# SHOPPING FOR Recessed Lights

No type of lighting offers more versatility for residential construction than recessed cans. One lighting catalog boasts of "a thousand options" to choose from. Unfortunately, this is a little overwhelming to sort through — which is why most of us go with whatever our electrician likes to install. The purpose of this article is to break down recessed lighting to its essential components and help you choose fixtures suited to a variety of applications.

by Dave Holbrook

No matter who manufactures it, a recessed downlight is made up of three basic components: the *housing*, commonly known as a "can"; the *trim*, which includes the interior baffle or reflector and the ceiling ring; and what designers and engineers call the *lamp*, which the rest of us call a "bulb." Differences in performance between one fixture and another come from the combined effect of these three components. By changing any one of the components, you change the performance of the fixture.

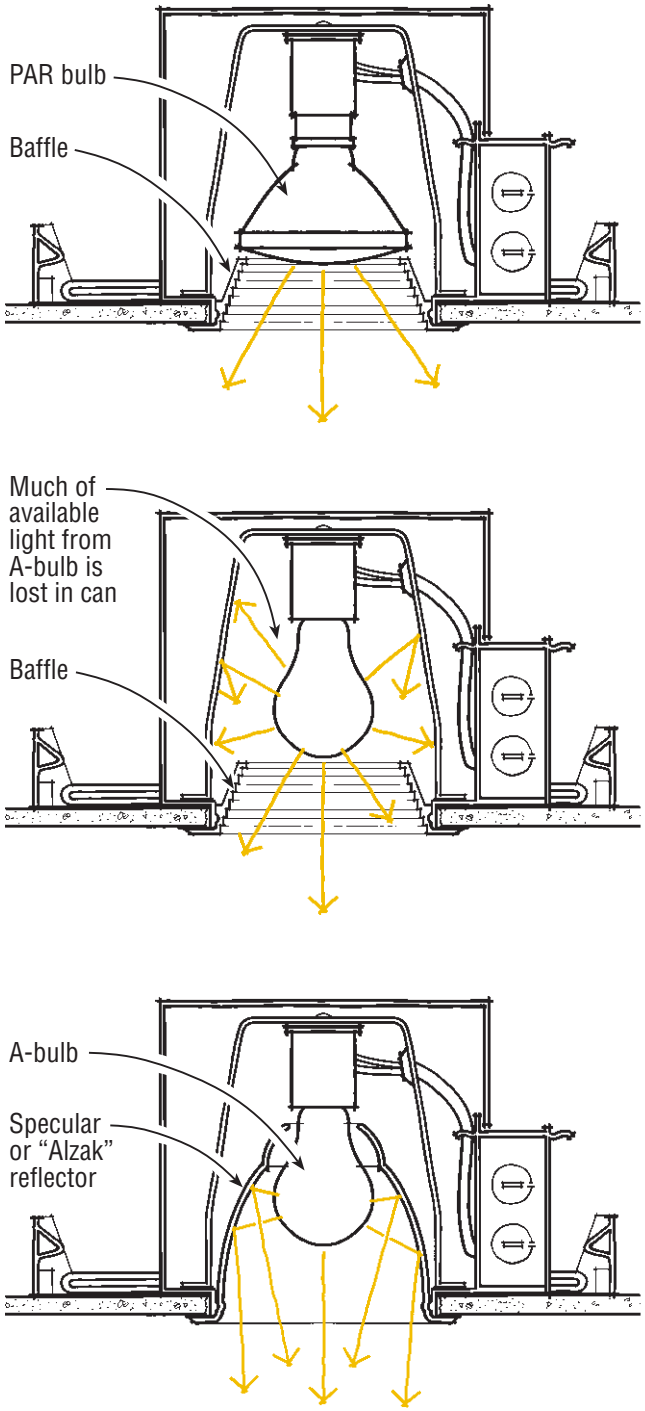
W.A.C.

If you use the wrong trim, half of the available light will never leave the fixture

## Start with the Bulb

To supply predictable and reliable illumination with recessed downlights, the real emphasis belongs on the bulb. It's important to note that, in general, recessed cans are designed for specific bulbs. You should always use the bulb specified for a given housing. However, it's a safe bet that most homeowners will buy the classic Edison bulb and screw it into the fixture when the original reflector bulb blows. Manufacturers address that likelihood by producing housings for residential use that accommodate various lamps. The problem is that the resulting effect will be different from the intended one; a reflector lamp combined with a baffle trim uses a focused bulb that relies little on the baffle for its effect (see "Matching the

## Matching the Trim to the Bulb




Off-the-shelf recessed cans commonly come with a black or white baffle designed to be used with a PAR bulb (top). Eventually, though, the homeowner may substitute a much less expensive A bulb, resulting in ineffective, wasteful lighting (middle). For clients who plan to use A bulbs, use a deep parabolic reflector (bottom), which directs most of the light out of the can.

Trim to the Bulb"). Substitute a non-directional bulb, and the result will be a subdued, unfocused light. You can guard somewhat against such an adverse effect by specifying a reflector trim that will help compensate for the substitution.

Different bulbs have different properties, beyond brightness, that determine their suitability for specific tasks. These include color, beam angle, energy usage, and output. But, although there are many types of bulbs available, common residential use centers on three main types: incandescent tungsten and tungsten/halogen; low-volt halogen; and tubular or compact fluorescent (see "Lamp Choices").

Bulbs are designated by shape, features, and size. Incandescent bulbs, which are most commonly used in recessed housings, include the universally familiar non-directional *"A"* lamp, and directional reflector spot bulbs, known as *PAR* (parabolic aluminized reflector) and *BR* (bulged reflector) lamps. The number that follows the letter designation indicates the diameter of the bulb in eighths of an inch. Therefore, a BR-30 bulb is a bulged reflector bulb that measures $^{30}/_{8}$-, or $3^{3}/_{4}$-inches, at its widest dimension.

***The A bulb*** is the one everybody knows; it dates back to Edison himself, and screws into a common lamp socket. It's available in a wide range of wattages, and has an average life expectancy of between 750 and 2000 hours, depending on the wattage, filament design, and the amount of on-off cycling. It produces light by electrical resistance, heating a tungsten filament in a vacuum until it glows white-hot. Only about 20% of the electrical energy consumed is converted to light; the other 80% is given off as heat, usually wasted.

An A lamp is considered to be non-directional, which means that it spreads light equally in all directions. When it's used in a recessed can, the trim and reflector combination focus the light, making it directional.

***PAR and BR lamps*** are directional bulbs, which means that their light is focused in a conical beam by means of an internal reflector. Commonly known as spot bulbs, they're ideally suited to recessed cans due to the predictability of their beam spread and strength of light. They're available in both tungsten and tungsten/halogen options.

***The MR-16 halogen*** (multifaceted reflector) lamp is a low-voltage workhorse, specifically developed to produce a tight, bright, focused beam of light for task and accent applications. The presence of halogen gas inside the bulb makes the short tungsten filament glow with a brighter, whiter, and more efficient light than a regular incandescent bulb. Halogen bulbs last longer than ordinary incandescents because tungsten is actually redeposited on the filament, rather than consumed, during electrical energy conversion.

***Fluorescents*** produce light by passing electrical current through mercury vapor inside a narrow glass tube, causing a phosphor coating on the tube to fluoresce, or glow. A ballast is necessary to regulate the electrical current. California's energy code mandates the use of energy efficent fluorescents for general lighting in kitchens and bathrooms. Current compact fluorescent (CF) technology eliminates most, if not all, of

the negative image of early fluorescent lighting. Electronic ballasts minimize the startup stutter, delay, and flicker, and the improved color-rendering capabilities of the more expensive CFs provide natural-looking illumination. Dedicated CF housings conceal the lamps, making the light source indistinguishable from other types. Because CF light is non-directional, reflective trims are used to focus the beam.

One shortcoming of fluorescent light is that, unlike the other residential lamp types, it's not readily dimmable. Dimmable ballasts are available, but they're an expensive option, costing at least twice as much as the magnetic or electronic ballast in a standard housing (which costs about $55). Manufacturers report very little demand, however, for dimmable CFs in residential use.

## Types of Recessed Housings

The housing, or can, makes the connection to the electrical system, contains the bulb and the heat it gives off, and, in conjunction with the trim, enhances or modifies the lighting effect.

Residential lighting typically uses 6- to 7-inch-diameter cans for general lighting, and 2- to 4-inch-diameter apertures for task and accent lighting. Cans are available in various depths for installation in shallow 2x6 ceiling joist bays, or may protrude above suspended ceilings or into unfinished attic space (see "Housing Options," next page).

***Standard "T" housings*** are made for use in both insulated and uninsulated ceilings. Because they're not shielded, insulation must be held back 3 inches from all sides of the can to prevent a fire hazard. The "T" stands for "thermally protected"; if the unit is equipped with a bulb that exceeds the recommended wattage (called "overlamping"), or if insulation is improperly placed against the housing, the integral device will automatically cycle the lamp on and off. It will continue to do so until the problem is corrected. Some lamps have a plastic fusible link that melts when overheated; it must be replaced to restore lamp service. A standard housing usually costs between $10 and $15.

***Type IC (insulation contact) housings*** are made to be installed in direct contact with insulation, permitting an unbroken thermal barrier. A typical IC can costs about $20. Some codes require that all cans be of the Type IC variety, to reduce the risk of fire from excessive heat buildup. It's possible to create a site-built box around a non-IC fixture, but it's a dubious effort at best. The small difference in cost, if any, doesn't justify the risk, uncertainty, and added labor of site modifications. An IC housing always includes a thermal protection device to guard against overlamping.

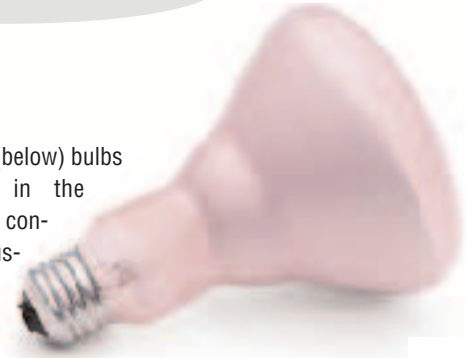
Some cans are made as IC/non-IC housings, using knockout vents to make the conversion. Venting the fixture may be especially desirable in a commercial suspended ceiling installation. By allowing excess bulb heat to escape above the ceiling, cooling costs are kept down. These cans may be returned to IC status with a proprietary gasketing kit.

Airtight cans, sometimes referred to as "Washington State compliant," are also available to prevent air leakage through the thermal envelope around the cans. Some cans are airtight-convertible, using a proprietary gasket option.

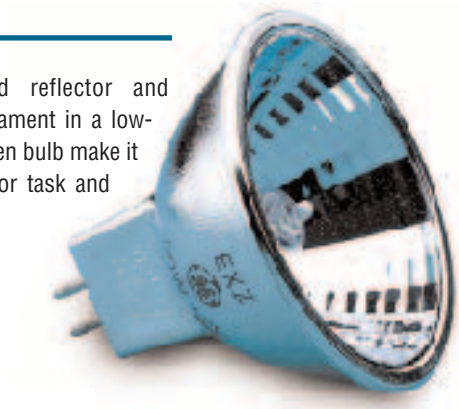
## New Construction vs. Retrofit

There's a suitable can for just about any situation, whether the job is in the framing stage or the ceiling is already up.

## Lamp Choices



PAR (right) and BR (below) bulbs are major stars in the recessed downlight constellation. Their focusing shape and internal reflective coating give them predictable luminosity and beam spread.



The multifaceted reflector and bright, precise filament in a low-volt MR-16 halogen bulb make it the best choice for task and accent lighting.

Double-, triple-, and quadruple-element compact-fluorescent bulbs produce equivalent levels of illumination with lower energy consumption than incandescent bulbs. This replacement bulb has a wide integral ballast at the base, which can interfere with installation in a tapered surround. Dedicated CF housings contain ballasts, and typically use pin-base lamps.

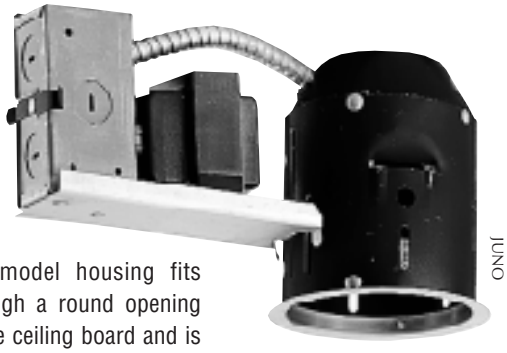
# Housing Options

COOPER/HALO

A standard “T” housing includes a junction box for the wiring connection and a can for the lampholder. To prevent dangerous overheating, a thermal protector interrupts the electrical current if you install an oversized bulb.

COOPER

To maintain an uninterrupted thermal barrier, a Type IC (insulation contact) can may be covered with insulation, and uses an outer enclosure to contain the heat produced by the bulb. An IC can always includes a thermal protector to guard against overlamping.



JUNO

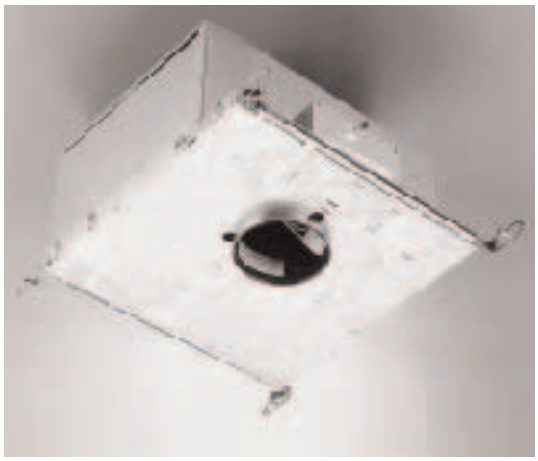
A remodel housing fits through a round opening in the ceiling board and is held in place with integral mounting clips. IC and non-IC cans are available. For installation in open framing, a new construction housing hangs from adjustable straps between joists.

JUNO

For cathedral ceilings, a sloped-ceiling can orients the bulb perpendicular to the floor.

COOPER

The unwieldy shape of a compact fluorescent bulb requires a special housing. As an option, the dual quad-elements in this fixture can be switched independently to provide a high/low lighting effect.



CAPRI

Like a line-voltage housing, low-volt cans are available in IC and non-IC versions. The housing contains the transformer, making the electrical connection the same as for a line-voltage fixture.

On an addition/remodel job, new and existing sections can feature matched recessed fixtures with no need for extra drywall tearout.

***New construction housings*** use bar hangers that mount between the joists, so that the housing can slide back and forth on the bars to adjust the position. The bars typically have an integral mounting spur that stabs into the joist; it should be followed up with a nail or screw for permanent mounting.

***Remodel housings*** install through a round hole cut in the drywall or plaster. Mounting clips on the can hold the ceiling flange tight against the finished surface. A remodel can minimizes drywall patching costs. Of course, you've got to avoid the framing and get a wire over to the can location. Remodel housings are available in Type IC in both line and low voltage. There's no appreciable difference in cost between new construction and remodel cans.

***Sloped ceiling cans*** orient the lamp perpendicular to the floor to control the beam spread and eliminate the direct glare of the bulb.

***Compact fluorescent housings,*** made for general lighting, are specially configured to accept irregular-shaped compact-fluorescent lamps oriented either vertically or horizontally within the can. They feature pin sockets and an integral ballast, and are available in both Type IC and non-IC. The bulbs mount deep in the fixture to conceal them from view.

***Low-voltage housings*** typically have small ceiling apertures and are designed for task and accent lighting. Low-voltage cans use smaller bulbs than line-voltage fixtures. The small filaments of low-voltage bulbs can be sharply focused, making them ideal for art lighting. The housing includes a built-in transformer, so the electrical connection is the same as that for line voltage housings. The low-volt magnetic transformer will "hum," particularly when dimmed with an ordinary incandescent dimmer; for noiseless operation you need to use a special low-volt dimmer that costs $10 to $20 more. Also, look for transformers set in potting resin, which effectively absorbs the hum-producing vibration. Low-voltage housings cost about $80 to $90, compared with $20 for a line-voltage can.

## Reflectors and Baffles

Choosing the housing is relatively straightforward; most of the options in recessed lighting involve the trim. The usual cone-shaped aluminum insert that surrounds the bulb plays a vital role in the light output of a can. The polished surface of a *reflector* transmits light out of the housing with varied levels of efficiency, while a *baffle* is used to reduce light output, or brightness. This is far more than a matter of appearance, and greatly affects performance.

***The black milligroove baffle*** is probably the look that comes to mind when you picture a recessed fixture ("see "Baffles, Reflectors, and Trims," next page). A baffle helps to control and shape the beam of light. The main purpose of the grooved black surface is to reduce glare from the bulb, which it does by absorbing 50% of the light. The wastefulness of this approach is similar to shifting a cooking pot halfway off the flame instead of reducing the heat. Furthermore, from an aesthetic standpoint, the contrasting black "hole" in a white ceiling calls attention to itself unnecessarily, especially when the light is off. Attempting to "beef up" a fixture by screwing in a higher wattage is not the right way to improve performance; in fact, it may blow the integral thermal protector by "overlamping" the fixture. There are other, better options.

***A white milligroove baffle*** also controls glare while addressing the adverse aesthetics of black trim. It's much less obtrusive in a white ceiling, and will yield about 70% of the available light. When discussing glare, keep in mind that it's a product of the bulb. If the surface of the bulb is more or less flush with the surface of the ceiling, as it is with many PAR spot bulbs, a baffle will do little or nothing to subdue it — the deeper the bulb, the less glare produced.

***Clear specular.*** The mirrorlike surface of a clear "specular" reflector transmits 100% of the light out of the can, and when unlit, reflects the color of the ceiling, allowing it to blend in. Although they can cost as much as $25 more than a black baffle, the increase in efficiency may allow you to reduce the number of fixtures, offering a trade-off in cost. Specular (also referred to as "Alzak") trims are also available in black and gold finishes. Each option has a direct effect on the light output. Black absorbs half of the light output; gold reduces it by 10% and changes the *color temperature*. Color temperature refers to the color of the light source itself, measured in degrees Kelvin, ranging from cool blue to hot white. Warm-colored objects, like wood finishes and human beings, will appear unnatural under "cool" light.

The bright efficiency of a specular trim may be considered too harsh for some applications; a brushed metallic surround, while still highly reflective, yields a "softer" light for the same price. A deep Alzak trim will also produce less glare than a shallow one. It's a good idea to evaluate some of these differences firsthand at a lighting showroom, before installation.

## Trims for General Lighting

The trim finishes off the hole in the ceiling, holds the baffle or reflector in place, and shapes and directs the light. In some cases, the trim is integral to the reflector or baffle inside the can. The choice of trim, however, depends entirely on the lighting purpose.

***Diffusers.*** Along with the standard white or metallic ring on the ceiling, general lighting trims include glass diffusers that completely conceal the bulb. These may be flush with the ceiling, or dropped down to spread some of the light across the ceiling plane. Rubber-gasketed "drop opal" diffusers are used for damp locations, like showers or exterior overhangs. Other glass trims are intentionally decorative, using color and sculpted forms to make a design statement.

A fresnel lens tightly focuses the light beam via raised concentric rings in the glass. It's particularly effective with

## Baffles, Reflectors, and Trims

HALO

COOPER

A highly reflective specular, or Alzak, trim is the most efficient way to get all of the light out of the can. When combined with a deeply recessed bulb, glare is reduced with no loss of illumination.

The black milligroove baffle (left) is probably the best known, and most commonly installed, recessed trim. Its purpose is to reduce glare, which it does by absorbing 50% of the bulb's light. A white milligroove baffle (below left) also cuts glare, but transmits more of the available light. A white baffle is also less obvious in the ceiling than a black baffle when the lights are off.

COOPER

A translucent diffuser obscures the bulb and refracts the light, spreading it across the plane of the ceiling. A rubber gasket adapts the diffuser for damp use in locations such as showers and entryways.

JUNO

COOPER

An eyeball trim makes it possible to aim the light. Simple eyeballs "clip" the beam of a fixed bulb to direct the light, while others rotate with the bulb without reducing light output (left). An eyelid trim (below left), also called a "scoop," clips and directs the beam, using an adjustable lamp base to produce a wall-washing effect.

non-focused incandescent "A" bulbs and compact-fluorescent lamps, when you want to concentrate and direct their output.

### Task and Accent Trims

To restrict lighting to a specific area, small-aperture housings and trim work best. Applications include lighting a work area or countertop, and accentuating a cabinet, wall display, or art objects. Small-diameter line-voltage reflector bulbs and focusable trims are available, but this is where the low-voltage MR-16 bulbs and trims really shine.

***Adjustable trims*** can be as simple as an "eyeball" that directs the beam in a given direction without changing the position of the bulb inside the housing. A more precise, focused version rotates the bulb and the trim within a fixed degree range. Some of these trims project noticeably below the ceiling plane.

A flat, oval aperture trim clips the beam of an adjustable lamp on two sides to create a vertical stripe of light. It's an effective trim when used to highlight wall displays and paintings.

In some housings, the lamp socket can be adjusted as much as 45 degrees from vertical. Depending on the depth of the housing, the trim, and the lamp used, the top of the beam may be clipped at the steepest adjustment.

***Pinhole spot.*** This trim is best used in conjunction with a low-volt housing and bulb. Its 2- to 4-inch aperture is used to spotlight an area such as the kitchen sink or other work surface. The intense output of a low-volt halogen MR-16 bulb is ideally suited to this type of application.

Mini-swivel trims allow the low-volt MR-16 lamp to swivel 35 degrees or more from vertical within a fixed baffle or reflector. If you can't locate the housing exactly where you'd like to because of framing or other constraints, this trim gives you some latitude.

***Wall washers*** are used to splash light on vertical surfaces, to emphasize a display and provide reflected light to the room. The "eyelid," or adjustable scoop trim, can be rotated to direct the bulb and beam. Used in series, this trim produces a "scalloped" light pattern on the wall.

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