

9.0 

ELECTRICAL AND PLUMBING

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9.1 INSTALLING ELECTRICAL SERVICES

Typically, electrical services are installed in the cavity of wood framed walls. However, this is not the case for ICF walls. With the exception of services placed through wall sleeves, services are not installed in ICF wall cavities. All services are located in the EPS panel of the ARXX form after the placement of concrete in the wall.

Standard Romex type wiring can be used for ICF walls.

9.1.1 PRIOR TO CONCRETE PLACEMENT: THROUGH-WALL PENETRATIONS

Prior to the wall assembly, the building plans should be examined carefully, to note the electrical service entry locations, the electrical panel, the external outlet locations and the exterior light locations. These locations should be marked clearly on the interior and exterior faces of the ICF walls, in order to provide for the installation of wall sleeves.

Wherever exterior electrical outlets or light fixtures are anticipated, $\frac{3}{4}$ " (19 mm) diameter or larger sleeves should be inserted laterally through the ARXX forms, at the required height. The sleeves should be located approximately 6" (150 mm) horizontally offset from the finished fixture location, in order to allow the wire to enter at the side of the utility box. The location and size should be coordinated with the electrical contractor.

Sleeve length can match form width, although some electrical contractors may prefer the sleeves to be shorter, allowing for expansion foam to be squirted around the sleeve ends to act as a thermal break.

A sleeve may be a PVC, aluminum, or steel pipe. The sleeve needs to be strong enough and properly secured to withstand concrete placement. A neat hole should be cut through both ICF panels, allowing for a snug fit for the sleeve. All penetrations through the wall and EPS must be sealed, so that they are air tight and water tight.

9.1.2 AFTER CONCRETE PLACEMENT: CABLES AND WIRE CHASES

After concrete placement, the chases for the wiring may be cut directly into the EPS foam panel of an ARXX form. For efficiency, the runs and services should be located to minimize any interference with the webs in the ARXX forms. Horizontal runs should be located exactly on the horizontal joint of the form, which allows for easy cutting, with between 1" and 3" (25 mm and 75 mm) of clearance from the end of the webs. All ARXX forms have markings to indicate the location of the vertical webs or fastening strips, typically spaced at either 6", 8" or 12" (150 mm, 203 mm or 305 mm) on center.

Grooves, or chases, should be cut to install the cables or wires. The grooves allow for a minimum coverage protection of $1\frac{1}{4}$ " (32 mm) from the back face of the gypsum board, conforming to US-NEC and CAN4 S124 standards for "Cables and Raceways Installed in Shallow Grooves".

Several options for cutting chases are available, but the cleanest is achieved using a hot knife, while the fastest is achieved using an electric chainsaw. Hot knives often come with their own depth stop clamping plates and a variety of interchangeable knife profiles and lengths. A depth stop for a small blade electric chainsaw can be made by a drilling a $\frac{3}{8}$ " (9.5 mm) diameter clear hole through the bar at an appropriate location, allowing for the chase depth and mounting, and then inserting a $\frac{3}{8}$ " (9.5 mm) diameter x 3" (75 mm) long threaded rod. The rod should be anchored in place by mounting nuts on each side of the bar.

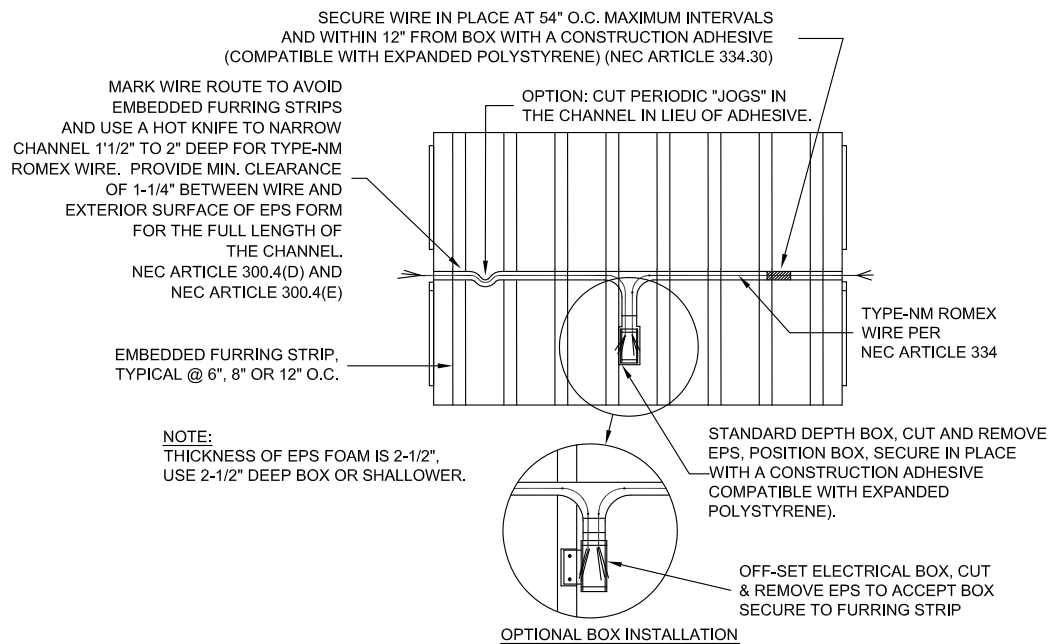
9.0 ELECTRICAL AND PLUMBING

9.1.3 CHASE CUTTING PROCEDURE AND PLANNING

The layout of the wiring runs on the wall should be marked before cutting with vertical runs between webs and horizontal runs along the horizontal seams. Lighting and outlet boxes should be located next to the webs, so that they can be attached securely to the webs.

Using a cutting tool, cuts should be made horizontally or vertically, as required, and always cutting to the required depth of 2" (50 mm). Horizontal cuts are easier to make if they are made along one of the horizontal joint lines between the courses of forms as this eliminates cutting through the webs. All turns should be angled or curved to minimize 90° bends in the wiring. As well, periodic jogs can be cut into the horizontal runs to help secure the wiring in place without additional adhesive (see Figure 9.1.3-1). Wiring should be secured in the cut channel at maximum intervals of 54" (1370 mm) and within 12" (305 mm) of the box.

FIGURE 9.1.3-1 INSTALLATION OF WIRING



9.1.4 WIRING

Standard Romex type wire can be tucked into the chase cuts easily, and it will stay in place under friction fit. Wider chases require small foam scraps to be inserted to hold the wire in place, or an EPS compatible low expansive spray foam can be used to secure the wire in place. Some electrical codes require a secure anchor on the wire, within 8" (203 mm) of a box. Since staples cannot be used with EPS foam, small nylon cable zip-ties or cable clamps with manufactured eyelets that use short concrete screws to anchor the wire in place may be used.

9.1.5 CONDUIT

Commercial and institutional projects may require metal or plastic conduit, which can be installed in the same manner as standard cable by cutting chases in the EPS of the ARXX foam panels after placement of concrete.

9.1.6 OUTLET BOXES

Either metal or plastic electrical outlet boxes can be used with ICFs. While a hot knife makes the cleanest foam cut, other tools such as a standard saw, keyhole saw or long blade utility knife may be used to clear the foam at the box locations. Boxes that are fitted with a stud flange can be easily screwed directly into the attachment strips of the webs by using shallow truss head or bugle headed screws. Other box types can be anchored through the back of the box to the concrete with a concrete screw or powder actuated nail. A standard 2¼" (57 mm) deep outlet box will fit into a chase in the foam panels of the ARXX forms are 2½" (63.5 mm) thick.



THE EPS PANEL ACTS AS A VAPOR BARRIER FOR AN ICF WALL. ANY OUTLET BOX CUT OUTS THAT EXPOSE THE CONCRETE REQUIRE POLY VAPOR BARRIER INSTALLED BEHIND THE OUTLET BOX AND THE POLY SEALED TO THE EPS WITH A LATEX CAULKING.

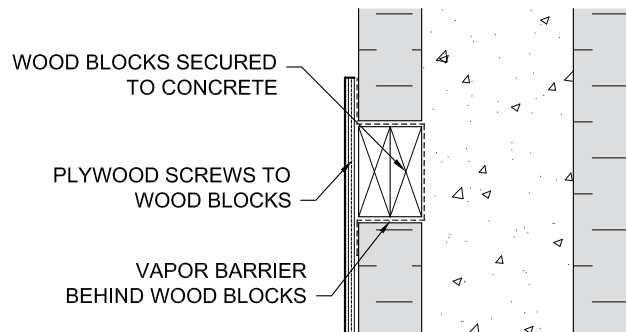
9.1.7 MAIN PANEL

Electrical panels can be installed either by face mount or by recessed mount.

A face mount is where the circuit breaker panel is mounted on a larger plywood base, which enables the wires to be stapled neatly to the plywood for easy circuit tracing. If wires must be concealed, 2" x 4" (38 mm x 89 mm) studs should be used to fur out around the plywood base mounted to the ARXX wall.

A recessed mount is where the circuit breaker panel is mounted flush to the face of the ARXX wall by embedding a 2" x 4" (38 mm x 89 mm) and plywood-backed window buck within the wall, flush to the interior wall face, which allows some concrete to flow behind the partial depth buck assembly.

FIGURE 9.1.7-1 PANEL BOX



9.1.8 EXTERIOR MASTS AND METERS

Any attachment to the ARXX wall on the exterior face of the building will have to penetrate the exterior finish and the EPS foam panel and it will need to be secured into the concrete core with appropriate concrete fasteners. All penetrations of the exterior finish must be sealed to be air and water tight.

9.0 ELECTRICAL AND PLUMBING

9.2 PLUMBING, PIPING AND MECHANICAL SERVICES

9.2.1 PLANNING PRIOR TO CONCRETE PLACEMENT

After assembling the ARXX forms and prior to the placement of concrete, the building plans should be carefully reviewed to note the locations of all required plumbing and mechanical penetrations, which will pass through the ARXX walls. A typical checklist should include the following:

- › water supply entry for municipal service as applicable
- › pump and water supply leads for well water supply as applicable
- › waste water sewer or septic leads
- › exterior hose bibs
- › sump pump waste water discharge
- › gas or propane services
- › oil fill and vent pipes, where applicable
- › furnace air intake and exhaust vents
- › HRV or heat exchanger intake and exhaust ports
- › hot water power vent exhaust leads
- › kitchen exhaust vents
- › wall-mounted bathroom exhaust fan leads
- › dryer vents
- › passive crawl space/cold room vents
- › central vacuum lines to adjacent garage spaces

9.2.2 SERVICES EMBEDDED IN CONCRETE

Plumbing or mechanical services are not permitted to be installed in the concrete, with the exception of penetrations through the wall. For the wall penetrations, vertical and horizontal runs should be located and cut into the EPS panels of the ARXX forms.



FOR ANY SERVICES THAT REQUIRE INSTALLATION IN THE CONCRETE CORE AND MAY IMPACT THE STRUCTURAL DESIGN OF THE WALL, AN ENGINEER SHOULD BE CONSULTED.

9.2.3 THROUGH-WALL PENETRATIONS

All through-wall service penetrations should be installed in accordance with Section 2.2.22 – Service Penetrations.

9.2.4 PIPE CHASES

After concrete has been placed, pipe chases can be cut into the foam to permit running small diameter pipes, up to 1½" (38 mm) diameter beneath the wall finish material. The wider diameter of pipe fittings should be considered when calculating the maximum size of pipe to fit within the foam.

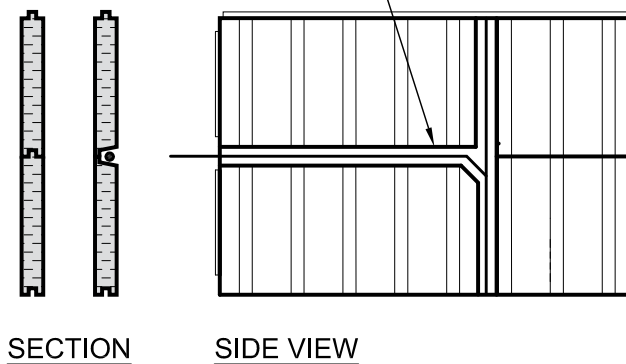
Many tools can be used for making these cuts, however, an electric chainsaw, a hot knife and side grinders are generally the fastest and cleanest installation tools for preparing foam cuts for sleeves.

9.0 ELECTRICAL AND PLUMBING

FIGURE 9.2.4-1 PLUMBING PIPE CHASE

WATER AND PLUMBING LINES UP TO 2-1/2" O.D. MAY BE INSTALLED IN THE POLYSTYRENE. LARGER PLUMBING LINES SHOULD BE INSTALLED PRIOR TO POURING CONCRETE.

MARK PIPE ROUTE TO AVOID EMBEDDED FURRING STRIPS AND USE A HOT KNIFE OR ROUTER TO CUT NARROW CHANNEL 2-1/2" DEEP FOR PIPING



ALL THROUGH-WALL PENETRATIONS SHOULD BE SEALED AIR TIGHT WITH CAULKING OR EXPANSION FOAM ON BOTH SIDES OF THE WALL.



ONCE THE CONCRETE IS IN PLACE, THE WEBS OF THE **ARXX** FORMS MAY BE CUT TO ALLOW HORIZONTAL SERVICES. ADEQUATE PROTECTION SHOULD BE INSTALLED TO PREVENT GYPSUM BOARD SCREW DAMAGE.