways from quiet and very subtle, where you don't notice where the light comes from, to bombastic where artifacts in dramatic beams stand out like the stars of a show. Like a Broadway producer, you choose the presentation you want down to the tiniest details.



A proscenium arch case is a workhorse. Used for a variety of artifacts



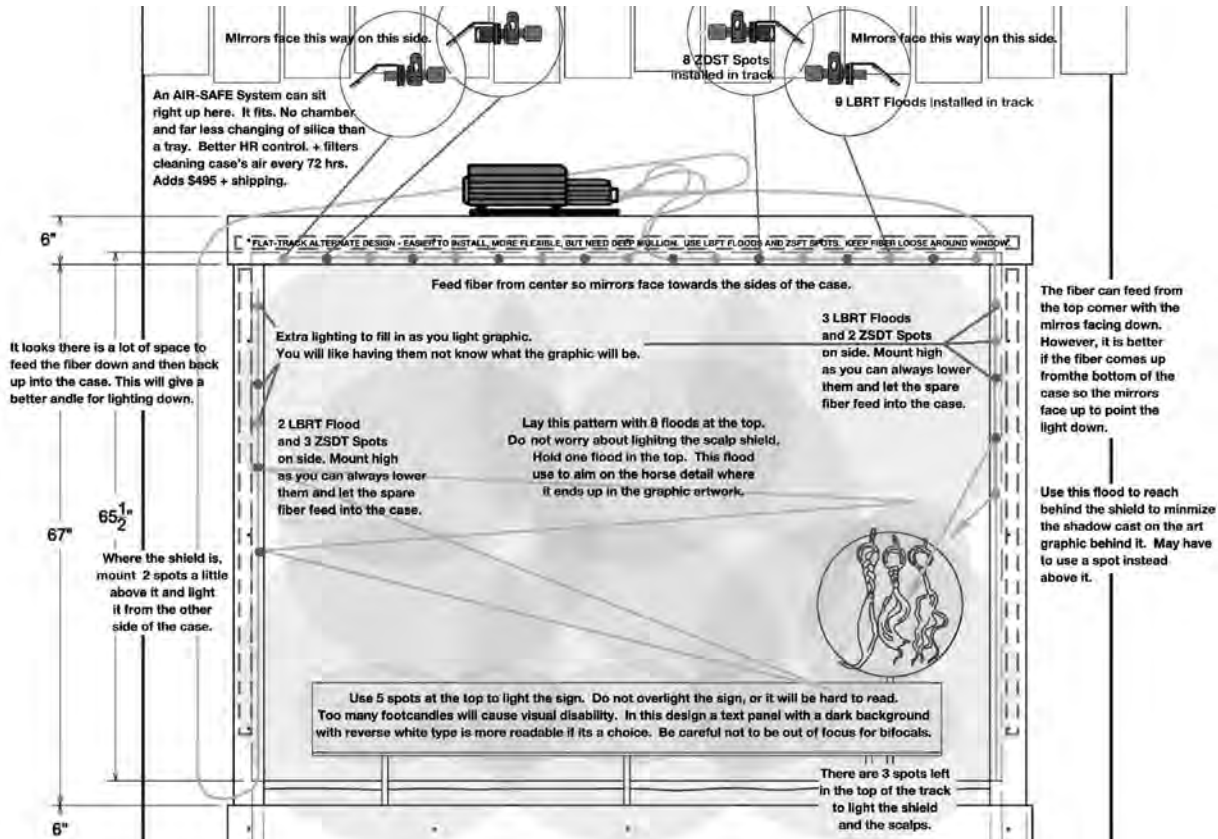
from rare books to sports memorabilia, Biblical antiquities to jewelry, dinosaurs to mummies, these cases are easy to recognize by the structure. They always have (1) a viewing chamber with (2) an arch of lights.

Proscenium arch cases can come in many shapes and sizes. Lighting can be from a top edge, a "U" of lights including the top edge and both sides, or a

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For professional builders that want a case to light frequent changes or for do-it-yourself museums, CORNER-TRACK as an inverted U has been popular. Most designs use 50% LBRT Floods and 50% ZDST Spots. The floods are adjusted to light the complete case. The spots light specific artifacts.

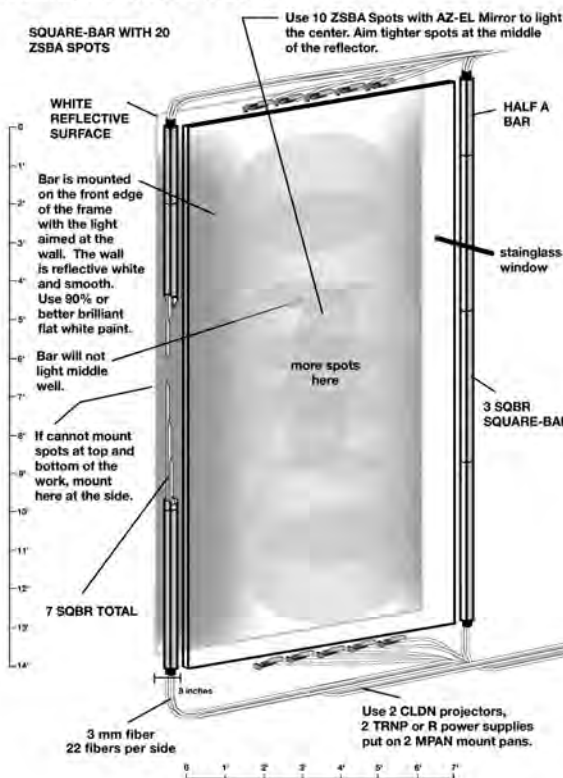
A ring of MR-11 halogen lamps or click-strips can make a proscenium arch case so hot that it ends up destroying its contents. NoUVIR has seen durable Lladro® figurines cracked by such displays. Even fluorescent lamps will raise the temperature of a case by 10°C or more, cutting artifact life in half. Everyone knows surround sound stereo is better. Now you can design safe, perfectly controlled, surround lighting.



REFLEX CASES

LIGHT BOUNCED TO FILL USING EYEBALLS OR OTHER HIDDEN SOURCES.

STAINGLASS WINDOW DESIGN

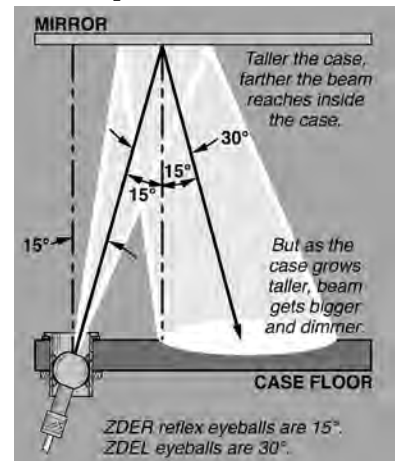


REFLEX CASES

Most cases are diadems or proscenium arches. Light shines in a direct line from the luminaire to the object. The third type of case, reflex cases, use reflection to bounce light onto an object. NoUVIR makes this difficult design possible.

Ideal for detailed objects that cast shadows within their structure like ship models, reflective objects that image lighting like engraved silver or objects that need transillumination like a stained glass window, a reflex case solves problems that cannot be handled by direct beams.

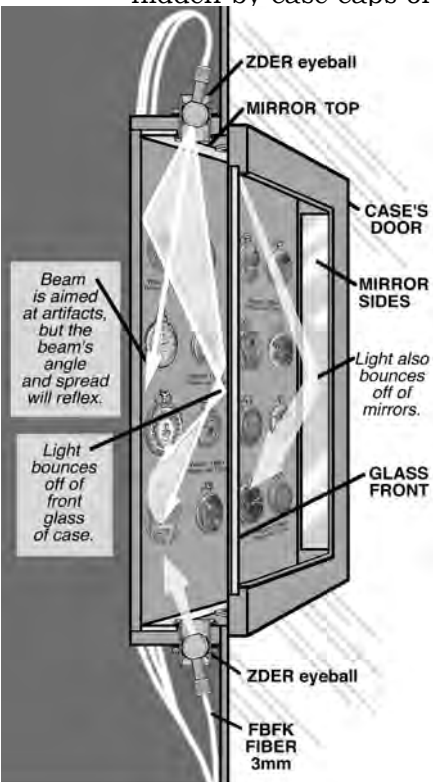
Lights are usually hidden in the base. A mirror placed on the clear bonnet of a case is almost invisible at a flat angle. The lighting seems to magically fill the case. Beams are aimed up, reflex off of the mirror and light down onto the objects. Reflex designs can also bounce light off of white case backs to evenly transilluminate crystal, glass sculptures, stained glass, or other translucent materials.



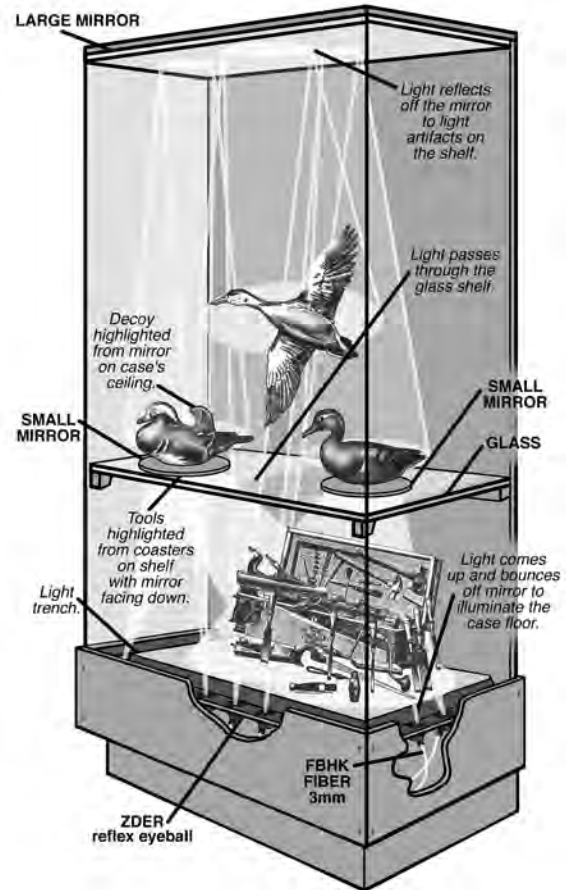
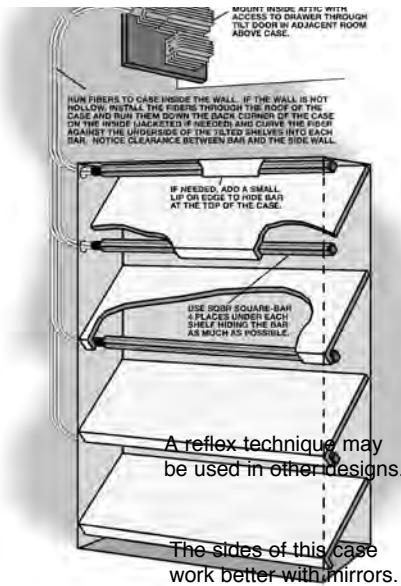
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Reflex cases are amazing. The beams and internal glow seems to come from nowhere. Shadows and reflections soften or vanish. The case's viewing box is radiant.

Because NoUVIR's luminaires have such wonderful aim and focus, a tight focus beam can reflex off the case mirror and tightly spot an artifact. Shadowed areas in the middle of a case where light normally does not reach disappear. **The secret is using an ordinary, plate glass mirror.** Light travels up past the objects usually sweeping their contours with beams. The beams hit the mirror and reflect back into the case creating a beam of light on the object. The mirror, seen on edge, is gray to the viewer. Mirrors can also be hidden by case caps or molding.



In glass-shelved cases use mirrors upside-down concealed under objects. The light is not only reflected from the mirror in the top of the case, but also from the bottom of the artifacts' on "coasters."



Reflex is also a wonderful technique for shallow cases. Case glazing is 50% to 70% reflective at shallow or grazing lighting angles. Mirrors reflect light from the sides, as in this clock wall case. But the front of the case is also used. Internal reflection of lighting when the door is closed brightens the case 20% to 40%. As a final resort for shadowed objects, aim spots to reflect off of case glazing. (And always check light levels on fugitive artifacts with the case's doors closed.)

Reflex cases can be created with any type of luminaire. The easiest reflex design uses **ZDER reflex eyeballs** mounted in a recess at the very edge of the inside of the case's perimeter with a common mirror upside-down on the case's bonnet. Painted flat black or any dark color, the recess disappears. Without any recess, the ZDER eyeball is still deep enough to hide the light sources in a case deck.

Reflex cases usually need access from underneath to adjust aim and focus. Plan bases with removable sides or doors large enough for access to all of the luminaires work well. Don't forget projector ventilation. Remember to angle recesses so beams do not hit the corners of platforms or mounts.



These Diadem Cases use a reflex technique for objects too close to the case's glass for good lighting angles. This Chinese tomb ceramic was in shadow. A spot bounces light off of the case side window, past the tomb roof and onto the tower. About 30% of the beam hits the floor beside the case.

Closing a door can reflect part of a beam back into a case. Notice how the Navajo basket interior lights up as the door is shut. Both the shirt and the base of the jug show more detail.



Need design help? Our technical support is free to all customers. Just give us a call at 302-628-9933.

Want lighting designs to get started with a Bill of Materials? NoUVIR can do professional consulting at an hourly rate. We will even visit a site. **For museums, NoUVIR Lighting will donate \$1,000 dollars in free lighting and exhibit design work.** Donated design work must involve fiber optic lighting design and artifact preservation. Design help is available on a first-come, first-serve basis based, subject to designer availability. Our company goal is saving our art, history and national heritage. Save the art! Preserve the artifacts! Conserve energy and resources! Make things look beautiful!

Help us save the world, one artifact at a time. It starts with you. Please call us today.

NO COMPANY MAKES PRODUCTS LIKE NOUVIR

The products in this catalog are proprietary. The way they work and how they look are unique, creative and singular to NoUVIR Lighting. These products are protected by patents, trademarks, trade dress, copyrights and trade secrets. No one makes fiber optic lighting perform like we do.

The products in this catalog and other NoUVIR catalogs and brochures are protected by U.S. patents. A list, including older patents, is provided below, but in no means is this list complete nor does it describe the full rights of the company or its inventors. Check the official USPTO web site for status as well as newly issued patents. See U.S. Patents 5,099,399; D329,505; 5,263,874; 5,268,977; 5,303,125; 5,315,683; 5,325,272; 5,377,089; 5,384,881; 5,393,470; 5,486,984; D405,898; 5,907,648; 5,909,525; 5,967,653; 6,024,775; 6,200,011; 6,402,349; 6,409,524; 6,439,749; 6,582,104; 7,223,002; 7,845,972 and 7,926,997. Both U.S. and foreign patents are pending at the time this catalog is being printed.

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NoUVIR's products were invented and are proudly made in the United States of America by a talented and diverse work force in Seaford, Delaware. Superior science applied with inventive brilliance and manufactured with care and attention to detail brings you the finest in lighting.

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(12) **United States Patent**
Miller et al.

(19) Patent No.: **US 7,926,997 B1**
(45) Date of Patent: **Apr. 19, 2011**

(54) **DECORATIVE HYBRID FIBER OPTIC ATC DOWNLIGHT**

(76) Inventors: **Jack V. Miller, Seaford, DE (US); Ruth Ellen Miller, Seaford, DE (US)**

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(h) by 6 days.

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(58) Field of Classification Search: **362/147, 150, 362/565, 364-365, 583, 284, 294, 296, 01, 362/503, 345, 373, 576, 580, 554**
See application file for complete search history.

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(57) **ABSTRACT**

A conversion-oriented recessed downlight fixture for an air-tight ceiling, having a reflector, (preferably bright aluminum) held in a hole in a ceiling with knock-outs bent down against the upper surface of the ceiling; a lamp housing (preferably black-anodized aluminum), removably attached to the upper end of the reflector, and a bezel assembly including a decorative trim element, is removably installed in the lower end of the reflector and held therein with screws/removably engaging the reflector, whereby the bezel and decorative element may be removed from the fixture for re-lamping.

4 Claims, 5 Drawing Sheets

