Low-Voltage Lighting

Versatility, lower wattage, and longer lamp life make up for the higher initial cost of low-voltage fixtures

CRAIG SAVAGE

JUNO LIGHTING

by Jeff Ridenour

Low-voltage systems are often identified with "smart-house" duties, such as remote control of appliances. But the simplest and most obvious use is for lighting. Low-voltage lighting fixtures are powered by a transformer that lowers the voltage and converts the current from 120 volts AC to 12 volts DC. Compared with traditional incandescent lighting, the main advantages of using low-voltage for lighting are more precise focus of the light, better light quality, and lower operating cost.

Improved Beam Control

With most incandescent fixtures, only the intensity of the light can be varied by changing the wattage of the bulb. With most low-voltage fixtures, however, the source of light is a halogen-filament lamp. The variety of halogen lamp shapes and sizes provides greater design flexibility by allowing for different beam spreads and intensities.

Beam spread. Inside a low-voltage bulb (the glass enclosure for the lamp), mirrors focus the width, or spread, of the light beam. The spread is expressed in degrees, and ranges from about 9 degrees for a "very narrow spot" to about 55 degrees for a "wide flood."

To get a feel for the spread, an 18-degree light beam traveling 5 feet from the ceiling to a countertop has a spread of about 20 inches; at the floor, its spread is 36 inches in diameter (see Figure 1). A 55-degree beam would have a 78-inch-diameter spread at the floor.

To light a 3 1/2-foot-wide hallway with an 8-foot ceiling, we typically install a 50-watt lamp with a very wide spread. But if the hall has art on the walls with a low-voltage "wash" illuminating it, we might narrow the beam of the general lighting or increase the distance between fixtures. This adds visual interest and still lights the passage.

Intensity. Ordinary light bulbs generate light by heating the filament to incandescence. The hotter the filament, the more efficiently it converts electricity to light. However, heat also shortens the life of the filament, so the design of each

lamp is a balance between efficiency and durability.

Adding halogen gas to the bulb lets it burn hotter without sacrificing life. Compared with a 75-watt incandescent, a 20-watt halogen lamp is smaller and brighter (in lumens per watt), and will last longer (Figure 2). In practice, typical tungsten halogen lamps are 50% brighter per watt and last twice as long.

Color rendering. The "color" of low-voltage light falls somewhere between the warm yellow of regular incandescent bulbs and the cool white of fluorescent lamps. The filaments in low-voltage lamps get very hot, so the light approaches the color of true daylight, which is a more comfortable light to read and work by. (There are also many more color gradients available in low-voltage lamps.)

Fixtures

The variety of low-voltage fixtures and their associated trim kits is enormous. The smaller size of some of these fixtures makes them especially useful in many places where larger incandescent fixtures don't fit. For example, I often use a fixture made by Halo, Hafele, and others that's about the size of a hockey puck, mounting it directly to the underside of upper kitchen cabinets (Figure 3). These units can even be recessed up to 5/8 inch into the underside of the bottom cabinet shelf. Pucks cost $25 each, but by spacing them 12 inches apart, they cost nearly the same as a $20-per-foot fluorescent — and halogen gives a much more dramatic and useful task light.

In many low-voltage fixtures, the lamps can rotate and move up and down within the housing. This allows more precise control over the aim of the focused beam of light by moving the bulb, not the reflector. Thus, recessed ceiling fixtures can be used to light not only horizontal surfaces like floors and counters, but to "wash" walls or art objects and paintings. Trim kits are also available that either condense or diffuse the light.

Installation Specifics

One difference between low-voltage and 110-volt systems is that low-voltage lights need 12-volt DC current supplied by a transformer. Older low-voltage lighting used large, expensive remote transformers for which the wiring

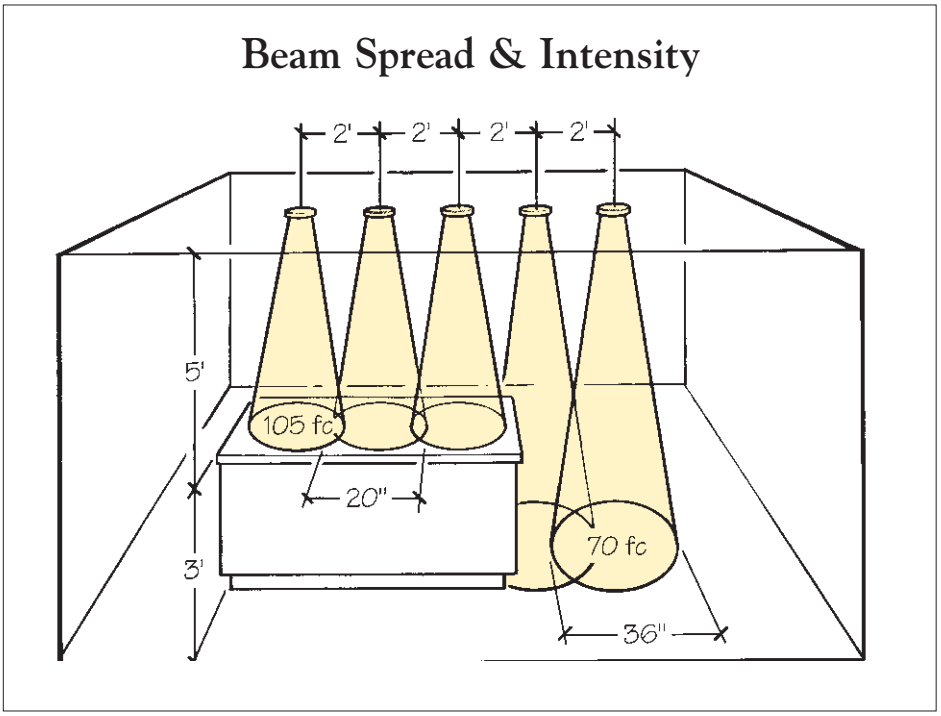
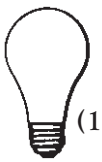
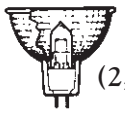


Figure 1. *Beam spread and intensity, measured in foot-candles (fc), vary depending on the distance to the illuminated surface, the aiming angle, the spacing of fixtures, and lamp wattage and design.*

Incandescent vs. Halogen



Incandescent
(1,000 working hr.)



Halogen
(2,000 working hr.)

Wattage	Lumens per watt	Wattage	Lumens per watt
25	9.2	5	12
40	10.7	10	17.5
60	12.1	20	19
75	12.8	50	18
100	13.8	100	25

Figure 2. *Halogen lamps are more expensive to buy than incandescent bulbs, but the higher initial cost is balanced by lower wattage, stronger light, and longer life.*

Low-Voltage Landscape

When it comes to landscape lighting, low-voltage lighting really shines. The tremendous flexibility of low-voltage lighting lets you experiment with endless combinations of color, intensity, and beam widths. We often work with customers at night, lighting the trees and shrubs with the same fixture but switching bulbs. The effects are really astonishing, and we always get rave reviews after one of those evening lighting sessions.

Low-voltage landscape lighting is by far the least expensive route for outdoor lighting. First of all, labor costs are 50% to 75% lower, because typical low-voltage fixtures simply "stab" into the ground. This eliminates the costly junction boxes and rigid attachments associated with high-voltage systems. Also, low-voltage wire is a direct-burial cable and only needs to be buried 12 inches deep. This makes it much easier to install than conduit. Weatherproof connections are easy, too — no junction boxes and no stakes. — *J.R.*

was more elaborate and labor intensive. Today, however, most low-voltage fixtures, like recessed lights and track lights, come with a built-in transformer integral to their design (Figure 4). Where a fixture is too small to accommodate a transformer, the lights can be grouped together and serviced by one remotely located transformer, as in the case of the Pucks mentioned above. This arrangement works well for tight spots, like inside a crown molding valance or in the top of a wall niche.

There are two types of transformers: magnetic and solid-state electronic. Magnetic transformers have been around for years and are commonly found in recessed cans; electronic transformers are found in smaller fixtures, like track lights. The solid-state versions are more efficient and have a longer life, making them more popular than the older magnetic transformers.

Wiring low-voltage fixtures costs the same as for an incandescent fixture. The wire, typically 12-2 or 14-2 Romex for a 15-amp circuit, is the same for either system. Pulling the wire and making the connections in the junction boxes are identical.

If you look hard, however, you might find some "economies of scale" with low-voltage. For example, you can place twice as many low-voltage fixtures as incandescent on a single circuit. You would save the labor and materials of a second home run, and you might save a second switch.

Lamp life. Other aspects of low-voltage lighting may seem more expensive at first glance, but low-voltage lighting is cost-effective and energy-efficient when the costs are spread over the life of the product. For instance, we pay around $25 for a 7-inch open-style 75-watt low-voltage recessed can, about $12 for a 40-watt low-voltage lamp (which is equivalent to a $1.50 75-watt incandescent), and another $50 for the transformer.

But the high up-front costs for low-voltage fixtures are soon negated. First, there is a savings in the longer lamp life. A typical 75-watt incandescent lamp lasts about 750 hours, whereas a low-voltage lamp of comparable intensity will last three or four times that long.

Second, operating costs for low-voltage fixtures are lower. According to figures recently released by the National Association of Home Builders, lighting can consume up to 20% of a home's power usage. Compared with incandescent bulbs, low-voltage lighting requires approximately half as much power for the same amount of illumination. So over time, low-voltage lighting costs roughly half as much as incandescent to operate. By replacing 75-watt incandescent bulbs with low-voltage lamps, it's not hard to realize a $20 savings per fixture per year.

To keep costs down, there are certain locations where low-voltage lighting doesn't make economic sense. Closets (unless it's a walk-in or wardrobe), the laundry, and the garage can all function well enough with incandescent or fluorescent lighting. If you can afford to put low-voltage lighting in only a few places, concentrate on the kitchen, the entry, and the vanity.

Also, beware of dimmers. To the customer, dimmers are a logical part of the low-voltage system. But dimmers cost about twice as much as conventional systems, because the number of lights you can gang together on one dimmer is limited with low voltage. Also mixing low-voltage fixtures with incandescent on the same circuit means you'll need two dimmers, one for each type of fixture. ■

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Figure 3. *Small circular low-voltage fixtures about the size of a hockey puck can be mounted directly to the underside of a kitchen wall cabinet, or recessed up to 5/8 inch into the bottom shelf.*

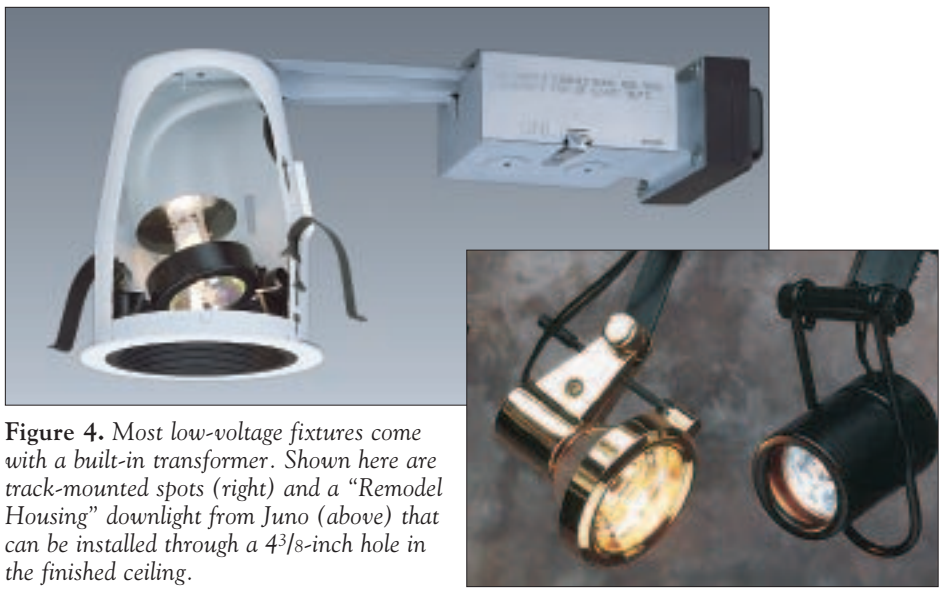

Figure 4. *Most low-voltage fixtures come with a built-in transformer. Shown here are track-mounted spots (right) and a "Remodel Housing" downlight from Juno (above) that can be installed through a 4 3/8-inch hole in the finished ceiling.*