DEPARTMENT OF SAFETY AND INSPECTIONS
*Ricardo X. Cervantes, Director*

CITY OF SAINT PAUL
*Christopher B. Coleman, Mayor*

*375 Jackson Street, Suite 220*
*St Paul, Minnesota 55101*

*Telephone: 651-266-8989*
*Facsimile: 651-266-9124*
*Web: www.stpaul.gov/dsi*

# RESIDENTIAL GARAGE WIRING

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This handout attempts to answer the questions asked most often by homeowners. The information contained in this is NOT all you need to know to do your project, it is only to assist you in the project. The wiring must be done to the standards of the latest state-adopted National Electrical Code (NEC). Libraries and electrical supply dealers have so-called "wiring made easy" books available that will assist you. An Electrical Permit is required for all electrical work, including wiring a garage. In a single-family residence, the owner-homesteader may obtain the permit to do the work his/herself. For other residential occupancies, with a few small exceptions, an electrical contractor must be hired to do the work and obtain the permit.
Some basic rules:

**1**. Most homeowners choose to run the electrical underground. The two most popular methods are direct-burial cable or PVC (plastic) conduit. Direct burial cable is designated as UF (**U**nderground **F**eeder) or for larger sizes, USE (**U**nderground **S**ervice **E**ntrance). These cables may be buried directly in the ground at 24 inches below grade. They must have mechanical protection such as PVC conduit wherever they are closer than 24" below grade. The most common points that this happens is where the run is brought up above grade to enter the house and garage. PVC conduit is the other popular method used. The PVC MUST be approved as electrical conduit-other types such as PVC plumbing pipe is not acceptable. Standard insulated conductors may then be pulled inside the PVC. These single conductors must have a "W"(for water-resistant) in their designation that is stamped on the jacket of the wire. Examples of this designation would be: THWN, XHHW, etc. Type NM Cable (Romex) cannot be run inside underground conduit- the outer jacket of the NM is not rated for wet locations. PVC conduit may be buried at 18 inches below grade. (This is measured to the top of the conduit, so the trench will have to be deeper than 18"). **All trenches must be inspected** for proper depth by the Electrical Inspector who's name is on the permit before the trench can be covered up.

**2**. A disconnect must be installed in the garage to shut off all power to the building. This disconnect must be immediately inside the garage at the entrance point of the feed from the house. If you are using a multi-circuit panelboard in the garage and have no more than 6 breakers in the panel, these breakers may be used as the disconnecting means. More than 6 breakers, you must have a main breaker in the panelboard. If you are running a single 15 or 20 ampere circuit from the house to feed a minimum number of lights and outlets, you may use a separate single-pole switch (such as a standard light switch) as a disconnect. This switch must be the first device that is on the circuit once it enters the garage, and it may be used only as a disconnect-it cannot be used to control lights or other equipment. This disconnect must be marked as the disconnecting means on its box cover. (See figure 1 on diagram pages)
**3**. "Romex" or Non-Metallic Cable (NM-B) may be used inside the garage. It must be drilled through the studs, not run on the face of them. Also, never drill through factory roof trusses, run the

Romex on the top edge in a location it will not be damaged. If you run Romex horizontally, such as between boxes on a wall, if the wall is not enclosed by sheetrock the Romex cannot be run horizontally lower than 8 feet above the floor. As an example, to run between two boxes on an unfinished wall, you would have to run the Romex up from one box to a height of 8' or more, run horizontally until you are even with the other box, and then run back down to the second box. This method is required because there is too much chance of physical damage to the cable by hanging tools, etc on the horizontal runs if they were lower than 8'. Other installation requirements in the National Electrical Code, including Article 334 also apply.

**4**. All 125-volt, single-phase, 15- and 20-ampere receptacles installed in garages must be of the Tamper-Resistant type and protected by a readily accessible Ground Fault Circuit Interrupter (GFCI), including any for garage door openers or specific appliances. There are two forms of GFCI protective devices. You may use a tamper-resistant receptacle-type GFCI protective device, or a breaker style GFCI protective device. Both devices are designed to be installed at the beginning of the circuit to be protected and several standard tamper-resistant outlets may be protected "downstream" by one GFCI outlet. See the manufacturer's instructions for details. On a GFCI, the line is the power in and the load is the power out to other receptacles. "Tamper-Resistant" receptacles are designed with a "shutter" over the slots so only a standard cord cap (plug) can be inserted. Add-on plug covers are not acceptable. Any receptacles on the exterior of the garage must be tamper-resistant, GFCI-protected and "weather resistant" (there will be a "WR" visible on the face of the receptacle). Exterior receptacles will also need an in-use (bubble) cover where exposed to direct rain.

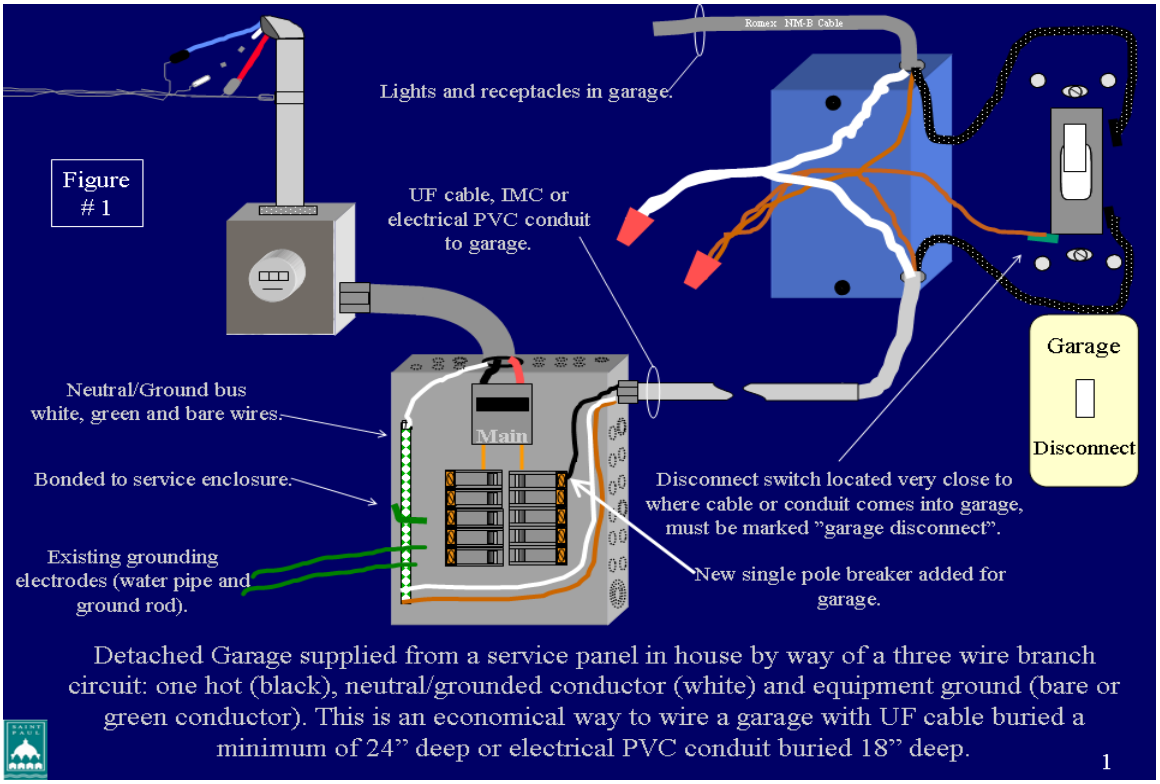
**5**. The National Electrical Code allows either a single circuit or a single feeder from the house to the garage. No multiple circuits between buildings are allowed.

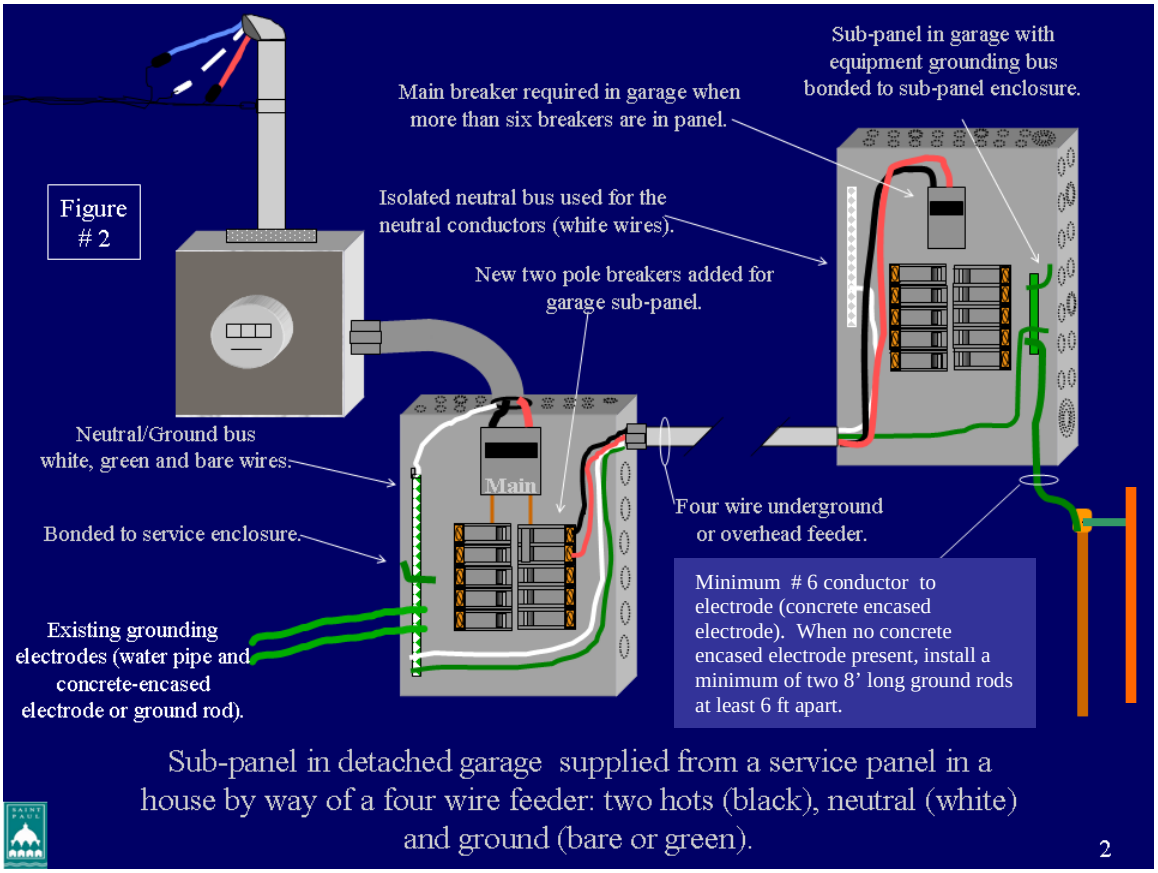
**6**. If a single circuit with a grounding conductor (either green or bare and attached to the grounding system in the house) is run from the house to the garage, no ground rods are required at the garage (see Figure 1). For feeders from the house to the garage, two 8-foot ground rods must be driven at least 6 ft apart outside the garage. An equipment grounding conductor is required with the feeder. When a feeder is supplying the garage, a grounding electrode is required at the garage. If there is no existing grounding electrode, (concrete encased electrode) two ground rods are required and are connected to the equipment grounding bar in the garage panel (see Figure 2). These two ground rods may be driven right outside the garage at least 6 ft apart, and a #6 copper ground wire attached to them. If the wire is subject to physical damage on the outside or inside of the garage, it must be protected by conduit. 1/2 inch PVC is usually the easiest method of protection. The #6 wire must be attached to the grounding system for the electrical in the garage.

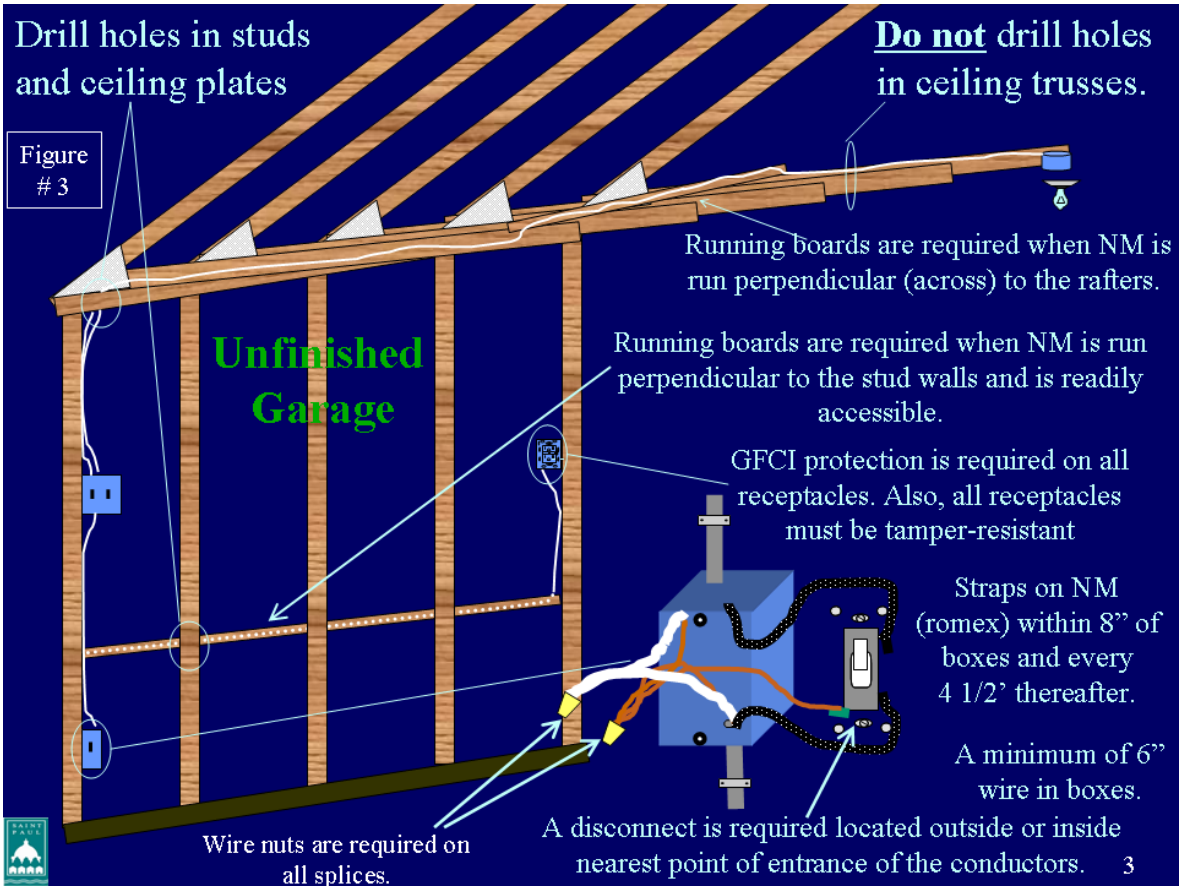
**7**. The minimum wiring required in a detached garage that has electricity would include a separate circuit with a disconnecting means for the power to the garage; switches at the service [human] door to control a light inside the structure; and a light outside the garage service door. Vehicular doors of a garage are exempt from any lighting requirements. A minimum of one GFCI- protected readily-accessible receptacle somewhere inside the garage is also required, and new to the 2014 NEC at least one receptacle outlet shall be installed for each car space.

8. If an outlet(s) is installed for the purpose of charging electric vehicles it shall be supplied by a separate circuit. This circuit shall have no other outlets.

Again, please be aware that these are NOT all the requirements for wiring a garage; they are the questions that we are asked most often. If you have other questions after consulting the wiring books available, call the Electrical Inspector for your area. In Saint Paul, they can be reached at (651)266-9003 between 7:30 and 9:00am Monday through Friday.


Romex NM-B Cable
Lights and receptacles in garage.
Figure # 1
UF cable, IMC or electrical PVC conduit to garage.
Garage
Disconnect
Neutral/Ground bus white, green and bare wires.
Main
Bonded to service enclosure.
Disconnect switch located very close to where cable or conduit comes into garage, must be marked "garage disconnect".
Existing grounding electrodes (water pipe and ground rod).
New single pole breaker added for garage.
Detached Garage supplied from a service panel in house by way of a three wire branch circuit: one hot (black), neutral/grounded conductor (white) and equipment ground (bare or green conductor). This is an economical way to wire a garage with UF cable buried a minimum of 24" deep or electrical PVC conduit buried 18" deep.
1


Sub-panel in garage with equipment grounding bus bonded to sub-panel enclosure.
Main breaker required in garage when more than six breakers are in panel.
Figure # 2
Isolated neutral bus used for the neutral conductors (white wires).
New two pole breakers added for garage sub-panel.
Neutral/Ground bus white, green and bare wires.
Main
Four wire underground or overhead feeder.
Bonded to service enclosure.
Minimum # 6 conductor to electrode (concrete encased electrode). When no concrete encased electrode present, install a minimum of two 8' long ground rods at least 6 ft apart.
Existing grounding electrodes (water pipe and concrete-encased electrode or ground rod).
Sub-panel in detached garage supplied from a service panel in a house by way of a four wire feeder: two hots (black), neutral (white) and ground (bare or green).
2


Drill holes in studs and ceiling plates
Do not drill holes in ceiling trusses.
Figure # 3
Running boards are required when NM is run perpendicular (across) to the rafters.
Unfinished Garage
Running boards are required when NM is run perpendicular to the stud walls and is readily accessible.
GFCI protection is required on all receptacles. Also, all receptacles must be tamper-resistant
Straps on NM (romex) within 8" of boxes and every 4 1/2' thereafter.
A minimum of 6" wire in boxes.
Wire nuts are required on all splices.
A disconnect is required located outside or inside nearest point of entrance of the conductors.
3