Edison screw

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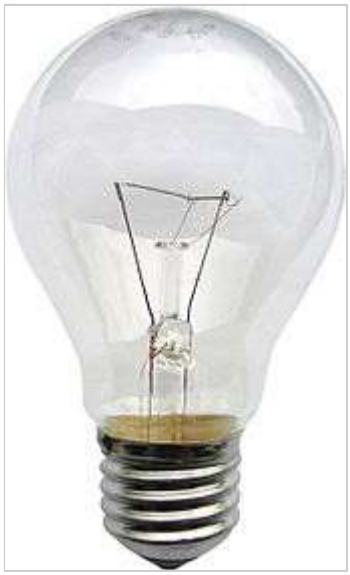
Edison screw (ES) is a standard socket for light bulbs. It was developed by Thomas Edison and was licensed in 1909 under the Mazda trademark. Normally, the bulbs have right-hand threaded metal bases (caps) which screw into a matching threaded sockets (lamp holders). For bulbs powered by the mains supply, the thread is connected to neutral and the contact on the bottom tip of the base is connected to live (hot).

In North America and continental Europe, Edison screws displaced other socket types for general lighting. In the early days of electrification, Edison screws were the only standard connector, and appliances other than bulbs were connected to the mains supply via light sockets. Today Edison screw sockets comply with international standards.



230-volt incandescent light bulb with E27 screw base

Contents

History

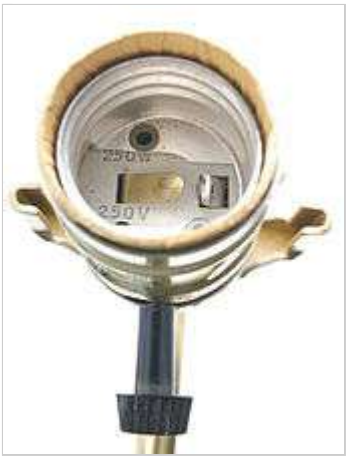
Early U.S. lamp manufacturers used different and incompatible bases. The Thomson-Houston Electric Company used a threaded stud at the bottom of the socket, and a flat contact ring. The Sawyer-Mann or Westinghouse base used a spring clip acting on grooves in the bulb base, and a contact stud at the bottom of the lamp. By about 1908, the Edison base was most common in the U.S., with the others falling out of use.[1]

In response to Edison's patent, Reginald Fessenden invented the bi-pin connector for the 1893 World's Fair. Other lamp bases include the bayonet mount and wedge base.

Types

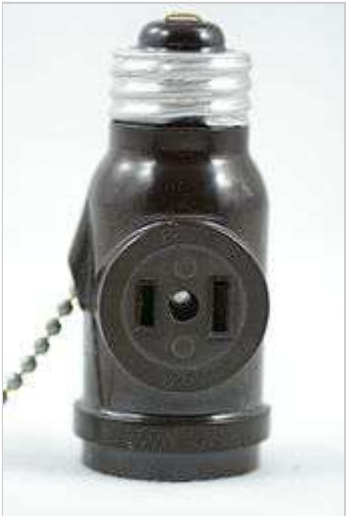
Specifications for all lamp mount types are defined in the following American National Standards Institute (ANSI) and International Electrotechnical Commission (IEC) publications:

- Lamp Caps — ANSI C81.61 and IEC 60061-1
- Lamp Holders — ANSI C81.62 and IEC 60061-2
- Gauges (to ensure interchangeability) — ANSI C81.63 and IEC 60061-3
- Guidelines for Electrical Lamp Bases, Lampholders and Gauges — ANSI C81.64 and IEC 60061-4


Three-way E26d light socket

Generally, the two standards are harmonized, although several types of screw mount are still defined in only one standard.

In the designation "Exx", "E" stands for "Edison" and "xx" indicates the diameter in millimeters as measured across the peaks of the thread on the base (male), *e.g.*, E12 has a diameter of 12 mm. This is distinct from the bulb glass diameter, which in the U.S. is given in eighths of an inch, *e.g.*, A19, MR16, T12.


E26 Edison screw to NEMA 1-15 adapter

There are four commonly used thread size groups for mains supply lamps:

1. Candelabra: E12 North America, E11 in Europe
2. Intermediate: E17 North America, E14 (Small ES, SES) in Europe
3. Medium or standard: E26 (MES) in North America, E27 (ES) in Europe
4. Mogul: E39 North America, E40 (Goliath ES) in Europe.

The E26 and E27 are usually interchangeable, as are the E39 and E40 because there is only a small difference in diameter. Additional screw thread sizes are available for other uses.

The large E39 "Mogul" and E40 "Goliath" base are used on street lights, and high-wattage lamps (such as a 100-/200-/300-watt three-way) and many high-intensity discharge bulbs. In areas following the U.S. National Electrical Code, general-use lamps over 300 W cannot use an E26 base and must instead use the E39 base, 300 W lamps may use either base. Medium Edison screw (MES) bulbs for 12 V are also produced for recreational vehicles. Large outdoor Christmas lights use an intermediate base, as do some desk lamps and many microwave ovens. Previously, emergency exit signs also tended to use the intermediate base, but U.S. and Canadian rules now require long-life and energy-efficient LED lamps, which can be purchased inside a bulb as a retrofit. A medium screw base should not carry more than 25 amperes current; this may limit the practical rating of low voltage lamps.[2]

E29 "Admedium" bases are used for special applications, for example UV spotlight bulbs in magnetic crack detection machines.

In countries that use 220–240 volts AC domestic power, standard-size E27 and small E14 are the most common screw-mount sizes and are prevalent throughout continental Europe, (The BC or bayonet mount fitting is the commonest light bulb fitting in the UK and many British Commonwealth countries, and is found in older installations in some other countries, including France and Greece.)

In 120-volt North America and 100-volt Japan, the standard size for general-purpose lamps is E26.[3][4]

E12 is typically used for candelabra fixtures. E17 is also sometimes used, especially in small table lamps and novelty lighting, and occasionally the lights on newer ceiling fans. Christmas lights use various base sizes E17 for C9 bulbs, E12 for C7 bulbs, E10 for decades-old series-wired C6 bulb sets (http://web.archive.org/web/20061020231535/http://www.oldchristmaslights.com/lamp_evolution.htm) in the U.S., and an entirely different wedge base for T1¾ mini lights. For a short time early on, these mini lights were manufactured using E5 screw bases.

A tiny E5 or E5.5 size is used only for extra-low voltages, such as in interior illumination for model buildings, and model vehicles such as model trains. These are often called "pea bulbs" if they are globe-shaped, but they commonly look like mini Christmas bulbs, or large "grain-of-wheat" bulbs. E10 bulbs are common on battery-powered flashlights, as are bayonet mounts (although those are usually held in with a circular flange located where the base meets the bulb). The E11 base is sometimes used for 50/75/100-watt halogen lights in North America, where it is called the "mini-can", and tighter threads are used to keep them out of E12-base nightlights and other places where they could start a fire.

There are also adapters between screw sizes, and for adapting to or from bayonet caps. A socket extender makes the bulb stick out further, such as to accommodate a compact fluorescent lamp with a self-ballast that doesn't fit in a recessed lighting fixture.

Most Edison screws have right-hand threads (lamp is turned clockwise to tighten), but left-hand threaded screws do exist, generally for use in special cases in which a specific voltage or wattage is required. This discourages using an incorrect bulb, which could result in an explosion or other incident.[5] Locations such as railway trains and the New York City Subway have used light bulbs that have left-hand threads in order to discourage theft of the bulbs for use in regular light fixtures.[6][7]

Other uses

The Edison screw socket was used as an outlet (such as for toasters) when mains electricity was still mainly used for lighting, and before wall outlets became common.

Some adapters for wall outlets use an Edison screw, allowing a light socket to become an ungrounded electrical outlet (such as to install Christmas lights temporarily via a porch light), or to make a pull-chain switch with two outlets, or to split it for two lamps. Another adapter can make a wall outlet into a lamp holder (lamp socket).

Various other accessories have been made, including a smoke detector that recharges over a few hours and lasts for a few days or weeks thereafter, and still allows the attached lamp to operate normally. There have also been electronics that stick onto the end of the screw base and allow the attached lamp to flash, for example, to attract the attention of arriving guests or emergency vehicles; others function as a dimmer or timer, or dim gradually in a child's bedroom in the evening.

Fittings

From left to right: E27, E14, and E10 bulbs

Designation	Base diameter (thread external)	Name	Application	IEC 60061-1 standard sheet
E5	5 mm	Lilliput Edison Screw (LES)	Indicator lights, decorative lights	7004-25[8]
E10	10 mm	Miniature Edison Screw (MES)	Flashlights, bicycle lights	7004-22
E11	11 mm	Mini-Candelabra Edison Screw (mini-can)	120 V halogen mini-candelabra	(7004-6-1)
E12	12 mm	Candelabra Edison Screw (CES), C7	120 V candelabra/night lamp	7004-28
E14	14 mm	Small Edison Screw (SES)	230 V candelabra	7004-23
E17	17 mm	Intermediate Edison Screw (IES), C9	120 V appliance	7004-26
E26	26 mm	[Medium] (one-inch) Edison Screw (ES or MES)	Standard 120 V lamps	7004-21A-2
E27	27 mm	[Medium] Edison Screw (ES)	Standard 230 V lamps	7004-21
E29	29 mm	[Admedium] Edison Screw (ES)		
E39	39 mm	Single-contact (Mogul- in America) Goliath Edison Screw (GES)	120 V 250+ W industrial	7004-24-A1
E40	40 mm	(Mogul) Goliath Edison Screw (GES)	230 V 250+ W industrial	7004-24

Three-way lamps have a *d* suffix to indicate double contacts, usually E26d or E27d, or rarely E39d. The second contact is used for the lower-wattage filament of the two inside the lamp. This extra contact is a ring located around the main contact. Unlike bayonet sockets, three-way and regular lamps are interchangeable, although the low filament or low setting doesn't work if mismatched.

The medium Edison screw has seven threads per inch, or about 3.6mm per thread. In the U.S., the Energy Independence and Security Act of 2007 requirement for greater energy efficiency only applies to the medium Edison screw, all other being considered "specialty" lamps.[9]

Diazed fuses DII uses the same E27 thread as standard 230 V lamps, but have a longer body and cannot be screwed into a lamp holder (socket). A lamp base is too short to contact the bottom terminal of a fuse holder. However it's possible (but not useful) to screw a DII fuse holder without a fuse in an E27 lamp holder.

Screw bases have a number of disadvantages compared to the bayonet fit type:

- The metal screw itself forms one of the contacts for the circuit. If the lighting system is not correctly wired, or a lamp is plugged into a non-polarized outlet, the metal screw can become energized, presenting an electric shock hazard to anyone attempting to change the lamp.
- If the lamp becomes loose in the socket due to vibration for example, it can lose contact with the center contact and stop working until it is tightened. The bayonet type is much less likely to become loose.
- As the metal thread carries current any arcing can jam the thread
- Corrosion is more likely to jam a screw thread than a bayonet fixing
- Screwing in and unscrewing the bulb places more force on the glass envelope

Screw bases have a number of advantages compared to the bayonet fit type:

- Screw bases are more suitable for small size bulbs
- A bulb fully screwed home is more secure than a bayonet fit bulb
- Moisture and debris is less likely to contaminate the contacts of a screw base bulb
- Spring contacts are not necessary on screw base bulbs (the spring tension must not only ensure a good contact but it must also hold the bulb securely in the bayonet so there is a compromise)

See also

- Multifaceted reflector

Notes

1. I.C.S. Reference Library volume 4B, International Textbook Company, Scranton PA 1908, page 43-41
2. General Electric *Incandescent Lamps* manual, publication no. TP 110, 1976 page 12
3. "The E26 is the standard 120 Volt American base." (http://www.ledwaves.com/FAQs.html) LED waves, FAQ, retrieved 30 January 2015
4. "E26: 一般電球、ボール電球の多くがこのサイズ。" (http://www.sharp.co.jp/support/advice/led_lighting/select_c1.html) Sharp Japan, support pages, retrieved on 30 January 2015

5. Eisenbraun, Blair (Mar 24, 2011). "Left Handed Incandescent Light Bulbs?". *eLightBulbs*. Retrieved 18 January 2015.
6. McManus, Chris (2004). *Right Hand, Left Hand: The Origins of Asymmetry in Brains, Bodies, Atoms and Cultures*. Harvard University Press. p. 46. Retrieved 2015-01-25.
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