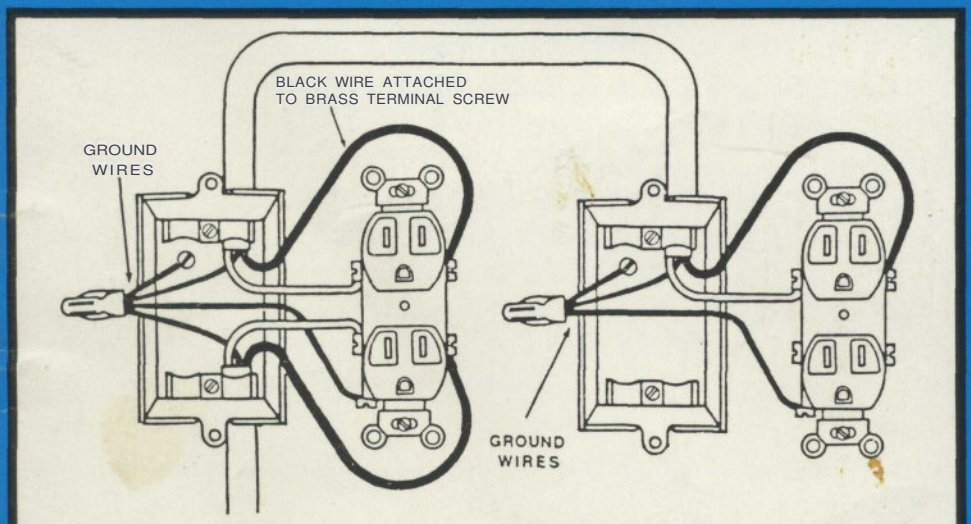
NO. 1

STEP BY STEP
GUIDE BOOK ON

Home Wiring



LOADED WITH SIMPLE, EASY TO FOLLOW WIRING DIAGRAMS

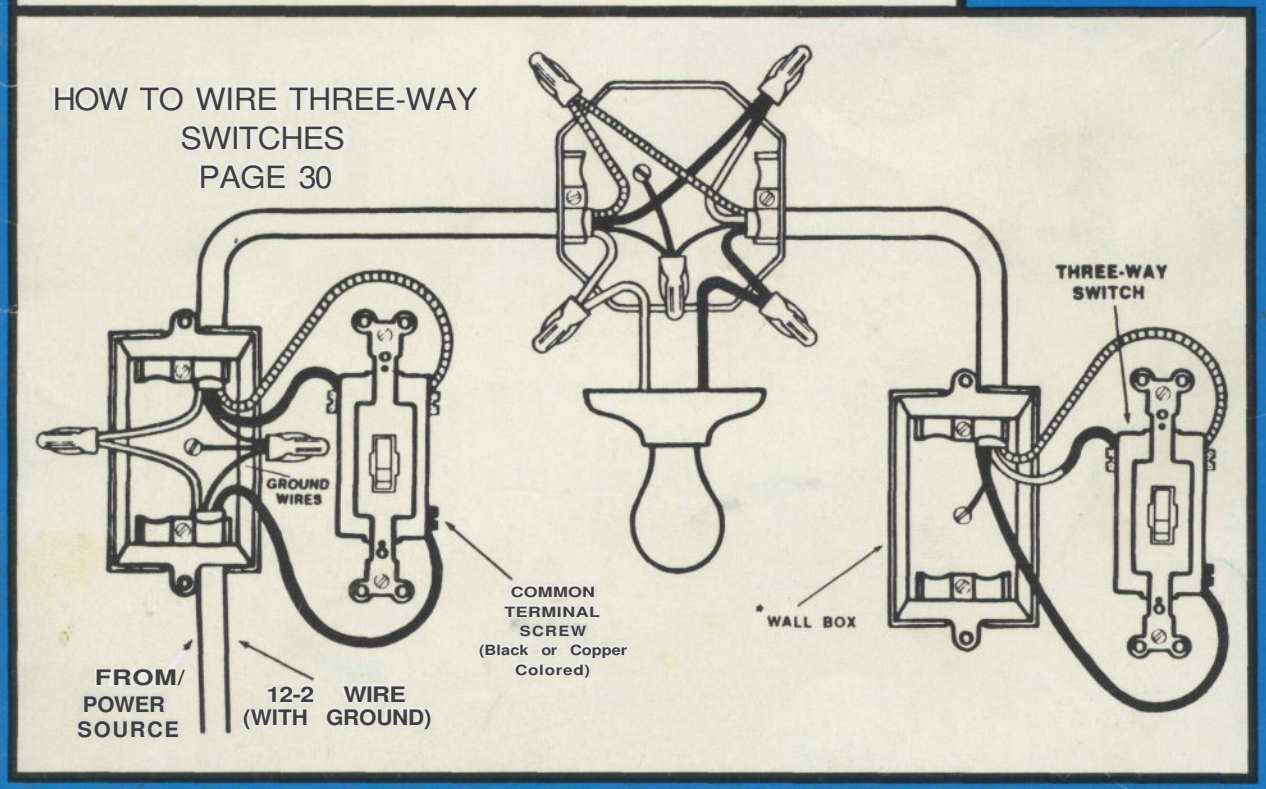


TABLE OF CONTENTS

IMPORTANT

ALL OF THE ILLUSTRATIONS IN THIS BOOK SHOW TYPICAL WIRING METHODS, ACTUAL INSTALLATIONS MUST BE ADAPTED TO INDIVIDUAL REQUIREMENTS, SO FOLLOW NATIONAL, STATE, AND LOCAL ELECTRICAL CODES.

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Author: Ray McReynolds

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P.O. Box 70865
Salt Lake City, Utah 84170

WIRING COLOR GUIDE	
WHITE WIRE	*nfutral*
BLACK WIRE	tor
RED WIRE	*hot*
BARE WIRE	*ground wire*

How the Home Electrical System Works

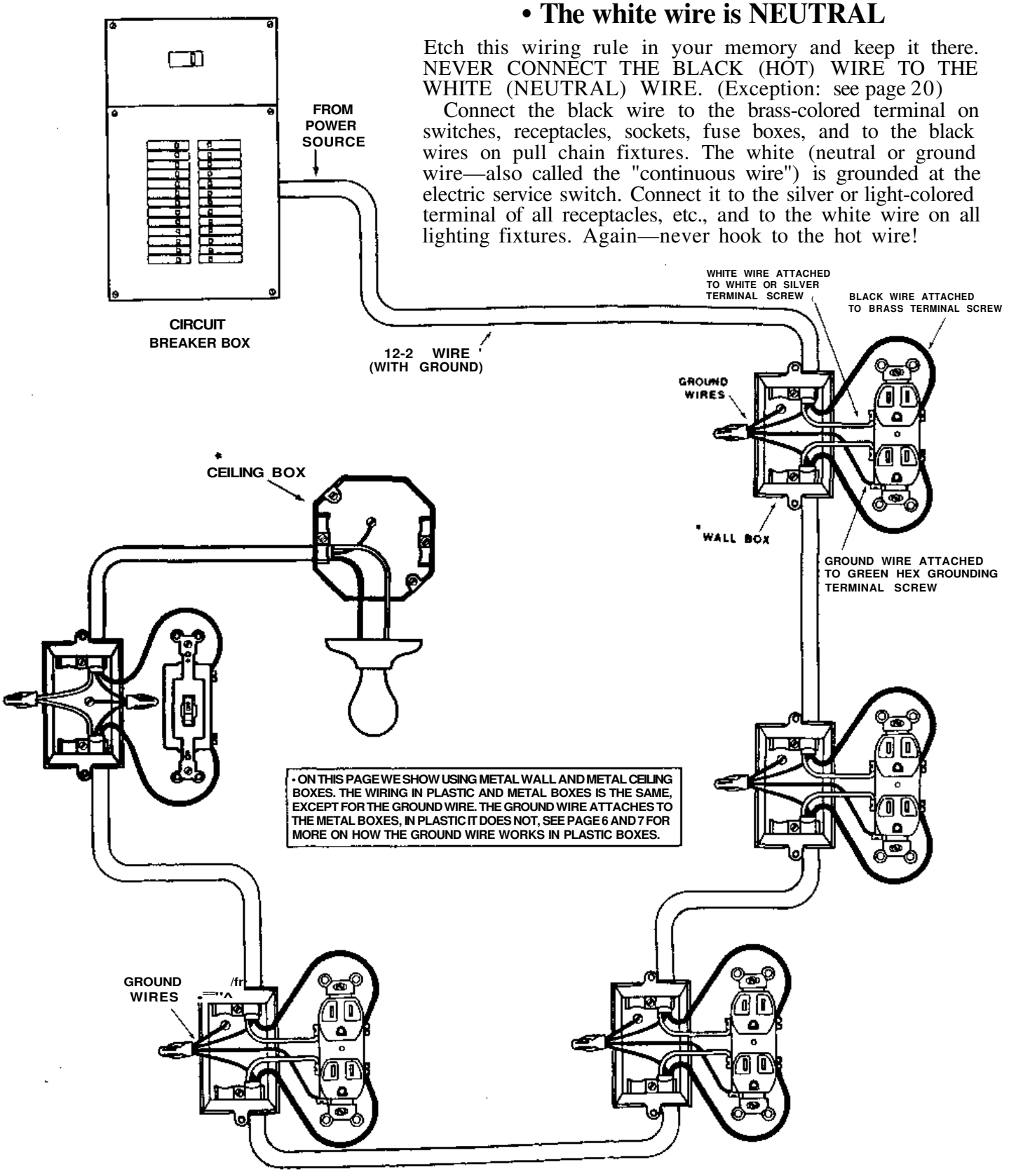
WIRE NUT GUIDE	
a mat NUT	USE RED WIRE NUTS WHERE WIRE NUTS ARE USED ON THIS PAGE INCLUDING GROUND WIRES

Color coding of wire

- **The black wire is HOT**
- **The white wire is NEUTRAL**

Etch this wiring rule in your memory and keep it there. NEVER CONNECT THE BLACK (HOT) WIRE TO THE WHITE (NEUTRAL) WIRE. (Exception: see page 20)

Connect the black wire to the brass-colored terminal on switches, receptacles, sockets, fuse boxes, and to the black wires on pull chain fixtures. The white (neutral or ground wire—also called the "continuous wire") is grounded at the electric service switch. Connect it to the silver or light-colored terminal of all receptacles, etc., and to the white wire on all lighting fixtures. Again—never hook to the hot wire!



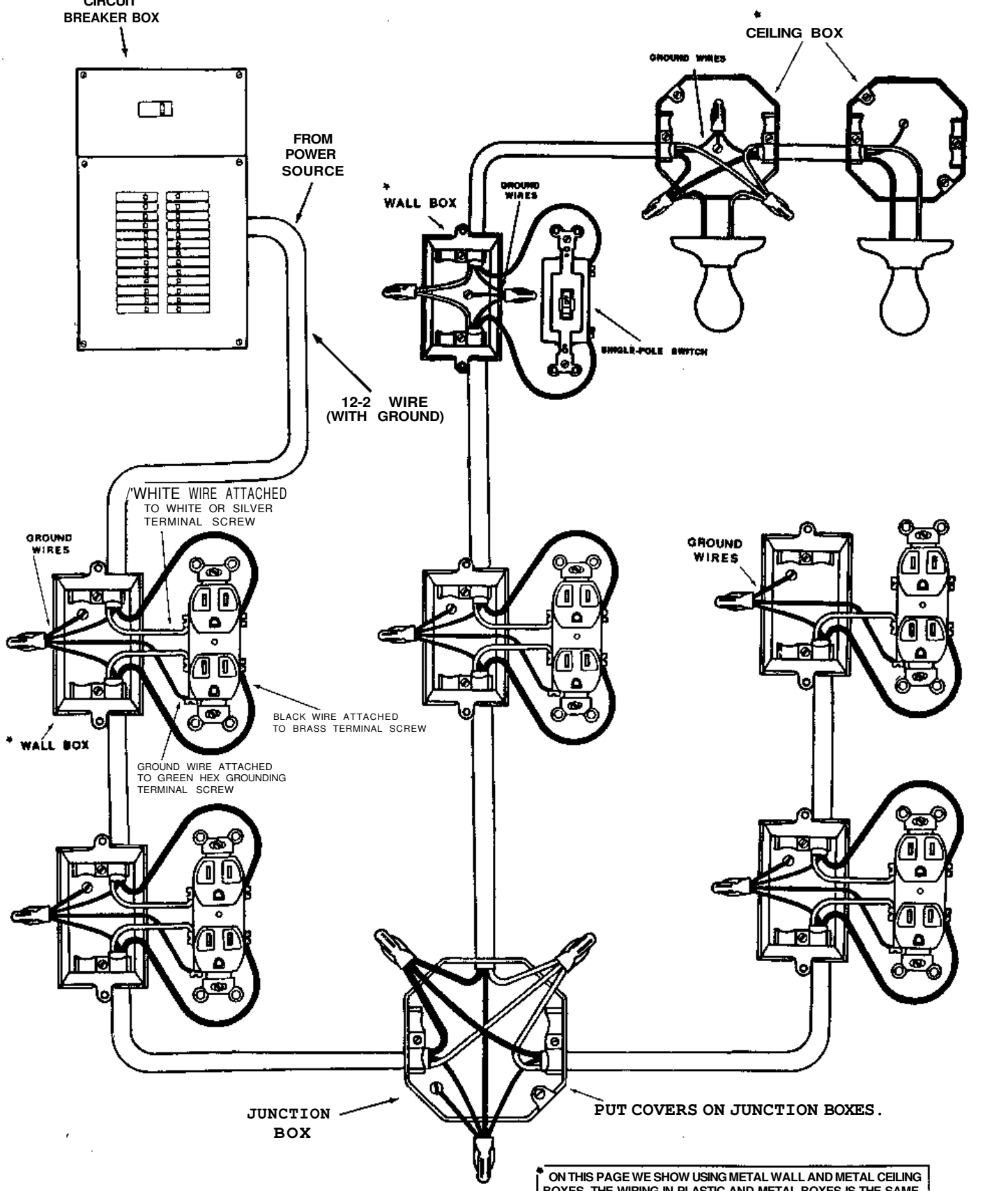
• ON THIS PAGE WE SHOW USING METAL WALL AND METAL CEILING BOXES. THE WIRING IN PLASTIC AND METAL BOXES IS THE SAME, EXCEPT FOR THE GROUND WIRE. THE GROUND WIRE ATTACHES TO THE METAL BOXES, IN PLASTIC IT DOES NOT, SEE PAGE 6 AND 7 FOR MORE ON HOW THE GROUND WIRE WORKS IN PLASTIC BOXES.

WIRE NUT GUIDE	
A WM NUT	USE RED WIRE NUTS WHERE WIRE NUTS ARE USED ON THIS PAGE INCLUDING GROUND WIRES

How the Home Electrical System Works

WIRING COLOR GUIDE	
WHITE WIRE	NEUTRAL
BLACK WIRE	HOT
RED WIRE	HOT
BARE WIRE	GROUND WIRE

THE PICTURE BELOW SHOWS HOW THE POWER SUPPLY COMES OUT OF THE BREAKER BOX SUPPLYING POWER TO THE OUTLETS AND HOW TO CHANGE DIRECTION OF THE WIRE WITH THE USE OF A JUNCTION BOX.



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How to Turn off Main Power Supply

Before starting any work, you must disconnect (or "kill") the circuit you'll be working on at its source in the service panel. If your circuits are protected by fuses, removing the appropriate fuse disconnects the circuit from incoming service. In a service panel equipped with circuit breakers, you can disconnect a circuit by switching its breaker to the OFF position.

To make sure you disconnect the correct circuit, turn on a light that's connected to the circuit before you remove the fuse or turn off the circuit breaker. The light will go out when you've removed the correct fuse or turned off the correct breaker.

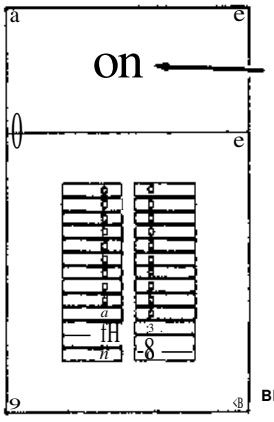
If you have any doubt about which fuse or breaker protects which circuit, shut off all current coming into your home at the main disconnect

While you're at your service panel, spend another moment to prevent a possible disaster. Tape a note on the panel explaining what you're doing so no one will come along and replace the fuse or reset the circuit breaker while you're working on the wiring. Then either carry the fuse with you in your pocket or tape the circuit breaker in its OFF position.

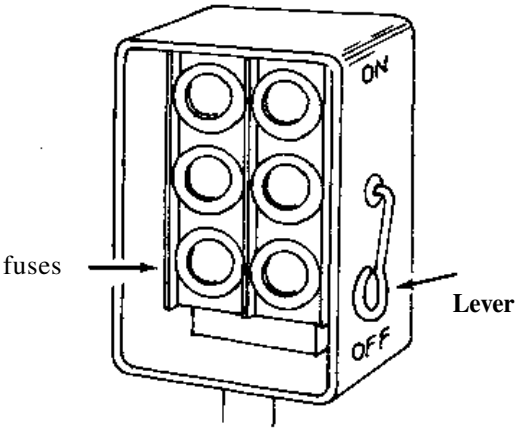
With the electricity turned off, you can work in complete safety. Still, it's a good idea to keep a few additional safety precautions in mind.

Remember that water and electricity don't mix. Never work on wiring, fixtures, switches, or appliances when you're wet or standing on a damp spot. Lay down dry boards to stand on if the floor or ground is wet.

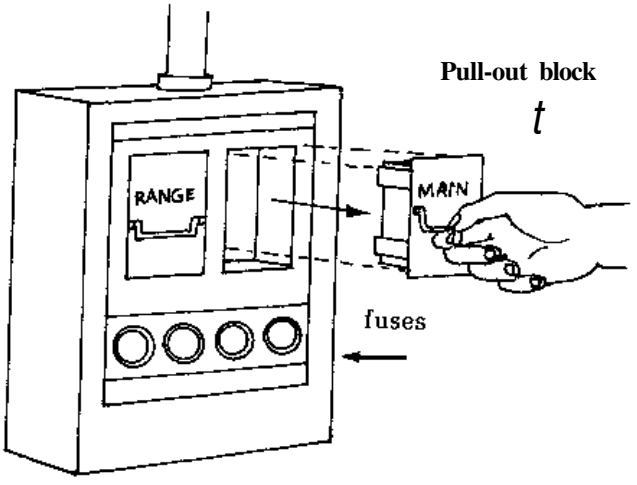
Chart Shows Color Coding of Wires and Terminal Screws		
Color of Wire	Color of Terminal Screw	Hot — Neutral or Grounding Wire
White	Silver or White	Neutral Wire
Black	Brass	Hot Wire
Red	Brass	Hot Wire
Green	Green	Grounding Wire
Bare Wire	Green	Grounding Wire



SWITCHING THE MAIN BREAKER TO THE OFF POSITION SHUTS OFF ALL POWER.



Lever disconnect. An external handle controls contact with two main fuses in the cabinet. When you pull the handle to the OFF position, you shut off the main power supply.



Pull-out block. The main cartridge fuses are mounted on one or two nonmetallic pull-out blocks. By pulling firmly on the hand-grips, you can remove the blocks from the cabinet and disconnect all power.

THE THREE WAYS TO GET POWER TO YOUR NEW WIRING JOB

Important To Your Safety

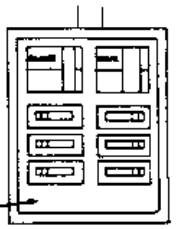
ALWAYS SHUT OFF POWER TO THE CIRCUIT YOU WILL BE WORKING ON, OR THE ENTIRE HOUSE IF YOU ARE NOT SURE WHICH FUSE OR BREAKER CONTROLS THE CIRCUIT.

NOTE: YOU MUST NOT EXCEED THE NUMBER OF POLES OR SPACES FOR WHICH THE PANEL BOARD IS APPROVED REGARD-LESS OF WHETHER THERE IS ROOM OR SPACE IN THE PANEL

ON NUMBER 3 CHECK WITH YOUR LOCAL ELEC-TRICAL INSPECTOR TO SEE IF IT IS PERMIT-TED.

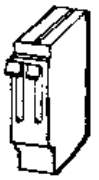
1. FIRST YOU LOCATE THE CIRCUIT BREAKER BOX THAT CONTRLOLS THE POWER COMING INTO THE HOUSE, SEE IF THERE IS ANY ROOM LEFT FOR THE CIRCUIT BREAKERS YOU NEED. IF THERE IS GET THE MAKE AND MODEL OFF OF IT AND GO TO YOUR LOCAL ELECT. PARTS STORE AND PURCHASE THE BREAKERS YOU NEED. (SEE PICTURE t1)

PICTURE f1



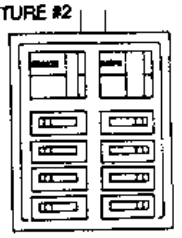
SEE IF THERE IS ROOM HERE FOR MORE BREAKERS.

2. SECOND, IF THERE IS NO ROOM LEFT IN CIRCUIT BREAKER BOX, CHECK MAKE AND MODEL AS IN #1 ABOVE AND SEE IF THEY HAVE A NARROWER CIRCUIT BREAKER THAT WILL FIT YOUR PARTICULAR BREAKER BOX. MOST CIRCUIT BREAKERS ARE 1" THICK BUT THEY MAKE SOME BREAKERS 1/2" THICK. TAKE OUT ONE THAT IS 1" THICK AND INSTALL 2 - 1/2" THICK ONES. (SEE PICTURE #2)



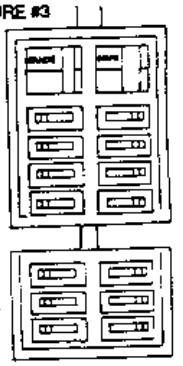
IF THIS PANEL IS FULL, TRY AND GET NARROW BREAKERS.

PICTURE #2

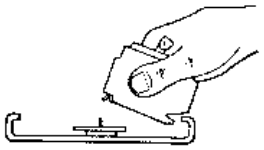


3. THIRD, IF WAYS #1 AND #2 DO NOT WORK FOR YOU, GO TO YOUR LOCAL ELECT. PARTS STORE AND GET A SUB-PANEL THAT WILL WORK WITH THE MULTI BREAKER YOU HAVE - BRAND ETC. GET ONE THAT HAS AS MANY NEW BREAKERS AS YOU NEED FOR YOUR JOB. (SEE PICTURE #3)

PICTURE #3



REGULAR MULTI BREAKER WITH SUB-PANEL ADDED.



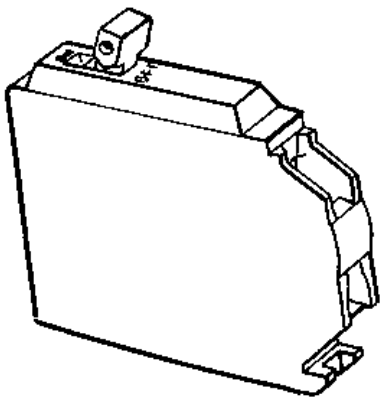
THIS SHOWS A BREAKER BEING ATTACHED TO THE BREAKER BOX.

Important

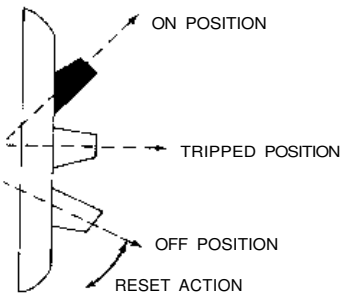
IF USING #14-2 WIRE WITH GROUND, USE A 15 AMP BREAKER TO PROTECT THE LINE.

IF USING #12-2 WIRE WITH GROUND, USE A 20 AMP BREAKER TO PROTECT THE LINE.

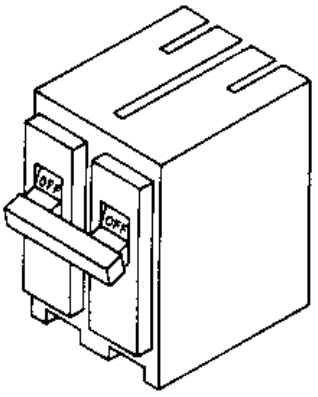
All About Circuit Breakers



Single Circuit Breaker



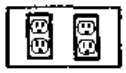
POSITIONS OF THE CIRCUIT BREAKER HANDLE



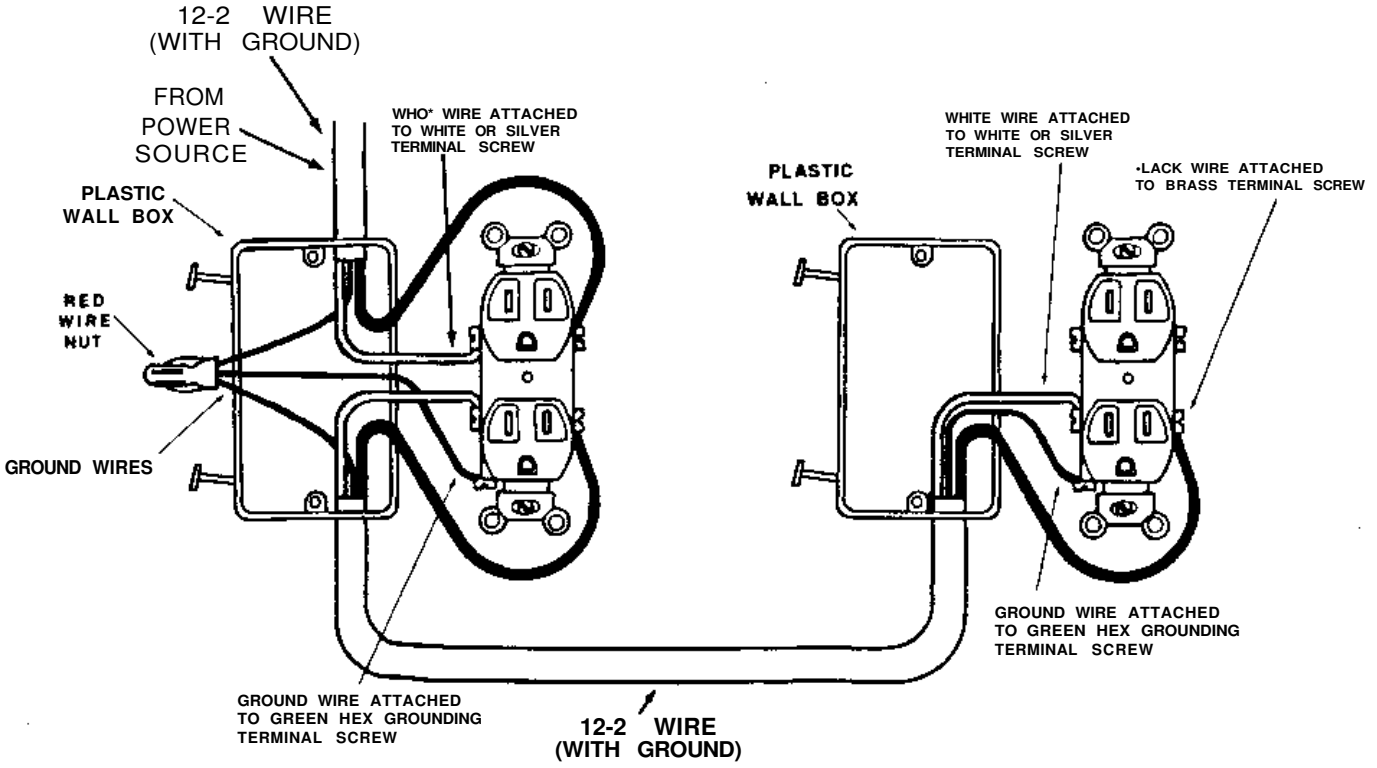
Double Circuit Breaker

More and more circuit breakers are being used in place of fuses. A circuit breaker looks something like a toggle switch, with a handle that lets it be used just like a switch to turn power on and off. Inside each breaker is a fairly simple mechanism which in case of overload trips the breaker and disconnects the load. If a breaker trips because of overload, in most brands you must force the handle beyond the OFF position, then return it to ON, to reset it. On some brands however, the handle merely goes to the OFF position; reset it by returning it to the ON position.

What is to be done when a breaker trips or a fuse blows? Most people will say: reset the breaker, or install a new fuse. Correct, but first find out why the fuse blew. Fuses are the safety valves of electrical installations.



How The Ground Wire Works in Plastic Wall Boxes



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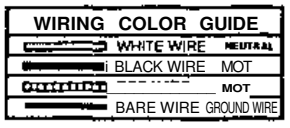
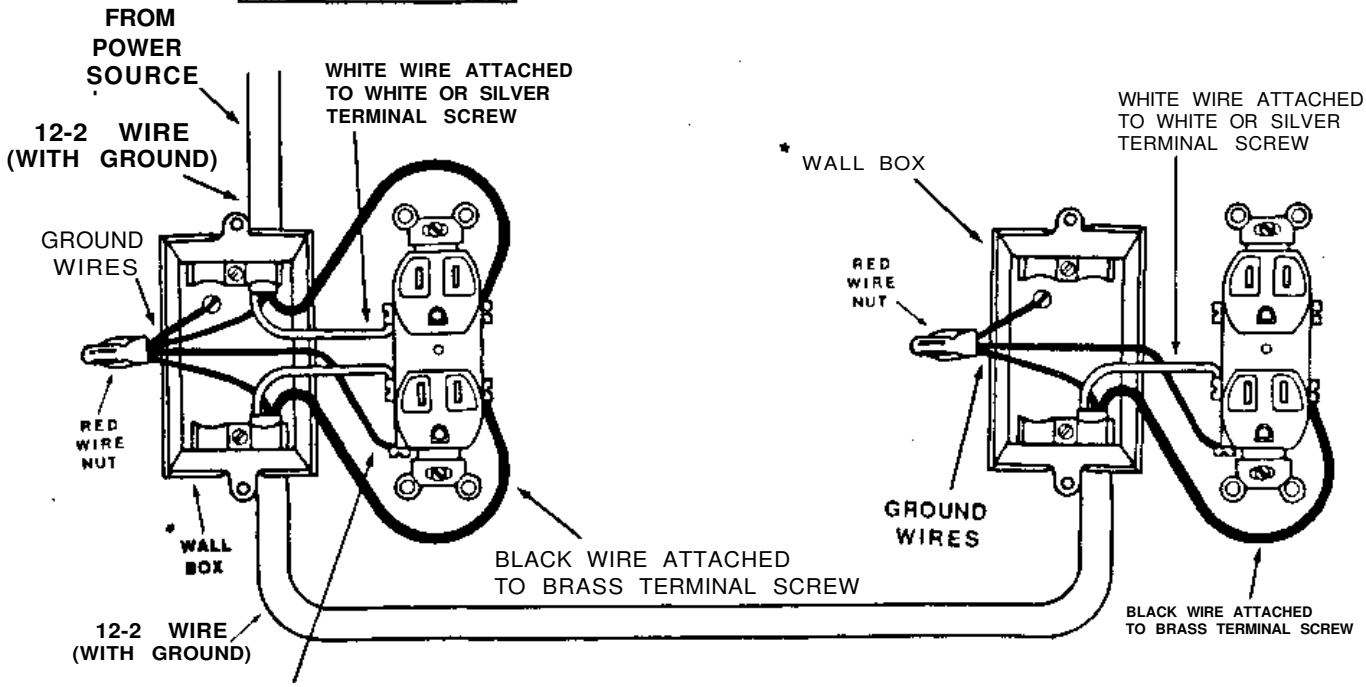


How to Wire Outlets

WIRING TWO OUTLETS



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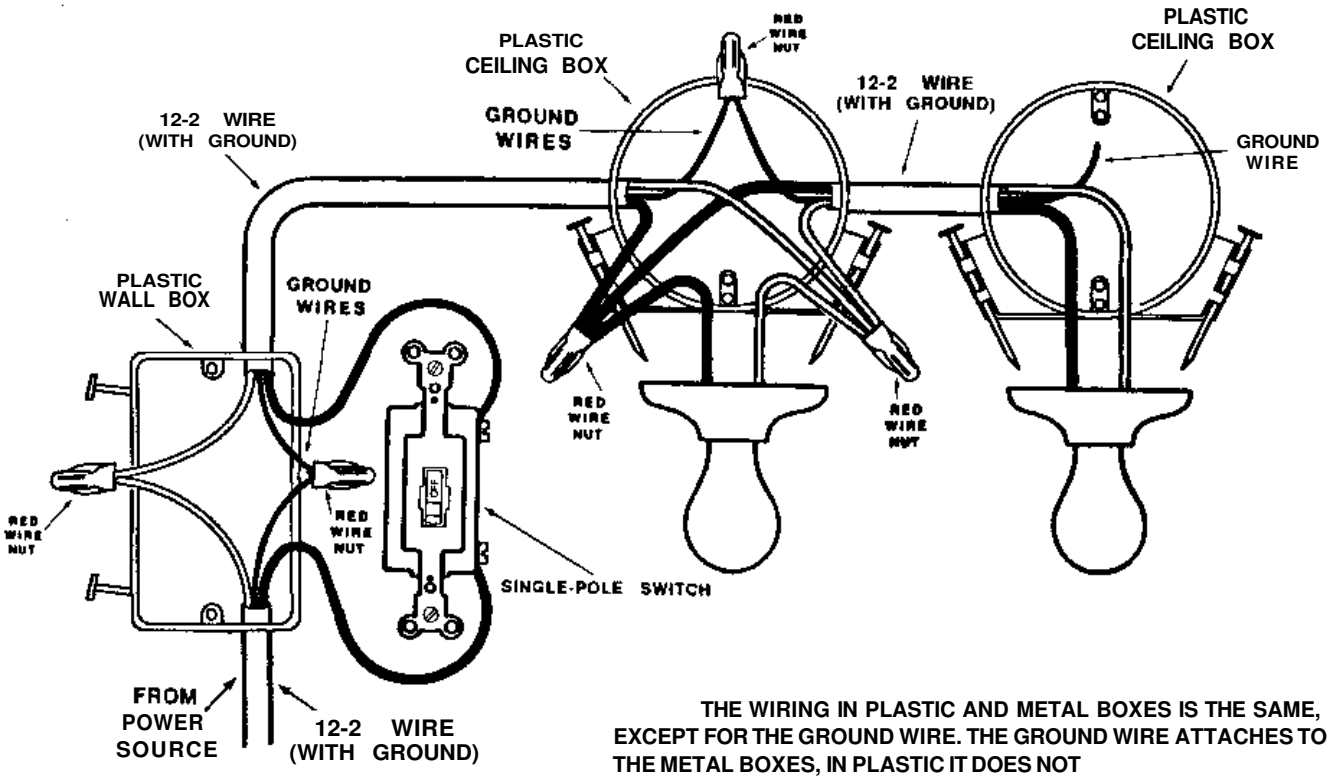
WIRING COLOR GUIDE	
WHITE WIRE	NEUTRAL
BLACK WIRE	HOT
RED WIRE	HOT
BARE WIRE	GROUNDWIRE

How The Ground Wire Works in Plastic Wall and Ceiling Boxes



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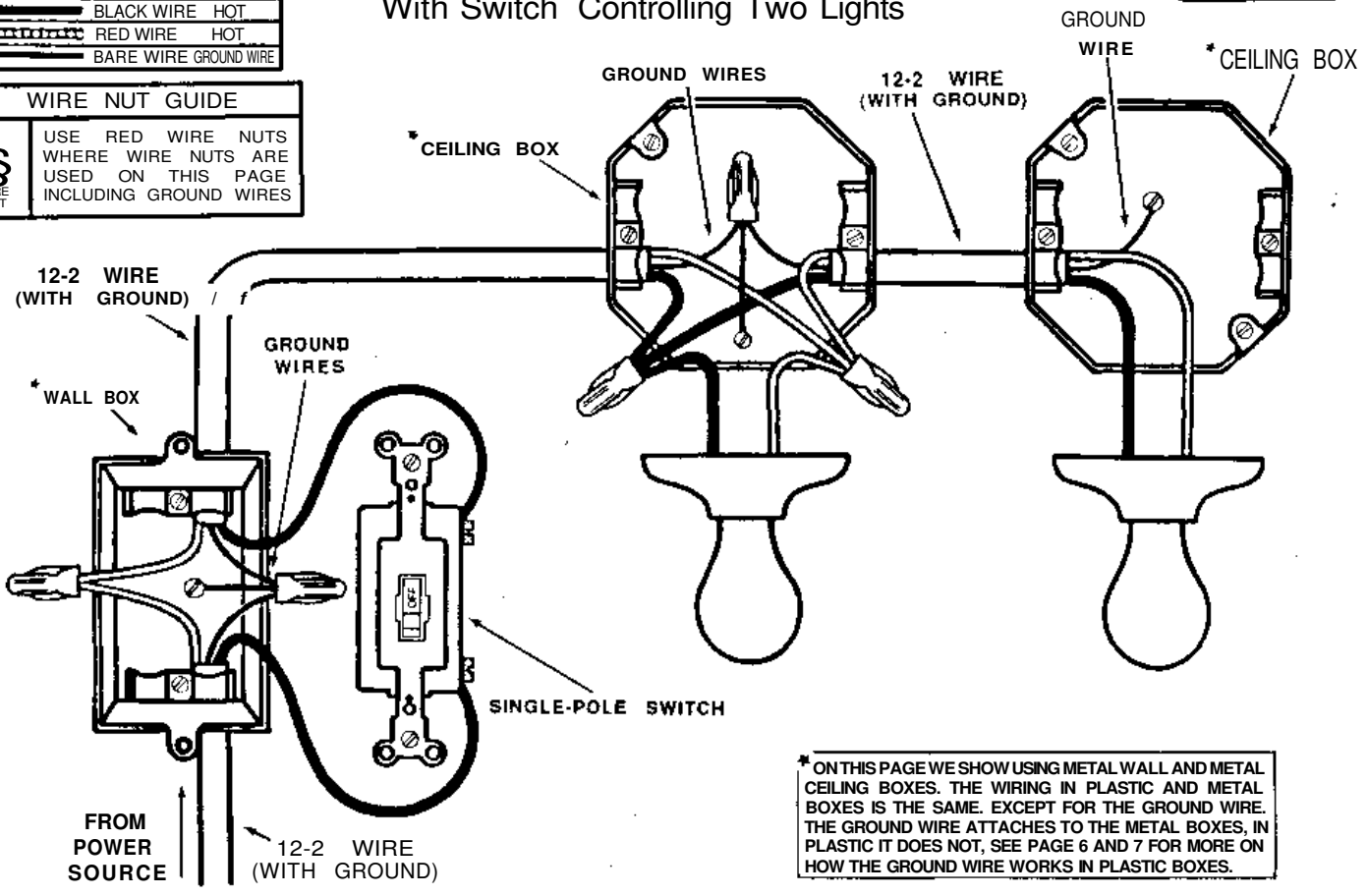
WIRE NUT GUIDE	
§ WIRE NUT	USE RED WIRE NUTS WHERE WIRE NUTS ARE USED ON THIS PAGE INCLUDING GROUND WIRES

How To Wire Single Pole Switch

With Switch Controlling Two Lights



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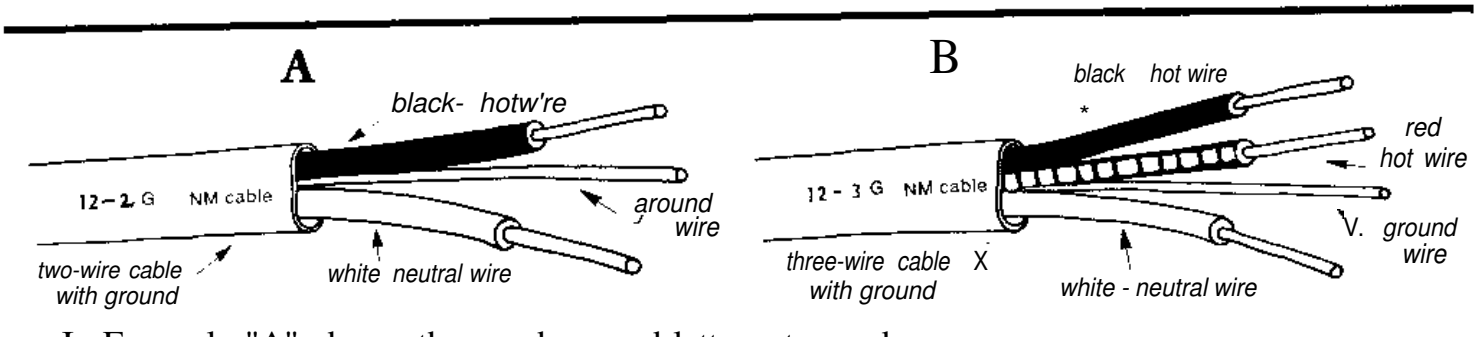
All About Electric Wire

CHECK WITH LOCAL CODES ON WIRING SIZES NEEDED FOR YOUR WIRING PROJECT

Chart Shows Copper Wire Size, Amps and Watts		
Wire Size (Actual Size)	Amps (Also Fuse or Circuit Breaker size)	Watts (Based on 120 Volts) at 80% loaded
• NO. 1 4 wire	1J amps	1800 watts
• NO. 12 wire	£\J amps	2400 watts
• NO. 1 0 wire	•30 amps	3600 watts
^P NO. 8 wire	40 amps	4800 watts
^P NO. 6 wire	JU amps	6000 watts

The larger the wire gauge number the smaller the diameter of the wire.

Chart Shows Color Coding of Wires and Terminal Screws		
Color of Wire	Color of Terminal Screw	Hot — Neutral or Grounding Wire
White	Silver or White	Neutral Wire
Black	Brass	Hot Wire
Red	Bras^s	Hot Wire
Green	Green	Grounding Wire
Bare Wire	Green	Grounding Wire



In Example "A" above, the numbers and letters stamped on the electric wire has the following meaning.

The "12" means it is No. 12 wire in size.
The "2" means it has two wires.
The "G" means with ground wire.
The "N-M" means non-metalic

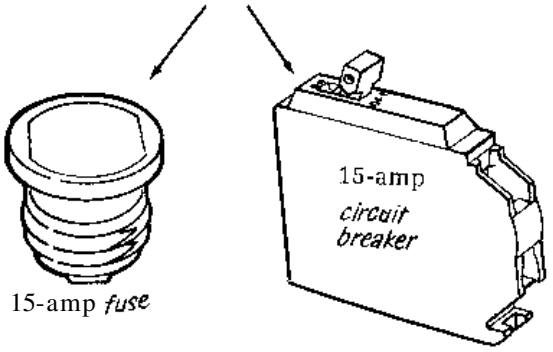
In Example "B" above, it is exactly like Example A except it has three wires instead of the two.

All About Electric Wire

When doing any electrical wiring, you have to use the right size fuses or multi-breakers to protect the electric wire against any overloads or short circuits. Also, wire can handle only so many watts before it becomes overloaded and blows fuses or kicks breakers off. Check below.

#14-2 WIRE WITH GROUND

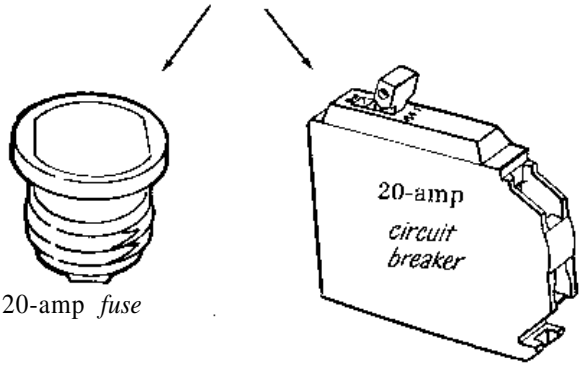
When working with No. 14 wire, use a 15 amp fuse or a 15 amp breaker to protect it against overloads or short circuits.



15-amp *fuse*

#12-2 WIRE WITH GROUND

When working with No. 12 wire, use a 20 amp fuse or a 20 amp breaker to protect it against overloads or short circuits.



20-amp *fuse*

Color coding of wire

- **The black wire is HOT**
- **The white wire is NEUTRAL**

Etch this wiring rule in your memory and keep it there. NEVER CONNECT THE BLACK (HOT) WIRE TO THE WHITE (NEUTRAL) WIRE. (Exception: see *page20)*

Connect the black wire to the brass-colored terminal on switches, receptacles, sockets, fuse boxes, and to the black wires on pull chain fixtures. The white (neutral or ground wire—also called the "continuous wire") is grounded at the electric service switch. Connect it to the silver or light-colored terminal of all receptacles, etc., and to the white wire on all lighting fixtures. Again—never hook to the hot wire!

Important

ALWAYS SHUT OFF POWER TO THE CIRCUIT YOU WILL BE WORKING ON, OR THE ENTIRE HOUSE IF YOU ARE NOT SURE WHICH FUSE OR BREAKER CONTROLS THE CIRCUIT. DOUBLE CHECK WITH A TESTING DEVICE TO BE ABSOLUTELY SURE THE CIRCUIT IS DEAD.

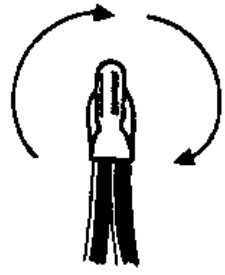
How To Use Wirenuts and Screw Terminals

HOW TO PUT ON WIRENUT

WIRE NUTS JOIN WIRE ENDS

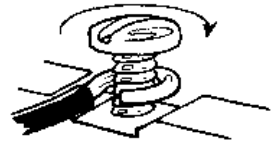
Step 1. Strip *off* about 1 inch of insulation from ends *of* wires you're going to join. Twist the stripped ends clockwise at least one and one-half turns.

Step 2. Snip % to $^1/_2$ inch *off* the twisted wires so the ends are even.



Step 3. Screw the wirenut on clockwise.

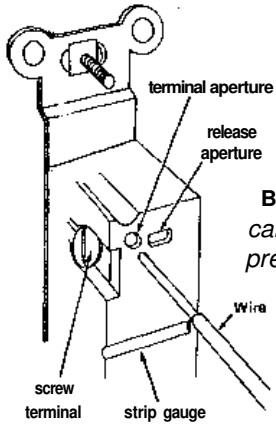
HOW TO JOIN WIRE TO SCREW TERMINALS



Step 1. Strip % inch of insulation *off* the wire end. Then use a pair of needle nose plyers to form a *half loop* in the bare wire.

Step 2. Hook the wire clockwise around the screw terminal. As you tighten the screw the loop will close. Always strip wires so no more than 1/16 inch of bare wire extends out beyond the screw head.

Wrong way Right way

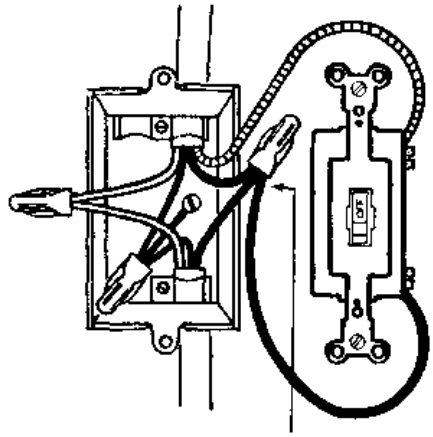


BACKWIRED OUTLETS AND SWITCHES

can be loosened from the wires by pressing a screwdriver point into the release aperture.

BACKWIRED OUTLETS AND SWITCHES

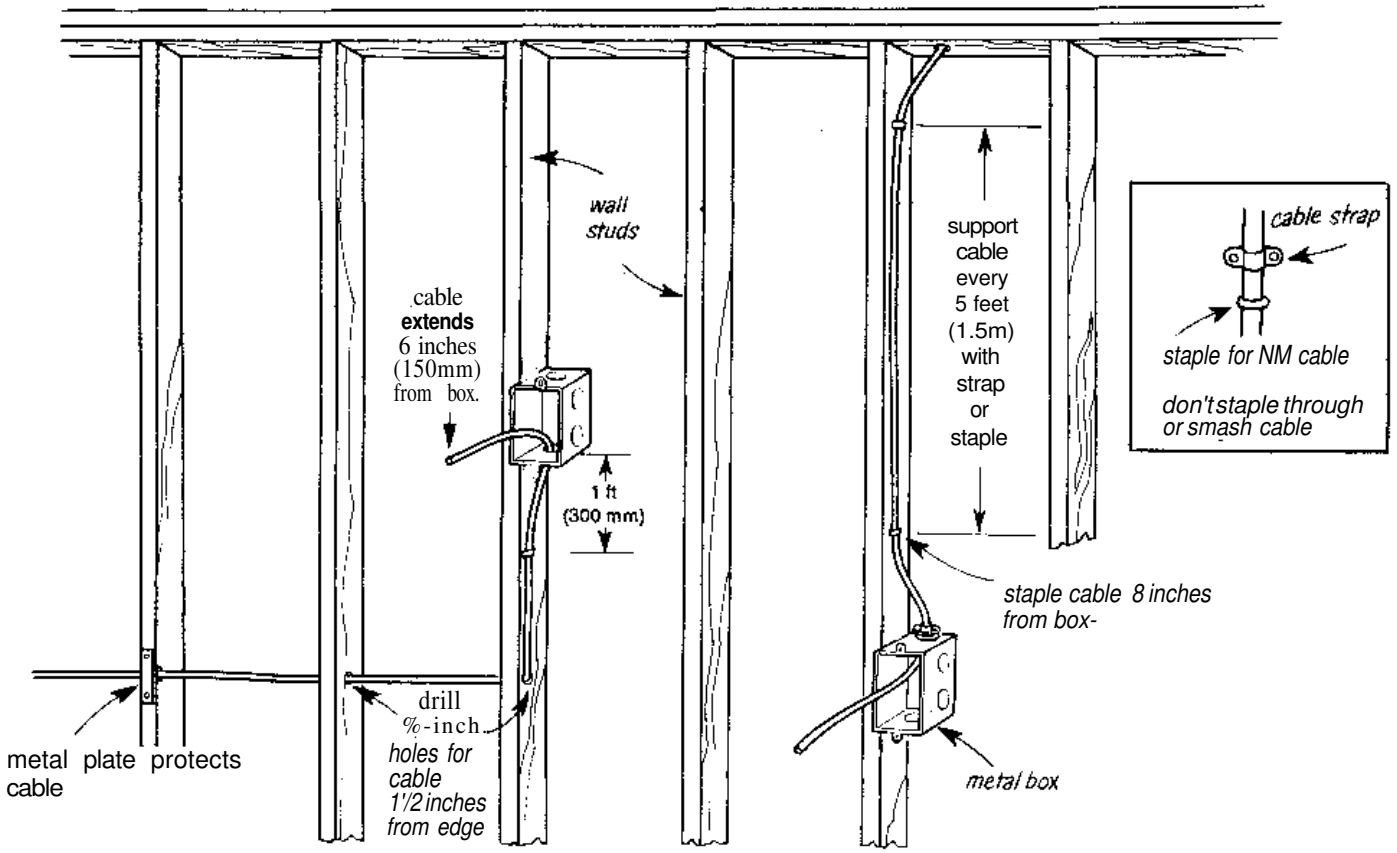
HOW TO JOIN SEVERAL WIRES TO SCREW TERMINALS

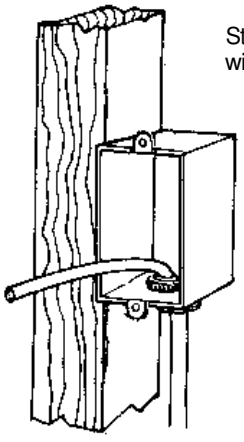


Pigtail splice

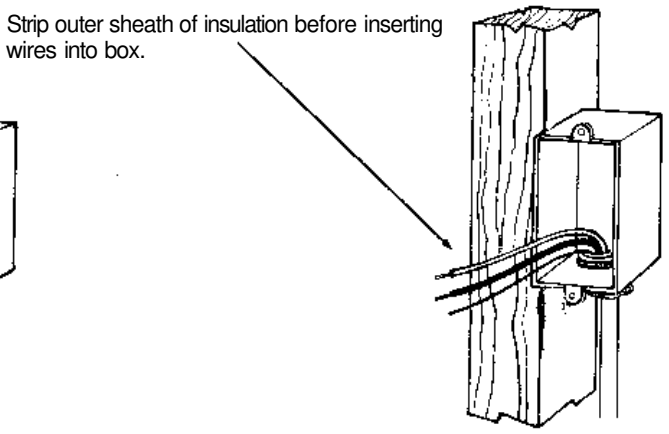
The electrical code requires that only one wire may be attached to a screw terminal — the above picture shows the only approved way to do this — it is called a pigtail splice.

How to Install Wiring in New Walls and Partitions





Step 1. Install box. Secure cables to box so that 6 inches *of* each cable extends from box. (150 mm)



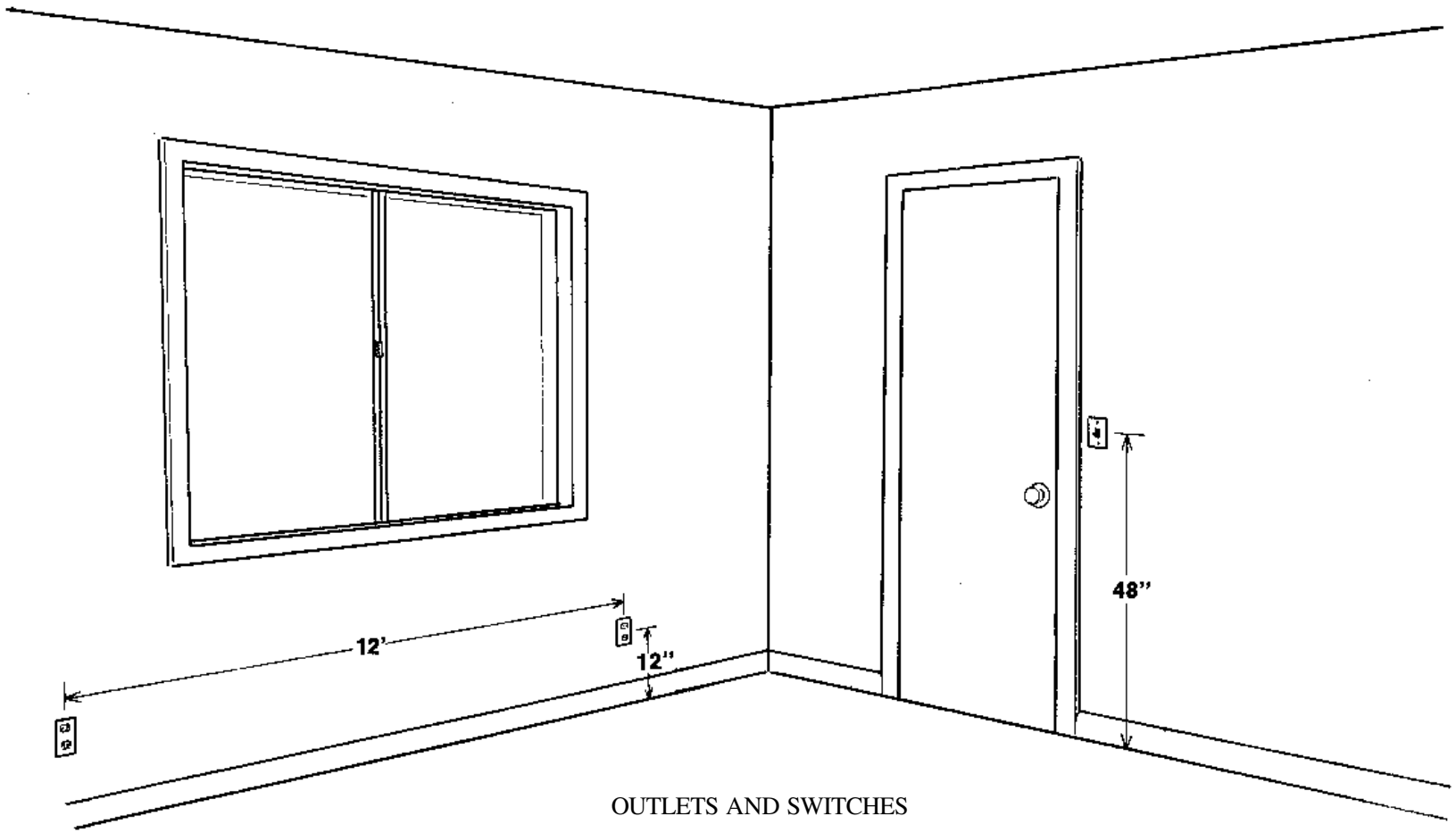
Step 2. Strip outer sheath *of* insulation to back *of* box; remove sheath and all separation materials. Strip *off* Vz to 3/4 inch insulation *from* wire ends.

OUTLETS AND SWITCHES

- ALL OUTLETS MUST BE OF THE GROUNDED TYPE.
- **Outlets Should Be No More than 12 Ft. Apart.**
- **Outlets Should Be 12 " High from Floor.**
- **Switches Should Be 48" High from Floor**
- **Switches Should Always Be Put on Same Side of Door that the Door Knob Is on.**

CHECK ON LOCAL CODES FOR MORE INFORMATION NEEDED ON OUTLETS AND SWITCHES FOR YOUR WIRING PROJECT

The Most Common Measurements for Outlets and Switches



OUTLETS AND SWITCHES

- ALL OUTLETS MUST BE OF THE GROUNDED TYPE.
- Outlets Should Be No More than 12 Ft. Apart.
- Outlets Should Be 12 " High from Floor.
- Switches Should Be 48" High from Floor.
- Switches Should Always Be Put on Same Side of Door that the Door Knob Is on.

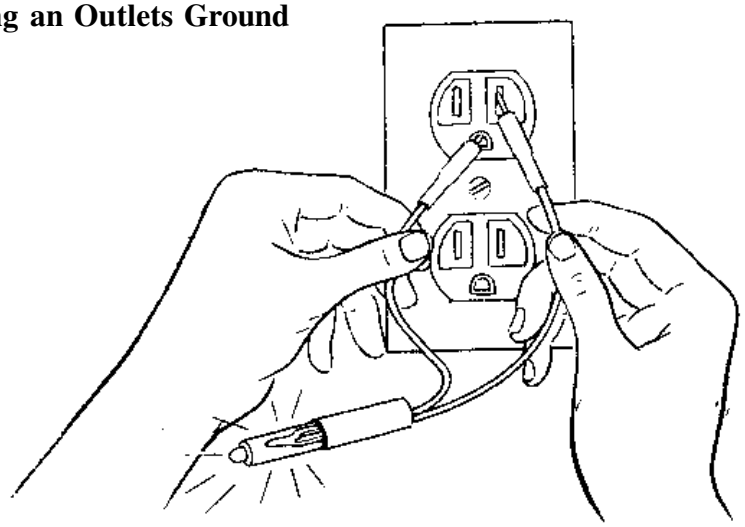
CHECK ON LOCAL CODES FOR MORE INFORMATION NEEDED ON OUTLETS AND SWITCHES FOR YOUR WIRING PROJECT

All About The Ground Wire

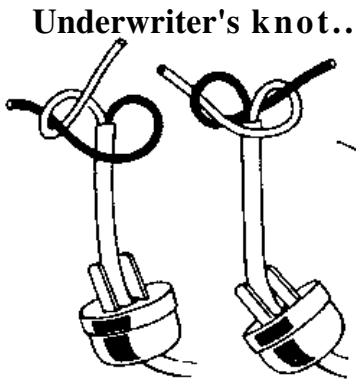
- USE THE GREEN OR BARE WIRE AS THE GROUND WIRE IN ELECTRICAL WIRING. USE THE GREEN-COLORED TERMINAL SCREW AS THE GROUNDING SCREW IN ANY ELECTRICAL WORK.
- IF YOU ARE USING ELECTRICAL WIRE THAT HAS NO GROUND WIRE IN IT, USE A GROUND WIRE THE SAME SIZE. FOR EXAMPLE, IF YOU ARE USING NUMBER 12 WIRE USE A NUMBER 12 GROUND WIRE.
- USE 10/32" STOVE BOLTS OR MACHINE SCREWS TO ATTACH THE GROUND WIRE TO THE BACK OF WALL BOXES, SWITCH BOXES, CEILING BOXES, AND JUNCTION BOXES.
- THE GROUND WIRE NOT ONLY PROTECTS YOU FROM GETTING SHOCKED, BUT PROTECTS THE ELECTRICAL ITEMS IN YOUR HOUSE FROM GETTING DAMAGED FROM LIGHTNING.

Checking an Outlets Ground

TEST THE GROUNDING OF A NEWLY INSTALLED OUTLET BY INSERTING ONE PROBE OF THE VOLTAGE TESTER INTO THE SEMICIRCULAR GROUND SLOT AND THE OTHER INTO EACH OF THE ELONGATED SLOTS SUCCESSIVELY. THE TESTER SHOULD LIGHT WHEN THE PROBE IS PLUGGED INTO THE HOT SLOT. (IN A MODERN OUTLET THIS SLOT IS SLIGHTLY SHORTER THAN THE OTHER SLOT.) IF NEITHER SLOT LIGHTS THE TESTER, THE OUTLET IS NOT GROUNDED AND THE WIRING MUST BE CORRECTED.



Underwriter's knot..



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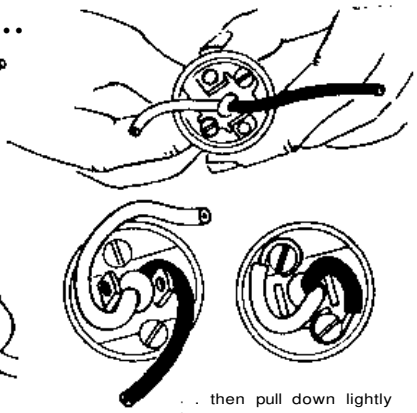
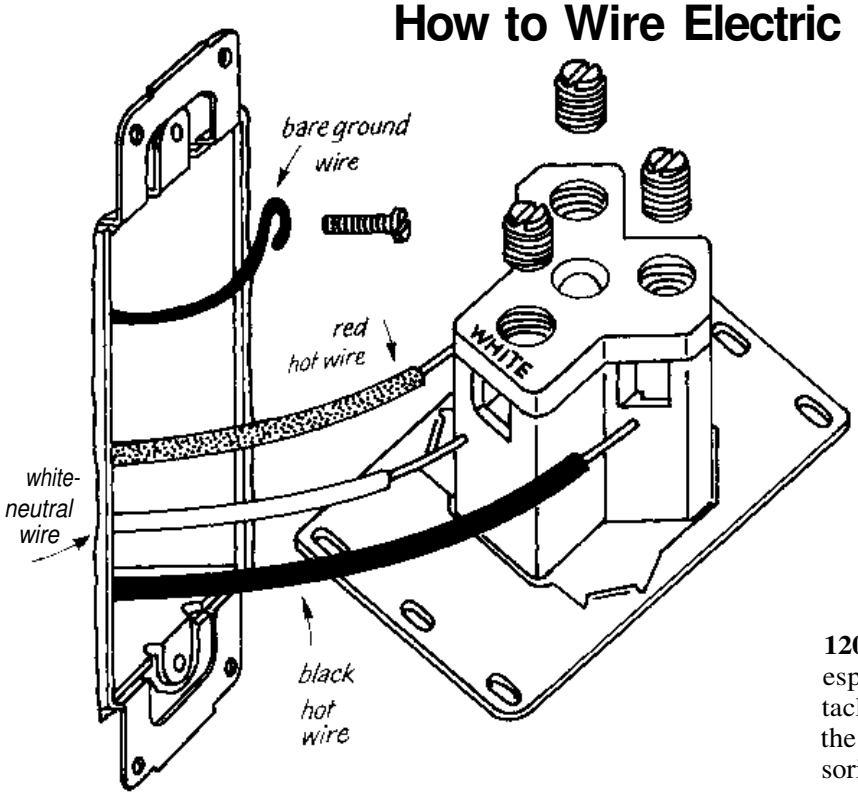
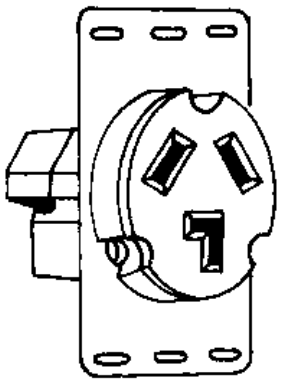


. . then pull down lightly into recess between prongs

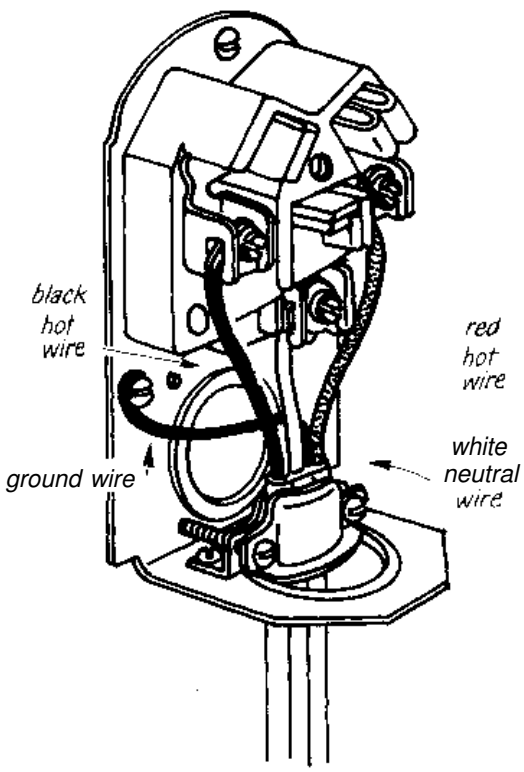
How to Wire Electric Dryers

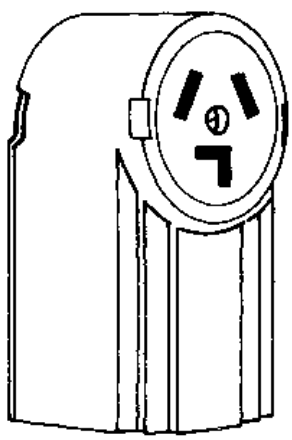




Recessed Dryer Recepticle

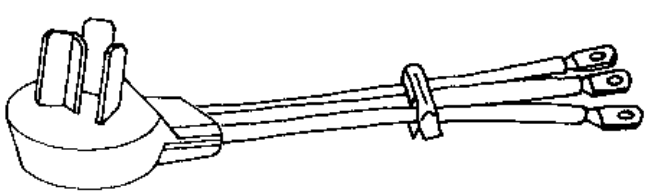
120/240-volt, 30-ampere, grounded. Designed especially for clothes driers, this large receptacle supplies 240 volts for the heating coils of the drier and 120 volts for such standard accessories as the timer and the pilot light.





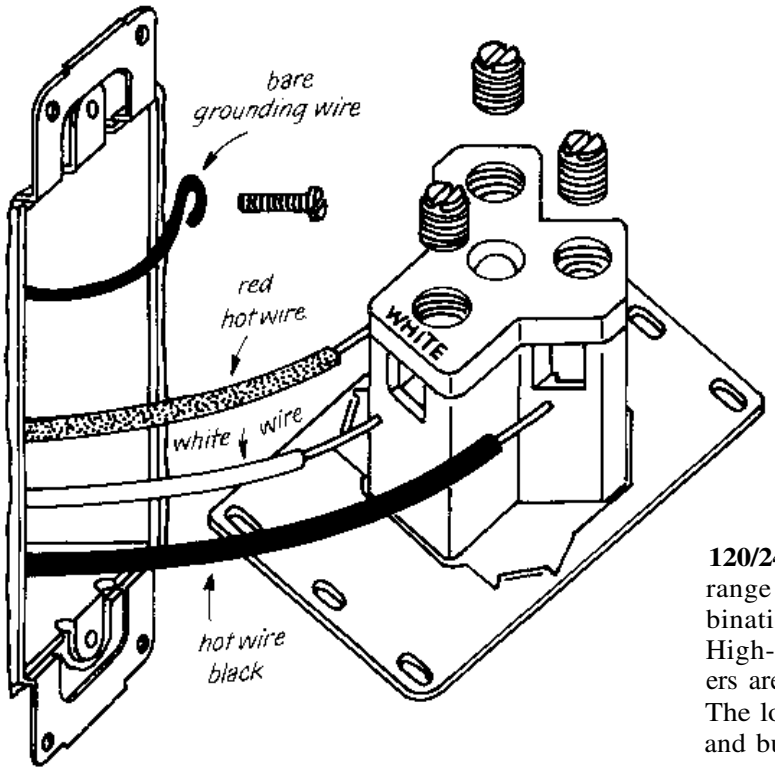
Surface Dryer Recepticle

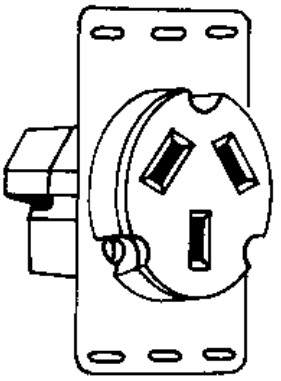
USE WIRE SIZE 10-3 WITH GROUND FOR ELECTRIC DRYERS.



Dryer Cord

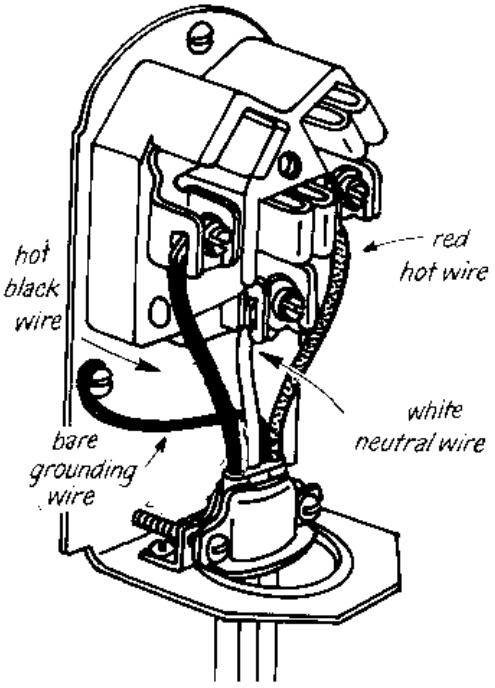
How to Wire Electric Range

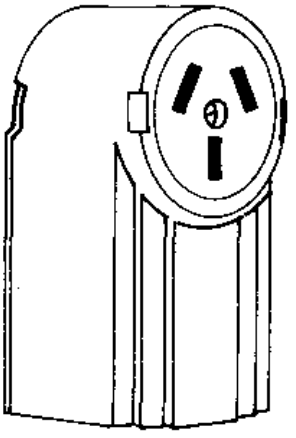




Recessed Range Recepticle

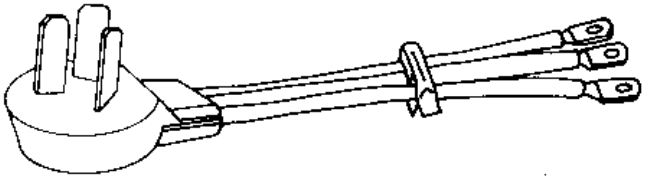
120/240-volt, 50-ampere, grounded. An electric range requires the high amperage and the combination of voltages provided by this receptacle. High-temperature settings of the oven and burners are connected to the 240-volt circuit.
The low temperature settings, timer, pilot lights and built-in receptacles operate on 120 volts.





Surface Range Recepticle

USE WIRE SIZE 6-3 WITH GROUND FOR ELECTRIC RANGES.



Range Cord

r

Watts Used by Different Electrical Items

Approximate Ratings		Approximate Ratings	
Air conditioner (central)	**5000**	Power tools	
(room, 1/3 ton)	800	Drill, 1/4 inch	150
(room, 3/4 ton)	**1300**	3/8 inch	250
(room, 1 ton)	**1600**	1/2 inch	350
Blender	**250-1000**	Grinder	200
Bottle warmer	400	Lather	300
Broiler	**1500**	Lawn Mower	300
Can opener	150	Sander, portable	750
Clock	2	Saw, bander	250
Coffee maker	**500-1000**	bench	**300-600**
Corn popper	500	jig	250
Dishwasher	**1000-1500**	radial arm	**1500**
Dryer	**4000-8000**	sabre	200
Electric blanket	200	Soldering iron	150
Fan (attic)	400	Projector (slide or movie)	350
(exhaust for range)	250	Radio, console	150
(portable)	100	portable	50
Floor polisher	350	Range, oven	**4000-8000**
Food warmer	500	top	**4000-8000**
Freezer, frostless	**350-500**	Refrigerator, frostless	**300-450**
standard	**250-400**	standard	**250-350**
Fryer, deep fat	**1400**	Roaster	**1350**
Frying pan, automatic	**1100**	Rotisserie	**1400**
Furnace, coal	400	Sewing machine	75
gas	150	Shaver	10
oil	750	Stereo, hi-fi	300
Garbage disposer	**400-900**	Sump pump	300
Grill	**1000**	Television, black and white	250
Hair Dryer	260	color	300
Heater (hot water)	**2000-5000**	Toaster	1000
(room)	**1250**	Vacuum cleaner	**300-800**
Hot plate (per burner)	750	Waffle iron	900
Iron (hand)	**1050**	Washing machine	600
(mangle)	**1600**		
Knife sharpner			
Knife sharpner	100		
Lamp (heat)	250		
(sun)	400		
Lights (flourescent circlines)	**22-32**		
(flourescent tubes)	**15-60**		
(incandescent, per bulb)	10 & up		
(night light)	7		
Microwave oven	600		
Mixer	150		

How to Find the Cause of a Short Circuit

Most short circuits occur in flexible cords, plugs, or appliances. Look for black smudge marks on faceplates or frayed or charred cords connected to dead circuit. Simply replace damaged cord or plug before installing new fuse or resetting breaker.

If you find no visible signs of trouble, though, you'll have to trace your way through circuit. To do this, turn off all wall switches and unplug every appliance on dead circuit. Then install new fuse or reset tripped breaker.

If fuse blows right away, pull out fuse or make sure circuit breaker is OFF. Remove each faceplate and inspect device and wiring. Look for charred wire insulation, wire shorted against back of metal box, or device literally falling apart. Replace defective switch or receptacle or faulty wiring. Then install new fuse or reset breaker.

If new fuse doesn't blow or breaker doesn't trip right away, turn on each wall switch, one by one, until fuse blows or circuit breaker trips.

When turning on wall switch causes fuse to blow or breaker to trip, short is in fixture outlet controlled by switch or in ON position of switch. With circuit dead, inspect outlet and switch for charred wire insulation and faulty connections. Replace faulty fixture or switch. Then install new fuse or reset breaker.

If turning on wall switches doesn't blow fuse or trip breaker, trouble is in appliance. Plug in and turn on appliances one by one. When fuse blows or breaker trips again, you'll know you've found offending appliance. Then install new fuse or reset breaker.

If circuit went dead as soon as you turned appliance on, appliance or its switch is probably defective and should be replaced or repaired.

If circuit went dead as soon as you plugged appliance in, plug or cord is probably at fault and should be replaced.

Note: If none of the above solves the problem and your fuse or breaker still blows or trips, your wiring is at fault. Call an electrician.

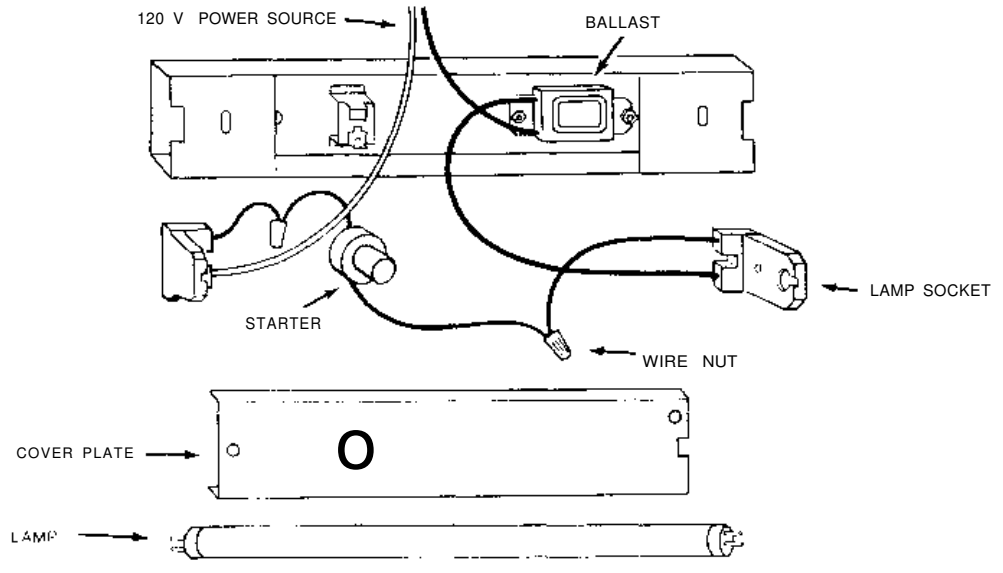
Important

ALWAYS SHUT OFF POWER TO THE CIRCUIT YOU WILL BE WORKING ON, OR THE ENTIRE HOUSE IF YOU ARE NOT SURE WHICH FUSE OR BREAKER CONTROLS THE CIRCUIT. DOUBLE CHECK WITH A TESTING DEVICE TO BE ABSOLUTELY SURE THE CIRCUIT IS DEAD.

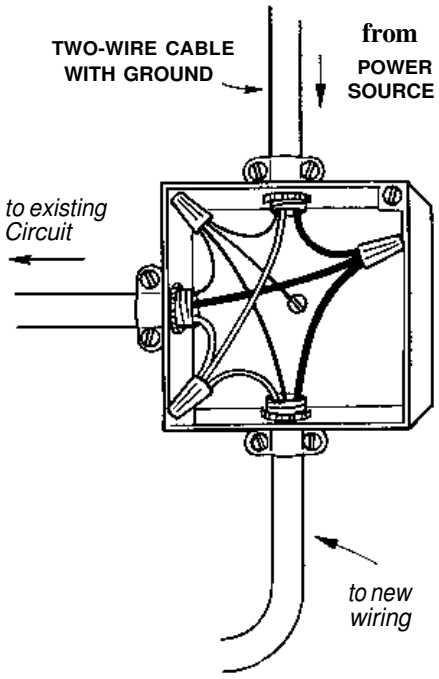
Color of Wire	Color of Screw	Hot - Neutral or Grounding Wire
White	Silver or White	Neutral Wire
Black	Brass	Hot Wire
Red	Brass	Hot Wire
Green	Green	Grounding Wire
Bare Wire	Electrical Box Ground	Grounding Wire

How to Fix Fluorescent Light Fixtures

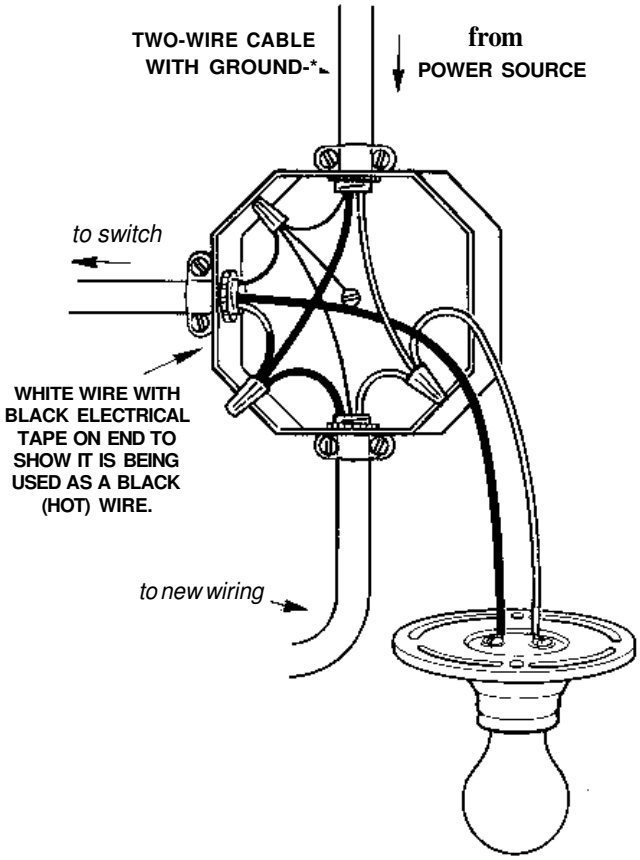
SYMPTOM	CAUSE	CURE
Lamp won't light	Tube burned out (blackened ends)	Replace tube
	Improper installation	Take out and install again
	Fuse blown or circuit breaker tripped	Replace or reset
	Starter burned out	Replace starter
	Dirty tube (rapid-start only)	Remove tube, wash, rinse, dry, and replace
	Tubeholder broken	Replace tubeholder
	Fixture too cold	Raise temperature to at least 50°F
	Oxide film buildup on tube pins	Rotate tube in tubeholders once or twice
Lamp flickers (Note: New tubes may flicker a short time after installation.)	Poor contact with tubeholders	Realign tubeholders; straighten and sand tubeholders if necessary
	Improper installation	Take out and install again
	Tube nearly worn out (blackened ends)	Replace tube
	Oxide buildup on tube pins	Rotate tube in tubeholders once or twice
	Fixture, too cold	Raise temperature to at least 50°F
Ends of tube are discolored (Note: Darkened bands about 2 inches from ends are normal.)	Tube almost worn out	Replace tube
If preheat type with new tubes	Defective starter	Replace starter
Discolored on one end only	Temperamental tube	Remove tube; turn end for end
Ends of tube glow, but center doesn't	Defective starter	Replace starter
	Defective ballast	Replace ballast
Lamp fixture hums	Ballast incorrectly installed	Check wiring on ballast diagram and correct
	Wrong type of ballast	Check wattage and type; replace ballast
	Defective ballast	Replace ballast



How To Wire into Boxes, Fixtures and Switches

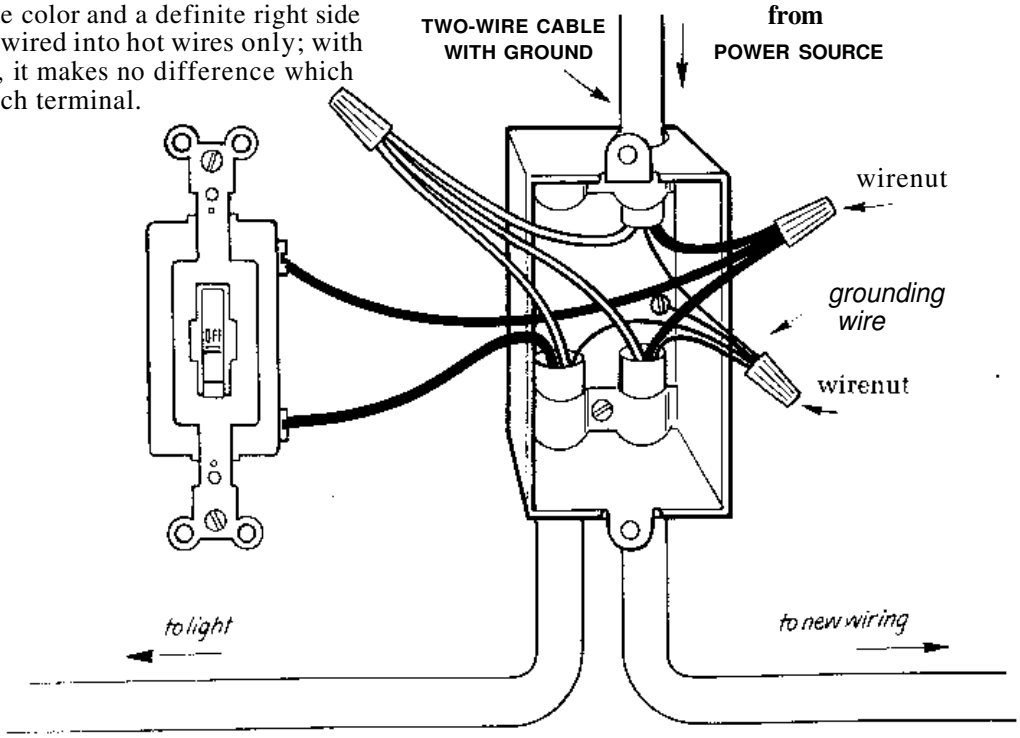


HOW TO WIRE INTO A JUNCTION BOX



HOW TO WIRE INTO A FIXTURE

Most switches in a home are of the single-pole or three-way types. Single-pole switches have two terminals of the same color and a definite right side up. All switches are wired into hot wires only; with a single-pole switch, it makes no difference which hot wire goes to which terminal.



Color Coding of Wires, Screw Terminals, Etc.

Chart Shows Color Coding of Wires and Terminal Screws For Switches, Outlets, Light Fixtures		
Color of Wire	**Color of Terminal Screw**	**Hot - Neutral or Grounding Wire**
White	Silver or White	Neutral Wire
Black	Brass	Hot Wire
Red	Brass	Hot Wire
Green	Green	Grounding Wire
Bare Wire	Electrical Box Ground	Grounding Wire

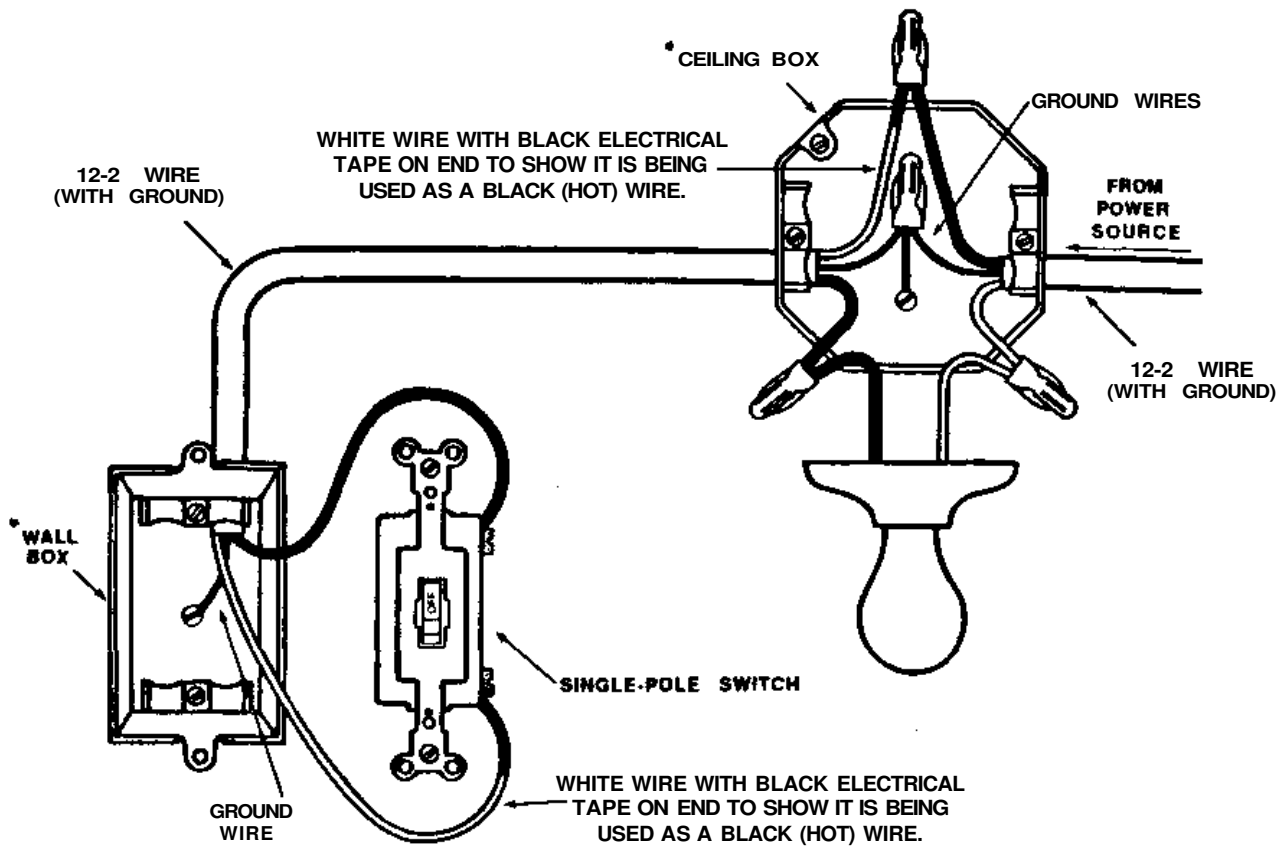
COLOR CODING OF WIRE — WITH ONE EXCEPTION

Up to this point we have assumed that a white wire is always a neutral wire. Wires that are black and red are always hot. But one situation offers an exception to this color coding.

The one exception to the rule is if the power source first goes thru the light fixture and then to the switch, you have to use a white wire as a hot black wire.

When using a white wire this special way, paint the wire insulation black (or tape it with black tape) at both ends where it joins a hot terminal or another hot wire. This identifies it as a hot wire. A example of this is shown in the picture below.

The Picture below is called a Switch Loop.

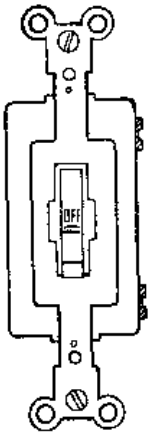


Electrical Symbols and a Wiring Layout

STANDARD ELECTRICAL SYMBOLS

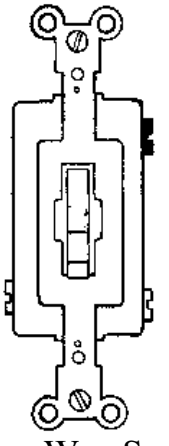
CEILING OUTLET	CEILING FAN	PUSH BUHON
WALL OUTLET	WALL FAN	DOORBELL
CEILING LIGHTING OUTLET	CEILING JUNCTION BOX	DOOR BUZZER
DUPLEX CONVENIENCE OUTLET	WALL JUNCTION BOX	RADIO OUTLET
SWITCH - CONVENIENCE OUTLET	CEILING PULL SWITCH	TELEVISION
WEATHERPROOF OUTLET	CLOCK OUTLET	SINGLE POLE" SWITCH
ELECTRIC RANGE	THERMOSTAT	DOUBLE-POLE SWITCH
ELECTRIC DRYER	GENERATOR	THREE-WAY SWITCH
230-VOLT POLARIZED OUTLET	ELECTRIC MOTOR	FOUR-WAY SWITCH
SPECIAL PURPOSE OUTLET	NIGHT LIGHT	WEATHERPROOF SWITCH

All About Switches



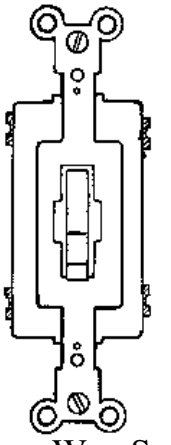
A Single Pole Switch

A single-pole switch controls a light or receptacle from one location. It has two brass-colored terminals and "on" and "off" markings on the handle.



A Three Way Switch

Three-way switches, used in pairs to control a light or receptacle from two locations, have three terminals; one black or copper-colored and two brass or silver-colored. There are no "on" and "off" markings.

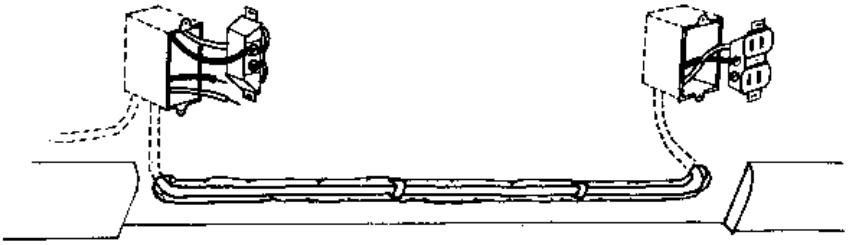


A Four Way Switch

A four-way switch works with three- way switches to control a light or receptacle from three or more locations. It has four brass-colored terminals and no "on" and "off" markings.

- Switches Should Be 48" High from Floor.
- Switches Should Always Be Put on Same Side of Door that the Door Knob Is on.

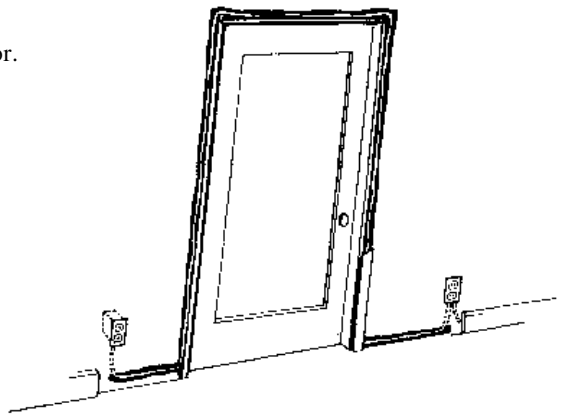
How to Add New Outlets to Existing Ones



THE PICTURE ABOVE SHOWS HOW TO ADD A NEW OUTLET TO AN EXISTING ONE BY RUNNING THE WIRE BEHIND THE BASEBOARD. USE 12-2 WIRE WITH GROUND, USE GROUNDED OUTLETS, BE SURE YOU DONT OVERLOAD THE CIRCUIT, COVER WIRE WITH A METAL PLATE OR USE METAL CABLE TO PROTECT WIRE. CHECK WITH LOCAL CODE TO SEE IF THIS WIRING ARRANGEMENT IS PERMITTED IN YOUR AREA.

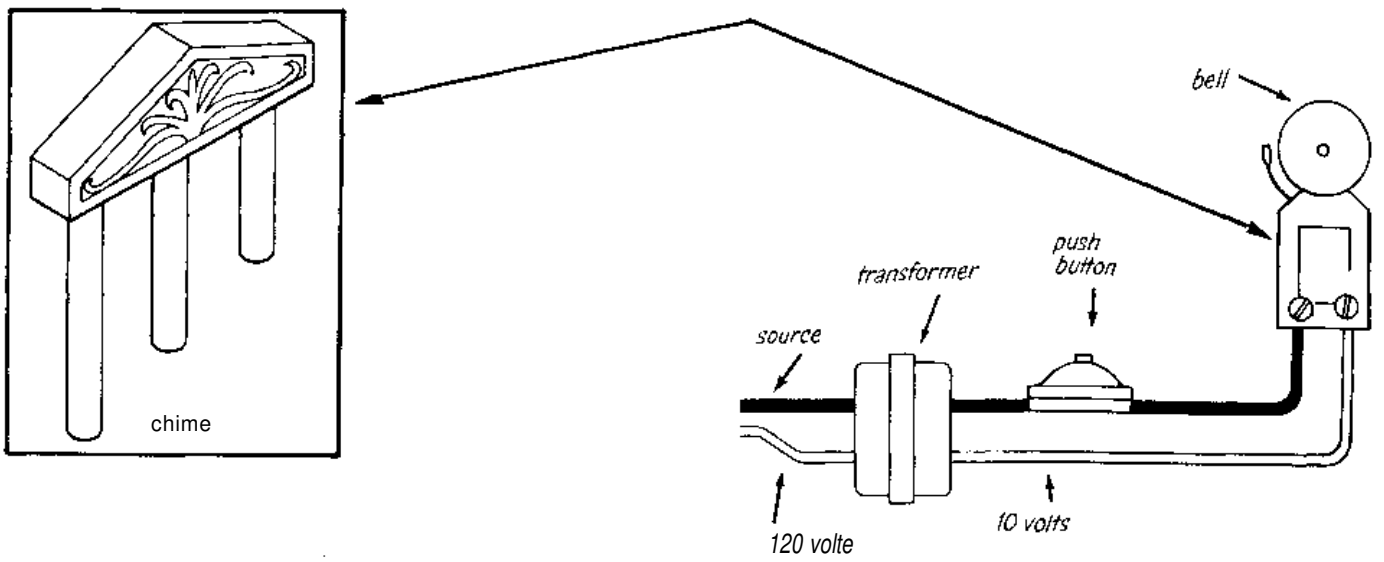
Step 1. Remove molding around door *frame* and as much baseboard as necessary on either side of door.

Step 2. Run cable between jamb and frame, notching spacers wherever necessary.

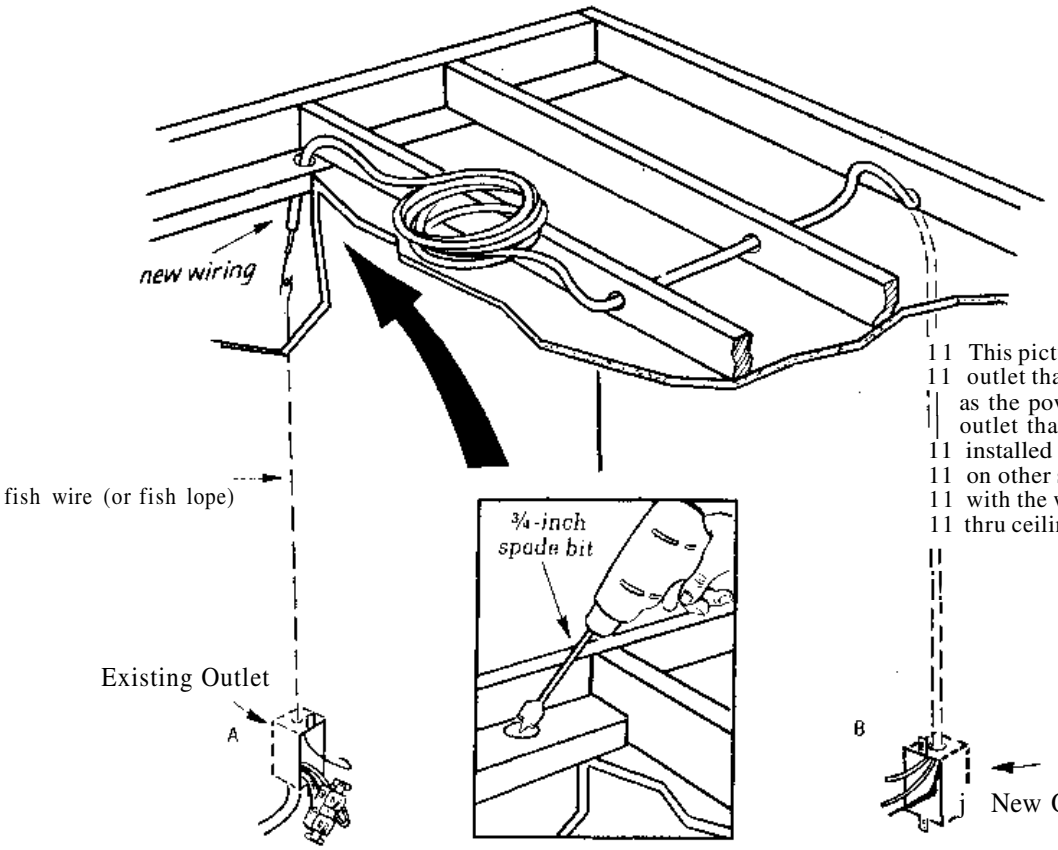


THE PICTURE ABOVE SHOWS HOWTOADDANEWOUTLETTO AN EXISTINGONEBYRUNNINGTHE WIRE BEHINDTHEDOOR CASING. USE **12-2** WIRE WITH GROUND, USE GROUNDED OUTLETS, BE SURE YOU DONTOVERLOAD THE CIRCUIT, COVER WIRE WITH A METAL PLATE OR USE METAL CABLE TO PROTECT WIRE. CHECK WITH LOCAL CODE TO SEE IF THIS WIRING ARRANGEMENT IS PERMITTED IN YOUR AREA.

How To Wire Doorbells and Buzzers



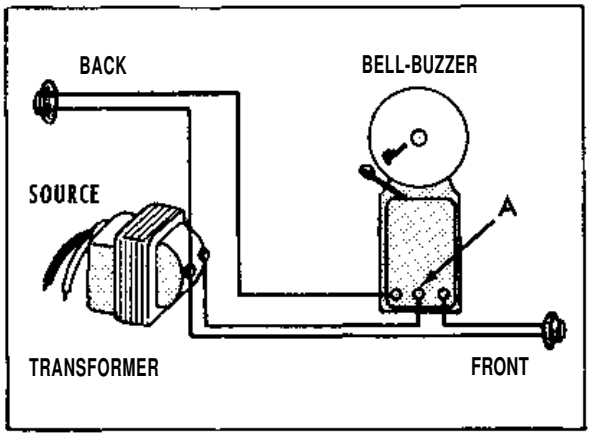
How to Add New Outlets to Existing Ones



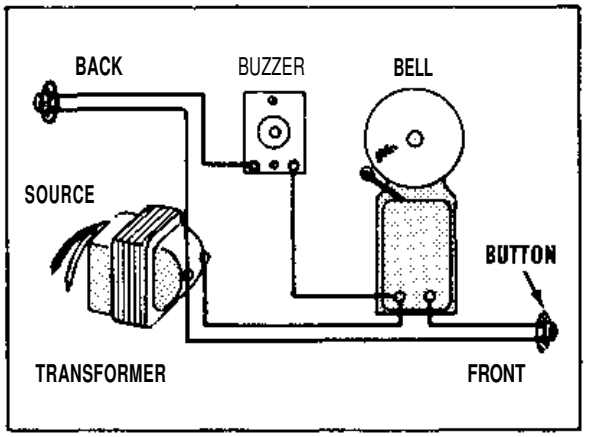
This picture shows an existing outlet that is being used as the power source *for* the new outlet that is being installed in the wall on other side *of* room with the wire going thru ceiling joist.

USE 12-2 WIRE WITH GROUND, USE GROUNDED OUTLETS, BE SURE YOU DON'T OVERLOAD THE CIRCUIT. CHECK WITH LOCAL CODE TO SEE IF THIS WIRING ARRANGEMENT IS PERMITTED IN YOUR AREA.

How To Wire Doorbells and Buzzers



Wiring for a front doorbell and a back-door buzzer.

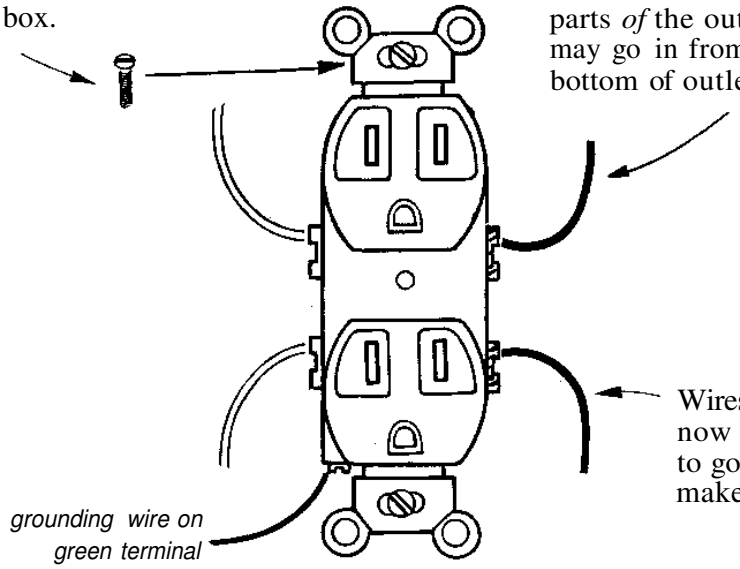


Wiring for a combination bell-buzzer unit.

All About Outlets

A 6/32 threaded screw holds the outlets to the wall box.

These wires going to top part *of* outlet make both the top and bottom parts *of* the outlet live. Wire may go in from top or bottom of outlet to do this.

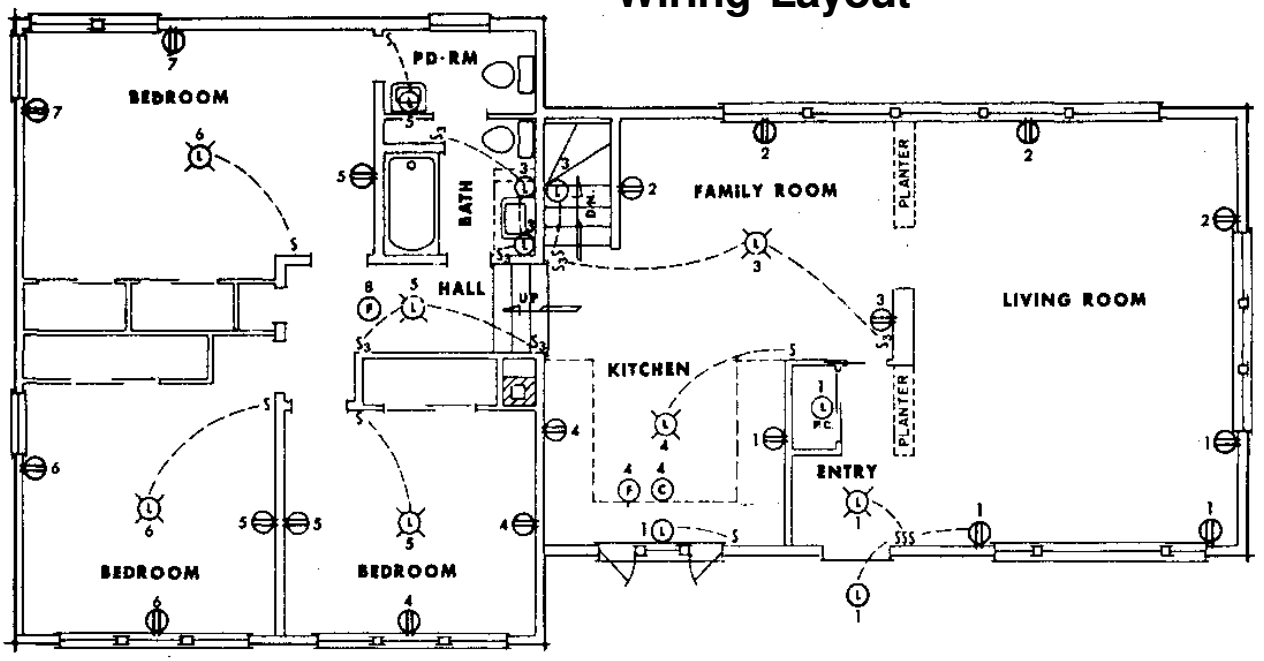


Wires coming out *of* outlet are now live and can be used to go to next outlets to make them live.

grounding wire on green terminal

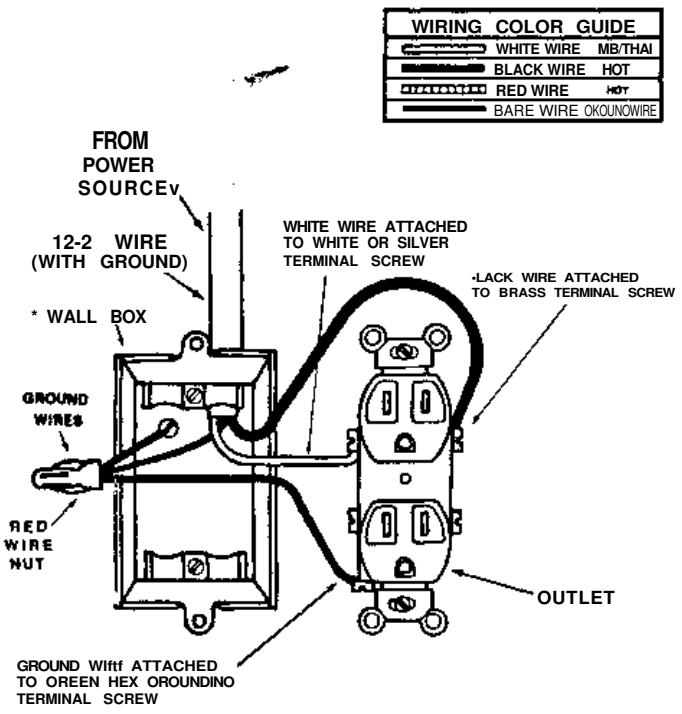
Outlets, also called receptacles, have three different colors of screw terminals. The brass-colored screws are hot terminals and here use the black wire. The white or silver-colored screws are neutral terminals, and here use the white wire. The green screw is the grounding terminal, and here use the bare wire for the grounding wire.

Wiring Layout



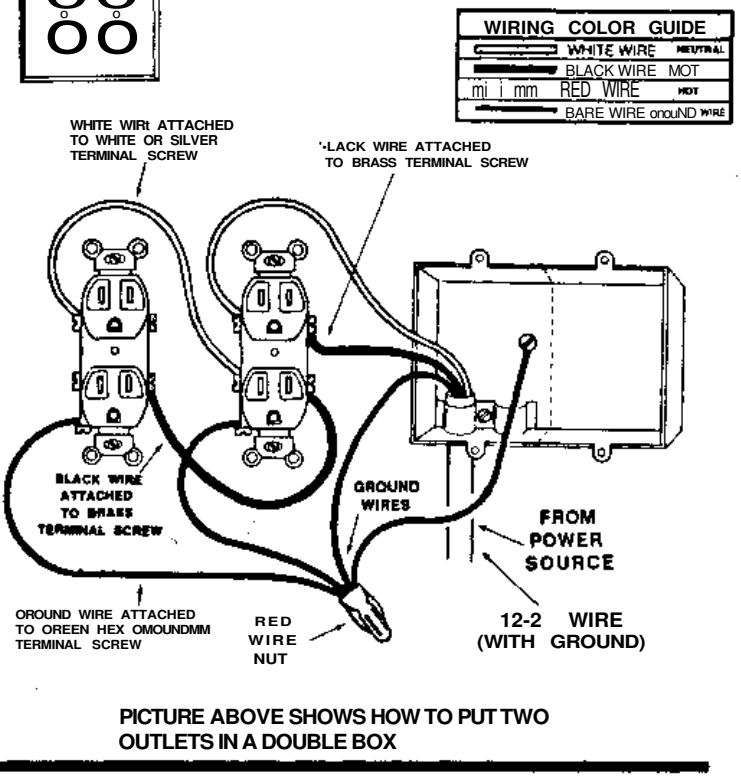
How to Wire Outlets

WIRING ONE OUTLET



How to Wire Outlets

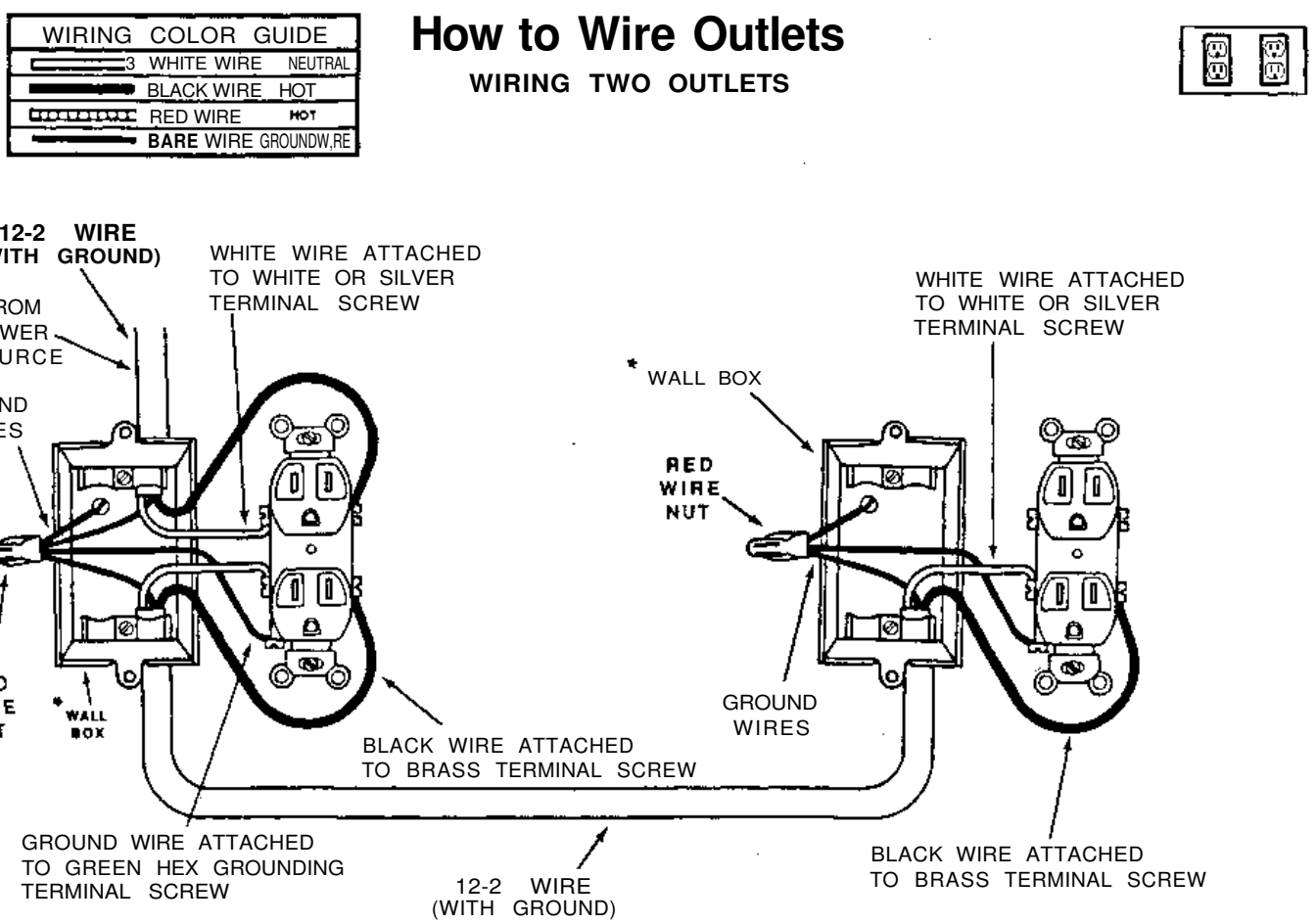
WIRING TWO OUTLETS



PICTURE ABOVE SHOWS HOW TO PUT TWO OUTLETS IN A DOUBLE BOX

How to Wire Outlets

WIRING TWO OUTLETS



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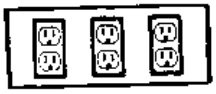


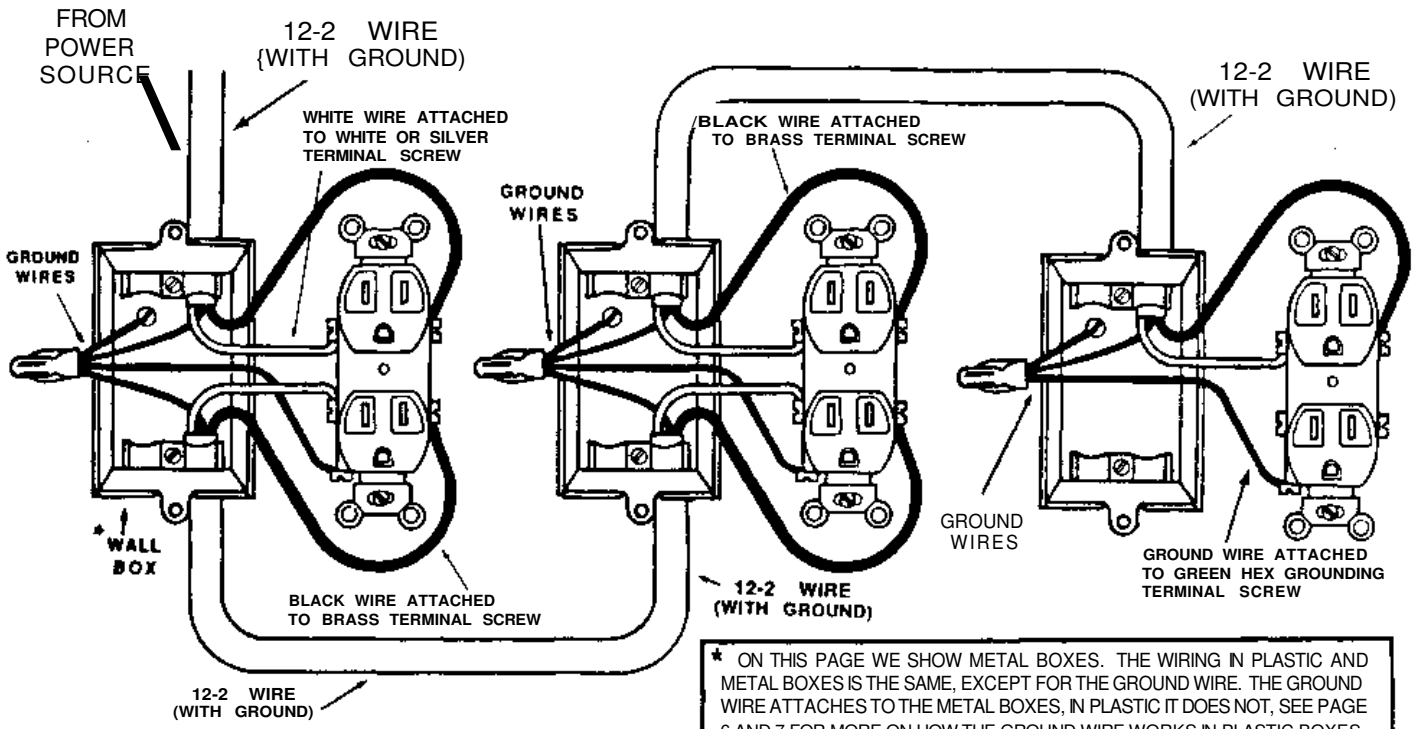
WIRING COLOR GUIDE
WHITE WIRE HBITIIM.
BLACK WIRE HOT
111T1111mREDWIRE HOT
BARE WIRE CHOUNDWIRE

How to Wire Outlets

WIRING THREE OUTLETS

WIRE NUT GUIDE

A WIRE NUT — USE RED WIRE NUTS WHERE WIRE NUTS ARE USED ON THIS PAGE INCLUDING GROUND WIRES



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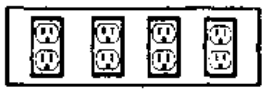


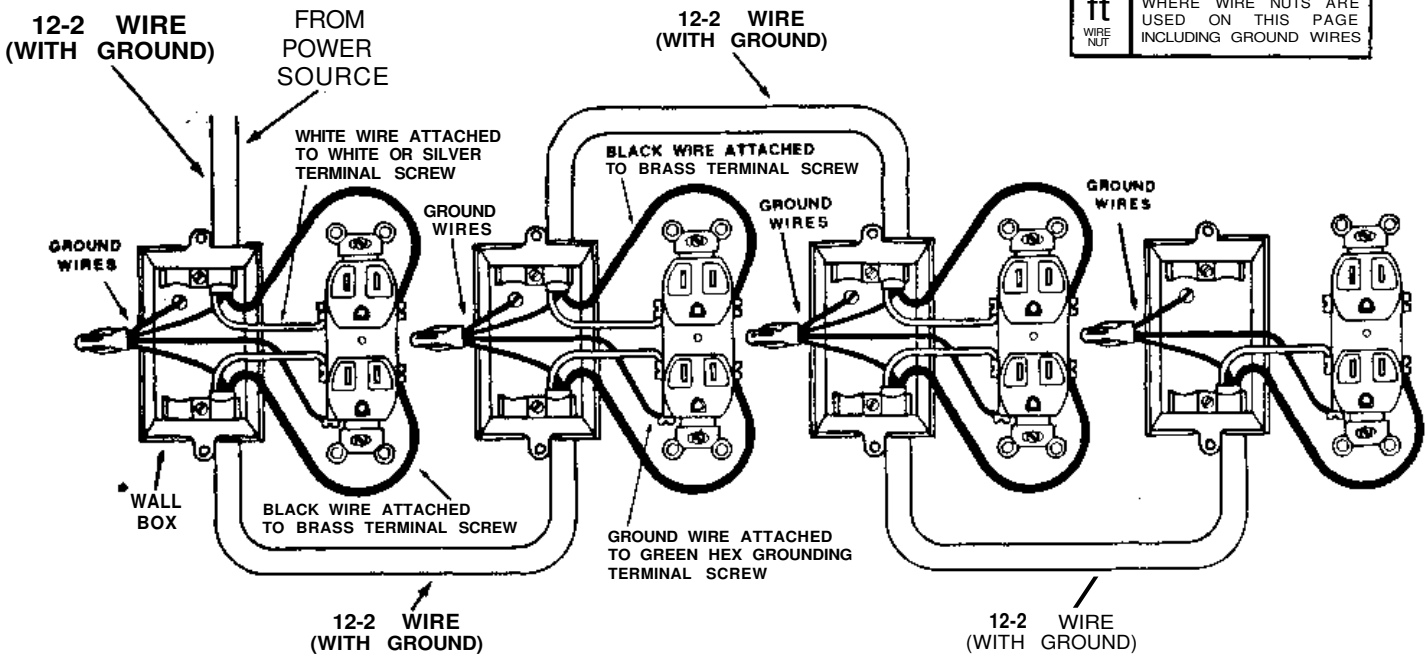
How to Wire Outlets

WIRING FOUR OUTLETS

WIRING COLOR GUIDE
WHITE WIRE MSUTHAL
BLACK WIRE HOT
RED WIRE HOT
BARE WIRE GROUND WIRE

WIRE NUT GUIDE

ft WIRE NUT — USE RED WIRE NUTS WHERE WIRE NUTS ARE USED ON THIS PAGE INCLUDING GROUND WIRES



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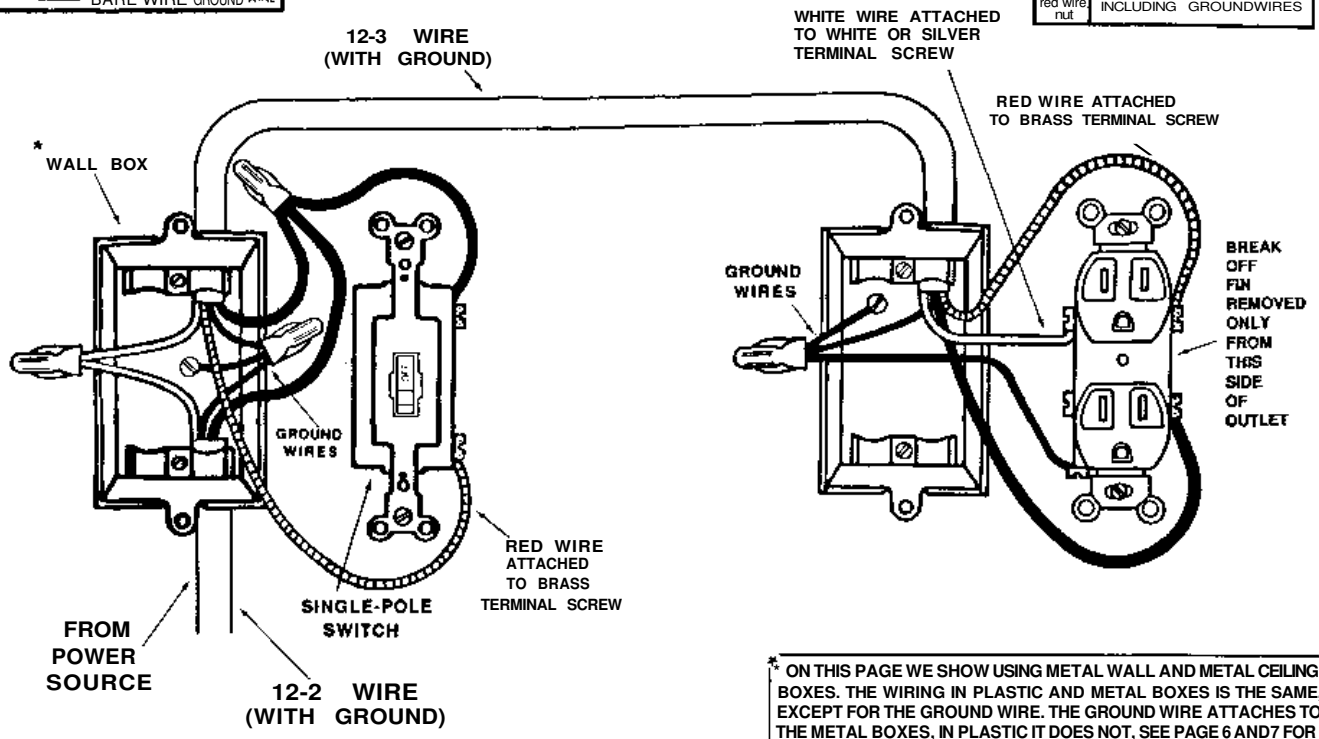
How to wire a split-circuit outlet

WIRING COLOR GUIDE	
WHITE WIRE	NEUTRAL
BLACK WIRE	MOT
RED WIRE	HOT
BARE WIRE	GROUND WIRE

THE SWITCH CONTROLS THE TOP HALF OF THE OUTLET
THE BOTTOM HALF OF OUTLET IS ALWAYS HOT

WIRE NUT GUIDE	
§ red wire nut	USE RED WIRE NUTS WHERE WIRE NUTS ARE USED ON THIS PAGE INCLUDING GROUNDWIRES



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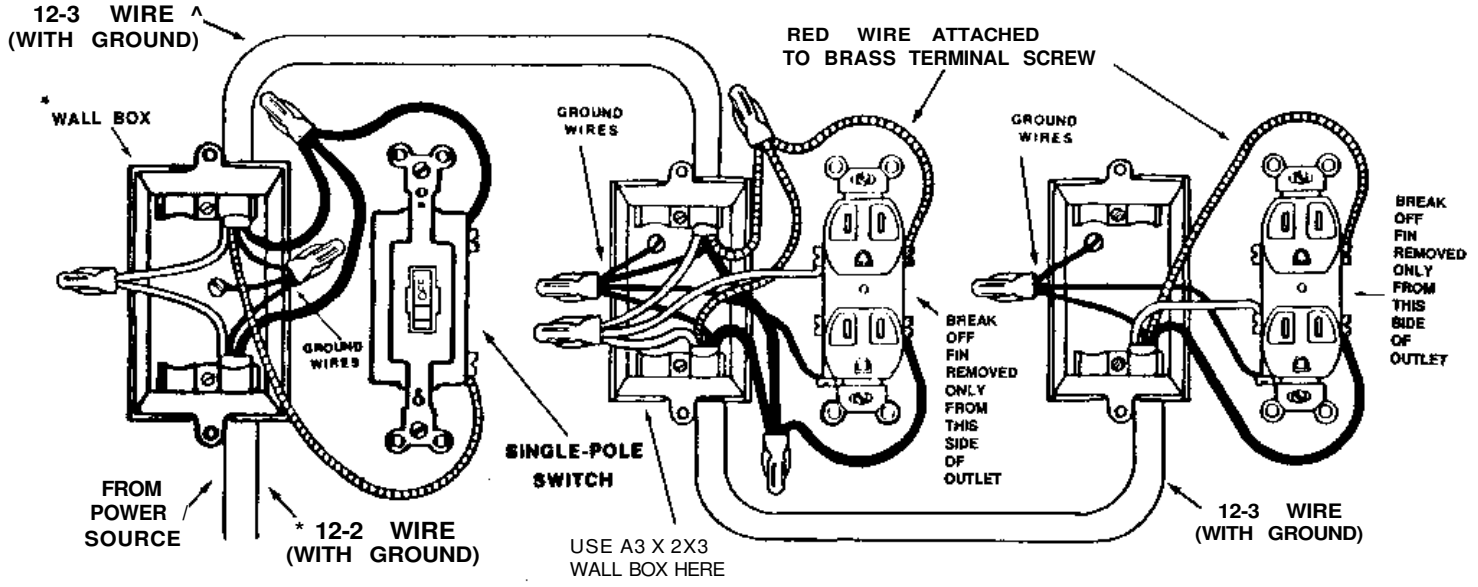
WIRING COLOR GUIDE	
WHITE WIRE	NEUTRAL
BLACK WIRE	HOT
RED WIRE	HOT
BARE WIRE	GKOUNDWIHE

How to wire split-circuit outlets

THE SWITCH CONTROLS THE TOP HALF OF THE OUTLET S
THE BOTTOM HALF OF OUTLETS IS ALWAYS HOT.

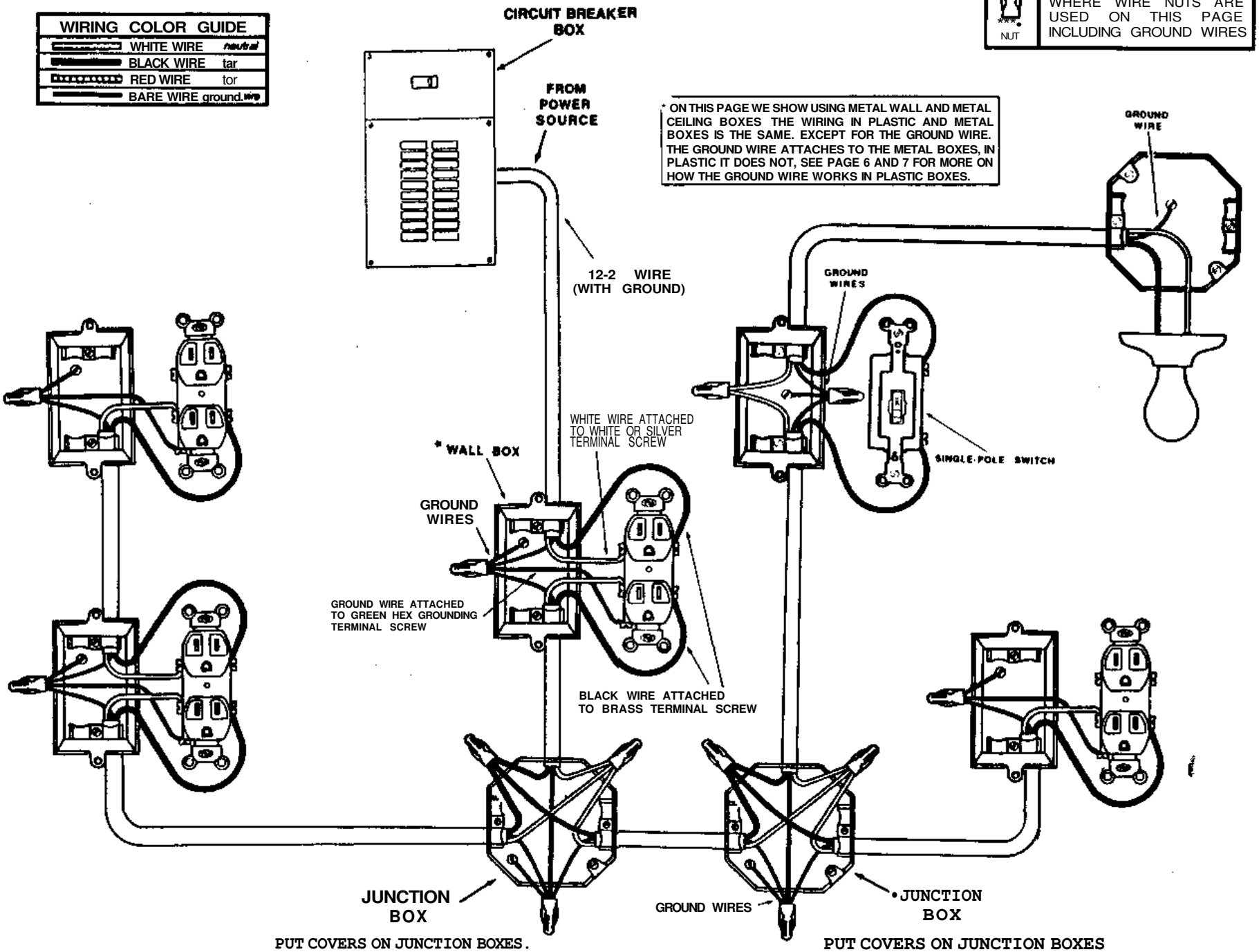


* THE WIRING IN PLASTIC AND METAL **BOXES** IS THE SAME. EXCEPT FOR THE GROUND WIRE, THE GROUND WIRE ATTACHES TO THE METAL BOXES, IN PLASTIC IT CONNECTS TO THE METAL TAB PROVIDED INSIDE THE BOX. SEE PAGE 647 FOR MORE ON HOW THE GROUND WIRE WORKS IN PLASTIC BOXES.

THE PICTURE BELOW SHOWS HOW THE POWER SUPPLY FROM THE BREAKER BOX GOES TO TWO DIFFERENT JUNCTION BOXES, AND GOES IN TWO DIFFERENT DIRECTIONS.

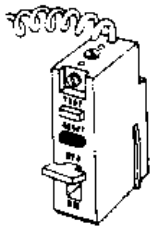
WIRING COLOR GUIDE	
WHITE WIRE	neutral
BLACK WIRE	tar
RED WIRE	tor
BARE WIRE	ground wire

WIRE NUT GUIDE	
NUT	USE RED WIRE NUTS WHERE WIRE NUTS ARE USED ON THIS PAGE INCLUDING GROUND WIRES



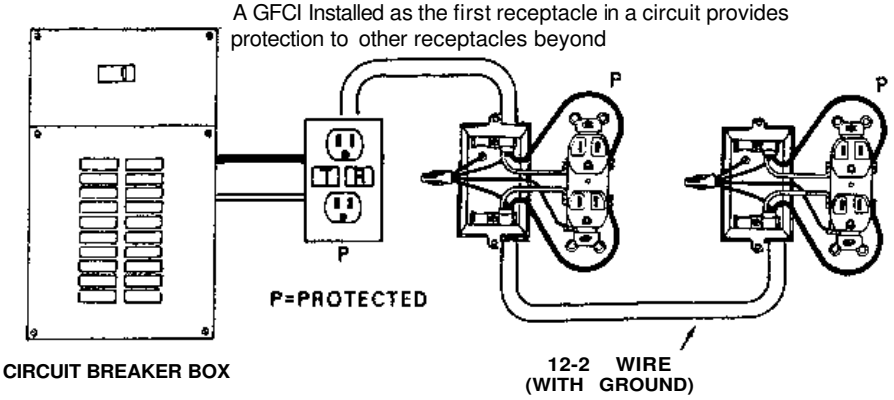
ALL ABOUT GROUND FAULT CIRCUIT INTERRUPTERS (GFCI)

GROUND FAULT PROTECTION IS A MUST WHEREVER ELECTRICITY IS USED NEAR WATER



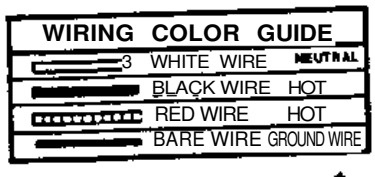
Circuit Breaker
Type GFCI

A GFCI Installed as the first receptacle in a circuit provides protection to other receptacles beyond

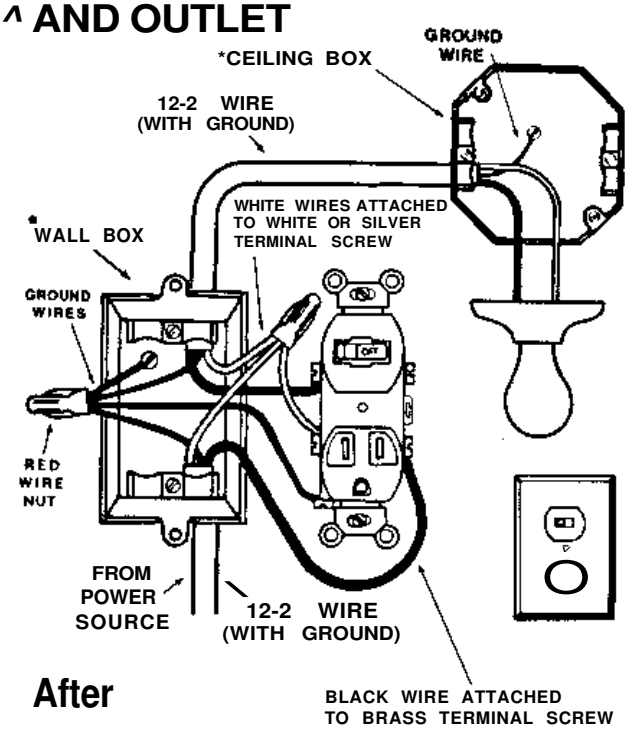


1. **THE GFCI'S TURN OFF POWER IN 1/40 OF A SECOND TO PROTECT PEOPLE FROM SHOCK HAZARDS.**
2. **THE ELECTRICAL CODE REQUIRES GFCI PROTECTION IN AND AROUND THE HOME.CHECK WITH ELECTRICAL INSPECTORS FOR MORE ON THIS.**
3. **THE MOST USED GFCI'S ARE THE CIRCUIT BREAKER AND THE OUTLET TYPE.**

HOW TO CHANGE A SINGLE POLE SWITCH TO A SWITCH AND OUTLET



Before



After

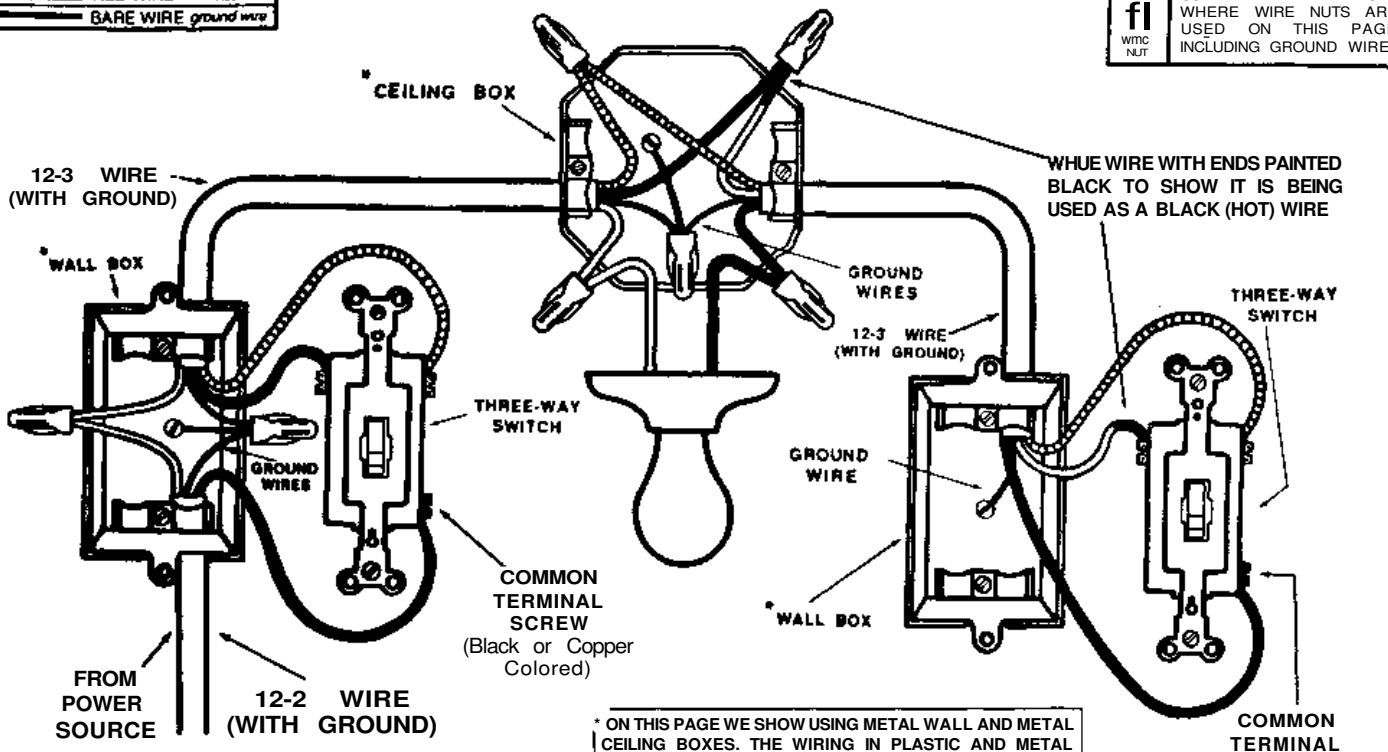
COMBINES A SINGLE-POLE SWITCH WITH AN OUTLET THAT IS ALWAYS HOT

How To Wire Three-Way Switches

With Switches Controlling One Light

WIRING COLOR GUIDE	
WHITE WIRE	neutral
BLACK WIRE	hot
RED WIRE	hot
BARE WIRE	ground wire

WIRE NUT GUIDE	
fl WIRE NUT	USE RED WERE NUTS WHERE WIRE NUTS ARE USED ON THIS PAGE INCLUDING GROUND WIRES



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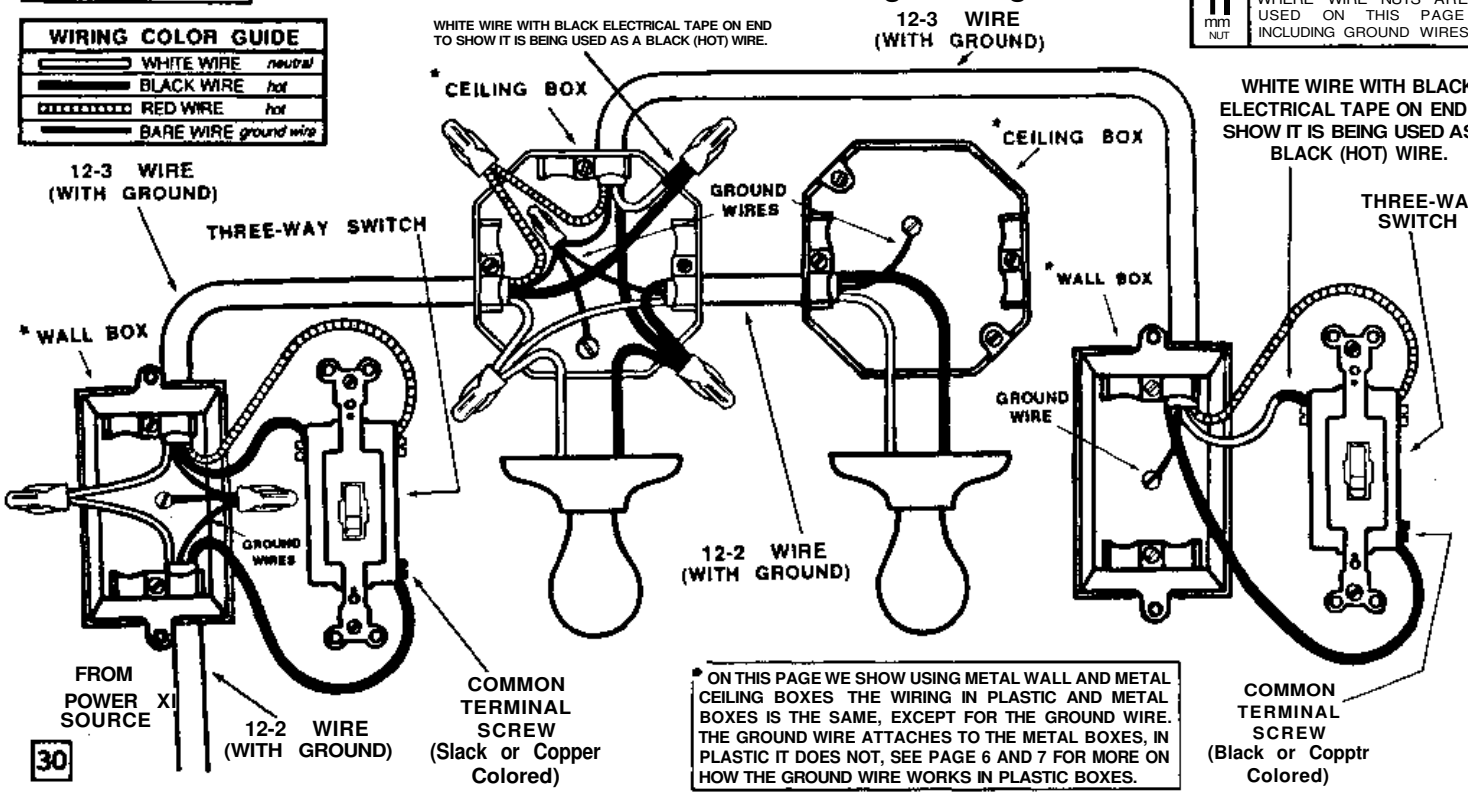
How to Wire Three-Way Switches

With Switches Controlling Two Lights

WIRING COLOR GUIDE	
WHITE WIRE	neutral
BLACK WIRE	hot
RED WIRE	hot
BARE WIRE	ground wire

WIRE NUT GUIDE	
fl mm NUT	USE RED WIRE NUTS WHERE WIRE NUTS ARE USED ON THIS PAGE INCLUDING GROUND WIRES



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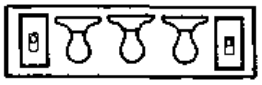
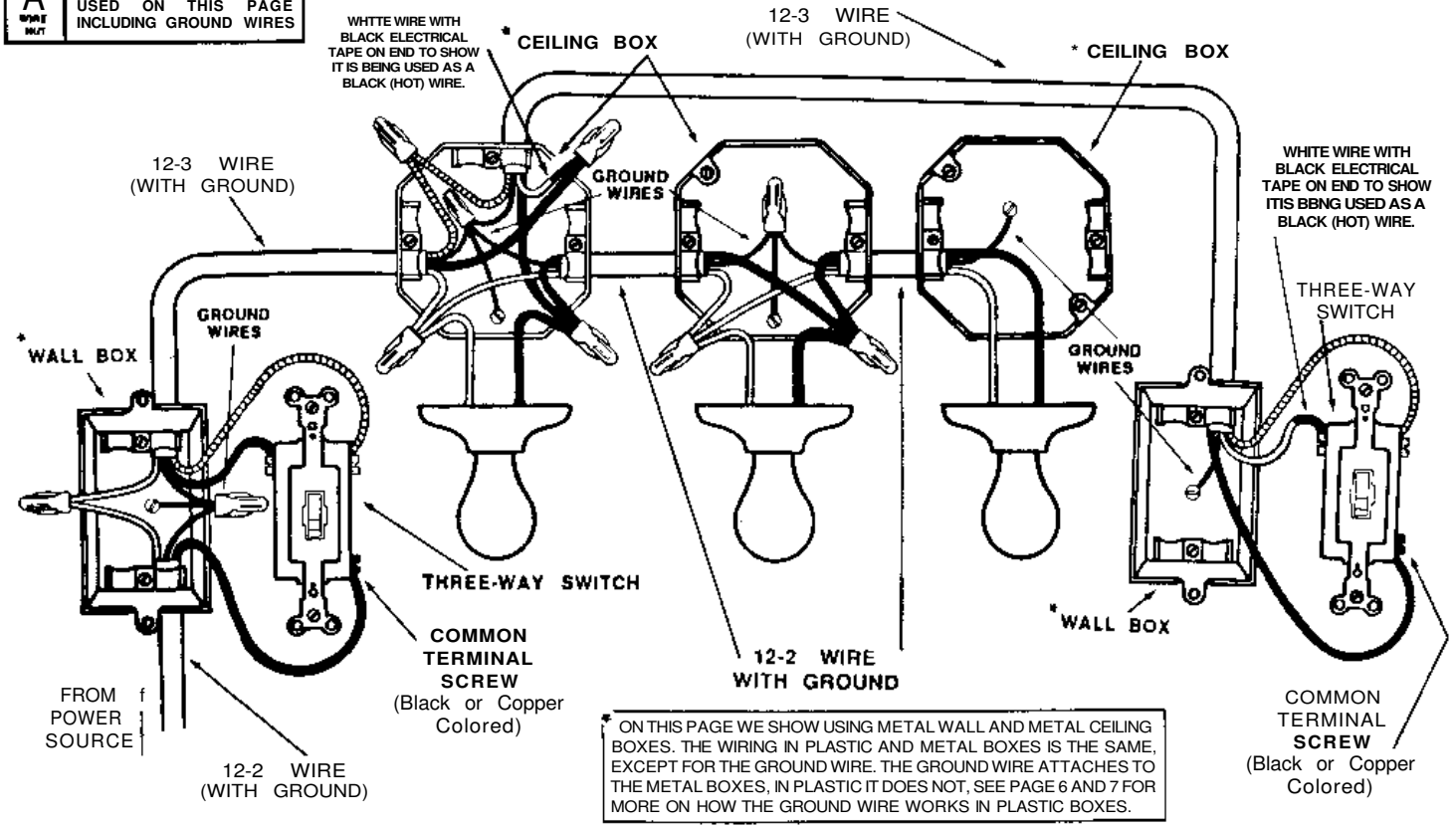
WIRING COLOR GUIDE	
WHITE WIRE	NEUTRAL
BLACK WIRE	HOT
RED WIRE	HOT
BARE WIRE	GROUND WIRE

WIRE NUT GUIDE	
A WIRE NUT	USE RED WIRE NUTS WHERE WIRE NUTS ARE USED ON THIS PAGE INCLUDING GROUND WIRES

How to Wire Three-Way Switches

With Switches Controlling Three Lights





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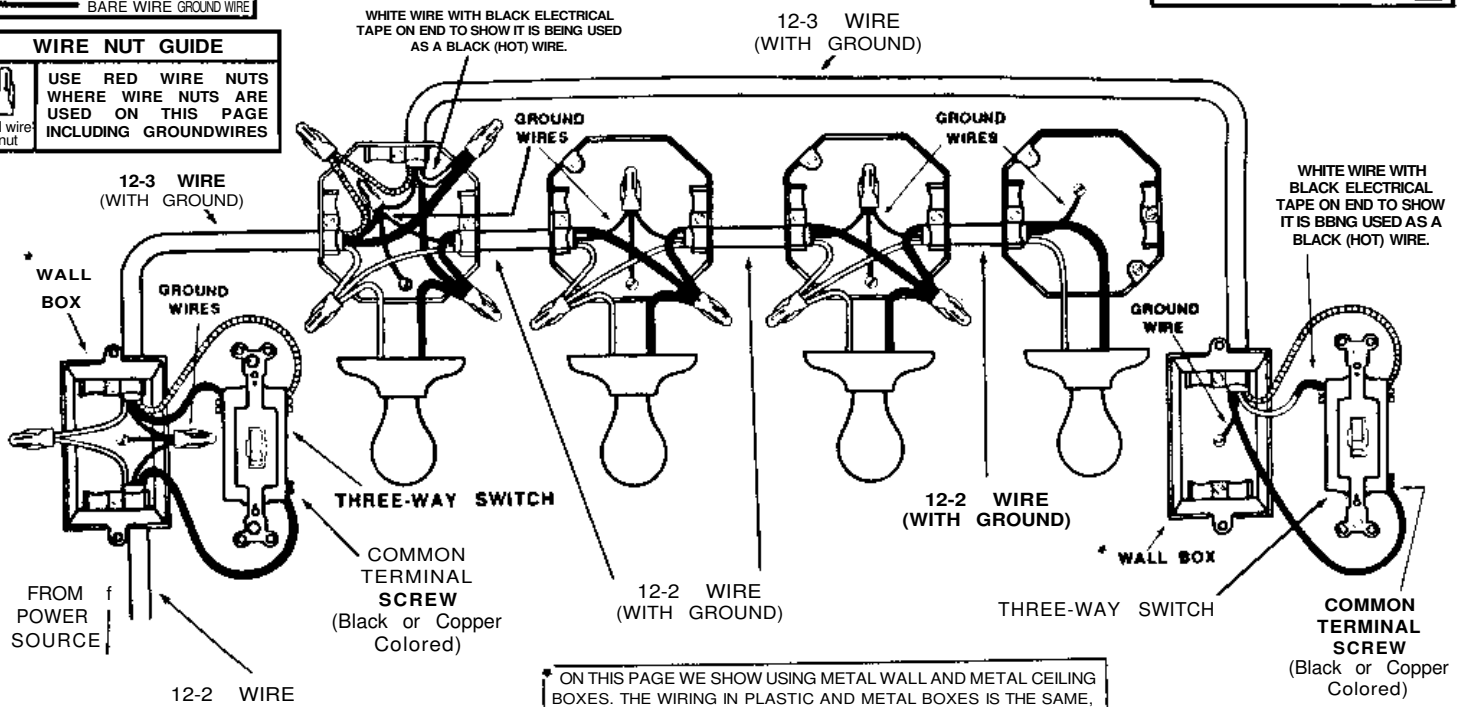
WIRING COLOR GUIDE	
WHITE WIRE	NEUTRAL
BLACK WIRE	HOT
RED WIRE	HOT
BARE WIRE	GROUND WIRE

WIRE NUT GUIDE	
red wire nut	USE RED WIRE NUTS WHERE WIRE NUTS ARE USED ON THIS PAGE INCLUDING GROUNDWIRES

How to Wire Three-Way Switches

With Switches Controlling Four Lights



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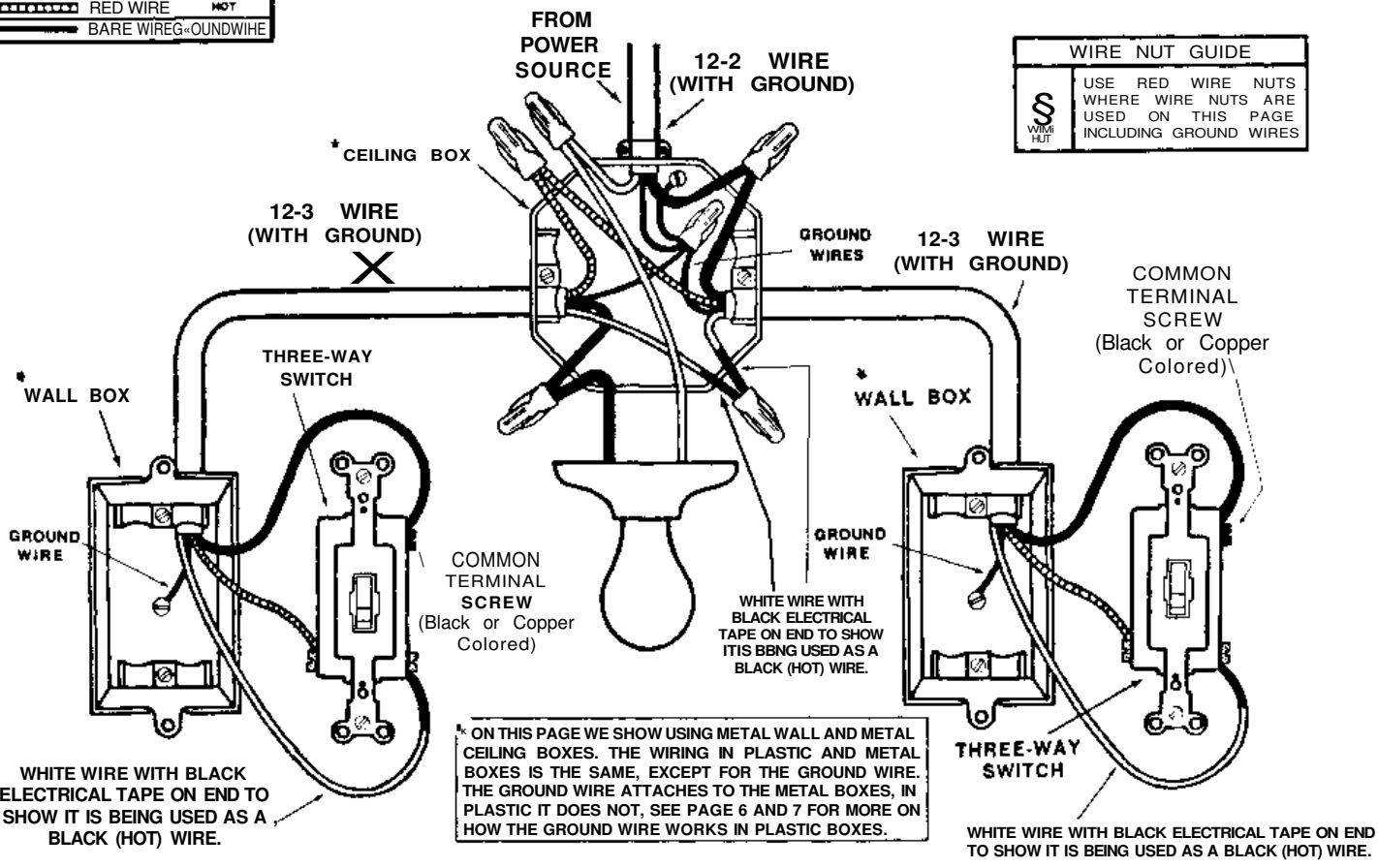
How To Wire Three-Way Switches

With Switches Controlling One Light

WIRING COLOR GUIDE
WHITE WIRE MEUTHAL
BLACK WIRE MOT
RED WIRE HOT
BARE WIREG«OUNDWIHE

WIRE NUT GUIDE
USE RED WIRE NUTS WHERE WIRE NUTS ARE USED ON THIS PAGE INCLUDING GROUND WIRES



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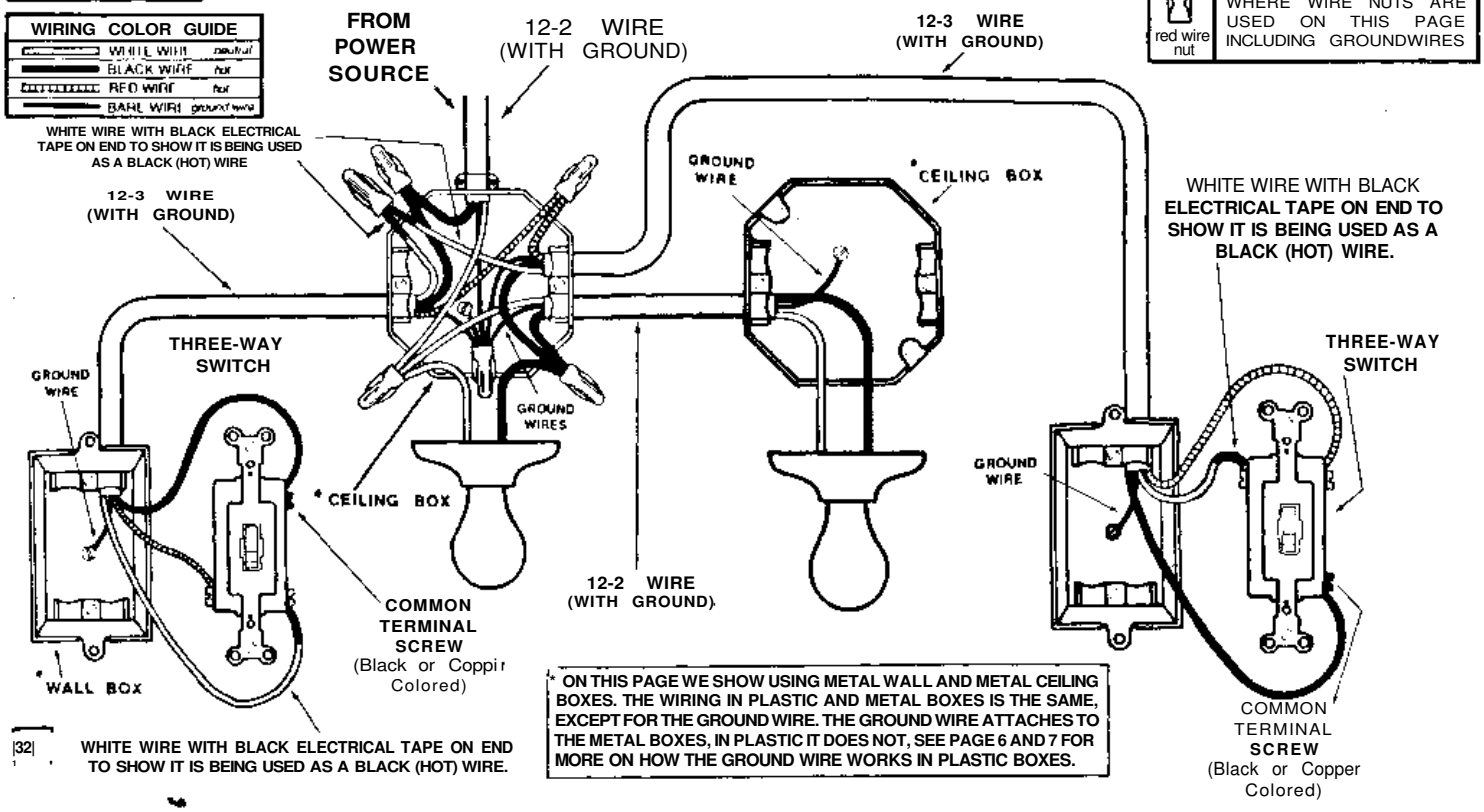
How to Wire Three-Way Switches

With Switches Controlling Two Lights

WIRING COLOR GUIDE
WHITE WIRE neutral
BLACK WIRE hot
RED WIRE hot
BARE WIRE ground wire

WIRE NUT GUIDE
red wire nut — USE RED WIRE NUTS WHERE WIRE NUTS ARE USED ON THIS PAGE INCLUDING GROUNDWIRES



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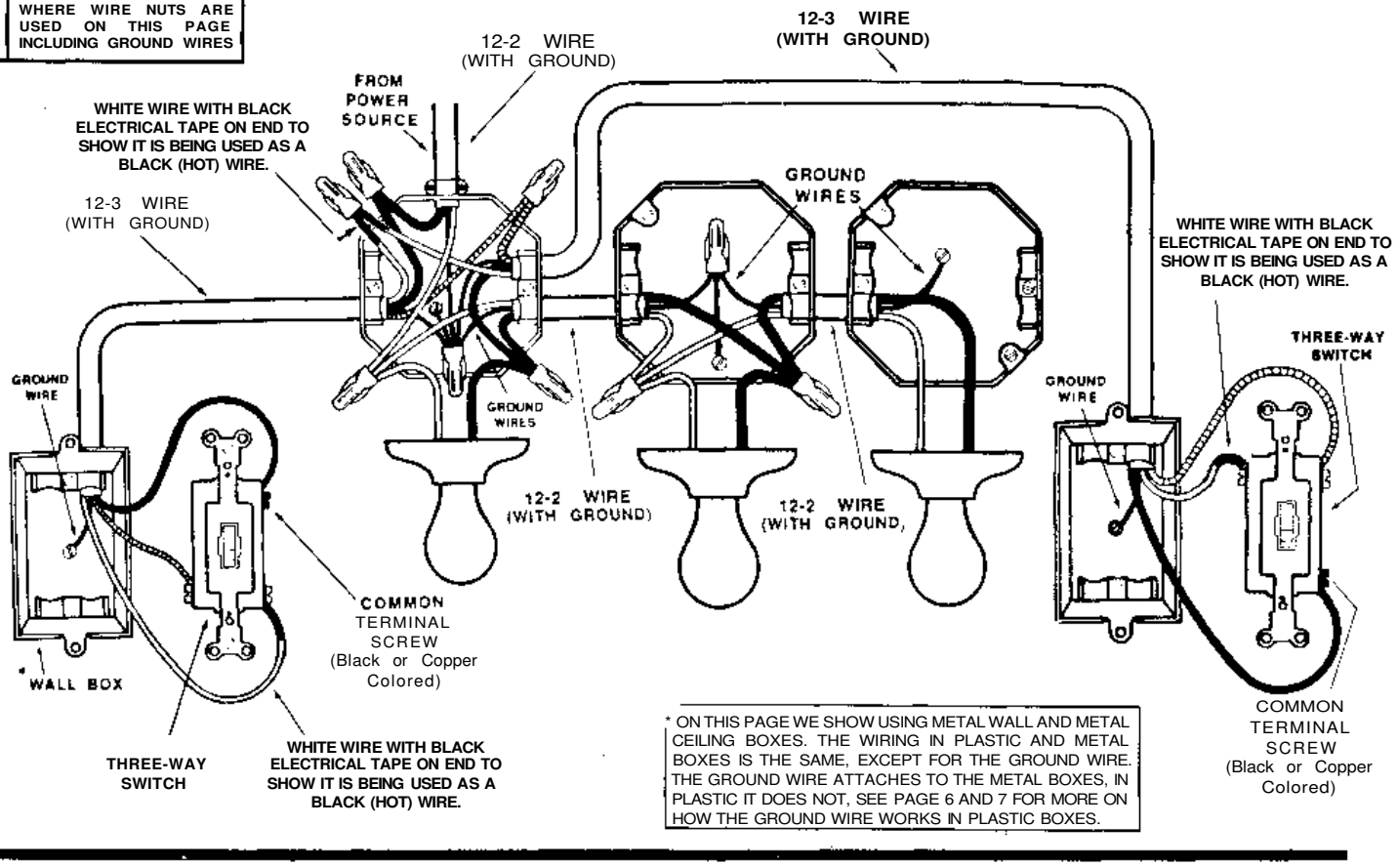
WIRING COLOR GUIDE	
WHITE WIRE	nwtral
BLACK WIRE	ha
RED WIRE	hot
BARE WIRE	ground win

WIRE NUT GUIDE	
fl WIRE NUT	USE RED WIRE NUTS WHERE WIRE NUTS ARE USED ON THIS PAGE INCLUDING GROUND WIRES

How To Wire Three-Way Switches

With Switches Controlling Three Lights



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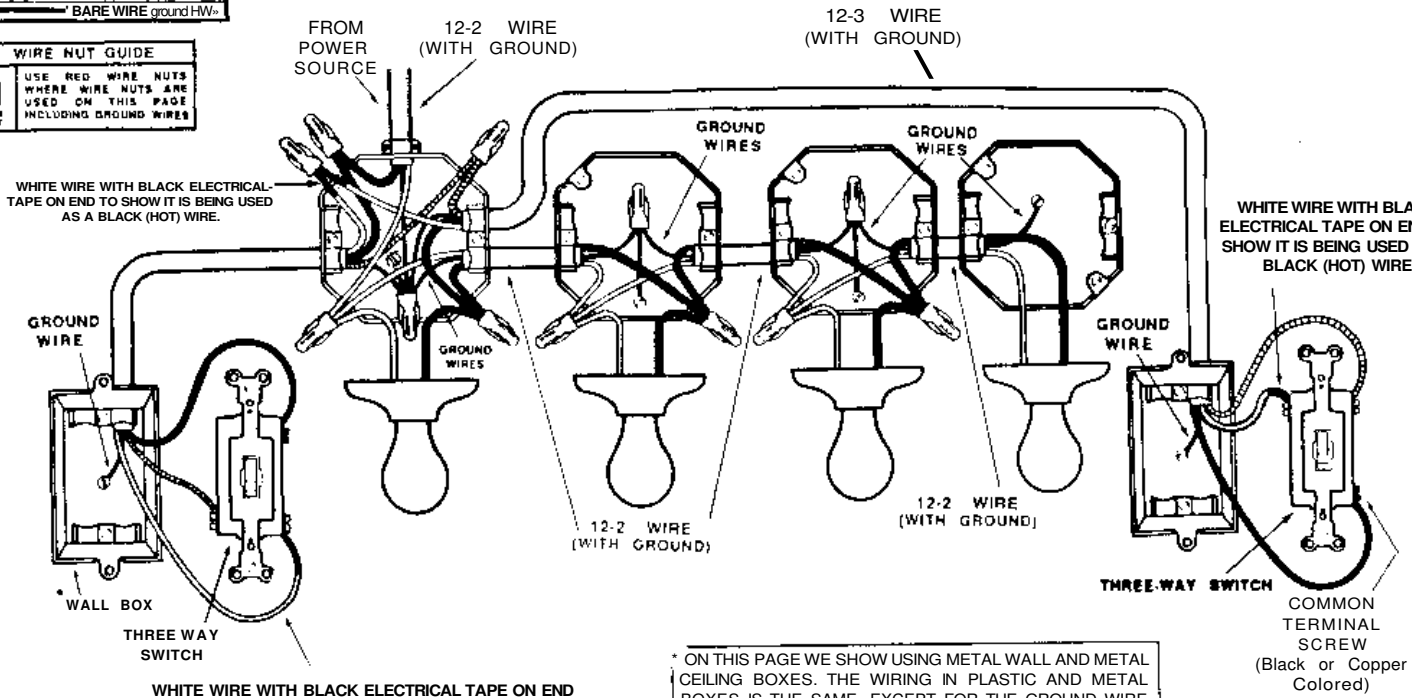
WIRING COLOR GUIDE	
WHITE WIRE	t»ulr»l
BLACK WIRE	ha
RED WIRE	hot
BARE WIRE	ground HW»

WIRE NUT GUIDE	
WIRE NUT	USE RED WIRE NUTS WHERE WIRE NUTS ARE USED ON THIS PAGE INCLUDING GROUND WIRES

How to Wire Three-Way Switches

With Switches Controlling Four Lights



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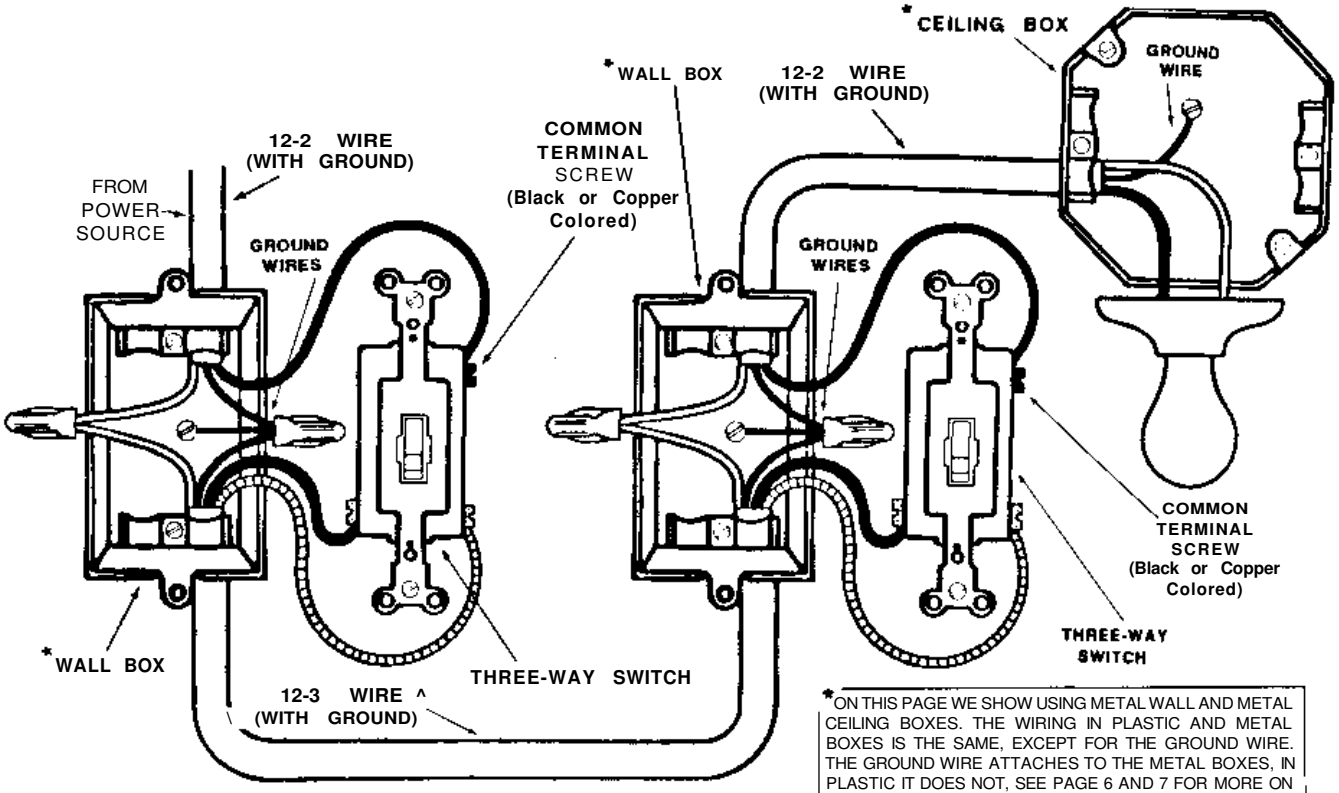
How to Wire Three-Way Switches

With Switches Controlling One Light

WIRING COLOR GUIDE	
WMITFWJRF	*neutral*
BLACK WIRE	*hot*
RED WIRE	*hot*
BARE WIRE	*ground wire*

WIRE NUT GUIDE	
fl red wire nut	USE RED WIRE NUTS WHERE WIRE NUTS ARE USED ON THIS PAGE INCLUDING GROUNDWIRES



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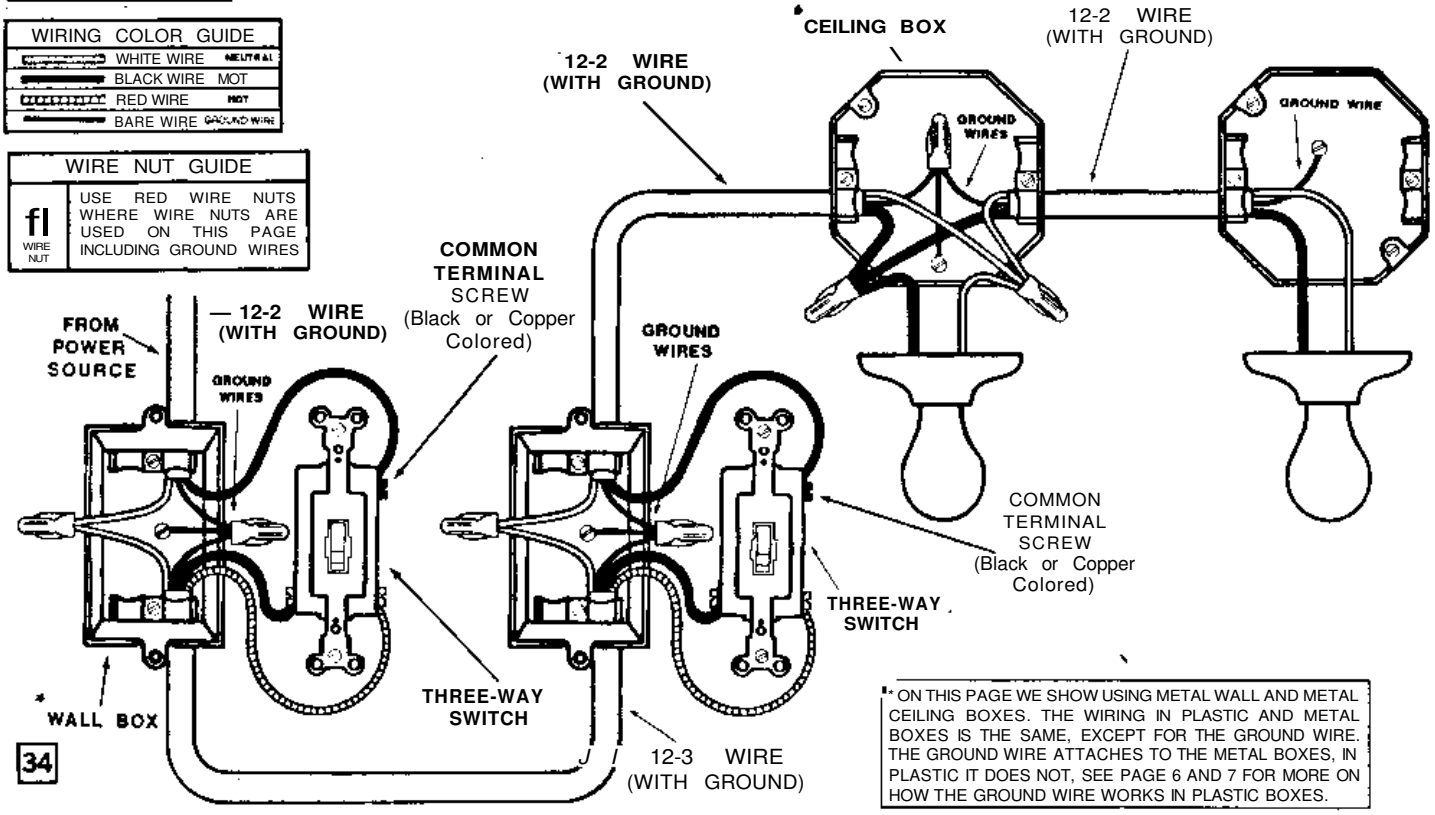
How To Wire Three-Way Switches

With Switches Controlling Two Lights

WIRING COLOR GUIDE	
WHITE WIRE	NEUTRAL
BLACK WIRE	HOT
RED WIRE	HOT
BARE WIRE	GROUND WIRE

WIRE NUT GUIDE	
fl WIRE NUT	USE RED WIRE NUTS WHERE WIRE NUTS ARE USED ON THIS PAGE INCLUDING GROUND WIRES



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WIRING COLOR GUIDE
- WHITE WIRE *neutral*
- BLACK WIRE *hot*
- IIIMHICT RED WIRE *hot*
- BARE WIRE ypux/*OT»

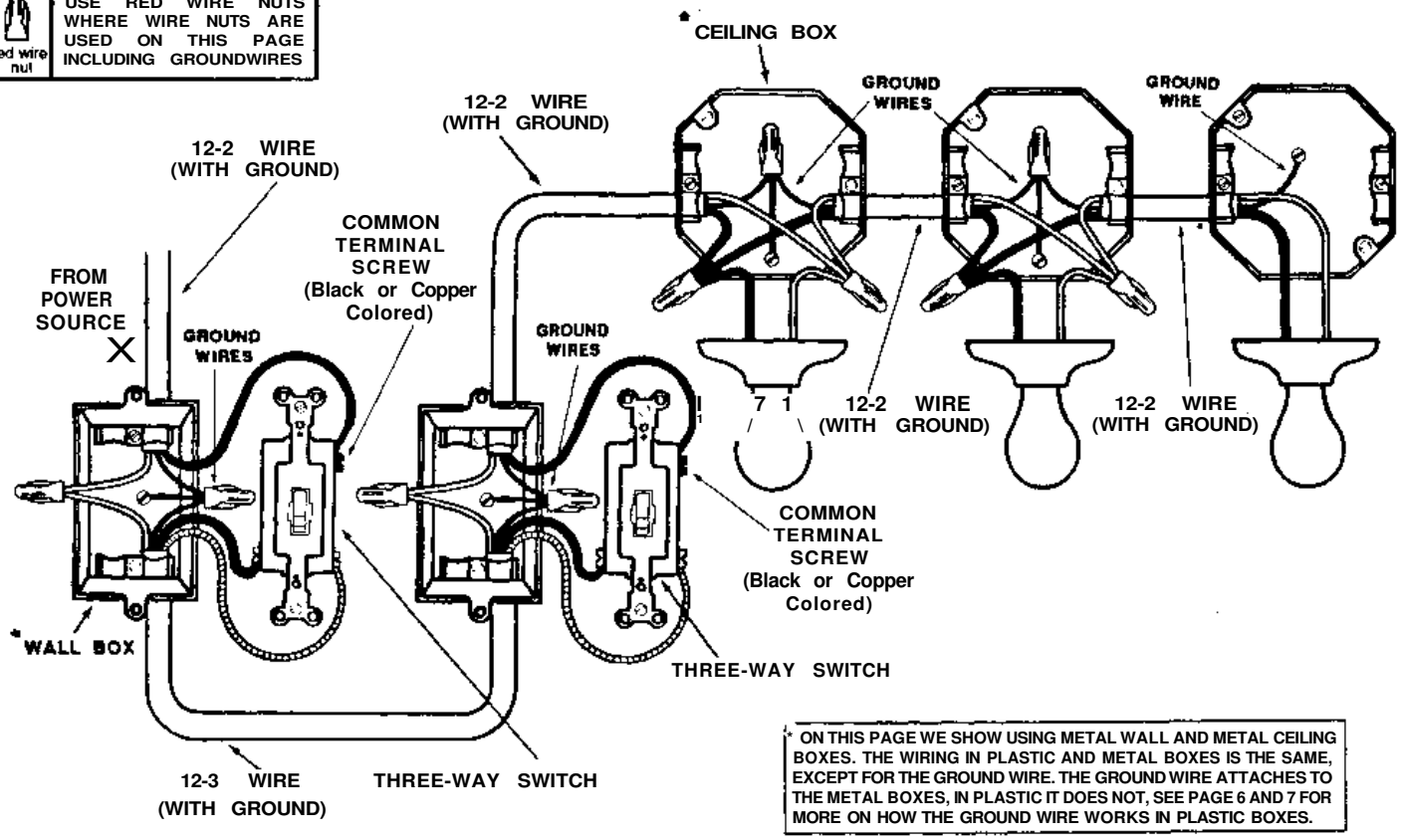
WIRE NUT GUIDE

red wire nut

USE RED WIRE NUTS WHERE WIRE NUTS ARE USED ON THIS PAGE INCLUDING GROUNDWIRES

How To Wire Three-Way Switches

With Switches Controlling Three Lights



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WIRING COLOR GUIDE
- WHITE WIRE *neutral*
- BLACK WIRE *hat*
- .mnmim RED WIRE: *hot*
- BARE WIRE *groundwir**

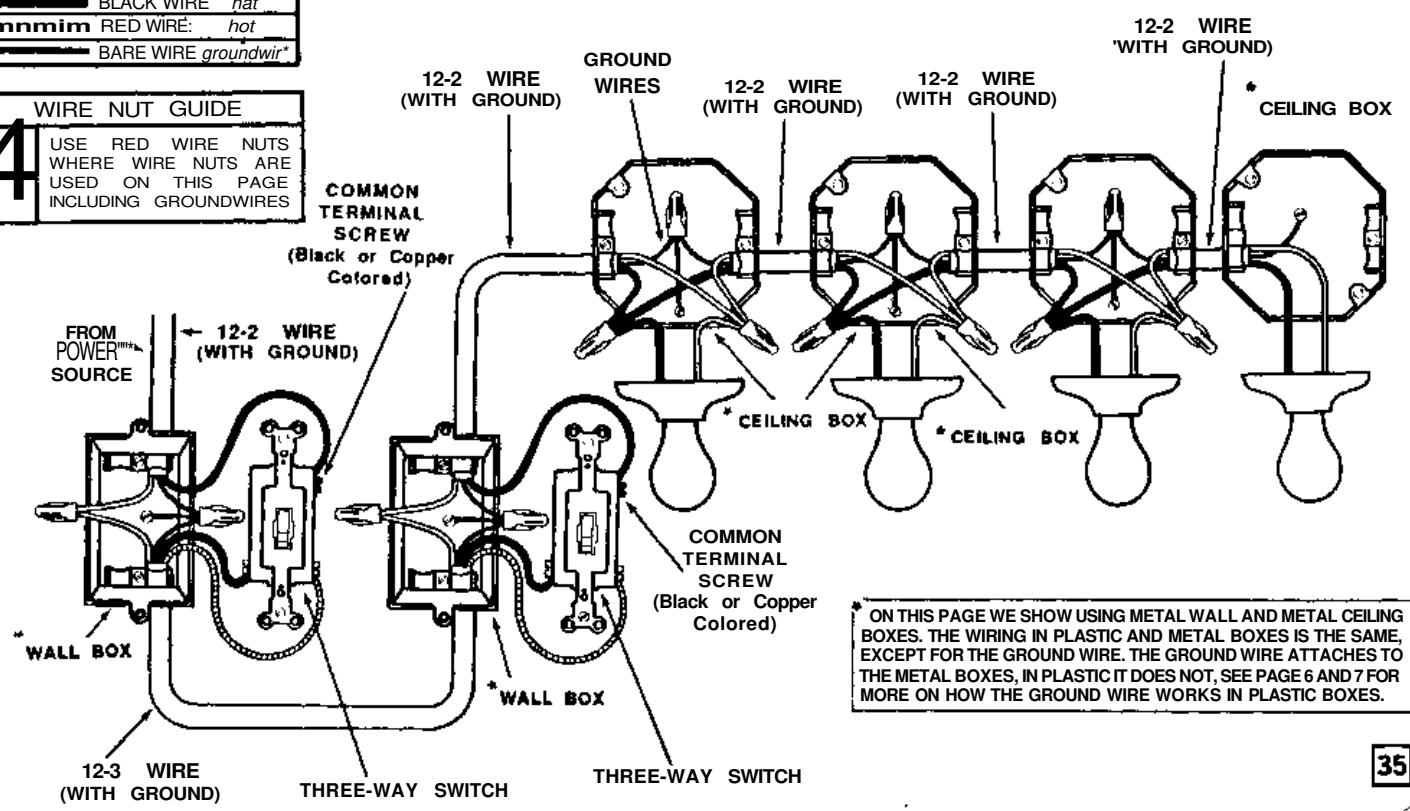
WIRE NUT GUIDE

4

USE RED WIRE NUTS WHERE WIRE NUTS ARE USED ON THIS PAGE INCLUDING GROUNDWIRES

How to Wire Three-Way Switches

With Switches Controlling Four Lights



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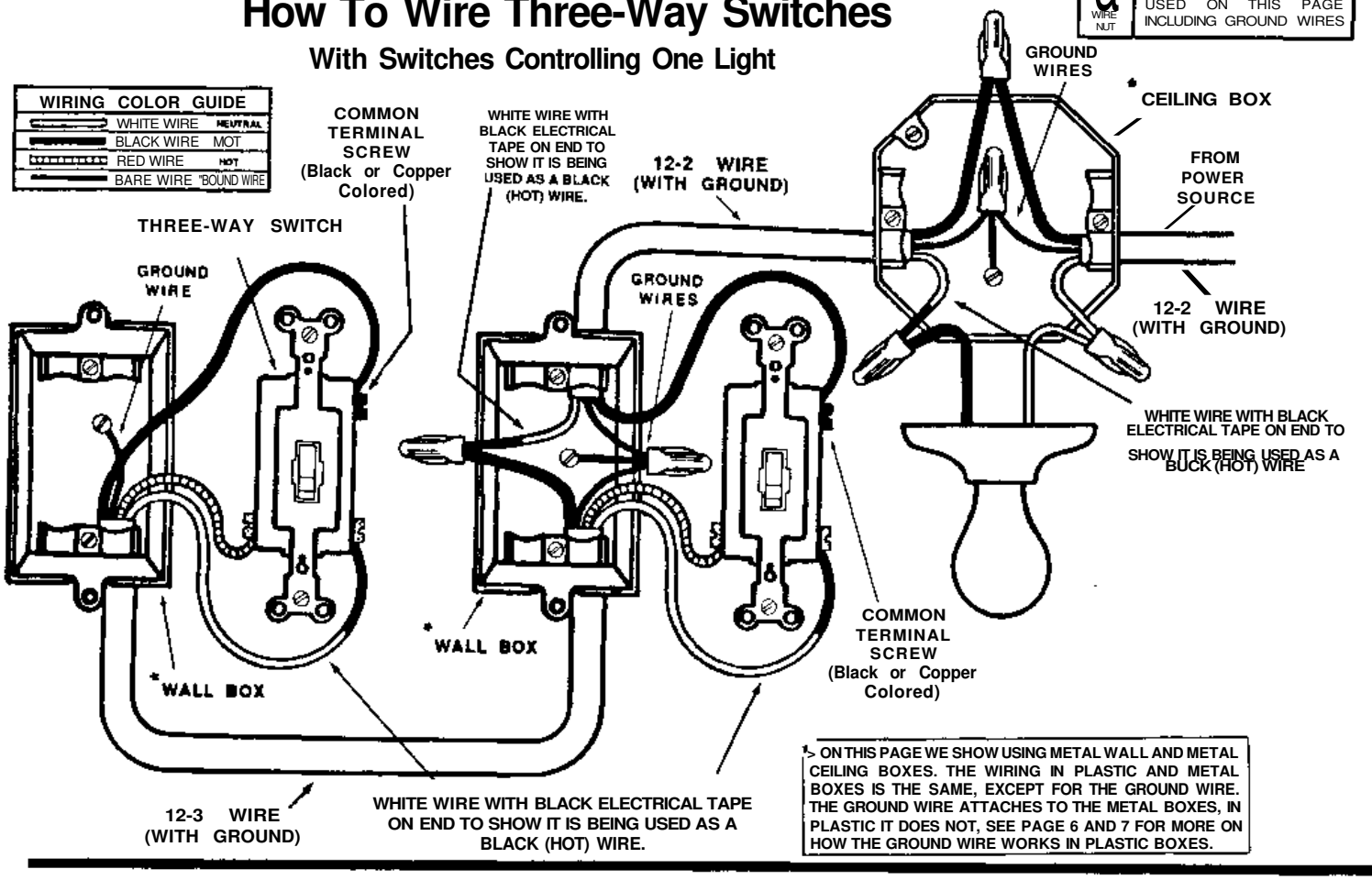
How To Wire Three-Way Switches

With Switches Controlling One Light

WIRE NUT GUIDE	
a WIRE NUT	USE RED WIRE NUTS WHERE WIRE NUTS ARE USED ON THIS PAGE INCLUDING GROUND WIRES

WIRING COLOR GUIDE	
WHITE WIRE	NEUTRAL
BLACK WIRE	HOT
RED WIRE	HOT
BARE WIRE	GROUND WIRE



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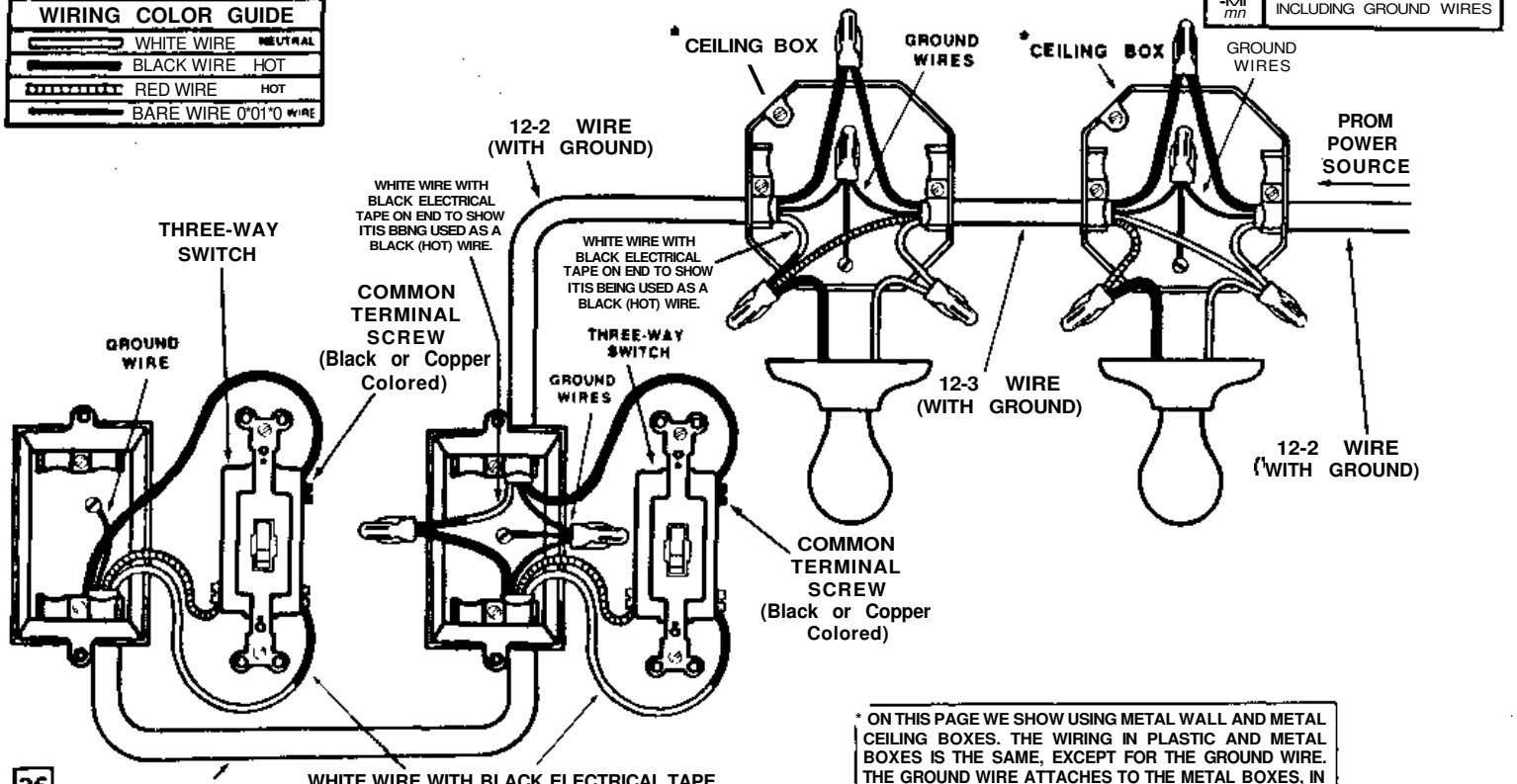
How to Wire Three-Way Switches

With Switches Controlling Two Lights

WIRE NUT GUIDE	
A WIRE NUT	USE MED WIRE NUTS WHERE WIRE NUTS ARE USED ON THIS PAGE INCLUDING GROUND WIRES

WIRING COLOR GUIDE	
WHITE WIRE	NEUTRAL
BLACK WIRE	HOT
RED WIRE	HOT
BARE WIRE	GROUND WIRE



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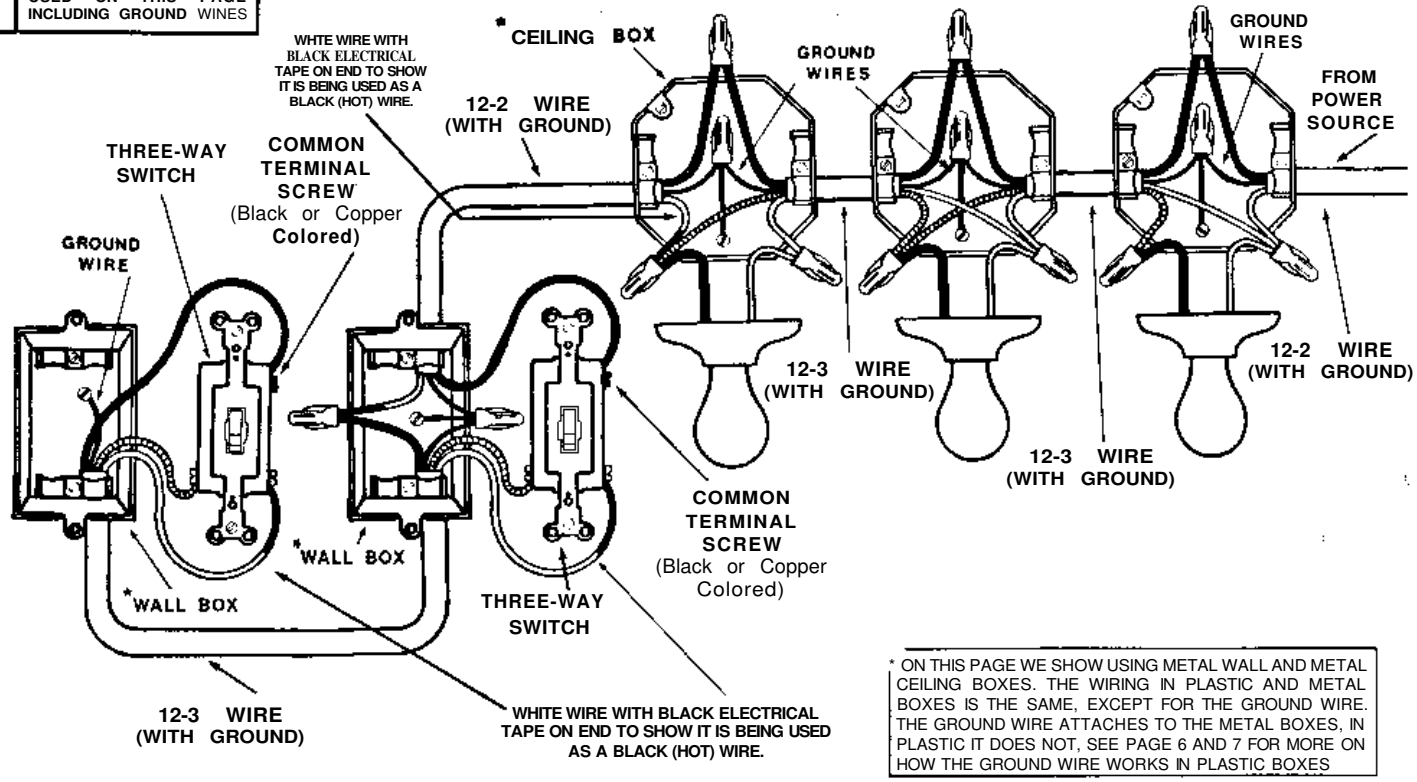
WIRING COLOR GUIDE	
WHITE WIRE	NEUTRAL
BLACK WIRE	HOT
RED WIRE	HOT
BARE WIRE	

WIRE NUT GUIDE	
A WIRE NUT	USE MED WINE NUTS WHERE WIRE NUTS ARE USED ON THIS PAGE INCLUDING GROUND WINES

How To Wire Three-Way Switches

With Switches Controlling Three Lights



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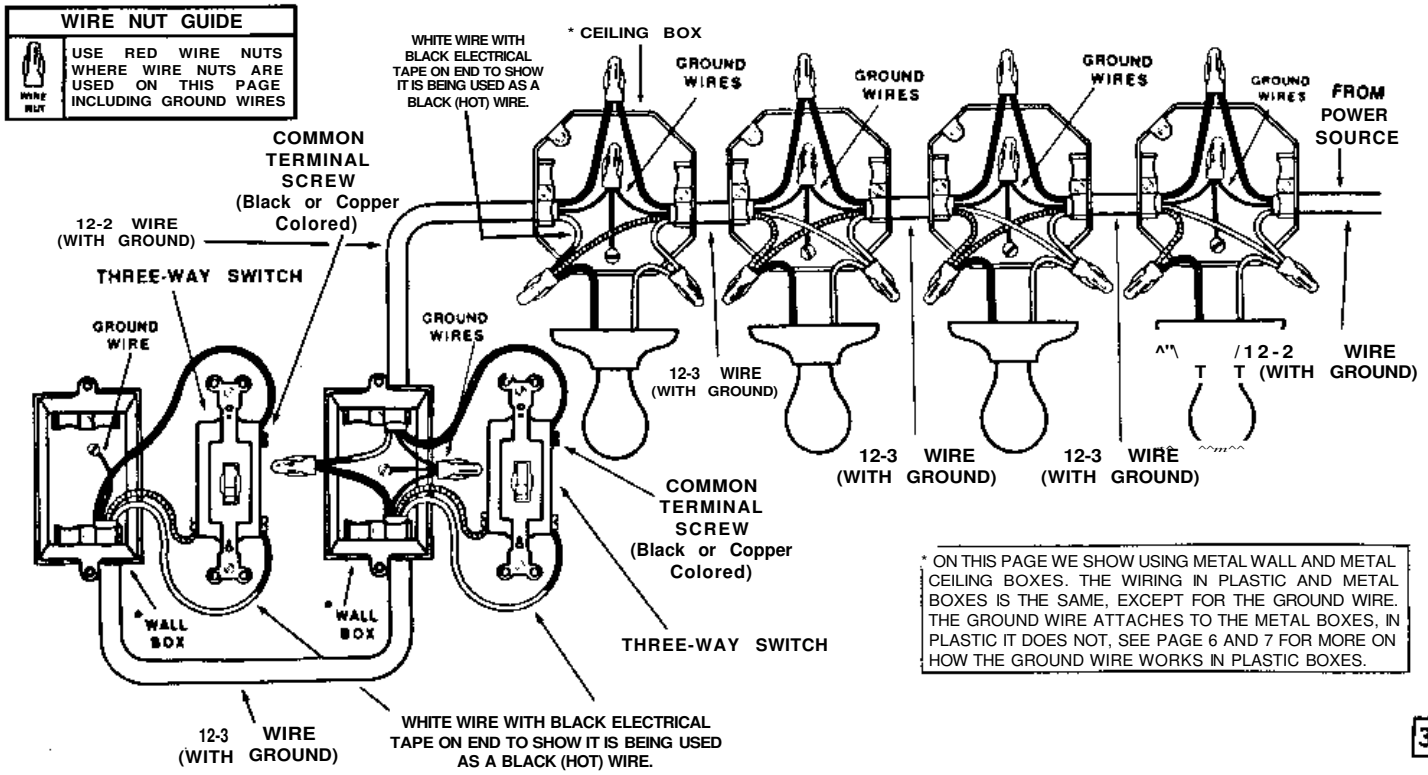
How to Wire Three-Way Switches

With Switches Controlling Four Lights

WIRING COLOR GUIDE	
WHITE WIRE	NEUTRAL
BLACK WIRE	HOT
RED WIRE	HOT
BARE WIRE	

WIRE NUT GUIDE	
WIRE NUT	USE RED WIRE NUTS WHERE WIRE NUTS ARE USED ON THIS PAGE INCLUDING GROUND WIRES



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How to Wire Single Pole Switch

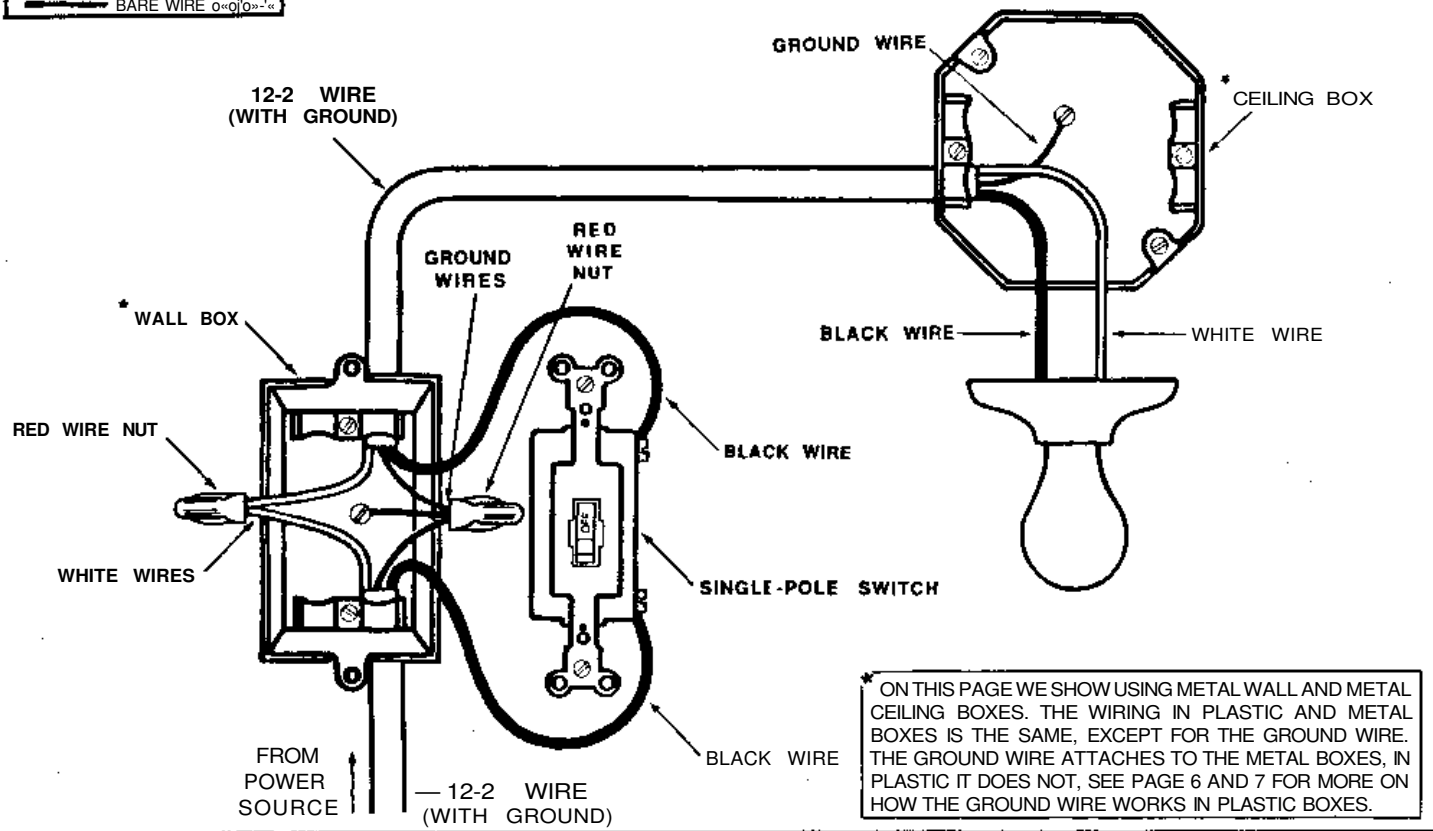
With Switch Controlling One Light

WIRING COLOR GUIDE

- WHITE WIRE — NEUTRAL
- BLACK WIRE — HOT
- RED WIRE — HOT
- BARE WIRE — GROUND WIRE

WIRE NUT GUIDE

USE RED WIRE NUTS WHERE WIRE NUTS ARE USED ON THIS PAGE INCLUDING GROUND WIRES



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How To Wire Single Pole Switch

With Switch Controlling Two Lights

WIRING COLOR GUIDE

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WIRE NUT GUIDE

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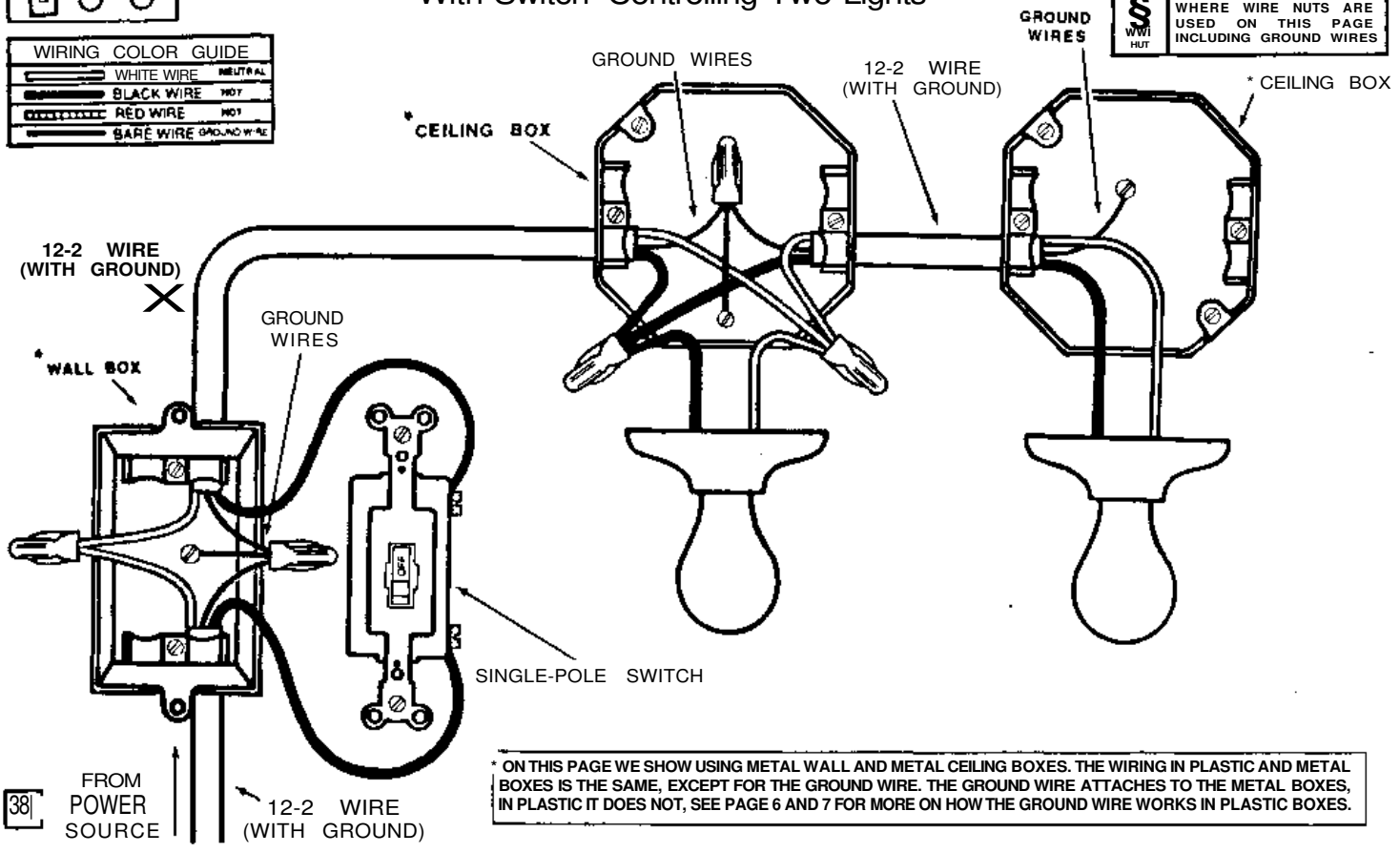

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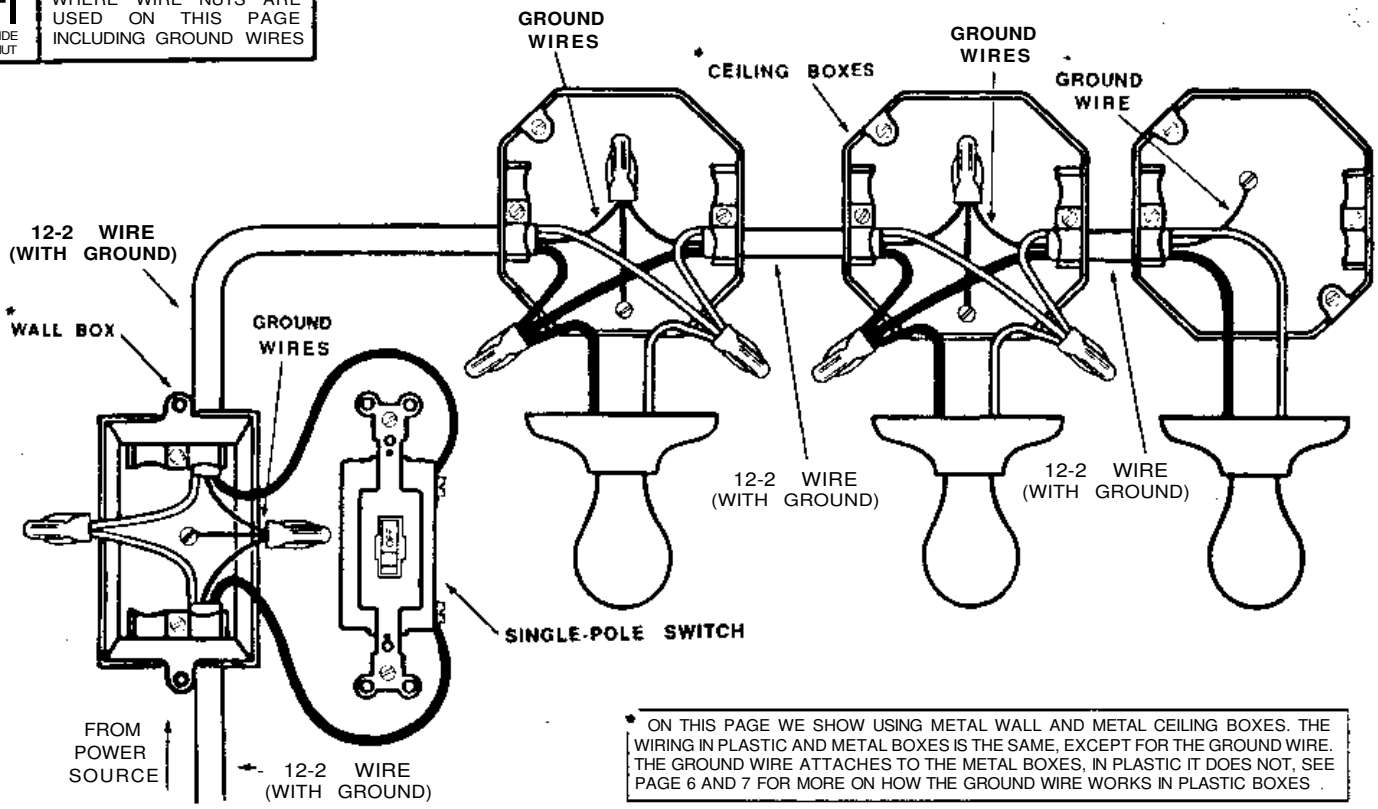
WIRING COLOR GUIDE	
WHITE WIRE	NEUTRAL
BLACK WIRE	HOT
RED WIRE	HOT
BARE WIRE	GROUND WIRE

WIRE NUT GUIDE	
WIDE NUT	USE RED WIRE NUTS WHERE WIRE NUTS ARE USED ON THIS PAGE INCLUDING GROUND WIRES

How to Wire Single Pole Switch

With Switch Controlling Three Lights



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WHITE WIRE	NEUTRAL
BLACK WIRE	HOT
RED WIRE	HOT
BARE WIRE	GROUNDWIRE

WIRE NUT GUIDE	
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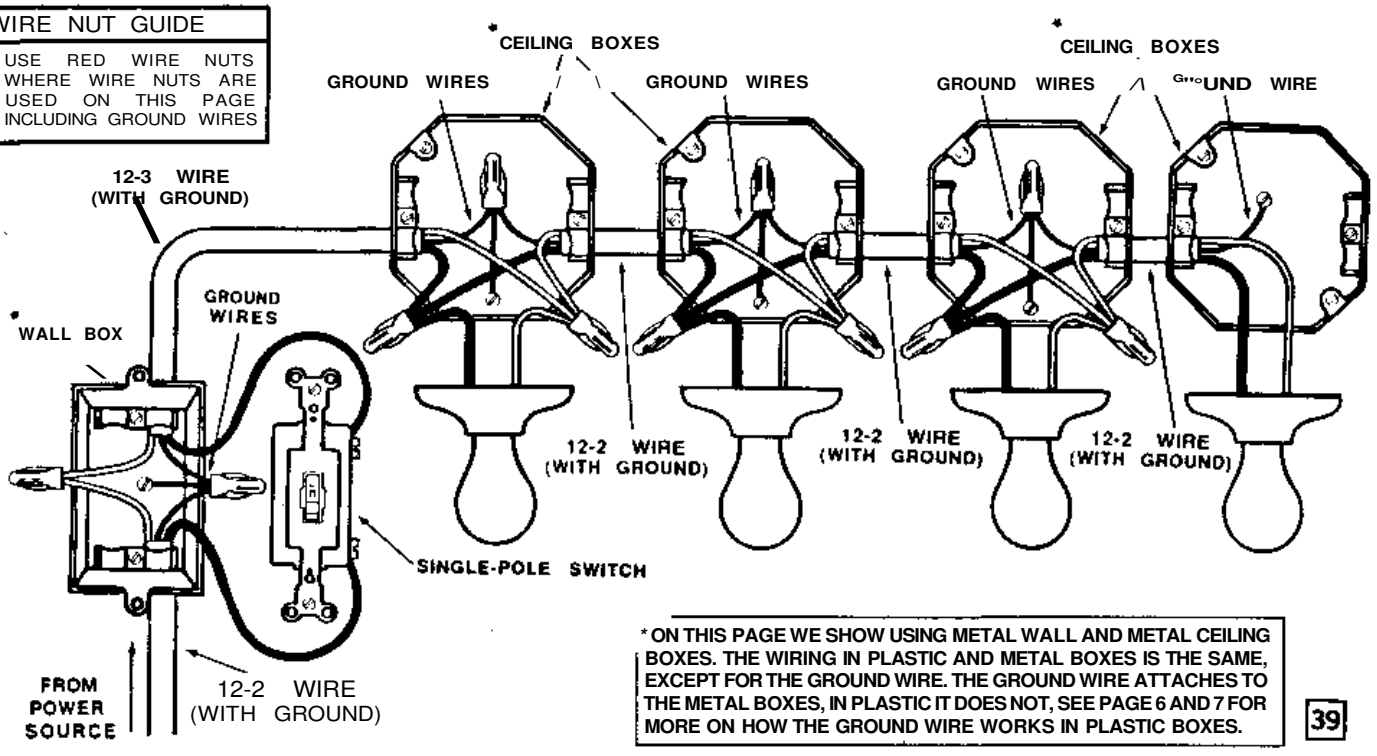
How To Wire Single Pole Switch

With Switch Controlling Four Lights



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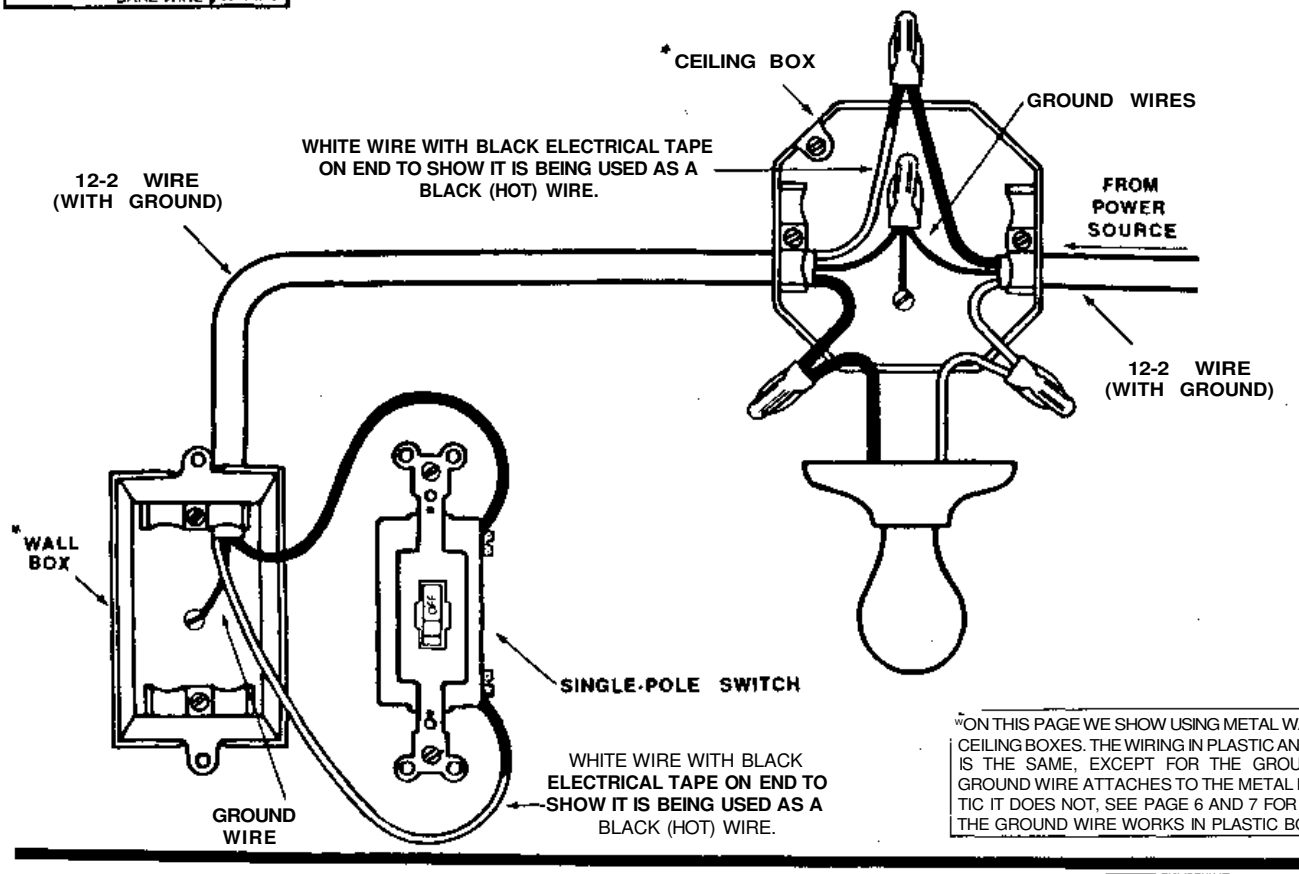
WIRING COLOR GUIDE	
WHITE WIRE	neutral
BLACK WIRE	ha
RED WIRE	hot
BARE WIRE	ground wire

WIRE NUT GUIDE	
ft red wire nut	USE RED WIRE NUTS WHERE WIRE NUTS ARE USED ON THIS PAGE INCLUDING GROUNDWIRES

How to Wire Single Pole Switch

With Switch Controlling One Light



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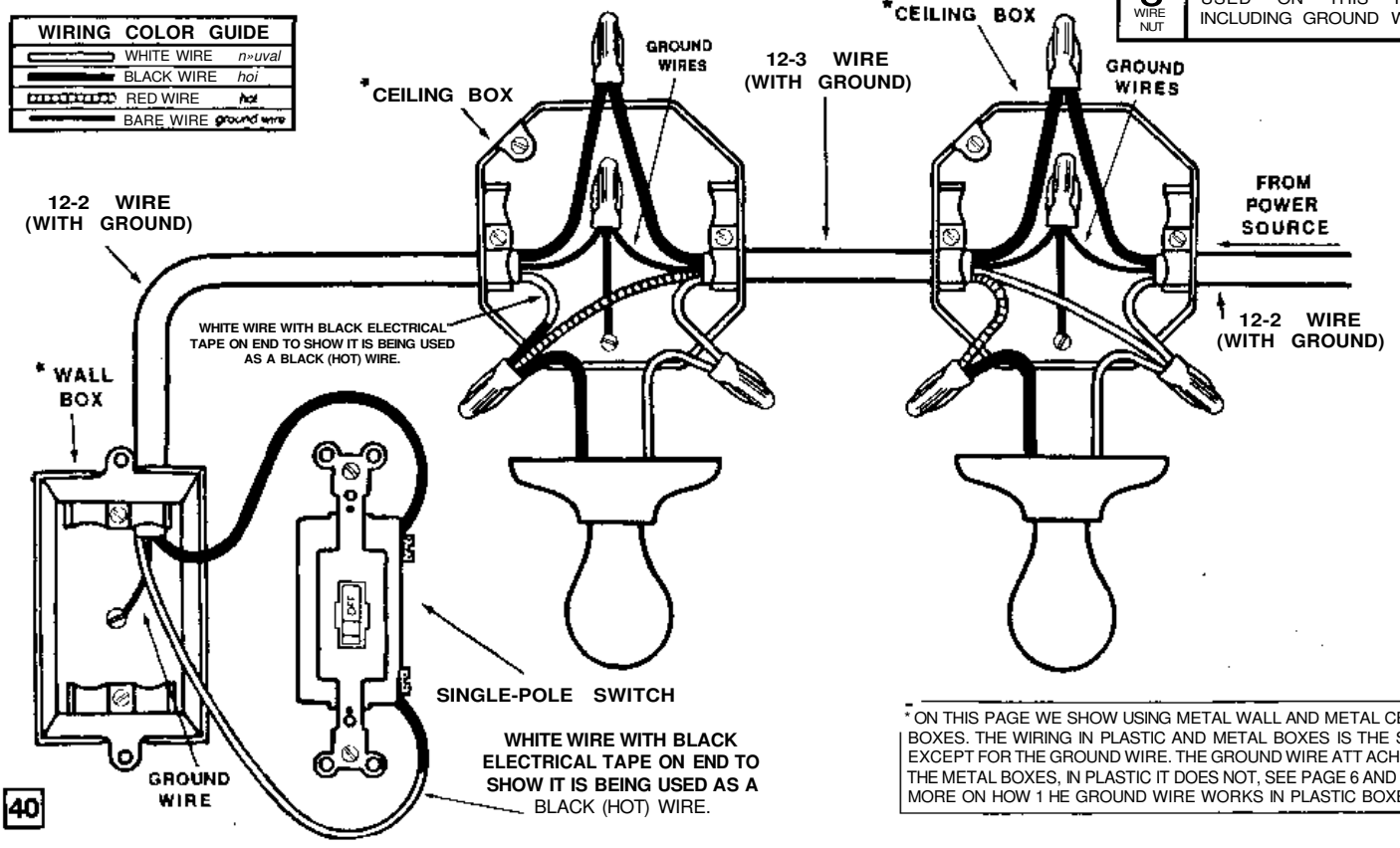
How To Wire Single Pole Switch

With Switch Controlling Two Lights

WIRING COLOR GUIDE	
WHITE WIRE	n»uval
BLACK WIRE	hoi
RED WIRE	hot
BARE WIRE	ground wire

WIRE NUT GUIDE	
§ WIRE NUT	USE RED WIRE NUTS WHERE WIRE NUTS ARE USED ON THIS PAGE INCLUDING GROUND WIRES



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WIRING COLOR GUIDE	
WHITE WIRE,	NEUTRAL
BLACK WIRE	HOT
RED WIRE	HOT
BARE WIRE	GROUNDWIRE

How To Wire Single Pole Switch

With Switch Controlling Three Lights

WIRE NUT GUIDE	
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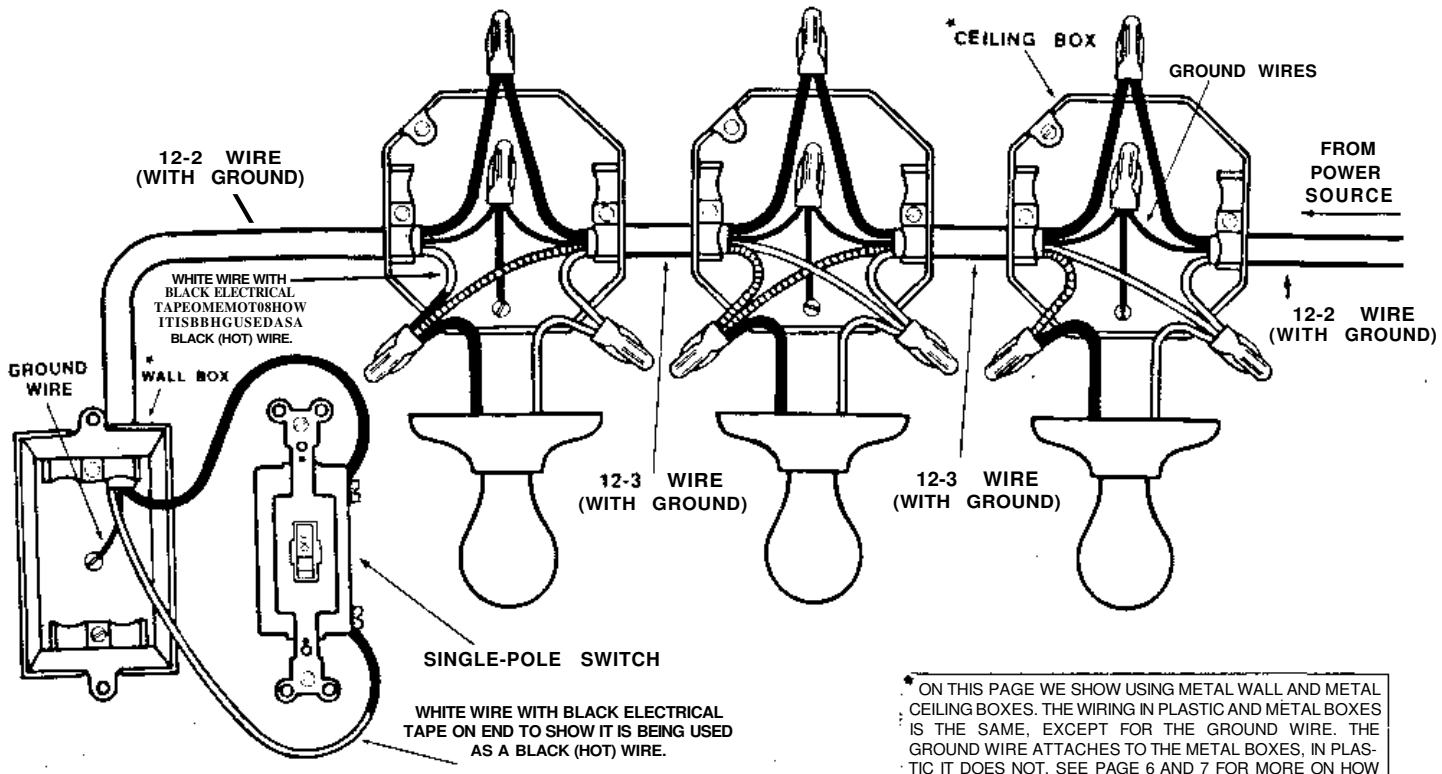

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WIRING COLOR GUIDE	
WHITE WIRE	NEUTRAL
BLACK WIRE	HOT
RED WIRE	HOT
BARE WIRE	GROUNDWIRE

How to Wire Single Pole Switch

With Switch Controlling Four Lights

WIRE NUT GUIDE	
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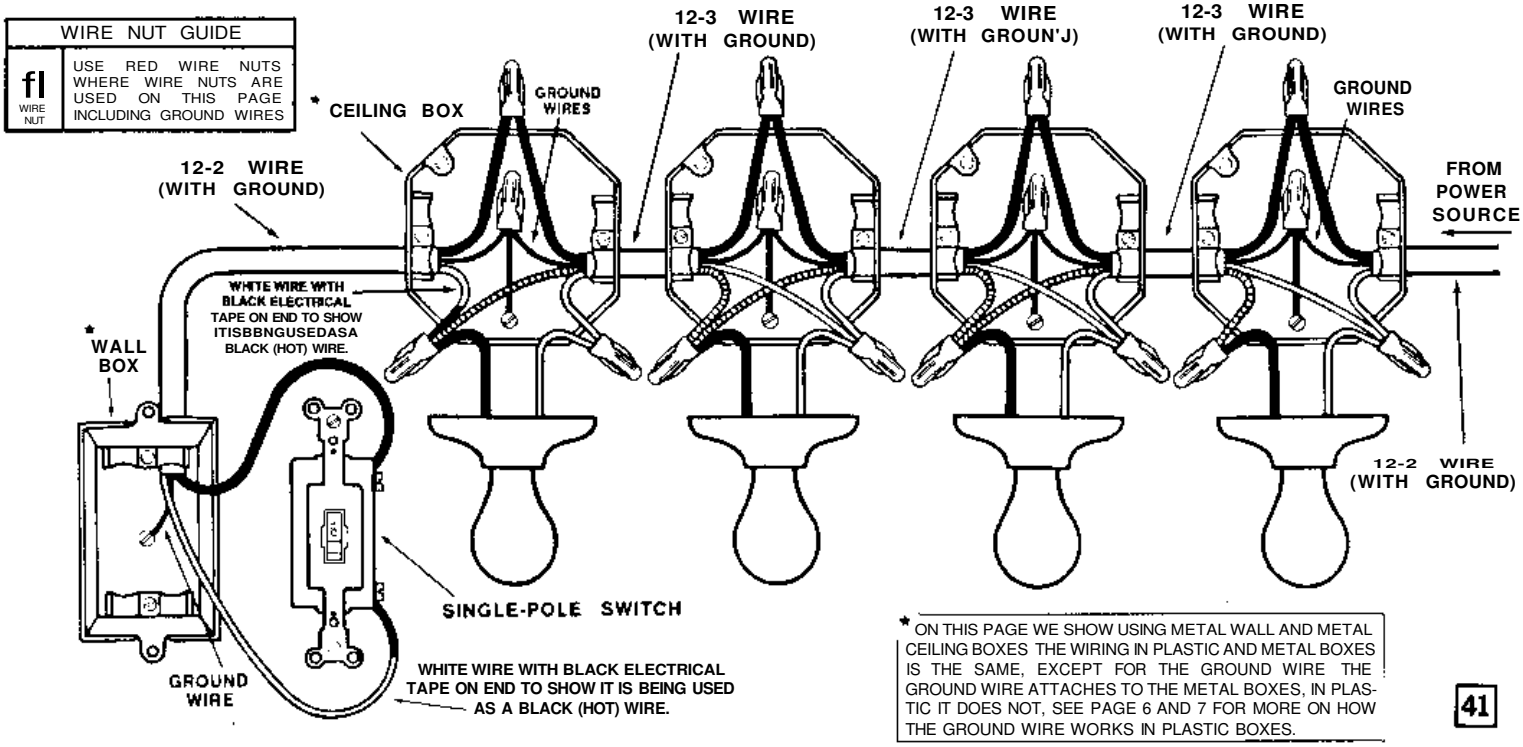

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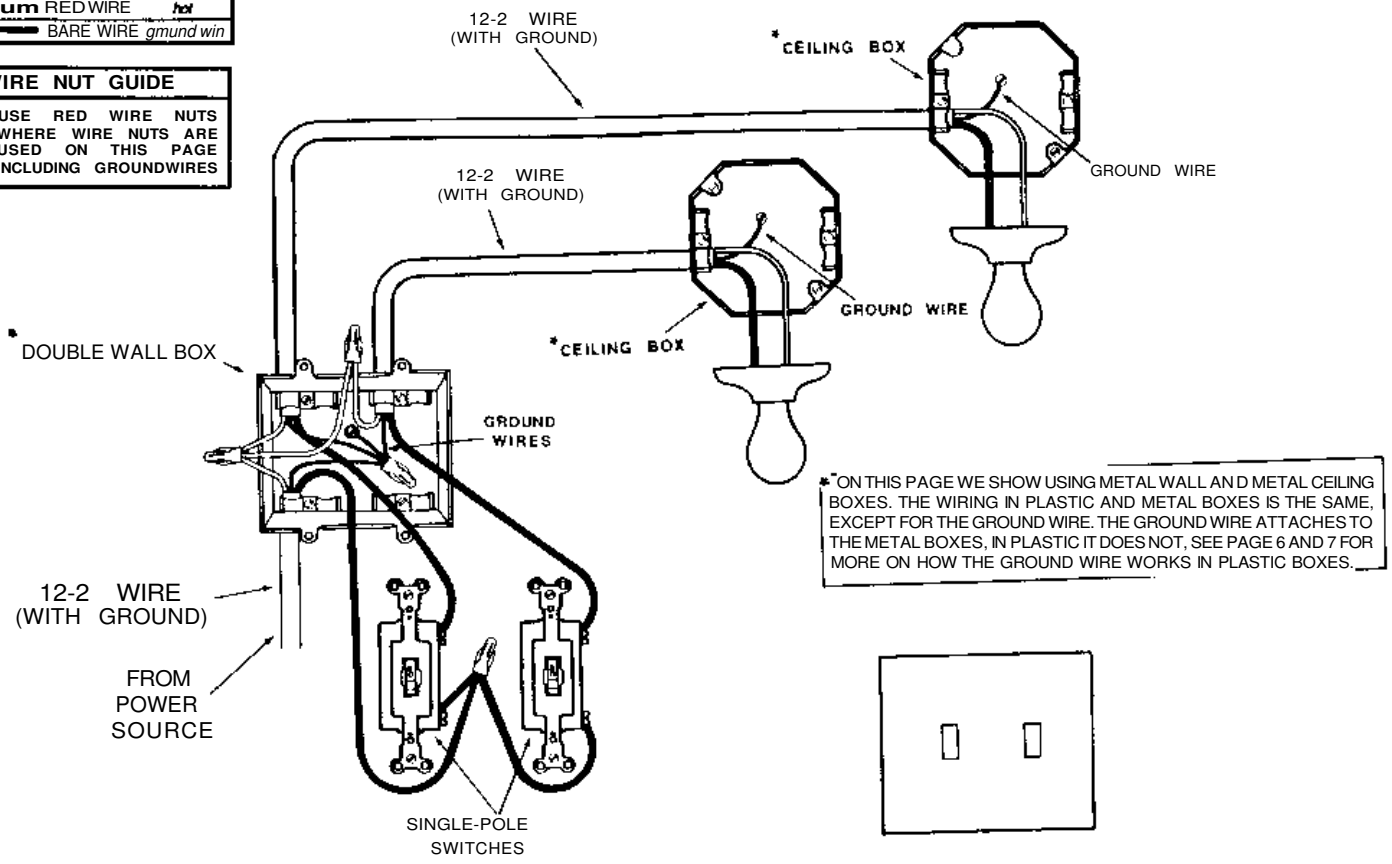
One Power Source Supplying Two Single Pole Switches With Lights

WIRING COLOR GUIDE	
WHITE WIRE	*neutral*
BLACK WIRE	*hot*
minium RED WIRE	*hot*
BARE WIRE	*gmund win*

WIRE NUT GUIDE	
fl. red wire nut	USE RED WIRE NUTS WHERE WIRE NUTS ARE USED ON THIS PAGE INCLUDING GROUNDWIRES



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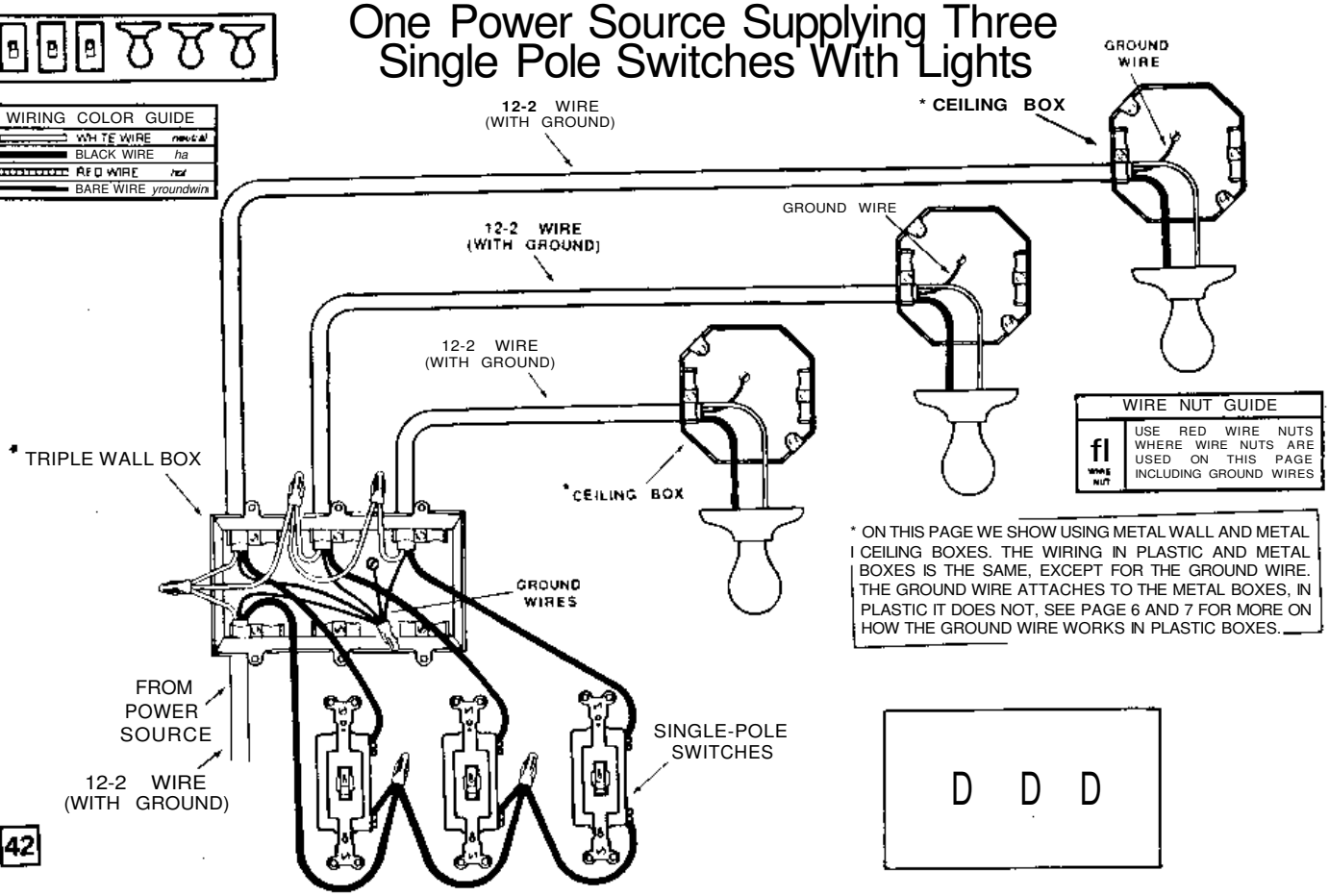
One Power Source Supplying Three Single Pole Switches With Lights

WIRING COLOR GUIDE	
WHITE WIRE	*neutral*
BLACK WIRE	*ha*
RED WIRE	*hot*
BARE WIRE	*yroundwin*



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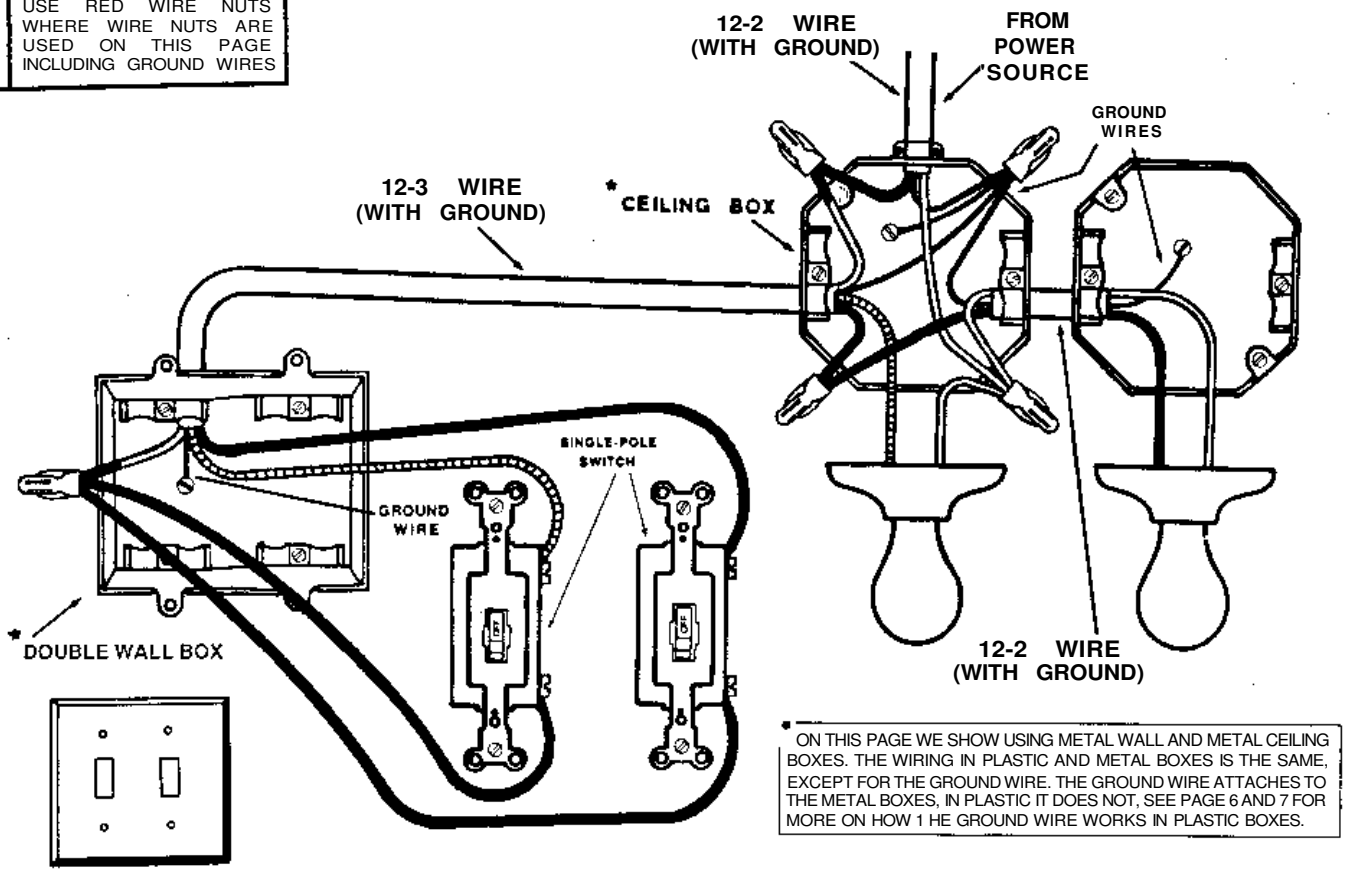
WIRING COLOR GUIDE	
WHITE WIRE	NEUTRAL
BLACK WIRE	HOT
RED WIRE	HOT
BARE WIRE (WOUND WIRE)	

WIRE NUT GUIDE	
WIRE NUT	USE RED WIRE NUTS WHERE WIRE NUTS ARE USED ON THIS PAGE INCLUDING GROUND WIRES

One Power Source Supplying Two Single Pole Switches with Lights



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WIRING COLOR GUIDE	
WHITE WIRE	NEUTRAL
BLACK WIRE	HOT
RED WIRE	HOT
BARE WIRE GROUND WIRE	

How to Wire a Single Pole Switch With Lights and Outlets

WIRE NUT GUIDE	
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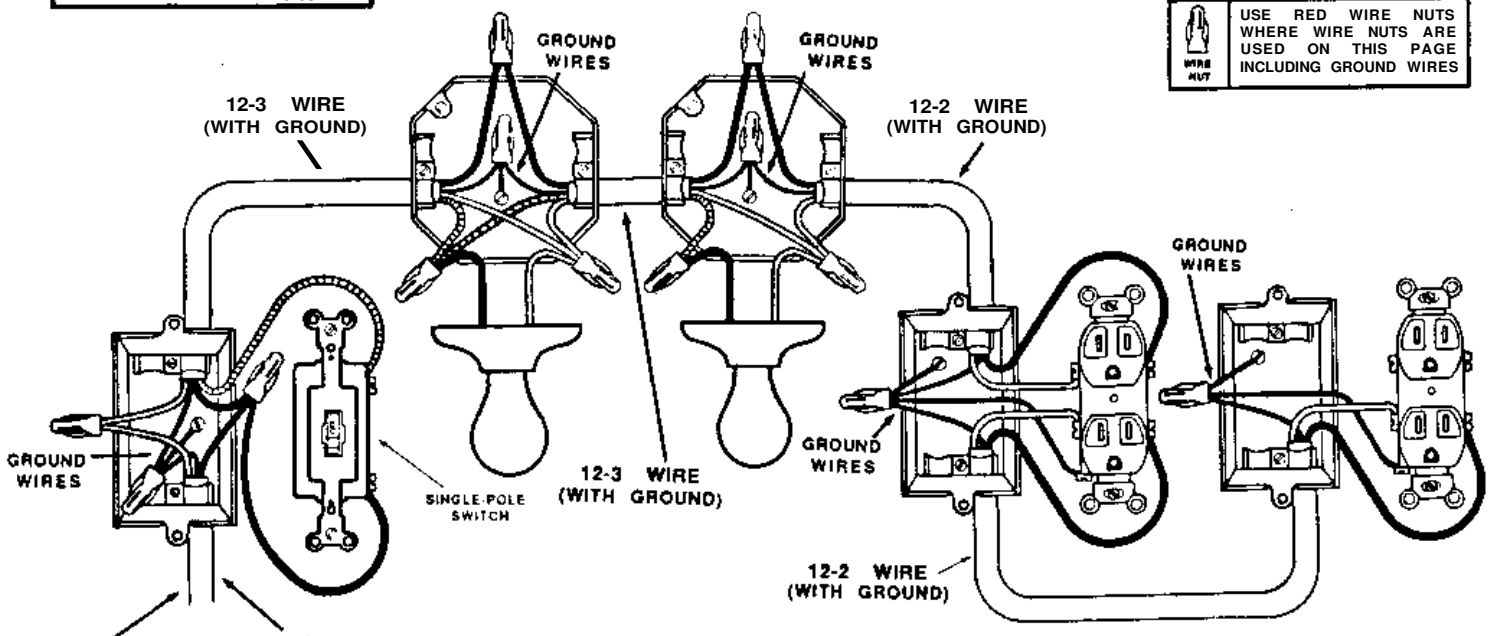

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All About Four-Way Switches

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BLACK WIRE	HOT
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BARE WIRE	GROUND WIRE

WIRE NUT GUIDE	
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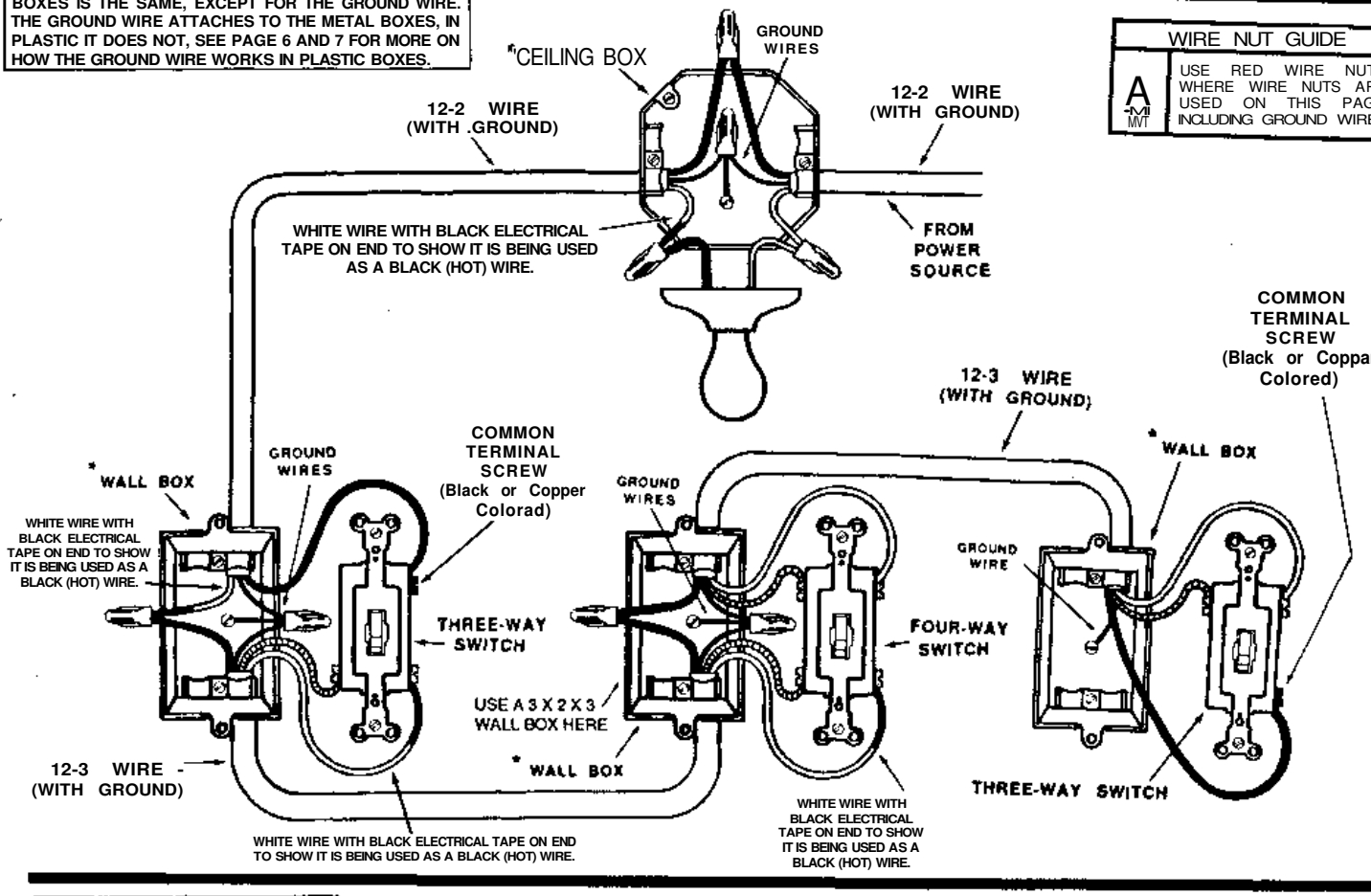

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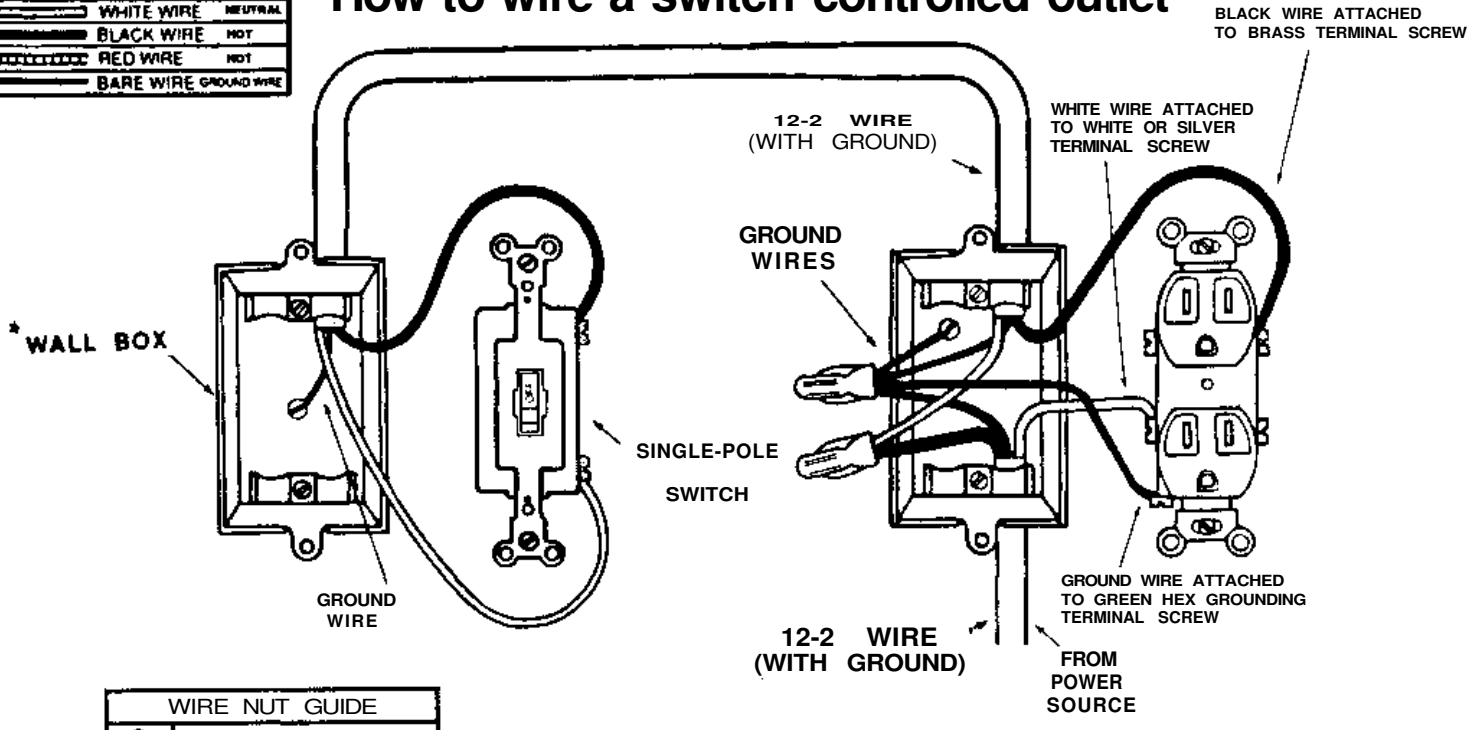
WHITE WIRE	NEUTRAL
BLACK WIRE	HOT
RED WIRE	HOT
BARE WIRE	GROUND WIRE

How to wire a switch controlled outlet



WIRE NUT GUIDE	
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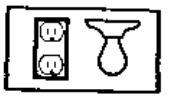
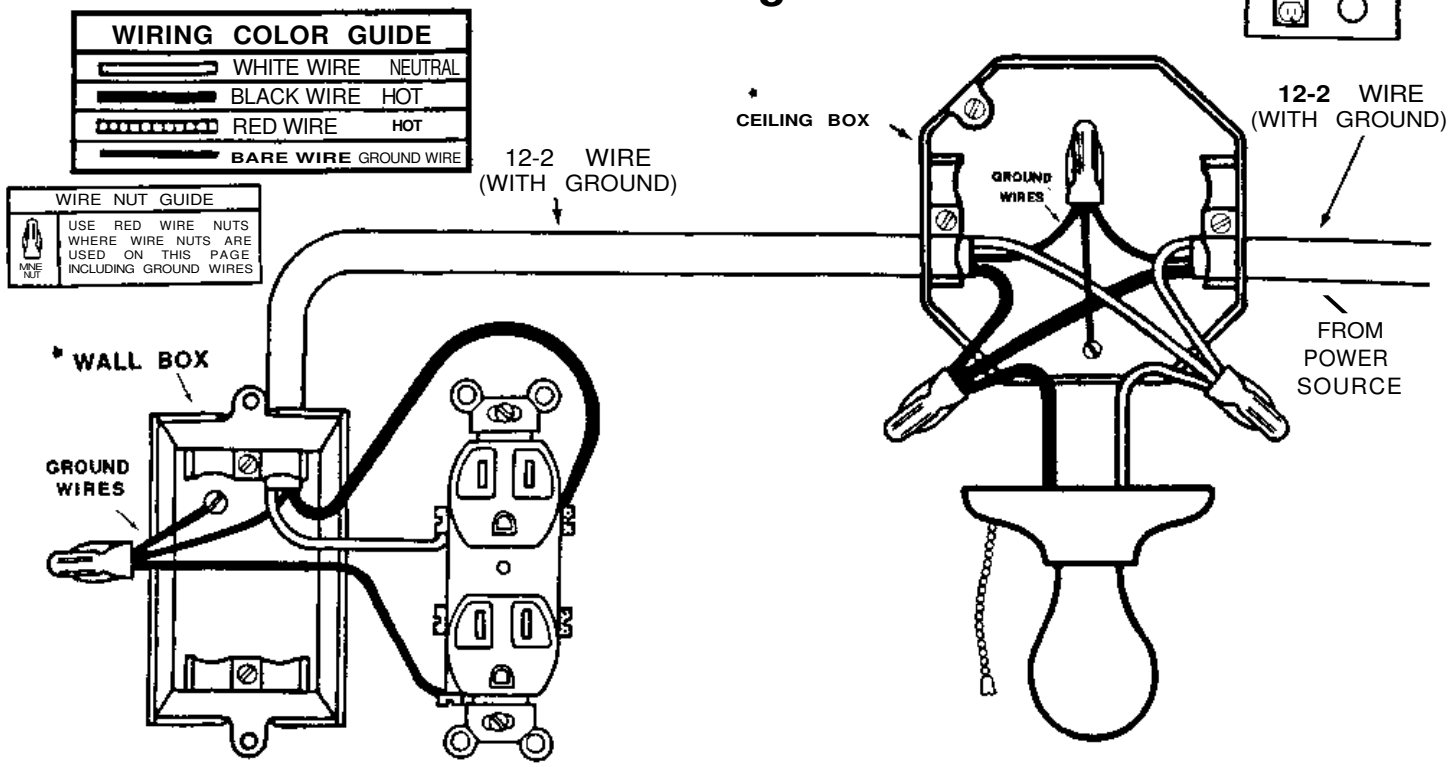
How to Wire Outlet and Light with Pull Chain





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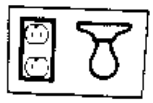

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WIRING COLOR GUIDE	
WHITE WIRE	neutral
BLACK WIRE	hot
RED WIRE	hot
BARE WIRE	ground wire

How To Wire Outlet-Switch and Light

WIRE NUT GUIDE	
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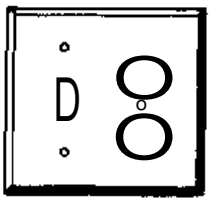

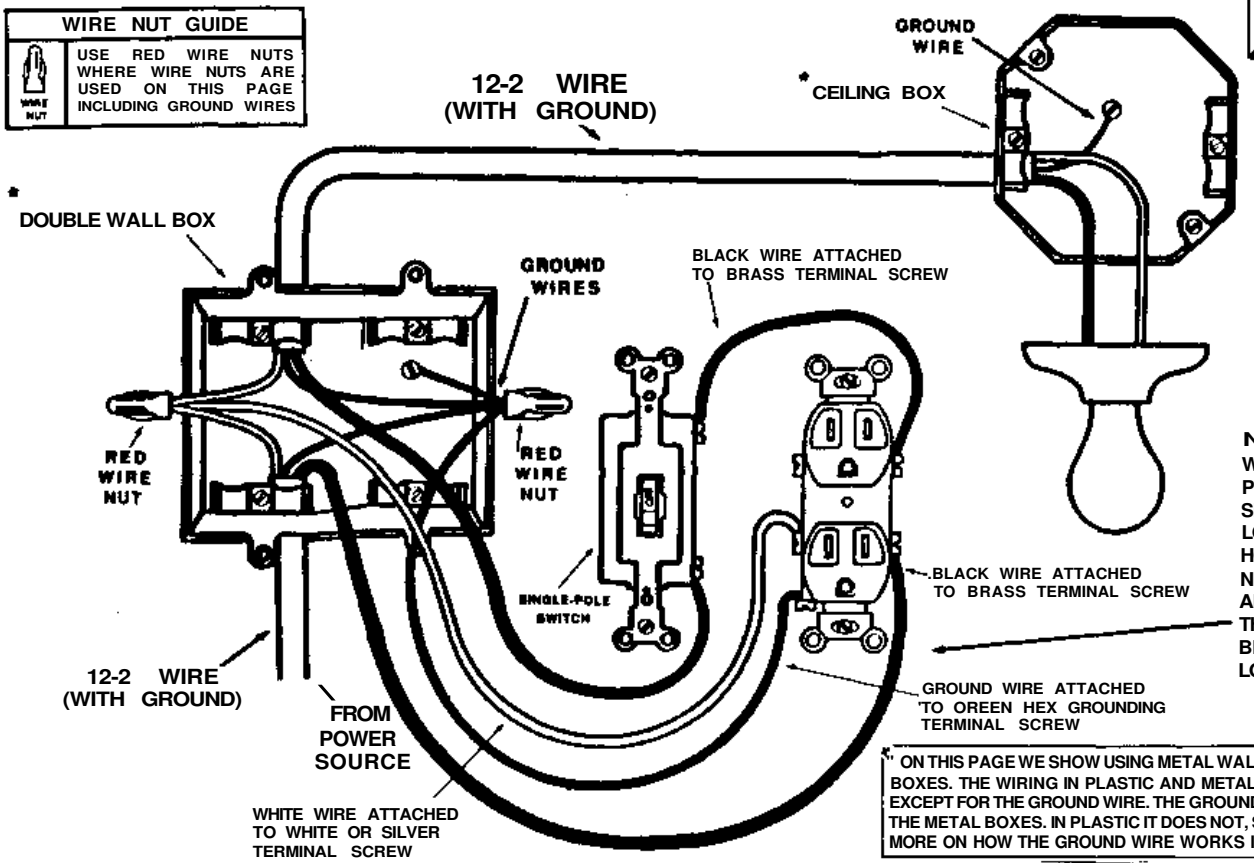

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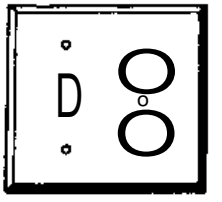
How To Wire Outlet-Switch and Light



WIRING COLOR GUIDE	
WHITE WIRE	*****
BLACK WIRE	HOT
RED WIRE	HOT
BARE WIRE	GROUND WIRE

WIRE NUT GUIDE	
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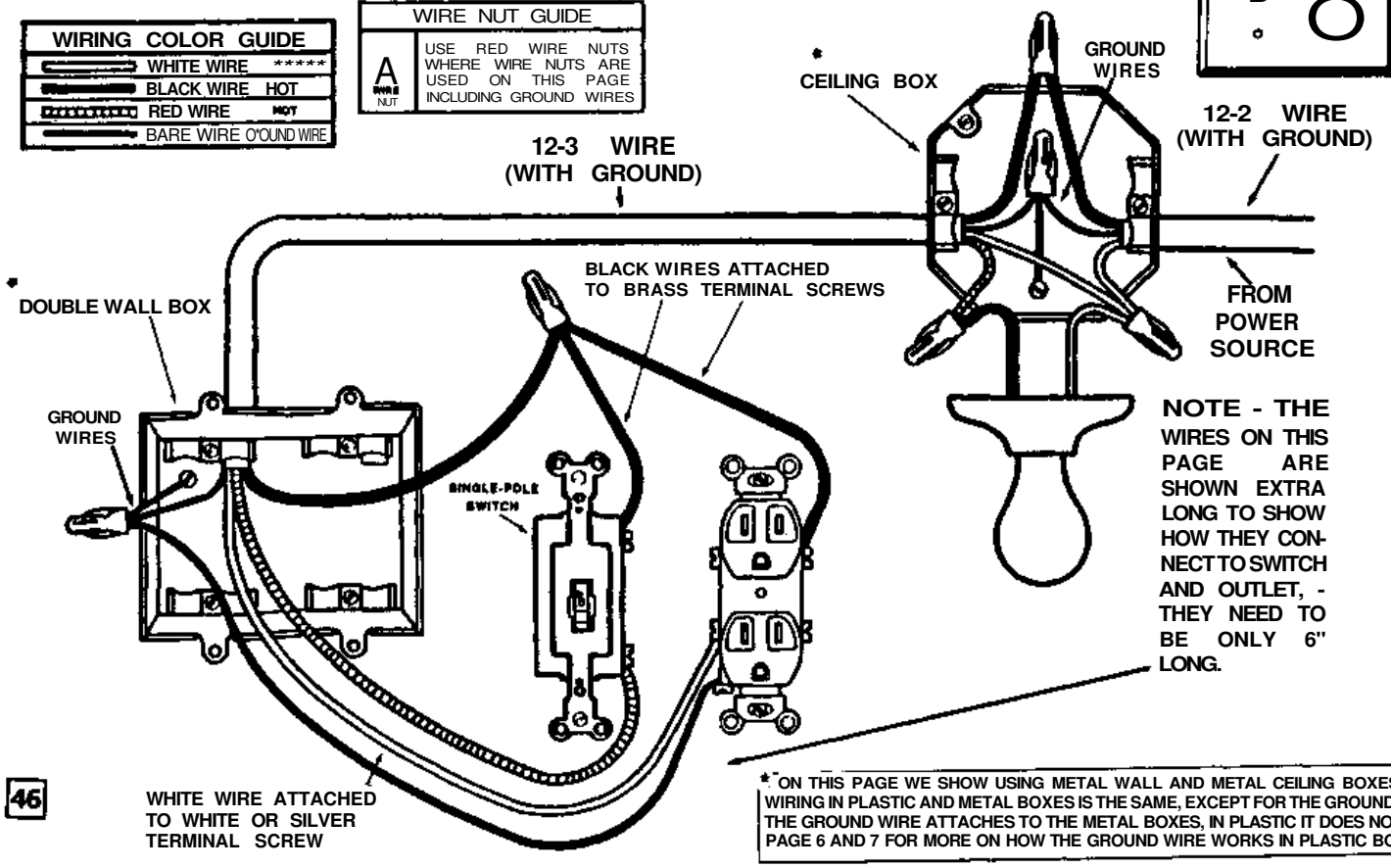

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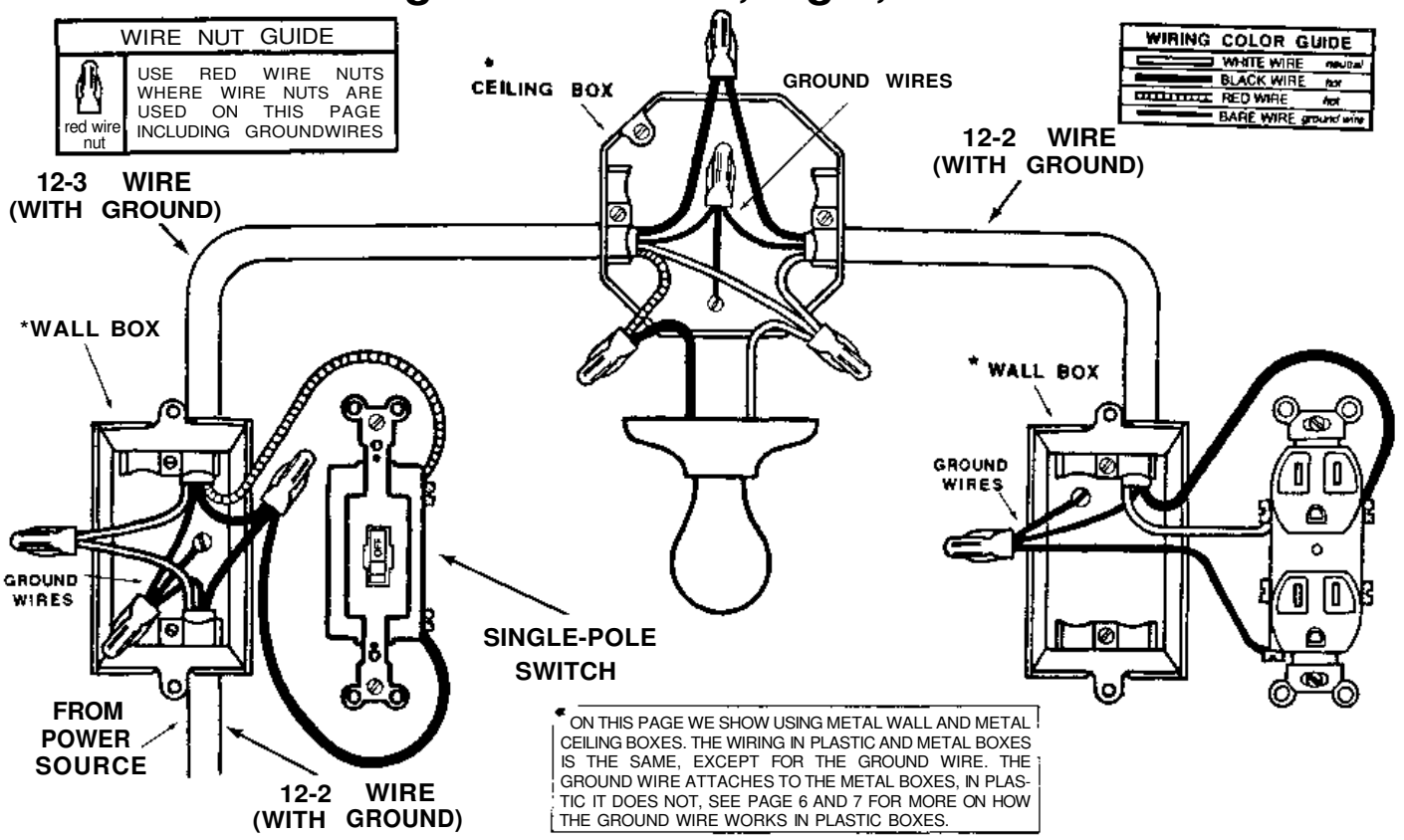
How to Wire a Single Pole Switch, Light, and Outlet



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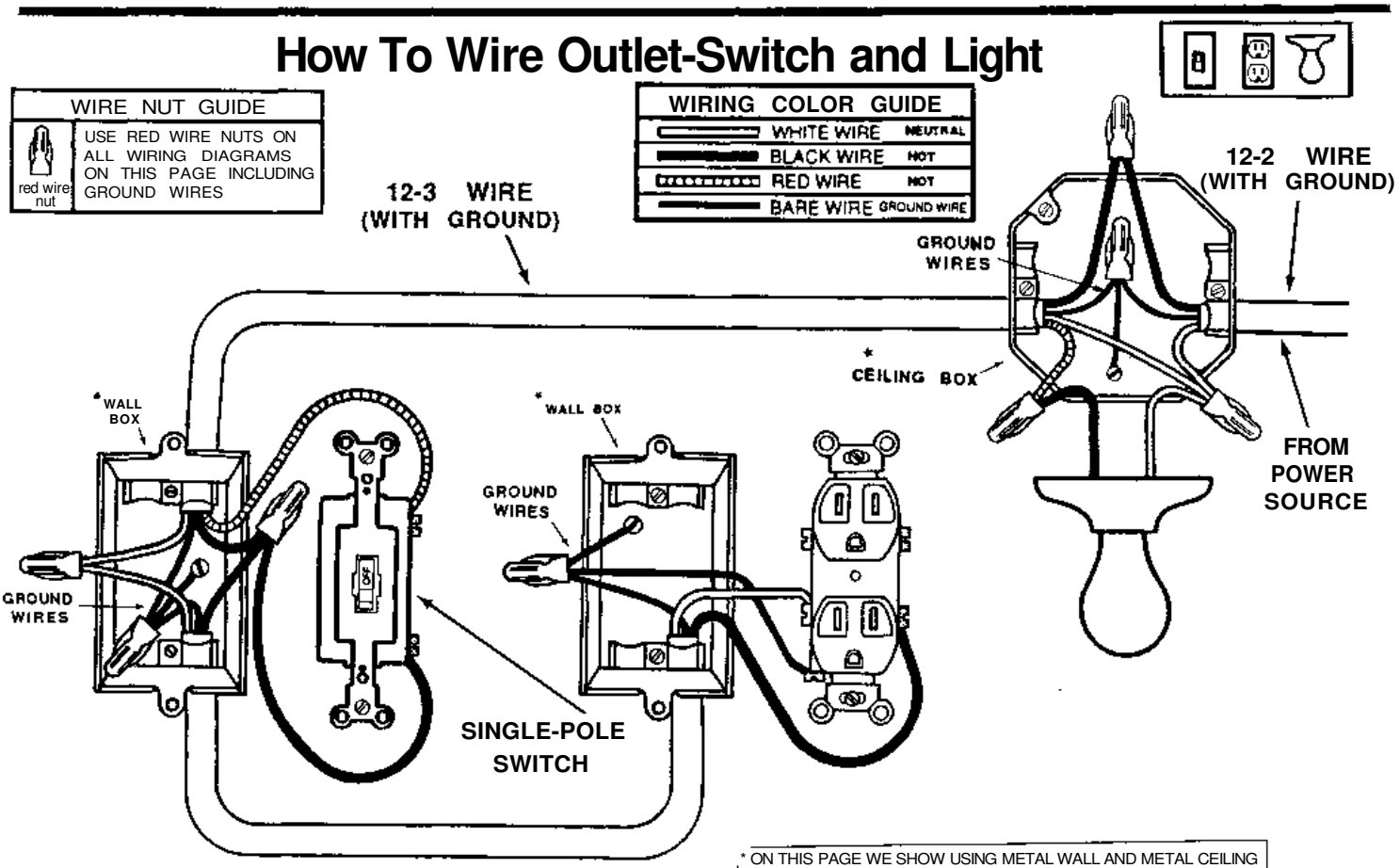
How To Wire Outlet-Switch and Light



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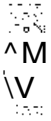
Explanation of Standard Electrical Terms

Receptacle or Outlet .....  A type of outlet to which electric cords can conveniently be plugged in.

Fuse ..... A safety device which breaks the flow of electricity whenever a circuit becomes overloaded.

Circuit-Breaker ..... Performs the same functions as a fuse in the "Circuit-Breaker" types of service panel.

Electric Service Panel ..... The main panel (or fuse cabinet) through which electricity is brought into the building and then distributed to various branch circuits. Contains the main disconnect switch for the entire wiring system, as well as fuses or circuit-breakers.

Conductors ..... Common trade term for electric wires.

Grounding ..... The connection of the electrical system to the earth, a precaution necessary to prevent damage from lightning and minimize danger from shocks.

"Hot" Wires ..... The power-carrying wires (usually black or red) as distinguished from the "neutral" wires (usually white).

Switch box ..... Type of protective box in which switch terminals are connected to the wires.

Fish wire ..... Narrow, springy metal type bent into a hook at one or both ends. Used to pull wire through walls, floors and ceilings in existing homes.

Fixture ..... Any mounted electrical device such as a switch, outlet, ceiling light, etc.

Line ..... Cable comprising or supplying a circuit.

Thin-wall conduit ..... Also called E.M.T. which stands for Electrical Metal Tubing.

Color-Coding ..... Identification of wires by color throughout the system to help assure that "hot" wires will be connected only to "hot" wires and that "neutral" wires run in a continuous uninterrupted connection back to the ground terminal.

Short circuit ..... An improper connection between "hot" "hot" wires or between a "hot" wire and a "neutral".

Circuit ..... Two or more wires through which electricity flows out from the source of supply to one or more outlets, and then back.

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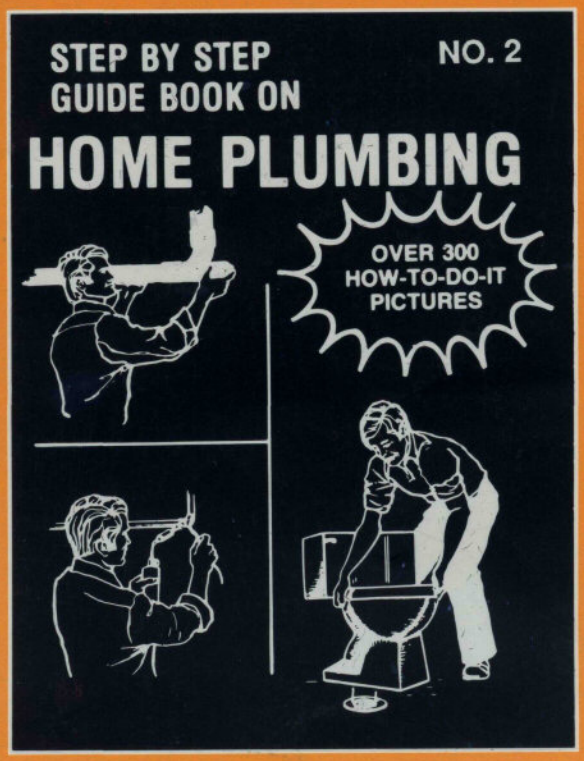

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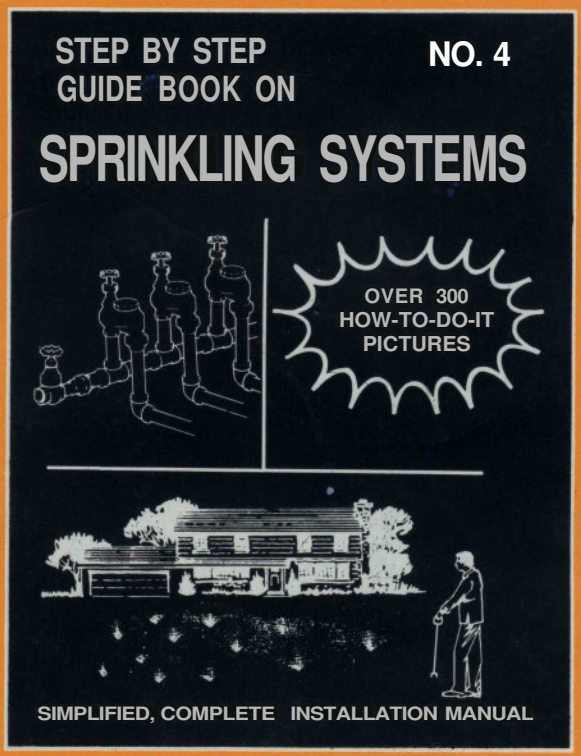

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