

LOAD LIMIT

Active Physical Science
Electricity

Fuse/Circuit Breaker

- Used to prevent circuit overload
- If current surpasses current allowed by fuse (or circuit breaker) it blows or trips
- Safety feature

Circuit Breaker Box



Fuse Box



Example:

- ⦿ most houses have 15-amp circuit breakers
- ⦿ 7 amp toaster and 7 amps coffee maker (total=14 amps), circuit ok
- ⦿ add blender @ 6 amps (total= 20 amps), circuit breaker will trip or fuse burns out
- ⦿ If circuit trips, you can flip circuit breaker back or replace the fuse

Power - the rate at which energy is used or generated.



POWER

$$P = I E$$

Unit for Power → WATTS (W)

Power = Current x Voltage

$$(W) = (A) \times (V)$$

POWER

$$P = I E$$

Power calculations apply to:

- ⦿ Power consumed by individual appliances connected in a household circuit
- ⦿ “Load Limit” or power limit of a household circuit

Example:

$$P = I * E \quad (W) = (A)(V)$$

- ⦿ **Houses in U.S. uses a 120-volt AC electric circuit.**
- ⦿ Calculate Load Limit in Watts
- ⦿ Multiply 120 V by the rating of the circuit breaker (in Amps)
- ⦿ Most homes have 15 amp or 20 amp breakers on each circuit
- ⦿ Load Limit for 120 volt circuit with a 20 amp circuit breaker:

$$P = I * E$$

$$P = (20A)(120V) = 2400 \text{ watts}$$

What is the load limit for a 120 volt circuit with a 15 amp circuit breaker/fuse?

$$P = I * E$$

$$P = (15A)(120V) = 1800 \text{ watts}$$

Load Limit in a Home

- ⦿ Load Limit of household circuit vs. power ratings of appliances:

$$P_{\text{Load Limit}} = P_1 + P_2 + P_3 + \dots + P_n$$

- ⦿ When sum of power ratings of each appliance connected to circuit exceeds Load Limit ($>P_{\text{Load Limit}}$) then circuit breaker **automatically** shuts circuit off for safety.

Example:

- ⊙ How many 60 watt light bulbs would it take to trip a typical household circuit (120 volt AC with 15 amp circuit breakers)?
 - 1st Calculate Load Limit
 - $P = IE$
 - $P = (15 \text{ A})(120 \text{ V}) = 1800 \text{ W}$

 - 2nd Figure Power per Bulb
 - $1800 \text{ watts} / 60 \text{ watts} = 30 \text{ light bulbs}$

 - What does this mean?
 - *The circuit could hold 30 light bulbs, but if you added 1 more light bulb then the circuit would trip because there would be 1860 watts on one circuit, exceeding the limit.*

- ⊙ What if you used 75 watt light bulbs?

- ⊙ $1800 \text{ watts} / 75 \text{ watts} = 24 \text{ light bulbs}$
 - ⊙ *Now 25 bulbs would trip the breaker*

IONIC BREEZE™
ELECTROSTATIC AIR CLEANER

Model number SI637

AC 110V 10W 50/60Hz

Patent & Patents Pending.

SHARPER IMAGE DESIGN™



CAUTION: This equipment should be inspected frequently and collected dirt removed from it regularly to prevent excessive accumulation that may result in flashover or a risk of fire.

CAUTION: High voltage inside! **INDOOR USE ONLY**

This device complies with part 15 of the FCC rules. Operation is subject to the following two conditions:

- 1) This device may not cause harmful interference, and
- 2) This device must accept any interference received, including interference that may cause undesired operation.

MADE IN CHINA

02NOV

Conforms to UL 867

What combination of appliances, listed below, will trip the typical household circuit?

Appliance	Power Used (watts)
Blender	200
Coffee Maker	1200
Deep Freezer	500
Refrigerator	615
Dishwasher	1200
Toaster Oven	1100
Toaster	1000
Microwave Oven	1450
Hair Dryer	600

Appliance	Power Used (watts)
Clothes Dryer	4900
Washing Machine	500
Vacuum Cleaner	750
Iron	1100
Computer	300
Television	150
Stereo	1200
Clock Radio	70
Box fan	175

What is the maximum number of appliances that can be connected to any one circuit without shutting off a circuit with a 20 amp fuse/circuit breaker?

Appliance	Power Used (watts)
Blender	200
Coffee Maker	1200
Deep Freezer	500
Refrigerator	615
Dishwasher	1200
Toaster Oven	1100
Toaster	1000
Microwave Oven	1450
Hair Dryer	600

Appliance	Power Used (watts)
Clothes Dryer	4900
Washing Machine	500
Vacuum Cleaner	750
Iron	1100
Computer	300
Television	150
Stereo	1200
Clock Radio	70
Box fan	175

(Hint: Calculate load limit, then see how many appliances can be connected to the circuit while staying under the load limit.)

Household Electricity

- ⦿ What is another device that controls the flow of electricity?

A switch.

- ⦿ opens and closes a circuit.
 - It controls the flow of electricity.
 - If it is open then there is no flow of electricity, but if it is closed then electricity can flow.