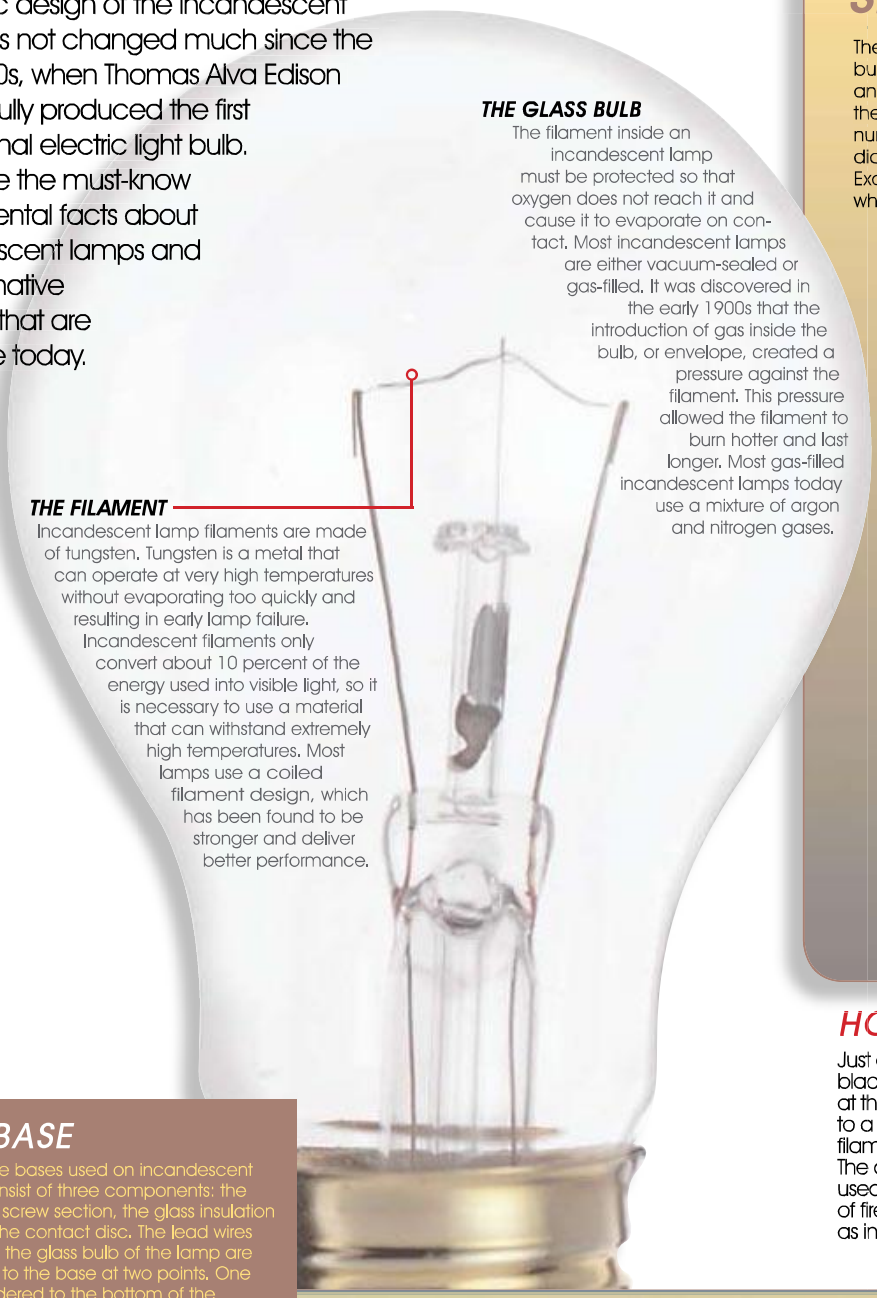
Incandescent Basics

The basic design of the incandescent lamp has not changed much since the late 1800s, when Thomas Alva Edison successfully produced the first operational electric light bulb. These are the must-know fundamental facts about incandescent lamps and the alternative choices that are available today.



THE GLASS BULB

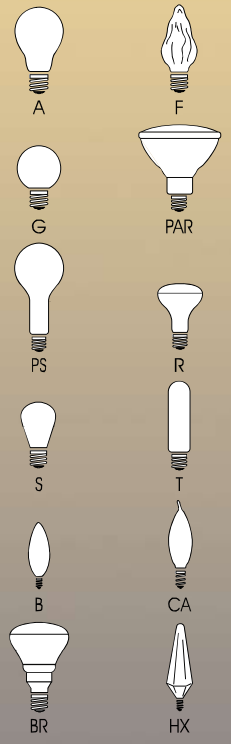
The filament inside an incandescent lamp must be protected so that oxygen does not reach it and cause it to evaporate on contact. Most incandescent lamps are either vacuum-sealed or gas-filled. It was discovered in the early 1900s that the introduction of gas inside the bulb, or envelope, created a pressure against the filament. This pressure allowed the filament to burn hotter and last longer. Most gas-filled incandescent lamps today use a mixture of argon and nitrogen gases.

THE FILAMENT

Incandescent lamp filaments are made of tungsten. Tungsten is a metal that can operate at very high temperatures without evaporating too quickly and resulting in early lamp failure. Incandescent filaments only convert about 10 percent of the energy used into visible light, so it is necessary to use a material that can withstand extremely high temperatures. Most lamps use a coiled filament design, which has been found to be stronger and deliver better performance.

Bulb shapes

The size and shape of a lamp's bulb are designated by a letter(s) and a number. The letter specifies the shape of the bulb and the number indicates the maximum diameter in 1/8-inch increments. Example: A G40 is a globe shape which is 5 inches in diameter.



HOW IT WORKS

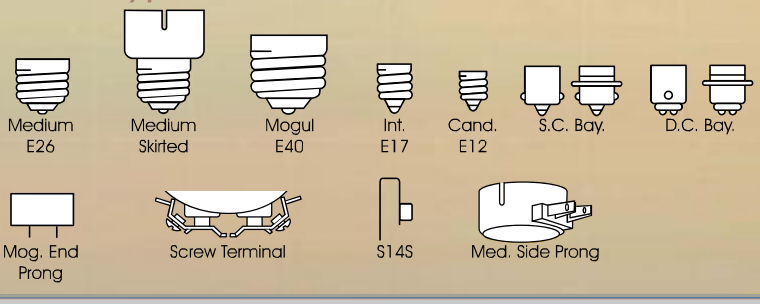
Just as a piece of metal being blacksmithed or the molten glass at the end of a blower's rod heats to a brilliant glow, so does the filament of an incandescent lamp. The difference is that electricity is used to heat the filament instead of fire. This phenomenon is known as incandescence.

THE BASE

Screw-type bases used on incandescent lamps consist of three components: the threaded screw section, the glass insulation ring and the contact disc. The lead wires which exit the glass bulb of the lamp are attached to the base at two points. One wire is soldered to the bottom of the contact disc and the other to the top edge of the screw section. The glass ring acts as an insulation barrier between the two points. This assembly completes the circuit and the lamp is electrified once the base is screwed into a socket and the contact disc touches the center point of the socket.

The base itself has nothing to do with the seal of the bulb; it is a separate part of the lamp that is attached with cement. Typically, bases are made from aluminum or brass. Brass bases tend to perform best due to their compatibility with most socket materials.

Base Types



Key Characteristics

Rated Voltage:

The lamp's filament is designed to operate within a specific voltage range in order for it to deliver its intended light output. Lamps that are burned at voltages higher than their rating will result in higher wattage, efficacy (lumens per watt) and lumens. Lamps operated below their rated voltage will significantly increase their life while reducing their wattage, efficacy and lumen output.

Lumen Maintenance:

As the filament of an incandescent lamp burns, the tungsten is slowly evaporating and depositing itself on the interior wall of the bulb. This creates the black coating seen after a bulb has been in use for a while.
Additionally, as the filament evaporates, the lumen output decreases until it reaches the end of its life when the wire breaks. It is recommended that a "group replacement" or relamping is conducted once a number of lamps have failed or a noticeable decrease in light output has taken place.

Burning Position:

For the most part, incandescent lamps can be burned in any position. However, take note and observe a lamp manufacturer's recommendations for use.

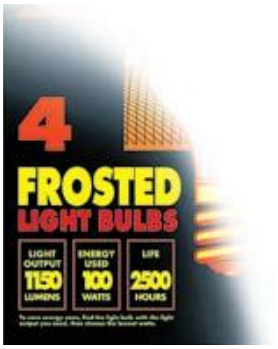
Light Output vs. Life

The life of an incandescent lamp and its lumen output are both determined by the filament design. These characteristics represent a give-and-take relationship—one must be sacrificed to improve the other. There are many choices available to the consumer, each one marketed for a particular application, purpose or feature.

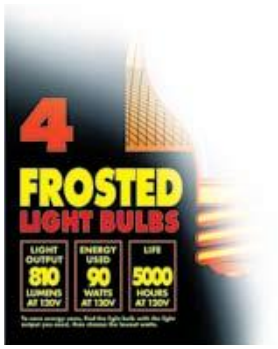
It is important to determine your customer's priorities and needs when recommending a light source purchase. Is the lamp going to be placed in a hard-to-reach area, making long life more important than light output? Or will it be a workhorse, illuminating important tasks and needing maximum lumens?

The Federal Trade Commission instituted new packaging labeling requirements in 1992 to explain the function of a lamp better to the purchaser. So if you know your way around this labeling, you can suggest optimum choices for your customer, or explain the features to customers to allow them to make their own educated decisions.

These examples of actual labels illustrate the differences between two standard household "A" lamps. One is marketed for longer life, while the other is marketed for greater lumen output. Note the life/light tradeoffs.



High Lumen Output



Longer Lamp Life