

Lighting Design Basics: Art Lighting

*From the book by Mark Karlen
and James Benya, Wiley and
Sons, 2004*

Presented by
ASID

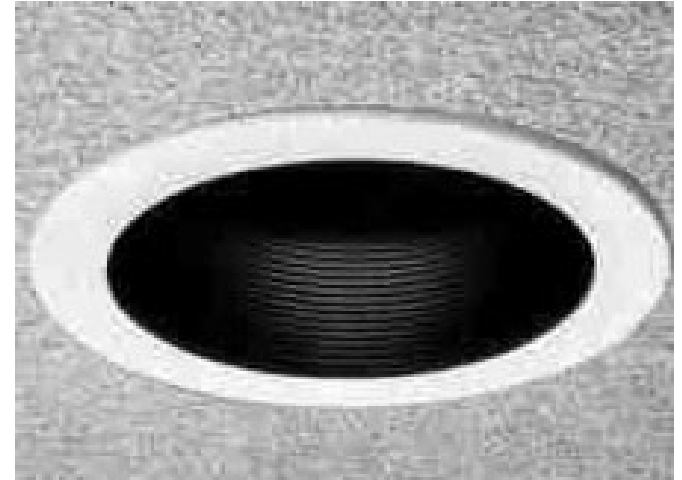
James Robert Benya, PE, FIES, FIALD,
LC

BENYA LIGHTING DESIGN
West Linn



Recessed Lighting

- Generally inexpensive
- Very popular
- Aesthetically “neutral”
- Good for task lighting
- OK for general lighting
- If chosen correctly, excellent for display lighting and a number of special applications



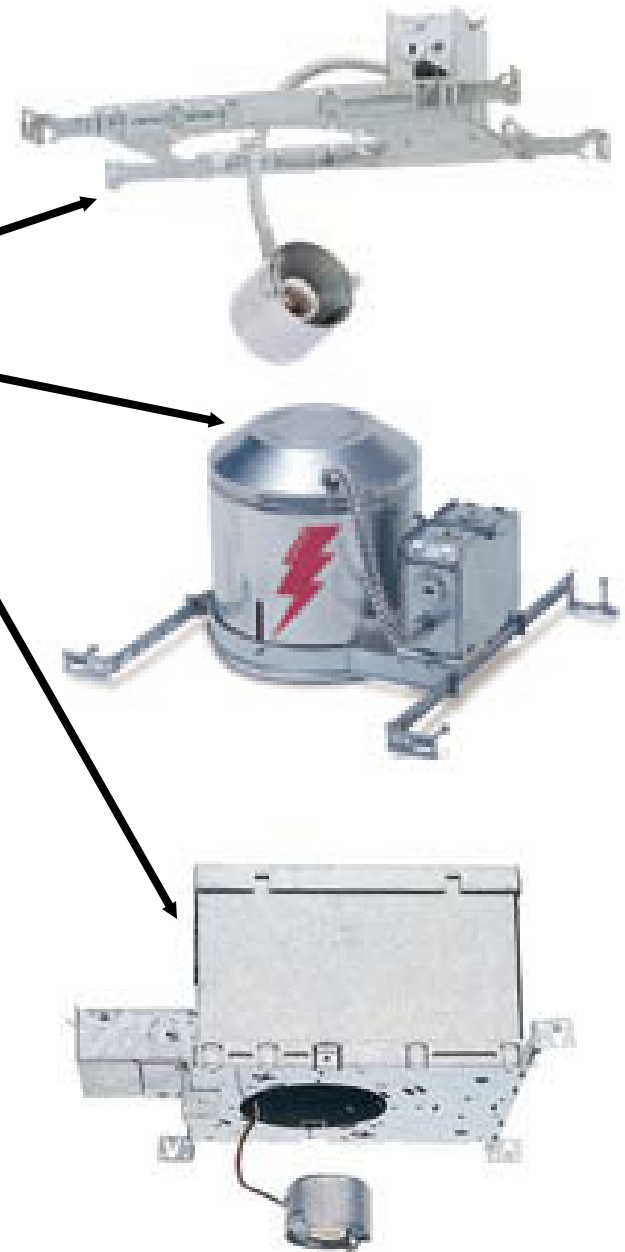
Recessed Lighting

- The "Housing"
 - For most residential use, fixtures are at most about 7" tall for 2x8 construction
- The "Trim"
 - 4", 5" and 6" incandescent
 - 3", 4", 5" and 6" low voltage
 - 4", 5" and 6" compact fluorescent



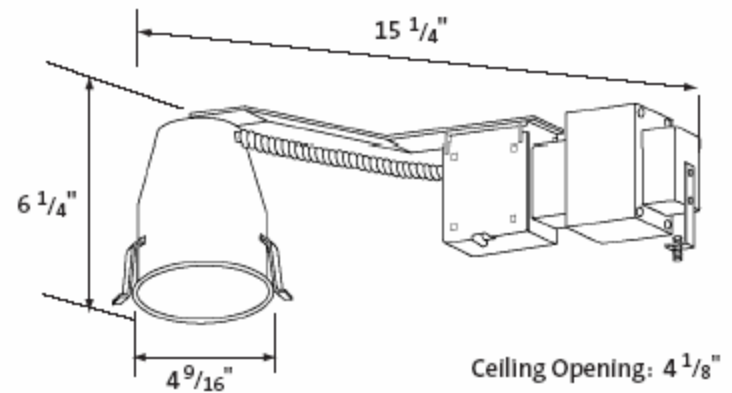
Standard Housings

- Incandescent non-IC
 - Incandescent IC
- Incandescent air tight IC
 - Low voltage non-IC
 - Low voltage IC
 - Low voltage airtight IC
- Compact fluorescent non-IC
- Compact fluorescent IC
 - Compact fluorescent airtight IC



Remodeler Housings

- Designed to fit through a single hole in the ceiling
- Usually not IC



Premium Housings



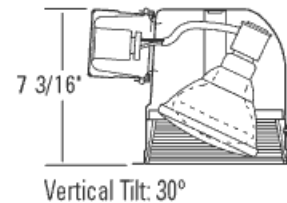
- Superior quality
- Interchangeable lamp capability
 - Incandescent
 - Low voltage
 - Compact fluorescent
- High quality interchangeable trims

Choosing Trims

- Is the trim suitable for your needs
 - Adjustable?
 - Right style?
 - Right color or material?
- Is the trim LISTED for the application?
 - Kitchen: indoor, dry location
 - Bathroom: indoor, dry location
 - Over shower or tub: Spa or shower rated
 - Steam shower: wet label, gasketed
 - Indoor pool or hot tub: wet label, non conductive trim, at least 7.5' above water level

Standard trims

- Downlight
 - Baffle
 - Cone
- Accent light
 - Gimbal
 - Eyeball
 - Pull down
- Wallwash
 - Eyelid



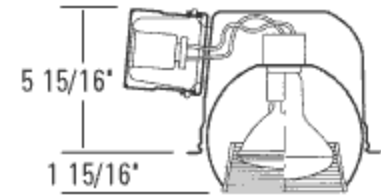
Using Standard Recessed Lighting

- Choose trims tastefully
- Use halogen lamps
 - 4" family use PAR20
 - 5" and 6" family use PAR30
 - 6" family also consider the PAR38
 - Avoid so called line voltage MR16 and PAR16

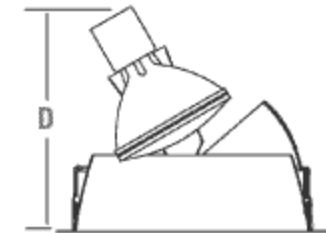




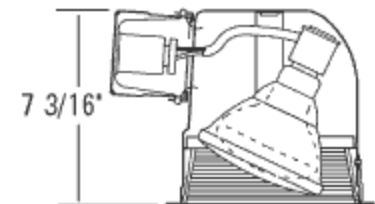
Adjustable Line Voltage Recessed Trims



Vertical Tilt: 40°



Vertical Tilt: 35°

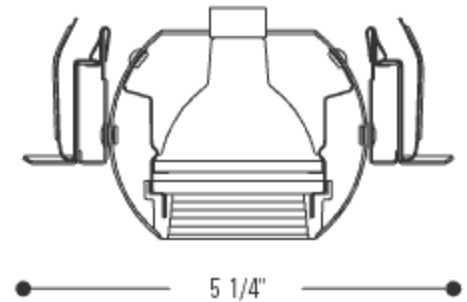
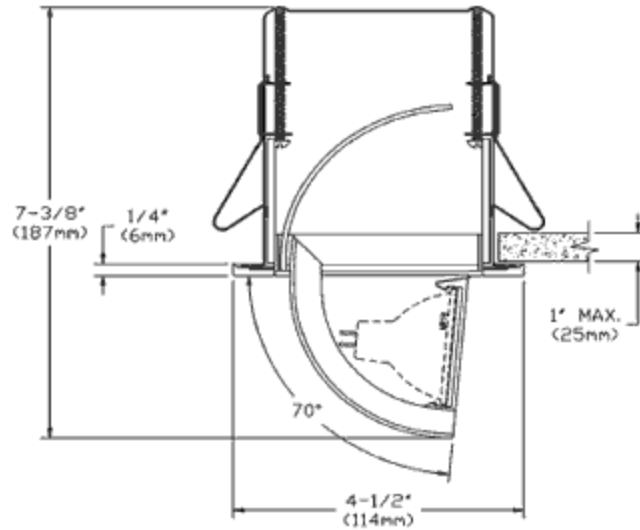
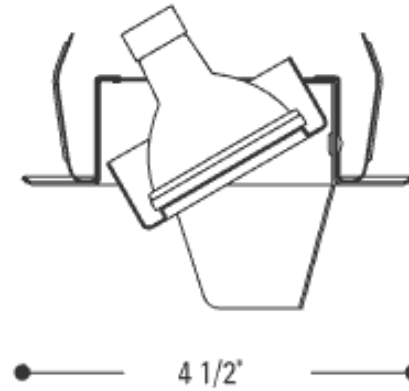
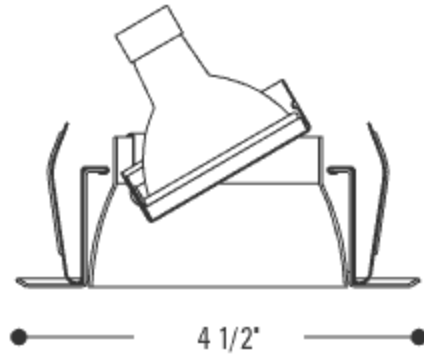


Vertical Tilt: 30°

Low Voltage MR-16 Lighting

- Typically used in a 3" or 4" recessed can
- Can be used (with the right trim) in a 5" or 6" can
- Use good quality MR16 lamps
- ALWAYS use a soft focus spread lens (Halo L111)
- Current Favorite: Sylvania 37MR16/IR





Low Voltage Trims

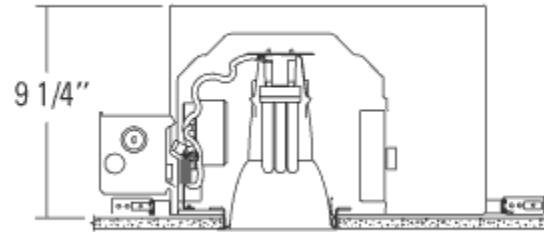
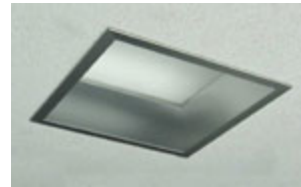
Other Low Voltage Trims



- Glass trim, gasketed for wet environments
- Low cost spa and shower light for tubs and shower stalls

Be Careful with Compact Fluorescent Downlights

- Square: not IC or AT but looks nice
- Round IC – way tall
- To get an airtight IC you are limited to 13 watts
- In the kitchen downlight you need 32 watts



Track



- Still used in museums for good reason
- Permits maximum flexibility
- Luminaires equipped easily with spread lenses and UV filters for artwork lighting
- Attaches to surface, permits dramatic lighting in condos

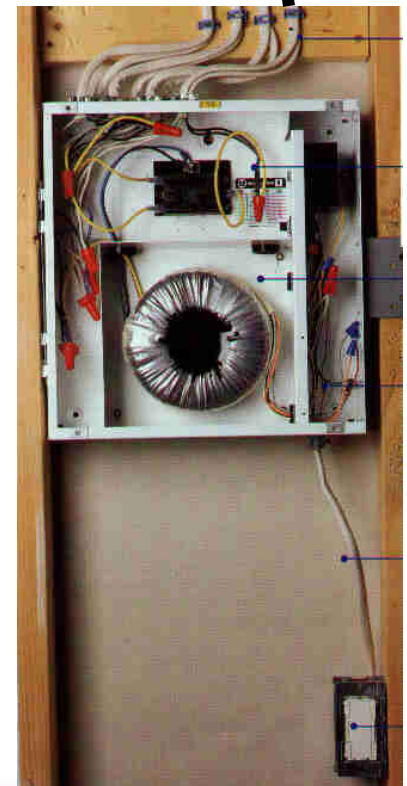
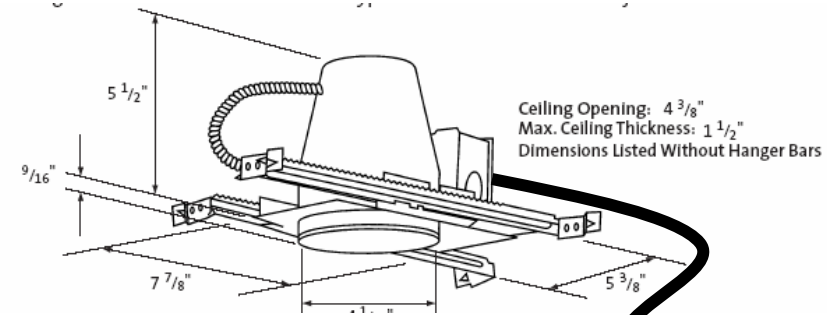
Track

- Standard 120 volt track
 - Low cost general purpose
 - High cost “museum grade”
- Low voltage track
- Low voltage specialty systems
 - Two cable systems
 - Two rail systems
 - Two conductor “bars”, “rods”, and ribbons



Low Voltage Lighting

- Most recessed low voltage lights have a transformer in the housing
- Most low voltage strips and some recessed housings can be connected to a remote transformer



Accent Lighting Using Low Voltage



Beam Quality

An unfiltered lamp tends to have

- **Striation**
 - lines and harsh edges
- **Halation**
 - rings sometimes with rainbowing
- **Sharp edges and rapid change**
 - well defined round or elliptical beams



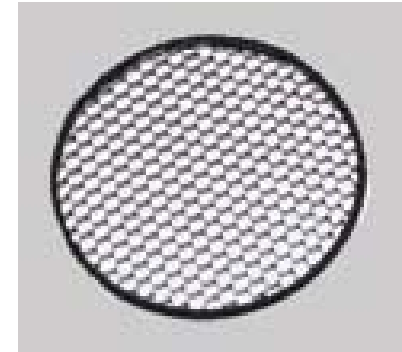
Taming the (MR16) Beast

- **Smooth the Beam**

- Softening Lens (Halo L111 or “solite”)
- Spread Lens
- Linear Lens

- **Shield the Source**

- Baffle or snoot
- Louver

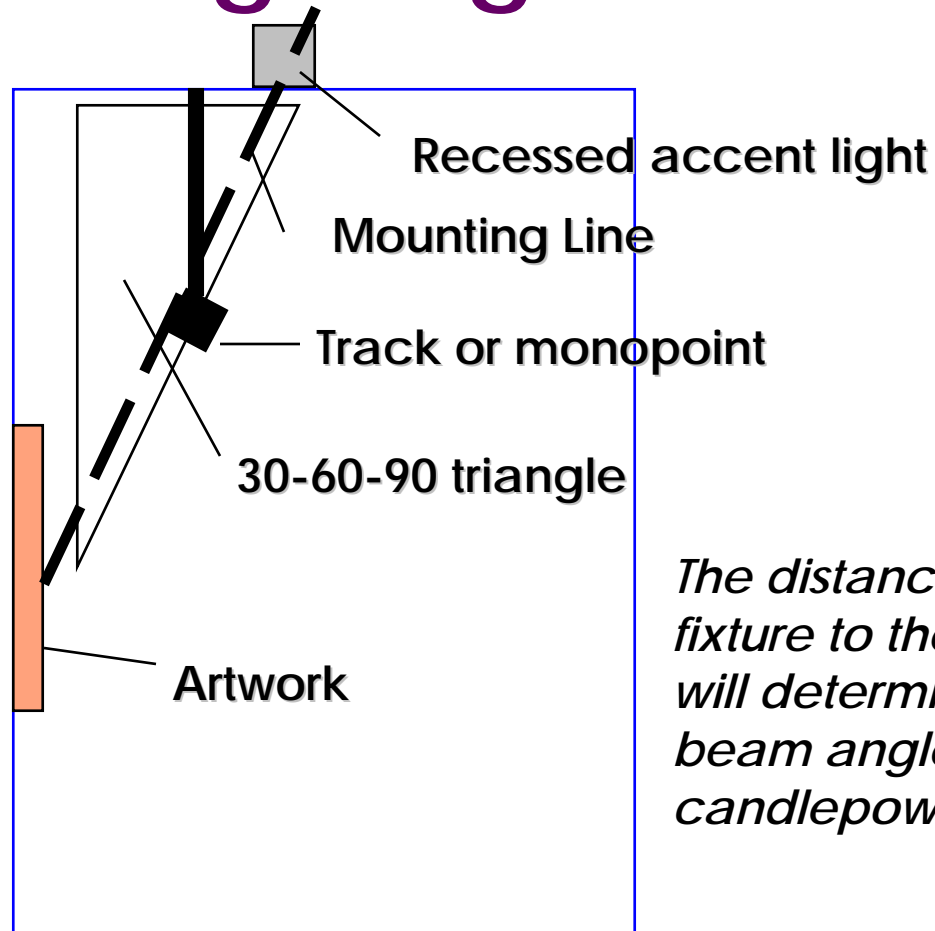


Accent Lighting Technique

- Should be located at about 30 degrees off vertical relative to focal point
- Do not get too close to wall - normally 24" minimum away
- Use 30-60-90 triangle to determine optimum position
- Only use lighting systems capable of hitting above 40 degrees (off vertical) in special situations.



Accent Lighting

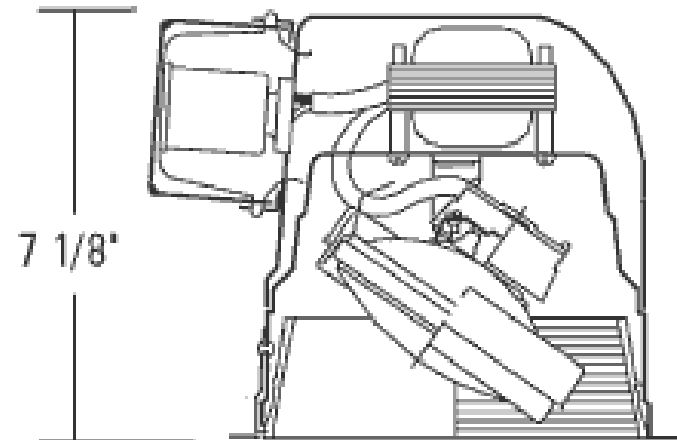


The distance from the fixture to the artwork will determine beam angle and candlepower

Accent Lighting with PAR36



For high ceilings use a low voltage 6" recessed luminaire and a 50 watt PAR36 low voltage lamp



Vertical Tilt: 35°

Accent lighting

- Living room, great room, family room
- Dining room
- Foyer
- Hallways/prime art locations
- Art niches
- Master bedroom reading and art lights
- Powder rooms

TITLE: Accessorizing: Designing with Lenses, Louvers and Color

AUTHOR: James R Benya, Benya Lighting Design

In modern architectural lighting, like in the theater, we use a combination of general or ambient lighting (“fill”) and accent or focal lighting (“key”) to create scenes. The greater the contrast between focus and background, the greater the dramatic effect. But unlike in the theater, architectural accent lights must be small, efficient, relatively inexpensive, and innocuous (if not attractive). We tend to use directional lamps, like AR, MR, PAR and R, because the lamp is the reflector, and the resulting luminaire is fairly small. There are also some good luminaires that use small lamps and the reflector is integral to the fixture; these are especially important for the new low-wattage ceramic metal halide lamps.

The problem with most architectural lighting equipment is that the quality of the projected beam is poor. The best lamps, like the incandescent PAR36, have beautiful beam patterns that can be aimed at artwork and architectural details and create predictable results. But the filaments and reflectors in many modern lamps like the MR16 and the PAR halogen lamps create beams of light that have striation, halation, and ragged edges. Aimed at artwork, the average MR16 lamp will create a scallop, a hot spot, a halo ring or two, and uneven streaks of light, not to mention a slight green tinge and color temperature about 300K greater than the ambient. This can be – and should be – fixed as part of a process many lighting designers call “focusing.” One might ask why we don’t use lamps and luminaires that don’t require this tender loving care. The answer is simple – cost and availability. You can buy MR16’s at Home Depot – good luck finding an AR lamp in stock anywhere in Des Moines.

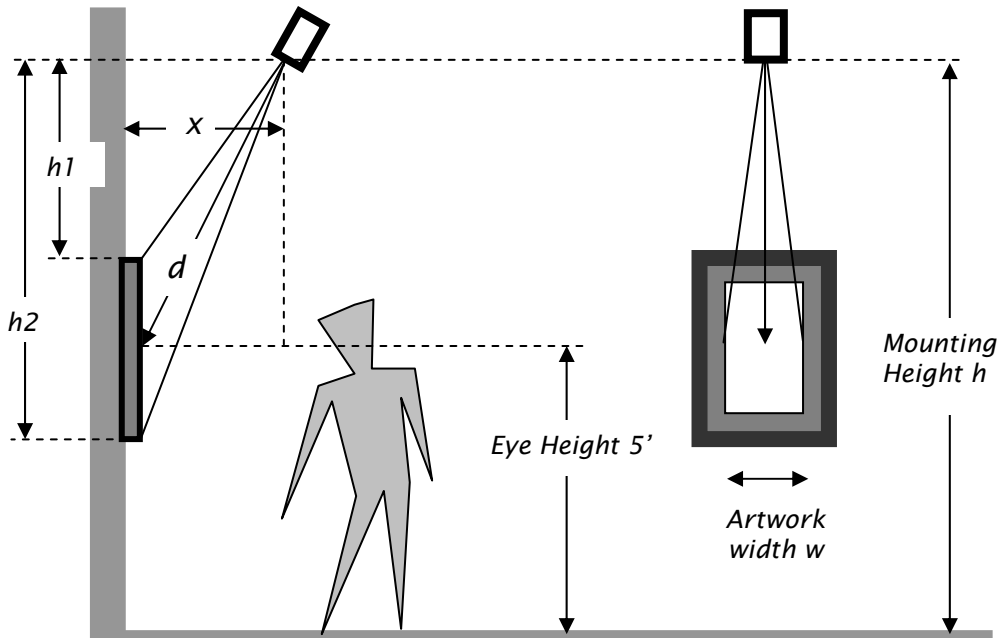
Focusing is a term stolen from theatrical lighting, and in architectural lighting it has a similar result even though the “focus” of a condensing lens system is almost never involved. Rather, focusing consists of four main activities: beam selection, beam modification, color, and shielding.

Beam Selection

Most projector lamps, such as PAR and MR types, are sold according to candlepower type. The principal candlepower types are:

(INSERT TABLE 1)

To determine the intended beam spread, find the angle needed to illuminate the object using the diagram below. Note that the diagram is a version of the distance squared law that most lighting designers have long since memorized. Then, find a lamp that produces the candlepower and beam spread most nearly matching the requirements.



Vertical Beamspread

$$(\tan^{-1} h_2/x) - (\tan^{-1} h_1/x)$$

Horizontal Beamspread

$$2 \times (\tan^{-1} ((w/2) / (x^2 + (h-5)^2)^{1/2}))$$

Most conventional lamps are “axial beam” lamps, meaning that the filament is oriented along the axis of the reflector to create a round beam. But certain lamps, especially high wattage PAR56 and PAR64 lamps employ a longitudinal filament, so the projected beam is oval in shape. For instance, a 1000W PAR64 **narrow spot** has a beam that is 8 by 20 degrees; the 1000W PAR64 **medium flood** has a beam 10 by 30 degrees. This means that during focusing, the beam must be rotated correctly to achieve the desired effect.

Beam Control

In order to tame the bad beam behavior of lamps like the MR16, one typically uses an accessory lens. Accessory lenses are generally used in place of the clear glass lens usually supplied with MR16 fixtures. For other lamps, an accessory holder may also need to be used. Professional lighting gear, especially for museums and high-end residential lighting, is often designed to permit stacking two or more lenses or other media.

The three most common beam shaping lenses are

- *Soft focus lens*, which consists of a very fine pattern of ridges and depressions. This lens is about 92 percent efficient, and it removes almost all halation and striation without significantly affecting the beam spread or candlepower. For instance, when added to a narrow spot lamp, the beam will be softened to a spot distribution, adding a few degrees to the beam. A soft focus lens preserves the “punch” of the beam while removing striation and halation.
- *Spread lens*, which can either be a sandblasted lens, an acid-etched lens, a prismatic lens, or a lenticular (pressed) lens. A spread lens changes the beam of the lamp significantly in all directions, making a flood out of a spot. A spread lens tends to remove the punch from the beam, with the resulting light becoming a wash with very soft edges. Efficiency varies with lens type, but in general spread lenses are 50 to 70 percent efficient. Personally, I tend to use this lens less often than the soft focus lens; a typical application is when I want to create an extremely broad and even wash.
- *Linear lens*, which consists of linear prisms running in one direction. This lens, also called a beamsplitter, elongates the beam in one direction and shortens it in the other, turning a round beam into an oval. When used with a spot lamp, the effect is very

dramatic, often creating a very long skinny beam of light. When used with a flood lamp, the effect is more subtle, making a moderate oval beam from a round one. Linear lenses are not very efficient, **but the effects are unique.**

Theoretically, two or more beam control lenses could be used together but the resulting loss of efficiency makes this concept undesirable. The “art” of focusing is learning how to combine the lamp with the right wattage and beamspread with the proper lens to achieve a result.

Color Control

The rapid increase in vibrant colored light using theatrical color changing instruments has been one of the great developments in lighting design in the past decade. But for accent and display lighting, fixed color lenses, including special filters for UV or IR light, can also be used, perhaps in a more subtle manner.

Commonly used lenses include

- *Saturated-color lenses*, including red, green, blue, magenta, cyan (aqua), and yellow. I also like to use amber, orange, and a few other colors. Mostly these are used for fun, creating an interesting effect in which the light itself becomes artwork.
- *Color-correction lenses*, including color temperature warming (cosmetic peach), color temperature cooling (light blue), and minus green (cosmetic pink). For instance, every glass-backed MR16 lamp and most quartz metal halide lamps have a tendency to turn slightly green, so adding a cosmetic pink filter creates a more attractive scene. These are lenses that could be stacked; for instance, a warming lens with a little pink will make an MR16 look like an R20, but with candlepower.
- *Special filters*, usually for artwork protection. UV filters are very commonly used in museums, and cold mirror IR filters can also be used in critical applications. Note: Be careful with the cold mirror lens. Ninety percent of the energy of an incandescent lamp becomes heat, and reflecting the IR back into the luminaire can overheat the lamp, socket, and wiring to disastrous results.

Lenses can be stained or dyed glass, dichroic-coated glass, or even theatrical gel. Each type has certain advantages: The stained glass lens is durable and the color of the beam is consistent; the dichroic can produce vibrant color, but often creates color shift and color halation; and the gel tends to have a short life. Gel is seldom used with smaller luminaires and lamps like MR16 due to heat; glass lenses are generally used in order to allow the glass to expand without cracking. Gel is often limited to occasional and temporary use.

Shielding

Most architectural light sources like PAR and MR lamps emit light throughout the hemisphere beyond the face of the lamp. Generally, (INSERT FIG 1) only the beam and a bit of the field is useful, the rest of it becoming glare. While it seems that glaring lamps are part of many European and Asian projects, in North America and especially in museums and galleries, glare control is an essential part of good lighting design practice.

Glare reduction amounts to preventing the outside field from leaving the luminaire at all. Most recessed luminaires and some monopoint/track luminaires shield the glare with a combination of recess depth and cone, which “baffle” the light from exiting the luminaire at unacceptable angles. A good example is the matte-black ribbed baffle commonly used on low-cost downlight trims. There are a number of track luminaires that employ a recessed lamp and ribbed baffle to effect the same result.

But when accessorizing most architectural lighting, including recessed, track and monopoint accent lights, luminaire size often restricts shielding options to very few choices. These include: (INSERT TABLE 2)

Accessorizing a Luminaire

One of the MR16 luminaire’s better qualities is that the lamp is generally required to have a safety glass in front of the lamp itself. In almost every luminaire, you can replace the clear glass with an accessory lens, and often you can add a snoot as well. To light moderately-sized artwork in residential and hospitality settings, I like to use a 25 degree, 37W IR or 50W standard MR16 with a soft focus lens and snoot in an inexpensive gimbal ring track or recessed luminaire.

To accessorize a PAR luminaire, it is often necessary to select a product with clips that hold lenses and other media. These clips are usually standard equipment on “museum grade” track lighting, but for ordinary track and recessed lighting, you may need to specify the clips separately. For MR16 luminaires, you can add a screw-on accessory holder that clamps only onto the lamp—a very useful accessory, especially when working with the delicate lampholders used on low-voltage monorail systems.

Pattern Projection

It has become increasingly popular to throw a light pattern onto a wall or floor. However, while there are a few “add-on” accessories that turn track luminaires into pattern projectors, don’t expect great results unless you employ a luminaire specifically designed to project a focused, collimated beam of light. Most projectors employ ellipsoidal optical systems and condensing lenses that permit the use of gobo patterns or slides, iris or shutters, and various focal-length lenses. While interesting patterns are possible by placing perforated metal or other materials in front of a clear MR16 lamp, don’t expect to project a bright, clear image of the name of your company without moving from ordinary architectural lighting into the realm of heavy-duty display and theatrical equipment.