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MECHANICAL SYSTEMS

Mechanical Systems

Mechanical systems help to “maintain the necessary conditions of environmental comfort, health, and safety” for the occupants that inhabit a building.

Although most of the hardware for these systems are normally hidden; in concealed construction spaces or special rooms, the layout of these systems should be carefully integrated with each other along side with the structural and enclosure systems of the building.

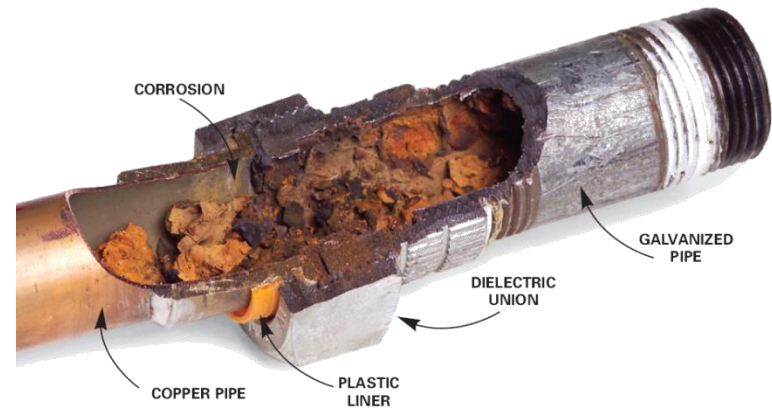
Water Supply

Water is a common element that is utilized in many a building : such as drinking, cooking and washing, HVAC (Heating, Ventilation, and Air Conditioning); for circulating water for heating and cooling while maintaining a desirable level of humidity, and storage for extinguishing fires in fire-protection systems.

Water must be supplied to a building in the correct quantity, proper flow rate, pressure, and temperature to satisfy requirements. For human consumption, it must be potable (free of harmful bacteria), while being treated for hardness or excessive acidity to prevent clogging /corrosions of pipes and equipment.



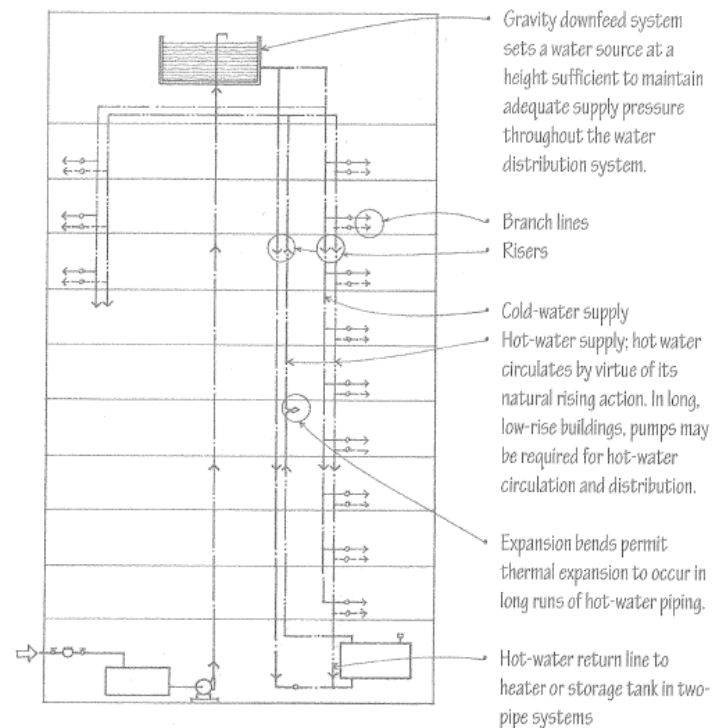
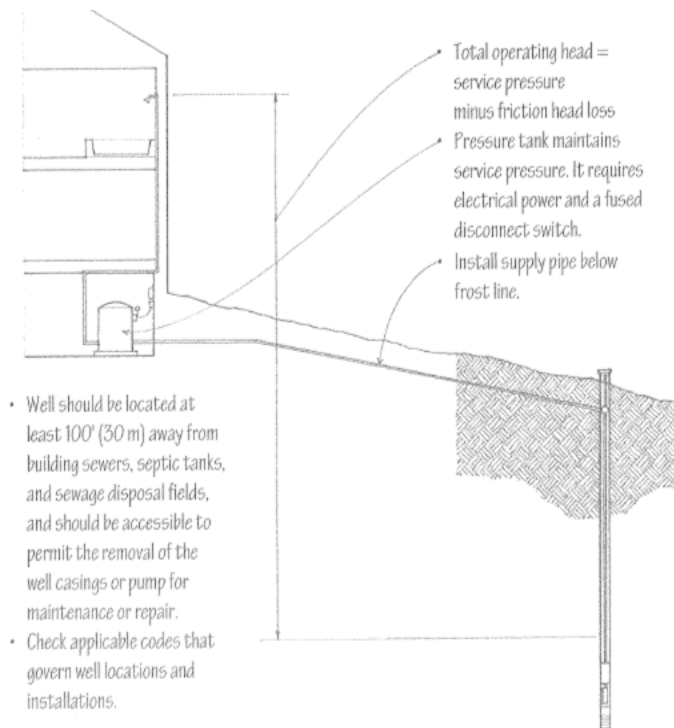
<http://www.motorship.com/news101/ships-equipment/onboard-potable-water-test-kit-for-mlc-regulations>



<https://armstrongplumbing.wordpress.com/tag/galvanized-pipe/>

Water Supply

Water supply systems operate under pressure. The service pressure has to be great enough to absorb pressure losses due to vertical travel and friction as water flows through pipes and fittings. For the upper limit for most private well systems, public water systems supply approximately 50psi of pressure.



Water Supply

Lines in which the water flow could consist of galvanized steel (stainless steel), copper, or polyvinyl chloride (PVC).



Galvanized Steel



Copper



PVC (Plastic)

Pipes are sized according to the number and types of plumbing fixtures that are served and pressure losses due to friction. The unit to calculate the estimation of pressure loss is “gpm” (gallons per minute), which based on the total number of units for a building.

Image 1: <http://galvanizedsteelpipe.org/galvanized-steel-pipe>

Image 2: <http://homeplumbinghow.com/problem-soldering-copper-pipe/copper-pipe-soldering-problem/>

Image 3: <http://homes-kid.com/plastic-plumbing-pipes.html>

Fire Protection Systems

Fire-alarm systems are installed in a building to automatically sound an alarm when activated by a fire-detection system. Consisting of heat sensors, such as thermostats, or smoke detectors that are activated by combustion.



Heat detector has an analog device containing rate-of-rise and fixed temperature heat sensors to detect fire.



Smoke detectors use an optical sensing chamber to detect smoke.



Fire alarm stations are designed for fire alarm installations in schools, hospitals, factories, and industrial locations.

Sprinkler systems consist of pipes that are located in or below ceilings, connected to a suitable water supply and supplied with either valves or sprinkler heads to open automatically at certain a temperature.

Fire Protection Systems

There are two types of sprinkler systems: dry pipe and wet pipe.

- **Wet Pipe Systems:** contains water at a high pressure to provide an immediate , continuous discharge through sprinkler heads.

- **Dry Pipe Systems:** contains pressurized air that is released when a sprinkler head opens; allowing water to flow through the piping and out the nozzle.



Wet Pipe System (left) Dry Pipe System (right).



Sprinkler Head

Image 1: <http://www.associatedfire.com/1311/winter-maintenance-on-your-wet-or-dry-sprinkler-system/>

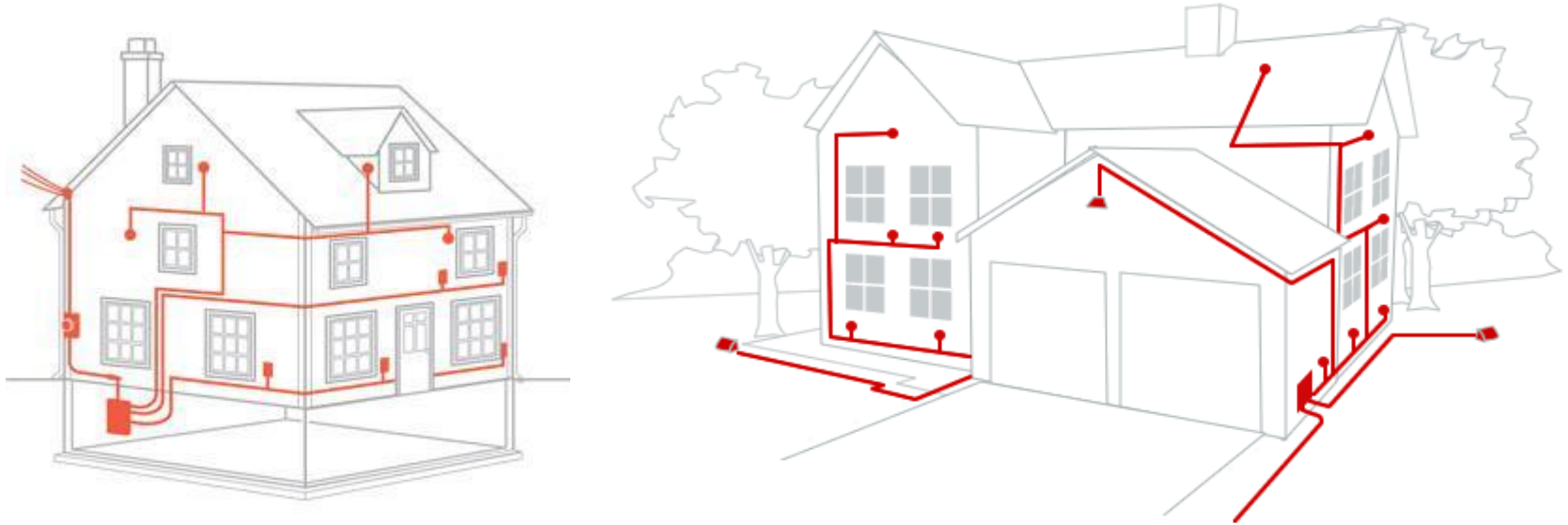
Image 2: <http://imgarcade.com/1/fire-sprinkler-head/>

Water Systems

The water supply system can be accommodated with floor and wall construction spaces, but should be coordinated with the building structure and systems.



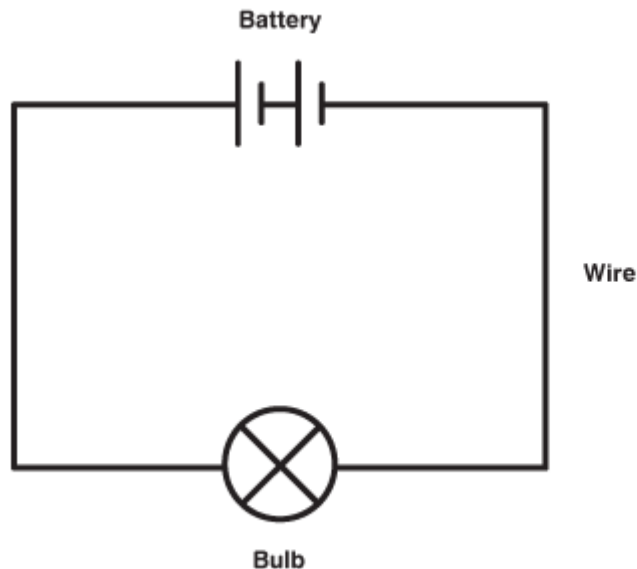
Electrical Systems



Understanding how electrical systems are applied in building construction

Electricity

Circuit: An **electrical circuit** is a network consisting of a closed loop, giving a return path for the current.



Electricity

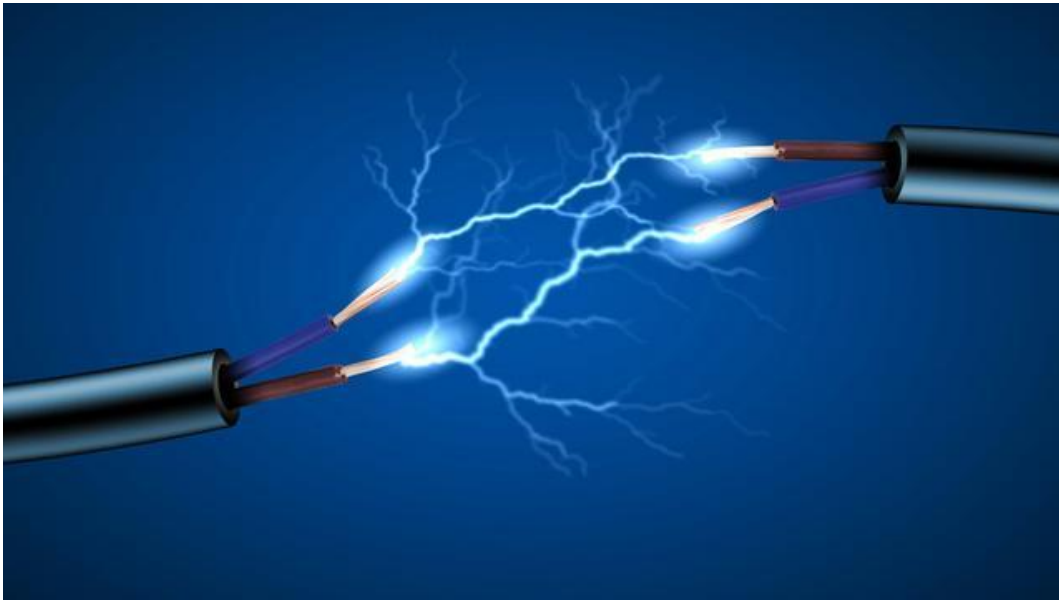
Voltage: is the derived unit for **electric** potential, **electric** potential difference (**voltage**), and electromotive force.



fource

Electricity

Current: An **electric current** is a flow of **electric** charge. In **electric** circuits this charge is often carried by moving electrons in a wire.(measured in Amps)



process

Currents Types DC vs AC

DC: Direct Current

AC: Alternating Current

Direct Current: is the unidirectional flow of electric charge.

Direct current is produced by sources such as batteries, thermocouples, solar cells, and commutator-type electric machines of the dynamo type.

Alternating Current: is a type of electrical **current**, in which the direction of the flow of electrons switches back and forth at regular intervals or cycles. **Current** flowing in power lines and normal household electricity that comes from a wall outlet is **alternating current**.

Electrical Symbols

ELECTRICAL SYMBOLS

Page 1

WALL	CEILING	SWITCH	OUTLETS

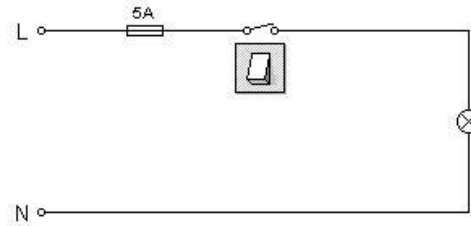
Electrical symbols are used in floor plans and is a form of communication.

Wall

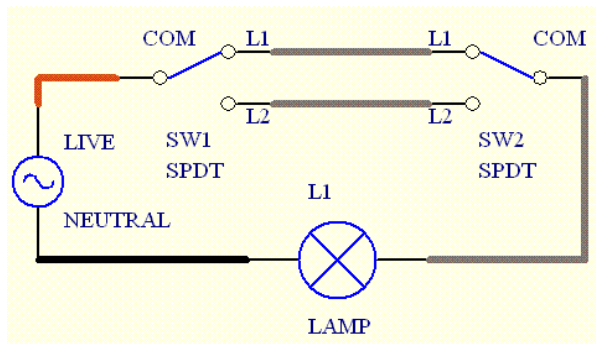
Switches

Outlets

Switches & Outlets



One Way



Two Way



GFCI:
ground fault circuit
interrupters



120 v
12-18 inches
AFF



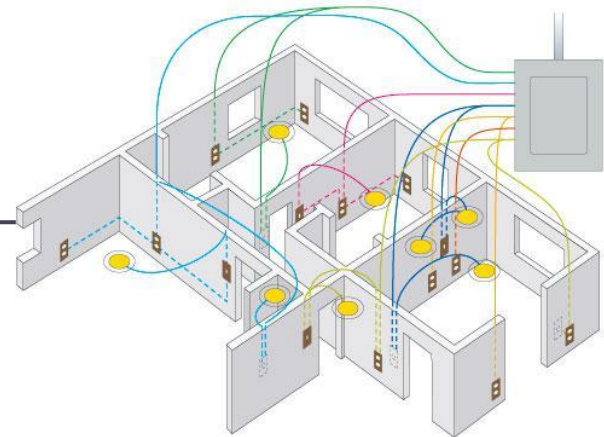
Light Switch

Requirements

Electrical meters



Electrical panels



Electrical room



Responsibilities

Relevant Electrical components that architects must have in their plans

- Lights**
- Switches**
- Fire alarms**
- Smoke detectors**
- Fire safety (exit signs)**
- Voltages**

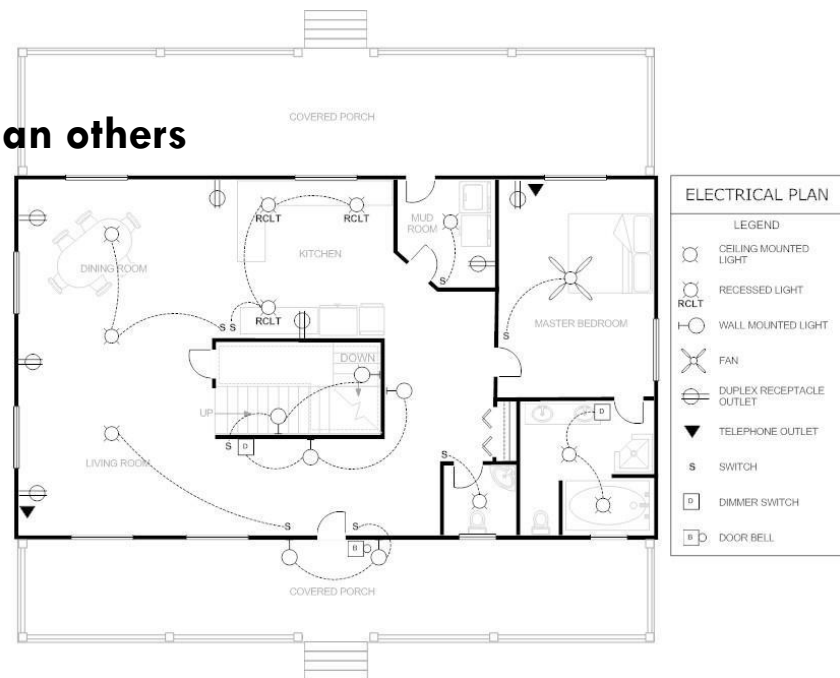
Location of Outlets and Switches

Requirements:Locations

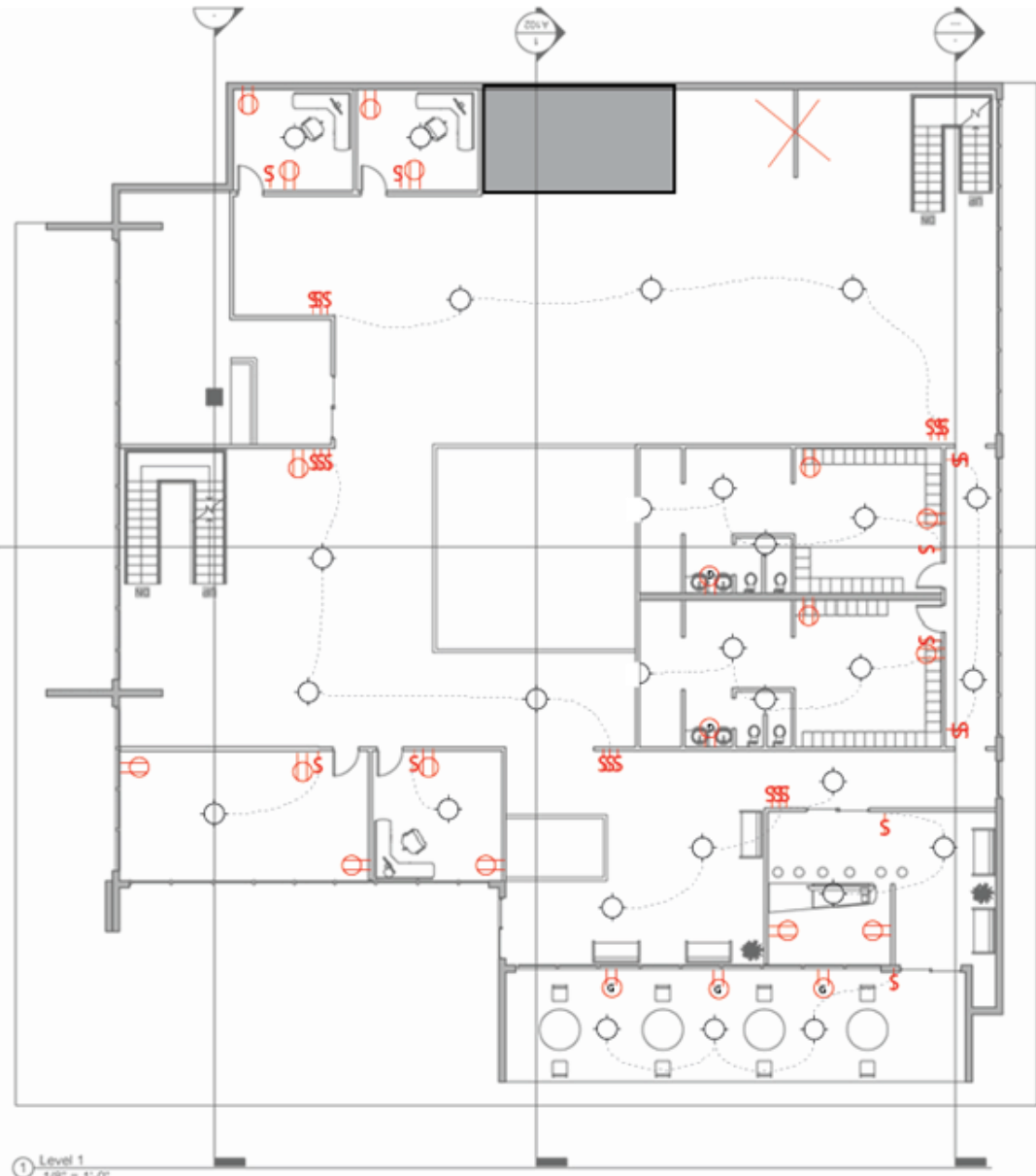
Every room entrance or hall should have a light switch

Outlets typically place every 12'

Certain appliances need more voltages than others



ELECTRICAL SYMBOLS
Page 1

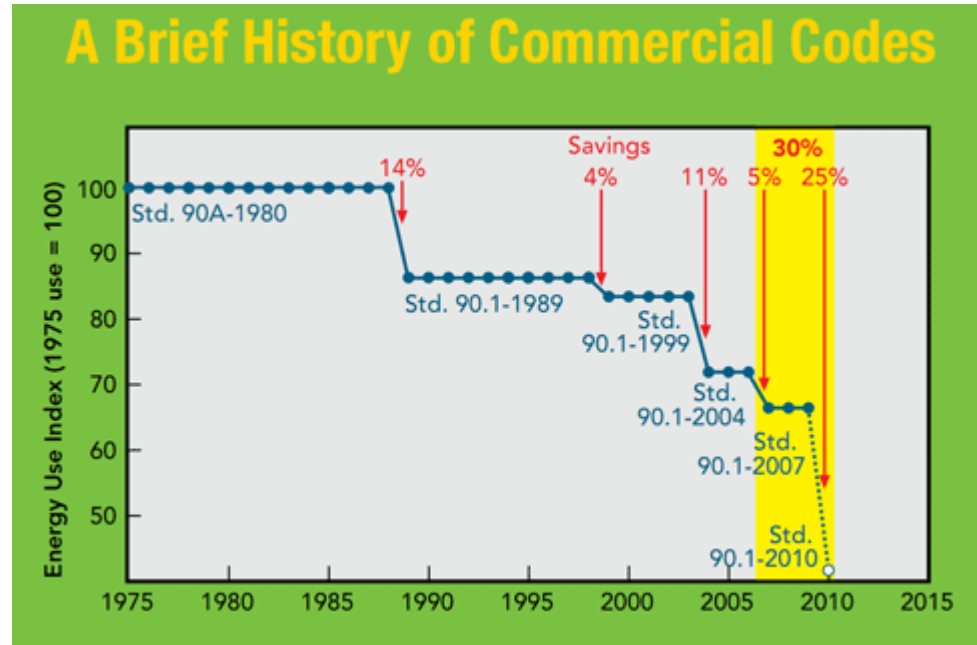


WALL	CEILING	SWITCH	OUTLETS
(O)	(O)	(S)	(S)
(D)	(D)	(S ₂)	(S ₂)
(F)	(F)	(S ₃)	(S ₃)
(J)	(J)	(S ₄)	(S ₄)
(L)	(L)	(S ₅)	(S ₅)
(L _{PS})	(L _{PS})	(S _E)	(S _E)
(S)	(S)	(S _{PL})	(S _{PL})
(V)	(V)	(S _K)	(S _K)
(X)	(X)	(S _{CB})	(S _{CB})
(C)	(C)	(S _{WCB})	(S _{WCB})
(B)	(B)	(S _{MC})	(S _{MC})
(DUPL)	(DUPL)	(S _{RC})	(S _{RC})
(S _{1,3})	(S _{1,3})	(S _{WP})	(S _{WP})
(R)	(R)	(S _F)	(S _F)
(S _S)	(S _S)	(S _{WPF})	(S _{WPF})
(SP)	(SP)	(SW)	(SW)
(FO)	(FO)	(PP)	(PP)

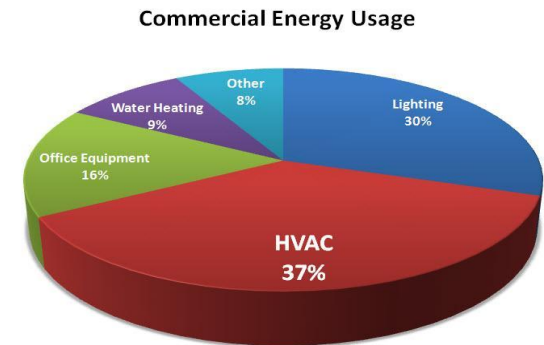
Reproduced from American Standard 1000.

① Level 1
1/8" = 1'-0"

Building Energy Codes



30 percent drop in energy consumption since 1975



Building Energy Codes

Nearly 5 million commercial buildings and 115 million residential households in the United States consume over 40 percent of the nation's total primary energy

Buildings consume 70 percent of electricity in the United States

In 2007, carbon dioxide emissions attributable to lighting, heating, cooling, cooking, refrigeration, water heating, and other building services totaled 2517 million metric tons—40 percent of the U.S. total and 8 percent of the global total.

Building Energy Codes

-IECC

-ASHRAE

Building Energy Codes

Complying with energy codes also affects the materials selected for the building by requiring, for example, glazing with correct efficiencies, proper insulation levels, and lighting controls that meet the intent of the code.

Lighting – Common Lamp Types

Incandescent Lamps – Most commonly found type of lamp, which has a metal filament made of tungsten and is encased in glass.

Fluorescent Lamps – A type of lamp that's a tube of mercury gas with electrodes at both ends. The glass is coated with phosphors, which result its whitish color.



Source: Building Systems, Wendell C. Edwards

Images from Lightbulbsmart.com

Lighting – Common Lamp Types

High Intensity Discharge (HID) – Arc lamps with separate electrodes encased in quartz. It contains mercury vapor and other gases inside. The quartz can also be coated in phosphors for the whitish color.

LED – Although not one of the basic lamps, it's still commonly found. It's short for Light Emitting Diodes, which is made of several layers of semiconductor materials that converts electricity directly to visible light.



Source: Building Systems, Wendell C. Edwards
Images from: gelifighting.com, eneltec.led.com

Emergency Lighting

Battery Pack Unit Lamps – Wall-mounted metal cabinet housing batteries with two to three external lamps. The lamp's battery are usually charged and will be quickly switched to battery usage when there's a power source outage.

Emergency Lamps – They're regular lamps with in-built batteries that are kept charged and will run on the batteries when there's an outage.



Source: Building Systems, Wendell C. Edwards
Images from lightservicesinc.net, liquidled.com.au

Emergency Lighting

Electrical Generator – Electricity generator that are used to support emergency lighting, power and HVAC during emergencies. They're usually found on the exterior and operates on fuel oil.

Lead-acid Batteries – Such as the ones you find in cars, can be used to support emergency lighting, power and HVAC during outage.



Source: Building Systems, Wendell C. Edwards

Images from powerdepot.com, diytrade.com