Electrical for Detached Garages:

Updated Feb 19, 2016 for 2015 CE Code in force Jan. 1, 2016

* Garage construction requires permits (electrical, building)
* Permits must be applied for at the time.
* Dial before you dig – Alberta One Call – www.albertaonecall.com 1-800-242-3447

Underground branch circuit feeding a detached garage:

There are several acceptable methods for feeding garages with underground wiring. Ensure the chosen method includes proper depth of burial, wire approved for wet locations and proper protection for the cable chosen.

NMD90 (known as Loomex or Romex) shown above is not rated for underground use!

Underground wiring methods. These are not the only approved methods but this shows the 3 most common methods:

1. NMWU cable in conduit - one continuous cable running from the panelboard in the house to a junction box, first device box or panel installed in the garage. The cable is protected by PVC conduit on all exterior surfaces and for the entire underground section. Buried minimum 18” below finished grade.

2. NMWU cable direct buried - one continuous cable running from the house panel to a junction box, first device box or panel installed in the garage. Cable protected by PVC conduit on all exterior surfaces to the bottom of the trench. Cable is then laid in the trench (direct buried) and protected by a layer of screened sand with a maximum particle size of 4.75 mm or screened earth at least 75 mm (3”) deep both above and below the cable. Buried minimum 24” below finished grade.

3. TECK Cable - one continuous cable running from the house panel to a junction box, first device box or panel installed in the garage. Directly buried a minimum 18" below finished grade. Note the metal armour on a TECK cable must run continuously both electrically and mechanically from end to end – the armour cannot be cut off at any point – and must be bonded at both ends. The bonding of the armour is accomplished by metal to metal contact with the cable connectors at the junction box or panel. Teck cable that contains a blue wire that will be utilized as a white "neutral" requires that wire be identified at both ends, normally done with white electrical tape. The outer jacket must be protected at ground level where it is subject to mechanical damage (see photos pg. 15).

Other considerations:

* Burial depth is measured from the top of the conduit or cable to finished grade. If the trench is in an area where vehicles drive, trench depth must increase by an additional 6"from the depths shown above.
* If you have trouble digging to the required depth because of hitting solid rock, the minimum cover requirements are permitted to be reduced by 6" where mechanical protection is placed in the trench over the underground installation. Several materials are suitable but most commonly 2x6 pressure treated planking is used. (see photos)
* All underground wiring must have a marking tape placed ½ way into the backfill of the trench (see photo). This warning tape says "caution electric line below" (or similar) and is available at electrical wholesalers and some home improvement centers.
* Communications circuits run to the garage (phone, CATV) – these cables must be in a separate conduit from the power. Inside the structures the communications cables must be spaced 2" away from any power cable.
* Electrical branch circuit wiring to the garage may be in the same trench as a gas sub-service line (the gas line from the house to the garage). It is recommended the two systems are separated by a 2X6 pressure treated plank. Note the minimum depth of burial for gas line is 15".

What size of wire, breaker and conduit is required?

Determine your total load and then refer to the following chart for (copper) wire, breaker and conduit size. Consider the power requirements of the equipment you plan to use and how many pieces of equipment you can use at one time. For many installations, the 40 Amp feeder is plenty, but don't underestimate your needs today (planning on electric heat?) or in the future (such as electric vehicle charging).

Type of Circuit	Size of wire (copper) 60°C	Maximum Breaker size	Size of wire (copper) 90°C	Maximum Breaker size	Size of Conduit
Single Circuit	14-2 NMWU	15 amps 1 pole	14-2 NMD90	15 amps 1 pole	¾" PVC
Double Circuit	14-3 NMWU	15 amps 2 pole	14-3 NMD90	15 amps 2 pole	¾" PVC
Feeder circuit for sub-panel in garage	10-3 NMWU	30 amps 2 pole	10-3 NMD90	30 amps 2 pole	1" PVC
	8-3 NMWU	40 amps 2 pole	8-3 NMD90	50 amps 2 pole	1" PVC
	6-3 NMWU	60 amps 2 pole	6-3 NMD90	70 amps 2 pole	1¼" PVC

- The breaker you install in the house panel must be from the same manufacturer as that panel. Even if they physically fit, mixing brands violates approvals section of the code.
- If wiring types are mixed, such as using NMWU underground then transitioning to NMD90 for the interior wiring, the breaker size must be chosen based on the lower ampacity rating of the 60°C rated NMWU wire.

Wiring the garage:

- Wire type – wire for inside the garage walls is NMD90 (loomex).
- Minimum outlets required are one duplex receptacle for each car space, one receptacle within 1 m of the garage door opener, one interior light and one exterior light at the man door entrance. Both lights are to be controlled by wall switches located just inside the garage door.
- Minimum circuit requirement is one 15 amp circuit feeding the garage. If the garage is fed from one 15 A circuit, all these required outlets may be fed off that one circuit. You can install additional lights or receptacles on this circuit up to a maximum of 12 (combination of lights and receptacles). Additional circuits would be required for any other loads over and above this.
- A separate dedicated circuit may be required for large gas fired unit heaters – see separate section for gas fired heaters.
- Receptacles installed outside and < 2.5 m from grade must be GFCI protected.
- Every 15 A and 20 A receptacle (inside or outside) to be Tamper Resistant type except for those located > 2 m above the finished floor or finished grade.

- If you are installing a panel in the garage, the maximum breaker size must match the conductor feeding the garage as well as the panel installed in the garage. For example if you install a #6 AWG wire, you install a 60 A breaker (at the house end) and a panel in the garage that is rated for (at least) 60 amps.
- The panel in the garage does not need a "main" breaker.
- Height of the panelboard – maximum height of the panelboard is 1.7 m from finished floor to the highest breaker position. Panels need 1 m clearance in front.
- The garage does not need a separate ground rod or plate. Bonding to ground is accomplished with the bonding conductor within the cable supplying the garage.
- If the garage is to be insulated, ensure vapor barrier hats are installed around all boxes and 6 mil vapour barrier is placed behind the panel when these items are mounted on the studs.
- Sealing the pipe or cable penetrations at the buildings – sealing is required around the outside of the conduit (or TECK cable) at the siding to prevent moisture from penetrating the building envelope. Normally done with silicone.
- All outdoor 15 and 20 A receptacles that are exposed to the weather require "in-use type" wet location cover plates**.** Cover must be marked **"extra duty"** (these have a metallic hinge pin)

Routing wiring inside the garage truss area:

This is a major mistake – NEVER DRILL THROUGH THE TRUSSES.
Wire can be laid on top of the trusses then stapled within 300mm (12”) of the light box or door opener receptacle box. If trusses are drilled (or otherwise damaged) the truss manufacturer or a structural engineer must provide a repair procedure.

Garage Gas Heaters – electrical requirements depend on the heater:

1) How is the power connected to the gas heater?
2) What is the electrical rating of the gas heater?

Electrical Code Rule Details:

- If the heater comes with a factory installed cord and cap and has an electrical rating does not exceed ⅛ h.p. (2.5 amps) it is allowed to be plugged into a receptacle that is on the garage circuit. Extension cords are not allowed so this normally requires wiring a receptacle within range of the factory cord.
- If the heater comes without a factory installed cord and cap, it is required to be connected with fixed wiring usually utilizing AC90 armoured cable (BX). It also could be fed off the garage circuit if the heater has an electrical rating not exceeding ⅛ h.p. (2.5 amps).
- If the heater has an electrical rating over ⅛ h.p. (2.5 amps) it would need to be installed with fixed wiring on a single branch circuit used for no other purpose, so a new dedicated circuit will be required. The gas heater cannot be fed off or plugged into any receptacle fed off the garage circuit.

Other notes for gas heaters:

- A heater requires a disconnect switch. If the heater is connected with flexible cord and cap plugged into a receptacle, this is suitable as a disconnecting means. Heaters connected with fixed wiring require installation of a disconnect switch near the furnace unless the breaker for this circuit is in a panelboard located inside the garage. The switch must be reachable without passing by the heater, it must not be mounted on the heater and it needs to be marked to indicate the equipment it controls.
- A gas permit is required for all installations.
- An electrical permit is required for all modified and new electrical wiring
- A gas line may share the trench with the electrical line. It is a recommended practice to separate the two lines with a 2x6 pressure treated plank.

Inspections required:

Both the Framing (building) and electrical inspection are to be called at the same time - building inspections cannot be called until all the electrical rough-in is complete. Only one inspection is normally performed for garage electrical work.

If the interior walls/ceiling are planned to be finished, inspection is required prior to covering any wiring with insulation/vapour barrier or finish materials. Have all splices completed at every box so the device (switch or receptacle) is ready to be installed. Wires may be connected to the breaker(s) but not energized.

All receptacles, breakers and the in-use cover plates for any outside receptacles are to be on site for first inspection.

If you are not "finishing" the interior (with drywall or plywood covering the walls), inspection can be called once the electrical installation is 100% complete.

The trench: Ideally inspectors would like to see the entire electrical trench when the inspection is called. However there are lots of reasons why owners want to fill the trench as quickly as possible – to keep the yard safe for children and pets, to prevent the trench from sluffing back in, to allow construction to proceed in stages. If the trench needs to be filled prior to the inspection day, you must present clear evidence of the wiring method and the depth of the trench. Photos taken with a tape measure in the trench showing depth are acceptable or you can leave one end of the trench open (at either the house or garage end).

Exception - Trenches containing gas lines. A trench containing a gas line is required to be inspected prior to the trench being backfilled.

Questions? – Ask an Airdrie Inspector - 403-948-8832

Some Airdrie installation photos and code related comments:

This is installation method #1 - NMWU cable in Rigid PVC Conduit - one continuous cable running from the panelboard in the house to a junction box or panel installed in the garage. The cable is protected by PVC conduit on all exterior surfaces and for the entire underground section. Must be buried a minimum 18”.

When this is backfilled, the bottom ½ of the trench is filled, then a marking tape is laid in the trench before the remainder of the trench is filled.

If the trench needs to be back-filled prior to the inspection day, you must present clear evidence of the wiring method and the depth of the trench. Photos taken with a tape measure in the trench showing depth are acceptable or you can leave one end of the trench open (at either the house or garage end). These 2 photos above along with a photo showing the long view of the trench (such as in the previous photo) are the type of photographic evidence that is required.

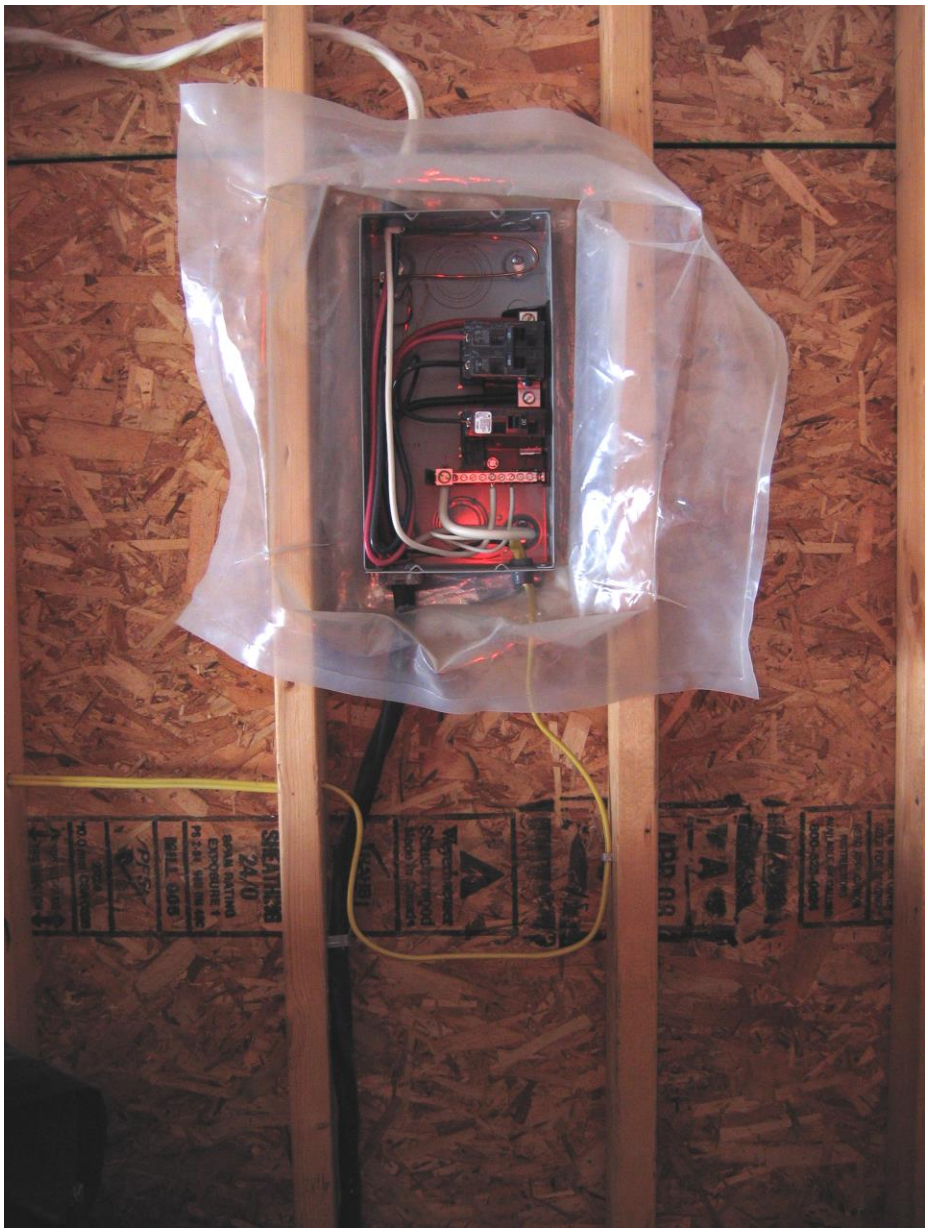
This is installation method #2 - NMWU cable direct buried - one continuous cable running from the house panel to a junction box or panel installed in the garage.

What is right?

Correct type of cable NMWU. It is protected by PVC conduit on the exterior surface down into the trench and terminating within 300mm of the bottom of the trench. An “LB” fitting is installed to transition from top of conduit to pass through the wall. The cable has enough slack in it so that it enters the conduit vertically. The loop in the cable at the bottom of the trench is a good idea in case there is any earth settlement.

What is wrong?

A direct buried cable (with no metal armour and not in a conduit) requires:
1) a sand or screened earth bed.
2) the cable to be buried a minimum 24” from top of the cable to finished grade – this trench is too shallow for this type of installation. This is why direct buried cable installation method is less popular. You must dig the trench 27” deep to allow for 3”of sand on the bottom and still have 24” remaining above the cable. There is also the issue of handling all the sand needed for the entire length of the trench.



This is what acceptable interior wiring would look like:

- The panel has been surrounded by a poly hat before mounting it on the studs. You can also use a sheet of 6 mil vapour barrier around the panel (or placed behind it if surface mounting). Wires pierce the sides of the poly then connect to the panel.
- The panel is solidly supported by 4 corners. Panel can be recessed into the stud space (as shown) or surface mounted. Allow space for insulation.
- Cables are strapped with the correct type and size of staple and routed so there are no excessive bends in the cable. Cable is run in the middle of the stud so that siding and drywall nails will not pierce the cable.

Installation using 2x6 pressure treated planks

If you have trouble digging to the required depth, the minimum cover requirements shall be permitted to be reduced by 6” (150 mm) where mechanical protection is placed in the trench over the underground installation. Mechanical protection shall consist of one of the following and, when in flat form, shall be wide enough to extend at least 50 mm beyond the conductor, cables, or raceways on each side:
(a) treated planking at least 38 mm thick; (normally 2x6 pressure treated planks are used)
(b) poured concrete at least 50 mm thick;
(c) concrete slabs at least 50 mm thick;
(d) concrete encasement at least 50 mm thick; or
(e) other suitable material.

Mechanical protection must cover the entire length of the trench.

This is what the marking tape looks like. The wiring is on the bottom of the trench, then the trench is filled ½ way to the top then the marking tape is installed and the backfill is completed.

If you are using TECK cable for the underground and transitioning to NMD90 (Loomex) for the interior run, it is required to have the armour of the TECK cable continuous both mechanically and electrically. In order to bond the armour when terminating on a plastic box, a grounding bushing is required on the end of the TECK connector. This bonds the armour to the bonding conductor to maintain electrical continuity. Note the PVC sleeve over the TECK cable provides the required additional mechanical protection to the outer jacket in areas where it is exposed to potential damage.